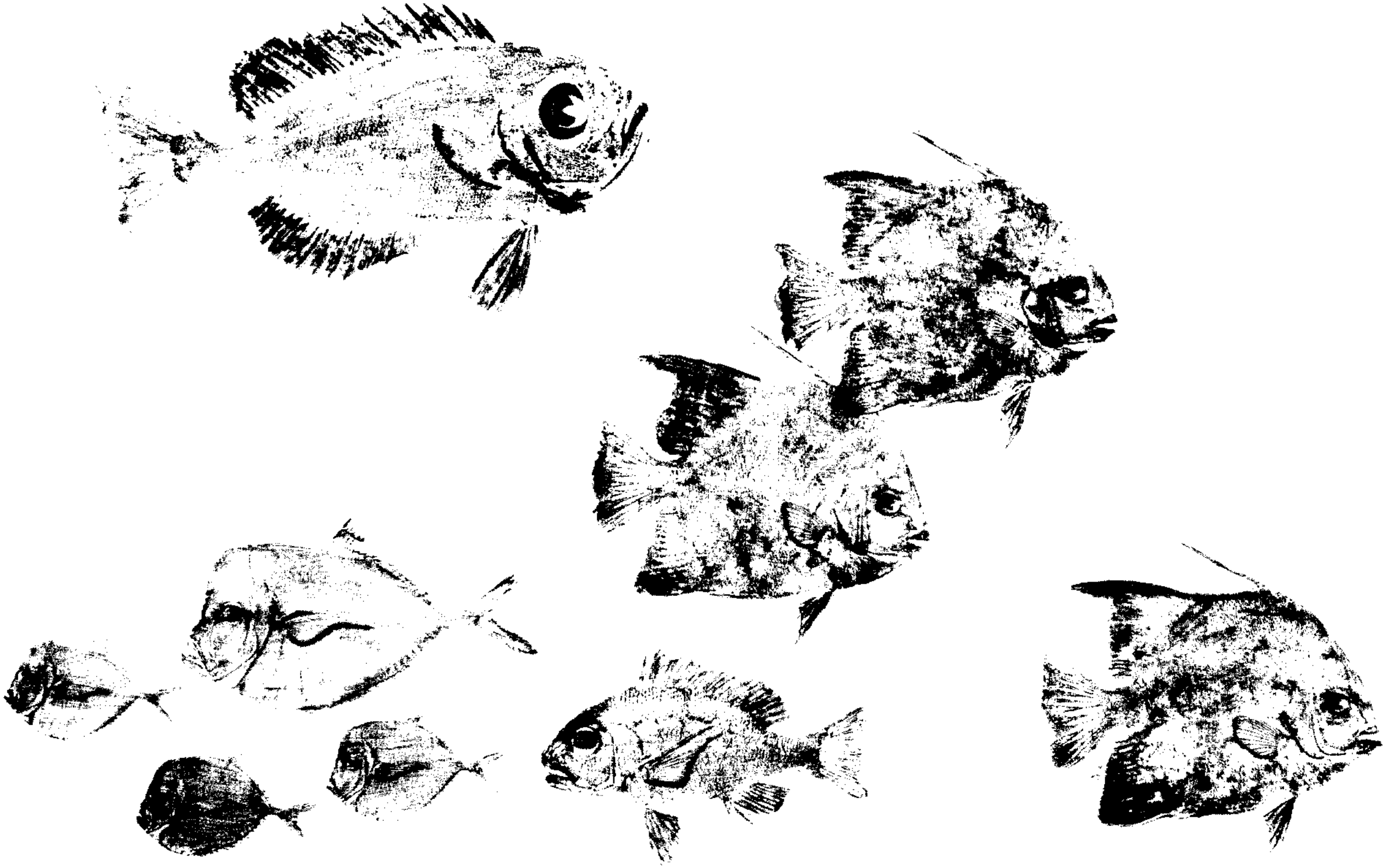

THE UNIVERSITY OF TEXAS AT AUSTIN
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FINAL REPORT

NITROGEN PROCESS STUDIES (NIPS): THE EFFECT OF FRESHWATER INFLOW ON BENTHOS COMMUNITIES AND DYNAMICS

by

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Table of Contents

Acknowledgements

In response to House Bill 2 (1985) and Senate Bill 683 1987), as enacted by the Texas Legislature, the Texas Parks and Wildlife Department and the Texas Water Development Board must maintain a continuous data collection and analytical study program on the effects of and needs for freshwater inflow to the State's bays and estuaries. As part of the mandated study program, this research project was funded through the Board's Water Research and Planning Fund, authorized under Texas Water code Sections 15.402 and 16.058(e), and administered by the Department under interagency cooperative contracts Nos. 8-483-607, 9-483-705, 9-483-706.

Preface

This final report is composed of five chapters. The study was performed from September 1986 through December 1989. Each chapter represents a major project or time frame.

During the first year (1986-1987: NIPS-1) of this study we completed the meiofaunal grazing experiment (Chapter 1), the effect of sediment resuspension on benthic metabolism and nutrient regeneration (Chapter 2), and community analyses of San Antonio Bay (Chapter 3). John Turany (Captain of the R/V KATY), Rick Kalke, John Kern, Joe Dirnberger, Won Bae Yoon, Lynn Tinnin, Judy Lee, and Skip Rhudy all helped out in various aspects of the experiments undertaken during that period. I am also very grateful for the assistance of Hugh MacIntyre for chlorophyll analyses, and Terry Whitledge for nutrient analyses.

During the second year (1987-1988: NIPS-2) of this study we performed the spatial and temporal metabolism study (Chapter 2), and community analyses of Nueces and Corpus Christi Bays (Chapter 3). Noe Cantu, Hayden Abel, and Mike Hall Captained the R/V ETTA ARMSTRONG during this work, and R. Kalke, J. Dirnberger, J. Kern, L. Tinnin, and Eileen Westerman helped gave technical assistance. I am also very grateful for the assistance of Dean Stockwell for chlorophyll analyses, and Terry Whitledge for nutrient analyses.

Finally, during the third year of the program (1988-1989) we completed the estuarine comparison experiment (Chapter 4), and the review of the benthic literature (Chapter 5). Rick Kalke played the largest role in both of these studies.

We have learned an awful lot about benthic processes and the role of freshwater inflow during these last three years. This information is critical to environmental managers in Texas. Texas is a water limited state. There will always be competing interests for freshwater in our state. The bays and estuaries also depend on freshwater, just like we depend on blood pumping and circulating throughout our bodies. Texas has about 7% of all the estuarine surface area in the nation. It is therefore important that Texas take a leading role in determining the effect and influence of freshwater inflow on the bays and estuaries. This is necessary so that we can continue to harvest the bounty nature has to offer.

There are three size classes of benthic organisms. The smallest are the microbes: one-celled bacteria, yeasts, fungi, microalage, and protozoans. They average from 1 to 100 µm in size. They are small, yet they have an enormous impact on the processes and productivity in sediment communities. The smallest metazoan animals are the meiofauna, 63-500 µm in size. These are tiny animals like nematodes, and harpacticoid copepods. They are also small, but have very rapid turnover times, so they can also be very important in benthic dynamics. Finally, there is the macrofauna, everything greater than 500 µm in size. This study has concentrated on the infauna, e.g., polychaete worms, small clams, snails, and crustaceans. Together, this community forms the base of the food chain which supports all marine life in the estuaries. There are also important synergistic relationships between the three groups of benthic organisms. Without one, the others do not function as well.

There are several aspects which have come out of this study which indicate the importance of the benthos, and of freshwater inflow. One is the relationship between freshwater inflow and marine exchange via passes into the Gulf.

San Antonio Bay is a small closed system (i.e., there is no exchange with the Gulf of Mexico). So, freshwater has an enormous impact on San Antonio Bay. Since it is small and closed, salinities are generally lower than in the Lavaca-Matagorda Bay Estuary which has comparable inflow. San Antonio Bay generally has the highest abundances and biomasses of bacteria, meiofauna, and macrofauna. It also has very high potential rates of trophic transfer. The community there is dominated by freshwater species. In contrast, open bays, i.e., bays with Gulf exchange like Corpus Christi and Matagorda Bays, have more oceanic communities. Even though the communities in these bays are very different in some respects, they function in similar manners. The Gulf seems to have the largest influence on community structure, but freshwater inflow has the largest influence on community function.

There are long-term and seasonal cycles. The seasonal pattern is unmistakable. There is spring recruitment, and decreases in abundance in the summer and late fall. The extent of the spring recruitment may be more sensitive to freshwater inflow than the die-backs of summer and fall. Therefore, the long-term cycles of floods and droughts can be very important in regulating year-to-year differences in benthic productivity. Abundances of animals seem to be much higher the year after an inflow event. The nutrients brought down the river and into the bay seem to stimulate the benthos for very long periods of time. But, after successive drought years, there appears to be a depletion of nutrients since abundances generally start to decrease. The timing of floods and storms is important. Although, the nutrients are necessary, large decreases in salinity can harm animals which depend on narrow salinity ranges as cues for reproduction.

The Texas coast is also very windy. This results in a great deal of sediment resuspension and the turbid waters which are typical of our bays. Apparently, resuspension is very important to increase the regeneration and recycling of nutrients. The benthos can supply about one-third of the nitrogen needed by primary producers when the wind is blowing. But, this can drop to only a few percent when the wind is calm. Texas benthos seems to be uniquely adapted to the windy conditions on our coast line. The wind is thus an energy source which fuels production in our estuaries. It also plays a key role in generating the circulation patterns which can move nutrients around the bays and estuaries. But, freshwater inflow and new nutrient input to the marine ecosystems must make up the difference between the requirements of the primary producers and the regenerated supply by the benthos.

If I have peaked your interest, please read on, all the details are inside.

Paul Montagna
December 14, 1989

The Effect of Freshwater Inflow on Meiofaunal Consumption of Sediment Bacteria and Microphytobenthos in San Antonio Bay, Texas

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ABSTRACT

Edaphic bacteria and microphytobenthos are known to be food resources for meiobenthic organisms. River inflow is a source of nutrients in estuaries. If inflow results in concomitant primary and secondary production, then meiofauna grazing rates should be higher in the freshwater influenced part of the estuary. Meiofauna grazing rates in San Antonio Bay were 3½ times greater in the freshwater influenced zone than in the marine influenced zone. However, this was due to a predominance of juvenile mollusks (temporary meiofauna) in the freshwater zone. Permanent meiofauna (i.e., harpacticoids and nematodes) all had higher grazing rates in the marine influenced zone. Grazing rates were higher on microalgae than on bacteria. Only one per cent of the bacterial population was removed per hour, but, four per cent of the microalgae were removed per hour. Grazing pressure on bacteria and microalgae was much greater than the standing stocks or productivity could withstand. Production of bacteria and microalgae in the head of the estuary was advected, resulting in higher biomass in the lower end of the estuary. Therefore, advection of microbial production from the river is very important in maintaining standing stocks of benthic meiofauna throughout the estuary.

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INTRODUCTION

Nutrient loading by rivers into bays and estuaries is thought to maintain or enhance productivity (Deegan et al., 1986; Nixon et al., 1986). Any enhanced productivity by microbial producers such as microalgae (via autotrophy) or bacteria (via heterotrophy) would be readily available to first trophic-level consumers such as meiofauna. Meiofauna are the smallest metazoa living in sediments with body lengths from 0.063 to 0.5 mm in length. Although some meiofauna are deposit feeders (Jensen, 1987), most are grazers which select or utilize single cell microbes as food (Montagna, 1984b).

There is a strong positive empirical relationship between bacterial abundance and chlorophyll concentration (Bird and Kalff, 1984), and bacterial production and net primary production (Cole et al., 1988). High nutrient concentrations in the heads of bays and estuaries should result in higher primary production than in the more marine influenced part of the estuary (Nixon et al., 1986). Benthic respiration (Hargrave, 1973) and biomass (Grabmeier et al., 1988) are positively correlated with primary production. High primary production should stimulate or correlate with higher secondary production by benthic bacteria (Graf et al., 1982). Benthic invertebrates are often thought to be food limited (Genoni, 1985; Lopez and Levinton, 1987). Enhanced productivity by microbes could then stimulate meiofaunal grazing rates on those microbes.

If invertebrates are food limited then meiofauna should respond to higher nutrient inputs and resulting microbial productivity with higher grazing rates. To test this hypothesis meiofaunal grazing rates were measured along a salinity gradient in San Antonio Bay, Texas. This study was part of a multidisciplinary effort to investigate the effect of freshwater inflow on nitrogen processes in Texas estuaries (Whitledge et al., 1989).

MATERIALS AND METHODS

Study design. Four stations in San Antonio Bay, Texas were chosen for study (Figure 1). Two stations (A and B) were at the head of the bay where freshwater influence is greatest. Two other stations (C and D) were near the Intracoastal waterway where marine influences were greatest (Figure 1). By using two stations in the freshwater influenced zone and two stations in the marine influenced zone we are replicating effects at the treatment level and avoiding pseudoreplication (Hurlbert, 1984). The four stations were sampled three times, in January, April and July 1987. Temperatures were similar in January and April but twice as warm in July (Table 1). Salinity throughout the bay was increasing through the winter, but a huge spring rain converted the entire system to a very fresh condition which persisted through July (Table 1). The sampling period was during an abnormally low salinity year due to higher than average amounts of rain and river inflow.

Measurement of grazing rates. In situ meiofaunal grazing rates on bacteria and microalgae were measured by incubating sediment slurries with two radiolabeled substrates, tritiated thymidine (^{3}HTdR) and ^{14}C-bicarbonate ($H^{14}CO_3^-$) (Montagna and Bauer, 1988). The top 2 cm (12 cm^3) of 60 cm^3 sediment cores were placed in 60 cm^3 clear centrifuge tubes. Five μCi of ^{3}HTdR and five μCi of $H^{14}CO_3^-$ were added to the slurries and samples were incubated for 2 h at in situ temperature. These slurries are different from the kind employed by Carman et al. (1989). They stirred up whole stoppered cores. We selected the aerobic section of the sediment and diluted it in our sea water based treatments.

Live, non-feeding controls were used to correct for non-grazing label uptake by meiofauna (Montagna, 1983). A saturated solution of nalidixic acid (200 μg ml^{-1}) plus 5′-deoxythymidine (2 μg ml^{-1}) (hereafter referred to as ND) was used to inhibit prokaryotic uptake of thymidine (Findlay et al., 1984; Montagna and Bauer, 1988). Live controls for this experiment consisted of 3 replicate slurries with $H^{14}CO_3^-$, ^{3}HTdR and ND added. These were incubated in the dark to inhibit photosynthetic fixation of CO_2.

After 2 h, incubations were terminated by adding 2% formalin, and a 1 ml subsample was withdrawn from the slurries. The subsample was filtered onto a 0.2 μm Millipore filter and was rinsed 3 times with filtered seawater to estimate uptake of $H^{14}CO_3^-$ by microalgae and ^{3}HTdR by bacteria. The subsample was dispersed and suspended in 5 ml distilled water and 15 ml Insta-Gel for dual-label liquid scintillation counting. Meiofauna were separated from sediments by diluting samples with 2% formalin, swirling to suspend the animals, and decanting them and the supernate onto 63 μm Nitex screen filters. Meiofauna were then rinsed into jars and kept in refrigerated 2% formalin until sorting (1 to 2 d). Three replicate cores were taken for each treatment.

Sorting was performed under a dissecting microscope and meiofauna were sorted by taxa into scintillation vials containing 1 ml distilled water. After sorting, meiofauna were dried at 60 °C and solubilized in 100 μl Soluene tissue solubilizer for 24 h. Samples were counted by dual-label liquid scintillation spectrophotometry in 15 ml Insta-Gel.

Meiofaunal grazing rates on bacteria and microalgae were estimated by the model proposed by Daro (1978) and modified by Roman and Rublee (1981) and Montagna (1984b). The meiofaunal grazing rate (G) is the proportion of material flowing from the donor (or food) compartment to the recipient (or predator) compartment per hour. G is expressed in units of h^{-1} and is calculated as follows (Montagna, 1984b): $G = 2F/t$, and $F = M/B$, where F is the fraction of label uptake in meiofauna (M) relative to bacteria or microalgae (B) at time t. The grazing rate was then log transformed for use in statistical analyses. Detransformed rates are reported throughout this manuscript. Detransformed 95% confidence intervals were calculated as follows: $10^{(\bar{X} \pm t_{(0.025,(n-1))} \times SE)}$, where SE is the standard error of the mean ($s/\sqrt{n}$).

Bacterial abundance and production. One-cm^3 subsamples for enumeration of bacteria were taken from larger cores. Bacterial samples were preserved in 4% buffered formalin that had been filtered through a 0.2 μm filter and were refrigerated until they were analyzed. A surfactant, Tween 80 (final concentration 0.001%), was used to facilitate dispersion of bacterial cells during homogenization of sediments (Yoon, 1986). Bacterial cell counts were measured using the acridine orange direct count (AODC) technique (Daley and Hobbie, 1975). The sampling design employed by Montagna (1982) was used: 10 fields were counted from two subsamples of three sediment cores (which yielded 60 counts for each station.

Benthic bacterial production was measured by the incorporation of ^{3}HTdR into nucleic acids (Fuhrman and Azam, 1980, 1982; Bauer and Capone, 1985). One concentration of thymidine was used (50 nM), and time course experiments (with five points) were performed. Since dilution experiments were not performed, productivity measurements may be underestimates of true production.

RESULTS

The animals that were found in the sediment cores were sorted into six groups. Three groups included juvenile macrofauna (Amphipoda, Mollusca, and Polychaeta) which are part of the temporary meiofauna. The amphipods occurred only in the January 1987 sampling period, but they did occur at all stations. The mollusks were composed of both bivalves and gastropods. Three groups were permanent meiofauna (Harpacticoida, Nematoda and other meiofauna). The category labeled "other" meiofauna were usually represented by rare forms, or forms which occurred in very low densities. At stations A and B this was mostly ostracods with some kinorynchs. At stations C and D this was mostly turbellarians, with some ostracods and kinorynchs. In July 1987 there were also a few mites in the C and D samples.

The meiofauna densities at stations A and B stayed relatively low ($0.251\times10^{6}\cdot m^{-2}$) and did not change over time. Nor were the densities at A and B significantly different from each other (Tukey multiple comparison test). In contrast, densities decreased over time at stations C and D and were on average about double that of the fresh stations ($0.512\times10^{6}\cdot m^{-2}$). Station C ($1.361\times10^{6}\cdot m^{-2}$) was always more dense than station D ($0.887\times10^{6}\cdot m^{-2}$) (Tukey multiple comparison test). Nematode composition of the meiofauna was similar to other marine environments at stations C and D at about 62%, but depauperate, only 35%, at stations A and B. The meiofauna densities covaried with salinity differences. Staying low at A and B when salinity was low, and decreasing at C and D as salinity decreased. Meiofauna densities were originally four times greater in marine stations than freshwater stations when salinity was high, but densities at C and D went down to the level of A and B when salinities became similar and fresh.

The labels used in this feeding experiment were also taken up by meiofauna in control experiments (Table 2). Formalin uptake averaged 12% of live uptake for ^{14}C, and 32% of live uptake for the ND treatment (Table 2). Formalin uptake averaged 32% of live uptake for tritium, and 56% of live uptake for the ND treatment (Table 2). About 70% of the tritiated label taken up was by non-feeding processes for mollusks, polychaetes and harpacticoids. About 40% of the ^{14}C label was taken up by non-feeding processes by mollusks, polychaetes and nematodes. The extensive uptake of label by non-feeding processes indicates the importance of using live controls in feeding experiments. Overall, the tritium is taken up at twice the rate of ^{14}C in the control experiments. This indicates that dissolved organic matter (thymidine) may also be incorporated (absorbed) by meiofauna. The other uptake process is adsorption (the formalin killed controls). Occasionally, label uptake was smaller in the feeding experiment than in the control experiments. This only occurred with nematodes and mollusks. The grazing rate was set to zero in all these cases.

Mollusks had the highest overall mean grazing rates on both bacteria and microalgae (Table 3). There were significant differences in grazing rates among stations and dates for both bacteria and microalgae (Table 4). In general grazing rates at the freshwater stations (A and B) were two orders of magnitude higher than in the marine influenced station (C and D) for both bacteria and microalgae (Table 4). Grazing rates were highest in summer (July) and lowest in winter (January) for both bacteria and microalgae (Table 4).

Amphipods occurred only in January and there were no differences in grazing rates among stations for bacteria (P=0.3992) or for microalgae (P=0.1229). Polychaetes also did not have significant differences in grazing rates among stations (P=0.5888 for bacteria and P=0.9032 for microalgae). Polychaetes had no differences in grazing rates on microalgae between seasons (P=0.1305), but grazing rates on bacteria were an order of magnitude higher in April than in January.

The situation for the permanent meiofauna (harpacticoids, nematodes, and others) was much more complex. Each group had significant interactions between stations and seasons for grazing on both bacteria and microalgae. In general nematodes had very low grazing rates (Table 3, Figures 2 and 3). The grazing rates on bacteria were often zero (Figure 2). The only time that nematodes had a reasonably high grazing rate was in the marine stations (C and D) during the winter (January) sampling period (Figure 3). Harpacticoid grazing rates were generally higher in the marine stations (C and D) for both bacteria (Figure 2) and microalgae (Figure 3). The only exception was a very low grazing rate on bacteria and microalgae at station C in July. Grazing rates by other meiofauna were highest at station B in January, and A in April and July for bacterial and microalgae, indicating a general trend of higher rates in the fresher stations.

Meiofaunal grazing rates were dominated by mollusks and other meiofauna for microalgae and just mollusks for bacteria (Table 5). All taxa had higher grazing rates on microalgae than on bacteria indicating that microalgae were being selected for over bacteria (Table 5).

The total meiofaunal grazing rate is the sum of the grazing rates of each taxa for each replicate. Not all taxa were found in all replicates, so the total rate does not equal the sum of the average taxa rates found in Table 3. The mean total meiofaunal grazing rate on bacteria was 0.0099 h^{-1} (with a coefficient of variation of 21%). The overall mean meiofaunal grazing rate on microalgae was about four times higher at 0.0411 h^{-1} (with a coefficient of variation of 24%). There were no significant differences for meiofauna grazing on microalgae during the three months (P=0.2477). However, there were differences between months for grazing on bacteria (Table 6). Higher rates were measured during July and April (which were the same) than in January (Table 6). This could easily be due to temperature effects alone. Station differences in grazing rates on both bacteria and microalgae were very similar (Table 6). The specific hypothesis that freshwater influenced stations (A and B) had different grazing rates than marine stations (C and D) was tested using linear contrast techniques and was significant. The average salinity at stations A and B was 6 ppt and at C and D 18 ppt over the course of this study (Table 1).

There were not large differences between either bacterial abundance or production in either of the fresh or saltier stations (Table 7). Bacterial abundance tended to increase with salinity. The marine stations had higher abundances than the fresh stations. Bacterial production did not correspond to station differences.

DISCUSSION

San Antonio Bay is part of the Guadalupe estuary. The estuary include the

Guadalupe and San Antonio River Basins. During this study the average salinities were 0.4 ppt at Station A, 2.4 ppt at B, 5.6 ppt at C, and 6.1 ppt at D. This was an extremely fresh period. The long-term historic average salinity at a Texas Water Commission monitoring site near station D is 18.9 ppt (TDWR, 1980). The stations were originally picked to represent two river influenced and two marine influenced sites. This design was successful. The average salinity at A and B was 1.4 ppt, which was much lower than the average at C and D which was 5.8 ppt (Table 1).

Grazing rates of total meiofauna on bacteria are 3½ times higher in freshwater influenced stations (0.0202 h^{-1}) than in marine influenced stations (0.0057 h^{-1}) (Table 6). This difference was due almost entirely to the dominance of juvenile mollusks in the grazing rates (Tables 4 and 5). Meiofauna densities in the marine stations were double that in the fresh stations, consequently the permanent meiofauna taxa had higher grazing rates in the marine influenced stations (Figure 2).

Since the grazing rates are 3½ times higher in the freshwater influenced stations than in the marine influenced stations, microbial productivity must be 3½ times greater in freshwater influenced stations than in marine stations so that food does not become limiting to benthic meiofauna. If this is not true than meiofauna could soon deplete the sediments in the freshwater zone of food, and there is no indication that is happening. Bacterial abundance or production changed little with either season or station (Table 7). In fact the average bacterial production was slightly higher in the marine influenced stations (2.32×10^6 cells$\cdot cm^{-3}\cdot h^{-1}$) than in the freshwater influenced stations (2.01×10^6 cells$\cdot cm^{-3}\cdot h^{-1}$). Oxygen consumption by sediments was also measured during the July sampling period (Montagna, unpublished data). The average respiration was almost twice as high at station A (2.1 mmol $O_2 \cdot m^{-2}\cdot h^{-1}$) as it was at station C (1.6 mmol $O_2 \cdot m^{-2}\cdot h^{-1}$). This would indicate that bacterial production may actually be higher in the freshwater influenced zone, but not by enough to explain the difference in grazing rates.

The average grazing rate on bacteria for the whole bay, 0.00990 h^{-1}, indicates that bacteria must turn over every 4.2 days to replace the biomass lost to meiofauna grazing. Such a rate seems fast compared to turnover times in other areas. Kemp (1987) reported a range of turnover times between 0.2 and 183 days for sediments. However, the average bacterial turnover time (abundance / production) we measured in San Antonio Bay is 766 h or about 32 days (Table 7). This is much slower than that required by meiofauna. We suspect that the production rates we measured using thymidine uptake rates were low for several reasons. It does not account for the grazing pressure. The average turnover time of 766 h for sediment bacteria is in the low end of the range of 11 studies reviewed by Kemp (1987). Finally, oxygen flux measurements are more than two orders of magnitude higher than bacterial production measurements made by the thymidine technique. Assuming a respiration quotient of 1, the oxygen uptake data indicates secondary production is in the range of 22 mg $C \cdot m^{-2} \cdot h^{-1}$ (Montagna, unpublished data). Using average bacterial cell volumes from July 1988 (Montagna, unpublished data) and conversion factors (Lee and Furhman, 1987), the average bacterial biomass is 10.2 $\mu g \cdot cm^{-3}$, and the average production rate would be 0.13 mg $C \cdot m^{-2} \cdot h^{-1}$. The alternative explanation is that most of the bacteria grazed is passing through the guts of meiofauna undigested, and still viable. However, this only needs to be true for juvenile macrofauna, since permanent meiofaunal grazing rates are low.

Protozoans are also bactivorous (Kemp, 1988), but were not examined during the current study. We can only assume that additional grazing pressure by protozoans would further increase the demand for bacterial biomass. However, Kemp (1988) estimated that ciliated protozoans only grazed 4% of the bacteria abundance per day in salt marsh, saline pond, and mangrove sediments. Changes in bacterial population abundances did not correlate with changes in protozoan abundance in tropical mangrove sandflats (Alongi, 1988) or microcosms (Alongi and Hanson, 1985). These studies indicate that protozoans may have a minor or no role in meiofaunal feeding experiments. In contrast, there is enhanced bacterial production and protozoan abundance on *Capitella capitata* tube caps (Alongi, 1985).

The bay-wide average grazing rates on bacteria measured in this study are three times higher than those measured in sandy sediments from San Francisco Bay, but only a third of those measured from salt marsh sediments in South Carolina (Table 8). The sediments in this study were fine subtidal muds.

Grazing rates of meiofauna on microalgae are two and one half times higher in freshwater influenced stations (0.0651 h^{-1}) than in marine influenced stations (0.0263 h^{-1}) (Table 6). This was due equally to juvenile mollusks and other meiofauna taxa, also having a strong influence (Table 5). Both of these groups had higher grazing rates in the fresher stations. Harpacticoids had higher rates at the more marine stations.

Microalgae in the water column and benthos were studied during these cruises by MacIntyre and Cullen (1988). In January 1987 both chlorophyll and productivity were higher in the marine than in the freshwater zone. In April a transition occurred, and by July biomass and production were much higher in the river influenced portion of the bay. A similar pattern of switching in feeding rates also occurred with harpacticoids and nematodes, but no the other meiofauna taxa (Figure 3). The average chlorophyll a content of the sediments (to a depth of 3 mm) during January, April and July was 4.5 $mg \cdot m^{-2}$ at A, 3.9 $mg \cdot m^{-2}$ at B, 5.8 $mg \cdot m^{-2}$ at C, and 5.4 $mg \cdot m^{-2}$ at D. Thus, the sediments of the marine zone had 33% more chlorophyll than the fresh zone. Average benthic midday production was 0.41 mg $C \cdot m^{-2} \cdot h^{-1}$ at station A, 0.48 mg $C \cdot m^{-2} \cdot h^{-1}$ at station B, 0.19 mg $C \cdot m^{-2} \cdot h^{-1}$ at station C, and 0.07 mg $C \cdot m^{-2} \cdot h^{-1}$ at station D. Thus, benthic production was about 2½ times greater in the freshwater influenced zone than in the marine influenced zone. Which is exactly the same ratio for the meiofauna grazing rates. Microalgal production in the sediment is only a small percentage of that in the water column. However, benthic production increases from 0.7% of total production in the freshwater zone to 2.3% of total production in the marine zone.

Apparently, nutrient input from the river stimulates microalgal growth, and this biomass is then advected down the bay with the currents. Meiofauna at the head of the bay respond by increasing their grazing rates, so that they receive as much food as they can before it passes them by. Other studies have shown the importance of flowing water in determining food availability to suspension feeders (Fréchette and Bourget, 1985). Since standing stocks are higher in the marine end of the bay, grazing rates can be lower, because biomass is high and advection might be low. Benthic filter feeders are known to be important in controlling phytoplankton biomass (Cloern, 1982).

The overall average grazing rate on microalgae was 0.0411 $h\cdot^{-1}$ (Table 8). This implies that microalgae would require turnover times of 24 h to be in equilibrium with the meiofaunal grazing rates. Assuming a carbon to chlorophyll ratio of 44.5 (de Jonge, 1980), the average microalgal biomass is 218 mg $C\cdot m^{-2}$. Since the overall average productivity is 0.288 mg $C\cdot m^{-2}\cdot h^{-1}$, the turnover time is about 758 h. This is much too slow for benthic microalgae to replace themselves due to losses by meiofaunal grazing. However, 38.8% of the grazing is by the filter feeding juveniles mollusks (Table 5) which probably are taking in water column microalgae as well. The grazing rate on microalgae by non-filter feeders is 0.00159 h^{-1}, which requires a turnover time of 63 h. Two factors explain the discordance between the high grazing rates, and low production values. First, is the fact that advection of algae is not accounted for, and this external supply of algae could easily make up the loss of algae due to grazing. Second, not all algae ingested are necessarily digested (Epp and Lewis, 1981). Zooplankton grazing is known to enhance algal growth by breaking up protective gelatinous sheaths and providing nutrients (Porter, 1976).

The average grazing rates on microalgae measured in this study are six times higher than those measured in South Carolina salt marsh sediments, and 51 times greater than those measured from San Francisco Bay sediments (Table 8). Microalgae are apparently being selected in Texas, but bacterial grazing rates are higher in South Carolina and California. In South Carolina and Texas meiofauna are having a large impact on microphytobenthos production. In contrast, meiofauna consumed only 10% of the microphytobenthos production in the Eems-Dollard estuary (Admiraal et al., 1983).

It appears as if meiofaunal grazing rates in San Antonio Bay are much greater than the microbial populations can support if all microbes ingested are also digested. However, that would be a totally unrealistic assumption. Laboratory studies have shown that harpacticoids can respire 25-38% of the ^{14}C label in 3 h during diatom feeding experiments (Decho, 1988). This indicates that assimilation efficiencies are near 62-75%.

Meiofauna also obtain their food from a variety of sources. Nematodes can be detritivores (Findlay, 1982), and harpacticoids can eat ciliates (Rieper, 1985). Harpacticoids (Decho and Fleeger, 1988) and nematodes (Lopez et al., 1979) also can have shifts in feeding preference from the juvenile to adult stages. Food production is not only production of bacterial, microalgal, and protozoan biomass. Detritus supply can also be important to meiofaunal organisms (Alongi and Hanson, 1985). Finally, dissolved organic matter can be important in the nutrition of meiofauna (Lopez et al., 1979; Montagna, 1984a). This is certainly true for juvenile mollusks, since 76% of the label uptake was due to non-adsorption, non-grazing processes (Table 1).

The grazing rates are remarkably different in the three different American estuaries. In all three estuaries temporary meiofauna, i.e., juvenile macrofauna dominate the grazing activity. Polychaetes were important in South Carolina, but relatively unimportant in Texas. Nematodes, harpacticoids and polychaetes have overlapping food requirements, and may be competitors for food resources (Alongi and Tenore, 1985). The relationship between meiofauna macrofauna and their microbial food is obviously very complex and very different in different environments. Nice, neat, simple and consistent explanations elude the authors, but certain factors are now obvious. Freshwater inflow, and the concomitant nutrients, does have a dramatic effect on meiofaunal grazing rates. This allows meiofauna to have grazing rates much greater than the turnover times or productivity rates of the food source would indicate, since advection replaces much of the grazed material. The juvenile macrofauna, i.e., temporary meiofauna, have a significant role as competitors to permanent meiofauna in benthic systems. Deposit feeding polychaetes are dominant grazers in intertidal depositional environments (like the South Carolina saltmarsh) and bivalves are the dominant grazers in subtidal environments dominated by flowing water (like San Antonio Bay).

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Table 1. Salinity (ppt) and temperature (°C) conditions at the San Antonio Bay stations during the experimental periods in 1987.

Date	Station	Salinity	Temperature
January 28	A	0.3	14.4
	B	0.4	14.8
January 30	C	6.5	15.5
	D	4.1	15.8
April 8	A	0.5	14.5
	B	6.3	15.2
April 10	C	9.2	14.5
	D	13.2	14.9
July 15	A	0.4	30.5
	B	0.4	30.5
July 17	C	1.1	30.5
	D	0.9	30.5

Table 2. Effect of treatment on average uptake of label (DPM•individual•2 h^{-1}) for each taxonomic group. Uptake is the average for all replicates. The three treatments were live feeding samples (L), control non-feeding samples (C), and formalin-killed controls (F).

	^{3}HTdR			$H^{14}CO_3^-$		
Taxa	L	C	F	L	C	F
Mollusks[1]	1580	1226	112	1037	386	117
Amphipods[1]	202	74	56	360	40	35
Polychaetes[1]	90	65	25	50	21	11
Others	17	9.1	13	25	2.6	1.6
Harpacticoids	14	9.5	3.5	14	3.8	1.2
Nematodes	12	3.6	3.3	3.4	1.3	0.5

[1] Juvenile macrofauna are part of the temporary meiofauna.

Table 3. Meiofaunal grazing rates (h^{-1}) on bacteria and microalgae. The rates are the overall averages for all stations and periods. Since some organisms were not found in all replicates the frequency of occurrence (n) is not always 36. Upper and lower 95% confidence intervals are uneven since the data is detransformed from logarithms.

Taxa	n	Bacteria		Microalgae	
		Mean	(L95%CI, U95%CI)	Mean	(L95%CI, U95%CI)
Mollusks[1]	30	0.003297	(0.001018,0.010629)	0.005968	(0.001681,0.021118)
Others	36	0.000730	(0.000498,0.001067)	0.005013	(0.003230,0.007778)
Harpacticoids	35	0.000546	(0.000331,0.000897)	0.002524	(0.001547,0.004113)
Polychaetes[1]	33	0.000164	(0.000098,0.000269)	0.000426	(0.000244,0.000737)
Amphipods[1]	5	0.000059	(0.000014,0.000188)	0.000643	(0.000173,0.002318)
Nematodes	36	0.000028	(0.000009,0.000068)	0.000816	(0.000476,0.001394)

[1] Juvenile macrofauna are part of the temporary meiofauna.

Table 4. Tukey multiple comparison tests on juvenile mollusk grazing rates for main effects in the experimental design. Lines indicate that the means are not significantly different at the 0.05 level. Mean grazing rates are in units of h^{-1}.

Grazing on bacteria	0.0201	0.0123	0.000668	0.000415
Station	B	A	C	D

Grazing on microalgae	0.0624	0.0172	0.000998	0.000862
Station	A	B	C	D

Grazing on bacteria	0.0131	0.00510	0.000437
Month	July	April	January

Grazing on microalgae	0.0226	0.0156	0.00551
Month	July	April	January

Table 5. Proportion and selection of microbes ingested. Proportion is the average per cent contribution of meiofaunal taxa to the total average meiofaunal grazing rate. Selection is the ratio of the average microalgae grazing rate (G_A) to the average bacterial grazing rate (G_B) for all samples.

	Proportion ingested		
Taxa	Algae	Bacteria	Selection (G_A/G_B)
Mollusks[1]	38.8%	68.3%	1.8X
Others	32.6%	15.1%	6.9X
Harpacticoids	16.4%	11.3%	4.6X
Nematodes	5.3%	0.6%	28.4X
Amphipods[1]	4.2%	1.2%	10.8X
Polychaetes[1]	2.8%	3.4%	2.6X

[1] Juvenile macrofauna are part of the temporary meiofauna.

Table 6. Tukey multiple comparison tests on total meiofaunal grazing rates for main effects in the experimental design. Lines indicate that the means are not significantly different at the 0.05 level. Mean grazing rates are in units of h^{-1}.

Grazing on bacteria	0.0292	0.0112	0.0073	0.0040
Station	B	A	C	D

Grazing on microalgae	0.0681	0.0621	0.0296	0.0229
Station	B	A	C	D

Grazing on bacteria	0.0243	0.0105	0.0038
Month	July	April	January

Table 7. Bacterial abundance and productivity in San Antonio Bay sediments. Average abundance and production for each month and station with the standard deviation in parentheses.

Month	Station	Abundance[1]	Production[2]
January	A	1.31 (0.31)	2.06 (0.62)
	B	2.00 (0.26	2.32 (0.87)
	C	2.02 (0.24)	2.65 (0.56)
	D	2.03 (0.17)	3.80 (0.89)
April	A	1.31 (0.21)	2.79 (0.65)
	B	0.77 (0.14)	1.53 (0.61)
	C	1.69 (0.21)	1.36 (0.82)
	D	2.03 (0.29)	2.35 (0.90)
July	A	1.86 (0.22)	2.13 (0.72)
	B	1.79 (0.24)	1.20 (0.78)
	C	2.15 (0.27)	2.53 (0.47)
	D	2.30 (0.27)	1.21 (0.85)

[1] Mean number: 10^9 cells•cm^{-3} (±standard deviation)

[2] Mean rate: 10^6 cells•cm^{-3}•h^{-1} (R^2)

Table 8. Average total meiofaunal grazing rates (h^{-1}) for all stations and seasons in three estuaries.

	Microalgae		Bacteria	
Area	Rate	CV	Rate	CV
San Antonio Bay, TX[1]	0.04110	24%	0.00990	21%
North Inlet, SC[2]	0.00648	32%	0.03372	89%
San Francisco Bay, CA[3]	0.00080	35%	0.00280	32%

[1] This study.

[2] Montagna, 1984b.

[3] Montagna and Bauer, 1988.

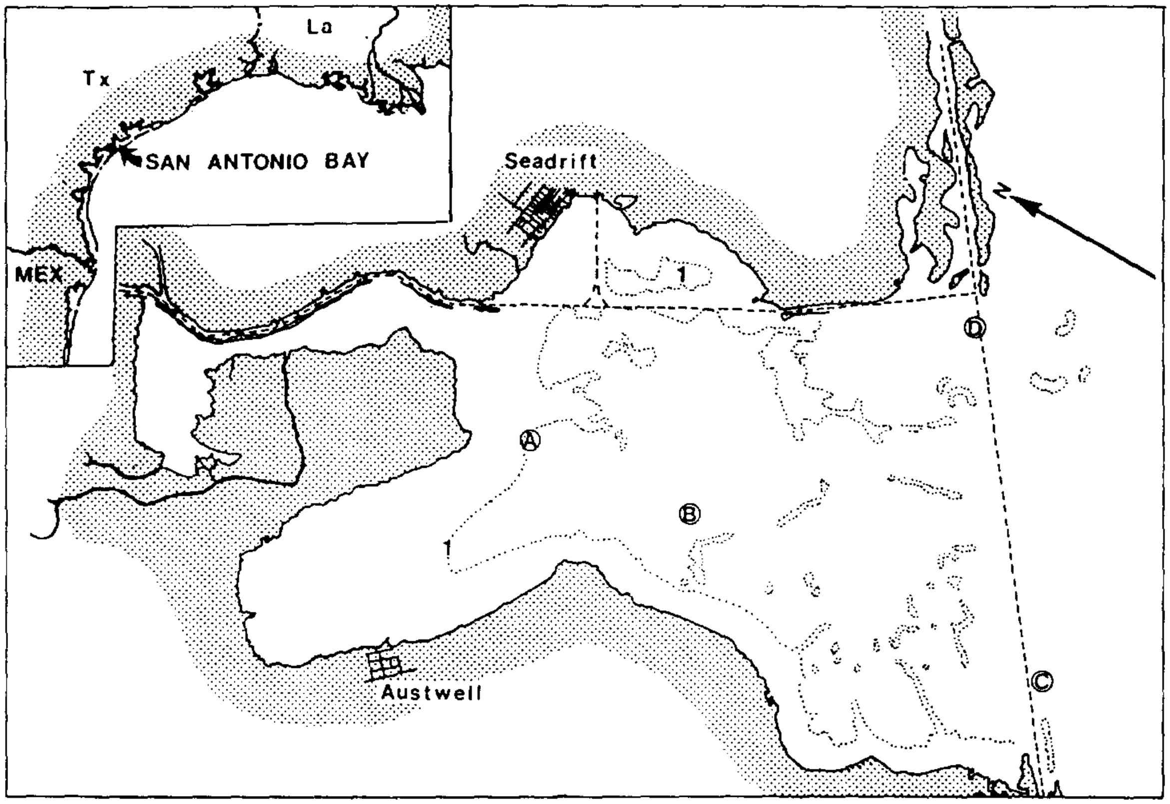

Figure 1. San Antonio Bay, Texas. The locations of the four sampling stations (A, B, C, and D) are shown. The Intracoastal Waterway is shown by a dashed line, and the 3 ft (1 m) contour is shown by a dotted line.

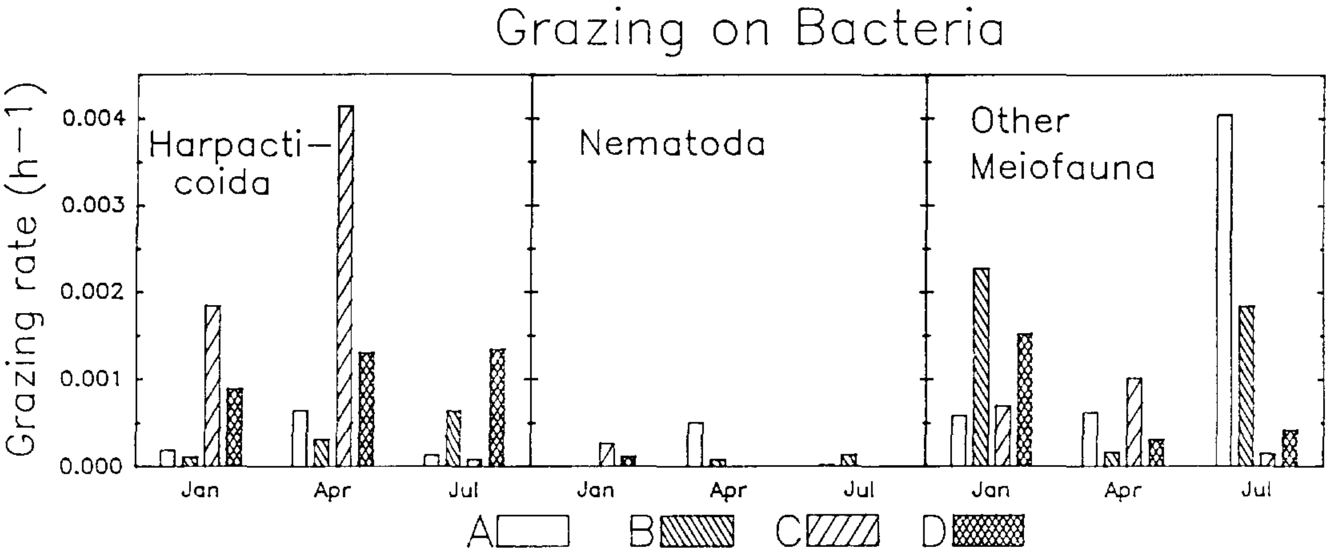

Figure 2. Mean meiofaunal grazing rates (h^{-1}) on bacteria in 1987. The interaction between stations and sampling periods was significant for all groups.

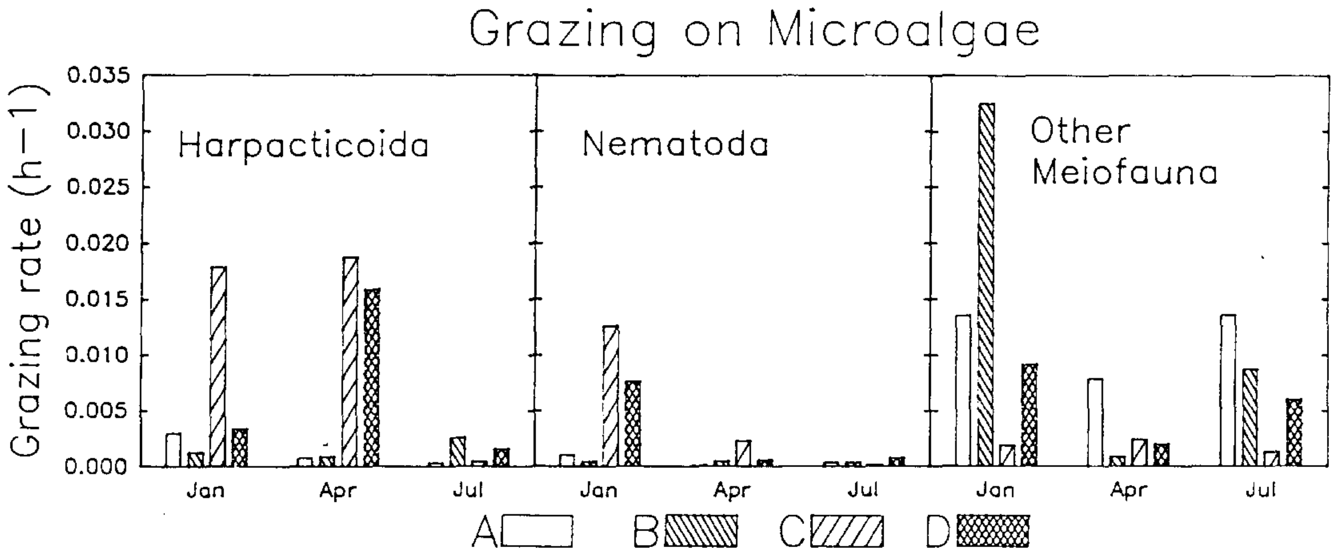

Figure 3. Mean meiofaunal grazing rates (h^{-1}) on microalgae in 1987. The interaction between stations and sampling periods was significant for all groups.

The Effect of Freshwater Inflow and Sediment Resuspension on Benthic Metabolism and Nutrient Regeneration in the Guadalupe and Nueces Estuaries, Texas

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ABSTRACT

Current flow has the potential to increase photosynthesis by resuspending large quantities of chlorophyll, and limiting nutrients into the water column. Resuspension can also enhance the decomposition of sediment organic matter by making buried organic matter available to aerobes and increasing rates of diffusion of metabolites, thus "stirring the pot". Increased flow rates do increase flux of sediment, chlorophyll, ammonia, nitrite, phosphate, and silicate to the water column, but decrease nitrate flux. The nitrate uptake and chlorophyll resuspension indicate that photosynthesis is probably enhanced by resuspension. However, increased photosynthesis is mitigated by increased turbidity and because resuspended pigment has low chlorophyll to phaeophytin ratios. The net effect is that increased current flow does not always result in increased oxygen consumption, since photosynthesis may be stimulated, but this is counter balanced by chemical oxidation of reduced ions released from the sediment. Spatial and temporal variability of both oxygen consumption and nutrient flux were not detectable within estuaries. Rates of benthic metabolism

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and nutrient recycling were much higher in the wet Guadalupe Estuary than in the dry Nueces Estuary. Indicating that there are significant differences due to freshwater inflow.

INTRODUCTION

As rivers flow down to the sea they bring sediments and nutrients into our bays and estuaries. This new nitrogen (N) and phosphorous (P) can stimulate primary production in estuaries (Nixon et al., 1986). Regeneration and recycling (old N and P) can supply 28 - 35% of the N and P required for primary production in estuaries (Nixon et al., 1976; Fisher et al., 1982). However, any productivity stimulation is mitigated by the turbidity caused by the sediment load which decreases light penetration and results in lower rates of photosynthesis (MacIntyre and Cullen, 1989). Resuspension of sediment also increases turbidity resulting in further inhibition of photosynthetic potential. Much of the sediment load contains organic matter which was originally buried in the upper reaches of the estuary. When this organic matter is metabolized nutrients are recycled into the water column and can further stimulate primary production Nixon et al., 1976).

Texas estuaries are very broad, shallow and windswept. This results in a great deal of resuspension and unconsolidated sediments. The turbidity in the Texas estuaries is typically quite high. On one hand the nutrient loading should increase productivity, on the other hand the turbid waters should limit productivity. River born particles should increase sedimentation rates, yet the wind churned waters maintain much of this sediment load in the water column and it is advected downstream. Desorption of ammonia occurs during resuspension (Simon, 1989). Benthos not only supplies recycled nutrients, but can also enhance the rate of pelagic recycling (Doering, 1989). Resuspension should increase diffusion and release of nutrients across the benthic boundary layer, and result in pumping nutrients out of the sediment.

If freshwater inflow increases productivity then the increased amounts of organic matter should result in increased amounts of benthic metabolism and nutrient regeneration. Over a 35-year period, between 1941 and 1976, the freshwater inflow balance (i.e., gains minus losses) in the Guadalupe estuary is on average five times greater than in the Nueces estuary (TDWR, 1980; 1981). This indicates that the estuaries are very different with regard to inflow. If there are differences due to inflow, then there should be differences in benthic metabolism and nutrient regeneration among the estuaries, and along salinity gradients within the estuary. Oxygen uptake is an good measure of total aerobic metabolism in sediments (Patching and Raine, 1983; Howes et al., 1984). Resuspension should increase the flux of nutrients out of the sediments, thus increasing rates of chemical oxidation (Boynton et al., 1981). Benthic chambers, in which resuspension could be varied, were employed to monitor changes in sediments, chlorophyll, oxygen and nutrient concentrations over time. These chambers were deployed along salinity gradients in the two estuaries with different inflow characteristics.

MATERIALS AND METHODS

Study design. The Guadalupe Estuary is composed of the Guadalupe and San Antonio Rivers which flow into San Antonio Bay (Figure 1). Over a 35-year period the Guadalupe Estuary received an average of 2.80×10^9 $m^3 \cdot y^{-1}$ of freshwater input, and the freshwater balance (input-output) was 2.54×10^9 $m^3 \cdot y^{-1}$ (TDWR, 1980). Two stations were occupied: a freshwater influenced station at the head of the Bay (station A), and a marine influenced station at the foot of the bay and south of the Intracoastal Waterway (station C) (Figure 1). Four field experiments were performed (November 1986, and January, April, and July 1987). Extensive field testing and validation of the benthic chamber system was performed during the July trip. Two other stations were also occupied. a second freshwater station (B) and a second marine influenced station (D). Only sediment samples were taken at these two station. Macrofauna and meiofauna samples were taken at all four stations and are reported on elsewhere (Montagna and Kalke, 1989).

This first study concentrated on the role of current flow and resuspension on metabolism and nutrient flux. Current velocities of 0, 0.1, 4.7, 8.4, 13.9, and 19.5 $cm \cdot s^{-1}$ were used because they simulate the range of currents found in

San Antonio Bay (Tony Amos, personal communication). Experiments were performed twice each day, once in the morning and in the afternoon. Diel differences were never found, so the two deployments are treated as replicates in the statistical analyses. Changes in the concentrations of nutrients, suspended sediments, and chlorophyll were measured during all trips. Oxygen concentration changes were measured during all the 1987 trips. Only clear chambers were deployed, so oxygen change should represent net primary production, and changes in nutrient concentration are the result of heterotrophic and photosynthetic processes carried out by bacteria and microalgae. However, in practice, changes are probably only due to bacterial metabolic processes, e.g., aerobic respiration. This is because the turbidity is so high at the sediment surface that no photosynthesis is taking place. MacIntyre and Cullen (1989) measured midday sediment photosynthesis at the same time that the chamber work was in progress. They found negligible photosynthesis at station A in July (1.2 mg C $\cdot$ m^{-2} $\cdot$ h^{-1}), and at station C in April (0.6 mg C $\cdot$ m^{-2} $\cdot$ h^{-1}). Sediment photosynthesis was 0 at station A or C in January, or A in April and C in July.

The second study was performed in the Nueces Estuary. The Nueces Estuary is composed of the Nueces River which flows into Nueces Bay, which is connected to Corpus Christi Bay (Figure 1). Over a 35-year period the Nueces Estuary received an average of 0.84×10^9 $m^3 \cdot y^{-1}$ of freshwater input, and the freshwater balance (input-output) was 0.51×10^9 $m^3 \cdot y^{-1}$ (TDWR, 1981). This system was studied in October 1987 - July 1988. Four Stations were occupied along the axis of the system. Two stations were in Nueces Bay (A and B), and Two stations were in Corpus Christi Bay (C and D) (Figure 1). Six bimonthly field experiments were performed. This study focused on temporal and spatial variability, and the effect of light on metabolism and nutrient flux. Light and dark chambers were used to distinguish between oxygen production and consumption. Changes in concentrations of oxygen, nutrients, chlorophyll, and suspended sediments were measured. Chambers with and without sediment resuspension (where the current flow was 19.5 cm $\cdot$ s^{-1}) were an additional treatment in the design. Macrofauna and meiofauna samples were taken at all four stations and are reported on elsewhere (Montagna and Kalke, 1989).

Chamber design. The goal in designing the benthic chamber was to produce an inexpensive chamber with reasonable flow characteristics. It had to be inexpensive because as many as eight synoptic replicate measurements were planned. Good flow characteristics include even erosion of sediment along the entire bottom of the chamber, replicable flow rates within the chamber, and a lack of a vertical gradient within the chamber. The chamber also had to be recirculating, and the water totally contained with no headspace, so that changes in chemical constituents could be measured. The chamber was designed like an annular flume (Taghon et al., 1984). An acrylic tube was cemented inside of a Nalgene polycarbonate aquaria yielding a racetrack 17.7 cm wide and 19 cm high, containing 11.17 l water, and covering an area of 588.0 cm^{-2} of sediment (Figure 2). Water was recirculated with a small bilge pump (Rule 500) placed outside the chamber so that the water would not be heated by the motor. This design is similar to one used by Fisher et al. (1982). Flow characteristics within the chambers are obviously very turbulent. Although these chambers could be called in situ annular flumes, it might be inappropriate for these devices to be used in the measurement of shear stress, critical erosion velocities, or sediment transport. The flow in the chambers was very turbulent, but from personal experience while diving, it is also very turbulent in the bays we studied. Current speeds were calibrated against voltage supplied by the reostat (Figure 2) by timing the number of laps made by floating particles in a fixed period of time. A total of 330 trials were performed. The relationship between voltage and current speed was fairly linear (R^2=0.91, Figure 3).

Four chambers were mounted on an aluminum rack so that they could be placed on the bottom simultaneously. Chambers had five syringe ports (leur locks) mounted horizontally to subsample water within the chamber. The top had two large holes, so that the chambers could be placed in the sediment (11 cm penetration) without creating excess water pressure. The chambers were left unstoppered for 30 min after deployment to let resuspended sediments settle, and reduced ions that may have been released to oxidize. For reasons explained in the results section, initial subsamples for nutrient analysis were taken 30 min after the chambers were stoppered.

Experiments were conducted to analyze the performance of the chambers. Flow rates within chambers were measured by timing particle circulation. Evenness of erosion was tested by measuring Tums dissolution at varying spots along the bottom of the chamber (Figure 4). The dissolution experiment was repeated three times, at two flow rates. The presence of vertical gradients within the chambers were tested by mounting the subsampling devices vertically within a special calibration chamber (Figure 5). Sampling was performed at 4, 8, 12, and 16 cm above the sediment surface.

Chemical measurements. Oxygen concentration changes were measured using Winkler titrations (Strickland and Parsons, 1972) during the January trip in San Antonio Bay, and with electrodes in all trips in both bays thereafter. Four chambers were outfitted with pulsed oxygen electrodes (Endeco, Inc., Marion, MA). These electrodes are of a new design in which the measurement of oxygen concentration is flow-insensitive (Langdon, 1984). The four electrodes are then connected to a Pulsed D.O. Sensor (T.M.) which controls the timing of the electrical pulses sent to each probe. These pulses are the sampling times. Data is interpreted by the Pulsed D.O. Sensor and logged automatically on a portable computer (Figure 2). In this way oxygen concentrations can be monitored continuously in four chambers. By measuring the changes in oxygen concentration over time, and adjusting for the area of sediment covered by the chamber and the volume of water contained in the chamber, the rates of benthic respiration and photosynthesis were calculated.

From the water subsamples the concentrations of ammonia, nitrate, nitrite, phosphate and silicate in fresh samples using highly precise techniques (Whitledge et al., 1986). Chlorophyll and turbidity were also measured. Flux of nutrients, sediment and chlorophyll were calculated.

The vertical distribution of the Carbon and Nitrogen content of sediments was measured in San Antonio Bay in January 1987. Ten cm cores were sectioned every cm. The top 1 cm of sediment was measured in April and June to determine if there were changes over time. Sediments were prepared for analysis of total organic Carbon (TOC) and Nitrogen (TON) by drying at 50 °C for 24 h, after which they were ground into a fine powder with a mortar and pestle. Inorganic carbon was removed from subsamples of the powdered sediments by allowing them to react with concentrated HCL vapor (Hedges and Stern, 1984). A thin layer of powder form each sample was spread on the bottom of a glass dish and placed in a desiccator. A petri dish containing HCL was placed in the bottom of the desiccator for 4 d. Any shell fragments present in the sediment samples reacted completely with the acid during this treatment. Samples were placed in clean vials and diluted with distilled water. The supernatant was drawn off after 24 h, and the samples were again brought to dryness and stored. Although Froelich (1980) demonstrated losses of organic Carbon of 5-45% by aqueous acid treatment, the distilled water was deemed necessary to avoid damage to the CHN analyzer. A Perkin-Elmer 240B elemental analyzer was used for sample analysis. Sample sizes of about 120 mg for sediments were necessary for adequate detection of TOC. Both HCL treated (TOC) and untreated (TOC+TOiC) portions of each sediment were analyzed, the difference between the fractions represents total inorganic carbon content.

Chlorophyll *a* and phaeophytin *a* concentration was determined flurometrically from 90% acetone extracted samples using the acid addition technique. Suspended sediments were measured as turbidity in JTU units using a Hach photometer. Turbidity was converted to suspended sediment (SS) concentration by making a standard curve of turbidity vs dry weight of filtered sediments. There was a linear relationship between JTU and SS (R^2=0.99, SS (mg · 1^{-1}) = 3.125×(JTU) +0.09688).

Statistical analyses. Flux rates were estimated by calculating the change in concentration of a variable over time, and adjusting it for the volume of water in the chamber, and the area of sediment that was covered. Oxygen concentration was sampled every 5 minutes by the electrodes. Nutrients were generally sampled four times. Chlorophyll and suspended sediments were usually only measured at the end of an experiment, so are not always reported as flux.

In San Antonio Bay a partially hierarchical analysis of covariance (ANCOVA) was used to test for differences in flux of oxygen, nutrients, chlorophyll, and suspended sediments between the two stations and four sampling dates as a function of water current speed. Each sampling date the experiment was run three times; in the morning, midday, and in the late afternoon. However, these three deployments are not a fully crossed effects, since you can never repeat the same circumstances during all deployments. That is, each deployment is unique to each station and date combination. Therefore each deployment is more like a replicate, which is a nested effect. The statistical model used was:

$$Y_{ijkl} = \mu + \alpha_j + \beta_k + \alpha\beta_{jk} + \gamma_{l(jk)} + X_m + \epsilon_{i(jklm)},$$

where: μ = overall sample mean, α_j = main effect of sampling date, β_k = main effect of stations, $\gamma_{l(jk)}$ = nested effect for replicate deployment, X_m = covariate for current flow, $\epsilon_{i(jklm)}$ = random error for each observation. The expected mean squares were calculated for each term, and the mean square of the interaction term ($\alpha\beta_{jk}$) is the proper denominator for the F-test for the date and station terms. The covariance part of this analysis is a two step process. First, we test for parallel effects of the response vs. current flow over all treatments, then we fit a common slope through all points. Least square means were used to determine the differences between treatments.

In the Nueces Estuary, a three-way analysis of variance (ANOVA) was used to determine in there was differences in flux of oxygen, nutrients, chlorophyll, and suspended sediments between the four stations and six sampling dates, and the presence or absence of current flow within the chamber. Each sampling date the experiment was run two times.

Pearson product correlation coefficients were used to determine if there were any linear relationships between salinity, water inflow, and temperature with the responses of the flux of oxygen, nutrients, chlorophyll, and suspended sediments. Tukey multiple comparison tests were used to find *a posteriori* differences between sample means of stations, dates, and flow combinations. Linear contrasts were used to find *a priori* differences between the freshwater influenced and marine influenced stations.

RESULTS

Freshwater inflow differences between estuaries. In the Guadalupe Estuary (and San Antonio Bay), 1987 was a wet year, with more rainfall and concomitant inflow than in the previous 35-year record. The freshwater balance for 1987 was $5.05\times10^9\ m^3 \cdot y^{-1}$, which is three times higher than the 35-year average. This was primarily due to a large rainfall and resulting flooding event in June 1987. Salinity levels in the lower part of San Antonio Bay were as high as 14 ppt in the spring, but were uniformly near zero after the flood in July. The average salinity at stations A and B was 6 ppt and at C and D 18 ppt over the course of this study.

In the Nueces Estuary (Nueces and Corpus Christi Bays), the sampling period between October 1987 and July 1988 was a very dry period. The inflow balance for that annual period was $-0.66\times10^9 \cdot m^{-3}$. In contrast, the 35-year average was $0.51 \times10^9\ m^3 \cdot y^{-1}$ (TDWR, 1981). By the end of the study period salinities were higher than marine water that is typical of the Gulf of Mexico. The average salinities at station A was 31 ppt, B was 33 ppt, C was 33 ppt, and D was 34.

Chamber calibration. In the laboratory there was no difference in the change in weight of Tums placed in the inner, center or outer edges of the chambers when water was flowing at $18\ cm\cdot s^{-1}$ (P=0.9061). There was also no difference in Tums erosion along the axis of the bed being eroded (P=0.2662). The chambers apparently will not selectively erode sediment along either edges or within spot of the sampling area. Whatever flow conditions exist in the chamber, they are even through out.

In the field (San Antonio Bay) turbidity increased rapidly with time, but there were no vertical differences in turbidity within chambers (Figure 6A, and 7A). Sediments are not infinitely erodible. Initially there is a great rate of erosion, and turbidity increases very rapidly. Between 20 and 40 min turbidity levels off or increases at a slow constant rate for up to two h.

Oxygen change was also not different vertically at station A in San Antonio Bay (Figure 6B). At station C in San Antonio Bay oxygen decreased rapidly at the depth closest to the sediment surface, but after 20 min, the rate of change was the same in all vertical samples within a chamber (Figure 7B).

Chlorophyll *a* also increased rapidly within the chambers, following turbidity curves very closely (Figure 8A). This would indicate that resuspension events have the potential to increase photosynthesis, since biomass is increasing. However, the Chlorophyll:Phaeophytin ratio decreased by 100% with the resuspension events (Figure 8B), indicating that most of the pigment being resuspended may have already passed through grazers guts, or that the pigment is very shade adapted.

Accuracy vs precision. As indicated in Figures 6B and 7B the pulsed D.O. probes can very precisely measure changes in oxygen concentration within a chamber. The precision of the calculated oxygen fluxes is very high 95% on average (or only 5% error). One field experiment was performed (in Corpus Christi Bay station C) where 16 deployments of the dark chambers were made over a three day period to assess accuracy of each measurement. The average oxygen flux was 0.878 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$, the standard deviation was 0.310, and the data was normally distributed (P=0.814). This indicates the coefficient of variation is 35%. Whereas, oxygen measurements can be made very precisely (within 5%), there is considerable variation in spatial heterogeneity of these measurements within a given site at any one time (35%).

San Antonio Bay (flux vs. flow). During most experiments suspended sediments (measured as JTU turbidity units) and chlorophyll concentration was measured only at the end of the experiments. Since these experiments were 3 h long, the concentrations of sediments and pigments represent maximum concentrations due to resuspension. There was a semi-log linear relationship between current flow regimes and turbidity (Figure 9). There were interactions between the dates and stations (P=0.0001), and the slopes of those cells were not parallel (P=0.0002). This was due largely to different initial conditions during different deployments. When wind was high there was not much sediment to erode, but when the seas were calm, a great deal of sediment can be resuspended. Both measures of pigments increased in the same semi-log linear fashion (Figures 10 and 11). Chlorophyll concentrations also did not have parallel responses among dates and stations (P=0.0266), but phaeophytin did (P=0.1455). Although both pigments increased with current speed, the chlorophyll to phaeophytin ratio decreased (Figure 12).

Sediment flux was measured in July 1987 at both stations A and C (Figure 13). There were no differences in sediment flux as a function of flow between either station A or C (P=0.1607). Although, a straight line fits the data (R^2=0.74), there appears to be a step function. Resuspension did not occur below water currents of about 10 $\text{cm}\cdot\text{s}^{-1}$. Below those current speeds there was a mean sedimentation rate of 3.2 $\text{g}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$ at both stations (Figure 13). Above 10

$cm \cdot s^{-1}$, the mean sediment resuspension rate into the water column was 12.7 $g \cdot m^{-2} \cdot h^{-1}$.

Oxygen flux did not appear to change with increasing flow at stations A and C (Figure 14, *P*=0.4894). Oxygen flux was not different between stations (*P*=0.5933) or dates (*P*=0.8315). The overall average rate of oxygen flux was -1.85 $mmol \cdot m^{-2} \cdot h^{-1}$, with a coefficient of variation (CV) of 195%. There was a positive linear relationship with oxygen flux and salinity (Figure 15). This was primarily due to higher salinities and oxygen fluxes at station C in January 1987 (Figure 15).

Ammonia (Figure 16) and nitrite (Figure 17) flux appear to increase at both stations with increasing flow. In contrast, nitrate flux appeared to decrease with increasing flow (Figure 18). ANCOVA demonstrated these trends were all statistically significant (*P*=0.0068, 0.0036, and 0.0266 respectively). However, the ammonia trend was not found in a simple correlation analysis (Table 1). There were no significant differences between dates and stations for any of the nitrogen nutrient fluxes. Phosphate appears to be releasing from sediments with increasing flow (Figure 19), but this was not significant (ANCOVA, *P*=0.1091). In contrast, simple correlation analysis suggested it was significant (Table 1). There were no significant differences between dates and stations. Silicate seemed to be sedimenting regardless of flow regimes (Table 1, Figure 20, ANVOVA *P*=0.1866). There were no significant differences in silicate flux between stations and dates.

Sediment TOC was higher at stations A and B averaging 1.21% than at stations C and D which averaged 0.76% by dry weight (*P*=0.0001). There appeared to be a decreasing amount of TOC with increasing depth in sediment at stations B and D (Figure 21), but the overall main effect for depth differences was not significant (*P*=0.2712). Total sediment nitrogen content was higher at station A (0.120%) than all the other stations which were the same (0.088%) (Tukey test). There were also differences in N content with respect to sediment depth (*P*=0.0070). The C/N ratio was highest at station B (14.0) and the same at stations C, A, and D, (9.9, 9.4, and 8.0 respectively) (Tukey test). There was no seasonal change in C, N, or C/N ratios in the top cm of sediment between January, April, and July 1987.

Nueces and Corpus Christi Bays (flux vs. temporal, spatial, and light variability). As a result of the San Antonio Bay experiment, it was determined that varying current flow was of little value. So, just two treatments, flow (19.5 cm $\cdot$ s^{-1}) and no flow was investigated, and therefore we were able to add light and dark treatments to the design.

There was a large difference in the sediment resuspension between chambers with and without current flow at 19.5 cm $\cdot$ s^{-1} (P=0.0001, 3-way ANOVA). The overall average flux for chambers without resuspension was -0.503 $g \cdot m^{-2} \cdot h^{-1}$, and 1.23 g $\cdot$ m^{-2} $\cdot$ h^{-1} in chambers with resuspension. Suspended sediments settled and resuspended at different rates among stations (P=0.0332, Figure 23), but were the same among stations and dates (P=0.2186, Figure 24). There were differences in sediment flux between dates (P=0.0440, Figure 24). There was more sediment flux at stations C and D than in B and A.

Chlorophyll flux behaved in a simpler way, that is, there were no interactions among stations or dates with flow. But there were differences among stations (P=0.0064, Figure 25), and dates (P=0.0033, Figure 25). The overall average flux for chambers without resuspension was -0.114 $mg \cdot m^{-2} \cdot h^{-1}$, and 0.243 mg $\cdot$ m^{-2} $\cdot$ h^{-1} in chambers with resuspension. There was more chlorophyll flux at stations D and C than in A and B.

Oxygen consumption and production rates were very variable (Table 2). No statistically significant trends in gross photosynthesis or respiration were evident in the data (Table 3). Neither were there any significant correlations with either salinity and temperature with gross photosynthesis or respiration (Table 4). Although, the inverse correlation of gross photosynthesis under resuspension with salinity (P=0.0528) and temperature (P=0.0574) was barely insignificant. The respiration rate under flow conditions was significantly correlated with temperature (Table 4). Respiration always increased as a function of current flow in all stations (Figure 27), and at all dates except May 1988 (Figure 28). Net photosynthesis decreased as a function of flow at stations B, C, and D, but not A (Figure 27), and in all months (Figure 28). The overall average gross photosynthesis rate without flow was 0.584 $mmol \cdot m^{-2} \cdot h^{-1}$, and the average respiration rate was -0.799 $mmol \cdot m^{-2} \cdot h^{-1}$. The overall average gross photosynthesis rate with flow was 0.639 $mmol \cdot m^{-2} \cdot h^{-1}$, and the average respiration rate was -1.330 mmol•m^{-2}•h^{-1}. These results indicate that consumption was about twice as high as production overall, and resuspension increased consumption almost twice as much as it increased production.

Nutrient fluxes were highly variable (Table 5). In fact, there was so much variability that no statistically significant differences were found for nutrient flux in any of the main effects in the three-way ANOVAs. However, some trends are suggested by the figures of the data. Ammonia flux almost always decreased in the chambers with flow (Figures 29 and 30). This was also statistically significant (P=0.0240, linear contrast). This is the opposite of what would be expected if sediment erosion was releasing reduced ions. Ammonia flux to the water column always increased in the light chamber relative to the dark chambers (Figures 29 and 30). This indicates some photosynthetic process is responsible for recycling sediment originated ammonia. The same trend was apparent for nitrite (Figures 31 and 32), but not nitrate (Figure 33 and 34). Nitrate flux did decrease with flow, but generally also decreased with light. This indicates that nitrate may not have been taken up by photoautotrophs. Phosphate flux did not exhibit any consistent patterns (Figures 35 and 36). Silicate flux was almost always positive (Figures 37 and 38). Silicate flux generally increased with light, but did not respond in any consistent pattern with flow. No statistically significant trends of nutrient flux with salinity or temperature were observed (Table 6).

DISCUSSION

The chambers seemed to work well. Erosion was even along the bottom of the chambers. In San Antonio Bay, the turbidity and oxygen changes vertically and with respect to time (Figures 6 and 7) indicate that there is an initial equilibration period in the chambers lasting about 30 min. After this period the environment in the chamber is more stable. For this reason initial subsamples for nutrient analyses were taken 30 min after the experiment was started.

Sediment concentration within chambers is apparently log-linear with respect to increasing water flow (Figure 9). Sediment flux in San Antonio Bay is linear with respect to increasing water flow (Figure 13). A step model also fits the data, but only increase R^2 by 7%. A linear model implies that sediment will be deposited at speeds below 6.5 $cm \cdot s^{-1}$, and resuspended above that speed. A step model predicts this net null flux speed to be closer to 10 $cm \cdot s^{-1}$. The sediments at both San Antonio Bay stations where this experiment was performed were very similar (Montagna and Kalke, 1989). Both stations were dominated by silt (33% at A and 35% at C) and clay (29% at A and 41% at C).

Sediment resuspension indicates that the inventory of sediment diatoms could be resuspended into the water column and thus increase rates of photosynthesis. Resuspension should also facilitate production by increasing nutrient flux of reduced ions from the sediment to the water. Chlorophyll and phaeophytin concentrations do appear to have a positive log-linear relationship with current flow (Figures 10 and 11). But the chlorophyll to phaeophytin ratio decreases with current flow (Figure 12). This implies that the resuspended pigment is coming from shade-adapted microphytobenthos, or that the diatoms have already been heavily grazed upon. We know meiofauna grazing rates are very high in San Antonio Bay (Montagna and Yoon, 1989). The low chlorophyll to phaeophytin ratio also implies that photosynthesis increases may not be as high as predicted by the linear increase in chlorophyll resuspension. Primary production in bottom waters in San Antonio Bay during the this study were on average only 1.5% that in the water column (MacIntyre and Cullen, 1989). The low productivity is obviously a result of the light attenuation by the high turbidity resulting from the resuspended sediment.

The net effect of increased chlorophyll but decreased light might result in no net gains in photosynthetic oxygen production with respect to current flow. This appears to be true in San Antonio Bay (Figure 14). This is also one reason why ammonia flux increases with increasing flow (Figure 16). Resuspension can increase the flux of reduced ions out of the anaerobic sediments. When in the water column these ions are available to photoautotrophs as nutrients. But, the photoautotrophs must compete with chemical oxidation for the reduced ions. Nitrate flux also increased with flow (Figure 17), but nitrate flux decreased. Since only the most oxidized form of Nitrogen decreased with flow. We can conclude that there was not photoautotrophic uptake, and most transformations were due to chemical oxidation.

In Nueces Estuary (Nueces and Corpus Christi Bays) we used only the highest current speed and no flow at all. This allowed us to add light and dark chambers to the design of the experiment. Comparisons of chemical fluxes with San Antonio Bay should only be made between light chambers (Table 7).

Sediment and pigments in Nueces Estuary responded the same way they did in San Antonio Bay (Figures 23 - 26). Oxygen flux responded in the opposite fashion, decreasing with high flow (Figure 28 and 29). Oxygen flux increased in the light chambers over the dark chambers without flow, but the pattern generally decreased with flow.

Ammonia flux increased with flow in San Antonio Bay (Figure 16), but generally decreased with flow in the Nueces Estuary (except the light chambers at station B, in October) (Figures 29-30). Nitrite increased with flow in the Guadalupe (Figure 17) and the Nueces Estuaries (except in the dark chambers at station C). (Figures 31 and 32). Nitrate flux decreased with flow in the Guadalupe (Figure 18), but increased with respect to flow in the Nueces Estuaries (Figures 33 and 34). Corredor and Morell (1989) found ammonia release, and nitrite and nitrate uptake by sediments in a tropical lagoon. Asmus (1986) found ammonia release, and nitrite and nitrate uptake by sediments in a seagrass bed. Simon (1989) also found ammonia release from estuarine sediments with resuspension, and called this process desorption. Raine and Patching (1980) found a positive correlation between oxygen flux and ammonia release in sediments from a semi-enclosed bay.

Since the nitrate was taken up and the ammonia and nitrite were released, this implies that there was photosynthesis occurring in the light chambers. But when, the sediment was resuspended oxygen demand increases, and photosynthesis does not. The flux of reduced ions out of the sediments was met with chemical oxygen demand, and perhaps increased aerobic respiration by bacteria.

Benthic metabolism and nutrient recycling does not have any obvious correlation with salinity. The one exception was with oxygen flux in Nueces Estuary, but this could be an artifact induced by outliers in the data. However, it may not be reasonable to assume that the only direct measure of the influence of freshwater inflow is a linear correlation with salinity. Sediment particles and nutrients are brought down the rivers. Transformations of the chemical species are then advected to lower reaches of the estuary. Thus, stations at upper and lower reaches of the estuary can have similar parameters (and no correlation with salinity), but the rates at the lower end is supported by advected nutrients from the upper end. That is, without the transformations in the river influenced parts of the bays, the marine influenced parts of the bays could not maintain their productivity.

The Guadalupe Estuary, with greater freshwater influence, had a much greater range in responses than the Nueces Estuary indicating greater metabolism and nutrient recycling (Table 7). Oxygen flux ranged from -12 to 8 mmol • m^{-2} • h^{-1} in the Guadalupe, but only from -3 to 3 in the Nueces. This indicates high potential production and consumption of carbon in the estuaries with greater freshwater influence. This could explain why macrofauna densities were 50% greater in the more freshwater influenced estuary. The average density during this study was 19,210 • m^{-2} in the Guadalupe, and 13,690 • m^{-2} in the Nueces (Montagna and Kalke, 1989). The average biomass was 4.67 g • m^{-2} in the Guadalupe, and 4.36 g • m^{-2} in the Nueces (Montagna and Kalke, 1989). These values are similar, indicating there are perhaps more smaller sized or juvenile organisms in the Guadalupe Estuary. In contrast, the meiofauna densities were 99% higher in the Nueces than in the Guadalupe. The average density of meiofauna during this study was 0.69×10^{6} • m^{-2} in the Guadalupe, and 1.37×10^{6} • m^{-2} in the Nueces (Montagna and Kalke, 1989).

The overall average net photosynthesis values indicate that metabolism in the Guadalupe Estuary is 8× higher in than in the Nueces Estuary when there is no resuspension and 3× higher when there is resuspension due to current speeds of 19.5 cm • s^{-1} (Table 7). Oxygen consumption increased slightly with resuspension. Ammonia was released with flow in the Guadalupe, and taken up in the Nueces Estuaries (Table 7). The effect of resuspension was generally consistent in both estuaries. Nitrite and phosphate flux increased with flow, but nitrate decreased.

By comparing the daily primary production and nutrient recycling values we can determine the role of freshwater inflow in maintaining production. The overall average daily primary production in the water column was 1.23 g C • m^{-2}

$\cdot$ d^{-1} in the Guadalupe Estuary (MacIntyre and Cullen, 1989), and 1.20 g C $\cdot$ m^{-2} $\cdot$ d^{-1} in the Nueces Estuary (Stockwell, 1989 personal communication). Using the Redfield ratios for C:N:P of 106:16:1 we can calculate the daily N and P demand for the phytoplankton. This would be 15.5 and 15.1 mmol N $\cdot$ m^{-2} $\cdot$ d^{-1}, and 0.969 and 0.944 mmol P $\cdot$ m^{-2} $\cdot$ d^{-1} in the Guadalupe and Nueces Estuaries respectively. Summing the total N input (Table 7), we find that during calm days (with no resuspension) there is 3.46 mmol N $\cdot$ m^{-2} $\cdot$ d^{-1}, and during windy days (with resuspension) there is 3.89 mmol N $\cdot$ m^{-2} $\cdot$ d^{-1} regenerated in the Guadalupe estuary, this accounts for 22% and 25% of the daily phytoplankton requirement. On calm days the system may be P limited, but on windy days there almost 1500× the P required being regenerated. In the Nueces Estuary there is a very different story. During calm days there is 0.288 mmol N $\cdot$ m^{-2} $\cdot$ d^{-1}, and during windy days there is -2.03 mmol N $\cdot$ m^{-2} $\cdot$ d^{-1} consumed. This accounts for 2% and none of the daily phytoplankton requirement. On calm days the system may be P limited, but on windy days there almost 144× the P required being regenerated. Previous estimates of productivity in Corpus Christi Bay (0.48 g C $\cdot$ m^{-2} $\cdot$ d^{-1}) are much lower, but the ammonia regeneration rates are very similar (2.9 mmol N $\cdot$ m^{-2} $\cdot$ d^{-1}) (Flint and Kalke, 1985; Flint et al., 1983). The resupply rate of old N in the Guadalupe is close to that found in other estuaries, but in the low end of the reported ranges. Regeneration and recycling (old N and P) can supply 13 - 40% of the N and P required for primary production in estuaries (Nixon et al., 1976; Fisher et al., 1982; Boynton and Kemp, 1985; Nowicki and Nixon 1985). Nitrogen appears to be limiting in both estuaries, but in the inflow-starved Nueces it is at a critical level. The constant wind we experience in Texas is very important in maintaining the balance of productivity.

There was a higher sedimentation and resuspension rate in the Guadalupe than in the Nueces Estuary (Table 7). Both estuaries had the same overall average clay content (35%) (Montagna and Kalke, 1989). But, the Guadalupe had a higher silt content (34%) compared to the Nueces (20%). This indicates that the higher sediment fluxes were probably due to the higher silt content.

Overall, it appears that the freshwater influences estuaries by depositing greater amounts of fine material and nutrients. This material is more easily resuspended, and that can synergistically affect the role the enhanced nutrient transport has. Thus, rivers influence estuaries by both sediment and nutrient input, and these factors have a synergistic interaction.

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Table 1. Pearson correlation coefficients (r) between nutrient fluxes and salinity and temperature in San Antonio Bay. Table also gives the probability (*P*) that the coefficient equals zero. There were 83 observations.

	Salinity		Temperature	
	r	*P*	r	*P*
PO4	0.2187	0.0470	-0.0706	0.5258
SIO4	0.3217	0.0030	0.0216	0.8461
NO3	-0.3078	0.0046	-0.1837	0.0964
NO2	0.2380	0.0303	0.0241	0.8288
NH4	0.1626	0.1419	0.1559	0.1593
TEMP	-0.4952	0.0001	.	.

Key to abbreviations:
PO4 = phosphate
SIO4= silicate
NO3 = nitrate
NO2 = nitrite
NH4 = ammonia
TEMP= temperature

Table 2. Oxygen flux rates, salinities, and temperatures for Nueces and Corpus Christi Bays stations. Chambers either had no flow or flow at 19.5 $cm \cdot s^{-1}$. Photosynthesis and respiration are in units of mmol $O_2 \cdot m^{-2} \cdot h^{-1}$, where positive values indicate oxygen production and negative values indicate oxygen consumption. Positive values indicate release and negative values indicate uptake from sediment

				Flow		No Flow	
Date	Sta	Sal	Temp	Photo	Resp	Photo	Resp
20OCT87	A	29	24.0	2.282	-2.126	0.5870	-1.4520
21OCT87	B	34	21.7	0.897	-1.927	1.8580	-1.1880
19OCT87	C	33	25.1	2.154	-1.200	1.3070	-2.4710
22OCT87	D	35	22.3	-1.013	-3.090	-0.8780	-0.7790
08DEC87	A	29	20.6	1.105	-0.491	1.2510	-1.1820
09DEC87	B	30	19.4	1.901	-1.963	-1.6349	5.1169
07DEC87	C	32	18.8	-1.435	-1.537	7.8330	-1.5650
10DEC87	D	32	18.9	4.088	-0.437	0.5400	0.8080
16FEB88	A	27	15.7	1.516	-1.736	0.3170	-1.0230
24FEB88	B	31	15.6	-0.040	-1.354	-0.9120	-1.2040
15FEB88	C	31	12.5	0.582	-1.952	-0.0620	-0.9520
23FEB88	D	30	15.6	0.573	-0.824	1.2340	-0.6620
12APR88	A	30	17.0	1.249	-2.533	-0.3630	-0.5660
14APR88	B	30	19.7	0.591	-1.700	0.7930	-0.2790
11APR88	C	31	19.5	1.055	-1.676	-0.4564	0.0014
13APR88	D	31	19.5	0.270	-1.150	0.6500	-0.2550
10MAY88	A	34	26.3	0.263	-0.613	0.5510	-1.0990
11MAY88	B	34	27.5	-1.792	0.496	0.3850	-1.6010
09MAY88	C	32	25.4	0.266	-1.418	0.0160	-0.6240
13MAY88	D	32	24.8	-1.734	0.641	0.9340	-1.4180
27JUL88	A	38	29.3	.	.	-0.0685	-1.2470
27JUL88	B	37	29.1	.	.	-0.6260	-1.3015
26JUL88	C	36	29.6	.	.	0.8075	-0.6350
26JUL88	D	45	30.6	.	.	1.1000	-1.8025

Table 3. Analysis of variance table for Nueces and Corpus Christi Bay study. There were 5 Dates (OCT87, DEC87, FEB88, APR88, MAY88), 4 stations (A B C D), and 2 treatments (flow and no flow).

RESPIRATION:				PHOTOSYNTHESIS:			
Source	DF	F	Pr > F	Source	DF	F	Pr > F
DATE	5	1.43	0.2683	DATE	5	1.22	0.3470
STA	3	0.52	0.6726	STA	3	0.44	0.7301
DATE*STA	15	0.54	0.8783	DATE*STA	15	0.39	0.9617
FLOW	1	1.87	0.1917	FLOW	1	0.05	0.8294
DATE*FLOW	5	1.51	0.2440	DATE*FLOW	5	0.28	0.9144
STA*FLOW	3	0.50	0.6858	STA*FLOW	3	0.44	0.7255

Table 4. Pearson correlation coefficients (r) between oxygen fluxes and salinity and temperature in Nueces Estuary. Table also gives the probability (*P*) that the coefficient equals zero. There were 24 observations.

	Salinity		Temperature	
	r	*P*	r	*P*
DF	0.2549	0.2293	0.4581	0.0244
LF	-0.2278	0.2844	-0.0909	0.6728
L	-0.2722	0.1981	-0.3065	0.1452
D	-0.2879	0.1725	-0.2596	-0.2206
PF	-0.4000	0.0528	-0.3931	0.0574
P	-0.0484	0.8225	-0.1060	0.6219

Key to abbreviations:
DF=Respiration, with flow
LF=Net photosynthesis, with flow
L =Net photosynthesis, without flow
D =Respiration, without flow
PF=Gross photosynthesis, with flow
P =Gross photosynthesis, without flow

Table 5. Sediment (SS), Chlorophyll (CHL), and nutrient flux data from Nueces and Corpus Christi Bays. ID is the chamber identification: 1=dark with flow, 2=light with flow, 3 light still, 4 dark still. A period indicates a missing value. Positive values indicate release and negative values indicate uptake from sediment

DATE	STA	ID	SS	CHL	NH_4	NO_2	NO_3	PO_4	SIO_4
OCT87	A	1	-3.787	.	.	.	.	.	.
OCT87	A	2	-1.550	.	.	.	.	.	.
OCT87	A	3	-0.091	.	-8.3	-2.4	1.0	13.4	297.5
OCT87	A	4	-0.036	.	-5.8	-24.2	-10.2	-84.1	61.7
OCT87	B	1	-0.689	.	-60.6	-53.5	-26.8	-50.9	147.3
OCT87	B	2	1.656	.	207.0	182.2	-76.8	112.2	273.5
OCT87	B	3	-0.304	.	4.2	-17.2	37.3	30.6	515.5
OCT87	B	4	-0.669	.	99.3	3.9	31.3	-0.9	199.9
OCT87	C	1	.	.	15.3	32.8	-41.1	9.8	254.7
OCT87	C	2	.	.	35.3	19.4	-23.5	5.2	234.4
OCT87	C	3	.	.	-4.1	10.5	-10.4	5.8	183.9
OCT87	C	4	0.000	.	38.2	6.7	-6.7	1.9	214.2
OCT87	D	1	3.647	.	-14.4	-27.3	-31.2	-1.3	189.3
OCT87	D	2	0.912	.	-11.1	4.5	-11.0	186.1	157.8
OCT87	D	3	-0.304	.	50.3	-0.8	-1.0	3.3	168.2
OCT87	D	4	-0.182	.	52.1	-10.5	4.0	-1.3	168.3
DEC87	A	1	0.304	0.378	-740.7	6.7	-74.0	-12.9	801.9
DEC87	A	2	0.426	0.351	-168.5	6.3	-35.1	25.3	647.9
DEC87	A	3	-0.213	0.061	883.4	-20.9	11.3	-9.7	494.0
DEC87	A	4	-0.061	0.096	289.8	-27.9	37.6	-9.6	709.5
DEC87	B	1	0.578	0.143	-150.5	24.0	-459.1	17.3	-51.7
DEC87	B	2	2.510	0.147	9.4	17.6	-82.9	7.2	16.3
DEC87	B	3	-0.213	0.046	-150.5	-2.7	-23.8	9.4	-106.2
DEC87	B	4	-0.122	0.049	12.5	4.9	-23.7	-17.5	2.8

Table 5 Continued. Fluxes from Nueces and Corpus Christi Bays.

DEC87	C	1	1.548	0.162	-108.4	-84.7	-350.5	-178.6	65.4
DEC87	C	2	3.201	-0.004	-353.3	15.3	-15.4	11.3	327.0
DEC87	C	3	-0.122	-0.083	91.7	-0.4	-8.5	-2.1	87.2
DEC87	C	4	-0.213	-0.089	74.4	-8.8	8.8	1.2	-65.5
DEC87	D	1	2.893	0.168	0.9	19.1	-11.3	-29.2	250.6
DEC87	D	2	0.304	0.339	8.5	11.1	-11.1	-39.2	68.1
DEC87	D	3	-0.030	0.120	192.6	21.8	1.4	4.5	147.1
DEC87	D	4	-0.213	0.028	103.8	3.8	3.9	14.6	-13.7
FEB88	A	1	2.257	0.179	127.0	34.3	-199.5	15.6	72.0
FEB88	A	2	-8.495	0.148	63.6	8.8	8.2	10.7	33.6
FEB88	A	3	-0.365	-0.113	-7.2	-4.2	-8.5	-0.2	18.2
FEB88	A	4	-3.276	-0.028	48.5	41.4	-48.4	-4.1	-0.9
FEB88	B	1	1.306	0.220	-35.4	14.4	-292.3	-11.6	4.8
FEB88	B	2	0.061	-0.178	17.0	23.7	-55.9	0.5	-43.7
FEB88	B	3	-0.608	-0.317	-269.8	-20.2	-27.4	-47.7	-19.4
FEB88	B	4	-0.608	-0.320	-114.8	-24.3	7.4	-26.0	-34.0
FEB88	C	1	2.516	1.048	-122.2	-20.7	-1243.8	-188.4	15.8
FEB88	C	2	0.873	0.859	-185.0	-13.3	-442.6	-160.7	28.9
FEB88	C	3	-0.365	-0.081	-79.7	-15.5	-221.7	-55.1	-23.6
FEB88	C	4	-0.304	-0.028	-105.2	-8.2	-90.0	-18.3	-10.5
FEB88	D	1	0.395	0.288	-80.9	-0.2	-895.5	-49.8	55.1
FEB88	D	1	0.122	0.055	83.3	1.0	-191.2	-10.4	-2.0
FEB88	D	2	0.517	0.120	-2.8	8.8	-26.4	2.0	27.9
FEB88	D	3	0.061	-0.007	9.9	-0.1	1.7	0.0	27.9
FEB88	D	4	0.152	-0.038	68.1	3.2	17.5	-6.3	57.9
APR88	A	1	0.683	0.155	-5.6	23.8	-605.3	101.6	102.7
APR88	A	2	-0.563	1.237	-48.2	19.4	-256.7	-23.6	145.5
APR88	A	3	-0.426	0.025	20.2	-8.2	-95.1	5.9	359.6
APR88	A	4	-0.669	0.009	-17.4	-21.5	-43.6	-32.8	-1609.6

Table 5 Continued. Fluxes from Nueces and Corpus Christi Bays.

APR88	B	1	3.573	0.357	25.7	30.9	-464.0	2.5	77.0
APR88	B	2	2.880	0.244	8.9	33.2	-251.7	10.1	119.9
APR88	B	3	-0.274	-0.049	4.0	-6.7	-153.3	5.0	34.3
APR88	B	4	-0.274	-0.088	861.5	-2.2	-99.2	0.9	34.2
APR88	C	1	1.067	0.216	-99.3	85.5	50.0	42.7	177.6
APR88	C	2	2.552	0.412	9.5	-16.5	-43.6	4.5	72.6
APR88	C	3	-0.851	0.123	18.0	-1.7	81.7	11.2	30.5
APR88	C	4	-0.334	0.063	-1.0	-22.9	-82.4	-15.8	20.0
APR88	D	1	1.094	0.848	157.4	-2.4	72.7	-13.5	51.4
APR88	D	2	3.171	0.975	-56.4	18.6	12.6	0.9	-0.8
APR88	D	3	-0.152	0.642	1.0	-3.6	34.7	-23.5	198.6
APR88	D	4	-0.061	0.099	4.9	-0.2	31.4	8.4	94.1
MAY88	A	1	6.888	-0.010	53.4	45.3	14.3	.	57.8
MAY88	A	2	7.910	-0.568	25.4	15.5	83.1	.	100.6
MAY88	A	3	-0.395	0.331	19.8	-23.2	24.1	.	100.6
MAY88	A	4	-0.517	-0.141	4.9	-61.8	82.4	.	14.9
MAY88	B	1	0.678	-0.194	18.2	27.6	-96.2	-5.0	-336.6
MAY88	B	2	-4.137	-0.075	16.4	27.6	-69.4	-53.7	117.0
MAY88	B	3	-2.918	-0.511	9.1	-42.8	-79.7	-18.2	-245.9
MAY88	B	4	-1.186	-0.366	-23.8	-52.2	23.8	-17.2	-87.1
MAY88	C	1	3.136	0.067	-24.7	-297.2	11426.6	.	10231.3
MAY88	C	2	1.586	0.085	9.9	0.9	-254.6	.	214.0
MAY88	C	3	-0.790	-0.255	-5.9	10.8	28.3	.	299.6
MAY88	C	4	-0.426	.	-3.0	-20.1	-38.5	.	0.0
MAY88	D	1	1.003	0.743	-16.2	7.1	6.4	-11.0	62.0
MAY88	D	2	3.128	0.833	-16.2	-16.3	16.3	-0.6	107.4
MAY88	D	3	-0.122	-0.017	3.8	-0.8	0.8	-12.2	-28.6
MAY88	D	4	-0.152	-0.180	11.1	2.4	-2.5	57.5	-51.4

Table 6. Pearson correlation coefficients (r) between nutrient fluxes and salinity and temperature in Nueces Estuary. Table also gives the probability (*P*) that the coefficient equals zero. There were 79 observations. Abbreviations are the same as used in Table 1.

	Salinity		Temperature	
	r	*P*	r	*P*
PO4	0.1074	0.3727	0.2603	0.0284
SIO4	0.0351	0.7588	0.1675	0.1400
NO3	0.0669	0.5579	0.2036	0.0719
NO2	-0.0644	0.5719	-0.1206	0.2898
NH4	-0.0286	0.8028	0.0954	0.4026
TEMP	0.7449	0.0001	.	.

Table 7. Comparison of average flux rates between two estuaries. Comparisons are made between flux in light chambers without resuspension (No flow conditions), and with resuspension (Yes, at a current speed of 19.5 cm • s^{-1}). For the Guadalupe estuary the least square means and 95% prediction intervals were computed, and for the Nueces estuary arithmetic means and 95% confidence intervals were computed. Abbreviations are the same as used in Table 1, with the addition of 02 for oxygen, and SS for suspended sediments. The units for nutrient flux are μmol • m^{-2} • h^{-1}, for oxygen mmol • m^{-2} • h^{-1}, and for sediments g • m^{-2} • h^{-1}. Positive values indicate release and negative values indicate uptake from sediment.

	Guadalupe Estuary				Nueces Estuary			
	No Flow		With Flow		No Flow		With Flow	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
P04	-0.535	(-170, 169)	65.1	(-106, 236)	-4.42	(-14.3, 5.44)	5.77	(-28.0, 39.5)
SI04	-413	(-2680, 1850)	-315	(-2590, 1960)	127	(36.3, 218)	139	(63.6, 215)
N03	214	(-574, 1000)	-3.93	(-796, 788)	-20.4	(-52.9, 12.2)	-80.9	(-142, -18.8)
N02	-8.48	(-73.5, 56.6)	30.0	(-35.4, 95.4)	-6.40	(-13.0, 0.212)	19.3	(-0.869, 39.4)
NH4	-62.0	(-434, 310)	136	(-237, 510)	39.1	(-62.8, 141)	-22.7	(-77.5, 32.2)
02	-1.72	(-8.86, 5.41)	-2.00	(-9.18, 5.17)	-0.214	(-0.886, 0.458)	-0.691	(-1.28, -0.100)
SS	-7.27	(-17.9, 3.41)	14.5	(3.77, 25.3)	-0.050	(-0.207, 0.107)	1.23	(0.194, 2.26)

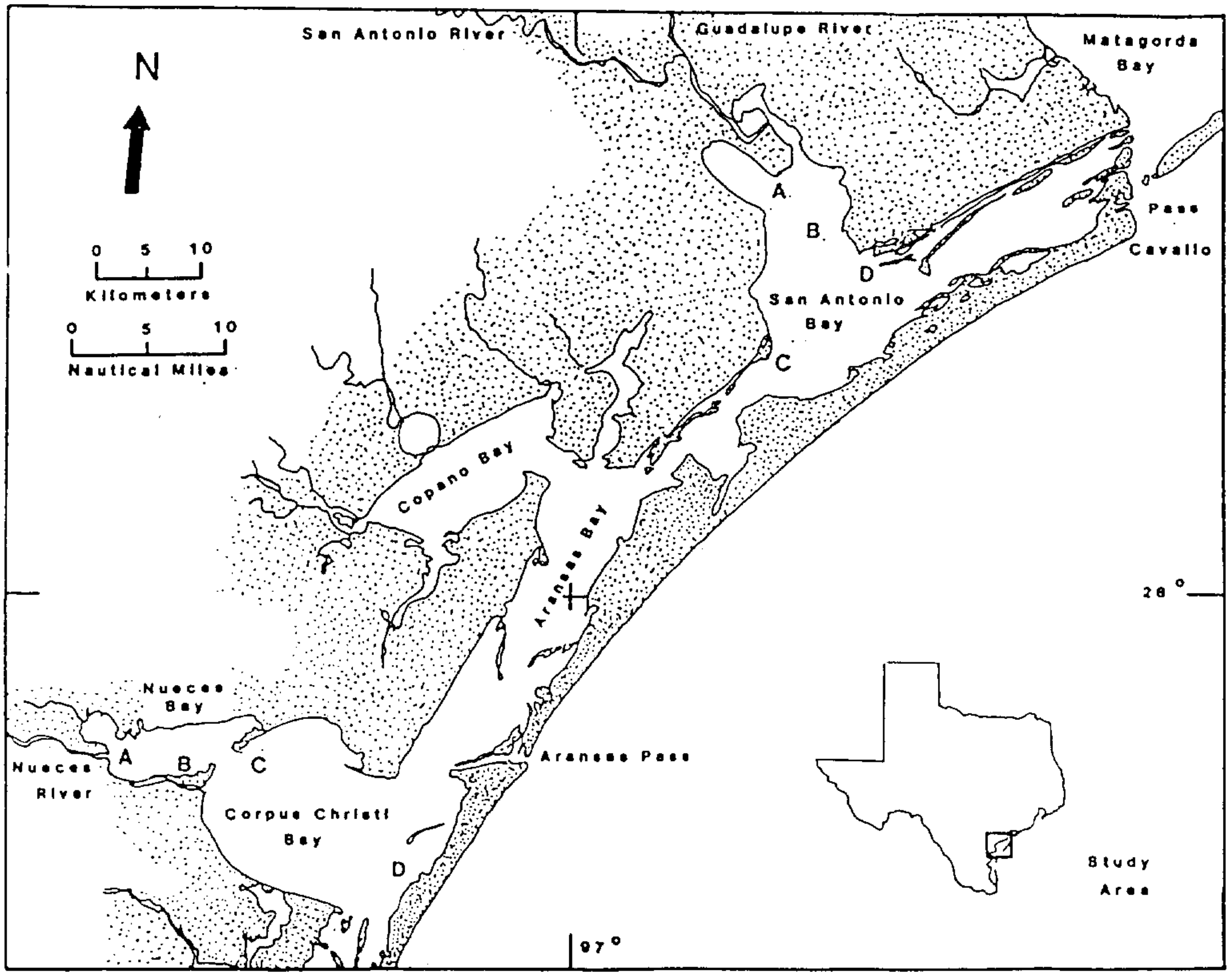

Figure 1. Map of study area indicating station locations. Four stations were in each of two estuaries. San Antonio Bay is in the Guadalupe Estuary, and Nueces and Corpus Christi Bays are in the Nueces Estuary.

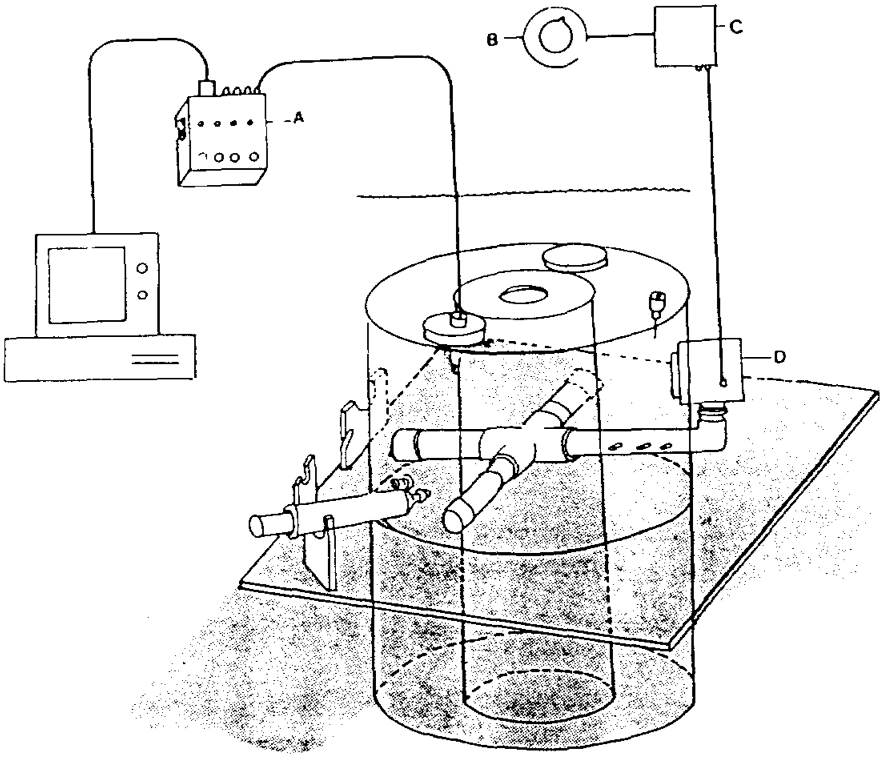

Figure 2. Benthic chambers. A. Pulsed dissolved oxygen controller with serial connection to computer. B. Varistat. C. AC to DC converter. D. Bilge pump.

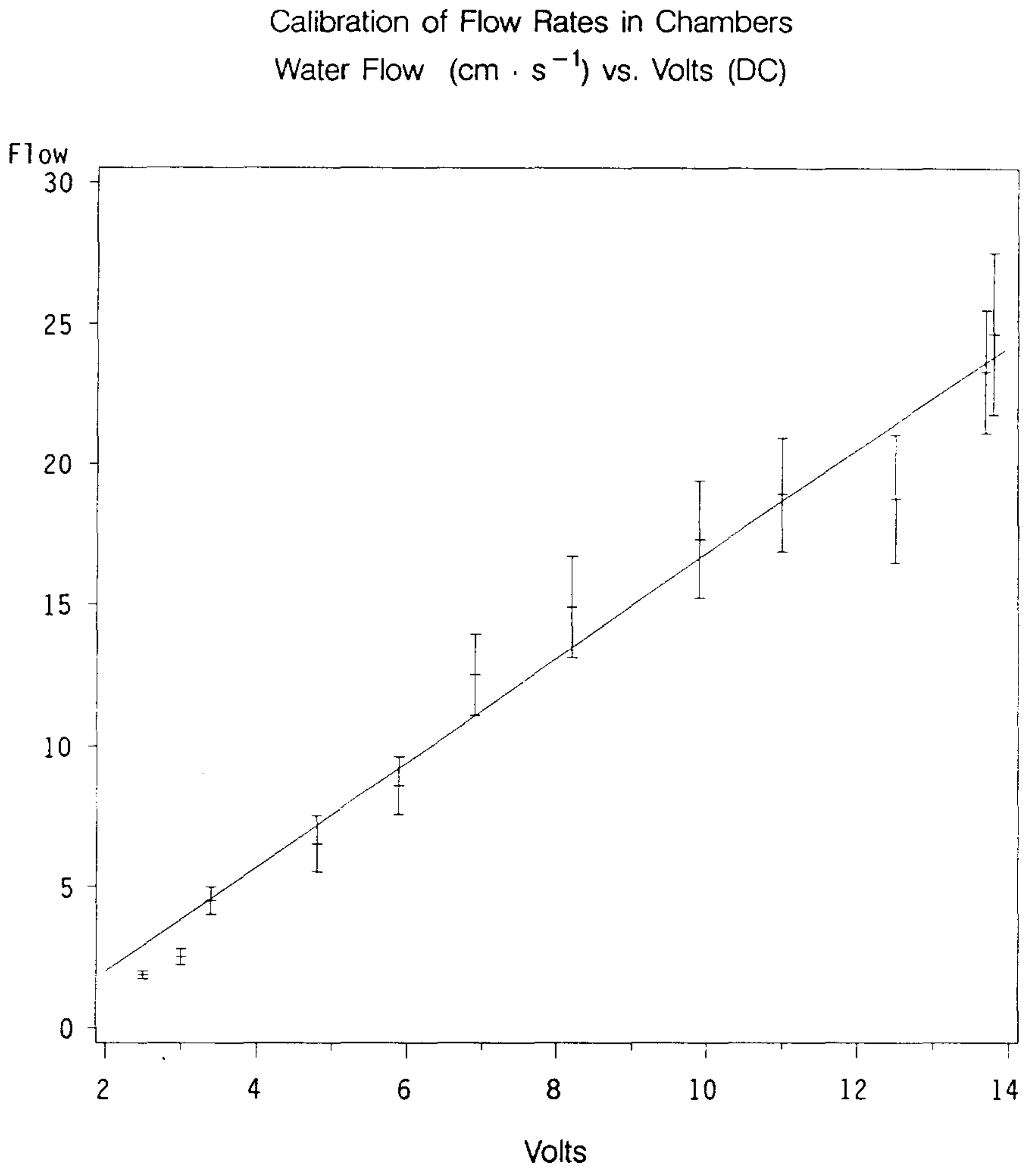

Figure 3. Calibration curve between voltage applied by the Varistat and current speed within the chamber. The formula from a linear regression is: speed (cm $\cdot$ s^{-1}) = 1.866×(DC volts) - 1.794.

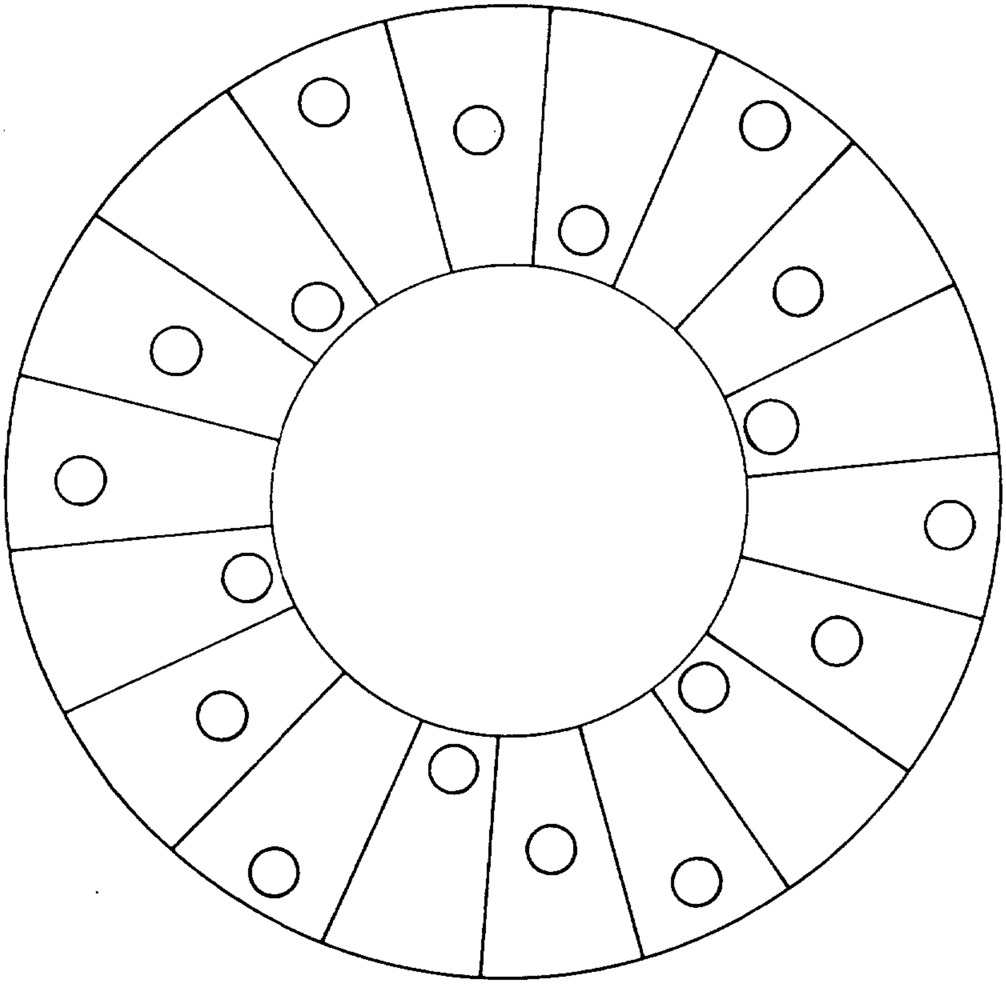

Figure 4. Locations of Tums (circles) in the experiment to calibrate chamber erosion characteristics.

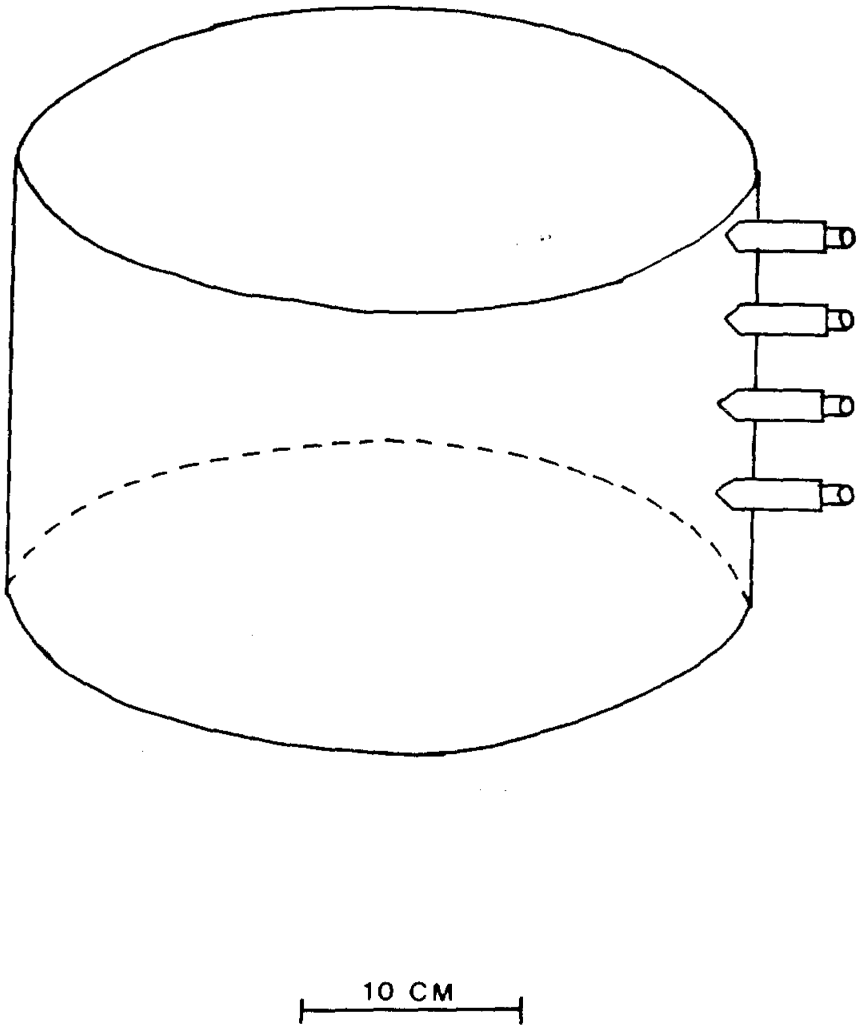

Figure 5. Calibration chamber with four sampling ports arranged vertically within one chamber. Depth intervals were 4, 8, 12, and 16 cm from sediment surface.

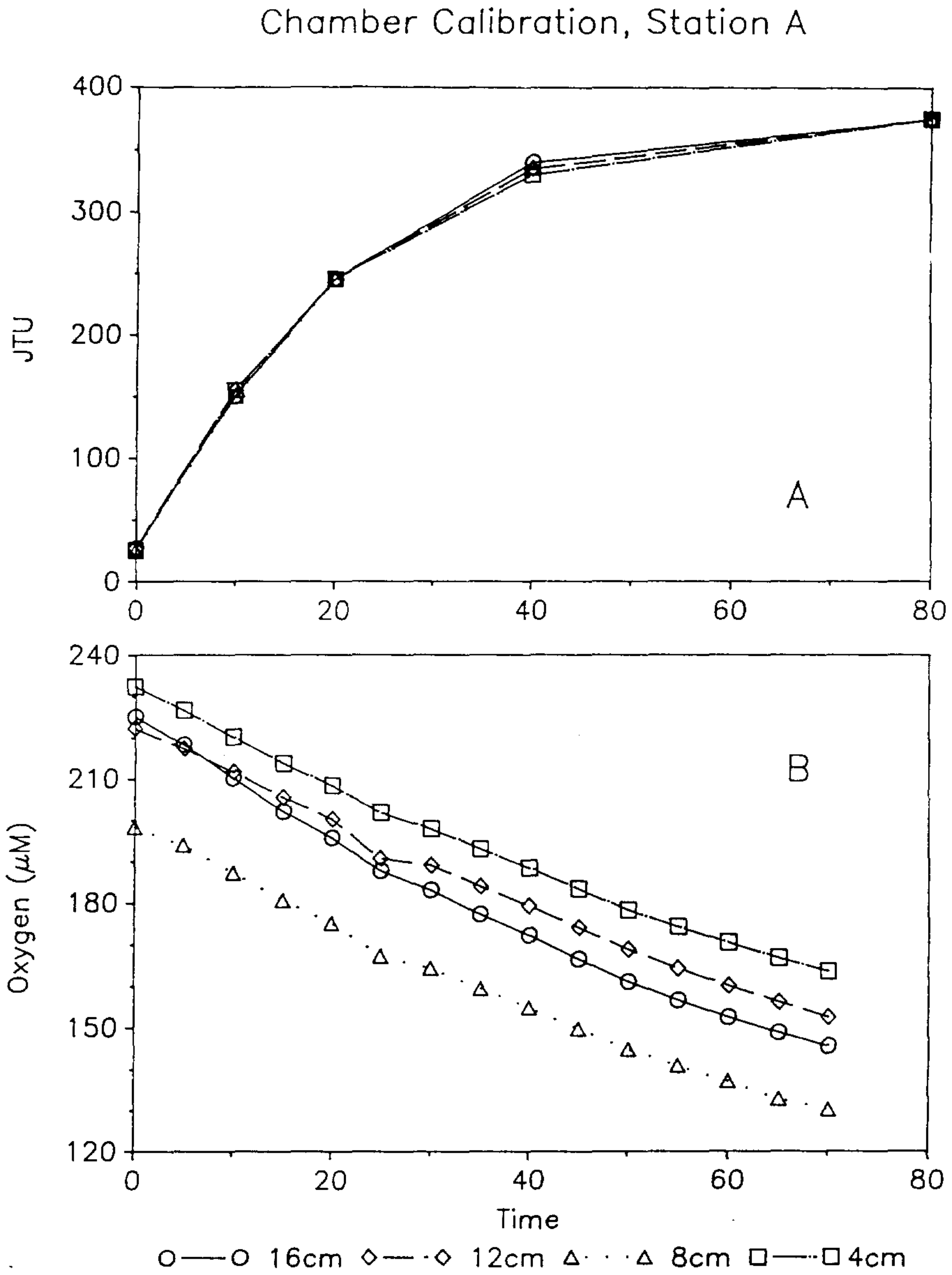

Figure 6. Chamber calibration data from San Antonio Bay, station A, July 13, 1987. Vertical depth intervals were 4, 8, 12, 16 cm from sediment surface, current flow within the chamber was 19 cm • s^{-1}. A: Suspended sediments (JTU) vs incubation time. B: Oxygen concentration (μM) vs. incubation time.

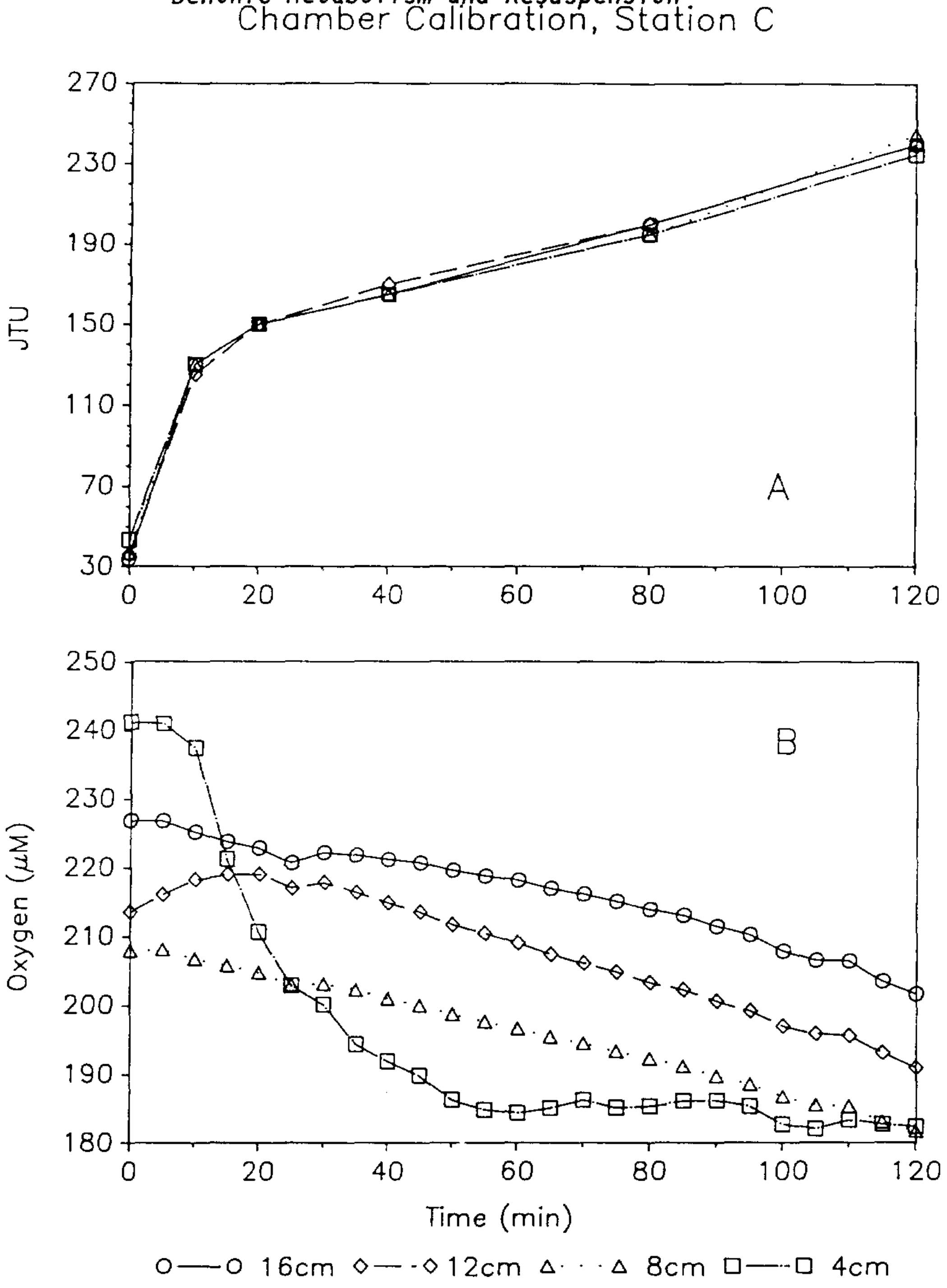

Figure 7. Chamber calibration data from San Antonio Bay, station C, July 15, 1987. Vertical depth intervals were 4, 8, 12, 16 cm from sediment surface, current flow within the chamber was 19 cm • s^{-1}. A: Suspended sediments (JTU) vs incubation time. B: Oxygen concentration (μM) vs. incubation time.

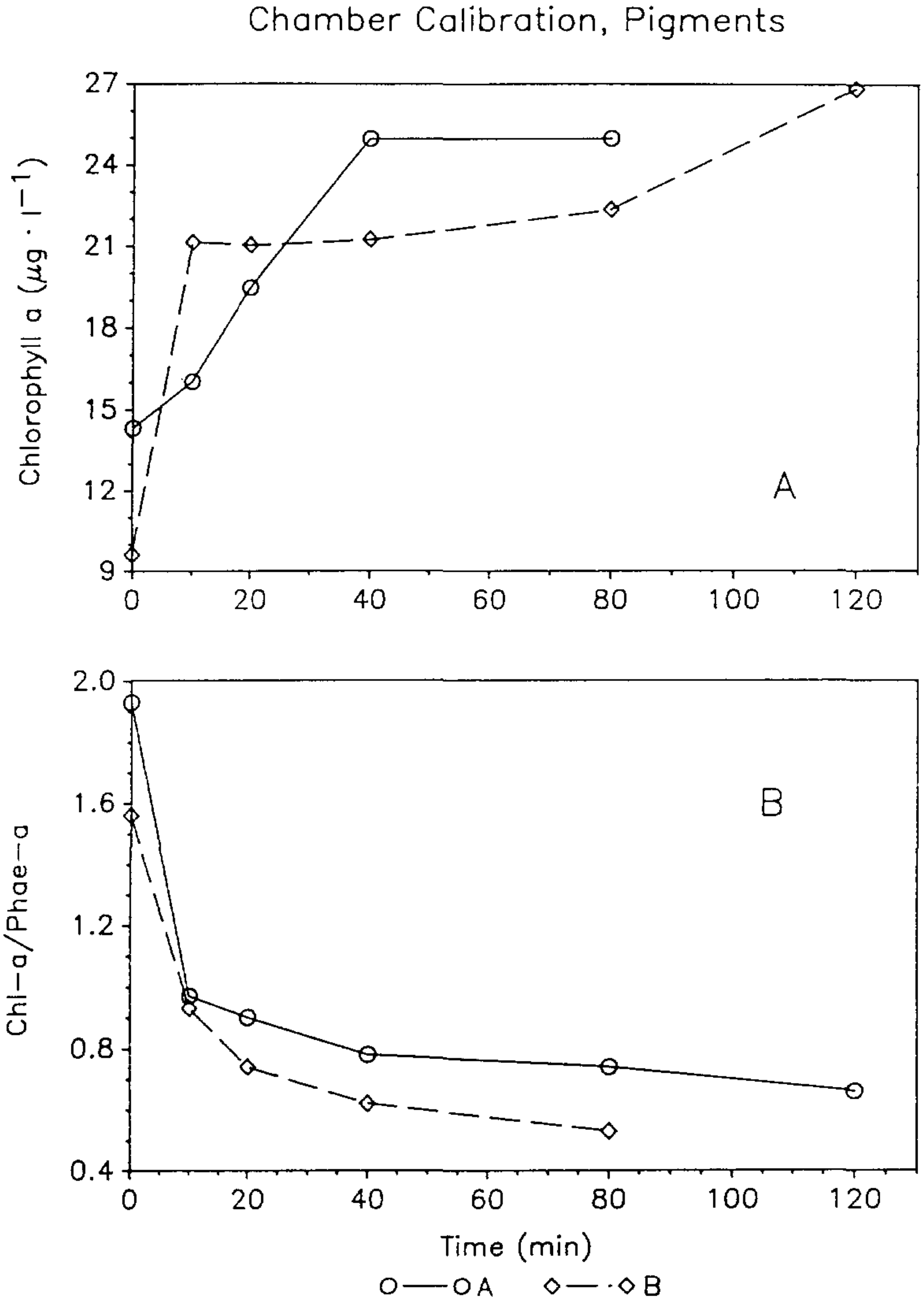

Figure 8. Pigment resuspension in chambers from San Antonio Bay, stations A (see Figure 6) and C (see Figure 7), July 1987. A: Chlorophyll concentration vs. time. B: Chlorophyll to phaeophytin ratio vs time.

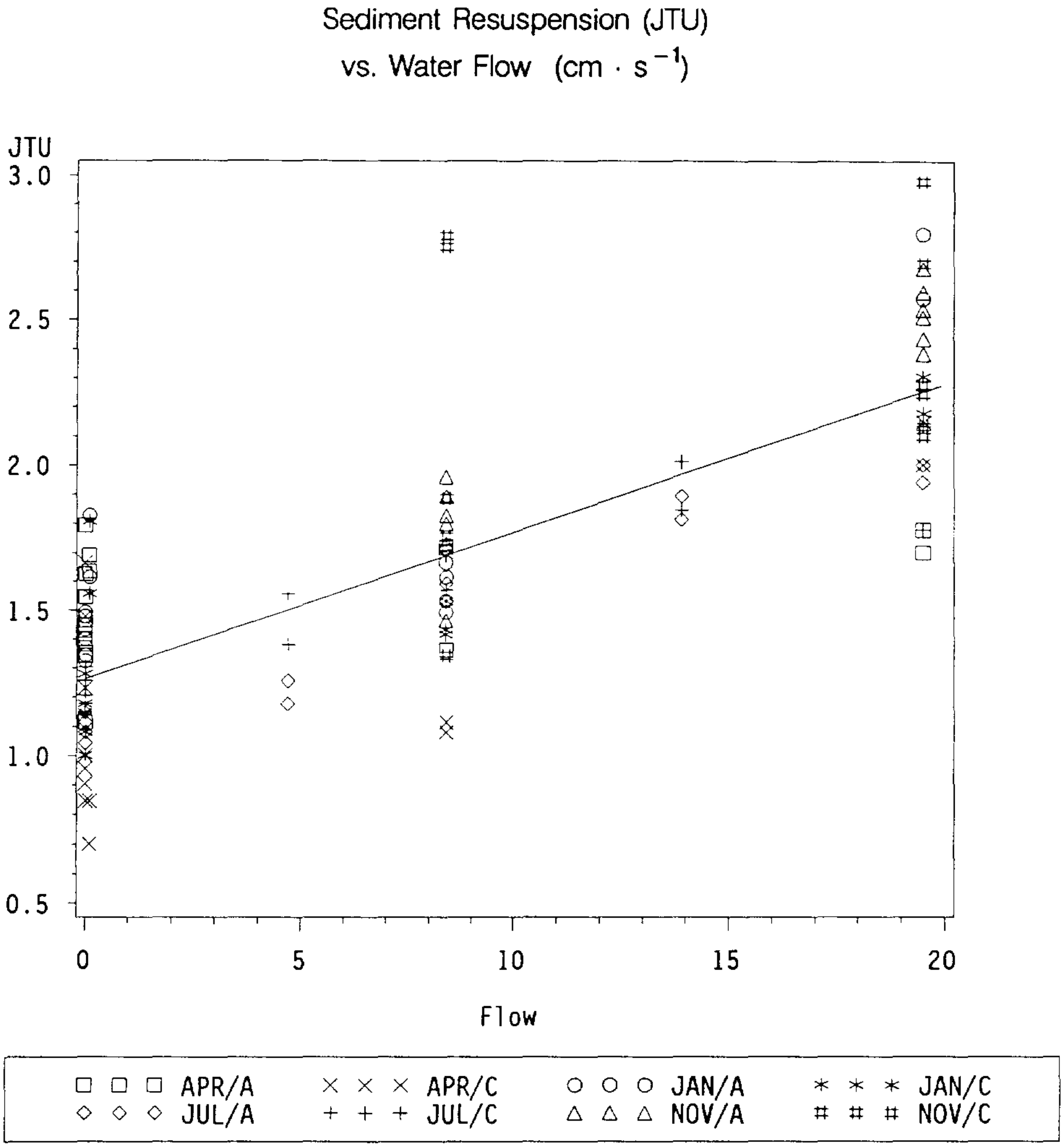

Figure 9. Sediment resuspension as a function of current flow from San Antonio Bay stations A and C, in 1986-7. Turbidity (Log_{10} JTU) was measured at the end of a 3 h incubation. The formula for the line fit through all 180 points is: Log_{10} JTU = 1.271 + 0.0514×(current speed in cm • s^{-1}), and $R^2=0.59$.

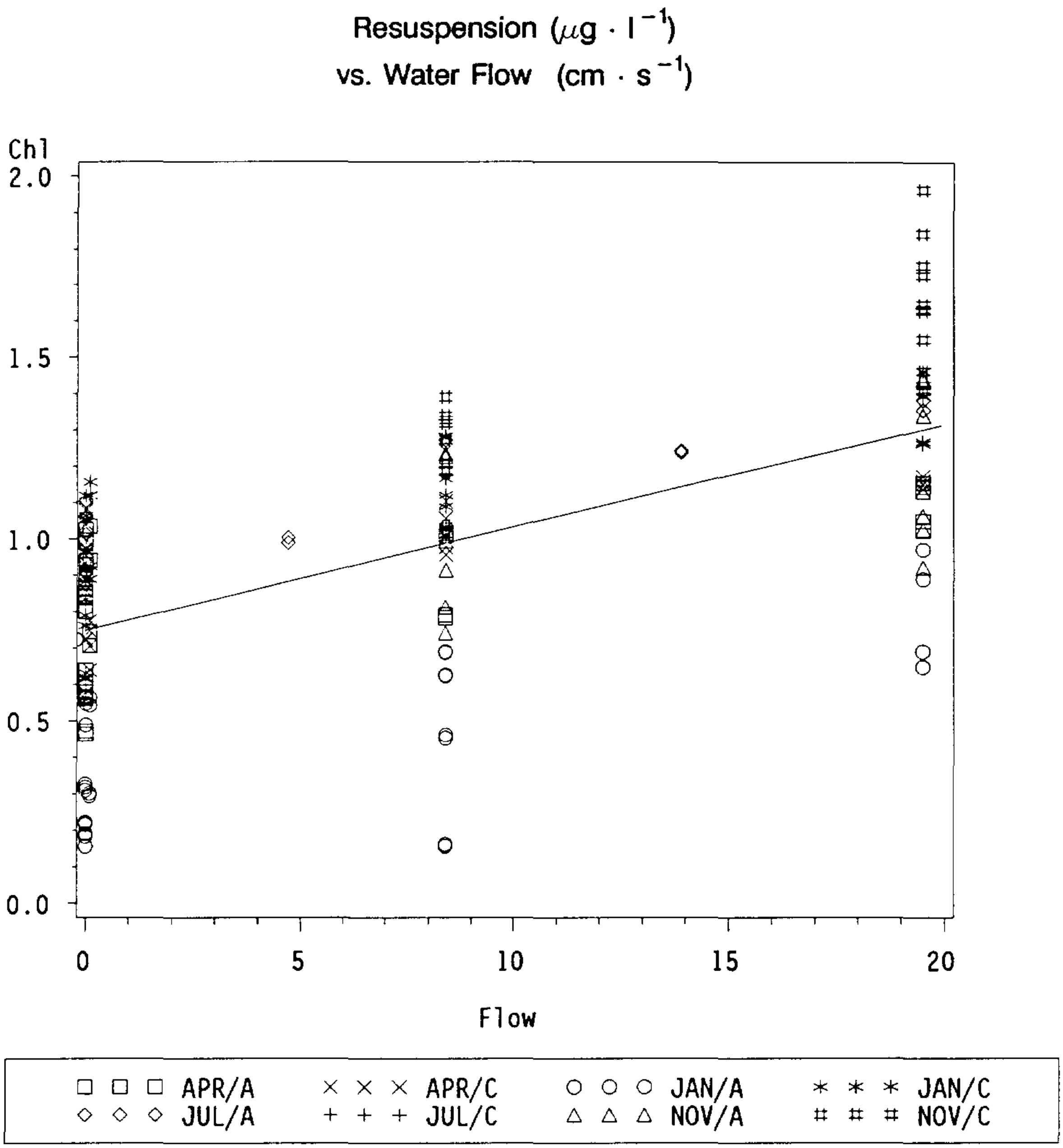

Figure 10. Chlorophyll resuspension as a function of current flow from San Antonio Bay stations A and C, in 1986-7. Chlorophyll concentration (Log_{10} μg $\cdot$ l^{-1}) was measured at the end of a 3 h incubation. The formula for the line fit through all 180 points is: Log_{10} chlorophyll = 0.750 + 0.0282×(current speed in cm $\cdot$ s^{-1}), and $R^2=0.37$.

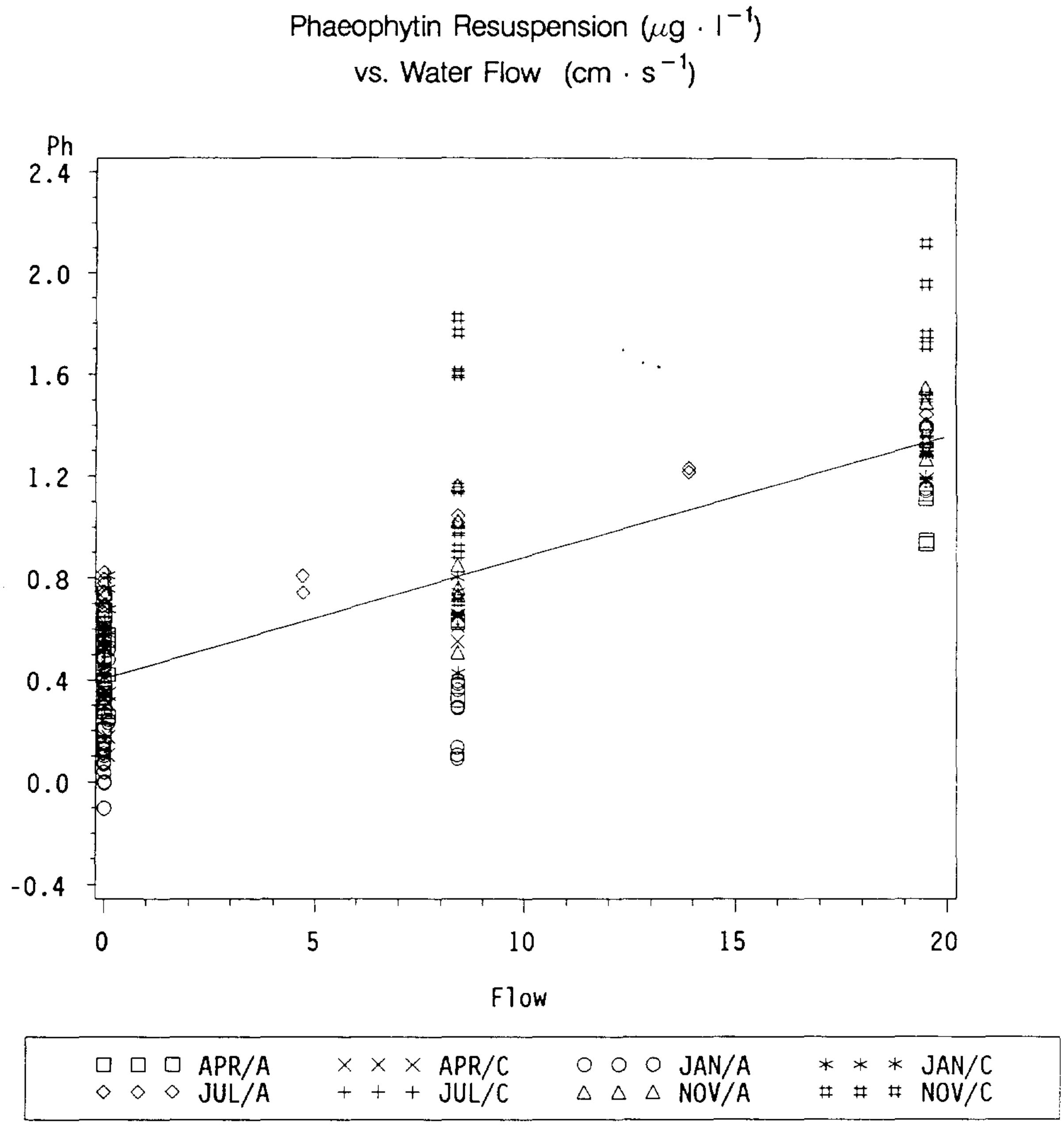

Figure 11. Phaeophytin resuspension as a function of current flow from San Antonio Bay stations A and C, in 1986-7. Phaeophytin concentration (Log_{10} µg · l^{-1}) was measured at the end of a 3 h incubation. The formula for the line fit through all 180 points is: Log_{10} phaeophytin = 0.4077 + 0.0475×(current speed in cm · s^{-1}), and R^2=0.62.

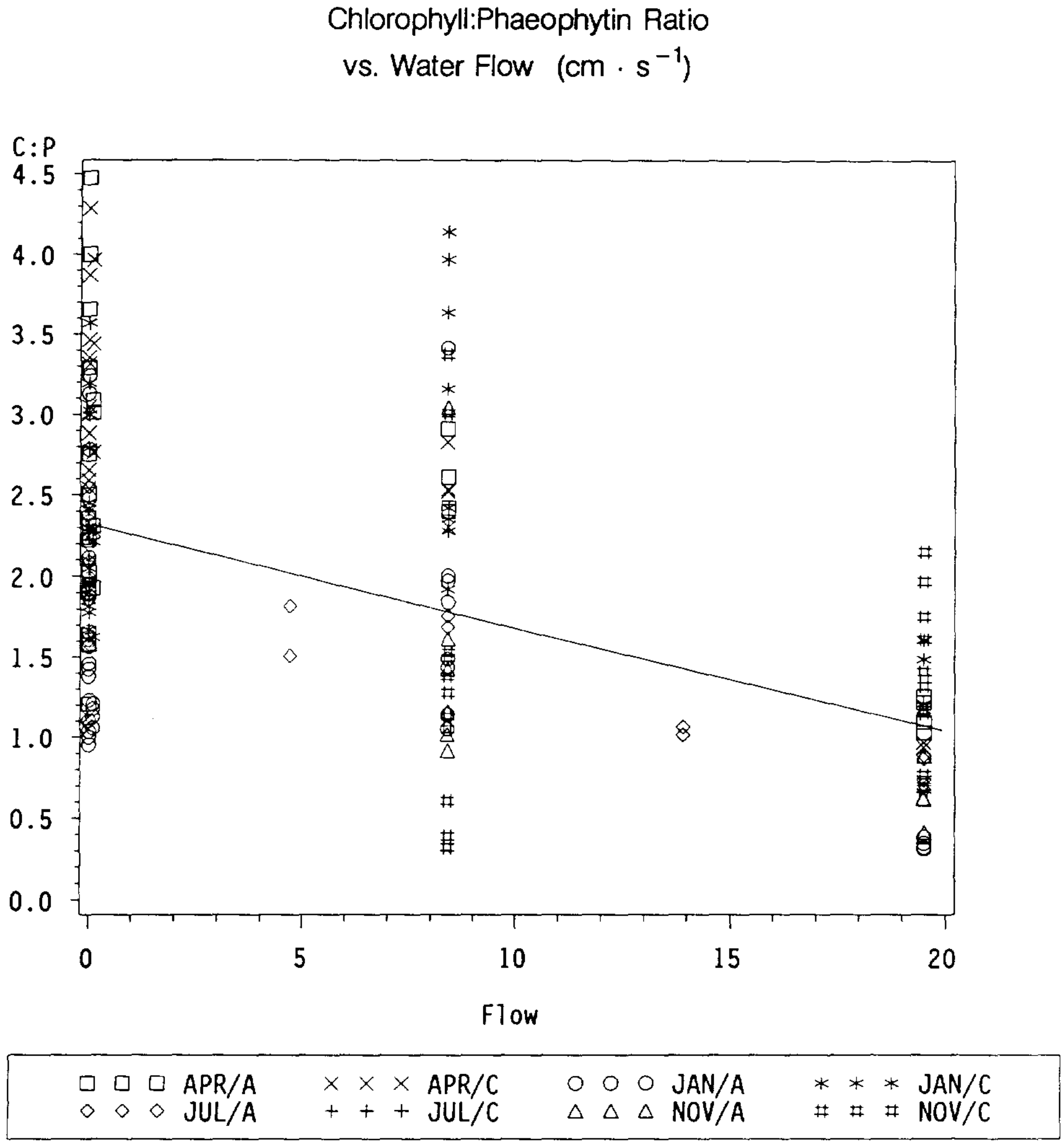

Figure 12. Chlorophyll-phaeophytin ratios at the end of a 3 h incubation as a function of current flow from San Antonio Bay stations A and C, in 1986-7. The formula for the line fit through all 180 points is: Log_{10} ratio = 2.319 - 0.0640×(current speed in cm • s^{-1}), and R^2=0.27.

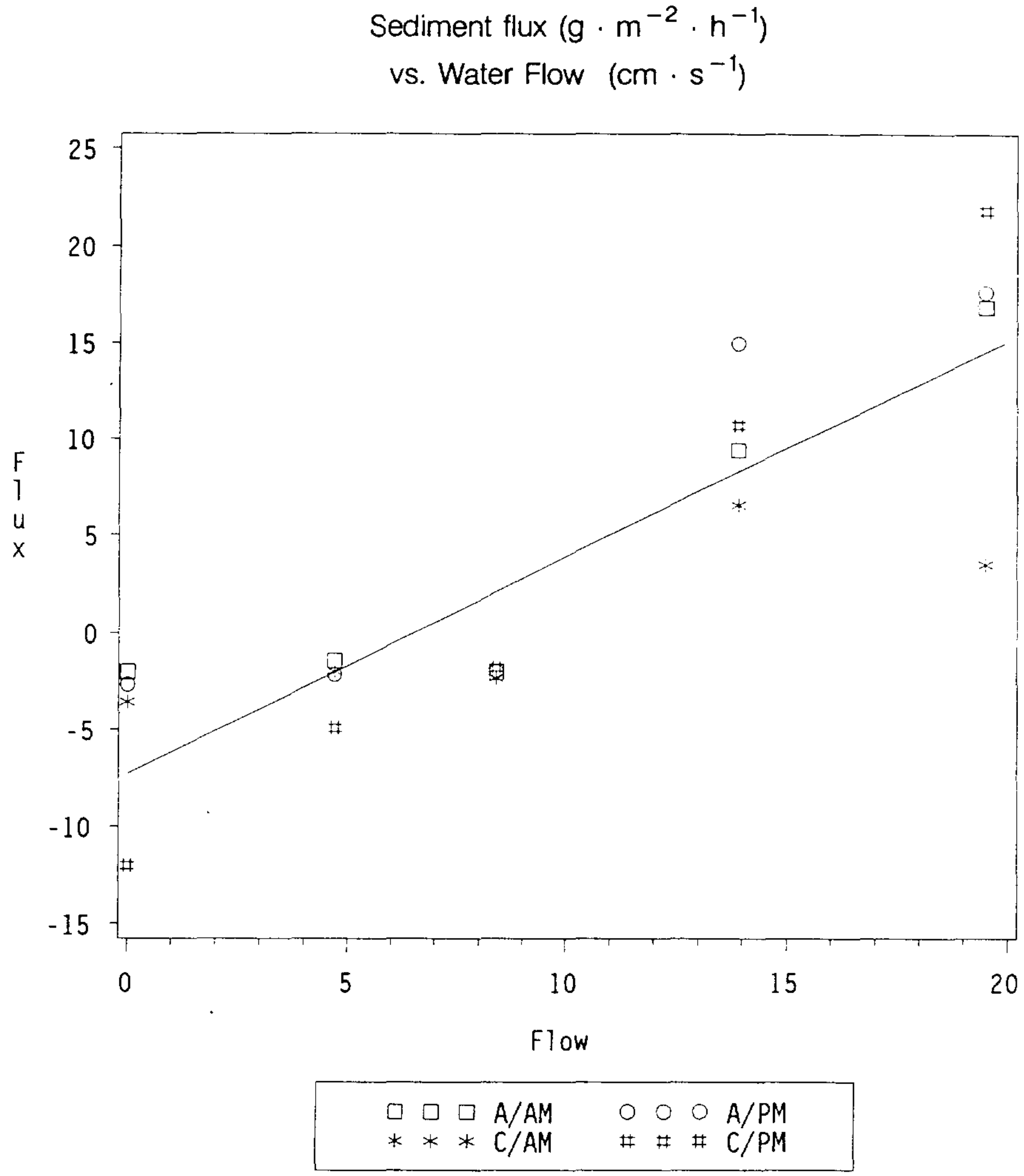

Figure 13. Sediment flux as a function of current flow rates from San Antonio Bay, July 1987. The first group letter refers to station A or C, and the second group letter refers to the deployment morning (AM) or afternoon (PM). The formula for the line fit through all 20 points is: Flux ($g \cdot m^{-2} \cdot h^{-1}$) = 1.1182×(current speed in $cm \cdot s^{-1}$) - 7.269 , and R^2=0.74.

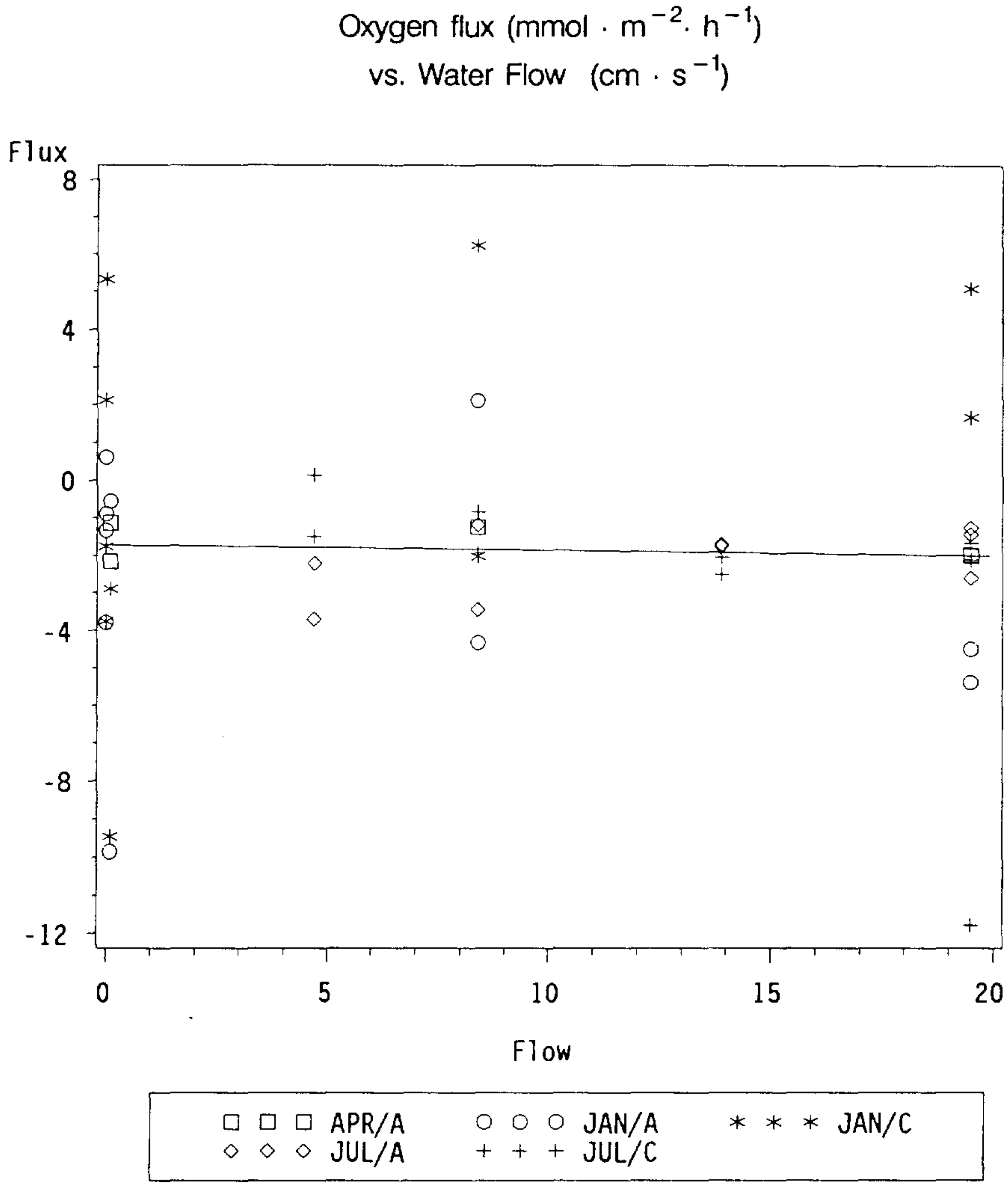

Figure 14. Oxygen flux as a function of current flow rates from San Antonio Bay. The first group letter refers to the month in 1987, and the second group letter refers to station A or C. The formula for the line fit through all 43 points is: Flux (mmol O_2 • m^{-2} • h^{-1}) = -0.0144×(current speed in cm • s^{-1}) - 1.723 , and R^2=0.001.

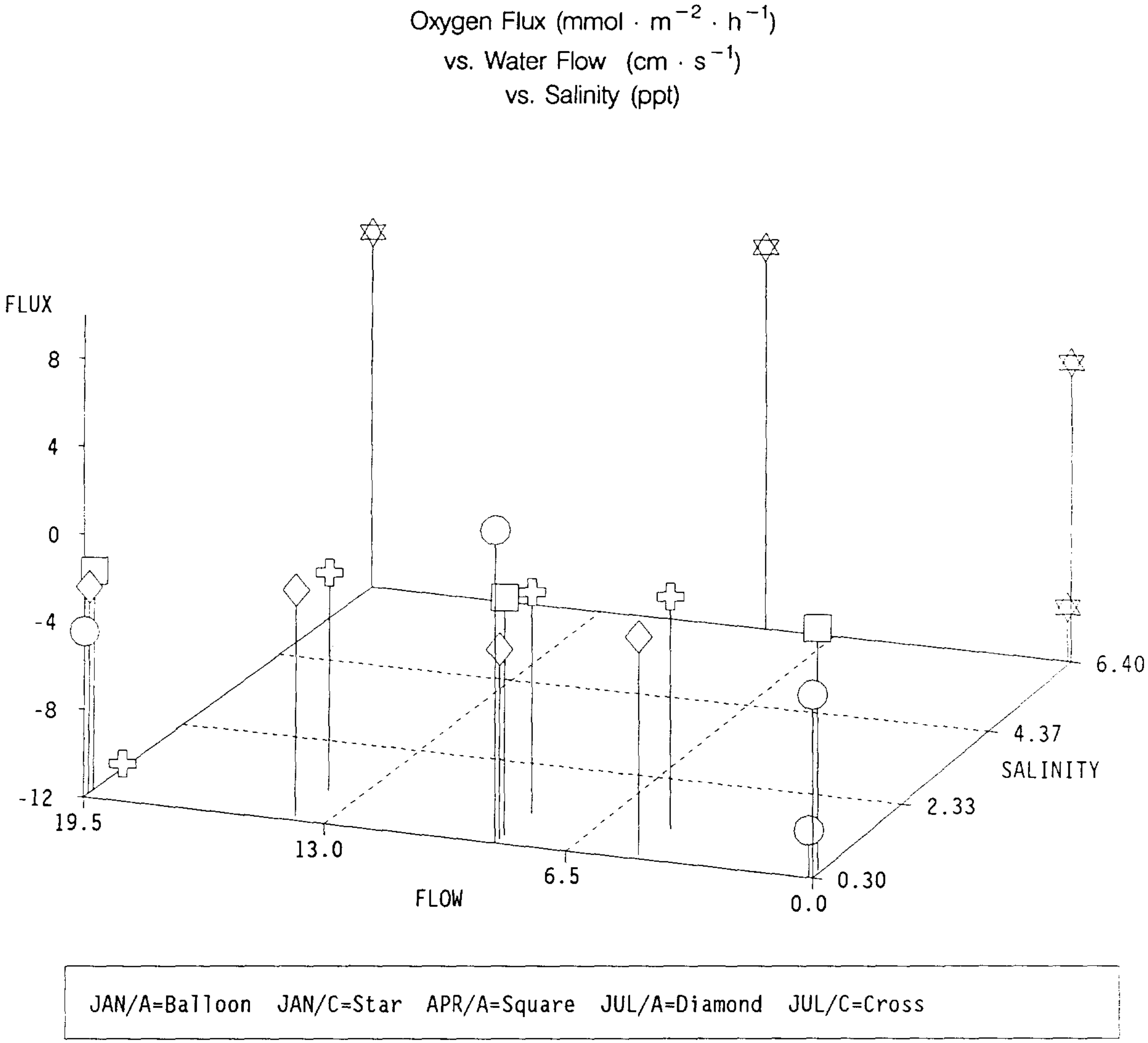

Figure 15. Oxygen flux as a function of current flow rates and salinity from San Antonio Bay. The first group letter refers to the month in 1987, and the second group letter refers to station A or C.

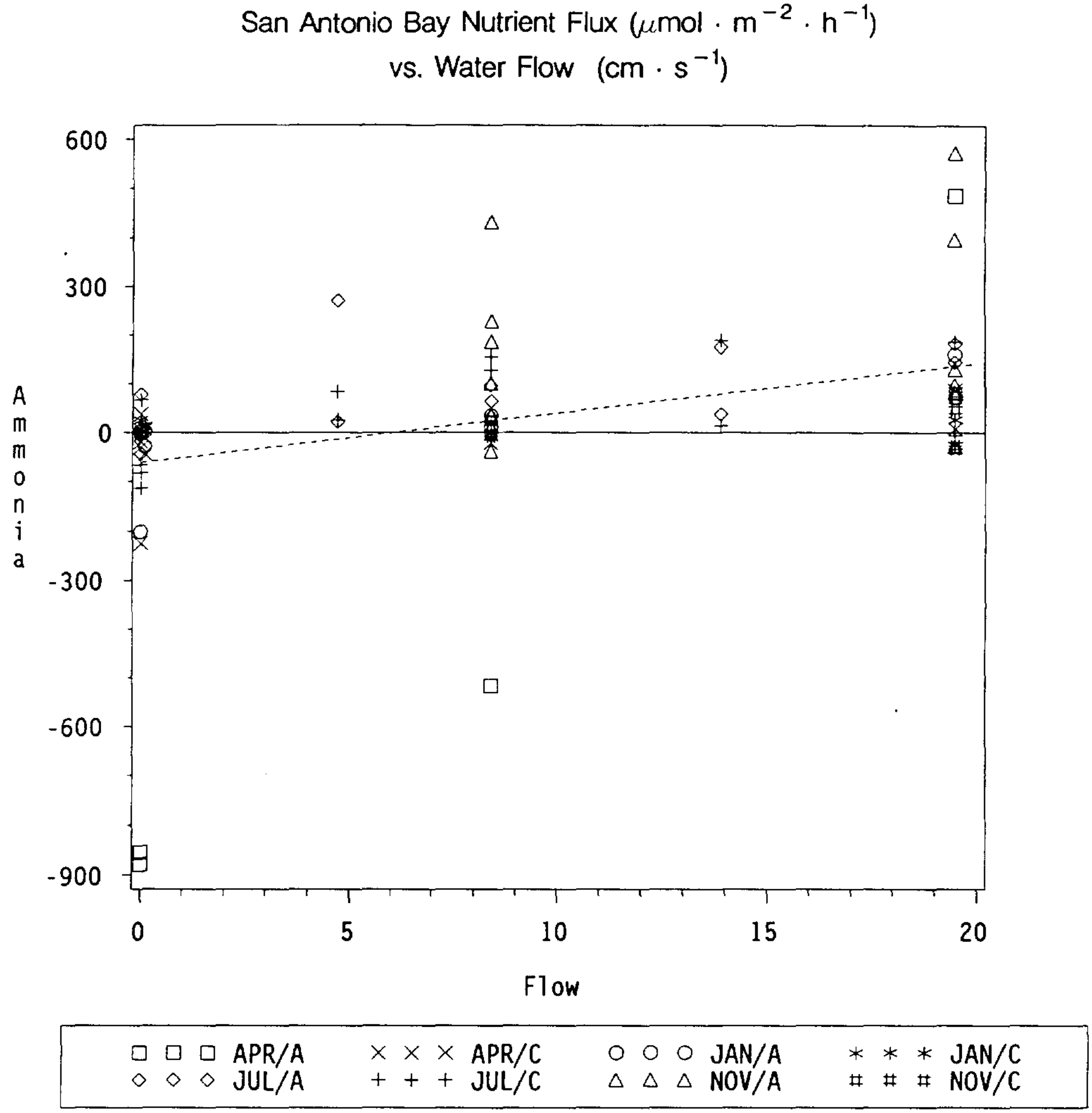

Figure 16. Ammonia flux as a function of current flow rates from San Antonio Bay. The first group letter refers to the month in 1986-7, and the second group letter refers to station A or C. The formula for the line fit through all 82 points is: Flux (μmol • m^{-2} • h^{-1}) = 10.17×(current speed in cm • s^{-1}) - 61.98, P=0.0020 for H_o:slope=0, and R^2=0.16).

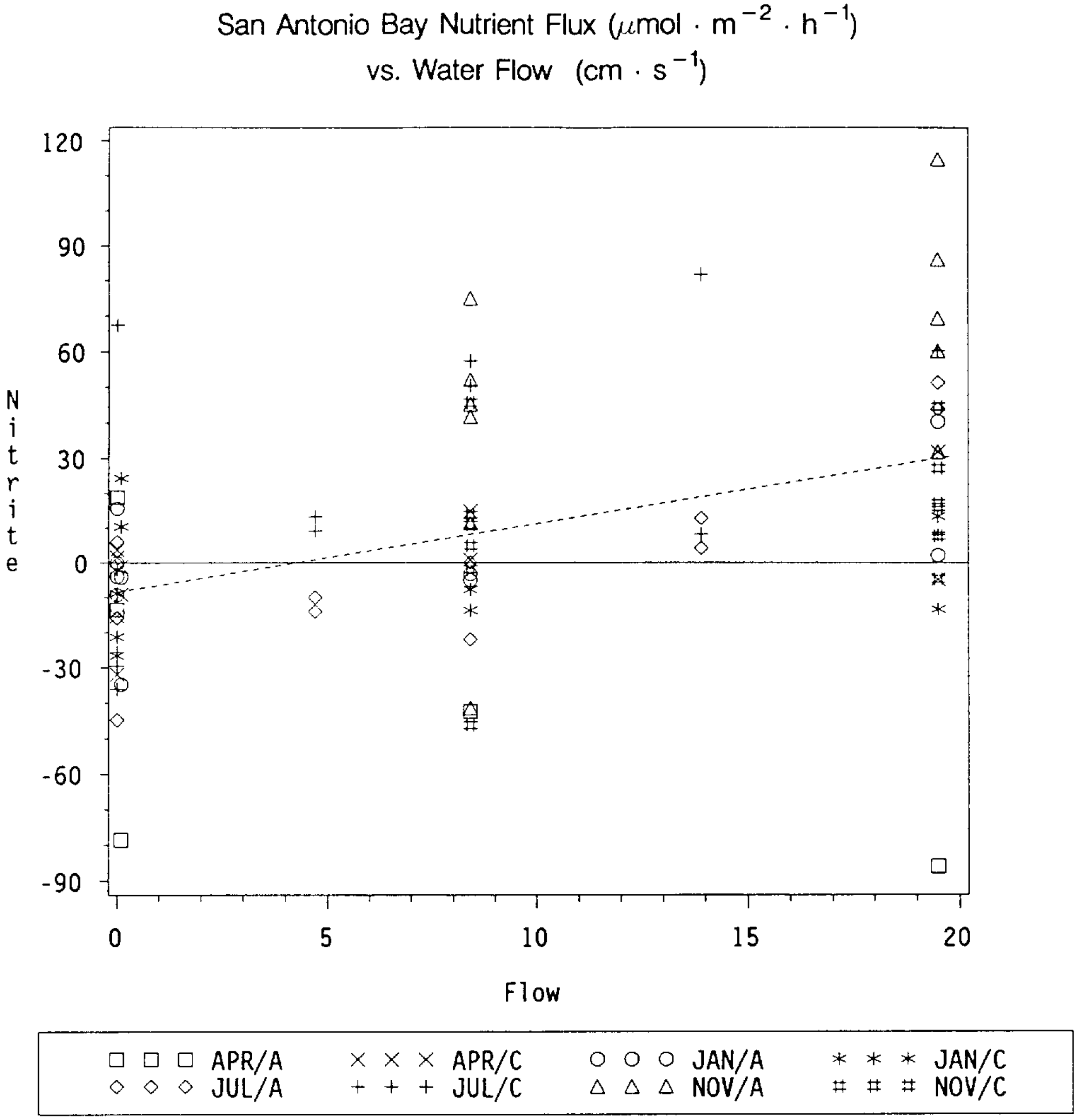

Figure 17. Nitrite flux as a function of current flow rates from San Antonio Bay. The first group letter refers to the month in 1986-7, and the second group letter refers to station A or C. The formula for the line fit through all 82 points is: Flux (μmol • m^{-2} • h^{-1}) = 1.974×(current speed in cm • s^{-1}) - 8.481, P=0.0001 for H_o:slope=0, and R^2=0.19).

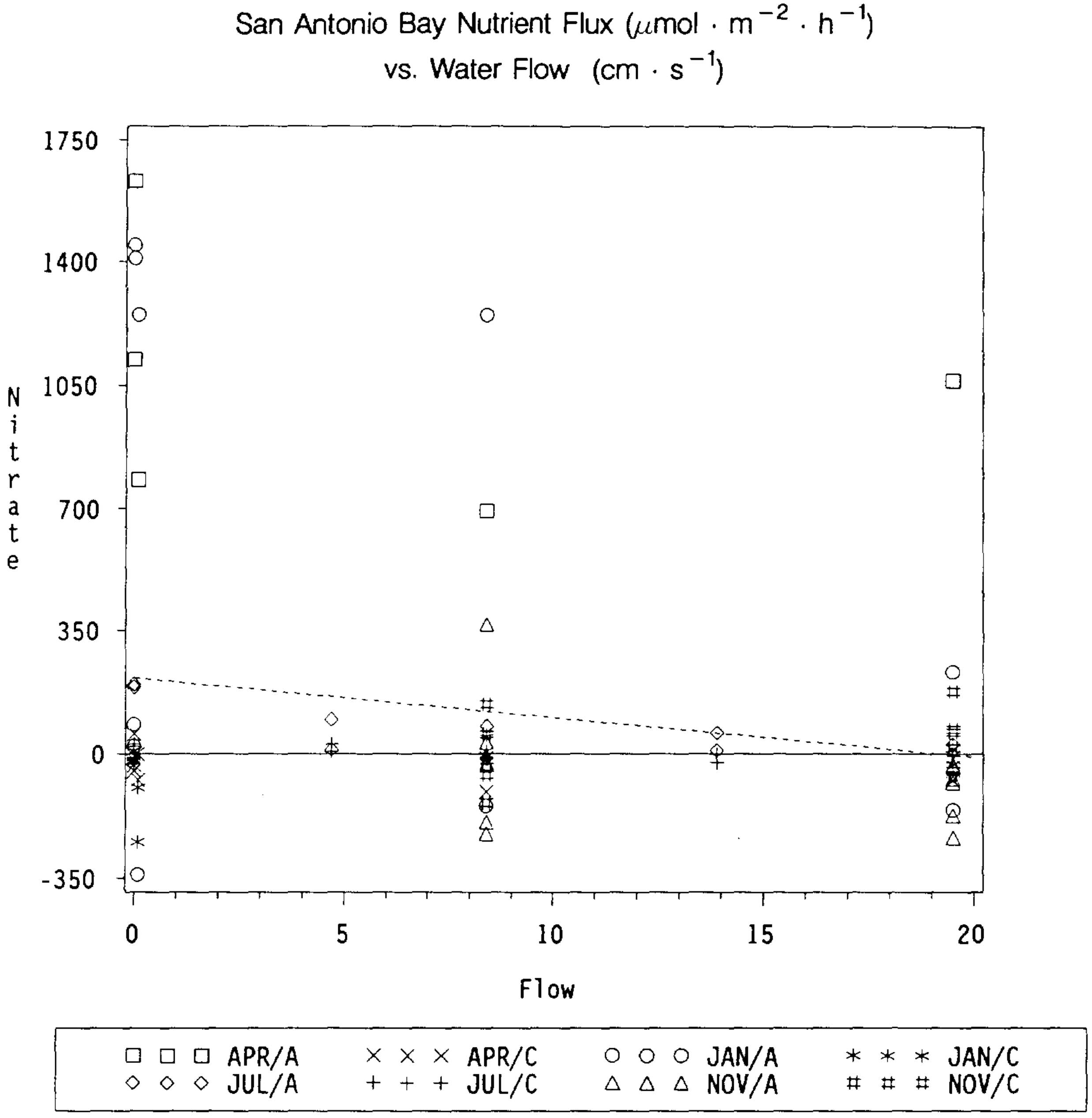

Figure 18. Nitrate flux as a function of current flow rates from San Antonio Bay. The first group letter refers to the month in 1986-7, and the second group letter refers to station A or C. The formula for the line fit through all 82 points is: Flux (μmol • m^{-2} • h^{-1}) = 11.20×(current speed in cm • s^{-1}) + 214.54 ,P=0.0454 for H_o:slope=0, and R^2=0.05).

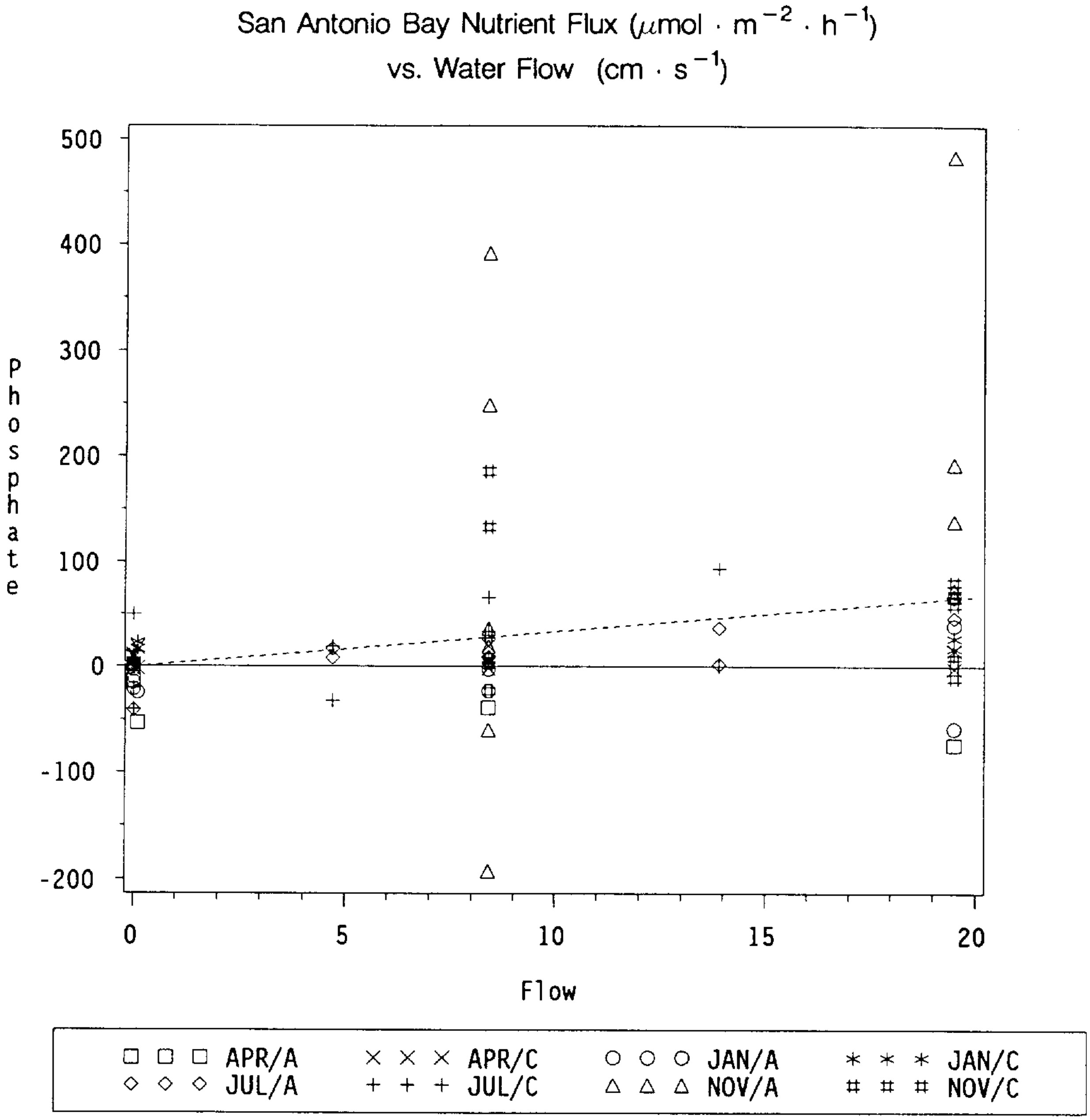

Figure 19. Phosphate flux as a function of current flow rates from San Antonio Bay. The first group letter refers to the month in 1986-7, and the second group letter refers to station A or C. The formula for the line fit through all 82 points is: Flux (μmol • m^{-2} • h^{-1}) = 3.363×(current speed in cm • s^{-1}) - 0.534, P=0.0064 for H_0:slope=0, and R^2=0.09).

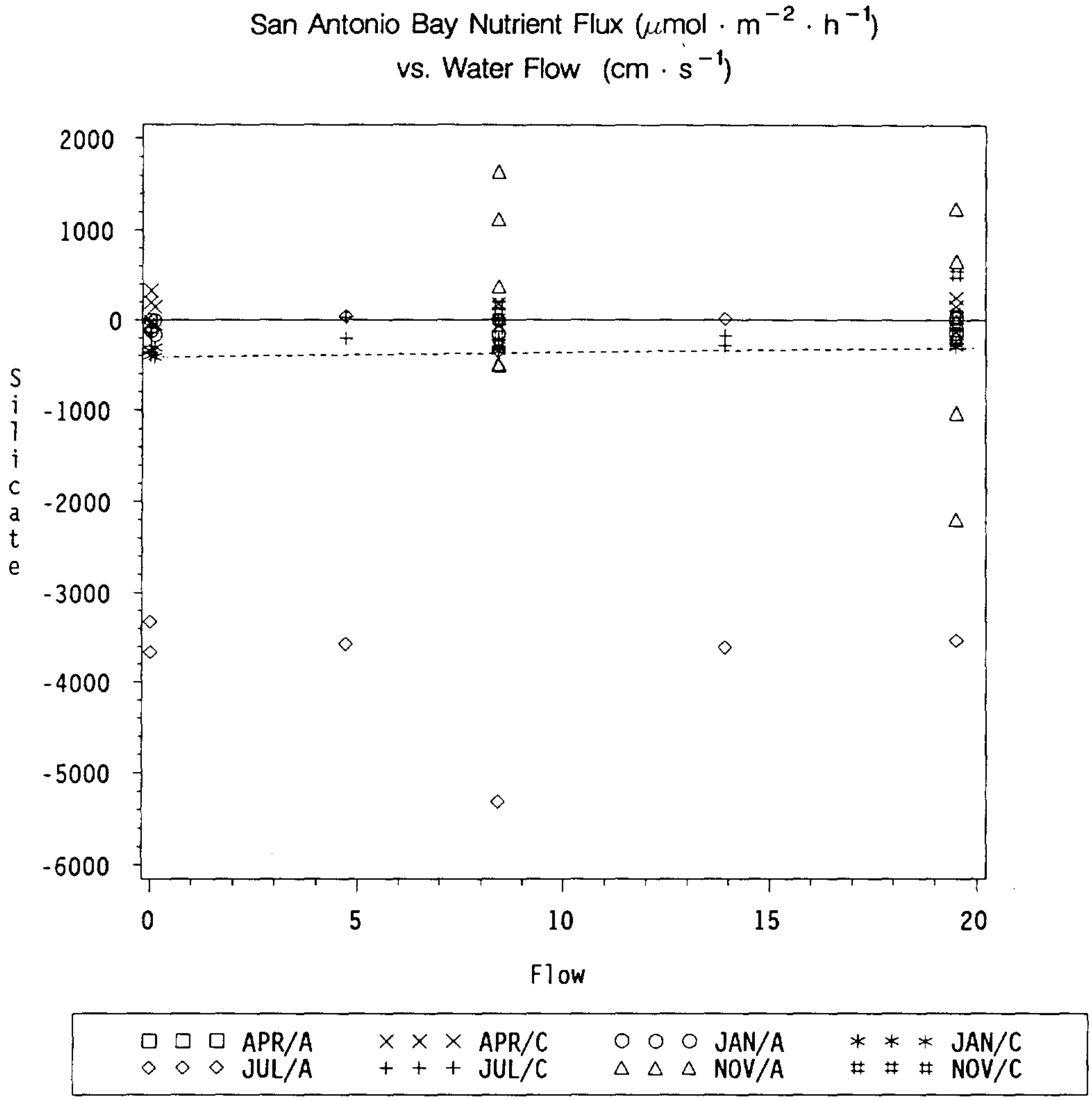

Figure 20. Silicate flux as a function of current flow rates from San Antonio Bay. The first group letter refers to the month in 1986-7, and the second group letter refers to station A or C. The formula for the line fit through all 82 points is: Flux (μmol • m^{-2} • h^{-1}) = 5.04×(current speed in cm • s^{-1}) - 413.57, P=0.002 for H_0:slope=0, and R^2=0.001).

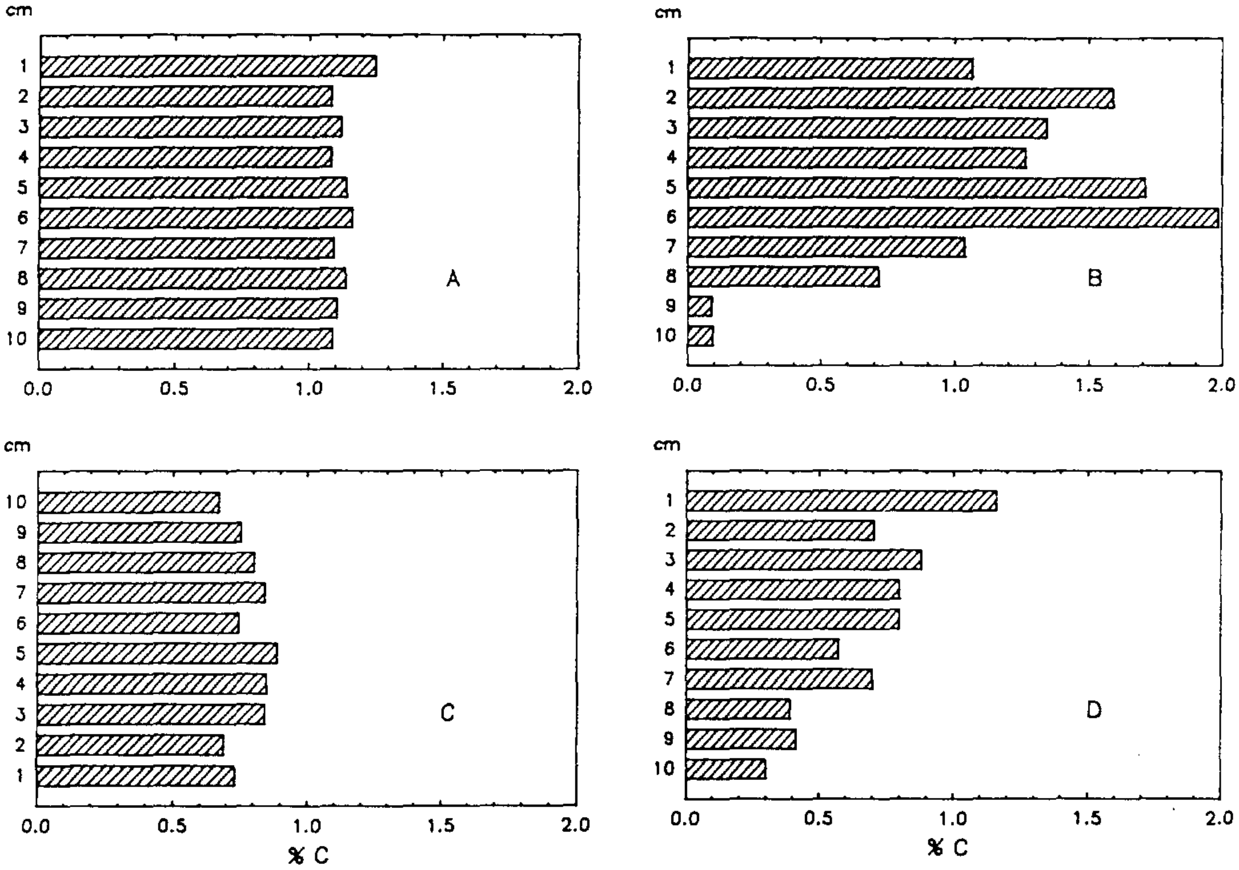

Figure 21. Vertical distribution of organic carbon content in sediments of San Antonio Bay, January 1987. A: station A, B: station B, C: station C, and D: station D.

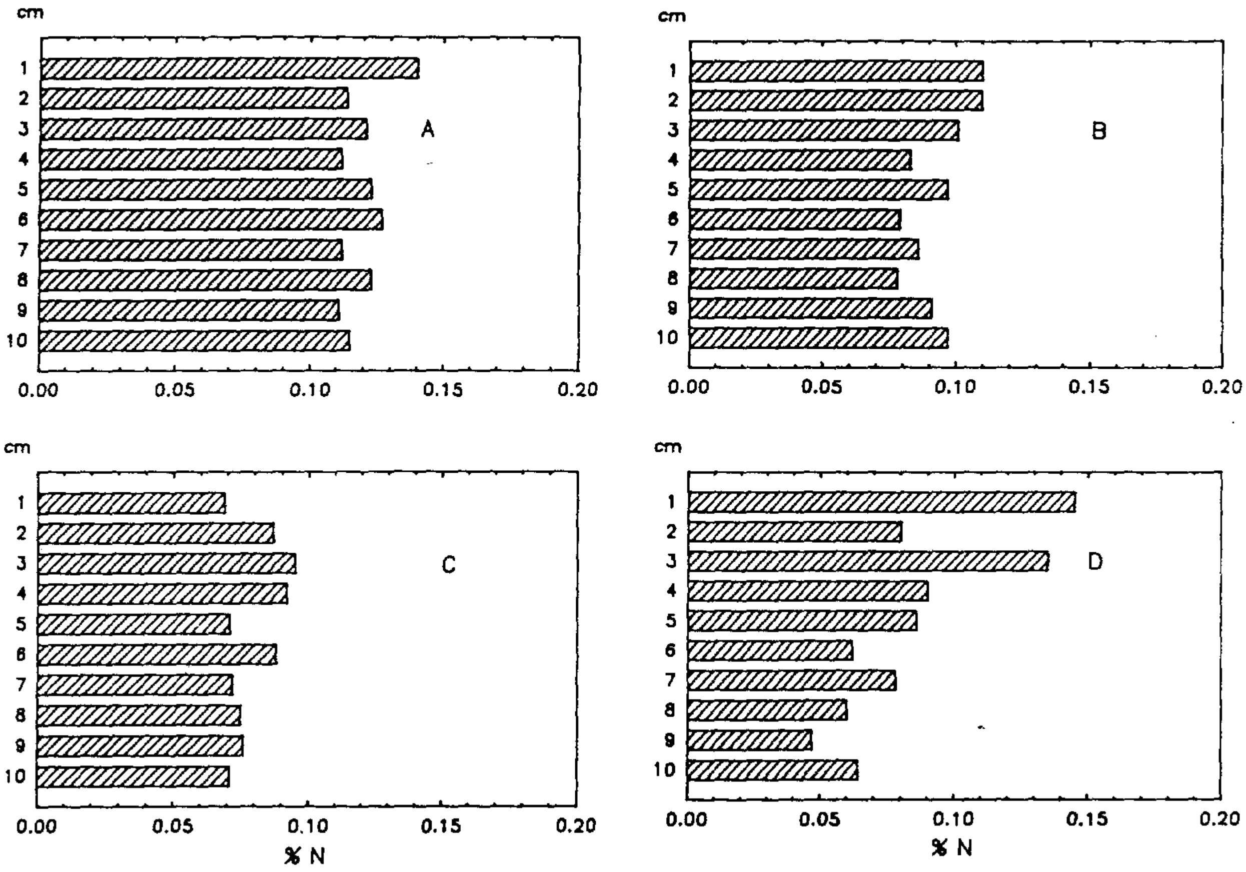

Figure 22. Vertical distribution of nitrogen content in sediments of San Antonio Bay, January 1987. A: station A, B: station B, C: station C, and D: station D.

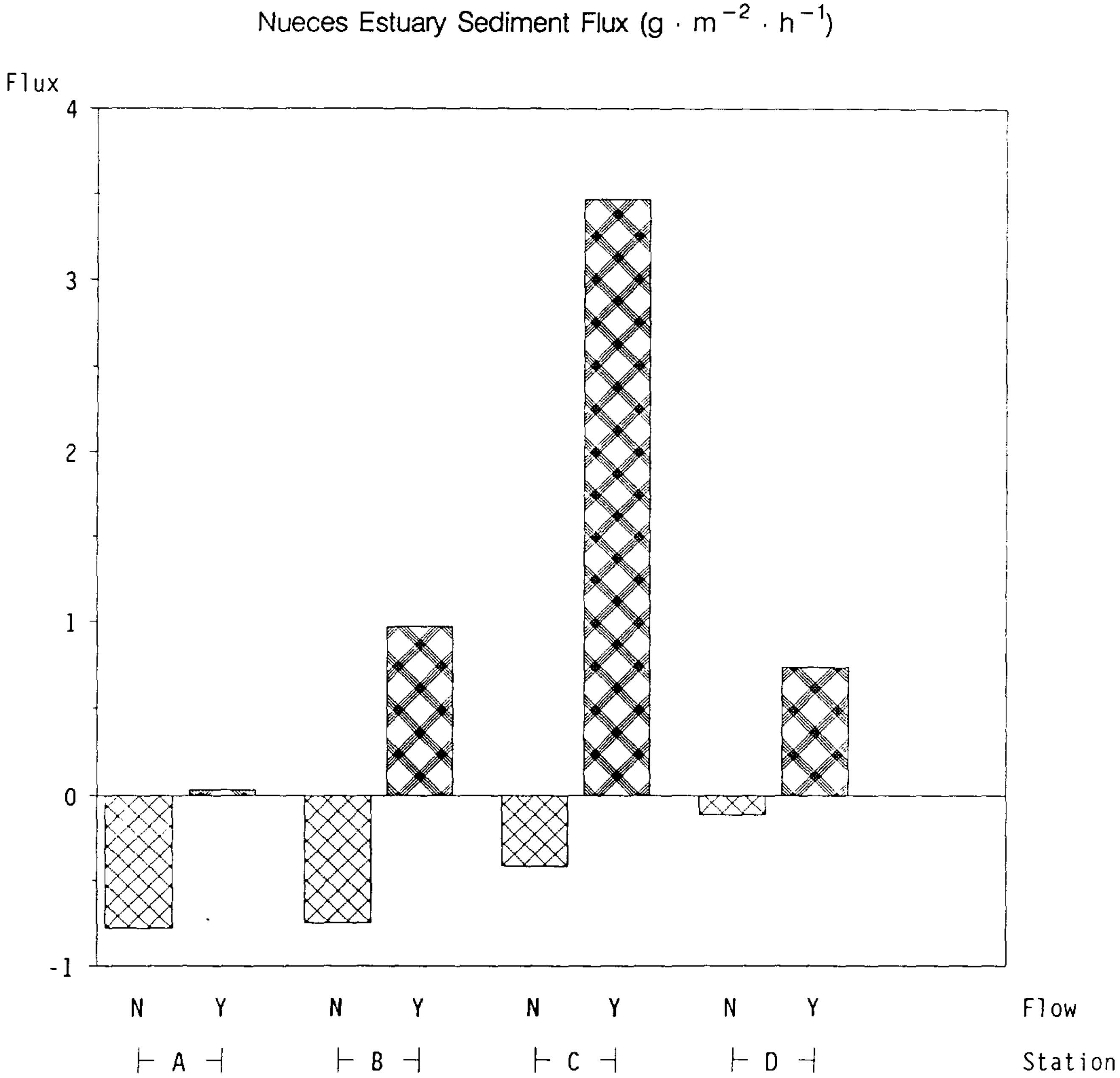

Figure 23. Sediment flux as a function of current flow (none or 19 cm · s^{-1}) from Nueces-Corpus Christi Bays, 1988. Average at stations A, B, C, and D.

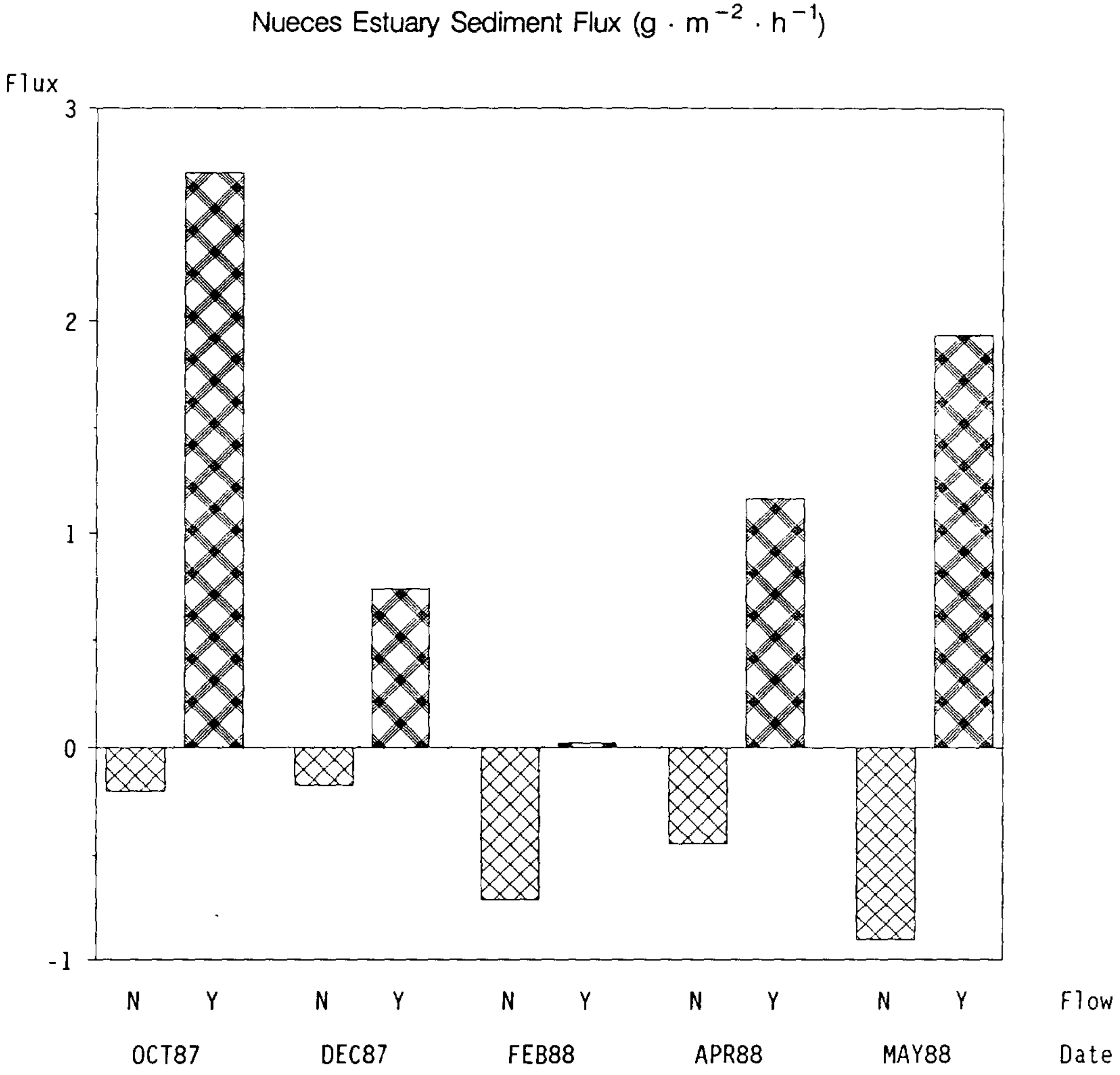

Figure 24. Sediment flux as a function of current flow (none or 19 cm • s^{-1}) from Nueces-Corpus Christi Bays, 1988. Average on different dates.

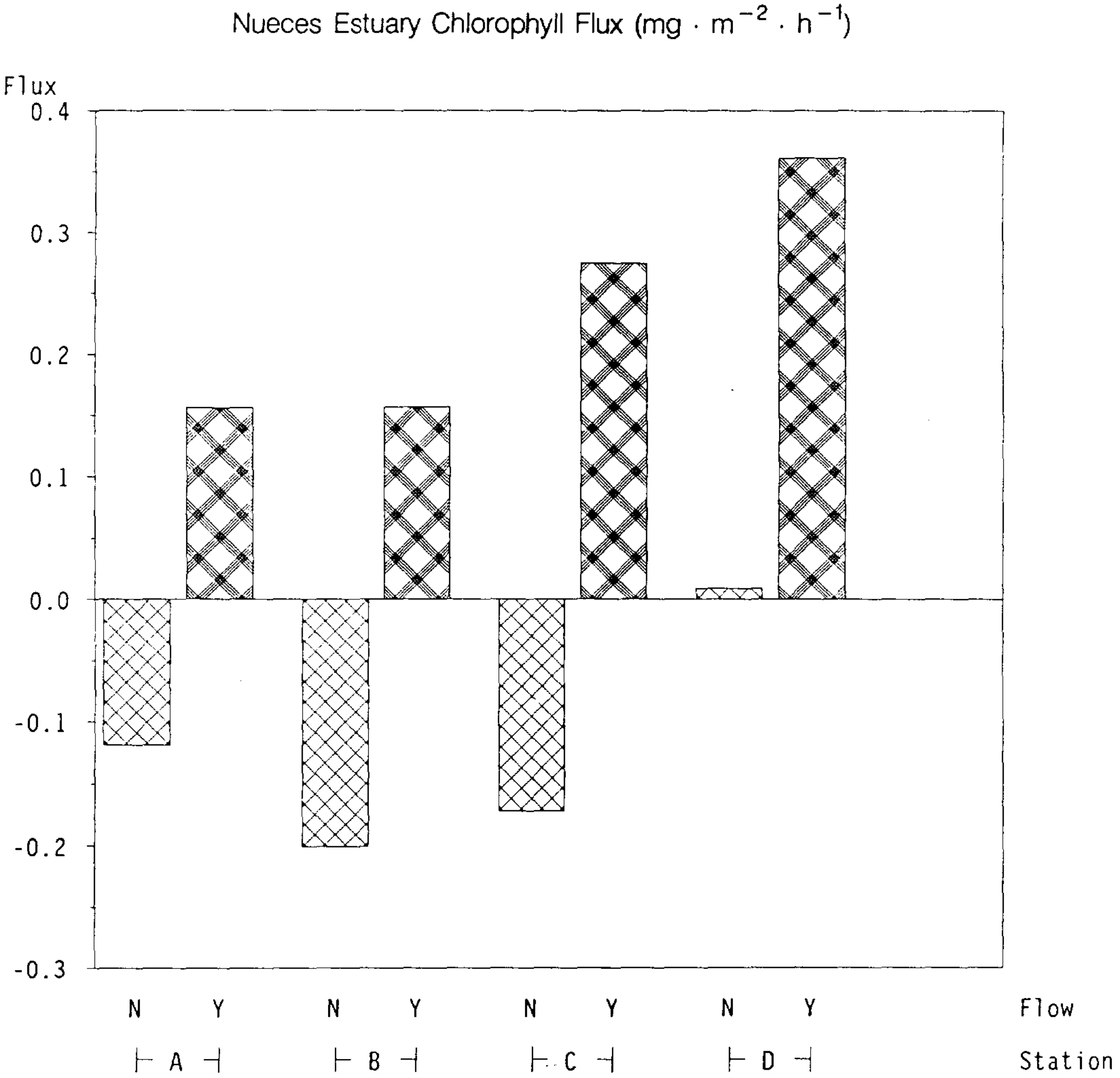

Figure 25. Chlorophyll flux as a function of current flow (none or 19 cm • s^{-1}) from Nueces-Corpus Christi Bays, 1988. Average flux at stations A, B, C, and D.

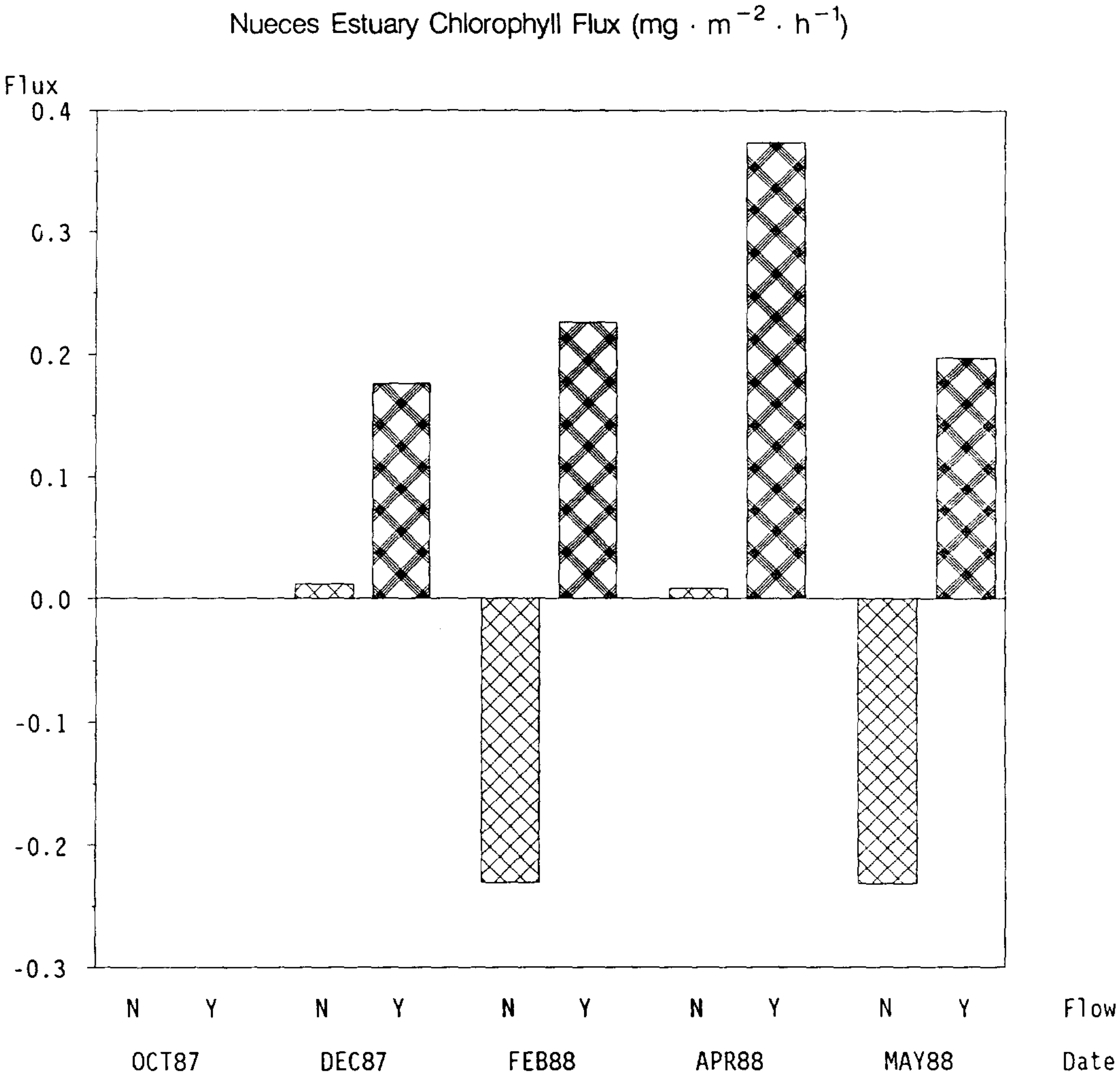

Figure 26. Chlorophyll flux as a function of current flow (none or 19 cm · s^{-1}) from Nueces-Corpus Christi Bays, 1988. Average on different dates.

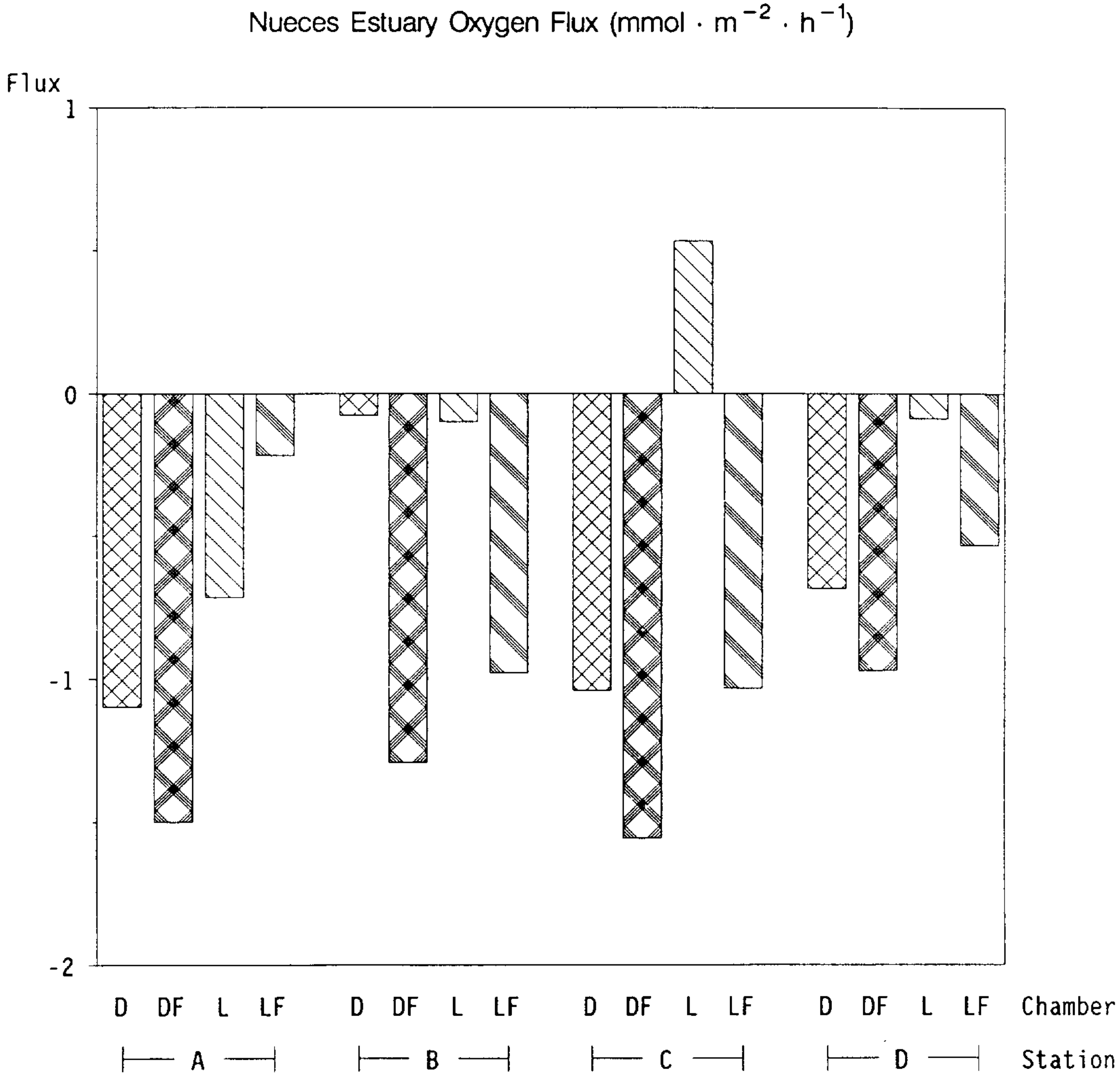

Figure 27. Oxygen flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux at stations A, B, C, and D. D=dark no current flow, DF=dark with current flow of 19 cm • s^{-1}, L=light no current flow, LF=light with current flow of 19 cm • s^{-1}.

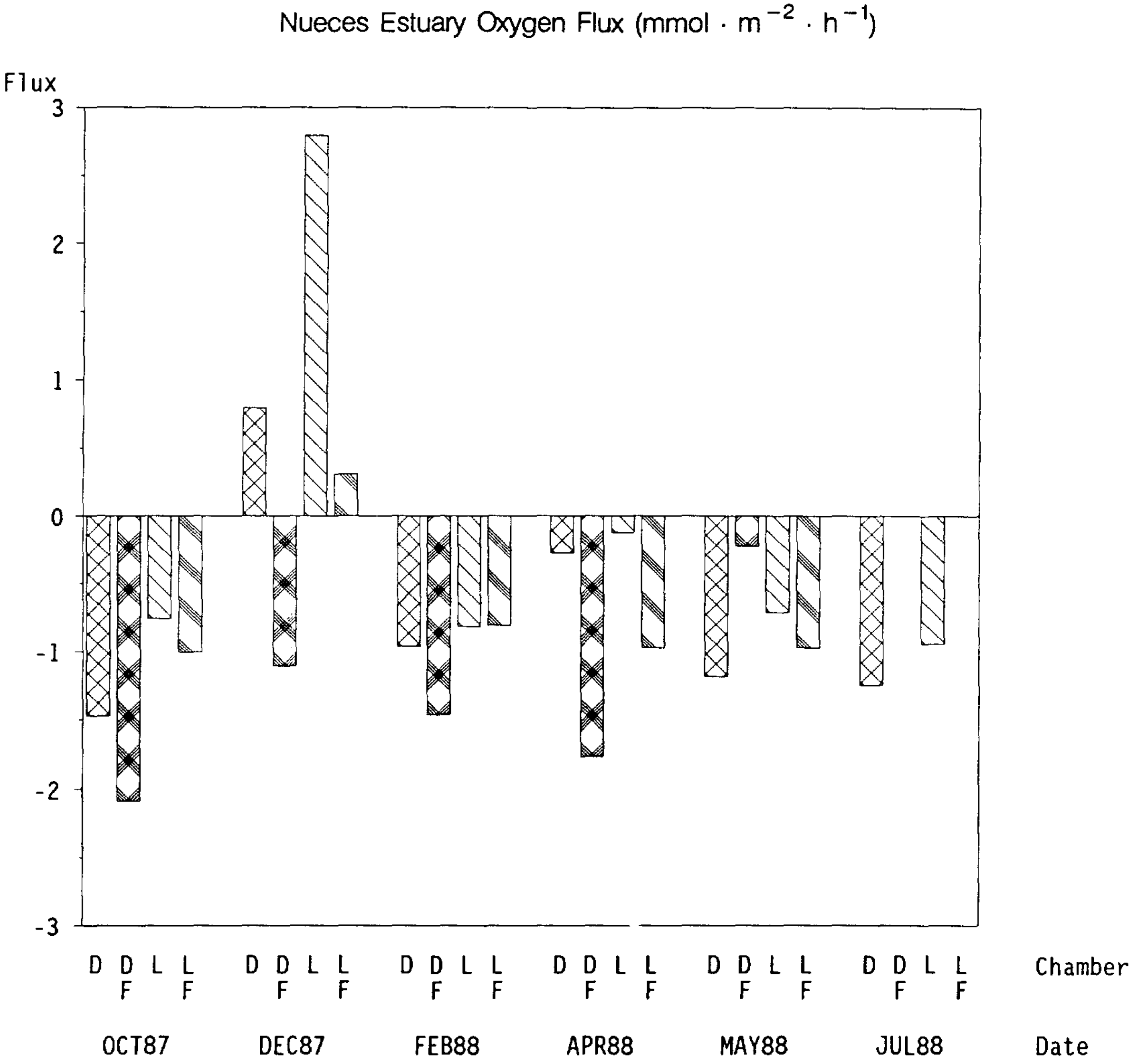

Figure 28. Oxygen flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux on different dates in 1988. D=dark no current flow, DF=dark with current flow of 19 cm · s^{-1}, L=light no current flow, LF=light with current flow of 19 cm · s^{-1}.

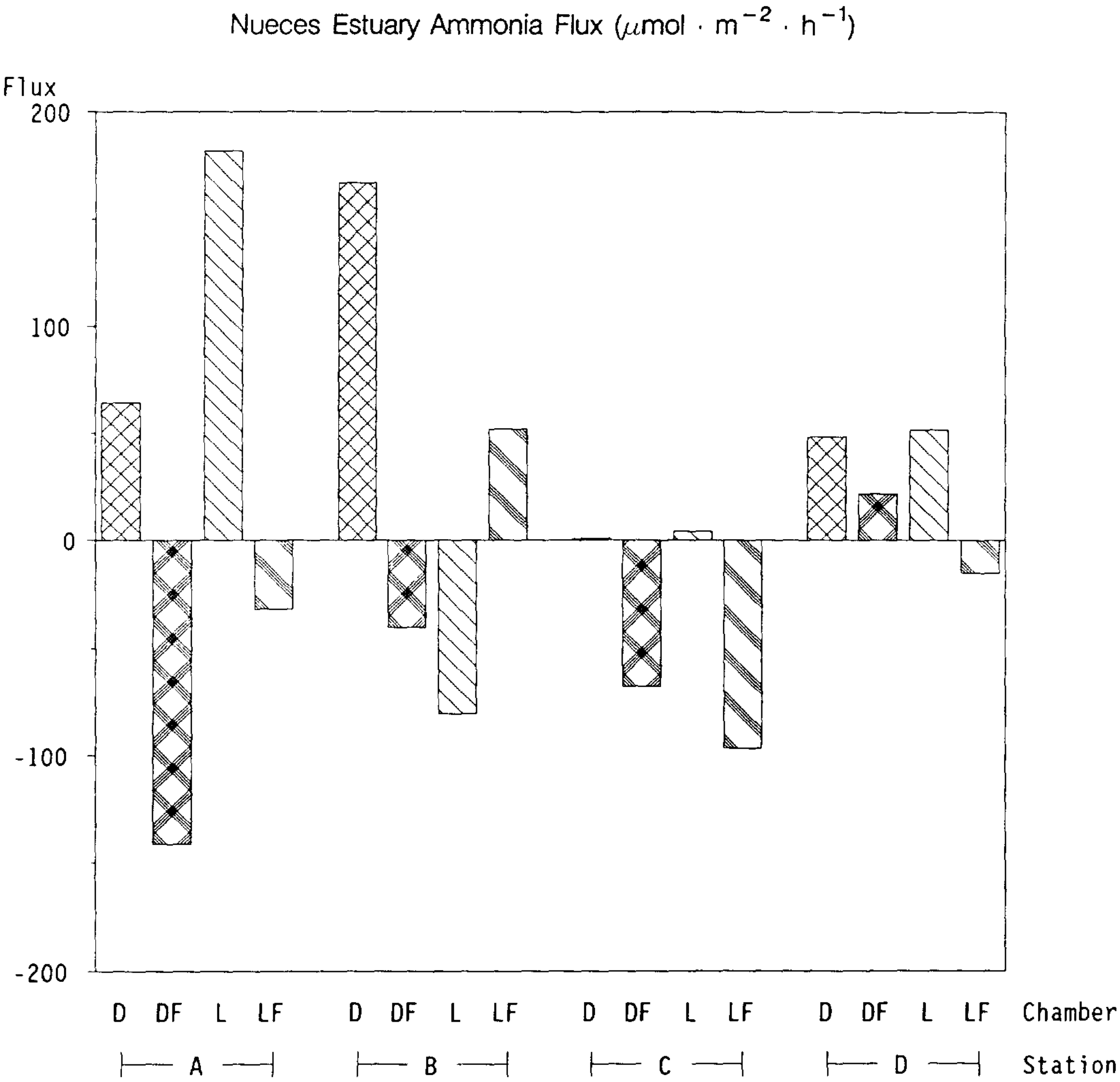

Figure 29. Ammonia flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux at stations A, B, C, and D. D=dark no current flow, DF=dark with current flow of 19 cm · s^{-1}, L=light no current flow, LF=light with current flow of 19 cm · s^{-1}.

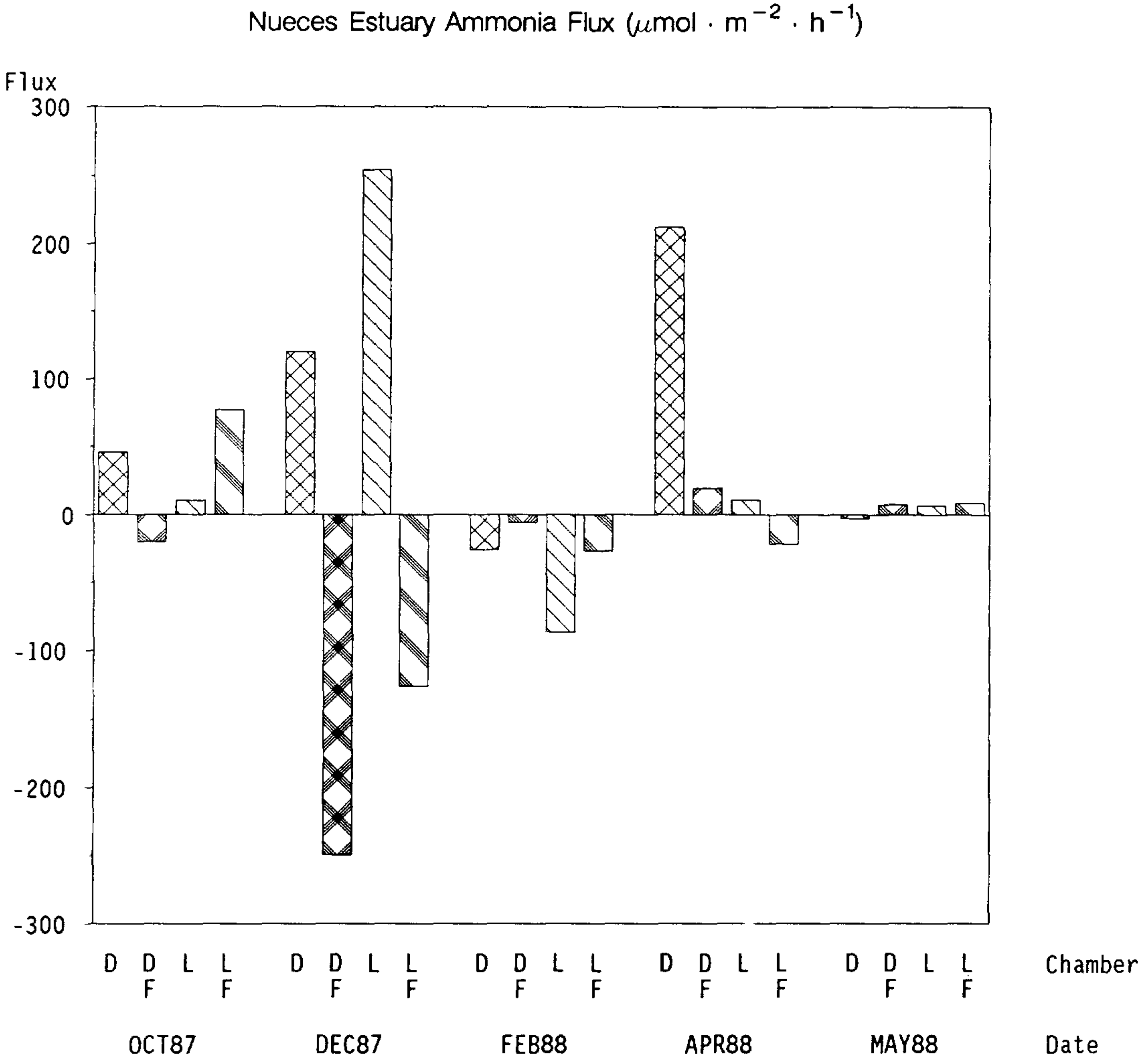

Figure 30. Ammonia flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux on different dates in 1988. D=dark no current flow, DF=dark with current flow of 19 cm • s^{-1}, L=light no current flow, LF=light with current flow of 19 cm • s^{-1}.

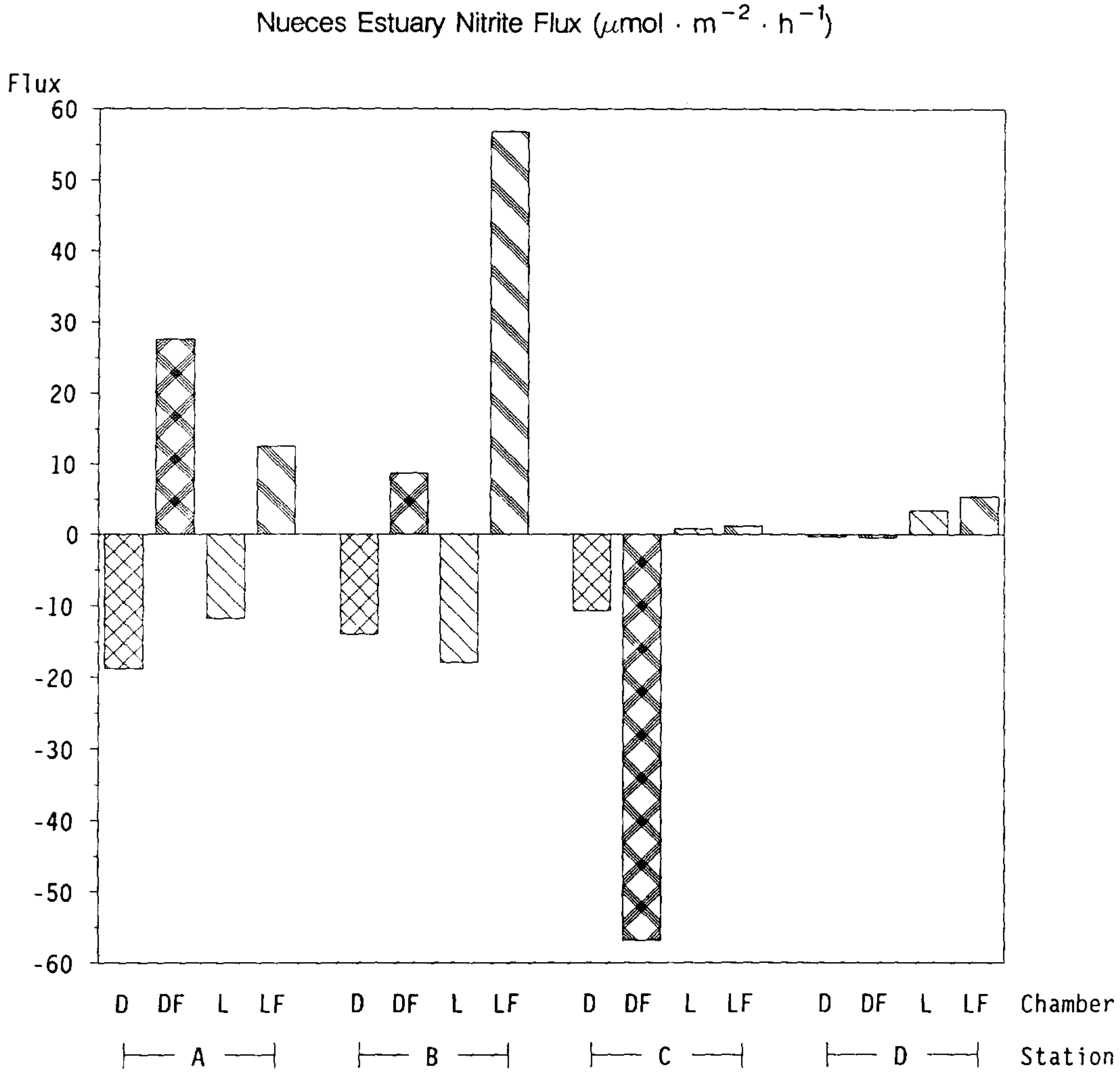

Figure 31. Nitrite flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux at stations A, B, C, and D. D=dark no current flow, DF=dark with current flow of 19 cm · s^{-1}, L=light no current flow, LF=light with current flow of 19 cm · s^{-1}.

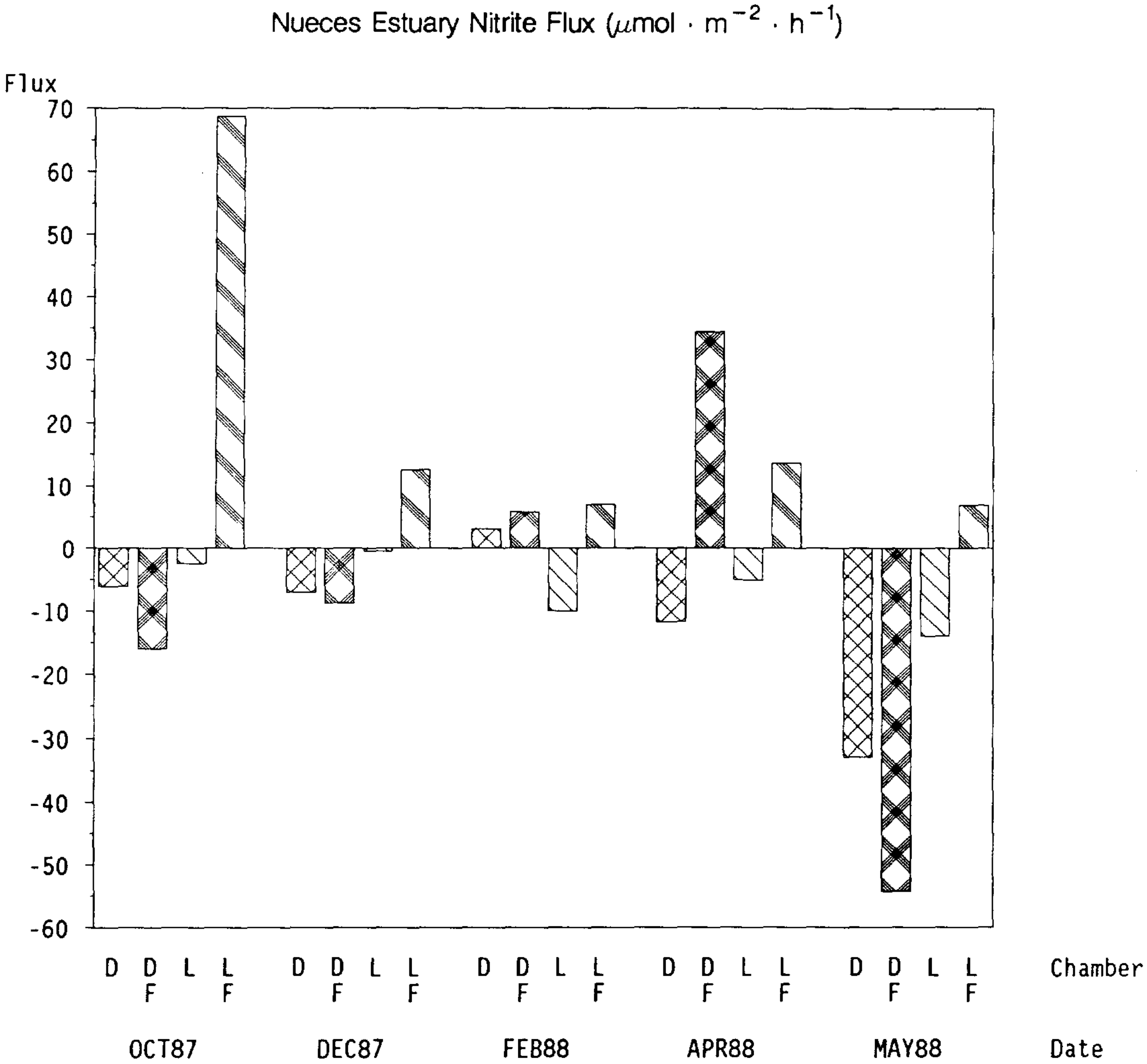

Figure 32. Nitrite flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux on different dates in 1988. D=dark no current flow, DF=dark with current flow of 19 cm · s^{-1}, L=light no current flow, LF=light with current flow of 19 cm · s^{-1}.

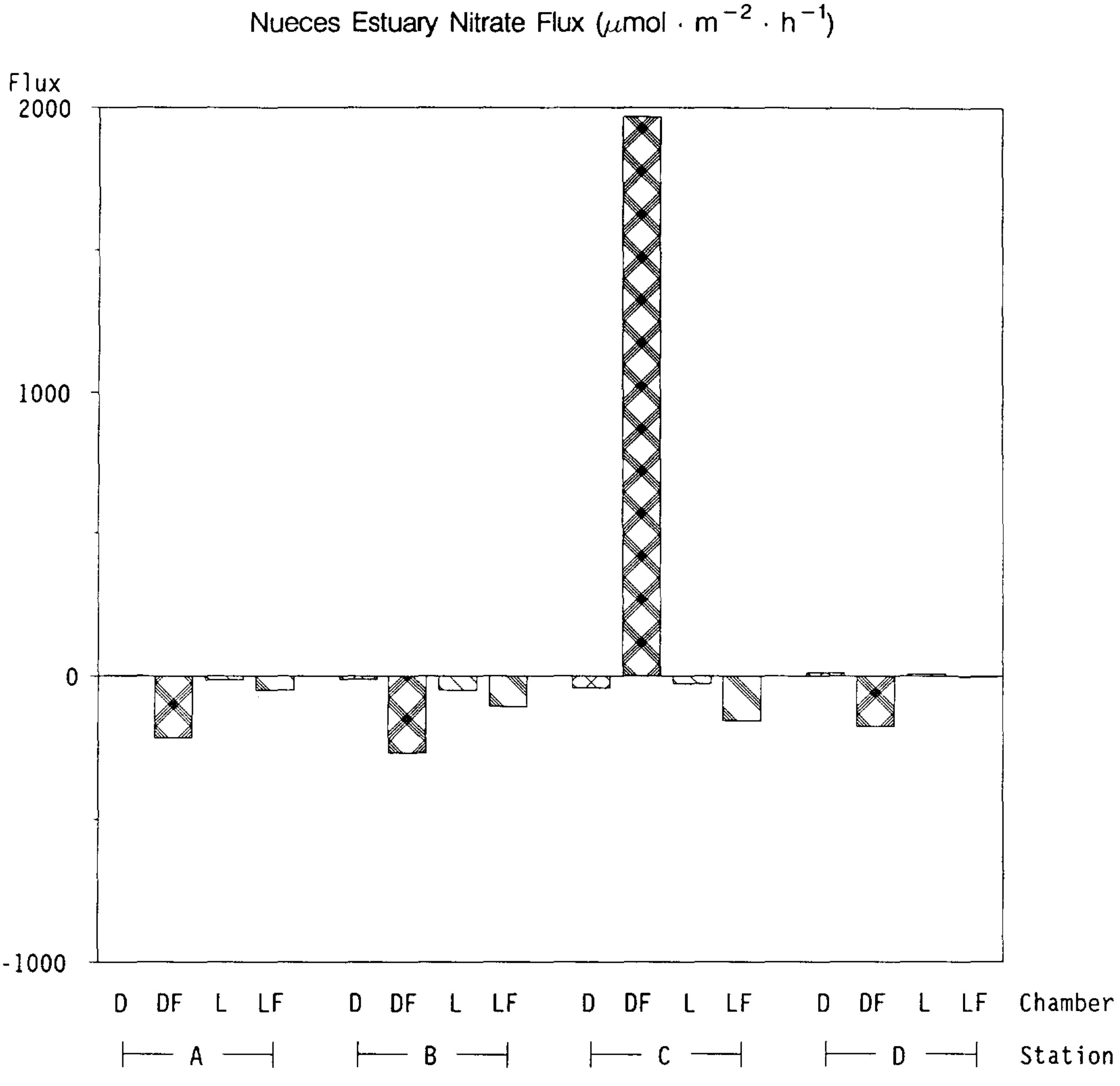

Figure 33. Nitrate flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux at stations A, B, C, and D. D=dark no current flow, DF=dark with current flow of 19 cm • s^{-1}, L=light no current flow, LF=light with current flow of 19 cm • s^{-1}.

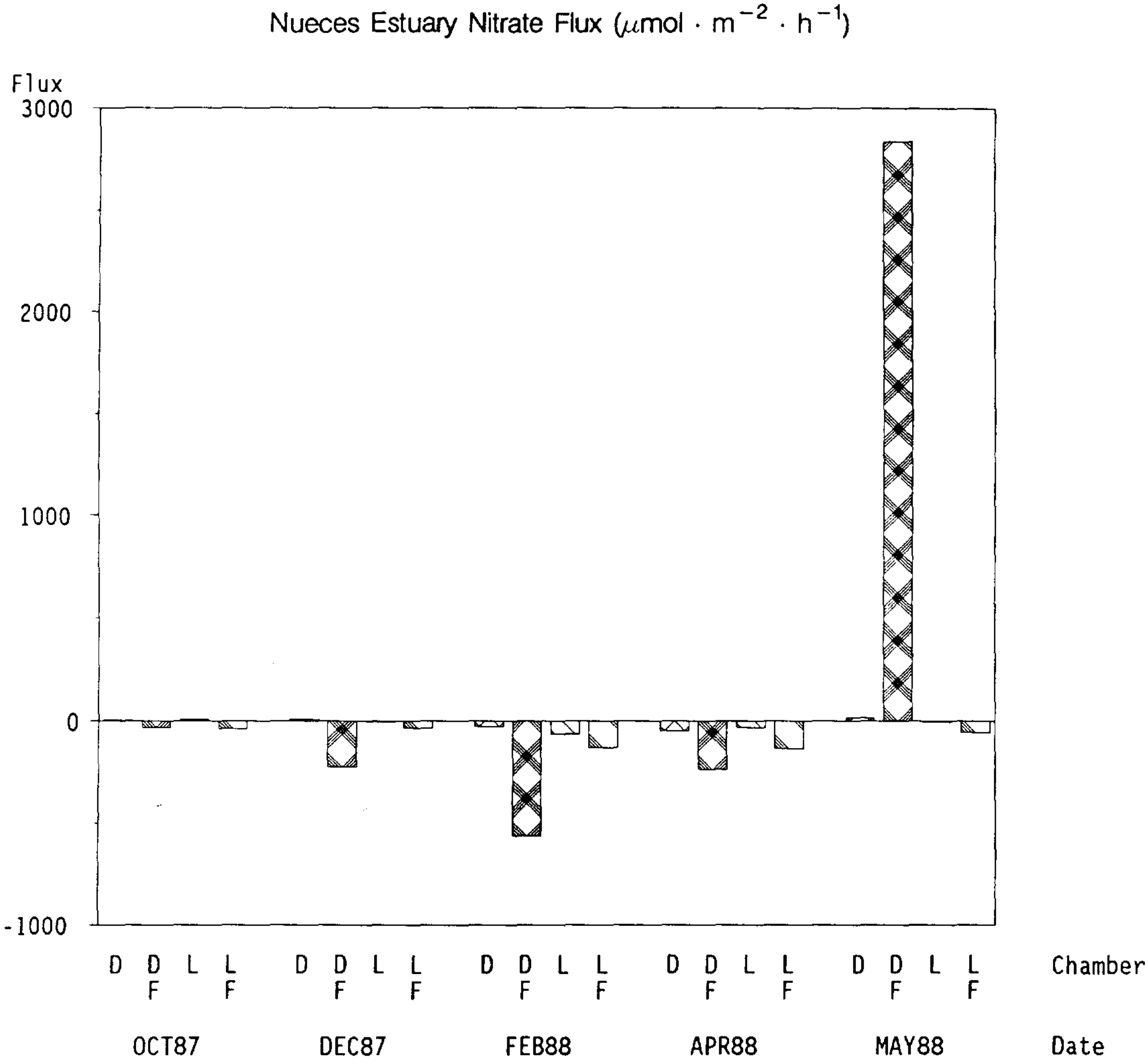

Figure 34. Nitrate flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux on different dates in 1988. D=dark no current flow, DF=dark with current flow of 19 cm • s^{-1}, L=light no current flow, LF=light with current flow of 19 cm • s^{-1}.

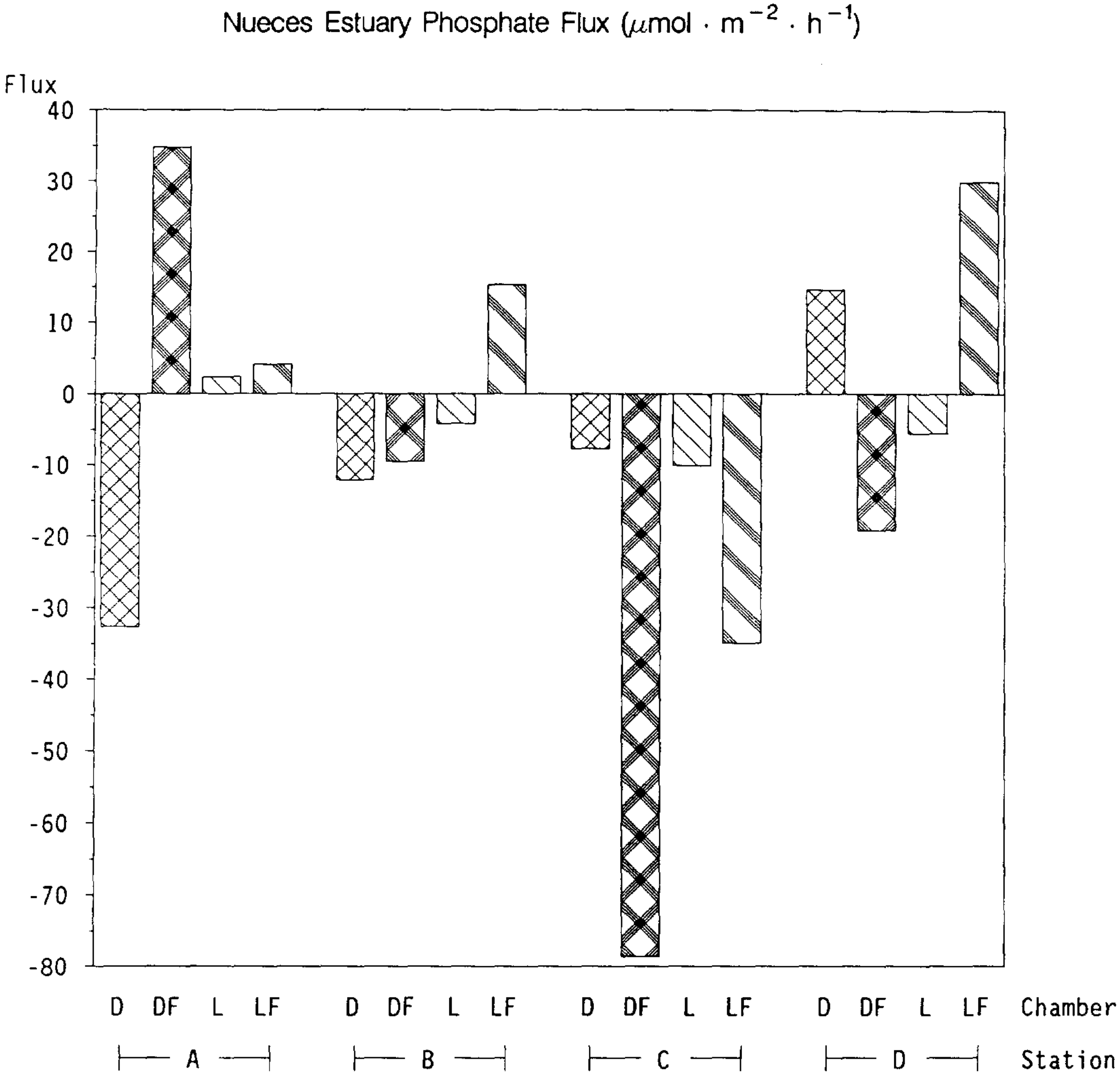

Figure 35. Phosphate flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux at stations A, B, C, and D. D=dark no current flow, DF=dark with current flow of 19 cm • s^{-1}, L=light no current flow, LF=light with current flow of 19 cm • s^{-1}.

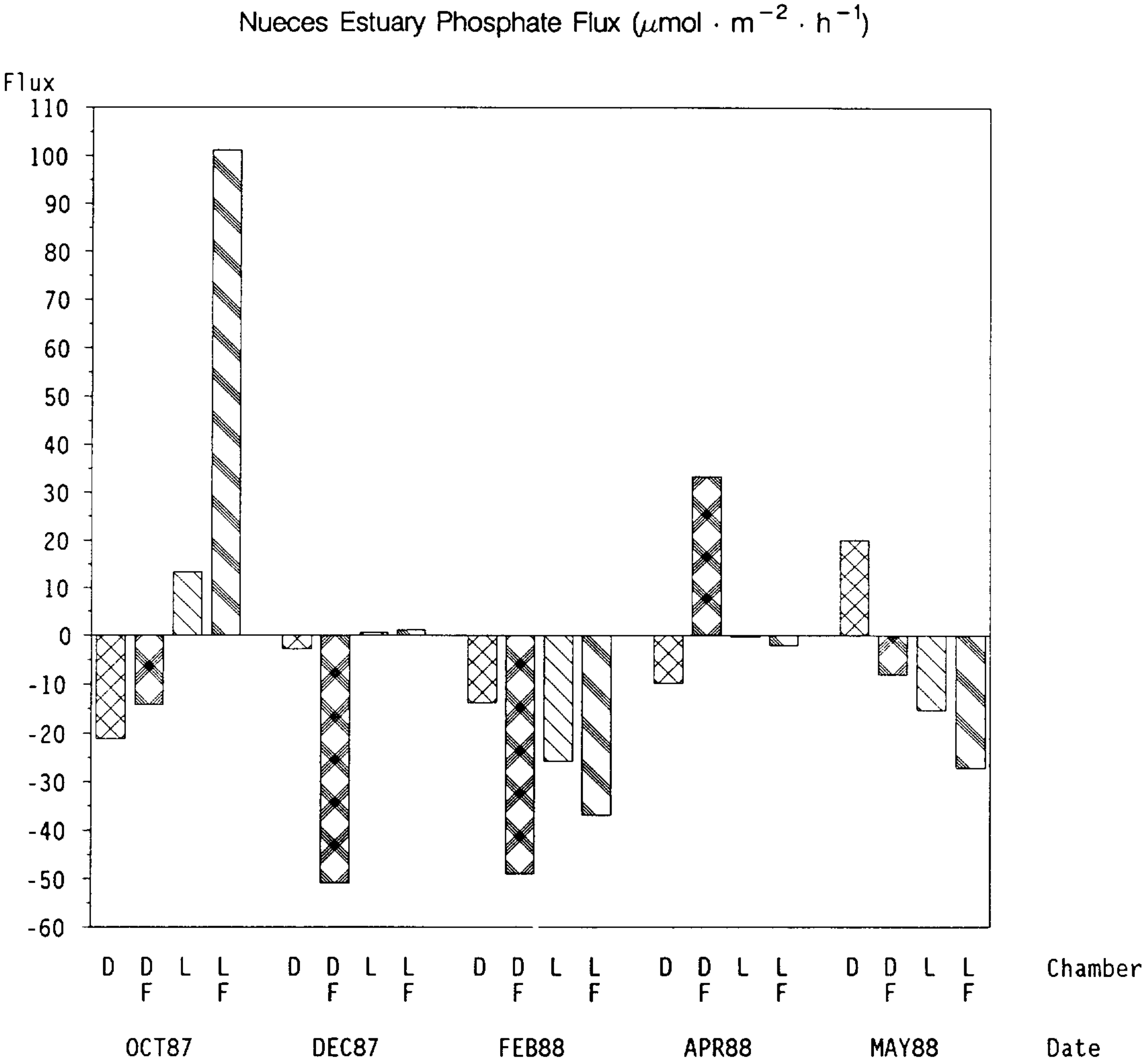

Figure 36. Phosphate flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux on different dates in 1988. D=dark no current flow, DF=dark with current flow of 19 cm • s^{-1}, L=light no current flow, LF=light with current flow of 19 cm • s^{-1}.

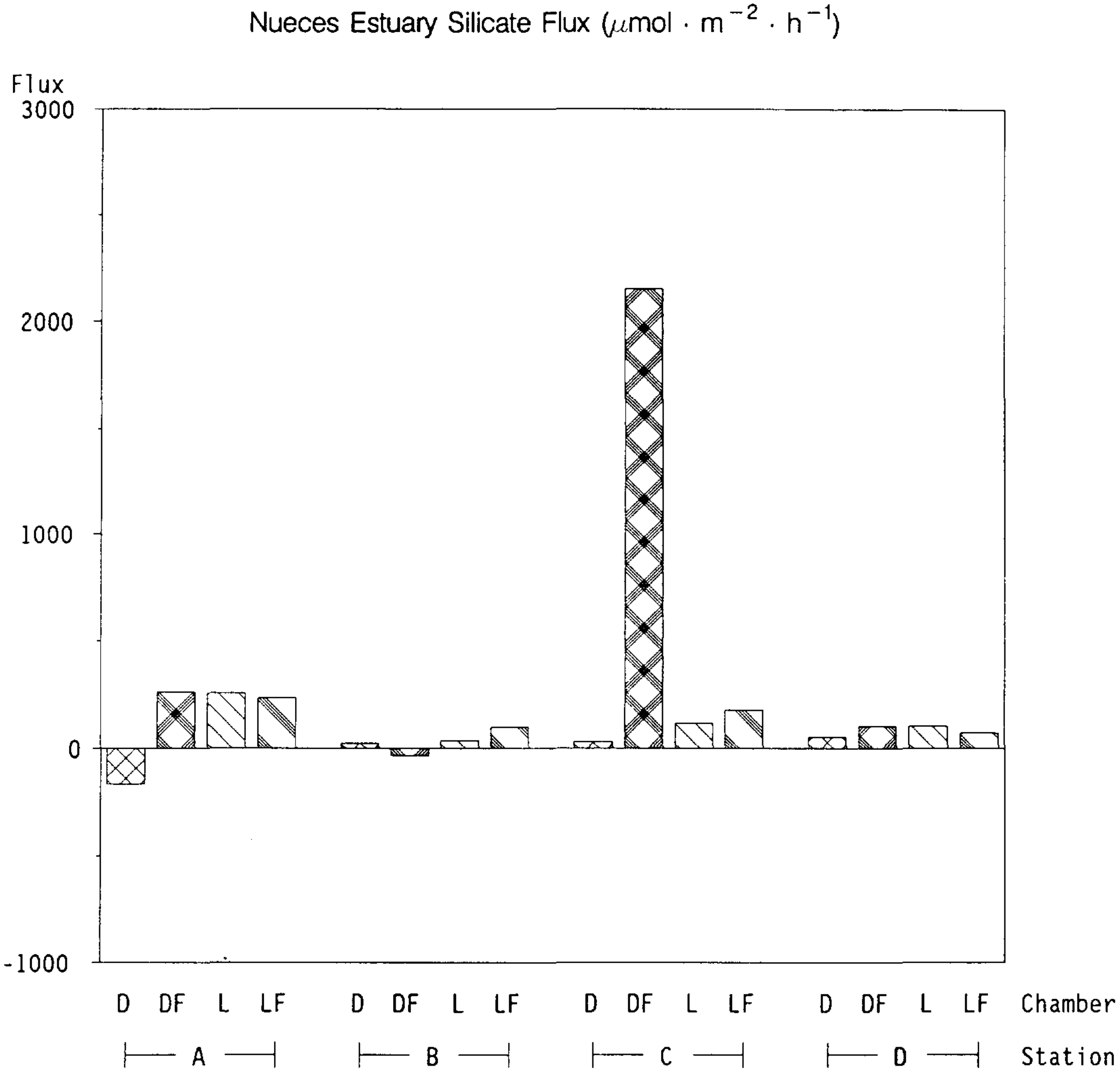

Figure 37. Silicate flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux at stations A, B, C, and D. D=dark no current flow, DF=dark with current flow of 19 cm · s^{-1}, L=light no current flow, LF=light with current flow of 19 cm · s^{-1}.

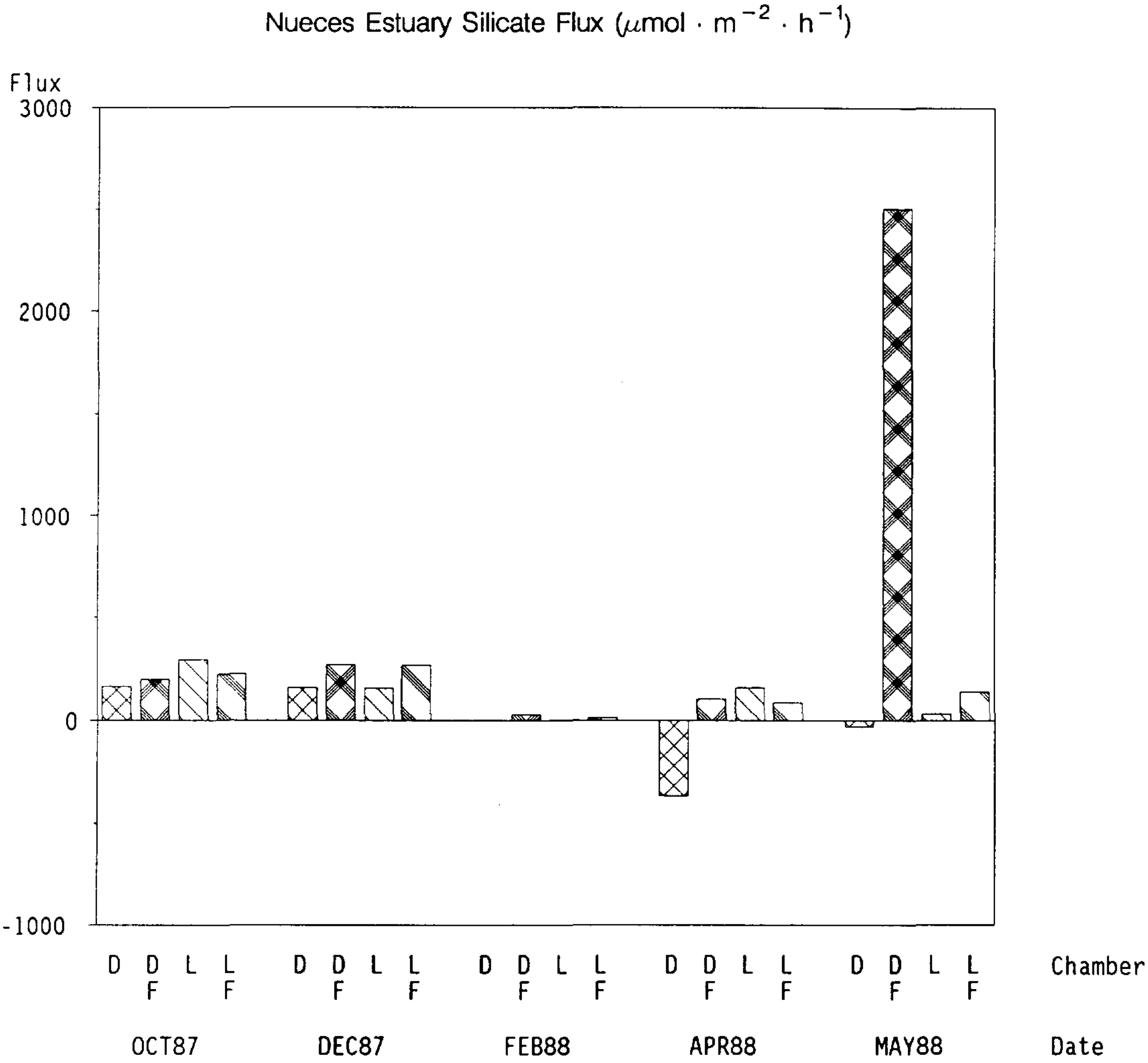

Figure 38. Silicate flux in four treatment chambers from Nueces-Corpus Christi Bay. Average flux on different dates in 1988. D=dark no current flow, DF=dark with current flow of 19 cm · s^{-1}, L=light no current flow, LF=light with current flow of 19 cm · s^{-1}.

The Effect of Freshwater Inflow on Meiofaunal and Macrofaunal Populations in San Antonio, Nueces and Corpus Christi Bays, Texas

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ABSTRACT

Two estuaries with very different inflow characteristics were compared to test the hypothesis that benthic productivity is enhanced by freshwater inflow. The Guadalupe estuary had 79 times more freshwater inflow than the Nueces estuary, and a third of the salt content. The Guadalupe had higher macrofaunal densities and biomass than the Nueces, and both parameters increase along a decreasing salinity gradient within the Guadalupe Estuary. Macrofauna density increased with increasing salinity in the Nueces Estuary. Meiofaunal densities were higher in the Nueces estuary, and decreased along increasing salinity gradients in both estuaries. These results indicate that macrofauna may be responding to freshwater inflow with increased productivity. Increased macrofaunal densities appear to be associated with decreasing meiofaunal densities.

INTRODUCTION

Marine benthic infauna are very susceptible to fluctuations in their environment since they are often limited in their mobility. Large changes in salinity regimes will have effects on the distribution and abundance of benthic infauna. Freshwater species, which can accommodate very low salinities are typical of the upper reaches of estuaries. Estuarine species, which can accommodate large swings in salinity will be found in the center of estuaries. Marine species which can not accommodate such shifts in salinity will be limited to the lower portions of the estuary.

Abundance and biomass of infauna may increase if nutrient loading from river input is transformed into food for benthic animals (Montagna and Yoon, 1989). This occurs when nutrients coming down the river stimulate primary production. The primary production is then deposited, but it may also be advected, so that increases in benthic productivity might only occur at the marine end of the estuary. However, this assumes that freshwater and low salinity does not have a negative impact on reproductive success. The net effect of freshwater inflow is then a product of freshwater inflow, physical processes (i.e., sedimentation, resuspension, and advection), and biological processes (i.e., recruitment and salinity tolerance).

If freshwater inflow enhances benthic productivity then increased abundance and biomass should be found in estuaries with greater inflow. Benthic macrofauna and meiofauna were studied in two estuaries (the Guadalupe and Nueces Estuaries) with historically different inflow patterns during a two year period. Over a 35-year period, between 1941 and 1976, the freshwater inflow balance (i.e., gains minus losses) in the Guadalupe estuary was on average five times greater than in the Nueces estuary (TDWR, 1980; 1981). This indicates that the estuaries are very different with regard to inflow. However, since the sampling programs in the two bays occurred in different years intra-bay comparisons are confounded with annual variation in inflow.

MATERIALS AND METHODS

Study design. In order to distinguish between freshwater influence and marine influence four stations were always chosen. Two stations which replicate each of the two treatment effects (freshwater and marine) were sampled. Generally these stations were along a salinity gradient in the estuarine system leading from river mouth to the foot of the estuary near the barrier islands. This design avoids pseudoreplication, where only one station has the characteristic of the main effect (Hurlbert, 1984). It is not possible to distinguish between station differences and treatment differences in pseudoreplicated designs.

Two estuaries were studied in detail. The Guadalupe and San Antonio Rivers flow into San Antonio Bay. Over a 35-year period the Guadalupe Estuary received an average of 2.80×10^{9} $m^{3} \cdot y^{-1}$ of freshwater input, and the freshwater balance (input-output) was 2.54×10^{9} $m^{3} \cdot y^{-1}$ (TDWR, 1980). This system was studied from January through July 1987. Four stations were occupied: freshwater influenced stations at the head of the bay (station A) and at mid-bay (station B), and two marine influenced stations near the Intracoastal Waterway, one at the southwestern foot of the bay (station C) and one at the southeastern foot of the bay (station D) (Figure 1). Stations were sampled five times in the first year.

The Nueces River flows into Nueces Bay, which is connected to Corpus Christi Bay. Over a 35-year period the Nueces Estuary received an average of 0.84×10^{9} $m^{3} \cdot y^{-1}$ of freshwater input, and the freshwater balance (input-output) was 0.51×10^{9} $m^{3} \cdot y^{-1}$ (TDWR, 1981). This system was studied from October 1987 through July 1988. Four stations were occupied along the axis of the system. Two stations were in the freshwater influenced Nueces Bay (A and B), and two stations were in the marine influenced Corpus Christi Bay (C and D) (Figure 1). Corpus Christi Bay has exchange of marine water from the Aransas Pass to the north, and the Laguna Madre to the south. Six field trips were performed.

Sampling and analyses. Salinities were measured with a hand-held refractometer. Sediment was sampled with core tubes by divers. The macrofauna was sampled with a tube 6.7 cm in diameter, and subsampled at depth intervals of 0-3 cm and 3-10 cm. The meiofauna was sampled with a tube 1.8 cm in diameter, and subsampled at depth intervals of 0-1 cm and 1-3 cm. Samples were preserved with 5% buffered formalin, sorted (on 63 μm sieves for meiofauna, and 0.5 mm sieves for macrofauna), identified, and counted.

Biomass of macrofauna was also measured. Individuals were combined into higher taxa categories, i.e., Crustacea, Mollusca, Polychaeta, and others. Samples were dried for 24 h at 55 °C, and weighed. Before drying, mollusks were placed in 1 N HCl for 1 min to 8 h to dissolve the carbonate shells, and washed. Some of the dried tissues were also analyzed for total organic Carbon (TOC) and Nitrogen (TON). They were ground into a fine powder with a mortar and pestle. A Perkin-Elmer 240B elemental analyzer was used for sample analysis.

Sediment grain size analysis was also performed. Analysis followed standard geologic procedures (Folk, 1964; E. W. Behrens, personal communication). Percent contribution by weight was measured for four components: rubble (e.g. shell hash), sand, silt, and clay. A 20 cm^3 sediment sample was mixed with 50 ml of hydrogen peroxide and 75 ml of deionized water to digest organic material in the sample. The sample was wet sieved through a 62 μm mesh stainless steel screen using a vacuum pump and a Millipore Hydrosol SST filter holder to separate rubble and sand from silt and clay. After drying, the rubble and sand were separated on a 125 μm screen. The silt and clay fractions were measured using pipette analysis.

Statistical analyses. Generally three replicate samples were taken for each date and station cell. Since cores were sectioned to obtain vertical distributions, depth zonation is a nested-random effect, not a crossed-fixed effect. That is, the vertical depth-interval samples from each core have a relationship with one another that must be taken into account. Therefore, numbers of individuals and biomass from vertical profiles were analyzed using a partially hierarchical model (Montagna et al., 1989). Total numbers and biomass per core (i.e., the sum of the two vertical sections) were analyzed using two-way analysis of variance (ANOVA) where the main effects were stations and sampling dates. Multiple ANOVA (MANOVA) was used to test for treatment effects on multiple independent variables, e.g., grain size. Wilks' Lambda was the test statistic used in MANOVA. Tukey multiple comparison procedures were used to find a posteriori differences among sample means. All analyses were performed using the SAS software system (SAS, 1985).

Water inflow data were obtained from the Texas Water Development Board and used to correlate inflow with salinity and biological parameters, e.g., biomass and density. The cell means of the independent variables were correlated with the cumulative sum of the freshwater inflow for 1, 7, 14, 21, and 28 days previous to sampling. Many figures have the mean of three replicate samples plotted with the daily freshwater inflow balance. The inflow balance is the net gain of water to the estuary. It is composed of the sum of the freshwater inputs (e.g., river, drainage, return flows, and precipitation) minus the sum of the outputs (e.g., diversions and evaporation).

RESULTS

The Guadalupe Estuary: San Antonio Bay. 1987 was a wet year with more rainfall and concomitant inflow than in the previous 35-year record. The freshwater balance for 1987 was 5.05×10^{9} $m^{3} \cdot y^{-1}$, which is three times higher than the 35-year average. This was primarily due to a large rainfall and resulting flooding event in June 1987 (Figure 2). Salinity levels in the lower part of San Antonio Bay were as high as 14 ppt in the spring, but were uniformly near zero after the flood in July (Figure 2). The average salinity at stations A and B was 1.4 ppt and at C and D 6.9 ppt over the course of this study.

Sediment grain size analysis was performed without replication twice, in June and July 1987 (Table 1). There was no difference in grain size composition from June to July (MANOVA, P=0.0884), or between the surface and bottom sections of the sediment cores (MANOVA, P=0.4386). However, there were differences between stations (MANOVA, P=0.0015). This was primarily due to a higher rubble content at stations A (11.5%) and B (7.6%) than at stations C and D (both 2.7%). Station B also had much less sand (4.0%) than the other stations (which averaged 30.7%).

The vertical distribution of macrofauna biomass changed within stations over different sampling periods (ANOVA, P=0.0040; Figure 3). Generally, there were higher biomasses in the deeper sections during June (with the exception of station A). Higher biomasses were also generally more prevalent in the deeper sections at the marine influenced stations (C and D) (Figure 3). The vertical distribution of density also changed within stations over the sampling period

(ANOVA, P=0.0090). This was due to high densities in the surface sediments during April and July in the freshwater zone (stations A and B) (Figure 4). Crustacea were generally absent from the deeper (3-10 cm) sections (Table 2). The biomass and density of the surface section (0-3 cm) was dominated by Mollusca at stations A and B, but the deep section was dominated by Polychaeta (Table 2). Mollusca dominated the biomass in both sections at stations C and D, but polychaetes dominated the density (Table 2). The overall mean biomass in the surface sections was 2.34 g $\cdot$ m^{-2}, and the density was 15,800 individuals $\cdot$ m^{-2}. The overall mean biomass in the subsurface section was 1.85 g $\cdot$ m^{-2}, and the mean density was 3,450 individuals $\cdot$ m^{-2}.

The total macrofaunal biomass to a depth of 10 cm varied seasonally (P=0.0050), and between stations (P=0.0026) (Figure 5). Even though the biomass at station A was very high in March and July, the interaction between dates and stations was not significant (P=0.1738). In both cases this was due to a very large density of the mollusk *Littoridina sphictostoma*. Biomass increased throughout the year, peaking in June at 7.01 g $\cdot$ m^{-2}. Biomass decreased in July, (after the large flood) but this was not significantly different from the June biomass (Tukey test). Average biomass at station A was 7.20 g $\cdot$ m^{-2}, at B 4.76 g $\cdot$ m^{-2}, at C 3.19 g $\cdot$ m^{-2}, and at D 3.53 g $\cdot$ m^{-2}. The average in the fresh zone (5.98 g $\cdot$ m^{-2}) was almost twice the biomass in the marine zone (3.36 g $\cdot$ m^{-2}). The mean biomass over all dates and stations was 4.67 g $\cdot$ m^{-2}. There were no significant differences in carbon or nitrogen content among the macrofaunal taxa tested. The average carbon content was 39.74%, and the nitrogen content was 8.56% for all macrofauna (Table 3). So the average biomass in the Guadalupe estuary is 1.86 g C $\cdot$ m^{-2}. The nitrogen inventory in sediment organisms is 0.400 g N $\cdot$ m^{-2}.

Total macrofauna densities to a depth of 10 cm did not change over time (ANOVA, P=0.0871) (Figure 6). Densities at station A appeared to increase through the spring and then fall after the large inflow event, but there was no significant interaction between dates and stations (P=0.0957). The average density at A (41.3×10^3 $\cdot$ m^{-2}) was significantly higher than the densities at B (18.9×10^3 $\cdot$ m^{-2}), C (9.17×10^3 $\cdot$ m^{-2}), or D (7.53×10^3 $\cdot$ m^{-2}), which were all the same (Tukey test). Densities were almost four times lower and relatively constant at the marine stations ($8.35\times10^3 \cdot m^{-2}$) than in the freshwater stations ($30.1\times10^3 \cdot m^{-2}$). The high densities at A were due to very large numbers of the mollusks *Littoridina sphictostoma*, and *Mulinia lateralis* (Table 4). The higher densities at both A and B relative to C and D were also due to the presence of the polychaetes *Streblospio benedicti* and *Mediomastus californiensis* (Table 4).

Salinity was inversely correlated with inflow (Table 5). The strongest correlation was with the cumulative inflow over the previous 28 d period (Table 5). Total biomass was positively correlated with the inflow on the day of sampling, but not with any cumulative inflow event (Table 5). Density was not significantly correlated with inflow.

Meiofauna from the top 1 cm of sediment was only sampled three times in 1987 (Figure 7). The densities at the replicate stations behaved the same way as each other, but with differing trends. At A and B densities stayed relatively low ($0.250\times10^6 \cdot m^{-2}$) and did not change over time. Nor were the densities at A and B significantly different from each other (Tukey multiple comparison test). In contrast, densities decreased over time at stations C and D and were on average about four times greater than that of the fresh stations ($1.124\times10^6 \cdot m^{-2}$). Station C ($1.361\times10^6 \cdot m^{-2}$) was always slightly more dense than station D ($0.887\times10^6 \cdot m^{-2}$) (Tukey multiple comparison test). Taxa composition of the meiofauna was similar to other marine environments at stations C and D, but depauperate in nematodes at stations A and B (Table 6).

The Nueces Estuary: Nueces and Corpus Christi Bays. The sampling period between October 1987 and July 1988 was a very dry period. The inflow balance for that annual period was $-0.66\times10^9 \cdot m^{-3}$. In contrast, the 35-year average was $0.51 \times10^9\ m^3 \cdot y^{-1}$ (TDWR, 1981). By the end of the study period salinities were higher than marine water that is typical of the Gulf of Mexico (Figure 8). The average salinity at station A was 31 ppt, B was 33 ppt, C was 33 ppt, and D was 34.

Sediment grain size analysis was performed in October 1987, and April and July 1988 (Table 1). Three replicate samples were taken at each sample period. Sediment composition changed among dates (MANOVA, $P=0.0004$), stations (MANOVA, $P=0.0001$), and vertical sections (MANOVA, $P=0.0125$). The Nueces Bay stations (A and B) were very similar in average rubble content (36.8% and 34.2%

respectively), and so were the Corpus Christi Bay stations (C and D) (19.7% and 12.4% respectively). However the sand and silt-clay contents always exhibited similar trends going from the head of the bay to the foot of the bay. The trend from A to B was the same as the trend from C to D. Sand content increased, and silt and clay decreased (Table 1). This indicates that the head of the bays are primarily depositional, and the foot of the bays are not. The source of the sand is probably sand dunes.

The vertical distribution of macrofaunal biomass in Nueces estuary changed within stations among sample periods (P=0.0105) (Figure 9). This was due to a large biomass of subsurface polychaetes at station D in February 1988, and station B in April 1988. In general there was less biomass in the surface 3 cm (1.58 g $\cdot$ m^{-2}) than in the subsurface (3-10 cm) sediments (2.78 g $\cdot$ m^{-2}). Station D generally had higher densities of deeper dwelling organisms (Figure 10). This was especially true in December 1987, when there were large numbers of the polychaete *Polydora caulleryi* found in the subsurface section. Total density at that time (December), in that section (3-10 cm) reached $68.2 \times 10^3 \cdot m^{-2}$. This very unusual event caused the overall average density to be equal in the surface ($6.92 \times 10^3 \cdot m^{-2}$) and subsurface ($6.75 \times 10^3 \cdot m^{-2}$) sections. At stations A, B, and C, there were generally twice as many animals in the surface section ($5.56 \times 10^3 \cdot m^{-2}$) than in the subsurface sections ($2.47 \times 10^3 \cdot m^{-2}$) (Table 7). At station A, mollusks dominated density and biomass in the surface, but polychaetes dominated density in the subsurface sections (Table 7). At station B, mollusks dominated biomass in the surface, but polychaetes dominated density in both sections (Table 7). At stations C and D, polychaetes dominated density and biomass in both sections (Table 7).

The total overall average biomass to a depth of 10 cm was 4.36 g $\cdot$ m^{-2}. There was a strong interaction between sampling periods and stations (P=0.0005) (Figure 11). Stations in Nueces Bay had similar biomass in the beginning and at the end of the study, but not during April and May (Figure 11). Stations in Corpus Christi Bay (C and D) always responded in the opposite direction between sampling periods, except between April and May (Figure 11). Station A had the lowest average biomass (2.32 $g \cdot m^{-2}$) (Figure 11). Biomass at the other stations increased along the gradient but were not significantly different (Tukey Test).

Average biomass at station B was 6.30 $g \cdot m^{-2}$, at C 3.26 $g \cdot m^{-2}$, and at station D 5.55 $g \cdot m^{-2}$.

Total macrofaunal density to a depth of 10 cm increased along the salinity gradient from A ($6.41 \times 10^3 \cdot m^{-2}$) to B ($8.52 \times 10^3 \cdot m^{-2}$) to C ($9.15 \times 10^3 \cdot m^{-2}$) to D ($30.61 \times 10^3 \cdot m^{-2}$) (Figure 12). There were no significantly different seasonal peaks (P=0.4169), but station D did have the high numbers of *P. caullyeri* in December (Table 8). The polychaetes, *Mediomastus californiensis* and *Streblospio bendicti*, dominated the species composition at stations A, B, and C (Table 8). The polychaetes, *Polydora caulleryi* and *Tharyx setigera*, dominated at station D (Table 8).

Meiofauna were more extensively studied in Nueces Estuary than in the Guadalupe Estuary. Meiofauna were sampled during every occasion, and the vertical distribution in the top 3 cm was determined (Figure 13). The vertical distribution of meiofaunal densities changed within stations over time (P=0.0001). This was due to differences between station D and all other stations (Figure 13). More animals were found in the surface sections (0-1 cm) in stations A, B, and C, ($0.931 \times 10^6 \cdot m^{-2}$) than in the subsurface sections (1-3 cm) ($0.477 \times 10^6 \cdot m^{-2}$). At station D, densities were lower in the surface section ($2.68 \times 10^6 \cdot m^{-2}$) than in the subsurface section ($3.055 \times 10^6 \cdot m^{-2}$).

Total meiofauna densities to a depth of 3 cm were always much higher at station D than the others (Figure 14). There were no differences in densities among sampling periods (P=0.06, 2-way ANOVA). Densities increased along the gradient from A ($1.08 \times 10^6 \cdot m^{-2}$), to B ($1.28 \times 10^6 \cdot m^{-2}$) to C ($1.86 \times 10^6 \cdot m^{-2}$) to D ($5.74 \times 10^6 \cdot m^{-2}$). The higher densities of animals at station D was due almost entirely to nematodes (Table 9). Community composition in Nueces estuary was dominated by nematodes in the saltiest station (D), but less so in the others (Table 9).

Salinity was inversely correlated with inflow (Table 10). The highest correlation was with the cumulative inflow balance for 28 d previous to sampling. No biological variables were correlated with inflow (Table 10).

DISCUSSION

The object of this study is to determine the effect of freshwater inflow on benthic communities. There are several essential elements to the design of this study which must be kept in mind while interpreting the results. There are two gradients, a salinity gradient, and a freshwater inflow gradient. The estuaries were divided into upper (freshwater influenced) bays and lower (marine influenced) bays. Sampling was performed over the course of one year to integrate seasonal variability.

The freshwater inflow gradient is predominantly between estuaries. The Guadalupe estuary receives on average 3.3 times more combined surface freshwater inflow than the Nueces estuary. During the course of this study, the Guadalupe received $6.699 \times 10^9\ m^3 \cdot y^{-1}$, and the Nueces received $0.085 \times 10^9\ m^3 \cdot y^{-1}$, for a total of 79 times more water. This unusual disparity was due to sampling in consecutive years, one that was very wet, and the next which was very dry. Sampling in different years does confound the differences between bays. However, in this case this is a minor factor since the change between the years had the effect of enhancing the difference, in terms of inflow, between the estuaries.

The salinity gradient due to the inflow goes from upper (Nueces Bay) to lower (Corpus Christi Bay) bays within Nueces estuary. In the Guadalupe estuary, freshwater flows down the western side of the bay, and marine water comes in mainly from the eastern side via Pass Cavallo (Figure 1). So, freshwater influence is along the north-south axis, but marine influence is along the east-west axis. Within each estuary treatment stations were replicated, i.e., there were two freshwater and two marine influenced stations. As indicated by the inflow, salinity differences between the bays was great (Table 11). There was also a large difference between the fresh and marine stations in San Antonio Bay. There was actually very little difference in salinities between the fresh (Nueces Bay) stations and the marine (Corpus Christi Bay) stations (Table 11).

Meiofaunal densities show clear increases with salinity (Table 11). They increase going from the inflow dominated Guadalupe Estuary to the Nueces Estuary. Meiofaunal densities also increase within an estuary from the fresh to marine stations. The lower densities in the freshwater influenced zone is due predominantly to decreased numbers of nematodes. Although nematodes are numerically superior, they process less than 5% of the food consumed by the meiofaunal community (Montagna and Yoon, 1989), indicating they do not dominate community dynamics. In terms of diversity, meiofauna are apparently marine organisms.

Overall average densities in the Guadalupe Estuary were 1.6 times higher than in the Nueces Estuary, indicating that greater inflow can lead to increases in benthic productivity. Biomass was about the same among the estuaries, indicating that there are somewhat smaller animals in the Nueces Estuary. Within an estuary the trends were opposite one another. In the Guadalupe Estuary densities were greater in the freshwater zone, but in the Nueces Estuary densities were greater in the marine zone (Table 11). Biomasses were almost twice as large in the fresh zone as in the marine zone in the Guadalupe, but they were the same in the two zones of the Nueces. The average size of an individual was small and about the same in upper San Antonio Bay (0.20 mg • individual) and Corpus Christi Bay (0.22 mg • individual). Individuals were larger in lower San Antonio Bay (0.40 mg • individual), and Nueces Bay (0.58 mg • individual). These opposing trends were due to three species. There was a burst of recruitment of *Littoridina sphictostoma* and *Mulinia lateralis* in upper San Antonio Bay (station A) which was apparently in response to the inflow event. The high numbers of *Polydora caulleryi* found at only one time in Corpus Christi Bay (station D) greatly skewed results for that bay. In December, *P. caulleryi* caused densities to skyrocket to 80,000 • m^{-2} (Figure 12). Half of total average density at station D is due to *P. caulleryi* (Table 8), which did not occur in any other samples. Flint and Kalke (1986) also found isolated, but high, densities of *P. caulleryi*. If *P. caulleryi* is eliminated from the current data base the trends remain the same, since average density in Corpus Christi Bay only decreases to 12,360 • m^{-2}, from 19,880 • m^{-2} (Table 11).

Macrofauna densities increase as salinity increases along the gradient in the Nueces Estuary (Table 8), but density decreases as salinity increases in the Guadalupe Estuary (Table 4). One possible explanation is that the estuaries have very different physiography and circulation patterns. The Nueces estuary is open to the Gulf of Mexico through the Aransas Pass, whereas the Guadalupe estuary is not. In one respect, densities in both bays increased along the axis from which water was flowing into the estuary. Because of the drought during the period between late 1987 and all of 1988, total inflow balance was negative in the Nueces Estuary. Water was exchanging between the Laguna Madre and Corpus Christi Bay. During July 1988, the salinity at station D in Corpus Christi Bay was 45 ppt, indicating that hypersaline water from the Laguna was moving northward into the bay. The Laguna is a very productive area due to its extensive seagrass beds, and much organic matter could have been advected to Corpus Christi Bay. One indication that this might be true is that the average bottom oxygen concentration was 116 μM at station D and 206 μM at station C (Montagna, unpublished data). The average bottom oxygen concentration was the same at both Nueces Bay stations (192 μM) (Montagna, unpublished data).

Harper (1973) sampled San Antonio Bay between March 1972 and February 1973. During this period average inflow increased from a dry to a wet year. Average inflow balance in 1972 was $2.758 \times 10^9\ m^3 \cdot y^{-1}$, and $5.236 \times 10^9\ m^3 \cdot y^{-1}$ during 1973. He also found increases in average densities from the marine zone ($3{,}300 \cdot m^{-2}$) to the freshwater zone ($9{,}800 \cdot m^{-2}$). But, his average densities were much lower than we report on here.

Matthews et al. (1974) sampled San Antonio Bay between April 1972 and July 1974. 1974 was a dry year also, with an average inflow balance of $2.910 \times 10^9\ m^3 \cdot y^{-1}$. They reported a bay-wide average of only $1{,}500 \cdot m^{-2}$ during that period. Like Harper (1973) they reported decreasing densities with increasing salinity.

Parker and Blanton (1970) sampled the Nueces Estuary in the 1950's, and report average densities of $3{,}000 \cdot m^{-2}$ in Nueces Bay and $500 \cdot m^{-2}$ in Corpus Christi Bay. These densities are much lower than those reported in this study.

Flint et al. (1983) sampled the Nueces Estuary between July 1981 and July 1983. Stations were established along a salinity gradient from upper Nueces Bay to Corpus Christi Bay. Average densities were $13{,}800 \cdot m^{-2}$ in Nueces Bay, and $21{,}070 \cdot m^{-2}$ in lower and central Corpus Christi Bay. The average salinity in 1981 ranged from 7 ppt in Nueces Bay to 25 ppt Corpus Christi Bay, and increased to a range of 26 to 30 ppt in 1982-3. The densities they reported are comparable to those found in this study.

Species diversity is higher in marine influenced estuaries and in the marine ends of estuaries (Figure 15). Based on diversity curves, it appears as if there are three zones, a freshwater, estuarine and marine zone (Figure 15).

In summary, macrofaunal and meiofaunal densities appear to have opposing trends with relationship to freshwater inflow. Macrofauna density and biomass appear to increase with increasing inflow, and decreasing salinity. In contrast, meiofauna numbers decrease. One explanation is that macrofauna respond positively to freshwater inflow, and meiofauna respond negatively. An alternative hypothesis is that macrofaunal-meiofaunal competition or macrofaunal predation on meiofauna are responsible for the decreasing numbers of meiofauna with salinity.

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Table 1. Sediment grain size analysis (%) for San Antonio, Corpus Christi, and Nueces Bays. For the Guadalupe Estuary (GE) n=1, and for the Nueces Estuary (NC) n=3.

Date	Bay	Sta	Depth	Rubble	Sand	Silt	Clay
JUN87	GE	A	3	9.7	30.2	32.7	27.4
JUN87	GE	A	10	16.7	24.6	30.7	28.1
JUN87	GE	B	3	13.6	6.7	30.4	49.3
JUN87	GE	B	10	4.8	2.3	30.5	62.4
JUN87	GE	C	3	3.4	27.7	30.6	38.3
JUN87	GE	C	10	2.3	19.0	30.0	48.8
JUN87	GE	D	3	5.5	65.2	15.6	13.7
JUN87	GE	D	10	4.4	78.0	8.6	9.0
JUL87	GE	A	3	6.7	25.9	39.7	27.7
JUL87	GE	A	10	13.1	26.6	27.9	32.6
JUL87	GE	B	3	6.5	3.0	33.6	56.9
JUL87	GE	B	10	5.4	4.1	34.0	56.5
JUL87	GE	C	3	1.9	14.7	40.2	43.2
JUL87	GE	C	10	3.2	23.8	38.2	34.8
JUL87	GE	D	3	0.4	14.7	38.0	47.0
JUL87	GE	D	10	0.4	18.4	33.0	48.3
OCT87	NC	A	3	7.0	25.2	32.8	34.9
OCT87	NC	A	10	9.9	19.0	35.3	35.7
OCT87	NC	B	3	0.9	67.9	12.4	18.7
OCT87	NC	B	10	1.0	66.1	13.2	19.8
OCT87	NC	C	3	1.3	9.9	35.3	53.4
OCT87	NC	C	10	4.9	25.5	32.6	37.0
OCT87	NC	D	3	0.6	64.6	8.2	26.6
OCT87	NC	D	10	0.5	71.7	6.0	21.8
APR88	NC	A	3	0.4	5.8	53.1	40.6
APR88	NC	A	10	0.9	22.5	34.0	42.6
APR88	NC	B	3	3.8	88.6	2.6	5.0
APR88	NC	B	10	2.7	78.5	7.5	11.3
APR88	NC	C	3	0.8	0.4	22.7	76.2
APR88	NC	C	10	3.0	2.8	28.1	66.1
APR88	NC	D	3	1.1	82.5	3.0	13.5
APR88	NC	D	10	1.0	79.5	3.1	16.3
JUL88	NC	A	3	0.5	7.3	37.2	55.0
JUL88	NC	A	10	3.4	11.4	35.0	50.2
JUL88	NC	B	3	3.2	74.9	5.8	16.1
JUL88	NC	B	10	8.9	66.1	7.0	17.9
JUL88	NC	C	3	0.9	3.7	30.0	65.4
JUL88	NC	C	10	0.9	5.2	29.2	64.7
JUL88	NC	D	3	2.2	76.6	3.2	18.0
JUL88	NC	D	10	2.1	71.9	4.4	21.7

Table 2. Average vertical distribution of macrofauna at stations A - D in San Antonio Bay. Mean biomass ($g \cdot m^{-2}$) and density ($n \cdot m^{-2}$) of taxa, with standard deviation in parentheses.

		Section			
		0-3 cm		3-10 cm	
Sta	Taxa	Density	Biomass	Density	Biomass
A	Crustacea	19(73)	0.0057(0.0220)	0	0
	Chironomids	340(559)	0.0272(0.0421)	0	0
	Mollusca	32028(26736)	6.2865(5.8054)	57(117)	0.0906(0.2252)
	Nemertea	19(73)	0.0123(0.0476)	19(73)	0.0055(0.0212)
	Others	76(227)	0.0240(0.0648)	0	0
	Polychaeta	5691(5146)	0.3284(0.2479)	3025(2634)	0.4246(0.4222)
B	Crustacea	265(541)	0.0174(0.0268)	0	0
	Chironomids	57(117)	0.0144(0.0468)	0	0
	Mollusca	7298(5536)	2.1903(1.6713)	378(366)	1.6358(2.1472)
	Nemertea	95(138)	0.0221(0.0384)	57(117)	0.1057(0.3648)
	Others	0	0	0	0
	Polychaeta	6447(4355)	0.3210(0.2006)	4311(3425)	0.4509(0.4693)
C	Crustacea	492(611)	0.0306(0.0433)	0	0
	Chironomids	38(146)	0.0057(0.0220)	0	0
	Mollusca	1342(1559)	0.7498(1.1360)	227(267)	1.5802(2.3705)
	Nemertea	38(100)	0.0100(0.0344)	19(73)	0.0059(0.0227)
	Others	0	0	454(952)	0.0121(0.0283)
	Polychaeta	4802(2060)	0.2842(0.1301)	1758(1344)	0.5090(0.7662)
D	Crustacea	189(350)	0.0040(0.0065)	38(100)	0.0040(0.0108)
	Chironomids	19(73)	0.0002(0.0007)	0	0
	Mollusca	1513(1311)	0.7389(0.8183)	378(350)	1.6640(2.5122)
	Nemertea	19(73)	0.0015(0.0059)	38(100)	0.0117(0.0327)
	Others	57(117)	0.0049(0.0125)	76(227)	0.0700(0.2701)
	Polychaeta	2250(854)	0.1840(0.1820)	2949(1896)	0.8474(0.6200)

Table 3: San Antonio Bay 1987, Carbon and nitrogen content of macrofauna. Mean per cent nitrogen, carbon and the N:C ratio. Standard deviations are given in parentheses.

TAXA	FREQ	%N	%C	N/C
Crustacea	3	9.21 (1.04)	43.63 (1.89)	0.2109 (0.0189)
Mollusca	10	8.45 (4.04)	39.79 (4.34)	0.2069 (0.0960)
Nemertinea	2	9.54 (1.35)	43.54 (0.95)	0.2188 (0.0261)
Polychaeta	8	8.01 (1.08)	36.26 (5.01)	0.2211 (0.0101)
Phoronida	1	10.26 .	47.76 .	0.2149 .
Overall	24	8.56 (2.29)	39.74 (3.79)	0.2135 (0.0479)

Table 4: San Antonio Bay macrofaunal species data. Dominance of taxa at stations (mean n•m^{-2} to a depth of 10 cm). Abbreviations: P.=phylum, SP.=subphylum, C.=class, O.=order, F.=family.

	Station			
TAXA	A	B	C	D
P. Platyhelminthes				
C. Turbellaria	57	0	454	76
P. Rhynchocoela	38	151	57	57
P. Annelida				
C. Polychaeta				
F. Hessionidae				
Gyptis vittata	0	0	19	0
F. Nereidae				
Neanthes succinea	0	0	38	19
F. Goniadidae				
Glycinde solitaria	0	0	132	38
F. Onuphidae				
Diopatra cuprea	0	0	19	0
F. Phyllodocidae				
Eteone heteropoda	0	0	0	19
F. Pilargidae				
Parandalia ocularis	0	0	0	38
F. Spionidae				
Polydora caulleryi	0	0	19	19
Polydora socialis	0	19	189	0
Paraprionospio pinnata	0	0	76	132
Streblospio benedicti	2250	2118	832	1097

Table 4 continued. San Antonio Bay macrofaunal species data.

F. Cossuridae				
Cossura delta	0	0	246	113
F. Capitellidae	0	0	0	57
Mediomastus californiensis	3422	8224	4235	3536
Capitella capitata	76	95	0	95
F. Maldanidae				
Dlymenella mucosa	0	0	57	0
F. Ampharetidae				
Hobsonia florida	2155	246	0	0
F. Pectinariidae				
Pectinaria gouldii	0	0	19	19
C. Oligochaeta	624	38	0	0
P. Molluska				
C. Gastopoda				
F. Hydrobiidae				
Littoridina sphinctostoma	27982	5029	624	76
F. Pyramidellidae				
Pyramidella sp	0	0	0	57
C. Bivalvia				
F. Mytilidae				
Brachidontes exustus	0	132	0	0
F. Mactridae				
Mulinia lateralis	3498	1645	548	832
Rangia cuneata	19	0	0	0
F. Tellinidae				
Macoma mitchelli	605	870	321	851
F. Solecurtidae				
Tagelus plebeius	0	0	76	76
F. Bodotriidae				
Cyclaspis varians	0	0	38	76
F. Leuconidae				
Leucon sp	0	0	19	0

Table 4 continued. San Antonio Bay macrofaunal species data.

SP.Crustacea				
C. Malacostraca				
O. Cumacea				
O. Isopoda				
F. Idoteidae				
Edotea montosa	0	38	19	0
F. Anthuridae				
Xenanthura brevitelson	0	0	0	19
F. Sphaeromatidae				
Cassidinidea lunifrons	0	19	0	0
O. Amphipoda				
F. Gammaridae				
Gammarus mucronatus	0	0	57	0
F. Ampeliscrdae				
Ampelisca abdita	0	0	38	0
F. Corophiidae				
Corophium louisianum	0	19	19	0
F. Oedicerotidae				
Monoculodes nyei	19	189	284	113
O. Decapod				
F. Callianassidae				
Callianassa sp juvenile	0	0	19	19
SP. Insecta				
F. Chironomidae				
Chironomid larvae	340	57	38	19
P. Phoronida				
Phoronis architecta	0	0	0	57
	41217	18888	9189	7544

Table 5. San Antonio Bay correlation analysis. Pearson correlation coefficients of salinity and macrofauna correlated with cumulated inflow at 1, 7, 14, 21, 28 day intervals. N=20.

Inflow	Salinity	Biomass	Density
D 1	0.0882	0.4707*	0.1070
D 7	-0.1256	0.1008	-0.0635
D 14	-0.3324	0.0440	-0.1514
D 21	-0.4403	-0.0904	-0.1999
D 28	-0.4648*	-0.0499	-0.1865

*Significent at 0.05 level.

Table 6. Average percentage composition of meiofauna taxa.

	San Antonio Bay				Nueces-Corpus Christi			
Taxa	A	B	C	D	A	B	C	D
Nematoda	31.9	38.4	67.9	56.2	52.6	56.3	44.96	83.9
Copepoda	15.2	30.4	22.7	19.6	16.9	28.2	37.0	7.9
Others	52.9	31.2	9.4	24.2	30.5	15.5	18.0	8.1

Table 7. Average vertical distribution of macrofauna at stations A - D in Nueces and Corpus Christi Bays. Mean biomass ($g \cdot m^{-2}$) and density ($n \cdot m^{-2}$) of taxa, with standard deviation in parentheses.

		Section			
		0-3 cm		3-10 cm	
Sta	Taxa	Density	Biomass	Density	Biomass
A	Crustacea	47(146)	0.0079(0.0314)	0	0
	Mollusca	2379(1616)	0.9264(0.1764)	315(363)	1.0473(1.3204)
	Nemertea	16(67)	0.0002(0.0007)	32(92)	0.0072(0.0251)
	Others	0	0	16(67)	0.0035(0.0147)
	Ophiuroidea	0	0	0	0
	Polychaeta	2159(1227)	0.0865(0.0482)	1450(962)	0.2376(0.1226)
	Sipunculida	0	0	0	0
B	Crustacea	646(1010)	0.0156(0.0281)	32(134)	0.0006(0.0027)
	Mollusca	2017(2336)	2.3310(3.4705)	189(364)	0.2606(0.8304)
	Nemertea	16(67)	0.0032(0.0134)	95(138)	0.0301(0.0514)
	Others	32(92)	0.0008(0.0023)	0	0
	Ophiuroidea	0	0	0	0
	Polychaeta	3151(1804)	0.9601(1.9373)	2348(2445)	2.6985(4.0056)
	Sipunculida	0	0	0	0
C	Crustacea	1323(1310)	0.1029(0.1864)	149(331)	0.0146(0.0301)
	Mollusca	1459(2658)	0.2771(0.6250)	203(325)	1.1330(1.8672)
	Nemertea	122(169)	0.0184(0.0399)	189(243)	0.1353(0.2708)
	Others	41(102)	0.0028(0.0094)	27(85)	0.0030(0.0108)
	Ophiuroidea	0	0	54(114)	0.2516(0.6216)
	Polychaeta	4443(2827)	0.3804(0.4471)	2390(1198)	2.2638(2.8915)
	Sipunculida	122(212)	0.1687(0.3948)	0	0
D	Crustacea	520(1084)	0.0405(0.1164)	47(109)	0.0069(0.0225)
	Mollusca	914(1178)	0.1298(0.2338)	662(1272)	0.1725(0.4854)
	Nemertea	268(283)	0.1267(0.2206)	142(201)	0.3775(0.9630)
	Others	504(862)	0.0367(0.0757)	142(243)	0.0482(0.0829)
	Ophiuroidea	0	0	16(67)	0.0169(0.0175)
	Polychaeta	8697(6003)	0.9929(1.1829)	18592(45624)	3.4910(5.3305)
	Sipunculidea	110(221)	0.1056(0.2264)	0	0

Table 8. Nueces-Corpus Christi Bays macrofaunal species data. Dominance of taxa at stations (mean $n \cdot m^{-2}$ to a depth of 10 cm). Abbreviations: P.=phylum, SP.=subphylum, C.=class, O.=order, F.=family.

TAXA	Station A	 B	 C	 D
P. Coelenterata				
C. Hydrozoa	0	16	0	0
P. Platyhelminthes	0	16	32	63
P. Rhynchocoela	47	110	299	410
P. Annelida				
C. Polychaeta				
F. Palmyridae				
Palenotus heteroseta	0	0	110	189
F. Phyllodocidae				
Eteone heteropoda	0	0	0	32
Anaitides erythrophyllus	0	0	16	16
F. Pilargidae				
Ancistrosy papillosa	0	0	0	63
Sigambra tentaculata	0	0	63	0
F. Hessionidae				
Podarke obscura	0	0	0	126
Gyptis vittata	0	79	205	284
Parahesione luteola	0	0	0	63
F. Syllidae	0	0	16	16
F. Nereidae	0	0	16	158
F. Goniadidae				
Glycinde solitaria	16	268	252	205

Table 8 continued. Nueces estuary macrofaunal species data.

F. Eunicidae				
Morphysa sanguinea	0	32	0	0
F. Onuphidae				
Diopatra cuprea	0	47	158	47
F. Lumbrineridae				
Lumbrineris parvapedata	0	0	32	0
F. Arabellidae				
Drilonereis magna	0	0	126	32
F. Dorvilleidae	0	16	0	0
F. Spionidae				
Polydora caulleryi	0	0	0	15078
Paraprionospio pinnata	0	95	441	488
Spiophanes bombyx	0	0	0	252
Streblospio benedicti	1859	536	977	725
Minuspio cirrifera	0	0	0	16
F. Mageionidae				
Magellona phyllisae	0	0	0	16
F. Chaetopteridae				
Spiochaetopterus costarum	0	0	0	32
F. Cirratulidae				
Tharyx setigera	0	32	95	1591
F. Cossuridae				
Cossura delta	0	819	252	441
F. Orbinidae				
Haploscoloplos foliosus	32	173	16	79
F. Paraonidae				
Paraonid group A	0	0	0	158
Paraonid group B	0	0	0	16

Table 8 continued. Nueces estuary macrofaunal species data.

F. Capitellidae				
Mediomastus californiensis	1670	2994	3435	6428
Notomastus latericeus	0	0	0	95
Notomastus cf *latericeus*	0	0	0	16
Capitella capitata	16	0	0	0
F. Maldanidae				
Clymenella mucosa	0	79	79	79
Maldane cf *Sarsi*	0	47	95	158
Asychis sp	0	32	0	0
Clymenella torquata calida	0	158	0	284
F. Ampharetiidae				
Melinna maculata	0	47	16	0
F. Terebellidae	0	0	0	16
F. Sabellidae				
Megalomma bioculatum	0	95	0	0
C. Oligochaeta	0	0	63	79
P. Mollusca				
C. Gastropoda	0	0	0	16
F. Vitrinellidae	0	0	0	110
F. Caeidae				
Caecum glabrum	0	0	0	142
Caecum johnsoni	0	0	16	0
F. Epitoniidae				
Epitonium sp	0	0	0	16
F. Calyptraeidae				
Crepidula plana	0	0	16	32
F. Nassariidae				
Nassarius acutus	0	0	0	16
F. Acteocinidae				
Acteocina canaliculata	16	158	0	32

Table 8 continued. Nueces estuary macrofaunal species data.

F. Pyramidellidae				
Pyramidella crenulata	0	16	0	0
Pyramidella sp	16	0	0	79
Turbonilla sp	0	0	16	142
C. Bivalvia				
Pelecypods	0	0	32	63
F. Nuculanidae				
Nuculana acuta	0	16	79	95
Nuculana concentrica	0	0	79	0
F. Kelliidae				
Aligena texasiana	0	16	0	473
F. Leptonidae				
Mysella planulata	0	32	0	0
F. Mactridae				
Mulinia lateralis	1576	1386	158	189
F. Solenidae				
Ensis minor	0	32	0	0
F. Lyonsiidae				
Lyonsia hyalina floridana	0	32	0	63
F. Periplomatidae				
Periploma cf *orbiculare*	0	0	95	0
F. Tellinidae				
Macoma mitchelli	1087	488	16	0
Macoma tenta	0	0	32	32
Tellina sp	0	0	0	47
SP. Crustacea				
C. Ostracoda				
O. Myodocopa				
F. Sarsiellidae				
Sarsiella texana	0	0	16	0

Table 8 continued. Nueces estuary macrofaunal species data.

C. Copepoda				
O. Cyclopoida				
F. Cyclopidae				
Cyclopoid (commensal)	0	32	0	0
C. Malacostraca				
O. Mysidacea				
Mysidopsis bahia	16	16	0	0
Mysidopsis sp juvenile	16	0	0	0
O. Cumacea				
F. Bodotriidae				
Cyclaspis varians	0	126	63	16
F. Leuconidae				
Leucon sp	0	0	788	16
Eudorella monodon	0	0	236	0
F. Diastylidae				
Oxyurostylis smithi	0	0	79	0
Oxyurostylis salinoi	0	32	0	0
O. Isopoda				
F. Anthuridae				
Xenanthura brevitelson	0	16	0	0
O. Amphipoda				
F. Ampeliscidae				
Ampelisca abdita	0	32	32	16
Ampelisca sp B	0	0	16	0
F. Corophiidae				
Corophium acherusicum	0	0	0	32
Microprotopus spp	0	189	32	32
Erichtonias brasiliensis	0	142	0	110
Lembos sp	0	0	0	63
F. Bateidae				
Batea catharinensis	0	47	189	16

Table 8 continued. Nueces estuary macrofaunal species data.

F. Liljeborgiidae				
Listriella barnardi	0	0	16	16
Listreilla clymenellae	0	0	0	16
F. Amphilochidae				
Amphilochus sp.	0	0	16	0
F. Stenothoidae				
Paramtopella sp	0	0	16	0
F. Oedicerotidae				
Monoculodes nyei	0	0	32	0
F. Caprellidae	0	47	47	158
O. Decapoda				
Megalops larvae unidentified	0	0	32	16
F. Pinnotheridae				
Pinnixa sp	0	0	0	16
F. Callianassidae				
Callianassa sp juvenile	0	0	0	16
P. Sipuncula				
F. Golfingiidae				
Phascolion strombi	0	0	126	110
P. Phoronida				
Phoronis architecta	16	0	47	599
P. Echinodermata				
C. Ophiuroidea	0	0	63	16
	6397	8555	9170	30629

Table 9. Nueces-Corpus Christi Bays meiofaunal species data. Dominance of taxa at stations (mean $10^3 \cdot m^{-2}$ to a depth of 3 cm).

	Station			
TAXA	A	B	C	D
P. Platyhelminthes				
C. Turbellaria	0	0	0	0.8
P. Rhynchocoela	0	0.2	0.2	0.8
P. Nematoda	568.7	723.6	905.1	4814.9
P. Kinoryncha	1.2	1.0	122.9	43.2
P. Annelida				
C. Polychaeta				
Polychaete larvae/juveniles	0.2	1.0	1.2	4.6
F. Syllidae	0	0	0.2	0
Sphaerosyllis erinaceus	0	0.2	0	0
F. Nereidae	0	0	0	0.6
F. Goniadidae				
Glycinde solitaria	0	0.4	0.2	0.6
F. Onuphidae				
Diopatra cuprea	0	0	1.4	0
F. Arabellidae				
Drilonereis magna	0	0	0	0.2
F. Dorvilleidae	0	0	0	0.2
Schistomeringos sp A	0	0	0	0.6
F. Spionidae				
Polydora caulleryi	0	0	0	4.6
Polydora sp	0	0	0	0.2
Paraprionaspio pinnata	0	0	0.6	0.2
Spiophanes bombyx	0	0	0	0.6
Streblospio benedicti	9.4	4.4	3.6	2.8

Table 9 continued. Nueces estuary meiofaunal species data.

F. Chaetopteridae				
Spiochaetopterus costarum	0	0	0	0.2
F. Cirratulidae				
Tharyx setigera	0	0	0.4	1.6
F. Cossuridae				
Cossura delta	0	1.4	1.8	1.2
F. Orbinidae				
Haploscoloplos foliosus	0	0.4	0	0.2
F. Paraonidae				
Paraonidae group A	0	0	0	0.2
F. Capitellidae				
Mediomastus californiensis	14.2	15.6	24.2	41.8
Capitellides jonesi	0	0.2	0	0
Notomastus latericeus	0	0	0	0.4
F. Maldanidae	0	0.2	0.4	0
Clymenella mucosa	0	0	0.2	0
Asychis sp	0	0	0	0.2
F. Terebellidae	0	0	0	0.4
F. Sabellidae	0	0	0.2	0
C. Oligochaeta	0	0	0.4	0
P. Arthropoda				
SP. Chelicerata				
C. Arachnida	0.2	0	0.2	1.6
SP. Crustacea				
C. Ostracoda				
O. Podocopa	49.4	14.8	29.6	23.6
C. Copepoda				
Nauplii	63.8	95.3	209.1	115.9

Table 9 continued. Nueces estuary meiofaunal species data.

O. Harpacticoida	52.0	174.3	82.1	124.0
F. Longipediidae				
Longipedia americana	0	4.0	4.2	4.2
F. Canuellidae				
Scottolana canadensis	5.6	4.2	0.4	1.2
F. Ectinosomatidae	16.8	8.8	5.4	43.6
Ectinosoma sp	8.4	1.0	3.2	1.6
F. Tachidiidae				
Microarthridion sp	0.2	7.8	135.7	0.4
F. Harpacticidae				
Harpacticus sp	0	0	0	0.2
Zausodes arenicolus	0	3.6	0.6	3.6
F. Diosaccidae				
Stenhelia sp	4.2	5.6	49.0	0
Dioasaccidae nauplii	6.2	12.2	79.4	0.6
F. Cletodidae				
Enhydrosoma spp	10.4	35.2	65.8	65.2
F. Laophontidae				
Laophonte spp	3.2	6.8	0.4	86.0
O. Cyclopoida	0	0	0.2	0.4
Cyclopoid copepod (commensal)	0.6	0.2	0	0
F. Cyclopidae				
Halicyclops sp	11.4	3.6	4.4	5.6
F. Clausidiidae				
Saphirella sp	0	0	0	0.4
F. Diaptomidae				
Pseudodiaptomus coronatus	0	0.2	0.2	0.8
O. Mysidacea				
Mysidopsis sp juvenile	0.2	0	0	0.4

Table 9 continued. Nueces estuary meiofaunal species data.

O. Cumacea				
F. Bodotriidae				
Cyclaspis varians	0	0.2	0	0
F. Leuconidae				
Leucon sp	0	0.2	1.8	0
F. Diastylidae				
Oxyurostylis smithi	0	0.2	0	0
O. Amphipoda				
F. Corophiidae				
Microprotopus spp	0	0.4	0	0
Photis sp	0	0	0	0.2
F. Stenothoidae				
Parametopella sp	0	0	0.2	0
P. Sipuncula				
F. Golfingiidae				
Phascolion strombi	0	0	0.4	0.
P. Tardigrade	0	0	0	0.2
P. Phoronida				
Phoronis architecta	0	0	0	0.6
P. Echinodermata				
C. Ophiuroidea	0	0	0.4	0.2
P. Chordata				
SP.Urochordata				
C. Ascidiaceae				
Ascidian larvae	0	0	0.2	0
P. Unidentified	230.5	140.3	94.1	317.2
Total all species	1080.6	1284.3	1858.3	5735.5

Table 10. Nueces and Corpus Christi Bays correlation analysis. Pearson correlation coefficients of salinity and macrofauna correlated with cumulated inflow at 1, 7, 14, 21, 28 day intervals previous to sampling. N=24.

		Macrofauna		Meiofauna
Inflow	Salinity	Biomass	Density	Density
D 1	0.1880	-0.0748	0.2138	-0.0577
D 7	-0.5877^{**}	-0.0249	0.3750	0.0908
D 14	-0.5297^{**}	0.0495	0.3478	0.0947
D 21	-0.5929^{**}	0.0399	0.3612	0.1042
D 28	-0.6807^{***}	0.0393	0.3642	0.1196

$^{**}0.01<P\leq0.001$

$^{***}0.001<P\leq0.0001$

Table 11. Summary of the relationship between freshwater and marine influenced stations in the Guadalupe and Nueces Estuaries. For each parameter the overall average of all sampling periods is given for the freshwater influenced stations (A and B), and the marine influenced stations (C and D).

	Guadalupe (1987)		Nueces (1987-8)	
Parameter	Fresh	Marine	Fresh	Marine
Salinity (ppt)	1.4	6.9	32	33
Meiofauna				
Density ($\times 10^6 \cdot m^{-2}$)	0.25	1.12	1.18	3.80
Macrofauna				
Density ($\times 10^3 \cdot m^{-2}$)	30.1	8.35	7.48	19.88
Biomass ($g \cdot m^{-2}$)	5.98	3.36	4.31	4.41

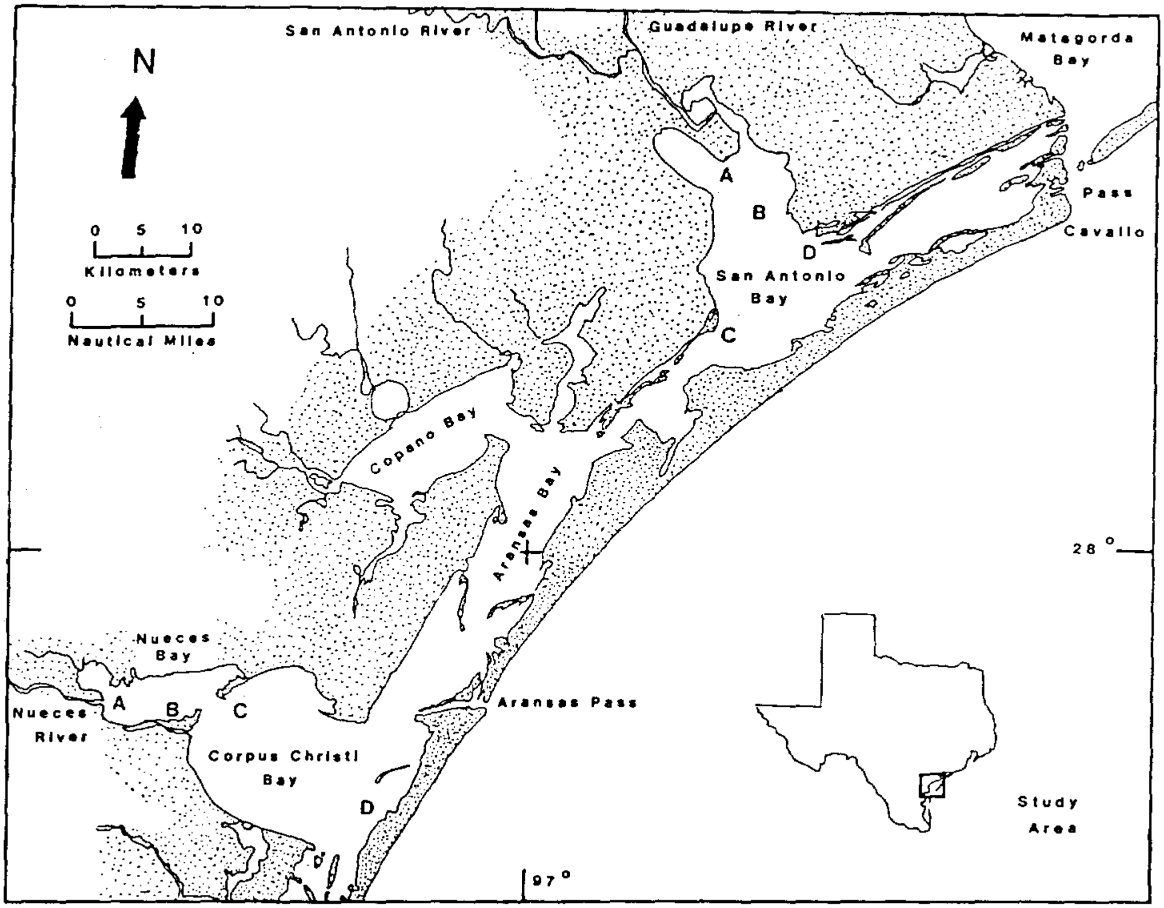

Figure 1. Map of study area indicating station locations. Four stations were sampled in each of two estuaries. San Antonio Bay is in the Guadalupe Estuary, and Nueces and Corpus Christi Bays are in the Nueces Estuary.

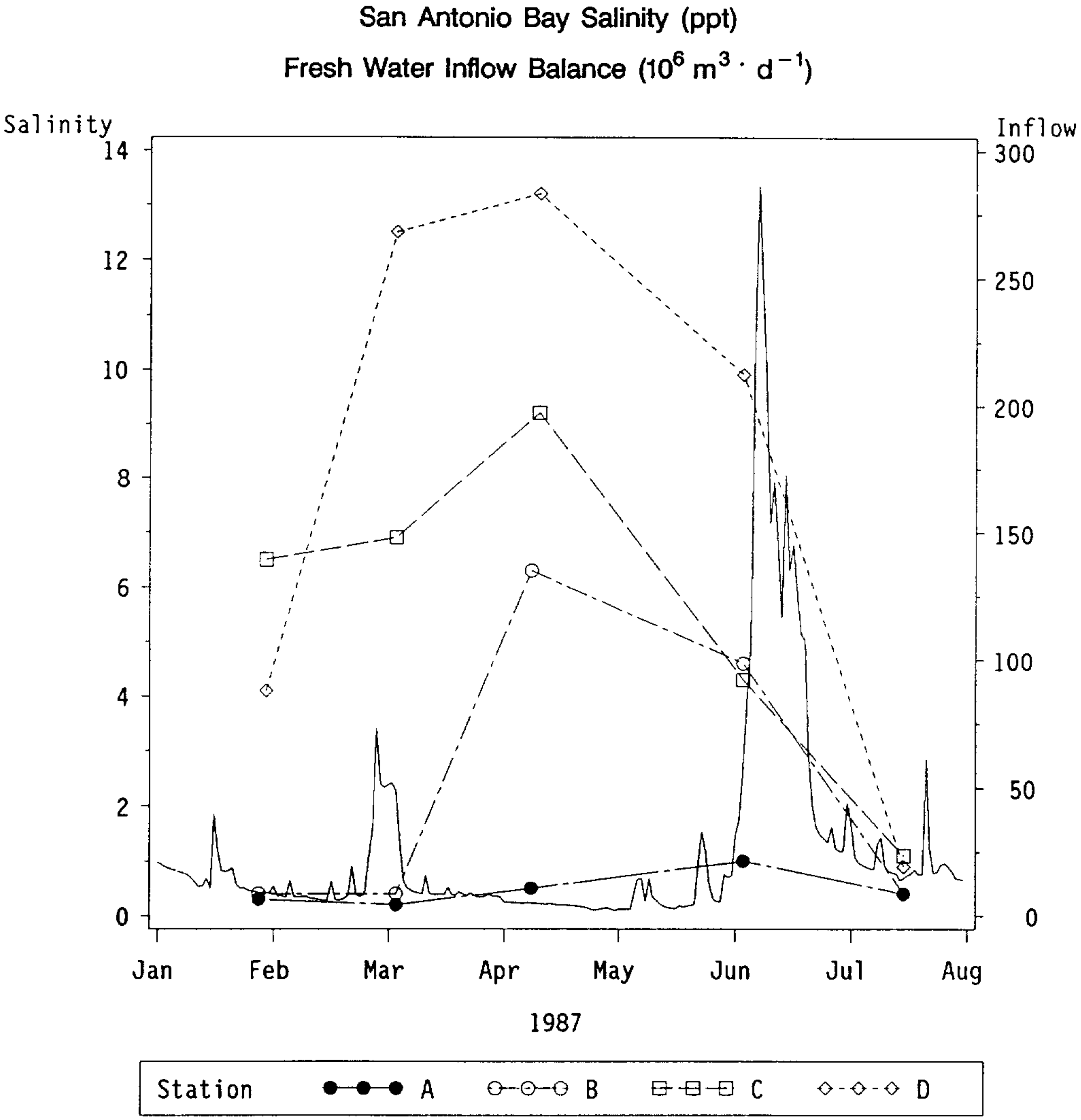

Figure 2. Salinity (ppt) and freshwater inflow balance in San Antonio Bay. Salinity is given for the four stations during each sampling period. Daily inflow balance is for the entire Guadalupe Estuary system.

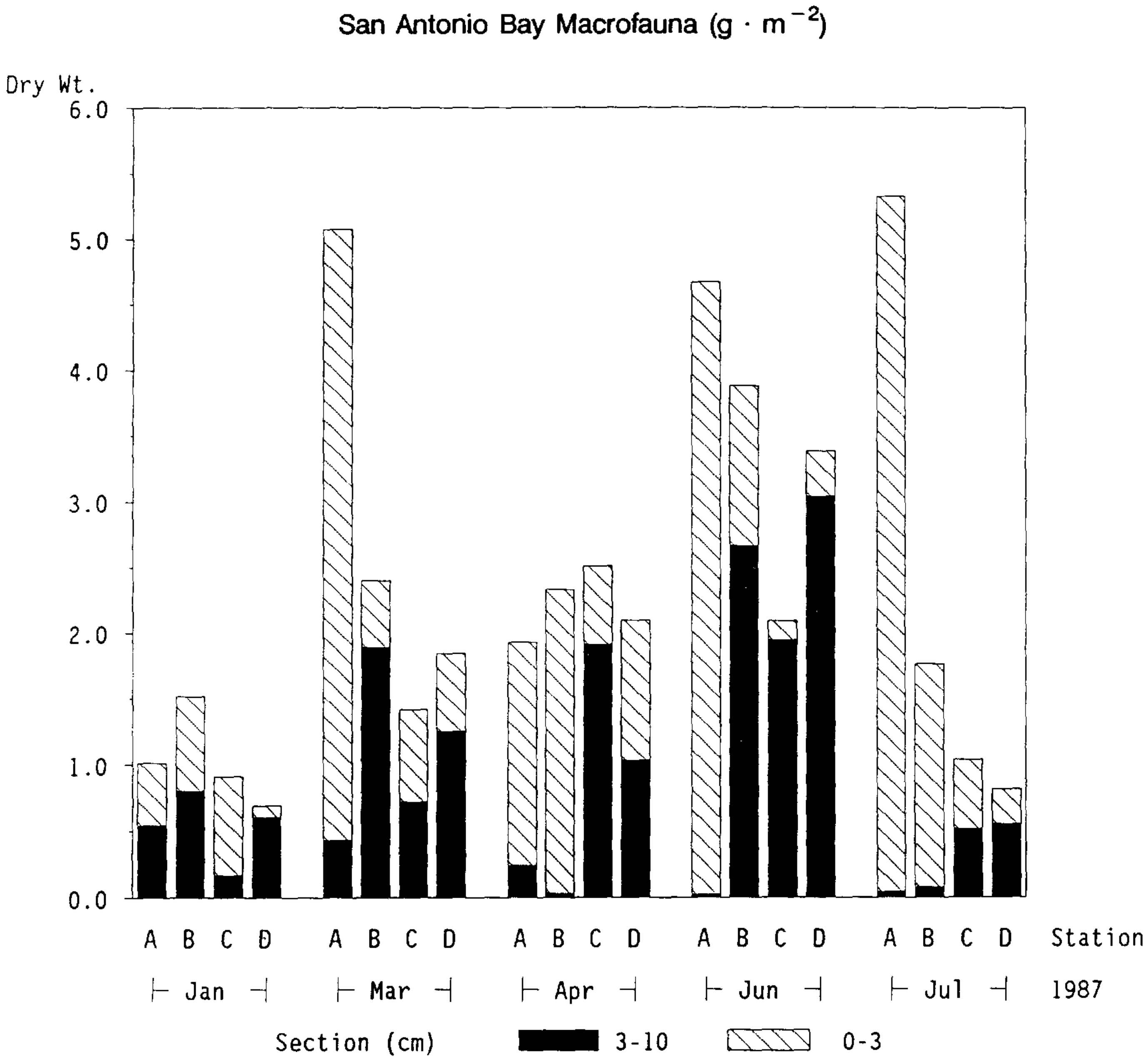

Figure 3. Vertical distribution of macrofaunal biomass (mean dry weight g · m^{-2}) in San Antonio Bay for each station and sampling period. Sediment cores were vertically sectioned at 0-3 cm and 3-10 cm intervals.

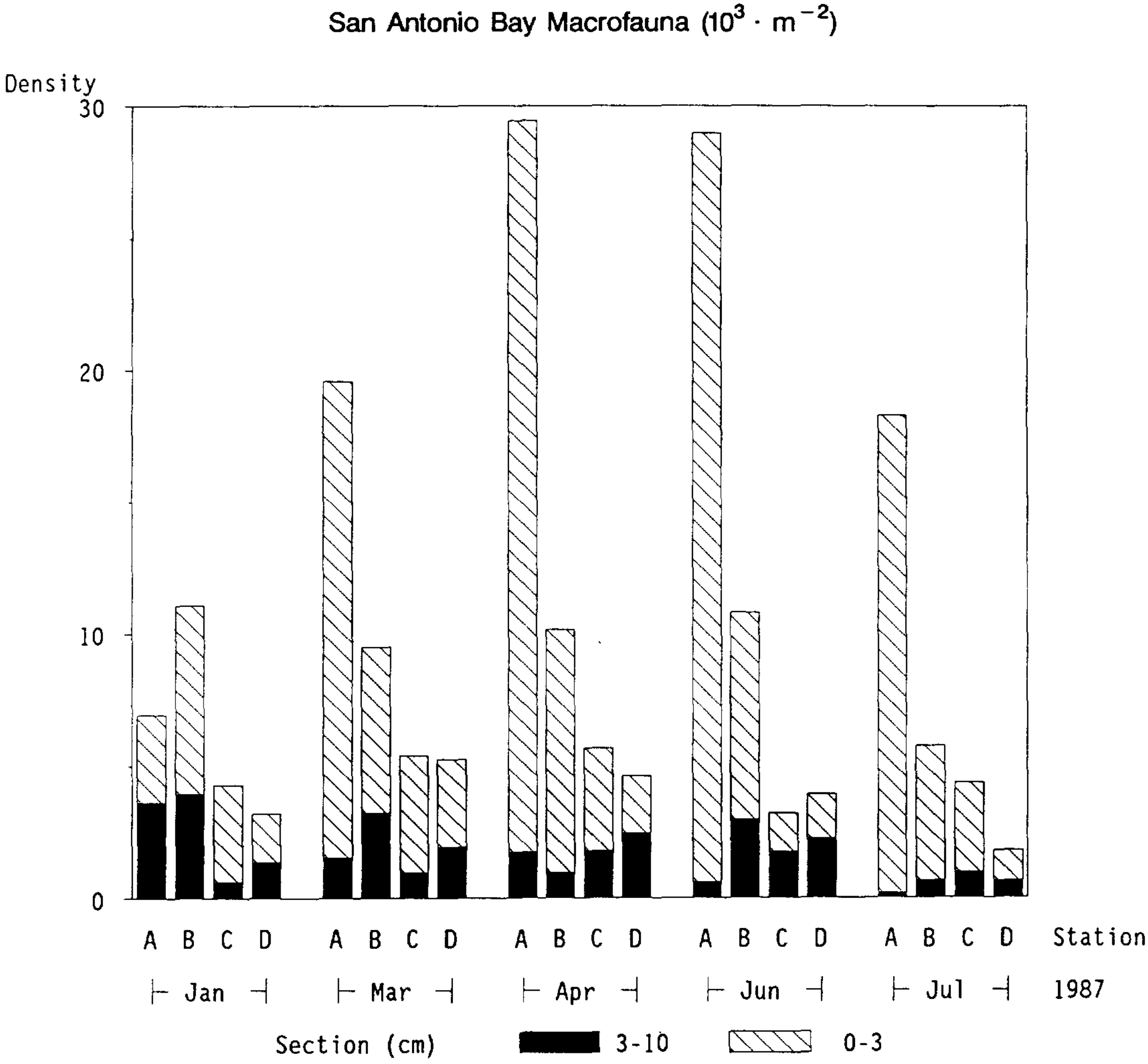

Figure 4. Vertical distribution of macrofaunal density (mean density $n \times 10^3 \cdot m^{-2}$) in San Antonio Bay for each station and sampling period. Sediment cores were vertically sectioned at 0-3 cm and 3-10 cm intervals.

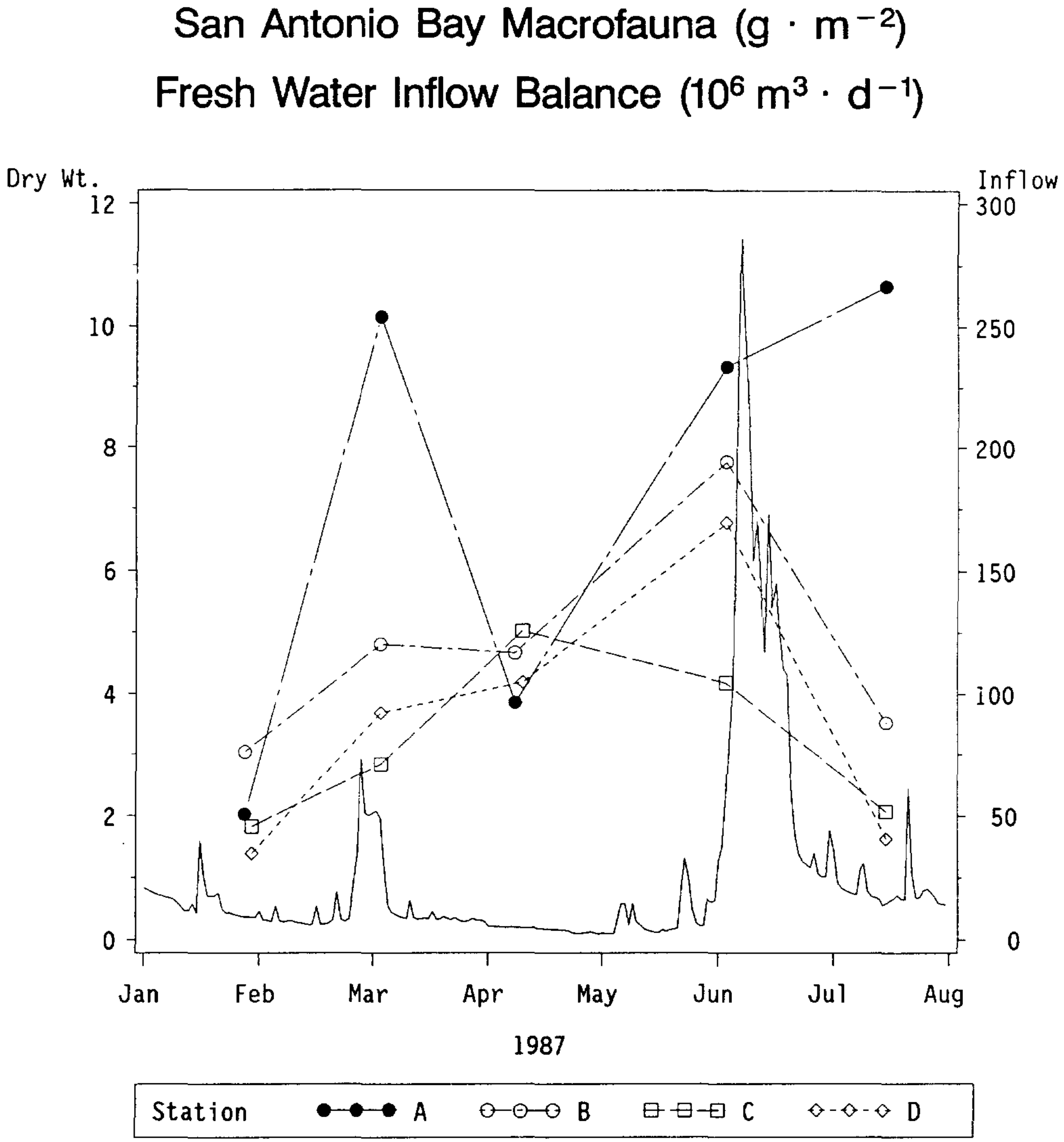

Figure 5. Macrofaunal biomass (mean dry weight $g \cdot m^{-2}$ to a depth of 10 cm) and freshwater inflow balance in San Antonio Bay. Daily inflow balance is for the entire Guadalupe Estuary system.

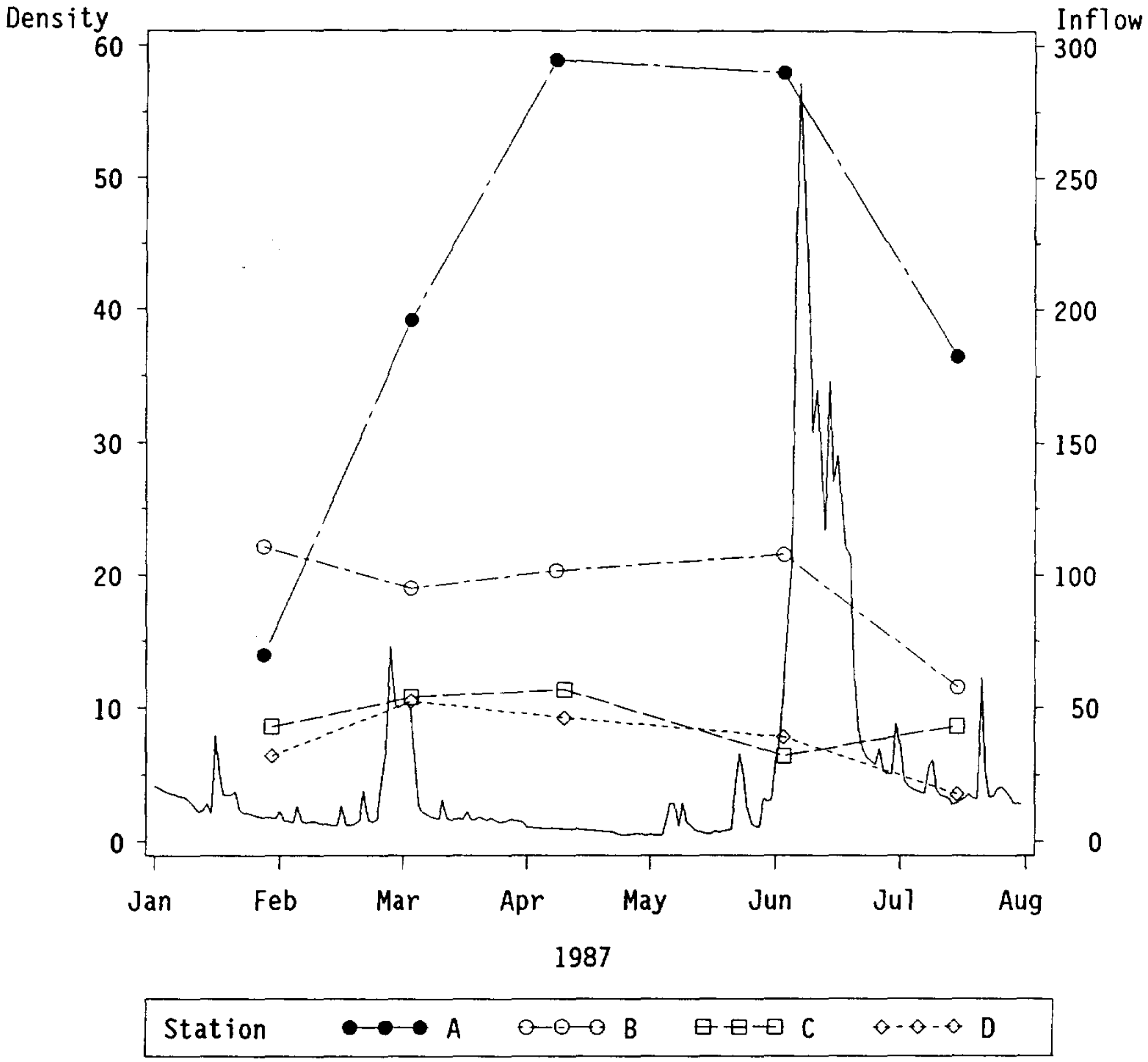
San Antonio Bay Macrofauna ($10^3 \cdot m^{-2}$)
Fresh Water Inflow Balance ($10^6 \, m^3 \cdot d^{-1}$)

Figure 6. Macrofaunal density (mean n×$10^3 \cdot m^{-2}$ to a depth of 10 cm) and freshwater inflow balance in San Antonio Bay. Daily inflow balance is for the entire Guadalupe Estuary system.

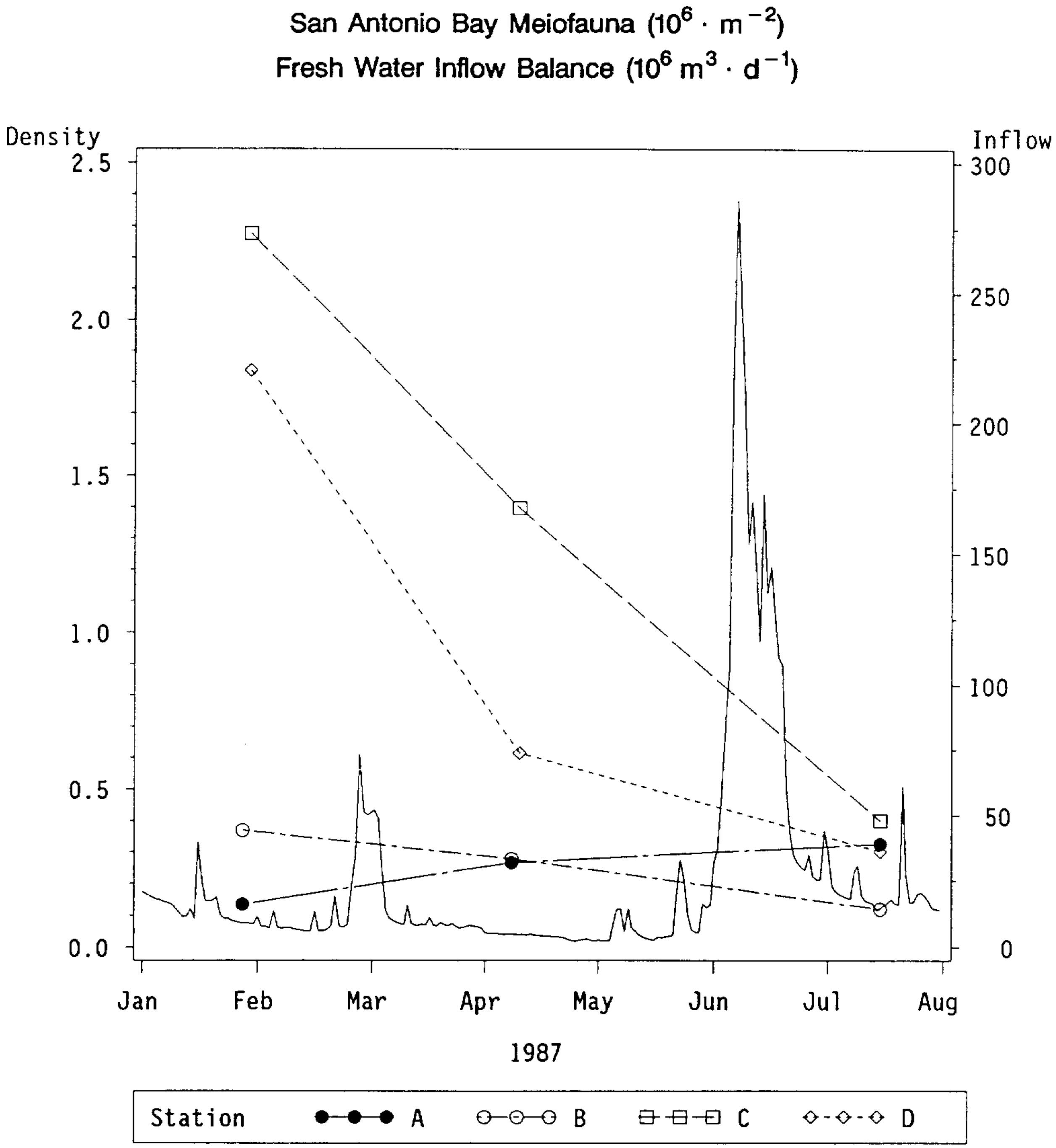

Figure 7. Meiofaunal density (mean $\times 10^6 \cdot m^{-2}$ to a depth of 1 cm) and freshwater inflow balance in San Antonio Bay. Daily inflow balance is for the entire Guadalupe Estuary system.

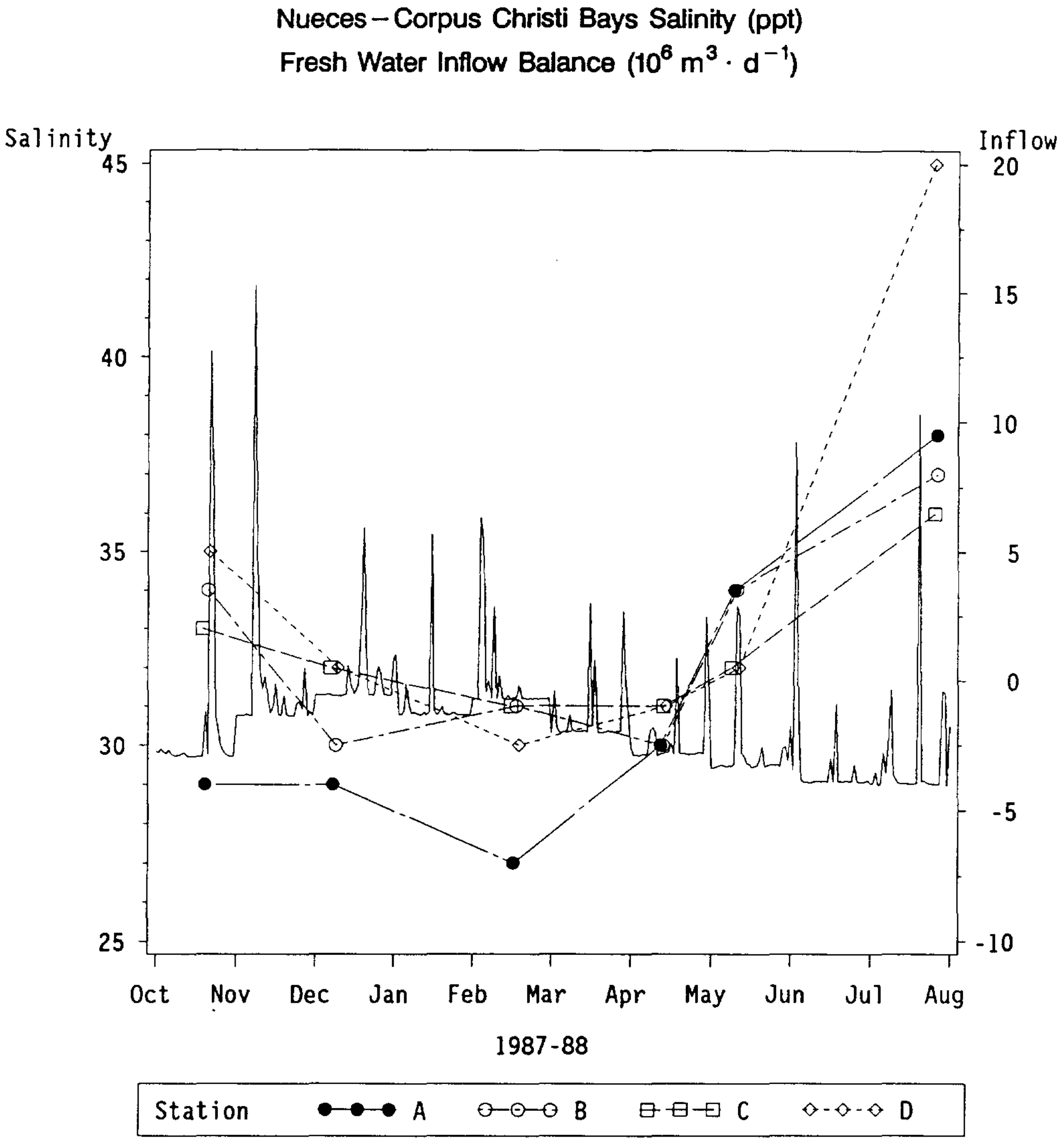

Figure 8. Salinity and freshwater inflow balance at the Nueces and Corpus Christi Bays stations. Daily inflow balance is for the entire Nueces Estuary system. Negative flows indicate that evaporation exceeds inflow.

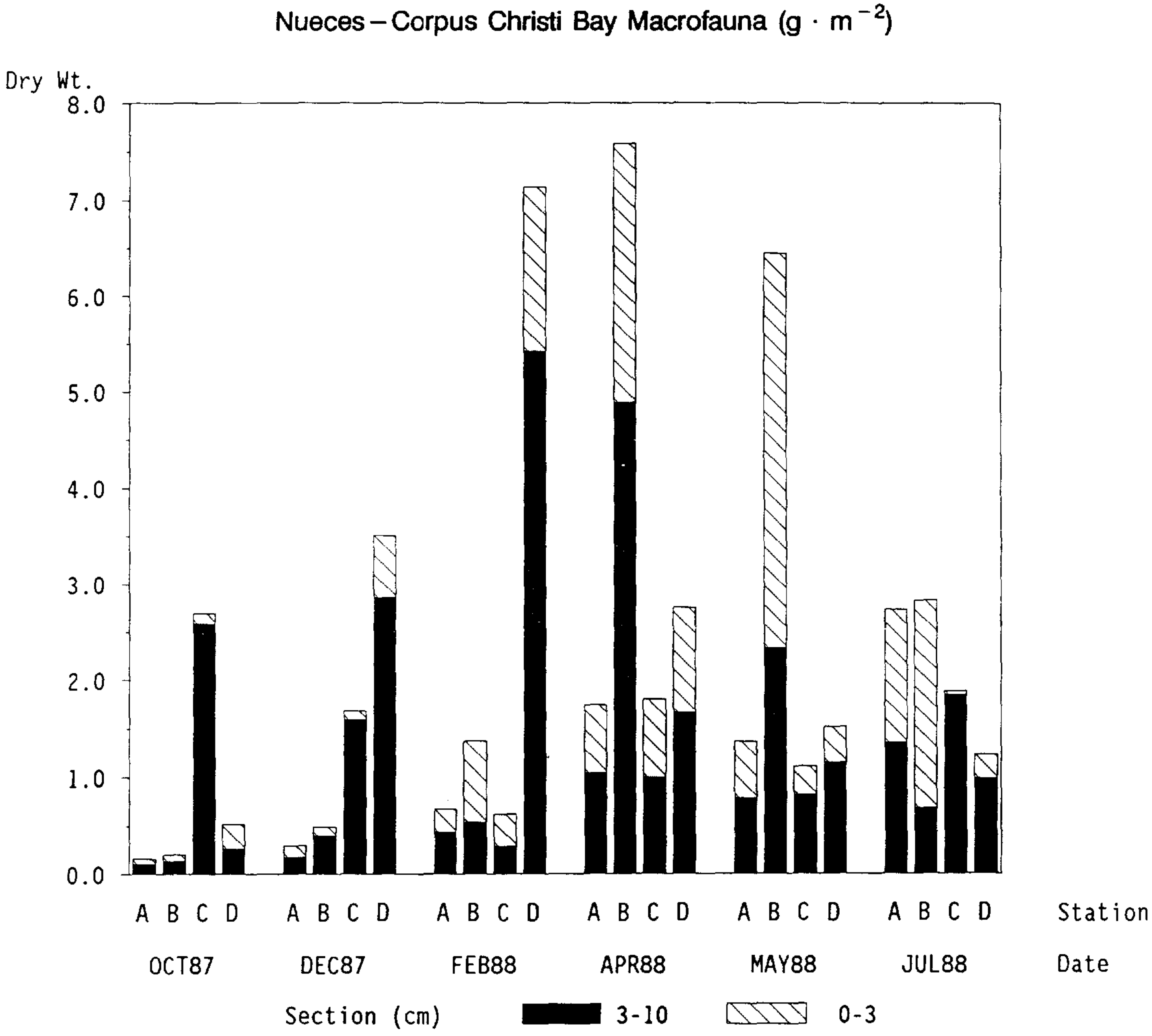

Figure 9. Vertical distribution of macrofaunal biomass (mean dry weight g • m^{-2}) in Nueces and Corpus Christi Bays for each station and sampling period. Sediment cores were vertically sectioned at 0-3 cm and 3-10 cm intervals.

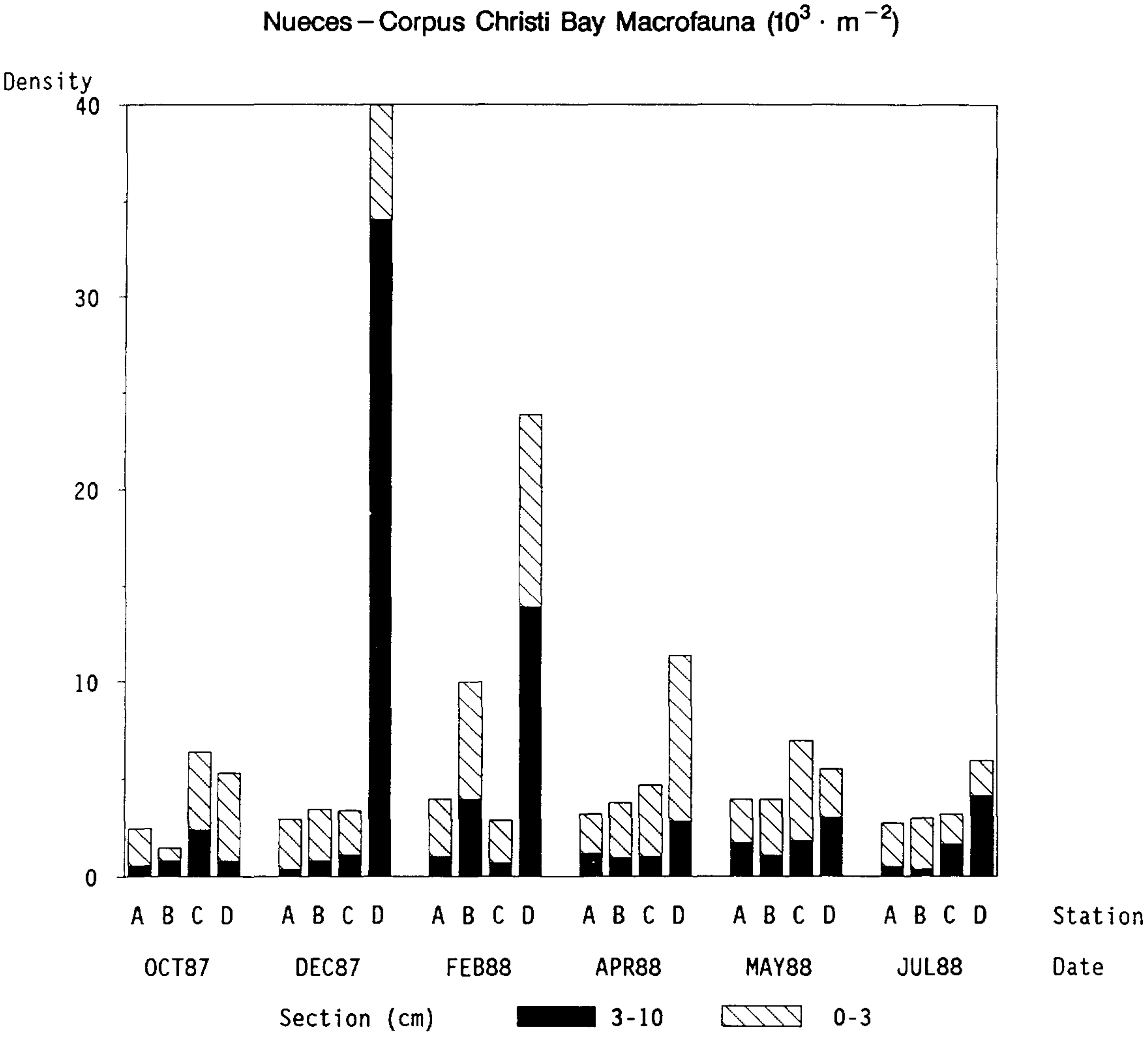

Figure 10. Vertical distribution of macrofaunal density (mean density n · m^{-2}) in Nueces and Corpus Christi Bays for each station and sampling period. Sediment cores were vertically sectioned at 0-3 cm and 3-10 cm intervals.

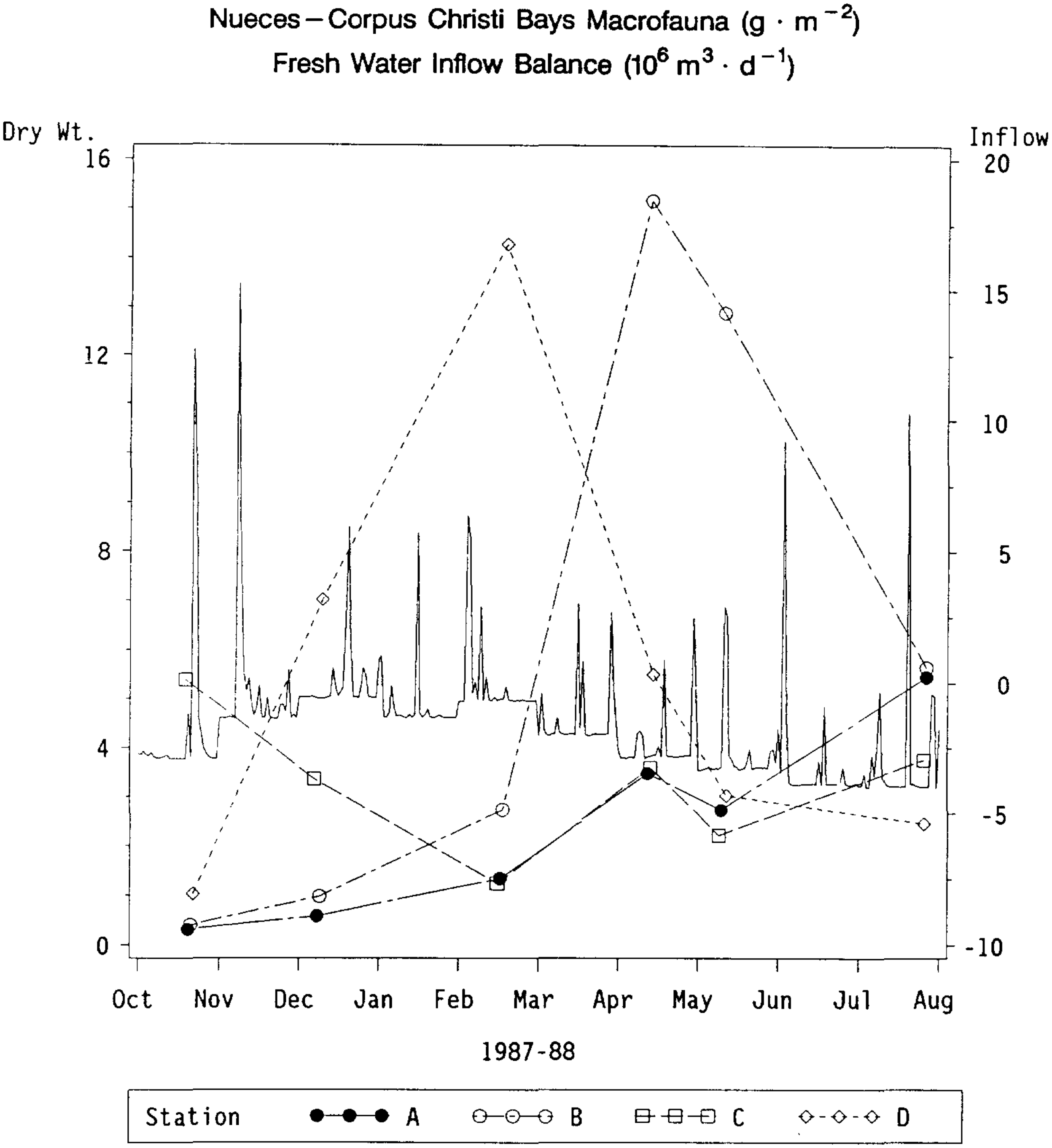

Figure 11. Macrofaunal biomass (mean dry weight $g \cdot m^{-2}$ to a depth of 10 cm) and freshwater inflow balance in Nueces and Corpus Christi Bays. Daily inflow balance is for the entire Nueces Estuary system.

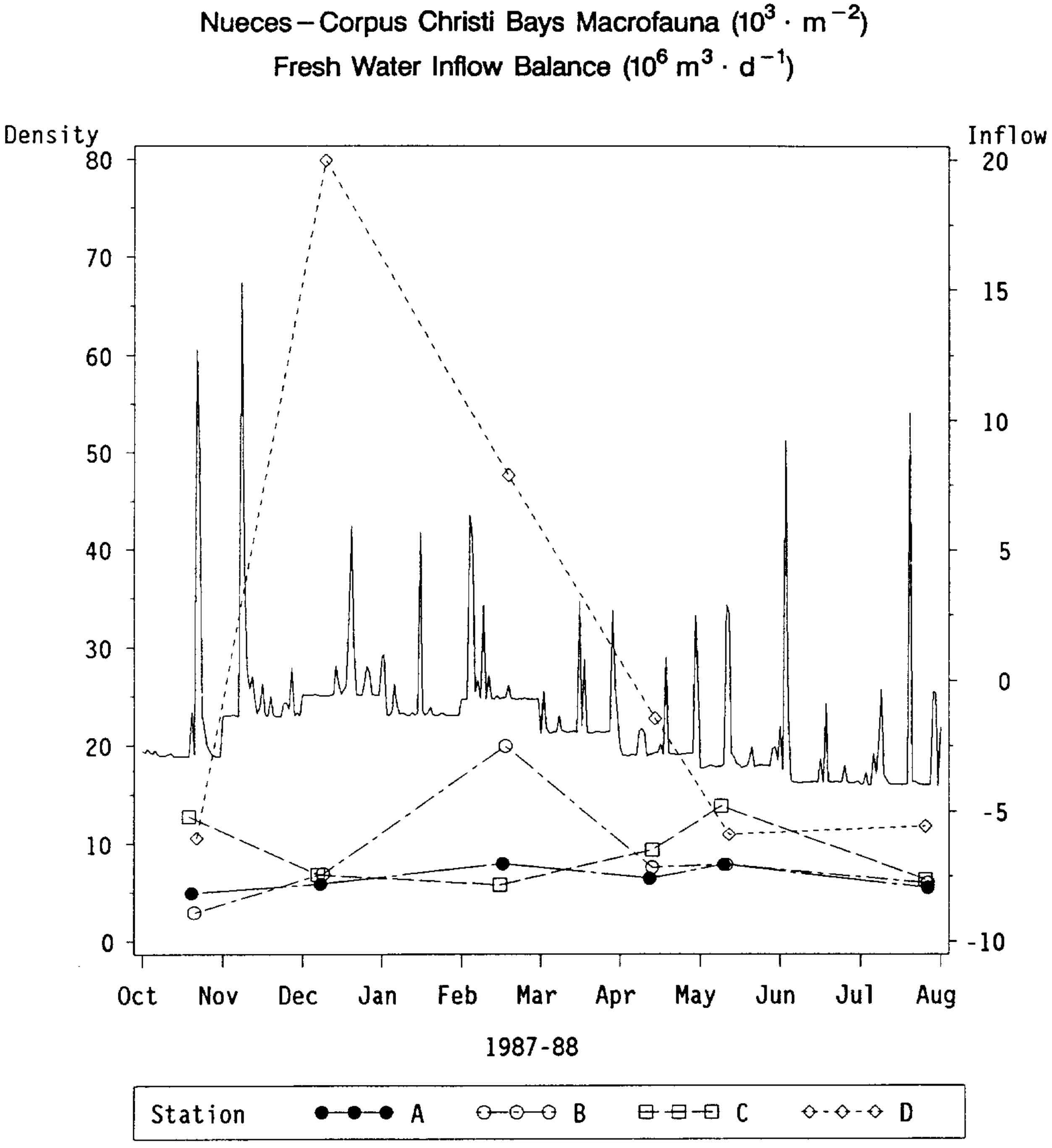

Figure 12. Macrofaunal density (mean density n×$10^3 \cdot m^{-2}$ to a depth of 10 cm) and freshwater inflow balance in Nueces and Corpus Christi Bays. Daily inflow balance is for the entire Nueces Estuary system.

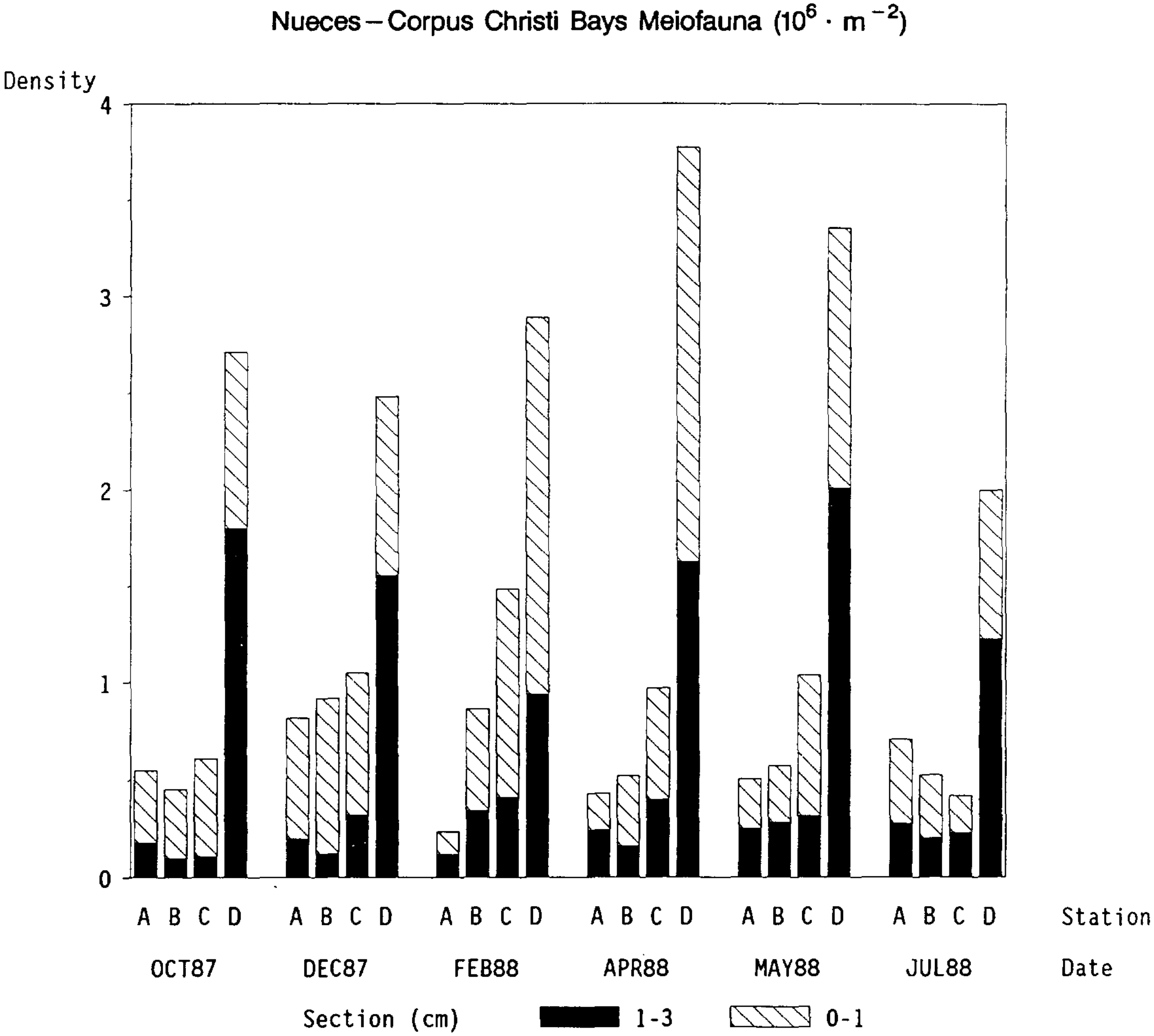

Figure 13. Vertical distribution of meiofaunal density (mean $\times 10^6 \cdot m^{-2}$) in Nueces and Corpus Christi Bays for each station and sampling period. Sediment cores were vertically sectioned at 0-1 cm and 1-3 cm intervals.

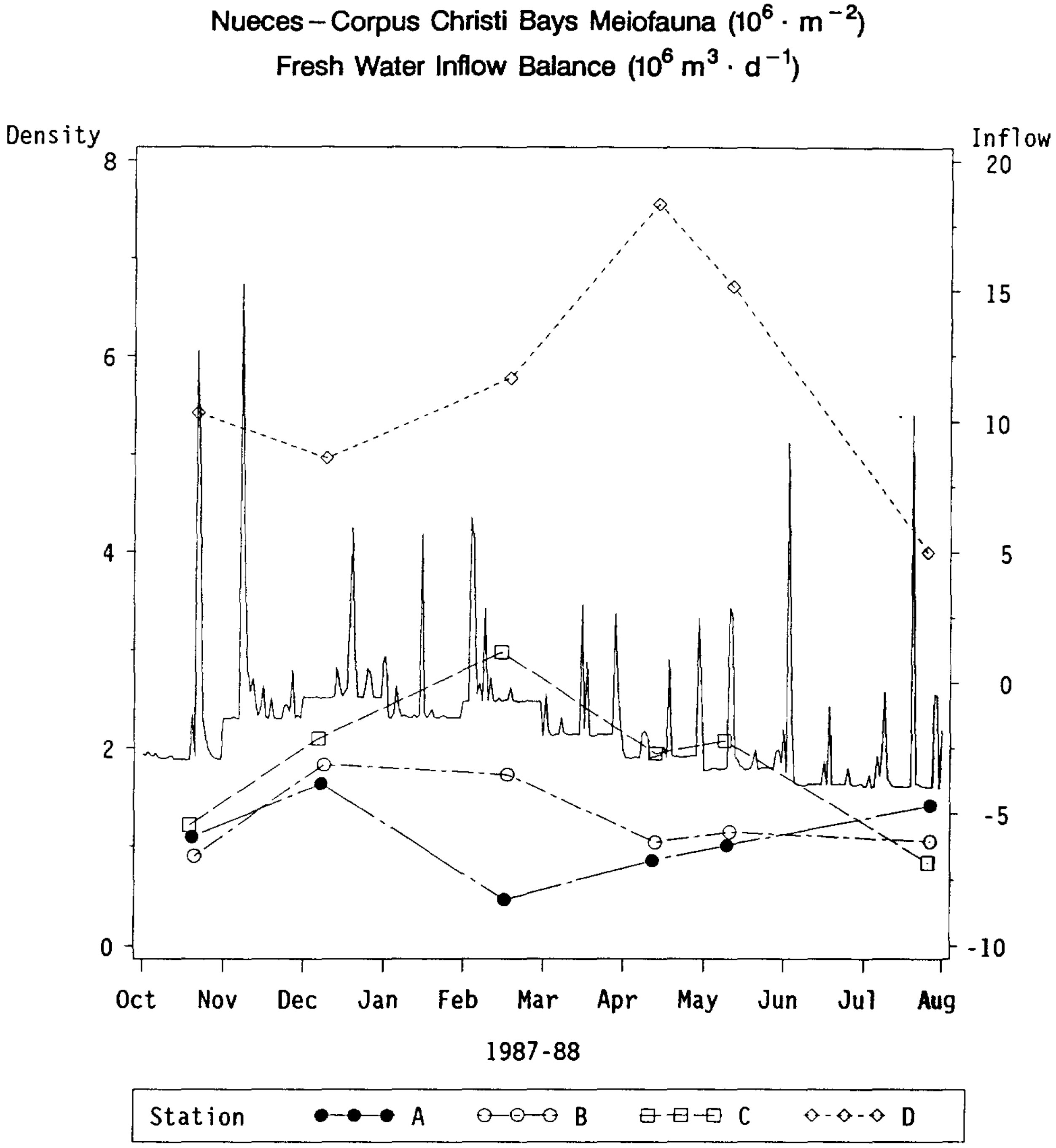

Figure 14. Meiofaunal density (mean $\times 10^6 \cdot m^{-2}$ to a depth of 3 cm) and freshwater inflow balance in Nueces and Corpus Christi Bays. Daily inflow balance is for the entire Nueces Estuary system.

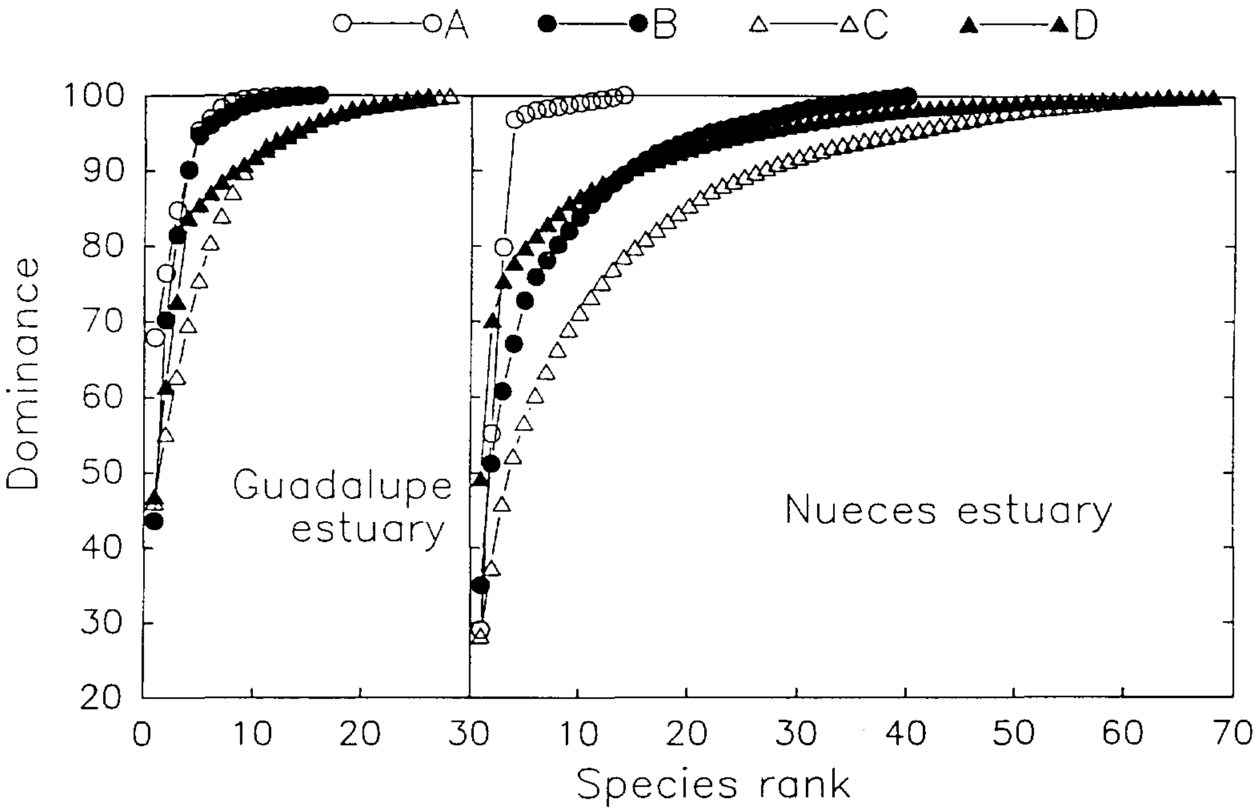

Figure 15. Species dominance curves for macrofaunal density in the Guadalupe and Nueces estuaries. Per cent dominance vs. species rank for all samples combined.

A Synoptic Comparison of Benthic Communities and Processes in the Guadalupe and Lavaca-Tres Palacios Estuaries, Texas

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ABSTRACT

Water use planning and management in Texas requires that we understand the effect of freshwater inflow on ecological processes which control and maintain productivity in our bays and estuaries. However, a large gap in our knowledge exists. We don't know if generalizations gathered in one estuary are applicable to another. This is not only true in Texas but in the nation as a whole. We in Texas are fortunate because, within short distances we have access to bays which are very different in the amount of freshwater input, and salinity. Thus, we have at our disposal a unique "natural experiment". That is, we can compare parameters across different systems synoptically. Two estuaries, the Guadalupe and the Lavaca-Tres Palacios, with similar historical inflow patterns were compared. Since the Guadalupe is smaller in area salinities are generally lower. Benthic processes lend themselves well to a comparative approach because: benthic communities are relatively sessile, reproductive events often have regular timing, sediments are sinks for many nutrients, and sediments are active sites of nutrient regeneration. Sediment oxygen uptake and nutrient regeneration are a good general measures of benthic community metabolism. The head of the Guadalupe Estuary generally had higher macrofaunal and bacterial densities and biomasses than the Lavaca Estuary. Macrofauna generally had a stimulatory effect of benthic metabolism. An important distinction between these two particular estuaries is that the Lavaca has direct exchange with the Gulf of Mexico, and the Guadalupe does not.

INTRODUCTION

The bays and estuaries of Texas are remarkably diverse. This is due in part to physiography, but differences in freshwater inflow play the largest role. A gradient of decreasing freshwater inflow, from north to south, is the most distinctive feature of our coastline. The inflow patterns appear to group into three distinct types which vary by about an order of magnitude each. Each type also has a distinctly different timing of peak inflow events. The northern estuaries receive peak inflow during the spring, the central estuaries are bimodal receiving peak inflows during the spring and fall, and the southern most estuaries receive peak inflows during the fall. These distinct patterns are very important, since growth, reproduction, and migration of many species is keyed to seasonal events. Current dogma dictates that estuarine productivity is based upon freshwater inundation and resulting nutrient enhancement. The timing and magnitude of inundation is believed to regulate finfish and shellfish production (Texas Department Water Resources (TDWR), 1982).

That Texas bays and estuaries differ in this key component of freshwater inflow provides us with a unique opportunity to perform "natural experiments". One could not hope to manipulate such environmental parameters such as salinity, or nutrient concentrations on large scales. But, within the same geographic location we have bays exposed to the same long-term climatic influences and geological history, yet different in precisely what makes an estuary an estuary: freshwater inflow.

When performing field experiments, the design must avoid confounding factors and pseudoreplication (*sensu* Hurlbert, 1984). Questions, such as: "what effect would increased inflow have on recruitment or productivity?", cannot be answered by short-term studies at a given site. Year-to-year variability is a confounding factor when comparing differences among bays sampled in different years. If only one "wet" year and one "dry" year are sampled then inflow is pseudoreplicated because of year-to-year variability, regardless of large differences in the amount of rainfall in each year. We can only separate differences due to effects freshwater inflow and salinity by comparing key processes synoptically among estuaries over several years.

Historical data indicates that finfish and shellfish harvest are inversely correlated; with harvest of more finfish in saltier estuaries, and more shellfish in fresher estuaries (Table 1; TDWR, 1982). However, our two-year study of Lavaca Bay benthos, indicated that increased biomass, particularly mollusk biomass, was correlated with increased salinity over time (Jones et al., 1986). The first year (1985) was "wet" with heavy freshwater inflow. The next year (1986) was "dry", inflow decreased by 300%, but biomass increased by 300%. Regardless of the difference in rainfall between years, we cannot conclude that there is higher benthic production in dry years than in wet years, because we don't know anything about year-to-year variability, and the bays were sampled during different time frames. In this study, benthic biomass might have increased in the second year anyway. This is a good example of pseudoreplication. The main effect, which is annual variation in precipitation, was only sampled once (i.e., one dry, and one wet year). So far, we can only hypothesize (based on the data) that: if there are high rates of freshwater inflow during periods of recruitment (the spring), then that will result in less benthic productivity (lower benthic standing stocks in the summer).

Another measure of secondary benthic production is metabolism. Oxygen uptake at the sediment surface is a good overall indicator of total benthic metabolism and carbon flow (Patching and Raine, 1983; Howes et al., 1984). Thus the hypothesis, that high rates of freshwater inflow during periods of recruitment (the spring) will result in less benthic productivity, can be tested using two indicators of productivity (changes in biomass and oxygen consumption).

Two estuarine systems were studied (Table 1). They receive similar amounts of freshwater inflow, but because the surface area of the Guadalupe is smaller it has lower salinity regimes. Previous intensive surveys in San Antonio and Lavaca Bays indicate that there are two zoogeographic zones in Lavaca and San Antonio Bays (our own unpublished data; Gilmore et al., 1976; Harper, 1973; Mackin, 1971; Matthews et al., 1983). One zone (in the upper reaches of the bays) is characterized by brackish water species such as the mollusks *Mulinia lateralis*, and *Littoridina sphinctosoma*. The second zone (more seaward) is characterized by marine species, predominantly polychaetes. Therefore, only four stations are required to characterize each bay. Two stations must be located in each of the two zones to avoid pseudoreplication of the effect of freshwater influence. Thus, there will be two stations at the head of the system to represent high impact of freshwater inflow, and two at the seaward end of the system to represent little or no freshwater impact.

Previous intensive surveys in San Antonio and Lavaca Bays indicate peak benthic abundances in the spring, sharp decreases in late summer, and lows in winter (our own unpublished data; Gilmore et al., 1976; Harper, 1973; Mackin, 1971; Matthews et al., 1983). These studies indicate that it is necessary to have at least three sampling periods per year. We sampled peak abundance periods in April, declining abundance periods in July, and the low abundance periods in November.

MATERIALS AND METHODS

Study design. In order to distinguish between freshwater influence and marine influence four stations were always chosen. Two stations which replicate each of the two treatment effects (freshwater and marine). Generally these stations were along the major axis of the estuarine system leading from river mouth to the foot of the estuary near the barrier islands. This design avoids pseudoreplication, where only one station has the characteristic of the main effect, and it is not possible to distinguish between station differences and treatment differences.

Two riverine systems were studied in detail (Figure 1). The Guadalupe and San Antonio Rivers empty into San Antonio Bay. Four stations were occupied: a freshwater station at the head of the Bay (station A) and at mid-bay (station B), and two saltwater influenced stations near the Intracoastal Waterway, one at the southwestern foot of the bay (station C) and one at the southeastern foot of the bay (station D).

The Lavaca River empties into Lavaca Bay, which is connected to Matagorda Bay. Matagorda Bay also has freshwater input from the Tres Palacios River. Four Stations were occupied along the axis of the system. Two stations were in Lavaca Bay (A and B), and two stations were in Matagorda Bay (C and D) (Figure 1). Five field trips were performed. Station A in Lavaca Bay was the same station 85 sampled in 1984-1986 (Jones et al., 1986).

Sampling and analyses. Sediment was sampled with core tubes by divers. The macrofauna was sampled with a tube 6.7 cm in diameter, and subsampled at depth intervals of 0-3 cm and 3-10 cm deep. The meiofauna was sampled with a tube 1.8 cm in diameter, and subsampled at depth intervals of 0-1 cm and 1-3 cm. Samples were preserved with 5% buffered formalin, sorted (on 63 μm sieves for meiofauna, and 0.5 mm sieves for macrofauna), identified, and counted. Biomass of macrofauna was also measured. Mollusk shells are removed and placed in 1 N HCl for 1 min to 8 h to dissolve the carbonate shells by the acidic vaporization technique (Hedges and Stern, 1984). Samples are then washed, and dried at 55 °C for 24 hours before being weighed. Dry weight biomass was converted to carbon (C) biomass by using a conversion factor (40% dry weight is C) derived for San Antonio Bay macrofauna (Montagna and Kalke, 1989).

Measurement of bacterial biomass. One cm^3 samples for bacterial enumeration were taken with soda straws. Samples were preserved in 4% buffered formalin that had been filtered through a 0.2 mm filter and refrigerated until processing. Bacterial cell counts were measured using the acridine orange direct count (AODC) technique (Daley and Hobbie, 1975) as modified by Montagna (1982). Direct count techniques, which use light microscopy, can lead to systematic errors in estimating bacterial abundance (Brock, 1984). However, they are also the easiest techniques to use that measure only bacterial-sized organisms and will yield relative results which will allow for station comparison (Montagna, 1982). Photographs of bacteria were used to estimate cell biovolumes (Fuhrman, 1981). Biovolumes were converted to biomass assuming 3.8×10^{-13} g $C \cdot \mu m^{-3}$ cell volume (Lee and Fuhrman, 1987). Estimates and variances of bacterial biomass were calculated by formulas given in Montagna (1984).

Chemical measurements. Oxygen concentration changes were measured using electrodes. Four cores were outfitted with pulsed oxygen electrodes (Endeco, Inc., Marion, MA). These electrodes are of a new design in which the measurement of oxygen concentration is flow-insensitive (Langdon, 1984). The four electrodes are then connected to a Pulsed D.O. Sensor (T.M.) which controls the timing of the electrical pulses sent to each probe. These pulses are the sampling times. Data is interpreted by the Pulsed D.O. Sensor and logged automatically on a portable computer. In this way oxygen concentrations can be monitored continuously in four cores. Three sediment samples, and one bottom water control are incubated in each sample run. The samples were incubated in the dark at *in situ* temperatures in a water bath. By measuring the changes in oxygen concentration over time, and adjusting for the area of sediment covered by the core and the volume of water contained in the core, the rates of benthic respiration were calculated. The flux rate in the bottom water is subtracted from the flux in the sediment core, therefore the fluxes are for sediment only. Carbon flux is estimated from the oxygen uptake data assuming a respiration quotient of 1.0 (Nixon et al., 1980).

Subsamples were taken from the overlying water in the sediment core tube at the beginning and end of the incubation period. From the water subsamples, the concentrations of ammonia, nitrate, nitrite, phosphate and silicate in fresh samples using highly precise techniques (Whitledge et al., 1986). Flux of nutrients were calculated in the same manner as for oxygen flux.

RESULTS

Physical factors. Freshwater inflow balance was very similar in both bays during the study (Figure 2). Unfortunately, data for the entire study period is not yet available. Temperature in both estuaries was very similar (Figure 3). The average temperature in the Guadalupe (24.3 °C) was not statistically different from that in the Lavaca (23.8 °C). The Guadalupe was slightly fresher during the study (Figure 4). The overall mean in the Guadalupe was 22.0 ppt, and the overall mean was 28.8 ppt in the Lavaca estuary. These were different (P=0.0001). The freshest was stations A and B in San Antonio Bays at the head of the estuary. Stations C and D in San Antonio Bay were similar to all station in the Lavaca-Matagorda system. (Figure 4).

Microbial and meiofaunal factors. Bacterial biomass for the bays sampled in April 1988 is shown in Table 2. Bacterial samples were also taken in Nueces Bay (Montagna and Kalke, 1989). Bacterial density was significantly less in Lavaca Bay than in Corpus-Nueces and San Antonio Bays which were the same. However, cell biovolumes were larger in Corpus-Nueces Bays compared to Lavaca and San Antonio. The net result was that there was a gradient in bacterial biomass (a function of cell abundance volume) where San Antonio Bay was much greater in Nueces-Corpus Bay, which was much greater than Lavaca Bay.

Meiofauna was only sampled three times in 1987 in the Guadalupe (Montagna and Yoon, 1989). At A and B densities stayed relatively low ($0.251 \times 10^6 \cdot m^{-2}$) and did not change over time. Nor were the densities at A and B significantly different from each other (Tukey multiple comparison test). In contrast, densities decreased over time at stations C and D and were on average about double that of the fresh stations ($0.512 \times 10^6 \cdot m^{-2}$). Station C ($1.361 \times 10^6 \cdot m^{-2}$) was always slightly more dense than station D ($0.887 \times 10^6 \cdot m^{-2}$) (Tukey multiple comparison test). Taxa composition of the meiofauna was similar to other marine environments at the stations C and D, but depauperate in nematodes at stations A and B (Table 3). The meiofauna densities covaried with salinity differences (Montagna and Yoon, 1989). Staying low at A and B when salinity was low, and decreasing at C and D as salinity decreased. Meiofauna densities were originally four times greater in marine stations than freshwater stations when salinity was high, but densities at C and D went down to the level of A and B when salinities became similar and fresh.

In Lavaca the meiofaunal density was highest at station D ($7.30 \times 10^6 \cdot m^{-2}$), but the other three stations were not significantly different (Tukey test). Density at station A was $4.53 \times 10^6 \cdot m^{-2}$, at station B $4.69 \times 10^6 \cdot m^{-2}$, and at station C $3.63 \times 10^6 \cdot m^{-2}$. Community composition was dominated by nematodes at all stations (Table 3).

Macrofauna. Densities were significantly higher in the Guadalupe ($47{,}200 \cdot m^{-2}$) than in the Lavaca ($22{,}600 \cdot m^{-2}$) (Figure 5). Densities peaked in the spring and dropped in summer and fall.

In the Guadalupe, densities were three times higher at the freshwater stations ($71.2 \times 10^3 \cdot m^{-2}$) than at the marine stations ($23.9 \times 10^3 \cdot m^{-2}$). The average densities at stations A was $61.0 \times 10^3 \cdot m^{-2}$, at B $81.5 \times 10^3 \cdot m^{-2}$, at C $28.1 \times 10^3 \cdot m^{-2}$, and at D $19.7 \times 10^3 \cdot m^{-2}$. However, densities were uniformly greater in 1988 than in 1989 at all stations in the Guadalupe, when salinities were lowerer. Biomass followed the same trends (Figure 6). Average biomass at station A was $11.13\ g \cdot m^{-2}$, at B $14.78\ g \cdot m^{-2}$, at C $2.62\ g \cdot m^{-2}$, and at D $3.01\ g \cdot m^{-2}$. The biomass in the freshwater stations was 4.6 times higher than in the marine stations (Figure 6).

In the Lavaca-Tres Palacios Estuary the macrofaunal density was highest at station D, but was not significantly different from the other stations (Figure 5). The average density at station A was $16.2\times10^3 \cdot m^{-2}$, at station B $12.4\times10^3 \cdot m^{-2}$, at station C $15.5\times10^3 \cdot m^{-2}$, and at station D $49.6\times10^3 \cdot m^{-2}$. Biomass showed the same trend (Figure 6); the average at was 5.07 $g \cdot m^{-2}$ at station A, 2.67 $g \cdot m^{-2}$ at station B, 6.60 $g \cdot m^{-2}$ at station C, and 13.67 $g \cdot m^{-2}$ at station D.

Nueces and Corpus Christi Bays were sampled in conjunction with Lavaca Bay only in April and July 1988. Four stations were sampled: A and B in Lavaca Bay an upper enclosed secondary bay in close proximity to freshwater inflow from the Lavaca River and C and D in Matagorda Bay, an open primary bay. Freshwater inflow during this sampling period was low. The mean salinities at stations A, B, C and D were 26.7, 28.4, 30.2 and 30.4 ppt, respectively (Table 4). The Guadalupe was thus sampled during a wet-dry cycle (Table 5). There was an increase in species number and diversity during the dryer part of the cycle (Table 6). The general trend is for species numbers, abundance and biomass is to increase from upper Lavaca Bay to lower Matagorda Bay (Table 7). This gradient is not as pronounced as that found in Nueces-Corpus Christi Bay (Table 7). The species composition in Lavaca and Matagorda Bays is similar to the Nueces-Corpus Christi Bay system but the mean numerical abundance is higher than those found in Nueces and Corpus Christi Bays. The polychaetes *Mediomastus californiensis, Streblospio benedicti* and *Glycinde solitaria*, the amphipod *Ampelisca abdita*, and the mollusk *Mulinia lateralis* comprise 82% of the total abundance at station A and 18% of the total abundance at station D. Dominant species in the lower primary bay were the polychaetes, *Mediomastus californiensis, Polydora caulleryi, Brania clavata, Gyptis vittata, Glycinde solitaria, Tharyx setigera, Drilonereis magna* and *Minuspio cirrifera;* the tanaidacean *Apseudes* sp A., the mollusks *Corbula contracta* and *Periploma cf. orbiculare*, a hemichordate, *Schizocardium* sp., and rhyncocoels. The mollusk biomass was highest at stations A (57%) and B (40%) decreasing at stations C (1%) and D (17%). Polychaetes accounted for approximately 50% of the biomass at all stations. At station B the hemichordate, *Schizocardium* sp. made up 42% of the biomass. This species was dominant in biomass in Corpus Christi Bay in 1981-1984 (Flint and Kalke, 1986a; 1986b). The ophuiroid, *Amphiodia limbata* occurred in Matagorda Bay accounted for 20 percent of the biomass at station D. Crustaceans contributed a notable percent of the biomass in the secondary and primary bay. *Ampelisca abdita* was most abundant at stations A and B, *Pinnixa chacei* was found at stations C and D and *Apseudes* sp A was dominant at station D (Montagna & Kalke, 1989).

Effect of macrofaunal biomass on oxygen and nutrient flux. There was a positive relationship between macrofaunal biomass and sediment oxygen consumption (Figure 7) (P=0.0007). There was one outlier, but when it is removed the relationship is still significant (P=0.0139). The intercept of the curve implies that when macrofauna are not present, bacteria and meiofauna are responsible for oxygen consumption at a rate of 8.73 mg C • m^{-2} • h^{-1}. The slope of the curve represents a C turnover time of 0.00101 h^{-1}, which is equivalent to 41 days. This number includes chemical as well as biological oxygen demand. Replicates had a tendency to cluster together (Figure 7). Summer generally had low biomasses, but uptake in the freshwater zones of the Lavaca were high reflecting temperature effects. Ironically temperature had an inverse correlation with oxygen consumption, because biomass was inversely correlated with temperature (Table 9).

Ammonia flux was not related to macrofauna biomass (Figure 8). Ammonia was correlated to silicate (P=0.0102) and nitrate (P=0.0377) flux. There were differences in ammonia flux between stations (P=0.0010), but not bays (P=0.6788). Replicates had a tendency to clump together. There was net uptake of ammonia at stations A in Lavaca, and C in the Guadalupe. There was release at stations A and D in the Guadalupe. The overall average was -1.06 mmol • m^{-2} • h^{-1}.

Nitrite regeneration was strong correlated with biomass (Figure 9). There was generally release in the uptake in the marine stations, and release in the freshwater stations. The overall average nitrite flux was -0.114 mmol • m^{-2} • h^{-1}. In contrast, Nitrate was negatively correlated with biomass, but this was not significant (Figure 10). The overall average nitrate flux was 0.134 mmol • m^{-2} • h^{-1}. Phosphate was not correlated with biomass either (Figure 11). The overall average phosphate flux was -0.582 mmol • m^{-2} • h^{-1}. Phosphate flux was positively correlated with salinity (Table 9) and nitrate flux (P=0.0001). Silicate release had a weak correlation with increasing macrofaunal biomass

(Figure 12). The overall average silicate flux was -12.0 mmol $\cdot$ m^{-2} $\cdot$ h^{-1}.

DISCUSSION

Prior to this study, in the spring of 1987, there was a very large inflow event. Salinities in the Guadalupe were down to 1 ppt in most parts of the estuary by July 1987 (Montagna and Kalke, 1989). This had a depressing effect on macrofauna densities. By the summer of 1988, and through 1989 there was a drought period, where rainfall was about 40% less than historical averages. The densities in the first dry year (1988) were almost double that of the wet (1987) year. But after two years of drought and rising salinities, densities fell back to levels comparable to the wet year. This implies that the pulse of nutrients brought into the bay has a stimulatory effect on benthic productivity during the first year of an inflow event. These nutrients are depleted if inflow decreases dramatically, as it does during a drought, and might limit productivity. Another implication of this result is that the freshwater inflow has a larger effect on smaller area bays, like San Antonio Bay, than on other bays. There is something about the stations at the head of San Antonio Bay (A and B) which yields higher macrofaunal abundances. In Nueces - Corpus Christi Bays the trend is the opposite. Higher densities were found in saline stations (Montagna and Kalke, 1989). However, when salinity increased during the summer, densities generally decreased. Lavaca Bay exhibited the same trends.

The higher productivity in San Antonio bay is evident since there is also higher bacterial biomass in there than in the more saline Nueces, and Lavaca systems. This is not reflected in oxygen consumption. The overall average oxygen flux (in carbon equivalents) for the Guadalupe is 9.24 mg C $\cdot$ m^{-2} $\cdot$ h^{-1}, whereas it is 13.7 mg C $\cdot$ m^{-2} $\cdot$ h^{-1} in the Lavaca Estuary. This is in spite of the lower density and biomass of bacteria and macrofauna in the Lavaca Estuary.

A confounding factor in the comparison of the Guadalupe and the Lavaca is influence from the Gulf of Mexico. The Lavaca is an open system with exchange through Pass Cavallo and a ship channel, whereas the Guadalupe is a closed system. The largest effect of Gulf influence is on community structure, especially in Matagorda Bay where oceanic species are found. These species can be numerous, large sized, and apparently can stimulate productivity (i.e., oxygen uptake).

Macrofauna have a stimulatory effect on the uptake of oxygen, nitrite, and silicate. The lack of a correlation with ammonia could be due to uptake by the sediment and release by macrofauna being counterbalanced.

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Table 1. Average annual freshwater inflow (for the period 1941-1976; Texas Department of Water Resources, 1982) and average annual harvest in Texas estuaries (for the period 1962-1987; Texas Parks and Wildlife Department, 1988). Commercial netting for redfish and trout was banned in 1981. In 1988 all gill-netting was banned.

			Harvest	
Estuary	Area[1]	Inflow[2]	Finfish[3]	Shellfish[3]
Lavaca-Tres Palacios	910	2,628	220	4,576
Guadalupe	579	2,063	177	3,406

[1] Mean tide (km^2)

[2] Net inflow includes gaged and ungaged inflows, diversions and return flow, and precipitation and evaporation (in thousands of acre-feet).

[3] Average annual commercial harvest during 1962-1976 (in thousands of pounds).

Table 2. Bacterial biomass parameters from three Texas bays (samples taken April 1988). Cell numbers and volume are Log_{10} transformed. Bacterial biomass is calculated by adding the log of numbers plus the log of volume then detransformed and multiplied by the conversion factor given in Lee and Fuhrman (1987).

Bay	Station	Cells Log(n)•cm^{-3}	Volume Log(μm^3)	Biomass μg C•cm^{-3}
Corpus-Nueces	A	8.04428	-1.40944	1.63919
Corpus-Nueces	B	7.68682	-1.43272	0.68216
Corpus-Nueces	C	8.21550	-1.58435	1.62530
Corpus-Nueces	D	7.71671	-1.84129	0.28524
Lavaca	A	5.88186	-2.26226	0.00158
Lavaca	B	6.51046	-1.54446	0.03514
Lavaca	C	7.23300	-1.74345	0.11731
Lavaca	D	7.63457	-2.48952	0.05307
San Antonio	A	8.31421	-1.69123	1.59503
San Antonio	B	8.69570	-1.71729	3.61574
San Antonio	C	8.60585	-1.88824	1.98330
San Antonio	D	8.95520	-1.86361	4.69222

Table 3. Average percentage composition of meiofauna taxa.

	San Antonio Bay				Lavaca-Matagorda			
Taxa	A	B	C	D	A	B	C	D
Nematoda	31.9	38.4	67.9	56.2	82.2	77.3	55.9	78.4
Copepoda	15.2	30.4	22.7	19.6	7.0	14.2	13.2	9.4
Others	52.9	31.2	9.4	24.2	10.8	8.5	30.9	12.2

Table 4. Comparison of macrofaunal abundance and salinity in three estuaries. Mean total abundance ($n \cdot m^{-2}$), and mean salinities (ppt) at freshwater zone stations (A and B) and marine zone stations (C and D) over time in San Antonio, Nueces, Corpus Christi, Lavaca, and Matagorda Bays. Nueces Estuary data from Montagna and Kalke (1989).

		Stations			
Bay and Dates	Parameters	A	B	C	D
San Antonio Bay	Abundance	41,217	18,887	9,189	7,544
Jan - Jul 1987	Salinity	0.5	2.4	5.6	8.1
San Antonio Bay	Abundance	69,695	80,637	30,676	20,514
Apr 1988 - Apr 1989	Salinity	13.3	19.4	26.0	28.4
Nueces-Corpus Christi Bays	Abundance	6,397	8,555	10,714	30,629
Oct 1987 - Jul 1988	Salinity	31.2	32.7	32.5	34.2
Lavaca-Matagorda Bays	Abundance	18,340	12,478	18,244	49,536
Apr 1988 - Apr 1989	Salinity	26.7	28.4	30.2	30.4

Table 5. Change in biomass and salinities between and wet and dry cycle in the Guadalupe Estuary, Texas. Average salinities (ppt) and average biomass ($g \cdot m^{-2}$ to a depth of 10 cm for the entire community) at freshwater stations (A and B) and marine stations (C and D) over time in San Antonio Bay. Also presented is the percent of the total biomass represented by the two dominant taxa (mollusks and polychaetes).

		Stations			
Date	Parameters	A	B	C	D
Jan - Jul 1987	Salinity	0.5	2.4	5.6	8.1
	Biomass	7.2	4.8	3.2	3.5
	Mollusks	89%	80%	73%	68%
	Polychaetes	11%	16%	25%	29%
	TOTAL	99%	96%	98%	97%
Apr 1988 - Apr 1989	Salinity	13.3	19.4	26.0	28.4
	Biomass	12.7	14.8	2.6	3.0
	Mollusks	61%	75%	31%	17%
	Polychaetes	35%	23%	62%	78%
	TOTAL	96%	98%	93%	95%

Table 6. Species dominance and diversity in the Guadalupe Estuary in a wet and dry cycle. Dominant species are listed with the average total abundance for the species list (percent composition of total). The overall species number, and mean salinities (ppt) at freshwater stations (A and B) and marine stations (C and D) over time in San Antonio Bay (1987 data from Montagna and Kalke, 1989).

Dates and Dominant Species		Stations			
	Parameters	A	B	C	D
Jan - Jul 1987					
Littoridina sphinctostoma	Salinity	0.5	2.4	5.6	8.1
Mediomastus californiensis	Abundance	97%	96%	72%	84%
Mulinia lateralis	Species	14	16	28	26
Streblospio benedicti					
Macoma mitchelli					
Apr 1988 - Apr 1989					
Streblospio benedicti	Salinity	13.3	19.4	26.0	28.4
Mediomastus californiensis	Abundance	94%	96%	89%	74%
Mulinia lateralis	Species	28	26	24	48
Littoridina sphinctostom					
Gastropod (*Littoridina*? juv)					

Table 7. Species dominance and diversity in the Nueces and Lavaca-Tres Palacios Estuaries. Dominant species are listed with the average total abundance for the species list (percent composition of total). The overall species number, and mean salinities (ppt) at freshwater stations (A and B) and marine stations (C and D) over time in Nueces, Corpus Christi, Lavaca, and Matagorda Bays. (Nueces data from Montagna and Kalke, 1989).

Bays, Dates and Dominant Species	Parameters	Stations			
		A	B	C	D
Nueces-Corpus Christi Oct 1987 - Jul 1988					
Streblospio benedicti	Salinity	31.2	32.7	32.5	34.2
Mediomastus californiensis	Abundance	97%	63%	38%	24%
Mulinia lateralis	Species	14	40	64	68
Macoma mitchelli					
Lavaca-Matagorda Apr 1988 - Apr 1989					
Mediomastus californiensis	Salinity	26.7	28.4	30.2	30.4
Ampelisca abdita	Abundance	82%	77%	40%	18%
Mulinia lateralis	Species	41	34	52	69
Streblospio benedicti					
Glycinde solitaria					

Table 8. Difference in biomass and salinities between two open estuaries. Average salinities (ppt) and average biomass (g • m^{-2} to a depth of 10 cm for the entire community) at freshwater stations (A and B) and marine stations (C and D) over time in Nueces, Corpus Christi, Lavaca, and Matagorda Bays. Also presented is the percent of the total biomass represented by the two dominant taxa (mollusks and polychaetes). (Nueces data from Montagna and Kalke, 1989).

		Stations			
Bays and Dates	Parameters	A	B	C	D
Nueces-Corpus Christi	Salinity	31.2	32.7	32.5	34.2
Oct 1987 - Jul 1988	Biomass	2.3	6.3	5.5	5.5
	Mollusks	85%	41%	30%	6%
	Polychaetes	14%	58%	56%	81%
	TOTAL	99%	99%	86%	87%
Lavaca-Matagorda	Salinity	26.7	28.4	30.2	30.4
Apr 1988 - Apr 1989	Biomass	5.4	2.7	8.0	13.7
	Mollusks	57%	40%	1%	17%
	Polychaetes	40%	52%	48%	45%
	Crustacea	2%	7%	6%	13%
	Hemichordata			42%	1%
	Ophiuroids			1%	20%
	TOTAL	99%	99%	98%	96%

Table 9. Correlation coefficients for physical, chemical and biological factors in both estuaries. Pearson correlation coefficients, the probability that r=0, and number of Observations. Abbreviations: SAL = salinity, TEMP = temperature, O2FLUX = oxygen consumption, GCM2 = macrofaunal biomass, PO4 = phosphate, SIO4 = silicate, NO3 = nitrate, NO2 = nitrite, NH4 = ammonia,

	SAL	TEMP	O2FLUX	GCM2
TEMP	0.16231	1.00000	-0.30732	-0.38272
	0.2704	0.0	0.0336	0.0073
	48	48	48	48
O2FLUX	-0.22912	-0.30732	1.00000	0.47339
	0.1172	0.0336	0.0	0.0007
	48	48	48	48
GCM2	-0.15959	-0.38272	0.47339	1.00000
	0.2786	0.0073	0.0007	0.0
	48	48	48	48
PO4	0.70747	-0.07676	-0.21012	0.07034
	0.0001	0.7215	0.3244	0.7440
	24	24	24	24
SIO4	-0.07787	0.11490	0.28493	0.43527
	0.7176	0.5929	0.1772	0.0335
	24	24	24	24
NO3	0.43143	0.23788	-0.32456	-0.11923
	0.0353	0.2630	0.1218	0.5790
	24	24	24	24
NO2	-0.03213	-0.13574	0.20699	0.69571
	0.8815	0.5271	0.3318	0.0002
	24	24	24	24
NH4	-0.21683	0.21207	-0.02812	0.21672
	0.3088	0.3198	0.8962	0.3091
	24	24	24	24

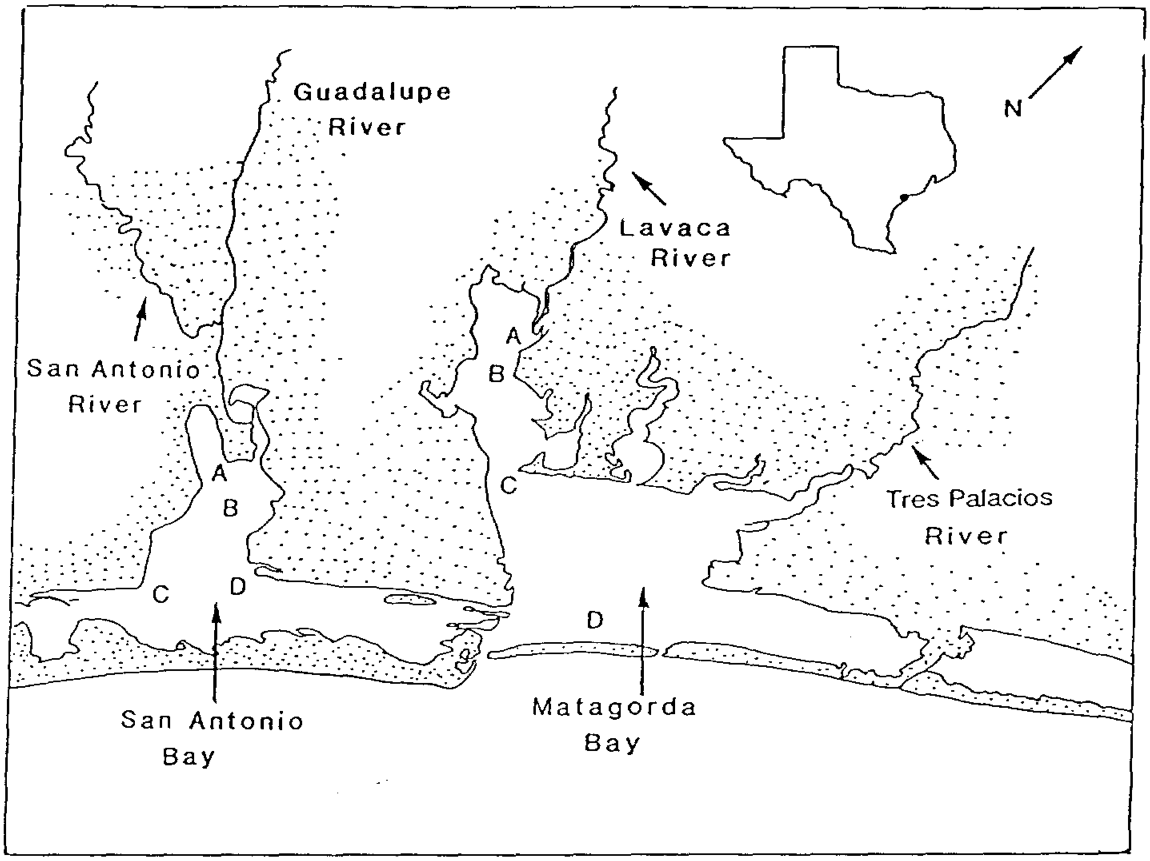

Figure 1. Study area. Four stations were studied in two estuaries. San Antonio Bay is in the Guadalupe Estuary, and Lavaca and Matagorda Bays are in the Lavaca-Tres Palacios Estuary.

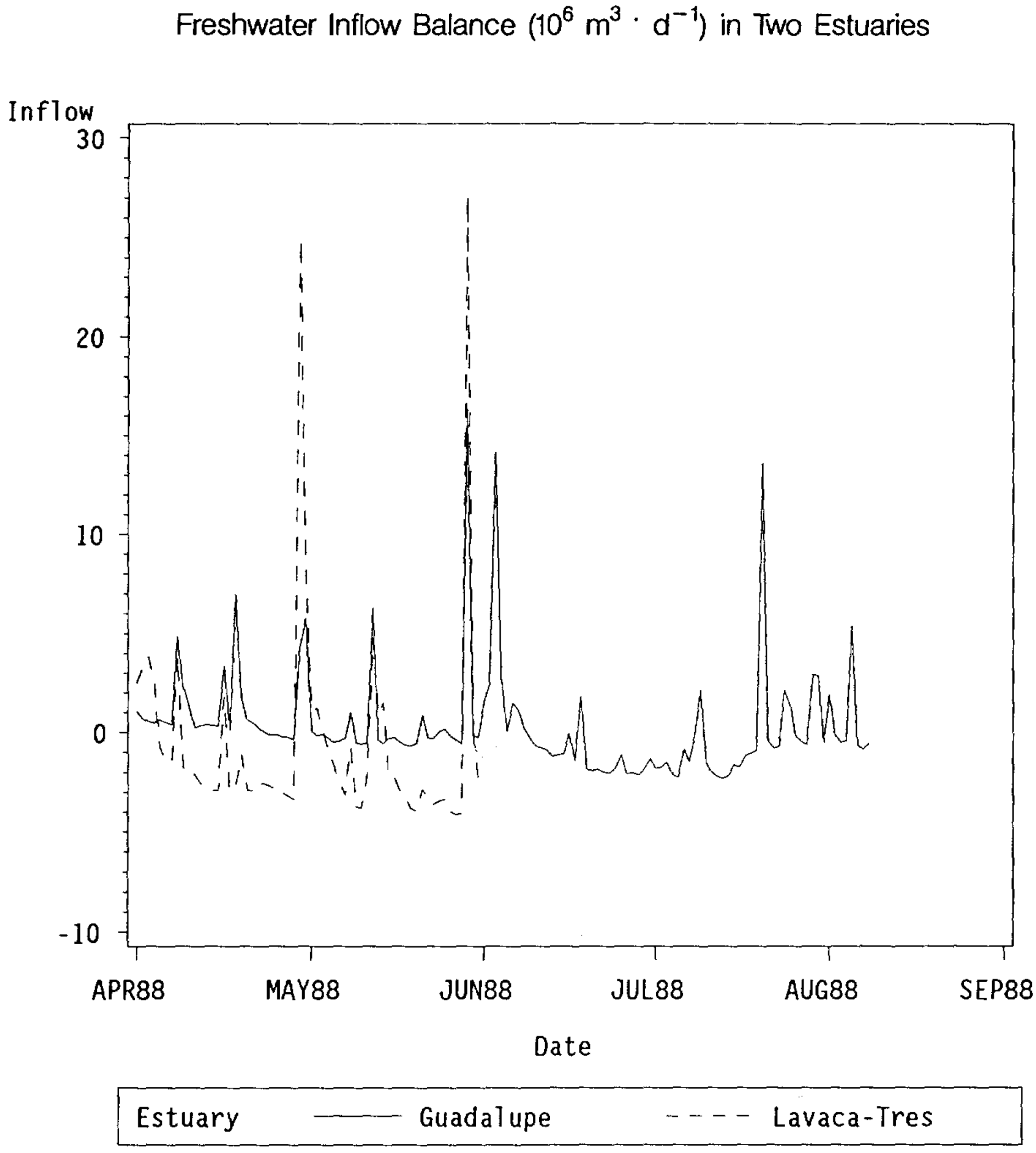

Figure 2. Freshwater inflow balance (gain minus losses) in two estuaries during the study period.

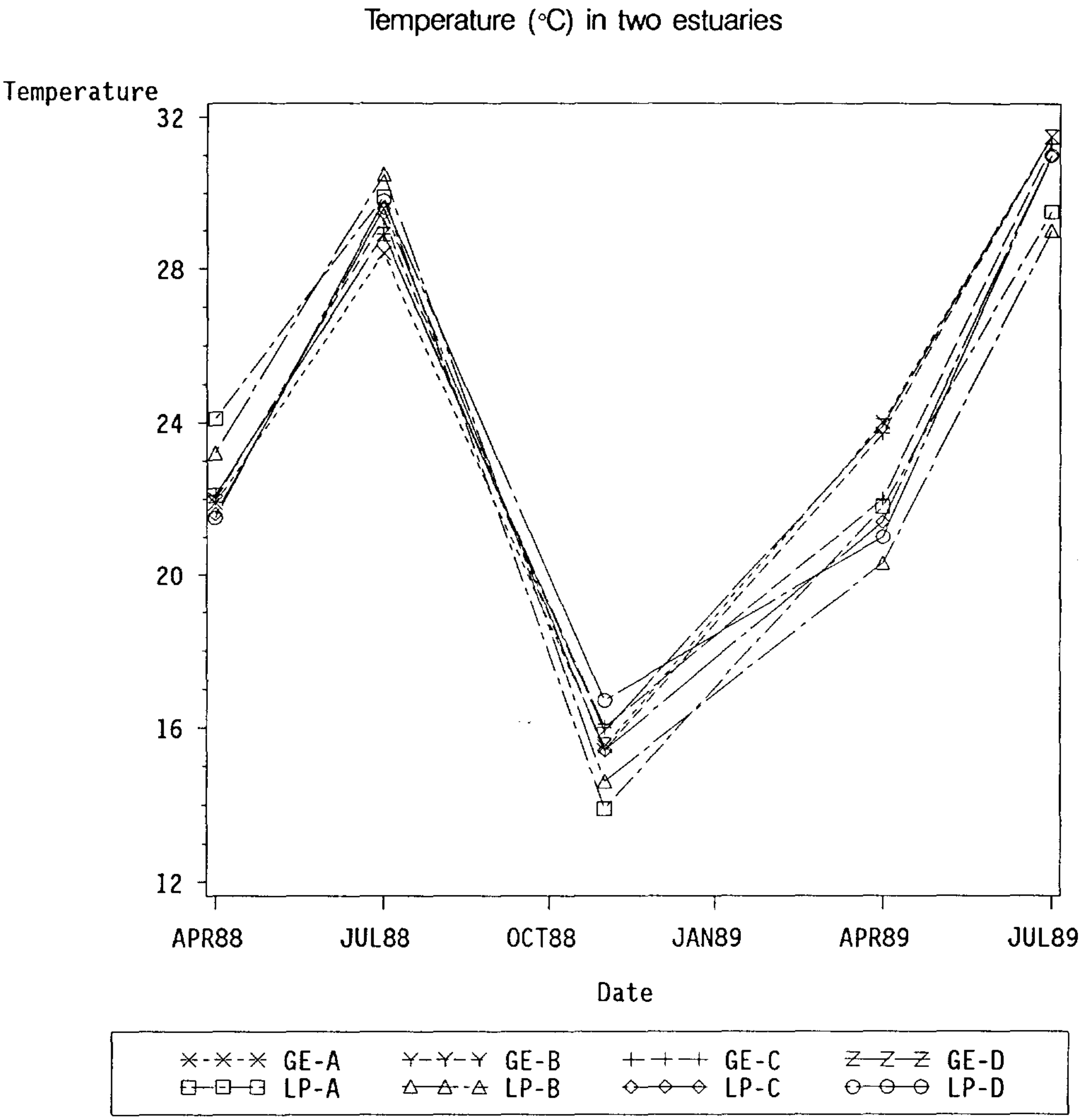

Figure 3. Temperature in the two estuaries during the study period.

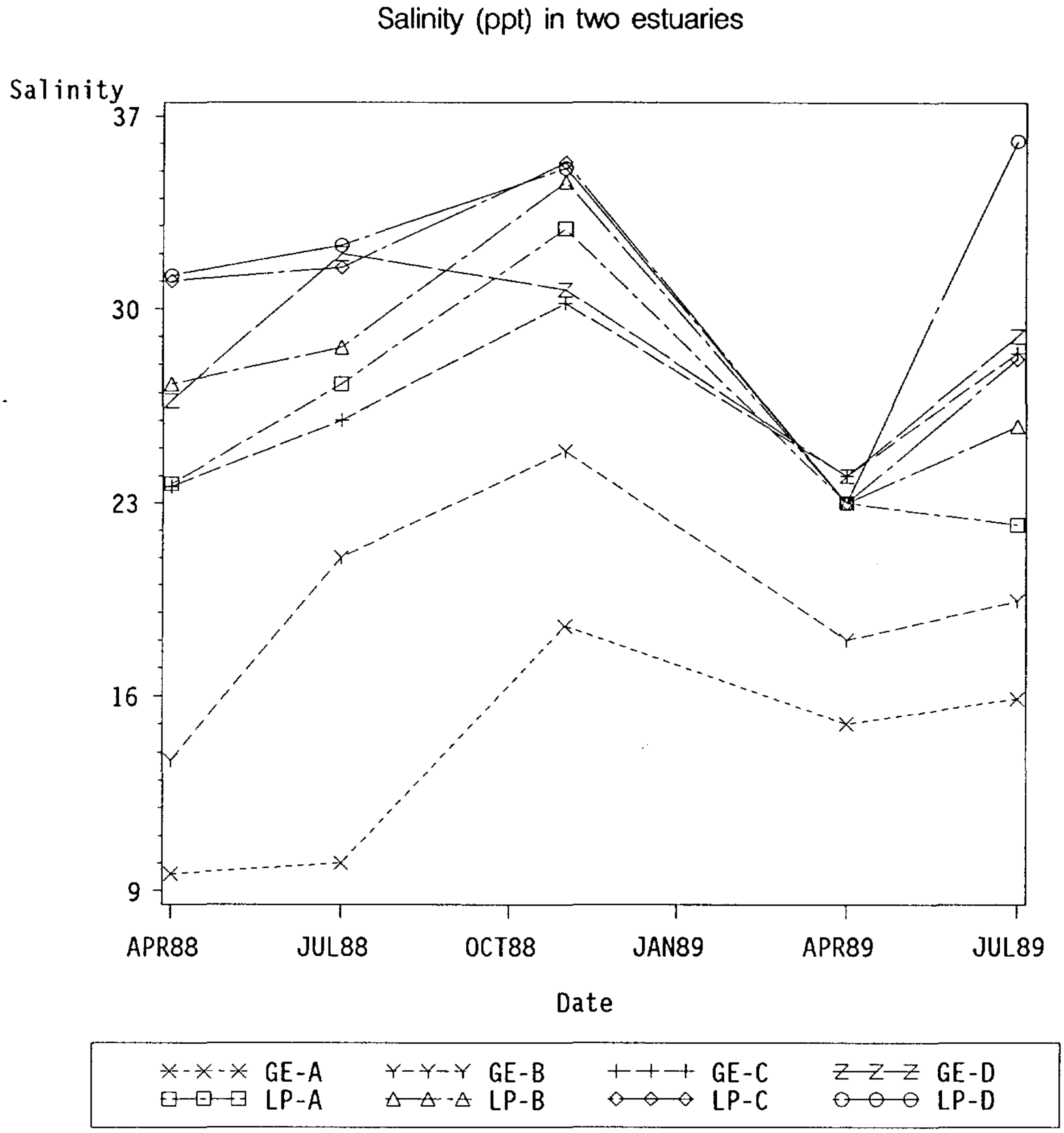

Figure 4. Salinity in the two estuaries during the study period.

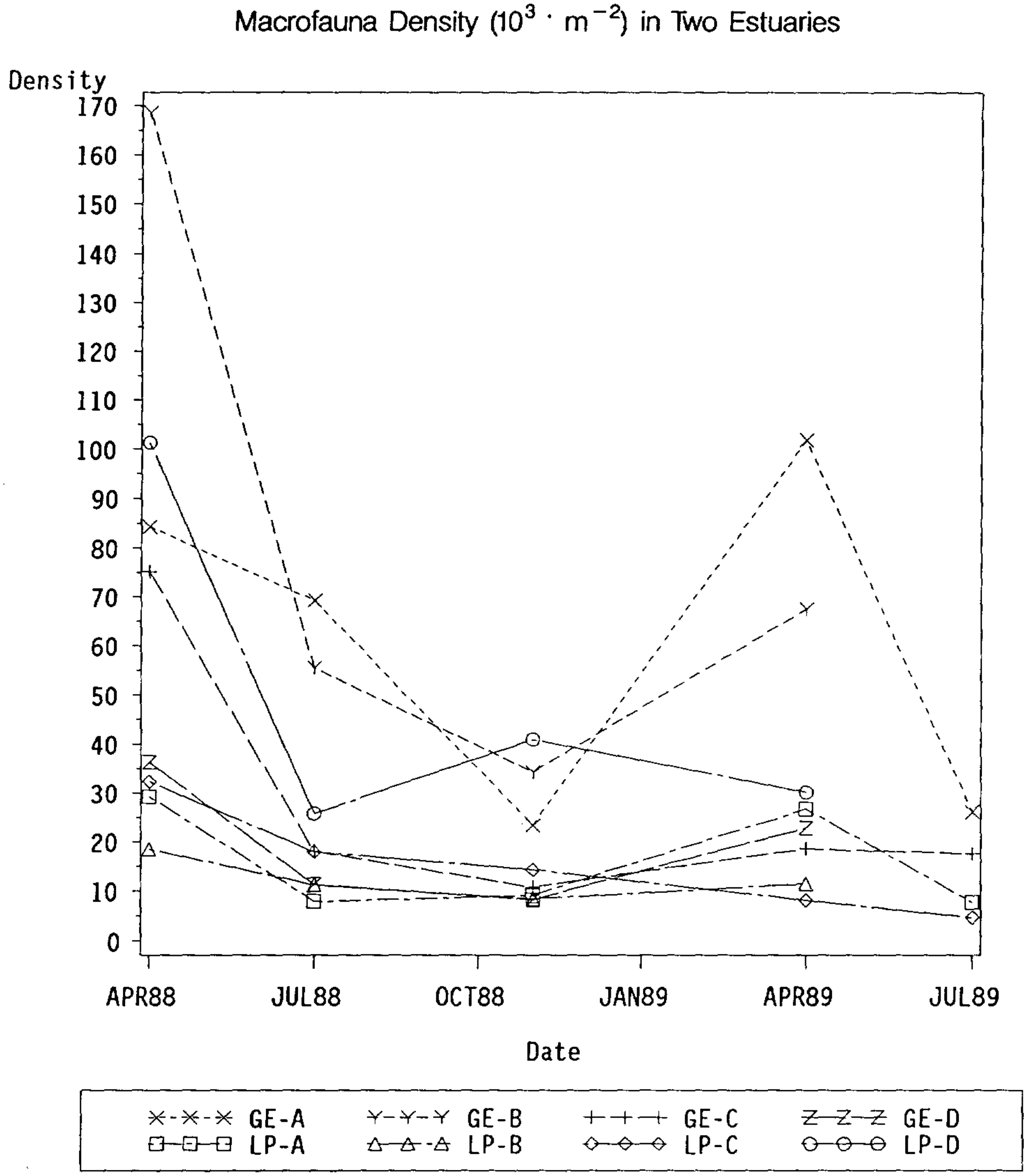

Figure 5. Macrofauna density to a depth of 10 cm in the two estuaries during the study period.

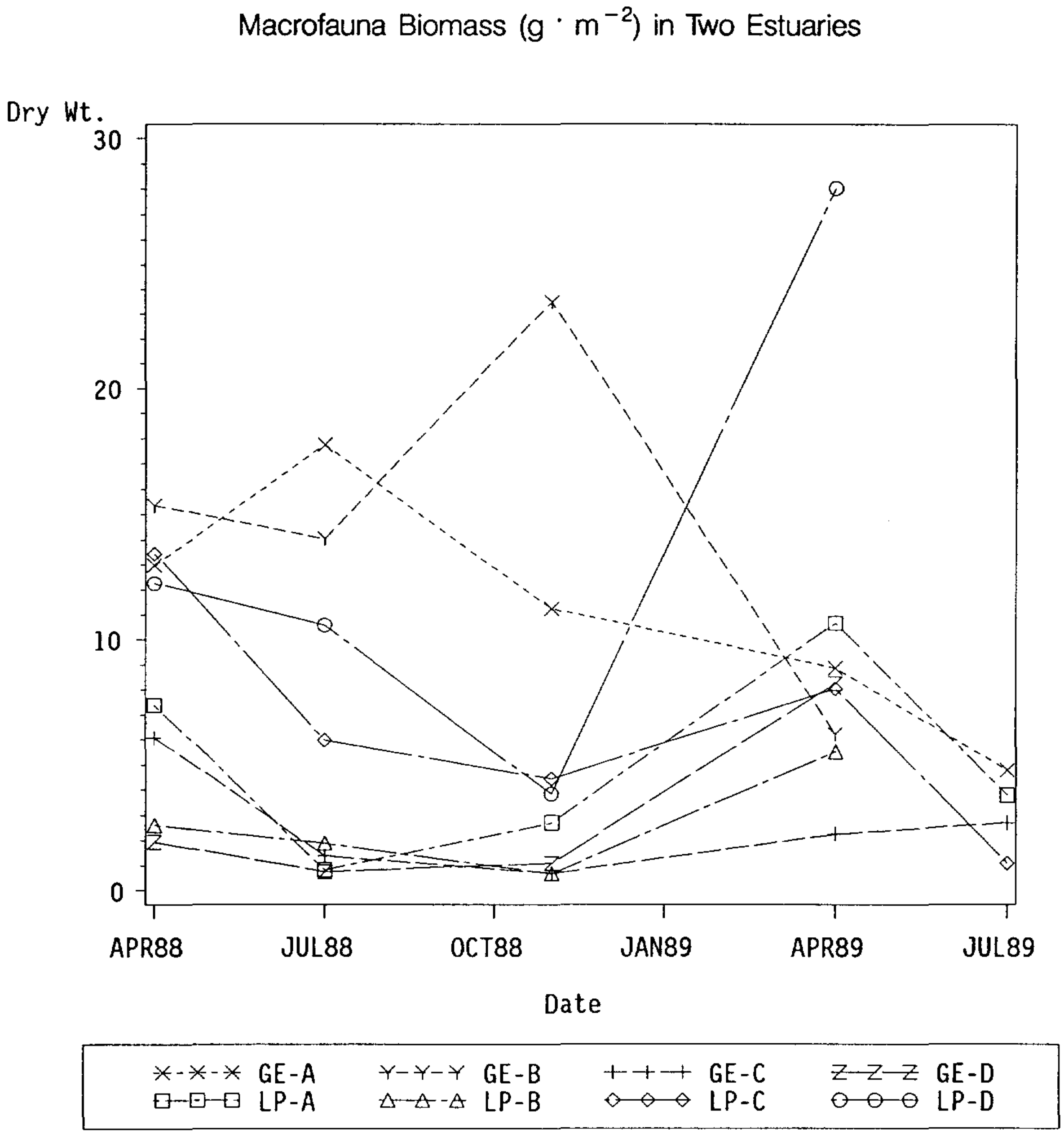

Figure 6. Macrofauna biomass to a depth of 10 cm in the two estuaries during the study period.

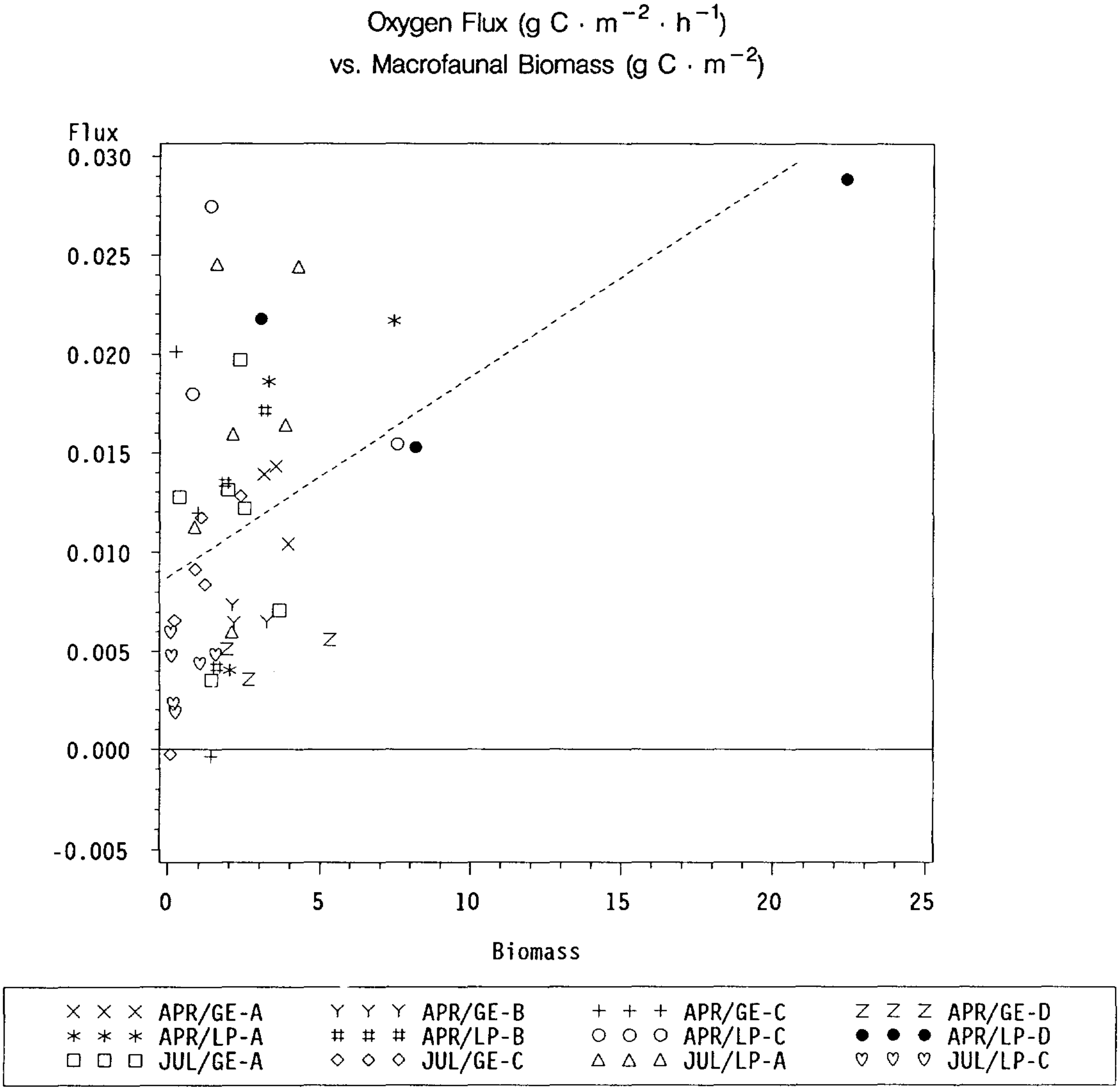

Figure 7. The effect of macrofaunal biomass on oxygen flux during 1989. The dotted line is from a linear regression, where flux (g C • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×0.00101 + 0.00873, *P* for H_o the slope is zero=0.0007, and R^2=0.22.

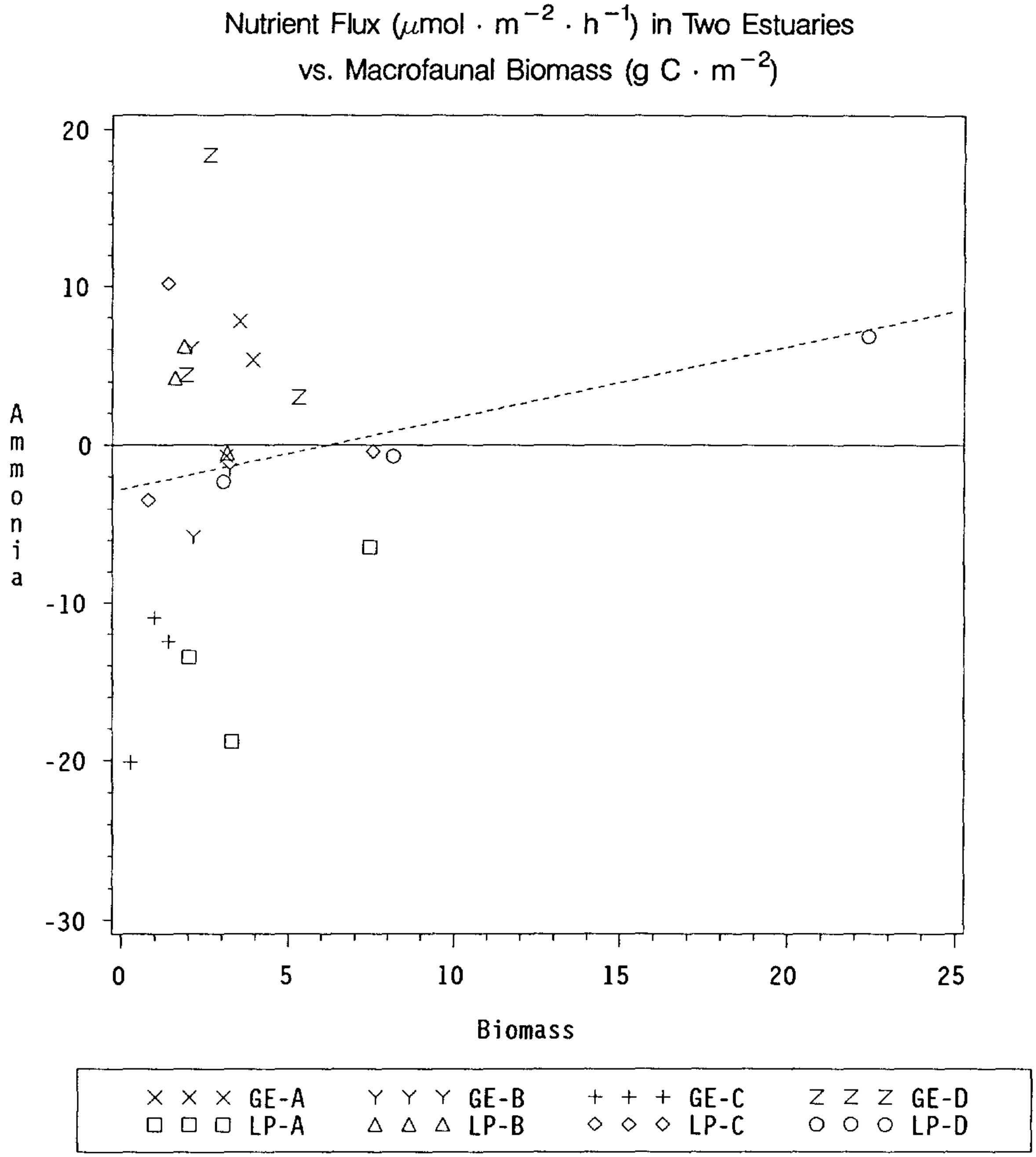

Figure 8. The effect of macrofaunal biomass on ammonia flux during April 1989. The dotted line is a linear regression, where flux (mmol $\cdot$ m^{-2} $\cdot$ h^{-1}) = Biomass (g C $\cdot$ m^{-2})×0.450 - 2.819, P for H_0 the slope is zero=0.3091, and R^2=0.05.

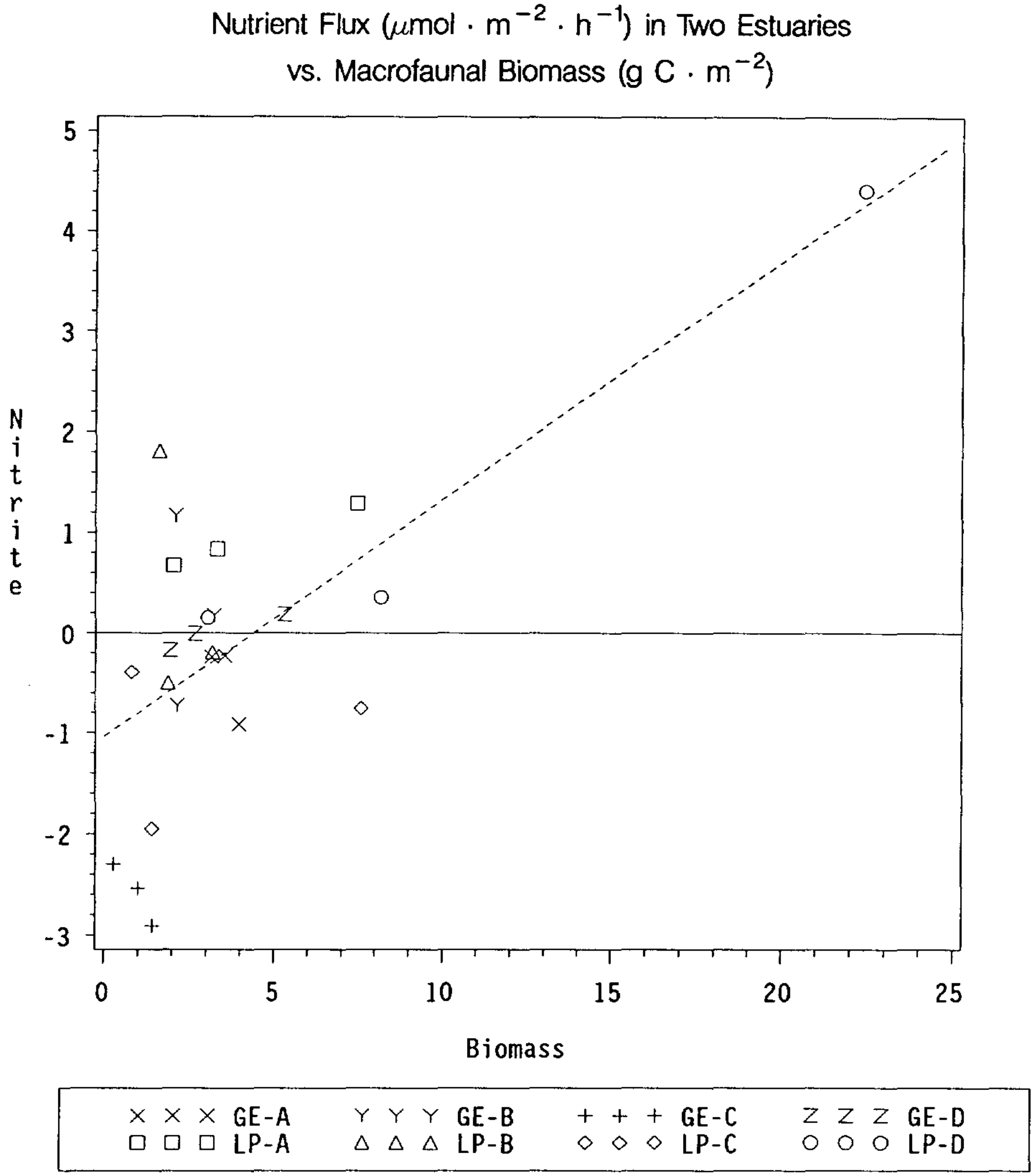

Figure 9. The effect of macrofaunal biomass on nitrite flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×0.237 - 1.038, *P* for H_0 the slope is zero=0.0002, and R^2=0.48.

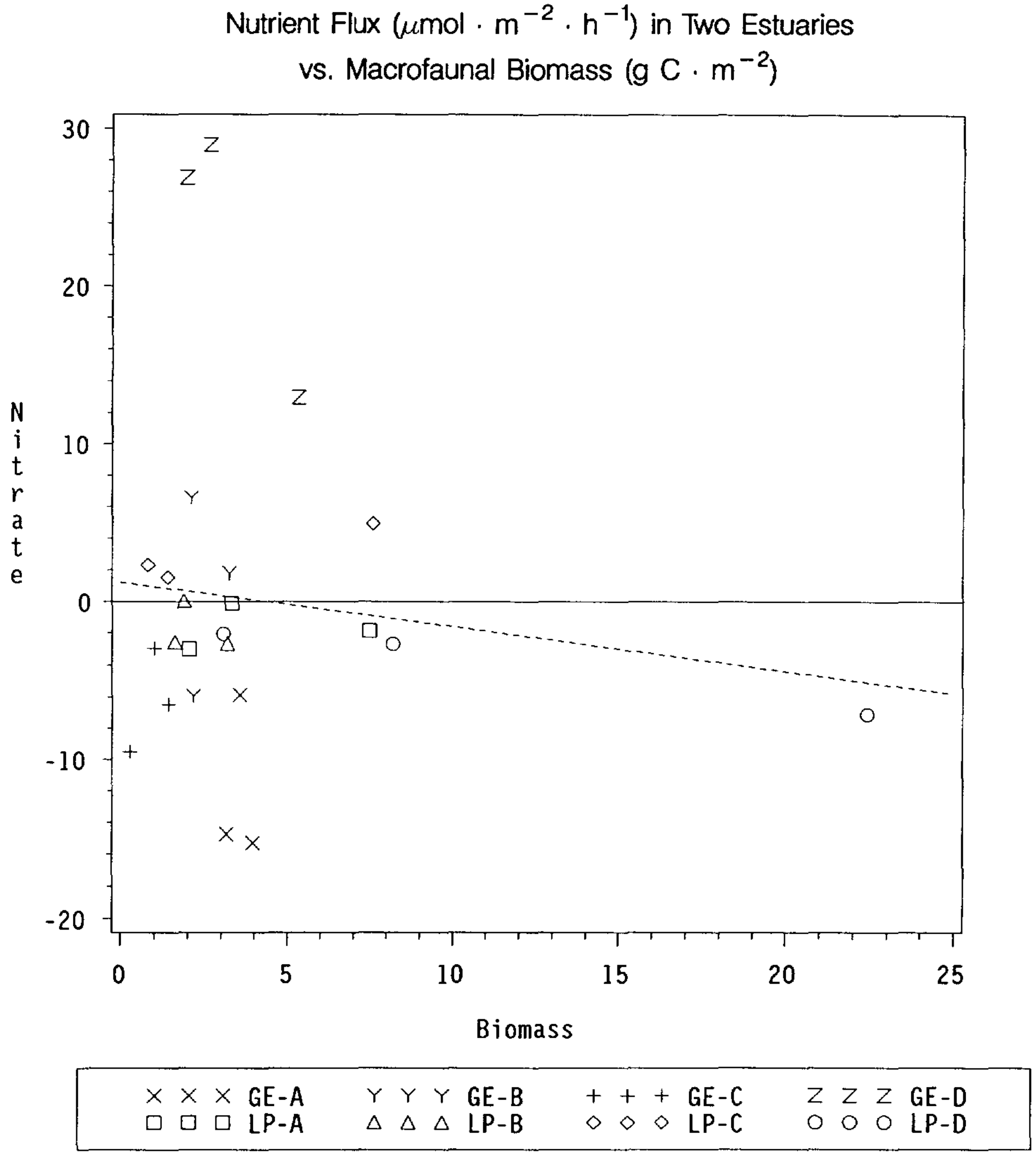

Figure 10. The effect of macrofaunal biomass on nitrate flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})x-0.281 + 1.230, *P* for H_0 the slope is zero=0.5790, and R^2=0.01.

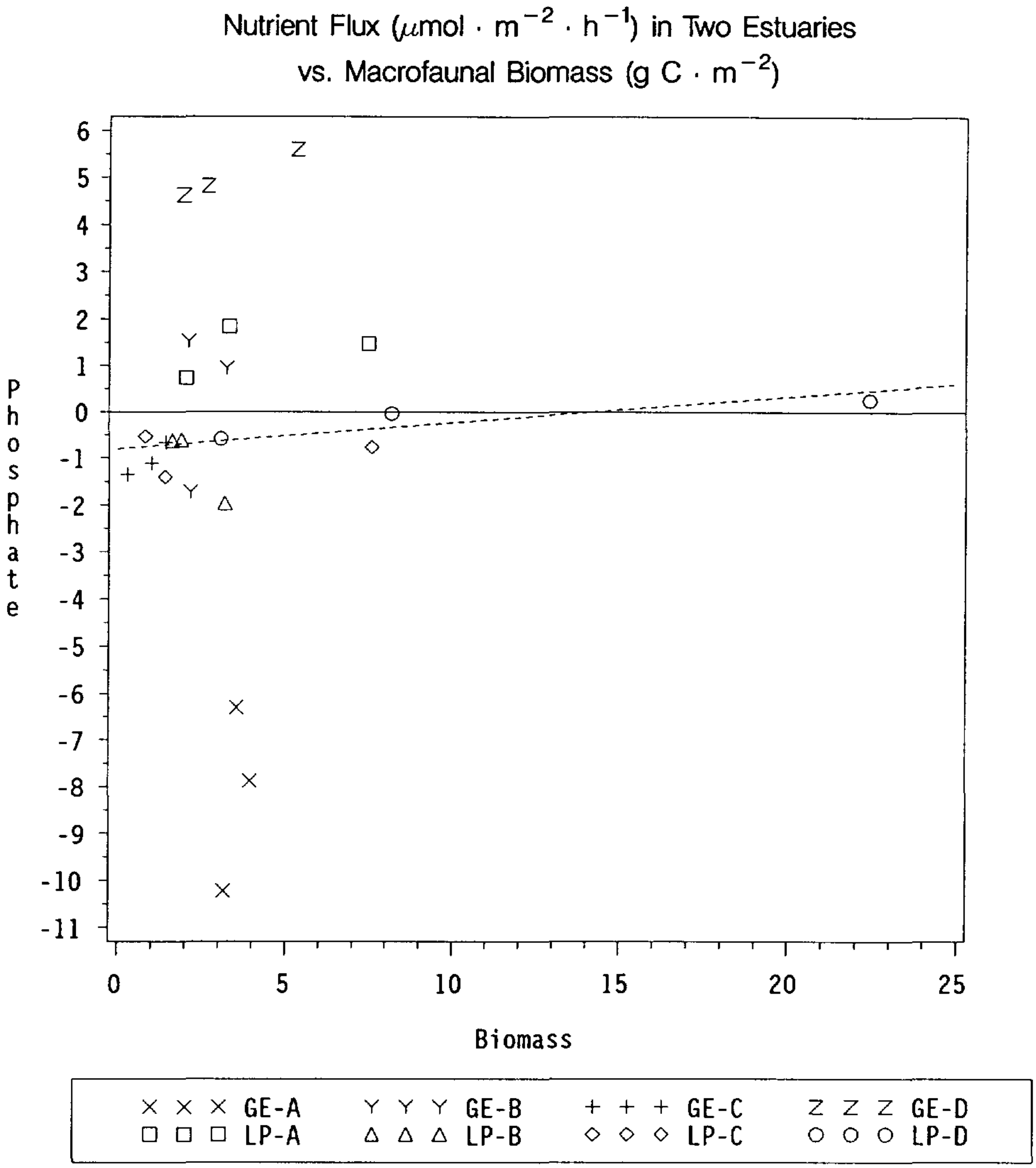

Figure 11. The effect of macrofaunal biomass on phosphate flux during April 1989. The dotted line is a linear regression, where flux ($\text{mmol}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$) = Biomass ($\text{g C}\cdot\text{m}^{-2}$)$\times 0.0566-0.8030$, *P* for H_0 the slope is zero=0.7440, R^2=0.01.

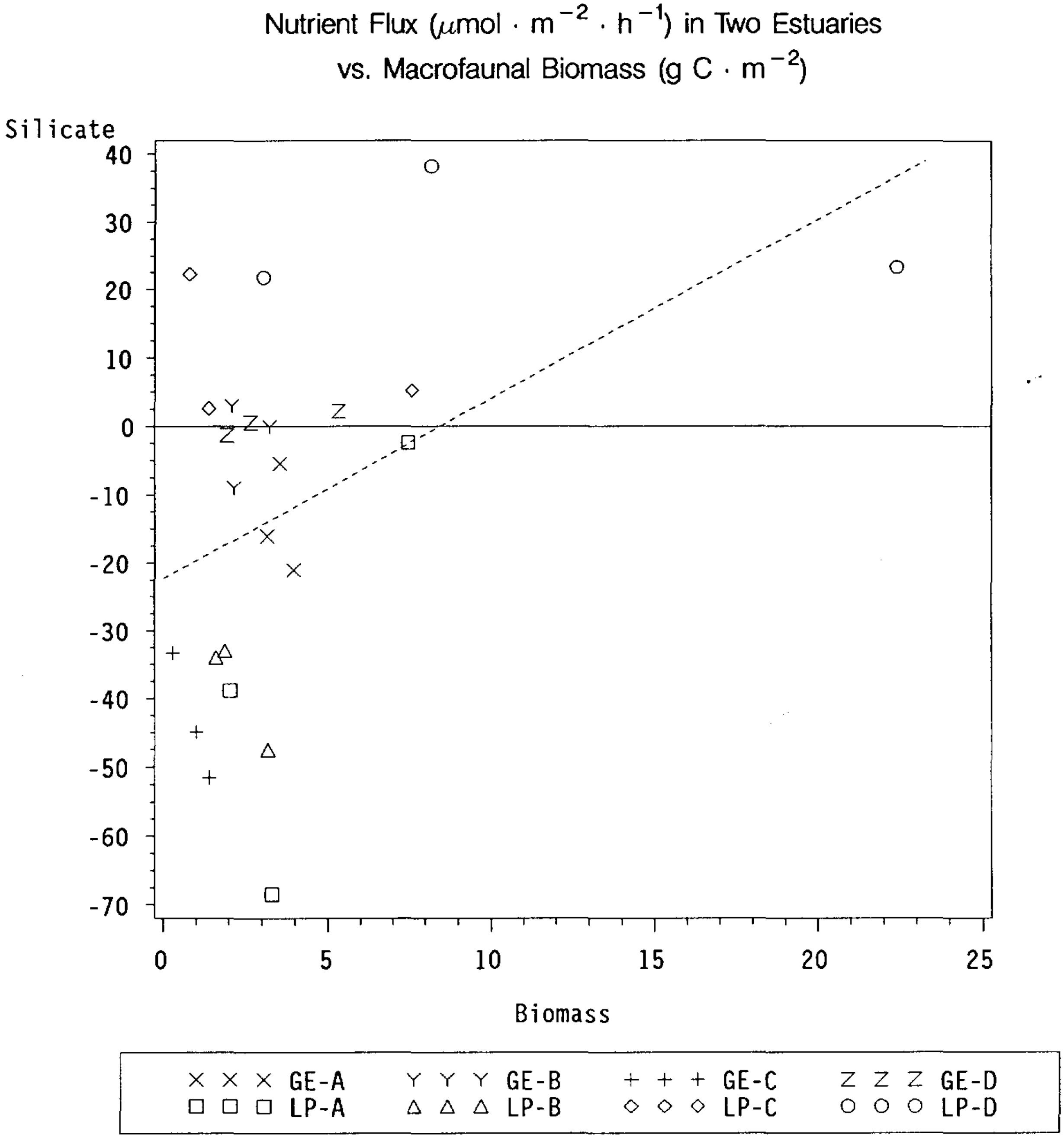

Figure 12. The effect of macrofaunal biomass on silicate flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×2.63 - 22.31, *P* for H_0 the slope is zero=0.0335, and R^2=0.19.

A Review: The Effect of Freshwater Inflow on the Benthos of Three Texas Estuaries

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ABSTRACT

The effect of freshwater inflow on benthic community structure in three Texas estuaries is the subject of a literature review. The Lavaca-Tres Palacios Estuary is fed by the Lavaca, Navidad and Tres Palacios Rivers, which empty into Lavaca and Matagorda Bays. The Guadalupe Estuary is fed by the San Antonio and Guadalupe Rivers which empty into San Antonio Bay. The Nueces Estuary is composed of the Nueces River which empty into the Nueces and Corpus Christi Bays. All three estuaries can be divided into marine, estuarine, and freshwater zoogeographic zones. But the boundaries of the zones are regulated by three factors. First, is the location of the estuary. There are four climatic zones on the Gulf coast of Texas, with a concomitant gradient of decreasing rainfall and freshwater inflow from north to south. Second, is whether the bay has an direct opening to the Gulf of Mexico. Third, is the interannual variability in rainfall and freshwater inflow. In general, species diversity increases with increasing salinity at the marine parts of the estuaries. The trends for biomass and abundance are not so clearly distinct. In an open system, like the Lavaca-Tres Palacios and Nueces Estuaries, biomass and abundance typically increase near the opening to the Gulf, but in a closed system, like the Guadalupe Estuary, abundance and biomass usually decrease toward the marine influenced zone. This indicates that the estuaries must be treated independently when making management decisions, but that we can develop a generic model which describes the effect of freshwater inflow on estuarine benthic dynamics.

INTRODUCTION

The Texas coastal region is an important natural resource to the economy of this state and nation. This region is composed of seven major estuarine systems and extends for approximately 370 linear miles. The Texas coastline encompasses four climatic types described by Thornwaite (1948): (1) Semi-arid regions from the Rio Grande to 30°3'N just south of Corpus Christi, (2) Dry subhumid region from Corpus Christi to the lower shores of Matagorda Bay (Port Lavaca), (3) Moist subhumid zone from Port Lavaca to Galveston and (4) Humid climate from Galveston to the Mississippi Delta. These climate zones are roughly correlated with rain fall, with their boundaries corresponding with the 25, 30, 40, and 50 inch average annual precipitation from the lower to the upper coast (Hedgepeth, 1953). There is also a concomitant gradient of decreasing freshwater inflow from north to south corresponding to these climatic boundaries. Fluctuations of the climatic boundaries are common. For example, Price (1949) determined that the expected dry-subhumid climate occurred less than 50 percent of the time for a hundred year period in the Corpus Christi zone.

Although there is an obvious difference between the estuarine systems in regards to climate and freshwater inflow they have one feature in common, both seasonal and year-to-year variation in rainfall. This variation is characteristic of estuaries, but it is extreme on the northwestern Gulf coast, and can have radical effects on the estuaries (Hedgepeth, 1953). Flooding can change the salinity of a bay from 15 ppt (parts per thousand) to nearly zero in a few days, or periods of drought with high temperatures may raise salinities to hypersaline conditions. For example, drought conditions from 1948 to 1956 resulted in low freshwater inflow, and caused salinities in Texas bays to increase to record highs with little variation between years. This was followed by a sudden change in the spring of 1957 in Mesquite and Aransas Bays where the salinities dropped from 40 ppt to 2-4 ppt in less than 3 weeks (Parker, 1959; TDWR, 1980b). From September 11 to 15, 1951 precipitation lowered salinity at the head of Alazan Bay from 55.3 to 1.4 ppt changing the average salinity in Alazan from 54.7 to 11.5 ppt (Breuer, 1957). Sudden changes in salinity following long term stable conditions can cause mass mortality (Parker, 1959; Stone and Reish 1965; Wells, 1961; Thomas and White, 1969).

Temperature is another important climatic factor. Temperature changes associated with cold weather fronts are often severe enough to cause mortality to fish and some invertebrates (Hedgepeth, 1953). Mass mortality following freezes along the Texas coast occur approximately every six to fourteen years, averaging one every ten years (Hedgepeth, 1953 cited in Gunter, 1947). In January-February, 1951, 60 to 90 million pounds of fish were killed, mainly in the Laguna Madre (Gunter and Hildebrand, 1951; Breuer, 1957). The most recent cold related fish kills occurred in the winters of 1983 and 1989.

Each estuarine system has its own hydrographic characteristics dependent on interactions between river inflows, climatic factors and tides and each needs to be studied in detail (Hedgepeth, 1953). Multidisciplinary inter-bay studies are important to understand each estuary and how they relate to each other. This review attempts to establish the relationship between benthic community structure and variations among Texas estuaries due to inter- and intra-annual climatic affects.

PHYSIOGRAPHY OF TEXAS ESTUARIES

The bays in the Texas estuarine system can be classified by structure into tertiary, secondary and primary bays (Texas Department of Water Resources, 1982). The tertiary bays are the lakes associated with the head waters of the estuary and are typically low salinity areas due to their proximity to freshwater inflow. The secondary bays are semi-enclosed bays of low to moderate salinities connected to the lower primary bays, which are the central part of the estuary with moderate to high salinities. Numerous oyster reefs are usually associated with the low to moderate salinity secondary bays. Texas estuaries are also classified based on their location and in relation to the Gulf of Mexico. Open bays are those with direct access to the Gulf, ie. Lavaca-Matagorda and Nueces-Corpus Christi bays and closed bays are those without direct access to the Gulf, ie. San Antonio Bay.

The physiography of the Texas estuarine systems results in a salinity gradient from low salinity in the upper estuary near freshwater inflow to higher salinity in the lower estuary near marine influence. This salinity gradient ultimately effects the zoogeographical distribution of benthic organisms and enables us to divide the estuarine system into three major zones ie. (1) a freshwater influenced zone in the upper bay, (2) an estuarine zone mid-bay, and (3) a marine zone in the lower bay. Species composition of these zones are freshwater species, brackish or estuarine species, and marine species as you go from fresh to marine water (TDWR, 1980a). Although most benthic studies reviewed describe faunal and salinity differences which relate to the zones we use, various terminology is used to describe these zones (Table 1).

GENERAL SALINITY EFFECTS ON BENTHOS

Ecological studies over the years have demonstrated the importance of salinity as a factor in affecting the distribution of marine and estuarine organisms. The number of species, but not necessarily the observed total biomass increases as one proceeds along a salinity gradient from the freshwater side of a large estuary to the open sea (Springer and Woodburn, 1960; Gunter, 1961). Sessile and non-motile organisms have optimum salinities at which they grow best and variations from the optimum inhibit growth (Gunter, 1961). The life histories of many motile species, i.e., commercially important penaeid shrimps and menhaden, are migratory. Spawning occurs offshore, followed by the migration of larvae and juveniles to low salinity nursery areas at the heads of estuaries (Gunter, 1957; Baldauf *et al*., 1970). Individuals of marine species of fishes that invade freshwater are predominantly the juveniles (Gunter, 1957).

Some of these trends change when the estuary becomes hypersaline. For example, in the Laguna Madre when the salinity increases (1) there are fewer species, (2) the number of individuals of each species increases, (3) the average individual of each vertebrate species is larger (4) the average individual of many invertebrate species, ie., blue crabs and barnacles decreases (Simmons, 1957). When salinity and temperature are variable and extreme in the Laguna (1) only a few species of marine invertebrates and individuals of each species may survive, (2) but when hydrographic conditions are stable and salinities and temperature are in the extreme range, a few tolerant species may become extremely abundant, (3) When physical conditions are stable and within the normal range for marine environments there will be many species but fewer individuals of each species (Parker, 1959).

Variations in salinity may be adverse for some organisms and beneficial for others. In general, when salinity changes within limits, the biomass remains fairly constant while the diversity or number of species changes (Hopkins *et al.*, 1973). Salinity changes may add or eliminate species from an environment. This may be considered beneficial or detrimental, depending on ones interest and point of view.

GUADALUPE ESTUARY

The Guadalupe Estuarine system, located between 28°10′ and 28°28′ North latitudes and between 96°36′ and 96°50′ West longitudes, is a shallow coastal plain estuary adjoining Mission Lake, Guadalupe Bay and Hynes Bay and San Antonio Bay. Approximately 4,856 ha (12,000 ac) of marshes and vegetated wetlands borders the bay system (Matthews *et al.*, 1974). The total system covers 52,609 ha (130,000 ac) and receives freshwater from the San Antonio and Guadalupe Rivers, Coleto Creek, and several small streams. San Antonio Bay is a shallow estuary with a mean depth of 2.5 feet (0.76 m). The Intracoastal Waterway traverses the lower bay from northeast to southwest and varies in depth from 12 to 15 feet (3.7 to 4.5 m) with a bottom width of about 125 feet (38.1 m) (TDWR, 1980b). San Antonio Bay is separated by a chain of islands (reefs) from Mesquite Bay on the west and Espiritu Santo Bay on the east. The bay extends 14 miles (25 km) in meridional direction, and is from 5 to 14 miles (9-25 km) wide. The bottom is covered with a network of oyster reefs built on soft mud; of which Panther Reef is the longest, extending over 4 miles north from Panther Point on Matagorda Island (Galtsoff, 1931). Oyster reefs are most numerous in the central portion of the bay where they rise almost to or actually to the surface (Shepard and Rusnak, 1957). In the narrow northern section of the bay the reefs form almost a continuous network of ridges, making navigation very difficult (Galtsoff 1931, and Captain John Turany, R/V KATY, personal communication).

Historical Salinity Regimes. Historically San Antonio Bay is a low salinity bay characterized by a well defined salinity gradient. On February 2-3, 1926 Galtsoff (1931) reported salinities of 4 ppt at the mouth of Guadalupe and Hynes Bay to 14 ppt at Panther Reef, and 17.7 ppt at First Chain of Islands at the entrance of Espiritu Santo Bay. The distribution of salinity indicates that fresh water from the Guadalupe River under most conditions flows down the west side of the bay to Mesquite Bay while higher salinity Gulf water enters the bay from the east through Pass Cavallo and Espiritu Santo Bay (Galtsoff, 1931; Shepard and Rusnak, 1957; Parker, 1959; Ladd, 1951).

Faunal distributions can also be used as an indicator of salinity regimes in the past and present. In San Antonio Bay most living freshwater species are found in the upper bay and along the west shoreline being conspicuously absent from the eastern shore (Parker, 1959). The distribution of *Rangia cuneata* in upper San Antonio Bay and along the west shoreline conforms with the dominant freshwater flow pattern (Ladd, 1951). Sediment distribution is also indicative of the flow pattern of low salinity, sediment laden water. The sediments in the San Antonio Bay delta extending down the bay center and west side are predominantly silt and clay while the sediment associated with Mesquite Bay to the southwest and Espiritu Santo Bay to the southeast where sediments are very sandy (Shepard and Rusnak, 1957).

Extreme flood conditions occurred on July 14, 1936 resulted in salinities ranging between 3 ppt and 5 ppt throughout Aransas Bay, and San Antonio and Copano Bays were virtually fresh (Collier and Hedgepeth, 1950). Parker (1959) cites similar conditions in May 1938, June 1941, October 1946 and June 1957.

Drought conditions from 1948 to 1953 with corresponding low river runoff caused salinities in the central bays of Texas to increase to record highs with little variation between maximum and minimum. Annual freshwater inflow data for the Guadalupe estuary indicates that drought conditions occurred from 1948 to 1956 (TDWR, 1980b). Gradual increases in salinity were noted since 1950 in spite of heavy discharge from the Guadalupe River in June, September and October 1951 (Parker, 1955). Salinities in lower San Antonio Bay in 1950 reported by Baker (1950) were 13.1 ppt to 24.4 ppt and by Parker (1955) in lower San Antonio and Mesquite Bays in 1951 were 23.9 ppt and 41.42 ppt. The API field party from Scripps Institution measured salinities from 23.9 ppt in the upper bay to 41.42 ppt in the lower bay in July and August 1951 (Parker, 1955). In January - February 1952 lower bay salinities were 27.39 ppt to 31.16 ppt in July - August 1952 salinities were from 14 ppt in Mission Bay to 42 ppt where San Antonio connects with Mesquite Bay (Parker, 1955; 1959; Williams and Whitehouse, 1952).

In late 1953 salinities were still above the "normal" salinity of 10 ppt to 17 ppt as suggested for San Antonio Bay by Ladd (1951). In November 1954 salinities ranged from 24 ppt at the river mouth to 36.8 ppt in Mesquite Bay with a 2 ppt salinity difference from central San Antonio Bay to the Gulf of Mexico (Parker, 1955; Phleger and Lankford, 1957). In the spring of 1957 the salinities in Aransas and Mesquite bays dropped from over 40 ppt to as low as 2-4 ppt in less than 3 weeks (Parker, 1959). Conditions described above would have resulted in low salinity conditions throughout San Antonio Bay. The average salinity ranges from the upper bay (Hynes Bay) to lower bay (Panther Point Reef and Intracoastal Waterway markers 21 & 31) from 1959 through 1964 and 1966 were as follows: 3.8-14.7 ppt, 4.1-16.4 ppt, 3.9- 7.8 ppt, 13.1-26.9 ppt, 24.6-31.21 ppt, 16.7-28.8 ppt and 5.1-15.6 ppt respectively (Childress, 1966; Martinez, 1966). Salinity increases from 1962 to 1964 correspond to declines in freshwater inflow for 1962 through 1964 (Childress, 1966; TDWR, 1980a). An average salinity of 5.7 ppt in the upper bay (station 243-4) and 17.3 ppt in the lower bay (291-1) occurred from April 1972 through February 1973 (Harper 1973). During this period freshwater inflow was 49% greater than the average inflow for the 35 year period of 1935-1970. In another study during this same period salinity averaged 4.1 ppt in the upper bay (station 243-4) and 13.2 ppt in the lower bay (station 291-1) (Matthews *et al.*, 1974).

From January through July 1987 high freshwater inflow resulted in an average upper bay salinity of 0.5 ppt and average lower bay salinities ranging from 5.6 to 8.1 ppt (Montagna and Kalke, 1989a). The period from April 1988 through April 1989 had less inflow which increased the upper bay average salinity to 13.3 ppt and the lower bay average salinities to 26.0 and 28.4 ppt (Montagna and Kalke, 1989b).

Faunal Assemblages. Authors of ecological surveys in the bay systems of Texas have tended to divide these systems into zoogeographic zones dependent upon faunal assemblages associated with the salinity gradients (Ladd, 1951; Parker, 1955; 1959; Harper, 1973; Matthews *et al.*, 1974; Phleger and Lankford, 1957; Parker *et al.*, 1953; Phleger 1956).

San Antonio Bay can be referred to as a closed bay, i.e., it is not open to direct Gulf influence. Ladd (1951) divided it into three zoogeographic zones characterized by distinct sediment, fauna, and salinity distributions: the bay head, inter-reef, and reef zones.

The first zone occurs in the upper bays near the mouth of streams or rivers in 2 to 5 feet water depth and the bottom is usually soft mud. Salinities typically range from 0 ppt to 9 ppt. Ladd (1951) characterized the fauna by a dominance of the mollusks *Rangia, Littoridina sphinctostoma, Tellina texana* (corrected as *Macoma mitchelli* by Parker, 1955), an abundance of 3 genera of foraminifera, and ostracods. *Mulinia lateralis, Ensis minor*, and barnacles also are found in this zone but they may be equally or more abundant in other areas.

Below the bay heads are the inter-reef and reef zones. The inter-reef areas are more like the bay-heads in regards to sediment with a bottom of gray or bluish mud in bay centers with some sand near shore. The average depth is 5 to 10 feet. Ladd (1951) states that no particular fauna inhabits this area, but his reference was mainly in regard to mollusks. *Rangia* and *Littoridina* are absent in most inter-reef areas.

The reef areas are dominated by oysters, *Crassostrea virginica*, mussels, bryozoans, crepidulas, barnacles, and serpulid worms. Also found are the gastropods, *Odostomia* sp. and *Anachis*, and the boring clam *Martesia*. Changes in fauna from the heads of the bay to the Gulf are correalated with the changes in the salinity gradient, and they may be gradual or abrupt as demonstrated by the distribution of *Rangia* and *Littoridina* (Ladd, 1951).

A shift in salinity and in the distribution of fauna during the drought of 1948 to 1953 was described by Parker (1955). High salinities resulted in the introduction of Gulf forms into Aransas Bay. New occurrences of twenty-three mollusc species were observed, and an increase in abundance of *Callinectes danae*. A decline of the white shrimp production occurred and in 1951 no living examples of *Rangia* or *Littoridina sphinctostoma* were found in San Antonio Bay.

Benthic foraminifera were studied at 32 stations in Aransas, Mesquite and San Antonio Bays for six seasons from August 1954 through June 1955. An upper and lower bay faunal assemblage was described in San Antonio Bay based on species distributions and numbers of individuals per sample. Patterns were similar to macrofauna distributions, i.e., there were fewer species and higher standing crop in the upper bay (Phleger, 1956; Phleger and Lankford, 1957).

Large scale climatic changes result in boundary changes of these salinity zones and the associated fauna making it necessary to construct two zoogeographic maps to describe San Antonio Bay during prolonged low and high salinity regimes (Parker, 1959). Parker (1959) characterized San Antonio Bay based on the occurrence of distinct species and salinity regimes. He reasoned that salinity is one of the more important factors influencing fauna distribution, while noting that river related nutrient input and high turbidity may also be important. Parker's two zones include: (1) river influenced, low salinity zone and (2) an enclosed bay zone of variable low to intermediate salinities characterized by soft bottom benthic communities and low salinity oyster reefs. This environment corresponds to Ladd's (1951) reef and inter reef zones. Drought periods may result in a shift to a high salinity oyster reef community. The extent of areal coverage of these proposed zones is dependent on the stability or variability of annual climatic conditions. For example, during dry years the river-influenced areas are reduced in size and during periods of high inflow their areal coverage is expanded.

The typical fauna in San Antonio Bay associated with Parker's (1959) zones are (1) River influenced - *Littoridina sphinctostoma*, *Macoma mitchelli*, and *Rangia cuneata*, (2) enclosed bay - *Retusa canaliculata*, *Nuculana concentrica*, *Nuculana acuta*, *Mulinia lateralis*, *Tagelas plebius*, *Ensis minor*, and *Amphiodia limbata*, and (3) low-salinity oyster reef - *Crepidula plana*, *Brachidontes recurvis*, *Crassostrea virginica*, and *Balanus eburneus*.

A study to determine the effects of shell dredging on the environment of San Antonio Bay was conducted from March 1972 through February 1973 (Harper, 1973). A low salinity zone averaging 5 to 12 ppt and a higher salinity zone averaging 15 to 18 ppt were defined for San Antonio Bay during this period. Species listed with the low salinity group were *Littoridina sphinctostoma*, *Hypaniola gunneri floridus*, and *Rangia flexiosa*. Species of the higher salinity zone were *Nereis succinea*, *Oxyurostylis salinoi*, *Ensis minor*, *Cumacea A*, *Glycinde solitaria*, *Cossura delta* and *Prionospio pinnata*. *Mediomastus californiensis*, *Streblospio benedicti*, and *Mulinia lateralis* were found throughout the study area. The total annual populations of benthic organisms were computed for each salinity group indicating an almost logarithmic decrease in benthic populations with increasing salinity. Harper (1973) states that this trend is probably only indirectly related to salinity and that the lowest salinity zone is closest to the mouth of the Guadalupe River which supplies much of the nutrient material to the bay.

The Texas Water Development Board funded a study of plankton and benthos in San Antonio Bay from March 1972 through July 1974 (Matthews *et al*., 1974). The bay was divided into 3 zones along a salinity gradient with zone 1 located in the lower salinity upper bay, zone 2 located mid-bay and zone 3 located in higher salinity water south of the intracoastal waterway. Species numbers declined and standing crop increased with low salinity in zone 1. Species most common in zone 1 and the line of stations directly adjacent from zone 2 were *Hypaniola gunneri floridus*, Chironomid larvae, *Rangia cuneata* and *Littoridina sphinctostoma*. *Mediomastus californiensis* occurred throughout mid and lower bay while *Streblespio benedicti* occurred only in zone 2. *Mulinia lateralis* was absent from zone 1, with a patchy distribution in zone 2, increasing in abundance in zone 3. The complete absence of *M. lateralis* from zone 1 may have been the result of misidentifying *M. lateralis* for *Rangia cuneata*.

The University of Texas Bureau of Economic Geology sampled the benthic fauna in San Antonio, Hynes, and Guadalupe Bays and Mission Lake in 1975 (White *et al*., 1985). Much of San Antonio Bay north of the Intracoastal Waterway contained a river influenced assemblage characterized by the mollusks *Rangia cuneata*, *Rangia flexuosa*, *Mulinia lateralis*, and *Texadina sphinctostoma* (White *et al*., 1985). *Hobsonia florida*, a low salinity polychaete, and the amphipod *Corophium acherusicum* were reported as abundant in Guadalupe Bay and Mission Lake. Extensive oyster reefs were reported throughout San Antonio Bay. A bay margin assemblage included a group of bay species, including *Mulinia lateralis*, *Streblospio benedicti*, and *Mediomastus califoriensis*.

The Texas Water Development Board funded a multidisciplinary freshwater inflow study in San Antonio Bay through The University of Texas Marine Science Institute from November 1986 through July 1987. Four stations (A, B, C & D) were sampled to distinguish between freshwater influence near the head of the bay and marine influence in the lower bay. During this study San Antonio Bay received the largest annual freshwater inflow in 47 years resulting in salinities ranging from 0.2 to 1 at Station A near freshwater inflow and in salinities ranging from 1.1 to 9.2 at station C and 0.9 to 13.2 at Station D in the lower bay. Additional sampling trips were made in April, July and November 1988, and April 1989, a low freshwater inflow period, as part of an estuarine comparison effort. Salinities during this period ranged from 9.6 to 18.5 ppt at station A and from

26.7 to 32 ppt at station D. During both study periods total species number increased from the lower salinity upper bay to the higher salinity lower bay. Mean abundance and biomass were highest at stations A and B in the wet year decreasing at stations C and D in the lower bay (Tables 1 and 2). As salinity increased during the dry period total species, abundance and biomass increased at all stations with the distribution trend remaining similar to the wet year ie., high abundance and biomass in the upper to middle bay decreasing in the lower bay. The highest number of species at station D was indicative of marine input from Espiritu Santo Bay. The polychaetes *Mediomastus californiensis* and *Streblospio benedicti*, and the mollusks *Mulinia lateralis* and *Littoridina sphinctostoma* were the dominant species in the upper and lower bay (Table 3). The species associated mainly with low salinity were *Littoridina sphinctostoma, Rangia cuneata, Hobsonia florida* and chironomid larvae. The bivalve *Rangia cuneata* was common at stations A and B but was never collected in high abundance. One 25 mm *Rangia* was picked up at station C while diving but no specimens were found in samples from the lower bay. Some species associated with the higher salinity lower bay were *Glycinde solitaria, Polydora caulleryi, Haploscoloplos foliosus, Gyptis vittata, Diopatra cuprea, Neanthes succinea, Megalomma bioculatum, Clymenella torquata calida, Paraprionospio pinnata, Mellina maculata, Isolda pulchella, Ensis minor, Aligena texasigna* and *Nuculana acuta*.

Biology of Dominant Species. The dominant benthic macrofauna species collected from San Antonio Bay in quantitative studies were the gastropod, *Littoridina sphinctostoma*, the bivalves, *Rangia cuneata* and *Mulinia lateralis*, and the polychaetes, *Mediomastus californiensis, Streblospio benedicti* and *Hypaniola gunneri floridus* (Harper, 1973; Matthews *et al.*, 1974). The distribution of these species is strongly linked to long term environmental conditions, although responses to flood conditions may result in rapid population changes.

Littoridina sphinctostoma, a gastropod, populations increase following peaks in freshwater inflow (Harper, 1973; Matthews *et al.*, 1974). This is apparently a breeding response caused by a salinity decline (Harper, 1973). *Littoridina* carries its eggs on the shell and undergoes direct development with the young ready to assume adult existence upon emerging from the egg. *Littoridina* *sphinctostoma* is commonly reported as one of the most dominant gastropod inhabitants of the river influenced upper bays of the Texas coast (Ladd, 1951; Ladd et al., 1957; Parker, 1955; 1959; Harper, 1973; Matthews *et al*., 1974; Gilmore *et al*., 1976; White *et al*., 1983; 1989; Staff *et al*., 1985; Cummins et al. 1986).

Rangia cuneata, a brackish water clam in the family Mactridae, is an excellent indicator of ecological effects of salinity changes in coastal waters and has been comprehensively studied by Hopkins *et al*. (1973). It is commonly the dominant species on the 0-15 ppt salinity zone and since 1955 its range has extended from along the Gulf of Mexico coastal estuaries to along the Atlantic coast from Georgia to Maryland. The well being of the species is not dependent on the physiology of the adult, since the adults can tolerate salinities from 0 to 38 ppt and temperatures from 10 to 35°C. Spawning is induced by a change in salinity either up from near 0 ppt or down from 15 ppt (Hopkins *et al*., 1973). The embryos and early larvae can survive only in salinities between 2 and 15 ppt. *Rangia* is not only a species for which low salinity, in the range of 1 to 15 ppt is optimal, it is a species which evidently cannot maintain a population outside this range (Hopkins & Andrews, 1970). It is most abundant far up tidal rivers where salinity may stay below 1 ppt continuously for months or even years. No living *Rangia* were found in San Antonio Bay in the drought summer of 1951 and spring 1952 although extensive collections were made throughout the bay (Parker, 1955). Individuals of *Rangia* get progressively larger in size from the center of San Antonio Bay to the Guadalupe River delta, into the mouth of the river and Mission Lake (Ladd, 1951).

Mulinia lateralis, another bivalve of the family Mactridae, is an extremely hardy species, ranging from Prince Edward Island, Canada to Yucatan, Mexico and in salinities from 5 ppt to 80 ppt (Parker, 1975). It has been considered as an opportunist of adversity because it can colonize rapidly after a disturbance event such as dredging or heavy rain (Flint and Younk, 1983; Flint *et al*., 1981). It is one of the more abundant mollusks in the low salinity bay heads of the Gulf coast (Hopkins *et al*., 1973). In San Antonio Bay Matthews *et al*. (1974) reported *Mulinia* widely distributed from their brackish water Zone 2 to their higher salinity Zone 3 and Harper (1973) reported it as one of his abundant species. Both indicated that the close resemblance of *Rangia* juveniles and *Mulinia* *lateralis* may have resulted in numerous misidentifications at the low salinity stations. In the Laguna Madre (Alazan Bay) *Mulinia lateralis* was the most abundant and widespread mollusc (Martin 1979, Cornelius 1984).

Mulinia lateralis is widely reported from other bays around the globe. Spawning was observed in the Tred Avon River, Maryland and Chesapeake Bay where it was observed to have a continuous period of setting from a single spawning cycle from May through November (Shaw, 1965; Holland *et al.*, 1977). In Alazan Bay, Texas Cornelius (1984) observed juveniles in all months except December, and Poff (1973) observed year round spawning in Trinity Bay, Texas. *Mulinia lateralis* has a very short generation time and is capable of successfully spawning at 3 mm in length which is approximately 60 days old (Calabrese, 1969a). Embryo survival and development for *Mulinia* as it is with *Rangia cuneata* is dependent on certain salinity and temperature ranges. *Mulinia lateralis* developed into normal larvae throughout the salinity range of 15 to 35 ppt and the temperature range of 10 to 30°C (Calabrese, 1969b). This clam is an important food item to bottom feeding organisms, i.e., the black drum (Pearson, 1929; Breuer, 1957; Simmons and Breuer, 1962; Martin, 1979) and to the greater and lesser scaup ducks (Cronan, 1957). Large rafts of scaup ducks were observed in upper San Antonio Bay in November 1988 corresponding to high densities of *Mulinia lateralis* (personal observation).

The polychaete, *Mediomastus californiensis* is a euryhaline species reaching peak abundance in San Antonio Bay at 12.5 ppt and gradually declining at higher and lower salinities. Population densities were not affected by flood conditions (Harper, 1973). Matthews *et al.* (1974), collected *M. californiensis* in brackish to higher salinity waters of 6 to 16 ppt.

Streblospio benedicti, a polychaete, preferred the salinity range of 10-12 ppt according to Harper (1973). It was restricted by higher salinities and virtually disappeared from upper San Antonio Bay following the flood. It was described as a brackish water species by Matthews *et al.* (1974), being associated only with the mid-bay zone.

Populations of the polychaete, *Hypaniola gunneri floridus*, were highest in the upper bay from June through August 1972 when the salinity was lowest. This species was not common above 10 ppt (Harper, 1973). Increased abundance of *H. gunneri floridus* was attributed to freshwater inflow by Matthews *et al.* (1974).

LAVACA - TRES PALACIOS ESTUARY

Lavaca Bay and Matagorda Bay are located at latitude 28°40′ North and longitude 96°36′ West. A detailed description of the upper Lavaca and Matagorda Bays is given by Gilmore *et al*. (1976). Lavaca Bay is a shallow estuary with a maximum natural depth of about 2.4 m and a surface area of about 16,576 ha. (40,959 acres). The perimeter of the upper bay shoreline is lined with patchy *Spartina*, and the surrounding low salinity marshes are vegetated mainly with *Juncus* downriver and *Phragmites* upriver. The majority of freshwater inflow into upper Lavaca Bay comes from the Lavaca and Navidad Rivers, while lesser contributions come from Venada, Garcitas and Placedo creeks. Circulation between the upper and lower bay is modified by the presence of the state highway 35 causeway, the remains of the old causeway, and Chicken Reef which extends from the northeast and southwest side of the bay parallel with the causeway. Marine influence enters through Pass Cavallo and the Matagorda ship channel.

Two tertiary bays or lakes are associated with the Lavaca River. Redfish Lake is approximately 4.8 km (3 miles) and Swan Lake is approximately 1.6 km (1 mile) north of Lavaca Bay. Redfish Lake is about 194 ha (479 acres) and Swan Lake is about 259 ha (640 acres). The salinity of Redfish Lake is usually similar to the rivers while the salinity in Swan Lake is more estuarine due to its proximity to and its connection to Lavaca Bay via Catfish Bayou.

The forty-nine year daily flow average (1939-1987) for the Lavaca River is 9.35 $m^3 \cdot s^{-1}$ (334 cubic feet/second) and the forty-year daily flow average (1939-1980) for the Navidad River is 16.0 $m^3 \cdot s^{-1}$ (572 cubic feet/second) into Lavaca Bay (USGS, 1980; Buckner *et al*., 1987).

During a multi-disciplinary study of the effects of freshwater on the Lavaca Bay System, from January, 1973 to June, 1975, Gilmore *et al*. (1976), reported about 59 percent above normal inflow conditions. Percentages were based on inflow from the Lavaca and Navidad Rivers, and Garcitas Creek gauging. Inflow was greater than 112 $m^3 \cdot s^{-1}$ (4,000 cubic feet/second) during 10 percent of the study and daily inflow ranged from 3-2658 $m^3 \cdot s^{-1}$ (100 cubic feet/second).

A two year study to monitor the effects of freshwater inflow on selected sites in the upper portion of Lavaca Bay was conducted from November 1984 through

August 1986 (Jones *et al.*, 1986). Daily average inflow from the Lavaca River prior to this study from January through November 1984 was 3.3 $m^3 \cdot s^{-1}$ (118 cubic feet/second) (65 percent below normal). Average daily inflow increased 70 percent to 10.9 $m^3 \cdot s^{-1}$ (389 cubic feet/second) (16 percent above normal) for November 1984 through August 1985 and decreased to 5.0 $m^3 \cdot s^{-1}$ (177 cubic feet/second) (47 percent below normal) for September 1985 through August 1986.

Since the closing of the dam on the Navidad river in May 1980 the freshwater inflow pattern has been altered; however, it has not deviated much from the historic flow rate of 16 $m^3 \cdot s^{-1}$ (572 cubic feet/second). The Palmetto Bend reservoir project on the Navidad river was designed to supply water for industrial and municipal use and was not intended for flood control. Major floods are allowed to pass through the flood gates and inundate the marsh system associated with the Lavaca-Navidad River delta. Initial filling of Lake Texana from May 1980 to December 1982 resulted in negligible inflow from the Navidad. Freshwater releases beginning in December 1982 through December 1983 on a monthly basis resulted in a daily mean flow of approximately 35 $m^3 \cdot s^{-1}$ (1,250 cubic feet/second) which is above average. January 1984 through December 1985 was a drier period averaging 9.5 $m^3 \cdot s^{-1}$ (340 cubic feet/day). The daily average flow rate from January 1985 through December 1985 increased to 18.5 $m^3 \cdot s^{-1}$ (662 cubic feet/second). Daily flow rates decreased from January through December 1986 averaging 7.9 $m^3 \cdot s^{-1}$ (282 cubic feet/second).

Gilmore *et al.* (1976) correlated mean daily river discharge from the Lavaca and Navidad Rivers plus Garcitas Creek for 4,6,9,15 and 30 day periods ending two days prior to a salinity determination with mean salinity data to test for salinity and freshwater inflows relationships. The nine day inflow had the highest correlation with salinity data ($r = -0.59$, $P \leq 0.01$).

Similar correlations were calculated for Lavaca River stream flow for 14 and 28 days prior to and including the first sampling day of each trip and the mean salinity data for upper Lavaca Bay stations. The 14 day mean inflow was significantly correlated with salinity ($r = -0.55$, $P \leq 0.05$) while the 28 day mean inflow was not significant (Jones *et al.*, 1986).

Historical Salinity Regimes. Galtsoff (1931) during a survey of oysters in Texas measured salinity from 4 ppt at the mouth of the Lavaca River to 20 ppt at Sand Point, to 24 ppt in lower Matagorda Bay on February 4-7, 1926. The salinity gradient at the time of these observations was 1.3 ppt per mile. Salinity was measured at two stations in Lavaca Bay from July 26 through April, 1927. The lowest salinity, 4.5 ppt, occurred in June and July and the highest salinity, 24.5 ppt, was recorded on September 9, 1926. Salinities for January 1966 to December 1966 in Lavaca Bay at channel marker #60 averaged 20.3 ppt and in lower matagorda Bay at buoy #68 averaged 28.2 ppt (Martinez, 1966). Variation between surface and bottom salinity indicates that stratification often occurs, especially in the deeper areas, e.g., the river channel and Matagorda Ship Channel. Salinity at the Lavaca River mouth varied from surface to bottom from 2.7 to 10.7 ppt and 8.2 to 16.0 ppt on February 20 and May 8, 1968 respectively (Hahl and Ratzlaff, 1970). On June 12 and July 18, 1968 surface and bottom salinities were 0.6 to 2.5 and 0.1 to 4 ppt at the river and 13.3 to 24.9 ppt and 12.0 to 26.3 ppt in the ship channel near Port O'Connor indicating mixing in the river and stratification in the ship channel. On April 9, 1969 surface salinity at the river was 8.8 ppt and surface salinity in the lower Matagorda Ship Channel was 28.5 (Hahl and Ratzlaff, 1972). Salinity decreased to 0.6 ppt at the river mouth on April 23, 1969 and increased only to 5.0 ppt by June 19, 1969.

Mackin (1971) studied the effects of oilfield brine effluents on biotic communities in Texas estuaries from September 1970 through June 1971. Although his sampling stations were designed to study oilfield brine, they were established in areas from up river near freshwater influence along a gradient to higher salinity estuarine sites. Areas sampled included the Menefee Lakes 1 and 2 associated with the upper river marsh system, the Lavaca River and Redfish Lake and the junction of Lavaca Bay and Matagorda Bay at the Magnolia Beach area. Menefee Lake 1 was in close proximity to the Lavaca River while Menefee Lake 2 was upstream from the head of Menefee Lake 1.

The Menefee Lakes in September 1970 had a salinity range of 1 to 4 ppt. The average salinity in Menefee 1 increased to 12.5 to 13.3 ppt in February and March, 1971 and decreased to 4 ppt in June 1971. Menefee 2 remained a fresh to brackish lake while Menefee 1 changed from a brackish pond to a moderately saline mini-bay.

In Redfish Lake salinities ranged from 1 to 7 ppt from September to December

1970 increasing to a high of 17 ppt in May, 1971.

The up-river station ranged from 0 ppt in September, 1970 to 13 ppt in May 1971 and the lower river station ranged from 0 ppt to 22 ppt for the same period. Low inflow periods obviously resulted in the movement of higher salinity bay waters up-river.

Mackin (1971) stated that the stations at the junction of Lavaca and Matagorda Bays, excepting for the Baffin Bay area, were the highest salinity areas studied. In October 1970 the salinity range from Station 1 to Station 10 was 20 to 26 ppt and in June 1971 all of the stations were approximately 29 to 30 ppt.

Salinities at the mouth of the Lavaca River from March 1970 to February 1971 ranged from 0.24 to 20.0 ppt and averaged 10.8 ppt (Blanton *et al.*, 1971). In lower Lavaca Bay for the same period salinities ranged from 10.9 to 28.4, averaging 20.4 for the year.

Freshwater inflow from Garcitas, Venado Creek and Chocolate Bayou primarily influences the bay area near the creeks while inflow from the Lavaca and Navidad Rivers influences the whole bay (Gilmore *et al.*, 1976). There is evidence that freshwater inflow tends to flow to the west side of Lavaca Bay with salinities averaging about 2 ppt lower than salinities on the east side. Gilmore *et al.* (1976), reported salinities ranging from 0 ppt at upper bay sites to 33 ppt in the lower bay with an overall average of 10 ppt for the period of January 1973 through June 1975.

A study of the freshwater inflow effects on the Lavaca River delta and Lavaca Bay was conducted from November 1984 to August 1986 (Jones *et al.*, 1986). The average salinity from up-river to the Lavaca River delta from November 1984 to August 1985 ranged from 1.4 to 8.0 ppt with an overall mean of 4.5 ppt. The period from October 1985 to August 1986 had an average salinity range from 4.3 to 14.8 ppt with an overall average of 13.5 ppt for the same area.

Faunal Assemblages. The distribution and abundance of benthic fauna in the Lavaca Bay system are associated with salinity zones within a salinity gradient from fresh to higher salinity waters. Studies on benthos in Lavaca Bay which related species distributions to salinity are Blanton *et al.* (1971), Mackin (1971), Gilmore *et al.* (1976), and Jones *et al.* (1986).

Three distinct habitats were sampled by Mackin (1971) in the Lavaca Bay system. Menefee Lakes and Redfish Lake are connected to the Lavaca River by bayous and are surrounded by marsh. The river stations were in the Lavaca River and the bay stations were located in lower Lavaca Bay. Menefee 2 remained as a freshwater zone throughout Mackin's study while Menefee 1, Redfish Lake and the river stations changed from a low salinity zone to a moderate salinity zone as the study progressed. A higher salinity zone was associated with lower Lavaca Bay.

The most abundant species in Menefee 1 were the oligochaetes *Limnodrilus* sp. and *Peloscolex gabriellae*, insect larvae *Tendipes*, the polychaetes *Polydora socialis* and *Streblospio benedicti* and the mollusc *Mulinia lateralis*. The fauna changed from a freshwater community to a marine community at about the same rate salinity increased. Total abundance increased with increasing salinity with peaks in April and May in both abundance and salinity. Mackin (1971) states that according to most studies the fauna of the transitional zone between the freshwater habitat of lakes and the higher salinity of estuaries should be the least productive of species and individuals. In Menefee Lakes variations in salinity result in sums of freshwater, brackish water and higher salinity species which results in total production far in excess of a permanent brackish water habitat. Changes in salinity gradients results in the movement of brackish water communities up and down the estuary.

The salinity at Menefee Lake 2 was low throughout the study with little variation (1-6 ppt). The dominance of *Tendipes* sp. throughout the year corresponds to the low salinity conditions.

The fauna of Redfish Lake was almost identical to Menefee Lakes. The main differences were the absence of the mollusks *Probythinella protera, Congeria leucophaeta* and *Rangia cuneata* from the Menefee Lakes and the greater number of insect species and greater number of crustaceans in the Menefee Lakes. *Streblospio benedicti*, *Polydora socialis, Mulinia lateralis*, were species which had a positive response to increased salinity at the lake stations. *Tendipes* was not collected in June 1971 following high salinities.

Intermittent high freshwater inflow in Lavaca River and incursions of higher salinity estuarine water caused salinity fluctuations from 0 ppt to 22 ppt at the river stations. The most dominant species in the river were *Tendipes* sp., *Mulinia lateralis*, *Mediomastus californiensis*, *Streblospio benedicti*, and harpacticoid copepods (most likely *Scottolana canadensis*). Responses to higher salinities were increases in *Mulinia lateralis, Streblospio benedicti, Mediomastus californiensis*, and the absence of Tendipes in June 1971.

Higher salinities with little variation between stations was characteristic of the stations in lower Lavaca Bay. The higher salinity zone was characterized by *Prionospio pinnata, Mediomastus californiensis, Glycinde solitaria, Cumacea* sp., *Mulinia lateralis, Nuculana concentrica, Retusa canaliculata, Nuculana acuta*, and *Pandora trilineata*. Mackin (1971) described the Lavaca Bay area as comparable to an oligotrophic lake, i.e., a high number of species with low individual productivity. This supports a statement by Parker (1959), i.e., when physical conditions are stable and within the normal range for marine environments there will be many species but fewer individuals per species.

A total of 150 species was collected from the bottom samples during Mackin's study. Slightly over half of the species were polychaetes, eight of which were numerically dominant. The mollusk, *Mulinia lateralis*, was the most dominant species reaching peak abundance in February and March, maintaining high numbers through June 1971. Total abundance was low in the summer through fall and high in the winter and spring.

The ecology of Lavaca Bay was studied by Blanton *et al*. (1971), from March 1970 through February 1971. A total of 60 taxa was reported for the benthos of which the dominant were polychaetes. No individual species abundance data was given. Most of the species from their species list were those with a preference for moderate salinities. Chironomid larvae were the only low salinity species reported.

Blanton *et al*. (1971) described upper Matagorda (Lower Lavaca Bay), Galveston, and Copano Bays as low energy estuaries with an average benthic abundance of approximately 3000 individuals/m^2. When comparing density abundance among some Texas estuaries and Hadley Harbor near Woods Hole, Massachusetts densities ranged from highs of 115,000•m^2 in grass flats and 15,000•m^2 in a silty clay bottom in Hadley Harbor to a low of less than 1000•m^2 in Corpus Christi Bay, Texas. The average density for Lavaca Bay for this comparison was 3,500•m^2. Blanton *et al*. (1971), found considerable variation in abundance at stations in lower Lavaca Bay but most months were near or exceeding 3,000•m^2. Lower abundance in the ship channel ranging from 0 to 2,075•m^2 was attributed to dredging and ship traffic.

The maximum density, 60,000·m^2, occurred near Mitchell Reef and averaged 11,895·m^2 for the year.

Moseley and Copeland (1974) and Moseley *et al.* (1975), studied the ecology of Cox Bay, and from November 1973 through November 1974, a tertiary bay adjacent to Lavaca Bay, for the period of August 1969 to June 1973. They studied Cox Bay before and during initial operation of Central Power and Light's power plant operation.

A total of 80 species were collected from Cox and Keller Bay and the Matagorda Ship Channel from August 1969 to June 1973. The dominant species were *Prionospio, Glycinde, Mulinia and Macoma.* Species numbers and individuals were low making analysis of patterns impossible (Moseley and Copeland, 1974). The use of a 1 mm sieve was probably their problem for obtaining low numbers. They concluded that the benthos was randomly distributed and power plant operation did not change random distribution in any significant way. Thirty-six species were collected from November 1973 through November 1974 of which 95 percent were mollusks and polychaetes. The most common species were the mollusc *Mulinia lateralis* and the polychaete *Mediomastus californiensis.* Other species were *Cossura delta, Glycera americana, Glycinde solitaria* and *Prinospio pinnata.* Analysis of the seasonal distribution of the benthos was not performed due to loss of data in computer analysis; however, species diversity was lowest during the warmer months of the year.

A study of the effects of freshwater on the benthic communities of Lavaca Bay was conducted for a 30 month study from January 1973 through June 1975 (Gilmore, 1974; Gilmore *et al.*, 1975; Gilmore *et al.*, 1976). Monthly samples were collected from the river area including the lower Lavaca River and Swan and Redfish Lakes and from Lavaca Bay. Freshwater inflow for the first 8 months of this study was 300 percent above normal.

The dominant species from the river area were *Rangia cuneata*, Chironomid larvae, *Hypaniola gunneri*, and *Littoridina sphinctostoma.* These species conform to those found in upper San Antonio Bay which is influenced by freshwater inflow from the Guadalupe River (Harper, 1973; Matthews *et al.*, 1974).

The upper and lower parts of Lavaca Bay were characterized by different species groups. The dominant species in the upper bay were *Littoridina sphinctostoma, Mulinia lateralis, Mediomastus californiensis, Streblospio* *benedicti*, and *Rangia cuneata*. Within this group, *L. sphinctostoma* and *R. cuneata* are restricted to low salinities while the other dominant species are generally found in moderate salinities with the exception of *M. lateralis* which can thrive in low or high salinities (Parker, 1975). The higher salinity lower bay was characterized by a dominance of the polychaetes, *Cossura delta*, *Nereis succinea*, *Glycinde solitaria* and a nemertean (Gilmore *et al.*, 1976).

Species diversity declined from the high salinity lower bay to the low salinity upper bay and river area (Gilmore *et al.*, 1976). The highest species diversity occurred in the late winter and early spring when sustained freshwater inflow were generally low (Gilmore *et al.*, 1976).

Lavaca Bay benthic populations increased as salinity decreased and organic carbon increased. Population increases were due to *M. californiensis*, *L. sphinctostoma* and *R. cuneata* at stations already occupied and their dispersion to lower bay stations occurred as salinity decreased (Gilmore, 1974).

Seasonal patterns varied over the 30 month study period. High summer and low winter populations were reported from January through August 1973 (Gilmore, 1974). Densities were low in late summer, high in the winter and spring followed by a decline in early summer during the period of September 1973 through July 1974 (Gilmore *et al.*, 1975). Densities remained low until early fall when they increased, decreased and remained low through the winter and spring and increased in the summer (Gilmore *et al.*, 1976).

Mean standing crop values from benthic studies in Lavaca Bay by Mackin (1971) ($1809 \cdot m^{-2}$) and Gilmore *et al.* (1976) ($1801 \cdot m^{-2}$) are similar to values reported by Matthews *et al.* (1974) ($1450 \cdot m^{-2}$) for San Antonio Bay. Higher mean densities were reported by Blanton *et al.* (1971) for March 1970 to February 1971 ($3500 \cdot m^{-2}$) and by Kalke in Jones *et al.* (1986) for the periods of November 1984 to August 1985 ($5320 \cdot m^{-2}$) and October 1985 to August 1986 ($6790 \cdot m^{-2}$) in upper Lavaca Bay. These differences can be attributed to collecting techniques, station locations, and inter-annual variability.

Reduction of inflow resulting from the Palmetto Dam will result in increased bay salinities and the range expansion of lower by species into the upper bay. *Rangia cuneata* and *Littoridina* having low salinity requirements would be restricted to areas farther upstream (Gilmore *et al.*, 1976).

The Lavaca and Matagorda Bay benthos was sampled in 1975 by the University of Texas Bureau of Economic Geology (White *et al.*, 1985). Lavaca Bay was characterized by a river influenced, an open bay center and an oyster reef assemblage. The river influenced area was represented by the brackish water species *Rangia cuneata*, *Texadina sphinctostoma*, and *Parandalia fauveli* and the ubiquitous bay species *Mulinia lateralis, Mediomastus califoriensis*, and *Ampelisca abdita*. This zone was described as being subjected to greater salinity fluctuation than other environments (White *et al.*, 1985). Species common to the Lavaca Bay open bay center were the polychaete *Paraprionospio pinnata* and *Cossura delta*, the mollusks *Acteocina canaliculata* and the crustacean *Ampelisca abdita*.

Mollusks dominated the oyster reef assemblage, i.e., *Crepidula plana, Diplothyra smithii*, and *Crassostrea virginica* along with the polychaete *Nereis succinea*.

The open bay center assemblage in Matagorda Bay was dominated by the mollusk *Nuculana concentrica* and the polychaete *Lumbrinereis verilli* and *Paraprionospio pinnata* which are also found on the inner shelf in the Gulf (White *et al.*, 1985). They found the highest number of species and individuals at an inlet influenced area near Pass Cavallo. Species from the pass were *Natica pusilla, Abra equalis, Tellina versicolor, Parviculina multilineata, Armandia agilis* and *Phyllodoce arenae*.

A two year study of freshwater inflow effects on the benthos of the Lavaca River Delta and the upper Lavaca Bay was conducted from November 1984 through August 1986 (Jones *et al.*, 1986). The first year followed a dry period of low inflow through most of 1984 and was characterized as a wet period with inflows 18 percent above normal. Inflow decreased in the second year to approximately 54 percent less than the first year.

The benthic macrofauna in the upper Lavaca Bay was limited to a few dominant organisms consisting of the polychaetes, *Mediomastus californiensis* and *Streblospio benedicti*, Chironomid midge fly larvae, and the mollusks *Macoma mitchelli* and *Mulinia lateralis* (Jones *et al.*, 1986).

The abundance of macrofauna was highest in the winter-spring period and lowest in the summer. These seasonal trends in abundance were inversely correlated with river inflow, i.e., the greatest abundance of macrofauna occurring when the river inflow was the lowest (Jones *et al.*, 1986).

The distribution of infauna by depth in the sediment was observed by sectioning sediment core samples at 0-3, 3-10 and 10-20 cm. The infaunal abundance decreased with depth and biomass increased with depth (Jones *et al.*, 1986).

There were only two species which had an obvious response to increased freshwater influence. Chironomid insect larvae and the polychaete *Hobsonia florida* had a positive lag response to freshwater inflow (Jones *et al.*, 1986).

No *Littoridina sphinctostoma* were reported and only a few individuals of *Rangia cuneata* were collected. This is contrary to the distribution of *L. sphinctostoma* and *R. cuneata* from January 1973 through June 1975 (Gilmore, 1974; Gilmore *et al.*, 1976). Low inflow during most of 1984 probably caused salinity increases above the tolerance limits for these species, causing their distribution to be limited to areas other than our sample sites. Large numbers of dead *Rangia cuneata* shells were found in Redfish and Swan Lakes but no live specimens were collected from these areas. It is possible that a few specimens of *L. sphinctostoma* were misidentified as *Odostomia* sp. (personal observation).

To compare estuarine benthic communities in relation to freshwater inflow between different bay systems The University of Texas Marine Science benthic group sampled the benthos in Lavaca and Matagorda Bays in April, July and November, 1988 and April 1989 in conjunction with sampling in San Antonio Bay and Laguna Madre (Montagna & Kalke, 1989b). Nueces and Corpus Christi Bays were sampled in conjunction with Lavaca Bay only in April and July 1988. Four stations were sampled: A and B in Lavaca Bay an upper enclosed secondary bay in close proximity to freshwater inflow from the Lavaca River and C and D in Matagorda Bay, an open primary bay. Freshwater inflow during this sampling period was low. The mean salinities at stations A, B, C and D were 26.7, 28.4, 30.2 and 30.4 ppt, respectively. The species composition in Lavaca and Matagorda Bays is similar to the Nueces-Corpus Christi Bay system but the mean numerical abundance is higher than those found in Nueces and Corpus Christi Bays. The general trend for species numbers, abundance and biomass is to increase from upper Lavaca Bay to lower Matagorda Bay. This gradient is not as pronounced as that found in Nueces-Corpus Christi Bay. The polychaetes *Mediomastus californiensis*, *Streblospio benedicti* and *Glycinde solitaria*, the amphipod *Ampelisca abdita*, and the mollusk *Mulinia lateralis* comprise 82% of the total abundance at station A and 18% of the total abundance at station D. Dominant species in the lower primary bay were the polychaetes, *Mediomastus californiensis, Polydora caulleryi, Brania clavata, Gyptis vittata, Glycinde solitaria, Tharyx setigera, Drilonereis magna* and *Minuspio cirrifera;* the tanaidacean *Apseudes* sp A., the mollusks *Corbula contracta* and *Periploma cf. orbiculare*, a hemichordate, *Schizocardium* sp., and rhyncocoels. The mollusk biomass was highest at stations A (57%) and B (40%) decreasing at stations C (1%) and D (17%). Polychaetes accounted for approximately 50% of the biomass at all stations. At station B the hemichordate, *Schizocardium* sp. made up 42% of the biomass. This species was dominant in biomass in Corpus Christi Bay in 1981-1984 (Flint and Kalke, 1986). The ophuiroid, *Amphiodia limbata* occurred in Matagorda Bay accounted for 20 percent of the biomass at station D. Crustaceans contributed a notable percent of the biomass in the secondary and primary bay. *Ampelisca abdita* was most abundant at stations A and B, *Pinnixa chacei* was found at stations C and D and *Apseudes* sp A was dominant at station D (Montagna & Kalke, 1989b).

NUECES ESTUARY

Freshwater inflow into the Nueces estuary is primarily from the Nueces River. The combined gaged and ungaged freshwater inflow from the Nueces River averaged 682,000 acre feet per year for the period of 1941 through 1976 (TDWR, 1982). The Nueces River delta is a marsh system covering an area of approximately 3,845 hectares (9,500 acres). Historically two annual flood events, approximately in May and September, result in the inundation of the deltaic marsh. Water depth at mean low water in Nueces Bay is less than three feet to less than 13 feet in Corpus Christi Bay.

Corpus Christi Bay is composed of Nueces, Oso and Corpus Christi Bays with a surface area of approximately 54,230 hectares (134,000 acres). It is located between 27°40′ and 27°55′ North latitudes and 97°10′ and 97°30′ West longitudes. Corpus Christi Bay borders between a semi-arid climatic zone to the south and a dry sub-humid zone to the north (Hedgepeth, 1953). This area has very sharp gradients of climatological and meteorlogical factors (Hood, 1953).

Historical Salinity Regimes. The intrusion of Laguna Madre waters into Corpus Christi Bay is evident from salinity gradients as reported in June and August

1952 (Hood, 1953). In August 1952, Hood measured bottom water salinities from 56 ppt near the entrance to upper Laguna Madre to 46 ppt near Shamrock Island. The overlying surface water during this period was 45 ppt.

Low salinities in Nueces Bay from June through December 1973 and in August and September 1974 were correlated with periods of high inflow from the Nueces River in June, September and October 1973, and August through September 1974 (Kalke, 1981). Salinity decreases in Corpus Christi Bay in June, September and October 1973 were correlated with high inflow from from Oso Creek however, increased inflow in June and September 1974 were not correlated with lower salinities. Higher salinity water associated with Corpus Christi Bay readily mixes with freshwater from the Oso resulting in a short term residence time for this freshwater source while the larger volume freshwater input from the Nueces River was more persistent.

Salinity patterns from October 1972 through May 1975 exhibited a great deal of variability. Freshwater inflow from the Nueces River and Oso Creek was considerable at times. Sources of high salinity waters were the Aransas Pass, the Fish Pass (currently silted over) and periodically Oso Bay. Occasionally, lower salinity water (20-25 ppt) from along the Gulf shore enters lower Corpus Christi Bay pushing higher salinity (25-30 ppt) bay water up the estuary (Holland *et al.*, 1975). The presence of low salinity coastal waters adjacent to Corpus Christi Bay occurred during the period from July 1981 to October 1983 was reported by Flint *et al.* 1986). Surface and bottom salinities, as with temperatures, were generally similar indicating wind mixing (Holland *et al.*, 1975). The most obvious salinity gradients occurred in channel areas.

Faunal Assemblages. Corpus Christi, lower Matagorda, Aransas and west Galveston Bays are characterized as large open bays with direct access to the Gulf of Mexico (Blanton *et al.*, 1971). The bay centers of these bay systems typically have soft surface sediments composed of fine clay and silt with high organic content. Sediment type is important in determining the type of fauna which inhabit different areas for example the soft bottom bay center usually have a low species diversity of mainly deposit feeders (Parker, 1959). Blanton *et al.* (1971) compared the benthic standing crop of Corpus Christi Bay ($500 \cdot m^{-2}$) with similar bays and determined that it was lower than other bays sampled.

Benthic collected in the early 1950's in Corpus Christi Bay had few or no organisms (Parker & Blanton, 1970; Blanton et al., 1971).

The bay margins of large open bays are characterized by sandy sediments, ranging from sand-silt-clay to almost pure sand (Parker, 1959). Larger clams, i.e., *Mercenaria* and *Cyrtopleura* are characteristic of this assemblage. The fine silty clays of the bay centers will not support the weight of these large clams. In contrast the fine well sorted sands next to the shorelines are too dense for these animals to penetrate (Parker, 1959).

The benthos of Corpus Christi, Copano and Aransas Bays was studied from October 1972 through May 1975 (Holland *et al.*, 1975). A total of three hundred and ninety five taxa were found during this period. The polychaetes were the most dominant of organisms numerically, spatially, and temporaly. Only two *Rangia flexuosa* and one chironomid larvae were collected from Nueces Bay during this study (Holland *et al.*, 1975). This indicates that the freshwater influenced area in upper Nueces Bay is minimal compared to other Texas bays i.e., upper San Antonio and Lavaca Bays. The polychaete *Mediomastus californiensis* was the most numerically abundant species along with *Streblospio benedicti*, *Prionospio pinnata*, *Cossura delta*, *Glycinde solitaria*, and *Gyptis vittata*. These are typical estuarine species associated with moderate to high salinities.

Mollusks were the second most common group of which the most abundant species were *Mulinia lateralis*, *Lyonsia hyalina florida* and *Macoma mitchelli*. Less abundant species collected were *Aligena texasiana*, *Mysella planulata*, *Tellina iris* and *Tellina alternata*.

The overall average standing crop for Nueces Bay 830 • 0.5 ft^3, S.D. = 744, was higher than standing crops in Corpus Christi Bay, 432 • 0.5 ft^3,S.D. = 432 (Holland *et al.*, 1975). Fluctuations in standing crop were variable in Nueces Bay between months and stations. Increases in populations of *Streblospio benedicti*, *Mediomastus californiensis*, *Corophium louisianum*, and *Mulinia lateralis* at various times caused major changes in standing crops in Nueces Bay. In general the mean standing crop values for Corpus Christi Bay were very stable during the entire study. Variations in densities between stations were attributed to sediment type, salinity and station location in relation to Aransas Pass.

A 4.5 year study of the benthic communities in Corpus Christi Bay was conducted between September 1974 and February 1976 (Flint and Younk, 1983). The sampling site was located near Sun Oil Docks, Port Ingleside, with three stations in the channel and three stations in the shoal waters parallel with the channel sites. Salinity was different between the bottom water, the channel, and shoal water stations. The salinity at the shoal water sites was usually lower than the channel waters due to the effect of offshore water following the bottom of the channel.

A total of 313 taxa were collected during this study, of which the most abundant were the polychaetes *Mediomastus californiensis*, *Paraprionospio pinnata*, *Streblospio benedicti* and *Aricidea jeffreysii*. The most abundant molluscs were *Mulinia lateralis*, *Lyonsia hyalina floridana*, and *Abra aequalis*.

The number of species were much greater at the shoal stations (mean = 55.5) than at the channel sites (mean = 21.6). Peaks in abundance occurred in the winters of 1975, 1977 and 1979. These winter peaks were associated with increased densities of the mollusks *M. lateralis* and *A. aequalis*.

Densities at the shoal stations averaged between 2,000 and 18,890 animals $\cdot$ m^{-2} with a mean species diversity of 3.76 compared to a comparable area in the Corpus Christi Bay study by Holland *et al*. (1975), where the densities ranged between 1,770 and 8,600 animals $\cdot$ m^{-2} with an annual mean species diversity of 3.61 (Flint and Younk, 1983).

Channel station mean densities between 390 and 6,440 animals $\cdot$ m^{-2} with a mean diversity of 2.96 compared favorably to a similar station sampled during the Holland *et al*. (1975) study where densities were between 870 and 8,580 animals $\cdot$ m^{-2} with an annual mean species diversity of 1.84.

Dredging of the channel during their study resulted in a decrease in population densities. The highest densities of *M. lateralis* for the study period occurred during the later stages of dredging probably as a result of minimal competition from other species disrupted during dredging. *Mulinia* densitites declined after the recolonization by *Paraprionospio pinnata* and *Mediomastus californiensis*.

Species and total density increased at the shoal sites during the winter periods of 1974-75 and 1976-77 which corresponded to the two lowest salinity periods during the entire study (Flint and Younk, 1983).

On September 18, 1979 during a 24 hour period a low pressure system impacted the Texas coast resulting in precipitation measuring as much as 33 cm in the Corpus Christi Bay area (Flint *et al.*, 1981; Flint and Rabalais, 1981). The benthic study reported by Flint and Younk (1983) was continued from October 1979 to July 1981 to document changes in the benthic habitat resulting from excessive riverine input and local runoff.

This freshwater inflow event resulted in a relative long term period of low salinities measured in the Corpus Bay system. The salinity decreased from approximately 32 ppt to 18 ppt from September 20 to September 27, 1979. Salinities remained below historic seasonal levels through the middle of October 1979 (Flint and Rabalais, 1981). This freshwater inflow event was unique to the area since such inflow had not occurred since Hurricane Beulah in 1967.

A list of the ten most abundant species for seven years of sampling from this area comprised 85% of the total fauna collected from the ship channel. The channel species in order of dominance were *Abra aequalis*, *Mediomastus californiensis*, *Oligochaetes*, *Balanoglossus* sp. (*Schizocardium n* sp), *Streblospio benedicti*, *Paraprionospio pinnata*, *Rhyncocoels*, *Mulinia lateralis*, *Sigambra tentaculata* and *Cossura delta*. The ten most dominant shoal species for the same period made up 70% of the total fauna collected. The shoal species in order of dominance were *Mediomastus*, *californiensis*, *Paraonidae* spp A, *Lyonsia hyalina floridana*, *Mulina lateralis*, *Abra aequalis*, *Balanoglossus* sp (*Schizocardium* n sp), *Streblospio benedicti*, *Oligochaete*, *Rhyncocoels*, and *Paraonidae* spp. B.

During the winter-spring of 1980 (January-May) following the September 1979 storm, the total mean infaunal density was greater than had ever been recorded in the bay before as indicated by the data from Flint *et al.* (1981) as well as data from (Holland *et al.*, 1975).

The fauna responsible for the majority of the post-storm increase in biomass were *Abra aequalis*, *Lyonsia hyalina floridana*, *Lucina multilineata*, and *Mulinia lateralis*, and *Rhyncocoels*. After the 1980 increase in benthic production infaunal biomass in 1981 returned to levels calculated for previous years (Flint *et al.*, 1983). The 1979 storm inflow event had a positive impact on the benthic productivity of the Corpus Christi Bay ecosystem (Flint *et al.*, 1981).

The Nueces estuary's benthic community structure, biomass, benthic metabolism and benthic nutrient regeneration were studied by scientists from the University of Texas Marine Science Institute from July 1981 through July 1983 (Flint *et al.*

1983). Sampling sites were established along a salinity gradient from upper Nueces Bay to the middle of Corpus Christi Bay. Salinities ranged from 5 to 34 ppt in Nueces Bay to 22 to 32 ppt in Corpus Christi Bay. The macroinfauna in Nueces Bay was dominated by *Mulinia lateralis, Streblospio benedictii* and *Mediomastis californienses* and was distinct from the rest of the study area. Species representative of the middle portion of Corpus Christi Bay were *Mediomastus californiensis*, *Polydora caulleryii*, *Paraprionospio pinnata*, *Gyptis vittata* and *Schizocardium* sp. A station along the ship channel, near Sun Oil Docks, had the highest species diversity and had similar community structure to coastal Gulf of Mexico stations indicating a strong Gulf influence in the Channel area (Flint *et al*. 1983).

The total number of species increased from upper to lower bay but abundance and biomass were lowest near the ship channel and Gulf waters. The highest abundance and biomass were found in the center of Corpus Christi Bay and was attributed to the stability of the environment (Flint *et al*. 1983). Infaunal biomass appeared to peak between January and July reaching a low usually in fall and early winter. In April 1982 colonization of the mid-Corpus Christi Bay area by the acorn worm *Schizocardium* sp resulted in an increase in biomass and abundance which remained high throughout the study.

Sediment composition in Nueces Bay was 50% sand with shell, 70% clay in middle Corpus Christi Bay, and 90% sand near the Aransas Pass Ship Channel. There was very little difference observed in overall sediment metabolism from upper Nueces Bay to Corpus Christi Bay, however; there was a general decrease in benthic nutrient regeneration from the upper Nueces Bay toward the Gulf influence at the channel site.

The University of Texas Bureau of Economic Geology in 1975 sampled the submerged lands of Texas to characterize these lands in terms of sediment distribution, selected trace and major element concentrations and benthic macroinvertebrate populations (White *et al*., 1983). The purpose of their study was to identify and enumerate the macrofauna, identify and characterize faunal assemblages and to correlate sediment faunal relationships. Temporal data was not taken during their study. Eight faunal assemblages were determined to characterize the bays and lagoons around the Corpus Christi area which includes the following: open bay center, open bay center depauperate, oyster reef, inter-reef, grass flat, bay margin, inlet influenced, and river influenced assemblages.

Nueces Bay is characterized by a river influenced assemblage where salinity is probably the most important environmental variable influencing species (White *et al.* 1983). The most common species collected in Nueces Bay were *Mulinia lateralis, Mediomastus californiensis,* and *Paraprionospio pinnata. Texadina (Littoridina) sphinctostoma,* characteristic of low salinity river influenced areas was not collected from Nueces Bay.

The largest area of Corpus Christi Bay was characterized by the open bay center depauperate assemblage and covers approximately half of the bay. The rest of the bay was comprised of inlet influenced, bay margin and open bay center assemblages. Species composition of the open bay center assemblage was dominated by *Mulinia lateralis, Paraprionospio pinnata*, and other deposit feeding polychaetes while the depauperate assemblages were populated mainly by *M. lateralis* and *P. pinnata*. The highest species counts in Corpus Christi Bay were associated with the area around the Corpus Christi Ship Channel.

The inlet influenced assemblage was composed primarily of molluscs with some species representatives being restricted to the inlet while some were also found on the inner shelf. The sediment at the inlet sites was sandy and the species diversity was high.

Oyster reefs in Corpus Christi Bay are not as extensive as in Copano Bay and the characteristic associated fauna are different (White *et al.* 1983).

The shallow bay margin assemblages were composed of the polychaete *Paraprionospio pinnata*, ubiquitous bivalves, and one dominant crustacean.

The University of Texas Marine Science Institute was contracted by the Texas Water Development Board to continue freshwater inflow work in Nueces/Corpus Christi Bay from October 1987 through July 1988. Four stations were sampled: A and B in Nueces Bay, an upper enclosed secondary bay and C and D in Corpus Christi Bay, an open primary bay influenced by Gulf of Mexico waters through Aransas Pass. Freshwater inflow was low during this study period resulting in high salinities, ranging from a mean of 31.2 ppt at station A to a mean of 34.2 ppt at station D. There was an absence of low salinity species, ie. *Littoridina sphinctostoma* and *Hobsonia florida* associated with lower salinity stations in San Antonio Bay. The species collected in Nueces/Corpus Christi Bay were similar to those found in Lavaca/Matagorda Bay, however, their total density was usually lower in the Nueces/Corpus Christi estuary. Species numbers, abundance and biomass increased from upper Nueces Bay to lower Corpus Christi Bay. *Streblospio benedicti*, *Mediomastus californiensis*, *Mulinia lateralis* and *Macoma mitchelli* accounted for 97% of the total abundance at station A and for only 24% of the total abundance at station D, due to a low abundance of *Mulinia lateralis* and *Macoma mitchelli* in the lower bay. Species common to lower Corpus Christi Bay were the polychaetes *Polydora caulleryi*, *Mediomastus californiensis*, *Tharyx setigera*, *Streblospio benedicti*, *Paraprionospio pinnata*, *Cossura delta*, *Clymenella torquata calida*, and *Gyptis vittata*; a phoronid *Phoronis architecta*, the mollusk *Aligena texasiana* and rhyncocoels. The mollusks dominated the biomass at stations A (85%) and B (41%) in Nueces Bay decreasing at stations C (30%) and D (6%) in Corpus Christi Bay. Polychaetes comprised only 14% of the biomass at station A increasing at stations B (58%), C (56%) and D (81%). The mollusk *Periploma cf. orbiculare* and the brittle star *Amphiodia limbata*, were common, although never abundant in Corpus Christi Bay. These species seem to prefer the soft sediment, high salinity environment found in open bay systems, i.e., Corpus Christi and Matagorda Bays.

SUMMARY

Benthic community studies over the years have produced variable results ie., differences in densitities, biomass and temporal distributions of benthic fauna. Physical factors that control benthic community structure in Texas estuaries are salinity, temperature, sediment type, waves and currents, radiant energy from the sun, and sediment chemistry. Salinity is most often used by authors to relate to the spatial distribution of species, abundance and biomass.

Most authors have organized Texas estuaries into zoogeographic zones which we have outlined in Table 1 (Ladd, 1951; Parker, 1959; Mackin, 1971; Blanton *et al.*, 1971; Harper, 1973; Matthews *et al.*, 1974; Gilmore *et al.*, 1976; White *et al.*, 1983; Jones *et al.*, 1986; White *et al.*, 1985; Montagna and Kalke 1989a; 1989b). Typically, these zones ranged from the freshwater influenced, upper or secondary bays, along a gradient to marine influence in the lower or primary bays. The authors have either defined their own, or used different terms which describe the zones and their associated fauna from the upper to lower bay. We recognize three generic zones in Texas estuaries in regard to a salinity gradient and the benthic communities along this gradient (Tables 2-4). These are a freshwater zone, an estuarine zone and a marine zone. The estuarine zone is where fresh and salt water are mixed, and salinities are intermediate. The boundaries of the estuarine zone are the most susceptible to intra- and inter-annual climatic variations. Since our studies have dealt with only the open bay, soft bottom communities we are not referring to zones or sub-zones, i.e. oyster reefs, bay margins and inlets in this summary which have been introduced in other studies.

Community differences were found between the open bays, e.g. Lavaca-Tres Palacios (Table 3) and Nueces Estuaries (Table 4), and the closed bay, i.e. the Guadalupe Estuary (Table 2). Although separated geographically the Lavaca-Tres Palacios Estuary and the Nueces Estuary are more similar to each other than each is to the Guadalupe Estuary. Both the Lavaca and Nueces estuaries have an upper secondary bay and a large open primary bay directly connected to the Gulf of Mexico via passes. The Guadalupe Estuary is very different. San Antonio Bay is divided into upper and lower San Antonio Bay and does not have direct access to the Gulf. Species occurrence and abundance data from the studies reviewed have made it possible to construct tables which summarize the species and average infaunal densities in relation to the three proposed zoogeographical zones (Tables 5-7).

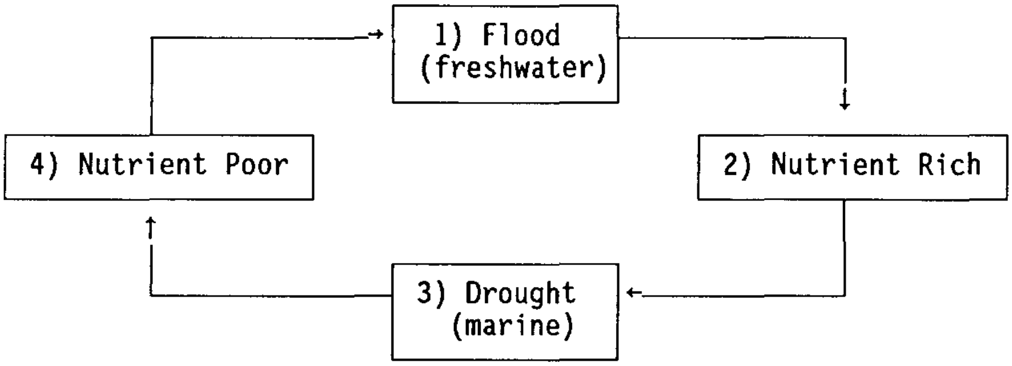
The total number of species in both open and closed systems increases along a salinity gradient from the freshwater influenced upper bay to the marine influenced lower bay (Tables 5-7). In the open estuarine system (Tables 6 and 7) species common to the upper secondary bay are usually replaced by more marine tolerant species in the lower bay. Total abundance and biomass also normally increase from upper to the lower bay.

Dominant species in the upper bay of the closed estuarine system (San Antonio Bay) are typically part of the dominant fauna in the lower bay during flood years but can be replaced by marine fauna in the lower bay during drought years. Infaunal density and biomass are usually higher in the upper San Antonio Bay and decrease in lower San Antonio Bay. This response is most likely due to nutrient input and sediment loading during periodic flooding.

CONCLUSION

When a benthic sample is collected in conjunction with hydrographic data, a record of the benthic community structure with known environmental factors can be compiled. Estuarine benthic organisms are mainly sessile, can tolerate some environmental fluctuations, and are relatively long-lived, therefore the benthic communities represent a good, long-term indicator of environmental conditions. However, seasonal patterns of reproduction and growth do exist, and there are limits to tolerance. So, environmental changes over time can have an effect on community structure. It is important to keep this in mind when sampling the benthos. It is important to look at the environmental data collected at the time of sampling, but also the historic data, i.e., freshwater inflow patterns prior to sampling, must be considered when analyzing benthic community structure.

The environment associated with the Texas estuaries is subject to hurricanes, inland flooding, droughts, and temperature extremes, which result in an esturine environment which is variable. However, the extremes are cyclical in a chaotic fashion, i.e., storms occurr at predictable intervals over the long term. The most important effect of these events is on the variability of freshwater inflow. Which in turn effects the salinity, nutrients, and sediment-load input to the estuary. This controls the ultimate effect on the benthic communities. The variability in freshwater inflow cycle results in predictable changes in the estuary, which are diagrammed in this temporal model:



Flood conditions introduce nutrient rich waters into the estuary which result in lower salinity. This usually happens very rapidly. During these periods the spatial extent of the freshwater fauna is increased. The estuarine fauna may even replace the marine fauna. The high level of nutrients can stimulate a burst of benthic productivity of predominantely freshwater and estuarine communities. This is followed by a transition to low inflow resulting in higher salinities, lower nutrient, marine fauna, and drought conditions. At first, the marine fauna may respond with a burst of productivity as the remaining nutrients are utilized, but eventually nutrients are depleted. The cycle is repeated with flooding and high freshwater inflow.

This model is supported by the data in the Guadalupe Estuary (Table 5). During successive wet years, densities decrease (stages 1, and 4 to 1). When a dry year follows a wet year the densities increase (stages 1 to 2). The same pattern also occurs in the Lavaca-Tres Palacios Estuary (Table 6) and the Nueces Estuary (Table 7). Other aspects of the model are supported by the Nueces Estuary data (Table 7). Although, there was intervening wet years, densities decreased during successive dry years (stages 3 to 4).

The results of benthic sampling depend on what state this cycle is in during the study. For example, benthic studies in Texas estuaries have often reported a response following a flood period which results in higher abundance and biomass of particular estuarine species (Mackin, 1971; Harper, 1973; Matthews *et al.*, 1974; Gilmore *et al.*, 1976; Kalke in Jones *et al.*, 1986; Flint *et al.*, 1981; Flint and Rabalais, 1981; Montagna and Kalke, 1989a, 1989b). The boundaries that authors draw on the various zones will also be a function on the state of the cycle that the estuary is in. The length of time that the estuaries are maintained in any given state will be a function of the periodicity of storms, floods, and droughts.

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Table 1. Estuarine zoogeographical zones defined by the occurrence and abundance of estuarine benthic infauna. The terminology used in this study is compared with the terminology used by other authors to define similar zones.

	Low Salinity	Moderate Salinity	High Salinity
Montagna & Kalke, 1989a	Freshwater	Estuarine	Marine
	Guadalupe Estuary (closed bay)		
Ladd, 1951	Bay-head facies	Reef and Inter-reef facies	
Parker, 1959	River influenced	Enclosed Bay-low and high salinity oyster reefs	
Harper, 1973	Low salinity group	---	High salinity group
Matthews *et al.*, 1974	Zone 1 (freshwater)	Zone 2 (brackish water)	Zone 3 (high salinity)
White *et al.*, 1985	River influenced	Enclosed bay centers and oyster reefs	
	Lavaca Tres-Palacios Estuary (open bay)		
Mackin, 1971	Freshwater Zone (lakes & rivers)	Moderate salinity (Redfish Lake & river)	High salinity (lower Lavaca Bay)
Blanton *et al.* 1971	---	Upper secondary (enclosed bay)	Large open bay
Gilmore *et al.* 1976	River Area	Low salinity upper bay	High salinity lower bay
Jones *et al.*, 1986	River & lake area	Low to moderate salinity upper bay	---
White *et al.*, 1985	River influenced assemblage	Open bay and oyster reef assemblage	Open bay center assemblage
	Nueces Estuary (open bay)		
Blanton *et al.*, 1971	---	Upper secondary enclosed bay	Large open bay
White *et al.*, 1983	River influenced assemblage	Open bay center assemblage	Open bay center, and depauperate assemblage

Table 2. Community characteristics of San Antonio Bay, Texas. Data is compiled from: Ladd, 1951; Parker, 1959; Harper, 1973; Matthews *et al.*, 1974; Montagna and Kalke, 1989a; 1989b.

Zone	Species	Salinity
Freshwater	*Hobsonia florida*	0-10 ppt
	Rangia cuneata	
	Rangia flexuosa	
	Chironomid larvae	
	Littoridina sphinctostoma	
	Streblospio benedicti	
	Mediomastus californiensis	
	Mulinia lateralis	
Estuarine	*Streblospio benedicti*	10-12 ppt
	Mediomastus californiensis	
	Mulinia lateralis	
	Littoridina sphinctostoma	
Marine	*Glycinde solitaria*	12-32 ppt
	Haploscoloplosa foliosus	
	Cossura delta	
	Paraprionospio pinnata	
	Diopatra cuprea	

Table 3. Community characteristics of the Lavaca - Tres Palacios Estuary (Lavaca and Matagorda Bays), Texas. Data compiled from: Mackin, 1971; Blanton *et al.*, 1971; Gilmore *et al.*, 1976; Jones *et al.*, 1986; Montagna and Kalke, 1989a; 1989b.

Zone	Species	Salinity
Freshwater	*Hobsonia florida*	0-13 ppt
	Rangia cuneata	
	Littoridina sphinctostoma	
	Mulinia lateralis	
	Streblospio bendicti	
	Mediomastus californiensis	
	Macoma mitchelli	
Estuarine	*Streblospio benedicti*	10-30 ppt
	Mediomastus californiensis	
	Mulinia lateralis	
Marine	*Paraprionospio pinnata*	30-33 ppt
	Mediomastus californiensis	
	Glycinde solitaria	
	Cossura delta	
	Nereis succinea	
	Mulinia lateralis	
	Nuculana concentrica	
	Nuculana acuta	
	Periploma cf. orbiculare	
	Schizocardium sp	
	Ophiuroid (Amphiodia limbata)	
	Apseudes sp A	

Table 4. Community characteristics of the Nueces Estuary (Nueces and Corpus Christi Bays), Texas. Data compiled from: Blanton *et al.*, 1971; Holland *et al.*, 1975; Flint and Younk, 1983; Flint *et al.*, 1981; Flint and Rabalais, 1981; White *et al.*, 1983; Montagna and Kalke, 1989a; 1989b.

Zone	Species	Salinity
Freshwater	Chironomid larvae	0-34 ppt
	Rangia flexura	
	Mulinia lateralis	
	Macoma mitchelli	
	Streblospio benedicti	
	Mediomastus californiensis	
	Paraprionospio pinnata	
Estuarine	*Mediomastus californiensis*	25-30 ppt
	Streblospio benedicti	
	Cossura delta	
	Glycinde solitaria	
	Mulinia laterales	
	Macoma mitchelli	
Marine	*Mediomastus californiensis*	30-45 ppt
	Streblospio benedicti	
	Mulinia maculata	
	Paraprionospio pinnata	
	Gyptis vittata	
	Tharyx setigera	
	Glycinde solitaria	
	Polydora caulleryi	
	Clymenella torquata calida	
	Phoronis architecta	
	Nuculana acuta	
	Aligena texasiana	
	Leucon sp.	
	Periploma cf. oriculare	
	Rhynchocoels	
	Schizocardium	

Table 5. Interannual variability of average benthic macrofauna abundance (individuals • m^{-2}) in the Guadalupe Estuary for the freshwater, estuarine and marine zones. The relative environmental conditions during each study have been classified according to the amount of inflow. Sampling gear and sieve size are given with each reference.

		Mean Abundance (individuals • m^{-2})		
Date	Inflow	Freshwater	Estuarine	Marine
[1]Apr. 72-Feb.73	Wet	9,520	3,110	3,060
[2]Mar. 72-July 74	Wet	450 to 6,550	270 to 7,350	120 to 2,030
[3]Jan.-July 87	Wet	41,217	18,887	8,367
[4]Apr. 88-Arp. 89	Dry	69,695	80,637	25,595

[1] Harper (1973) 2 in. ID core on pole, 0.5 mm sieve.

[2] Matthews *et al*. (1974) 0.09 m^2 Peterson grab, 0.5 mm sieve (only ranges reported).

[3] Montagna and Kalke (1989a; 1989b) 6.4 cm ID core using SCUBA, 0.5 mm sieve.

[4] Montagna and Kalke (1989a; 1989b) 6.7 cm ID core using SCUBA, 0.5 mm sieve.

Table 6. Interannual variability of average benthic macrofauna abundance (individuals • m^{-2}) in the Lavaca-Tres Palacios Estuary for the freshwater, estuarine and marine zones. The relative environmental conditions during each study have been classified according to the amount of inflow. Sampling gear and sieve size are given with each reference.

Date	Inflow	Mean Abundance (individuals • m^{-2})		
		Freshwater (River & Lakes)	Estuarine (Upper-Lower Lavaca Bay)	Marine (Matagorda Bay)
[1]Estimated or predicted	---	500	3,000	15,000
[2]Mar. 70-Feb. 71	Wet	-	3,500	-
[3]Sept.70-June 71	Wet	1,827	1,809	1,809
[4]Jan. 73-June 75	Wet	770	1,700 to 3,070	-
[5]Nov. 84-Aug.85	Wet	4,520	7,530	-
[6]Oct. 85-Aug.86	Dry	5,190	6.620	-
[7]Apr. 88-Apr. 89	Dry	-	15,400	33,890

[1] Parker and Blanton (1970) 0.04.m^2 Van Veen, 0.25 mm sieve.
[2] Blanton *et al.*, (1971) 0.04.m^2 Van Veen; 0.25 mm sieve.
[3] Mackin (1971) 225 cm^2 Eckman; 0.2 mm sieve.
[4] Gilmore *et al.* (1976) 0.09.m^2 Peterson, 0.5 mm sieve.
[5] Jones *et al.* (1986) 7.5 cm ID core using SCUBA, 0.5 mm sieve.
[6] Jones *et al.* (1986) 7.5 cm ID core using SCUBA, 0.5 mm sieve.
[7] Montagna and Kalke (1989a; 1989b) 6.7 cm ID core using SCUBA, 0.5 mm sieve.

Table 7. Interannual variability of average benthic macrofauna abundance (individuals • m^{-2}) in the Nueces Estuary Estuary for the freshwater, estuarine and marine zones. The relative environmental conditions during each study have been classified according to the amount of inflow. Sampling gear and sieve size are given with each reference.

		Mean Abundance (individuals • m^{-2})		
Date	Inflow	Freshwater (upper Nueces Bay)	Estuarine (Lower Nueces Bay)	Marine (Corpus Christi Bay)
[1]No Date	-	-	-	500
[2]Oct. 72-May 75	Wet & Dry	8,300	8,300	4,320
[3]Sept. 74-Feb. 76	Dry	- -	- -	*5,529 **1,387
[4]Oct. 79-July 81	Wet	- -	- -	*12,304 **8,716
[5]July 81-July 83	Dry	-	13,800	21,070
[6]Oct. 87-July 88	Dry	-	8,555	20,672

*Study site located at Aransas ship channel near Sun Oil dock, Ingleside, TX, in shoal areas at the edge of channel.

**Study site located at Aransas ship channel near Sun Oil dock, Ingleside, TX, in the ship channel.

[1] Blanton *et al.* (1971) 0.0.m^2 Van Veen, 0.25 mm sieve.
[2] Holland *et al.* (1975) 0.09.m^2 Peterson, 0.5 mm sieve.
[3] Flint and Younk (1983) 0.09.m^2 Peterson, 0.5 mm sieve.
[4] Flint *et al.* (1981) 0.09.m^2 Peterson, 0.5 mm sieve.
[5] Flint *et al.* (1983) 7.5 cm ID core using SCUBA, 0.5 mm sieve.
[6] Montagna and Kalke (1989a; 1989b) 6.7 cm ID core using SCUBA, 0.5 sieve.

Data Appendix

Table of Contents

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SALTEMP.DAT  Salinity and temperature data for all benthic sampling.

 Bay codes:
   GE = Guadalupe Estuary
   NC = Nueces Estuary
   LP = Lavaca-Tres Palacios Estuary

BAY TRIP STATION SALINITY (ppt) TEMPERATURE (C)
NC  OCT87  A  29  24.0
NC  OCT87  B  34  21.7
NC  OCT87  C  33  25.1
NC  OCT87  D  35  22.3
NC  DEC87  A  29  20.6
NC  DEC87  B  30  19.4
NC  DEC87  C  32  18.8
NC  DEC87  D  32  18.9
NC  FEB88  A  27  15.7
NC  FEB88  B  31  15.6
NC  FEB88  C  31  12.5
NC  FEB88  D  30  15.6
NC  APR88  A  30  17.0
NC  APR88  B  30  19.7
NC  APR88  C  31  19.5
NC  APR88  D  31  19.5
NC  MAY88  A  34  26.3
NC  MAY88  B  34  27.5
NC  MAY88  C  32  25.4
NC  MAY88  D  32  24.8
NC  JUL88  A  38  29.3
NC  JUL88  B  37  29.1
NC  JUL88  C  36  29.6
NC  JUL88  D  45  30.6
LP  APR88  A  23.7  24.1
LP  APR88  B  27.3  23.2
LP  APR88  C  31.0  21.6
LP  APR88  D  31.2  21.5
LP  JUL88  A  27.3  29.9
LP  JUL88  B  28.6  30.5
LP  JUL88  C  31.5  29.6
LP  JUL88  D  32.3  29.8
LP  NOV88  A  32.9 13.9
LP  NOV88  B  34.6 14.6
LP  NOV88  C  35.3 15.4
LP  NOV88  D  35.1 16.7
LP  APR89  A  23  21.8
LP  APR89  B  23  20.3
LP  APR89  C  23  21.4
LP  APR89  D  23  21
LP  JUL89  A  22.2 29.5
LP  JUL89  B  25.8 29
LP  JUL89  C  28.2  31
LP  JUL89  D  36.1 31
GE  JAN87  A .3  14.4
GE  JAN87  B .4  14.8
GE  JAN87  C  6.5  15.5
GE  JAN87  D  4.1  15.8
GE  MAR87  A  .2  15
GE  MAR87  B  .4  16
GE  MAR87  C  6.9  16
GE  MAR87  D  12.5  17.5
GE  APR87  A  .5 14.5
GE  APR87  B  6.3 15.2
GE  APR87  C  9.2 14.5
GE  APR87  D  13.2  14.9
GE  JUN87  A  1  26.2
GE  JUN87  B  4.6 26.7
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GE  JUN87  C  4.3 26.2
GE  JUN87  D  9.9 26.4
GE  JUL87  A  .4  30.5
GE  JUL87  B  .4  30
GE  JUL87  C  1.1  30.5
GE  JUL87  D  .9  30.5
GE  APR88  A  9.6 21.9
GE  APR88  B  13.7 22.0
GE  APR88  C  23.6 22.1
GE  APR88  D  26.7 22.1
GE  JUL88  A  10  28.4
GE  JUL88  B  21  29.3
GE  JUL88  C  26  28.9
GE  JUL88  D  32  28.9
GE  NOV88  A  18.5 15.5
GE  NOV88  B  24.9 15.4
GE  NOV88  C  30.2 16.0
GE  NOV88  D  30.7 15.9
GE  APR89  A  15   24
GE  APR89  B  18   23.7
GE  APR89  C  24   22
GE  APR89  D  24   23.9
GE  JUL89  A  15.9 31.5
GE  JUL89  B  19.4 31.5
GE  JUL89  C  28.4 31.3
GE  JUL89  D  29   31.5
```

MEIOGRAZ.DAT Meiofauna grazing data set.

Experiment performed in 1987, in San
Antonio bay.

TAXA CODES: AMP=amphipod, COP=copepod, MOL=mollusk, NEM=nematodes,
OTH=other miscellaneous taxa, POL=polychaetes.

GBACT=Grazing rate on bacteria (h^-1).
GALGA=Grazing rate on microalgae (h^-1).

MONTH	STATION	REPL	TAXA	GBACT	GALGA
JAN	A	1	AMP	0.000021	0.00040
JAN	B	1	AMP	0.000228	0.00326
JAN	C	1	AMP	0.000042	0.00052
JAN	C	2	AMP	0.000102	0.00078
JAN	D	2	AMP	0.000028	0.00020
APR	A	1	COP	0.000685	0.00082
APR	A	2	COP	0.000798	0.00084
APR	A	3	COP	0.000495	0.00067
APR	B	1	COP	0.000579	0.00084
APR	B	2	COP	0.000188	0.00114
APR	B	3	COP	0.000278	0.00075
APR	C	1	COP	0.003108	0.03894
APR	C	2	COP	0.002422	0.01291
APR	C	3	COP	0.009428	0.01316
APR	D	1	COP	0.002203	0.03422
APR	D	2	COP	0.001755	0.02649
APR	D	3	COP	0.000570	0.00442
JAN	A	1	COP	0.000109	0.00290
JAN	A	2	COP	0.000141	0.00169
JAN	A	3	COP	0.000450	0.00541
JAN	B	1	COP	0.000000	0.00097
JAN	B	2	COP	0.000310	0.00182
JAN	B	3	COP	0.000559	0.00122
JAN	C	1	COP	0.001414	0.00919
JAN	C	2	COP	0.002573	0.04035
JAN	C	3	COP	0.001721	0.01541
JAN	D	1	COP	0.002171	0.00451
JAN	D	2	COP	0.000342	0.00207
JAN	D	3	COP	0.000942	0.00412
JUL	A	2	COP	0.000167	0.00059
JUL	A	3	COP	0.000106	0.00021
JUL	B	1	COP	0.000446	0.00227
JUL	B	2	COP	0.001977	0.00233
JUL	B	3	COP	0.000291	0.00341
JUL	C	1	COP	0.000009	0.00042
JUL	C	2	COP	0.000166	0.00038
JUL	C	3	COP	0.000247	0.00066
JUL	D	1	COP	0.001088	0.00083
JUL	D	2	COP	0.002947	0.00499
JUL	D	3	COP	0.000751	0.00099
APR	A	1	MOL	0.000632	0.04112
APR	A	2	MOL	0.032524	0.04961
APR	A	3	MOL	0.022482	0.10249
APR	B	1	MOL	0.004336	0.01653
APR	B	2	MOL	0.034941	0.11111
APR	B	3	MOL	0.083078	0.11384
APR	C	1	MOL	0.000000	0.00000
APR	D	3	MOL	0.007776	0.00796
JAN	A	2	MOL	0.000046	0.00634
JAN	B	1	MOL	0.015681	0.00736
JAN	B	2	MOL	0.000423	0.00837
JAN	B	3	MOL	0.041942	0.00000
JAN	C	1	MOL	0.005874	0.02509
JAN	C	2	MOL	0.00015	0.00007
JAN	C	3	MOL	0.00000	0.00000

```
JAN     D      1      MOL      0.00000     0.00000
JAN     D      2      MOL      0.00046     0.00249
JAN     D      3      MOL      0.00041     0.00165
JUL     A      1      MOL      0.01900     0.05371
JUL     A      2      MOL      0.37380     0.44091
JUL     A      3      MOL      0.22660     0.11734
JUL     B      1      MOL      0.03797     0.11085
JUL     B      2      MOL      0.08150     0.09286
JUL     B      3      MOL      0.04898     0.09869
JUL     C      1      MOL      0.00824     0.01980
JUL     C      2      MOL      0.00254     0.00276
JUL     C      3      MOL      0.03091     0.10055
JUL     D      1      MOL      0.00000     0.00000
JUL     D      2      MOL      0.00153     0.00375
JUL     D      3      MOL      0.01054     0.03081
APR     A      1      NEM      0.00078     0.00010
APR     A      2      NEM      0.00234     0.00013
APR     A      3      NEM      0.00006     0.00015
APR     B      1      NEM      0.00833     0.00045
APR     B      2      NEM      0.00000     0.00047
APR     B      3      NEM      0.00000     0.00062
APR     C      1      NEM      0.00000     0.00592
APR     C      2      NEM      0.00000     0.00101
APR     C      3      NEM      0.00000     0.00206
APR     D      1      NEM      0.00000     0.00083
APR     D      2      NEM      0.00000     0.00083
APR     D      3      NEM      0.00000     0.00033
JAN     A      1      NEM      0.00000     0.00063
JAN     A      2      NEM      0.00000     0.00093
JAN     A      3      NEM      0.00003     0.00196
JAN     B      1      NEM      0.00000     0.00053
JAN     B      2      NEM      0.00000     0.00085
JAN     B      3      NEM      0.00000     0.00023
JAN     C      1      NEM      0.00000     0.00519
JAN     C      2      NEM      0.00463     0.06167
JAN     C      3      NEM      0.00046     0.00625
JAN     D      1      NEM      0.00047     0.01825
JAN     D      2      NEM      0.00040     0.00614
JAN     D      3      NEM      0.00000     0.00397
JUL     A      1      NEM      0.00022     0.00037
JUL     A      2      NEM      0.00000     0.00074
JUL     A      3      NEM      0.00000     0.00023
JUL     B      1      NEM      0.00026     0.00032
JUL     B      2      NEM      0.00033     0.00039
JUL     B      3      NEM      0.00002     0.00062
JUL     C      1      NEM      0.00000     0.00047
JUL     C      2      NEM      0.00000     0.00000
JUL     C      3      NEM      0.00000     0.00065
JUL     D      1      NEM      0.00000     0.00053
JUL     D      2      NEM      0.00000     0.00118
JUL     D      3      NEM      0.00000     0.00079
APR     A      1      OTH      0.000567      0.006985
APR     A      2      OTH      0.000825      0.008838
APR     A      3      OTH      0.000513      0.007987
APR     B      1      OTH      0.000158      0.000710
APR     B      2      OTH      0.000118      0.000652
APR     B      3      OTH      0.000235      0.001425
APR     C      1      OTH      0.000991      0.004986
APR     C      2      OTH      0.000597      0.000890
APR     C      3      OTH      0.001754      0.003194
APR     D      1      OTH      0.000235      0.001027
APR     D      2      OTH      0.000473      0.004739
APR     D      3      OTH      0.000269      0.001716
JAN     A      1      OTH      0.000405      0.012374
JAN     A      2      OTH      0.000536      0.010842
JAN     A      3      OTH      0.000930      0.018483
JAN     B      1      OTH      0.002285      0.052066
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JAN    B    2    OTH    0.001434     0.031336
JAN    B    3    OTH    0.003568     0.020931
JAN    C    1    OTH    0.000346     0.001090
JAN    C    2    OTH    0.000989     0.001346
JAN    C    3    OTH    0.000980     0.004776
JAN    D    1    OTH    0.001246     0.013244
JAN    D    2    OTH    0.001422     0.007662
JAN    D    3    OTH    0.001983     0.007556
JUL    A    1    OTH    0.001341     0.001252
JUL    A    2    OTH    0.013292     0.088546
JUL    A    3    OTH    0.003690     0.022551
JUL    B    1    OTH    0.001179     0.007756
JUL    B    2    OTH    0.001063     0.003340
JUL    B    3    OTH    0.004930     0.025750
JUL    C    1    OTH    0.000147     0.001081
JUL    C    2    OTH    0.000312     0.000867
JUL    C    3    OTH    0.000067     0.002520
JUL    D    1    OTH    0.000947     0.011016
JUL    D    2    OTH    0.000411     0.004259
JUL    D    3    OTH    0.000192     0.004611
APR    A    1    POL    0.000178     0.001635
APR    A    2    POL    0.001594     0.004976
APR    A    3    POL    0.000377     0.002070
APR    B    1    POL    0.001179     0.003072
APR    B    2    POL    0.000327     0.000823
APR    B    3    POL    0.000180     0.000525
APR    C    1    POL    0.000161     0.000755
APR    C    2    POL    0.003166     0.002026
APR    C    3    POL    0.000932     0.000239
APR    D    1    POL    0.000210     0.001152
APR    D    2    POL    0.000050     0.000072
JAN    A    1    POL    0.000038     0.000827
JAN    A    2    POL    0.000028     0.000352
JAN    A    3    POL    0.000000     0.000000
JAN    B    1    POL    0.000000     0.000620
JAN    B    2    POL    0.000058     0.000295
JAN    B    3    POL    0.000615     0.002762
JAN    C    1    POL    .00001957     .0000313
JAN    C    2    POL    .00027245     .0002374
JAN    C    3    POL    .00013862     .0001532
JAN    D    1    POL    .00014820     .0004254
JAN    D    2    POL    .00007804     .0003920
JUL    A    2    POL    .00008946     .0001951
JUL    A    3    POL    .00009041     .0001414
JUL    B    1    POL    .00083773     .0011536
JUL    B    2    POL    .00032063     .0000000
JUL    B    3    POL    .00007387     .0002037
JUL    C    1    POL    .00007292     .0003069
JUL    C    2    POL    .00017363     .0000980
JUL    C    3    POL    .00012034     .0014681
JUL    D    1    POL    .00008899     .0001732
JUL    D    2    POL    .00088402     .0028482
JUL    D    3    POL    .00025705     .0015816
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N2OXFLUX.DAT NIPS-2 Oxygen flux data from chamber experiments.

Nueces and Corpus Christi Bays.

Design: DF=dark chamber with flow of 19.5 cm/sec.
D =dark chamber without flow.
LF=light chamber with flow of 19.5 cm/sec.
L =light chamber without flow.
Dark=respiration, light=net photosynthesis, and L-D=gross photosynthesis.

All flux values are in mmol O2/m^2/h. negative values indicate sediment uptake, and positive values indicate release from sediment.

DATE	STATION	SALINTY	TEMP	DF	LF	L	D
OCT87	A	29	24.0	-2.126	0.156	-0.865	-1.4520
OCT87	B	34	21.7	-1.927	-1.030	0.670	-1.1880
OCT87	C	33	25.1	-1.200	0.954	-1.164	-2.4710
OCT87	D	35	22.3	-3.090	-4.103	-1.657	-0.7790
DEC87	A	29	20.6	-0.491	0.614	0.069	-1.1820
DEC87	B	30	19.4	-1.963	-0.062	3.482	5.1169
DEC87	C	32	18.8	-1.537	-2.972	6.268	-1.5650
DEC87	D	32	18.9	-0.437	3.651	1.348	0.8080
FEB88	A	27	15.7	-1.736	-0.220	-0.706	-1.0230
FEB88	B	31	15.6	-1.354	-1.394	-2.116	-1.2040
FEB88	C	31	12.5	-1.952	-1.370	-1.014	-0.9520
FEB88	D	30	15.6	-0.824	-0.251	0.572	-0.6620
APR88	A	30	17.0	-2.533	-1.284	-0.929	-0.5660
APR88	B	30	19.7	-1.700	-1.109	0.514	-0.2790
APR88	C	31	19.5	-1.676	-0.621	-0.455	0.0014
APR88	D	31	19.5	-1.150	-0.880	0.395	-0.2550
MAY88	A	34	26.3	-0.613	-0.350	-0.548	-1.0990
MAY88	B	34	27.5	0.496	-1.296	-1.216	-1.6010
MAY88	C	32	25.4	-1.418	-1.152	-0.608	-0.6240
MAY88	D	32	24.8	0.641	-1.093	-0.484	-1.4180
JUL88	A	38	29.3	.	.	-1.061	-1.6180
JUL88	A	38	29.3	.	.	-1.570	-0.8760
JUL88	B	37	29.1	.	.	-1.174	-1.7630
JUL88	B	37	29.1	.	.	-2.681	-0.8400
JUL88	C	36	29.6	.	.	0.583	-0.7530
JUL88	C	36	29.6	.	.	-0.238	-0.5170
JUL88	D	45	30.6	.	.	-0.761	-1.3070
JUL88	D	45	30.6	.	.	-0.644	-2.2980

```
N2NUFLUX.DAT  NIPS-2 nutrient flux data from Nueces-Corpus Christi Bay.
All nutrient fluxes are in umol/m^2/h.

    D     F F                  S
    A S T L O        P         I         N        N        N     C
    T T R O R        O         O         O        O        H     H        S
    E A T W M        4         4         3        2        4     L        S

DATE  S T R R    PO4       SIO4       NO3     NO2       NH4   CHL        SS
OCT87 A D Y N     .          .          .       .         .     .     -3.7865
OCT87 A L Y N     .          .          .       .         .     .     -1.5504
OCT87 A L N N   13.395    297.54      0.95   -2.375    -8.27    .     -0.0912
OCT87 A D N N  -84.075     61.75    -10.17  -24.225    -5.79    .     -0.0365
OCT87 A D Y Y  128.535    437.29     96.80  285.760   105.07    .     -1.3376
OCT87 A L Y Y   17.195    500.65     24.13   58.330    11.88    .     -2.2192
OCT87 A L N Y  -15.675    166.72    -10.45  -25.745   -34.77    .     -0.0608
OCT87 A D N Y    4.465    521.45     -3.99   -2.090     3.61    .     -0.0304
OCT87 C D Y N    9.785    254.69    -41.14   32.775    15.30    .         .
OCT87 C L Y N    5.225    234.36    -23.46   19.380    35.34    .         .
OCT87 C L N N    5.795    183.92    -10.45   10.450    -4.08    .         .
OCT87 C D N N    1.900    214.22     -6.65    6.745    38.19    .      0.0000
OCT87 C D Y Y    3.230    214.23     -1.62   14.155    75.33    .      8.1272
OCT87 C L Y Y    3.895    305.14     -7.60   20.045     4.09    .     36.7253
OCT87 C L N Y   -2.660    274.84     30.69  -22.420    -7.03    .     -0.0608
OCT87 C D N Y    0.000    133.38     19.76    5.225  -847.12    .     -0.1824
OCT87 B D Y N  -50.920    147.25    -26.79  -53.485   -60.61    .     -0.6887
OCT87 B L Y N  112.195    273.50    -76.76  182.210   207.00    .      1.6559
OCT87 B L N N   30.590    515.47     37.34  -17.195     4.18    .     -0.3040
OCT87 B D N N   -0.950    199.88     31.26    3.895    99.28    .     -0.6688
OCT87 B D Y Y  -29.165    115.71     46.36  -26.315    32.02    .     -1.8694
OCT87 B L Y Y   83.885    115.71    -24.89  135.375   189.43    .     -1.5059
OCT87 B L N Y   11.590    -63.08     44.56   -4.370    74.10    .     -0.5168
OCT87 B D N Y   -4.940   -126.26      2.66    2.375     6.75    .         .
OCT87 D D Y N   -1.330    189.34    -31.16  -27.265   -14.44    .      3.6469
OCT87 D L Y N  186.105    157.80    -11.02    4.465   -11.12    .      0.9120
OCT87 D L N N    3.325    168.25     -0.95   -0.760    50.35    .     -0.3040
OCT87 D D N N   -1.330    168.34      3.99  -10.545    52.06    .     -0.1824
OCT87 D D Y Y    1.900     63.08     14.06    0.000    19.19    .     -0.1216
OCT87 D L Y Y    1.235     84.17      9.02    0.950     7.41    .     -0.3040
OCT87 D L N Y   -2.660     84.17      9.02   -7.600    -0.19    .     -0.2432
OCT87 D D N Y  -14.440    105.16    -36.10  -15.865   -20.42    .     -0.1824
DEC87 C D Y N -178.600     65.36   -350.45  -84.740  -108.39  0.16217   1.5480
DEC87 C L Y N   11.305    326.99    -15.39   15.295  -353.31 -0.00389   3.2013
DEC87 C L N N   -2.090     87.21     -8.45   -0.380    91.67 -0.08293  -0.1216
DEC87 C D N N    1.235    -65.46      8.83   -8.835    74.38 -0.08892  -0.2128
DEC87 C D Y Y   31.540    130.82      0.76   25.840    36.48 -0.08693   0.3154
DEC87 C L Y Y    1.235    108.97     43.99    0.475  -412.96 -0.01976   0.3635
DEC87 C L N Y   -2.090     43.51    -11.12    2.185   134.14 -0.07705  -0.1520
DEC87 C D N Y   -3.705    108.96     44.27   -8.835    89.39  0.13452  -0.6080
DEC87 A D Y N  -12.920    801.90    -74.01    6.745  -740.72  0.37753   0.3040
DEC87 A L Y N   25.270    647.90    -35.06    6.270  -168.53  0.35131   0.4256
DEC87 A L N N   -9.690    494.00     11.30  -20.900   883.40  0.06137  -0.2128
DEC87 A D N N   -9.595    709.46     37.62  -27.930   289.75  0.09557  -0.0608
DEC87 A D Y Y   23.560    771.12    -15.01  -13.870  -300.86 -0.12635  -0.2128
DEC87 A L Y Y   13.585    709.46     45.60  -36.005  -150.10  0.27407   0.0485
DEC87 A L N Y   13.585    494.00     35.72   -6.840  2095.51 -0.27436  -0.2736
DEC87 A D N Y   25.175    709.46    -61.46    3.705  1387.85  0.05785  -0.1824
DEC87 B D Y N   17.290    -51.68   -459.13   24.035  -150.48  0.14279   0.5776
DEC87 B L Y N    7.220     16.34    -82.93   17.575     9.41  0.14687   2.5099
DEC87 B L N N    9.405   -106.21    -23.75   -2.660  -150.48  0.04626  -0.2128
DEC87 B D N N  -17.480      2.76    -23.66    4.940    12.54  0.04892  -0.1216
DEC87 B D Y Y   18.335     70.87    -11.12   11.875  -224.30  0.29393  -0.1216
DEC87 B L Y Y   47.500     98.04    -12.25   32.490  -184.30  0.29991  -0.1824
DEC87 B L N Y  -15.200    -38.10     -0.29    5.035   -67.45  0.05928  -0.1216
DEC87 B D N Y   13.870    -10.93     10.17    6.270  -162.83    .      -0.0912
DEC87 D D Y N  -29.165    250.61    -11.30   19.095     0.95  0.16806   2.8928
DEC87 D L Y N  -39.235     68.11    -11.12   11.115     8.46  0.33905   0.3040
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DEC87 D L N N    4.465    147.06      1.42   21.850   192.57  0.12027  -0.0304
DEC87 D D N N   14.630    -13.68      3.89    3.800   103.83  0.02840  -0.2128
DEC87 D D Y Y -154.755     19.10    303.34  -65.930  -963.40  0.28329   0.0608
DEC87 D L Y Y   31.350    106.21     10.07  -10.165  -304.28  0.22183  -0.2128
DEC87 D L N Y -121.600   -187.91    -14.16  -40.185  -376.30  0.06080  -0.0304
DEC87 D D N Y   -7.790   -174.33    -14.92  -31.730  -514.81 -0.01302  -0.1520
FEB88 C D Y N -188.385     15.77  -1243.84  -20.710  -122.17  1.04757   2.5157
FEB88 C L Y N -160.740     28.88   -442.60  -13.300  -184.96  0.85871   0.8731
FEB88 C L N N  -55.100    -23.56   -221.73  -15.485   -79.70 -0.08065  -0.3648
FEB88 C D N N  -18.335    -10.45    -89.96   -8.170  -105.16 -0.02774  -0.3040
FEB88 C D Y Y   -9.120     41.99    -17.48  -14.440  -225.72  0.54853   0.3570
FEB88 C L Y Y   -4.560    219.26     18.52  -23.750  -234.17  0.19504   0.2736
FEB88 C L N Y  -18.335     28.88     26.12  -24.890    77.99 -0.80864  -0.7296
FEB88 C D N Y   -4.560      2.66     24.41  -16.435   -71.25 -0.83534  -0.5472
FEB88 A D Y N   15.580     72.01   -199.50   34.295   127.02  0.17946   2.2570
FEB88 A L Y N   10.735     33.63      8.17    8.835    63.55  0.14763  -8.4946
FEB88 A L N N   -0.190     18.24     -8.55   -4.180    -7.22 -0.11257  -0.3648
FEB88 A D N N   -4.085     -0.95    -48.35   41.420    48.55 -0.02764  -3.2764
FEB88 A D Y Y    6.270     33.63     -2.85   11.495     5.13  0.09833  -0.0955
FEB88 A L Y Y    4.180     31.63      4.09    3.420    -9.03  0.06394   0.1874
FEB88 A L N Y    1.615     -3.80      4.18    0.950   -21.56 -0.56468  -1.4592
FEB88 A D N Y    0.095    -22.99      0.29    3.325    -4.18 -0.61902  -3.6451
FEB88 D D Y N  -49.780     55.10   -895.47   -0.190   -80.94  0.28813   0.3952
FEB88 D L Y N     .          .         .        .        .       .        .
FEB88 D L N N     .          .         .        .        .       .        .
FEB88 D D N N     .          .         .        .        .       .        .
FEB88 D D Y Y   16.340    135.18    -50.82   15.865    91.58  0.29744  -0.0608
FEB88 D L Y Y   44.460     81.41     11.02  -11.020    29.83  0.32347   0.1520
FEB88 D L N Y    1.235    108.40     -1.71   -9.880   -53.20  0.04769  -0.1216
FEB88 D D N Y  -20.235    -18.24    -12.44    0.760   -34.10  0.04503  -0.0304
FEB88 D D Y N  -10.355     -1.99   -191.23    1.045    83.32  0.05500   0.1216
FEB88 D L Y N    1.995     27.93    -26.41    8.835    -2.75  0.12027   0.5168
FEB88 D L N N    0.000     27.93      1.71   -0.095     9.88 -0.00722   0.0608
FEB88 D D N N   -6.270     57.85     17.48    3.230    68.11 -0.03838   0.1520
FEB88 D D Y Y  -14.535     -1.99     -8.26    9.880   -35.72  0.17338  -0.0608
FEB88 D L Y Y  -10.355     -1.99    -15.29   -2.280  -134.52  0.20539   0.0000
FEB88 D L N Y   -6.175    -21.94     -6.94    2.090    25.08 -0.03116   0.0000
FEB88 D D N Y   -2.090     17.96     -5.79    1.045  -106.69  0.05197  -0.0304
FEB88 B D Y N  -11.590      4.85   -292.31   14.440   -35.44  0.22049   1.3058
FEB88 B L Y N    0.475    -43.70    -55.86   23.655    17.01 -0.17755   0.0608
FEB88 B L N N  -47.690    -19.38    -27.36  -20.235  -269.80 -0.31682  -0.6080
FEB88 B D N N  -26.030    -34.01      7.41  -24.320  -114.76 -0.31968  -0.6080
FEB88 B D Y Y  -28.405      0.00     15.01  -39.615  -146.49 -0.25868  -0.0486
FEB88 B L Y Y   26.980      4.85    -41.13   31.825   152.57 -0.08398   0.1216
FEB88 B L N Y  -28.405     -9.78      3.89  -13.110  -142.79 -0.22715  -0.3952
FEB88 B D N Y  -50.160    -58.23     31.44  -40.660  -161.12 -0.28823  -0.6080
APR88 C D Y N   42.655    177.55     49.97   85.500   -99.28  0.21556   1.0671
APR88 C L Y N    4.465     72.58    -43.60  -16.530     9.50  0.41249   2.5525
APR88 C L N N   11.210     30.50     81.70   -1.710    17.96  0.12293  -0.8512
APR88 C D N N  -15.770     19.95    -82.36  -22.895    -0.95  0.06280  -0.3344
APR88 C D Y Y    2.185    146.11     -1.62  -13.395   -56.72  0.15561   0.0000
APR88 C L Y Y   31.445    272.18    -20.62   20.615    -1.90  0.04493   0.4560
APR88 C L N Y    2.185    -11.49     14.44  -14.440    -0.95 -0.14953  -0.3648
APR88 C D N Y    4.560     30.50     79.04   -3.800     0.10 -0.02204  -0.3040
APR88 A D Y N  101.555    102.70   -605.34   23.845    -5.61  0.15476   0.6831
APR88 A L Y N  -23.560    145.54   -256.69   19.380   -48.17  1.23662  -0.5629
APR88 A L N N    5.890    359.57    -95.09   -8.170    20.24  0.02470  -0.4256
APR88 A D N N  -32.775  -1609.59    -43.60  -21.470   -17.39  0.00874  -0.6688
APR88 A D Y Y   13.395   1344.16    -74.48    9.500  -131.19 -0.45790  -0.8816
APR88 A L Y Y  -78.090   -453.82     -2.75  -62.225   -25.37  0.33307   0.4102
APR88 A L N Y   37.810   -154.19    -58.71   12.730     5.32 -0.04684  -1.5200
APR88 A D N Y  -32.775   1172.96    -51.68   24.985    -3.61 -0.04712  -1.1552
APR88 B D Y N    2.470     77.04   -463.98   30.875    25.75  0.35672   3.5731
APR88 B L Y N   10.070    119.89   -251.66   33.155     8.93  0.24377   2.8796
APR88 B L N N    5.035     34.30   -153.33   -6.650     3.99 -0.04893  -0.2736
APR88 B D N N    0.855     34.20    -99.18   -2.185   861.46 -0.08826  -0.2736
APR88 B D Y Y   15.105    162.74    -33.73   29.830    38.57  0.47092   1.9536
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APR88 B L Y Y    4.180    291.08     20.42  -24.225     43.51  0.58102   2.1087
APR88 B L N Y   -5.890    -94.14    -48.07  -14.345     -6.94 -0.05671  -0.2736
APR88 B D N Y   -1.710     77.14    -12.35  -11.020     -7.98 -0.09338  -0.2736
APR88 D D Y N  -13.490     51.39     72.68   -2.375    157.41  0.84769   1.0944
APR88 D L Y N    0.855     -0.76     12.64   18.620    -56.43  0.97461   3.1711
APR88 D L N N  -23.465    198.55     34.67   -3.610      0.95  0.64163  -0.1520
APR88 D D N N    8.360     94.14     31.44   -0.190      4.94  0.09937  -0.0608
APR88 D D Y Y  -18.430   -205.49     72.58   -2.470      0.95 -0.03240   0.0000
APR88 D L Y Y   50.350    179.74     66.03    4.180      0.95  0.44023   0.0912
APR88 D L N Y   53.770    -77.14     72.68   -2.470      0.00 -0.15542  -0.1216
APR88 D D N Y   -6.745    -34.20     34.77   -3.610    -33.63 -0.11989  -0.1216
MAY88 C D Y N     .     10231.31  11426.60 -297.160    -24.70  0.06679   3.1360
MAY88 C L Y N     .       214.03   -254.60    0.855      9.88  0.08493   1.5863
MAY88 C L N N     .       299.63     28.31   10.830     -5.89 -0.25536  -0.7904
MAY88 C D N N     .         0.00    -38.47  -20.140     -3.04     .     -0.4256
MAY88 C D Y Y     .       -42.84     26.79  -26.790     -3.99  0.28927  -3.1475
MAY88 C L Y Y     .       256.79    229.43  -14.535     -6.93  0.42959   2.4092
MAY88 C L N Y     .         0.00      6.08  -25.650      4.94 -0.23569  -0.7296
MAY88 C D N Y     .        42.75    153.80  -36.670    -16.82 -0.23465  -0.8816
MAY88 A D Y N     .        57.76     14.34   45.315     53.39 -0.00959   6.8885
MAY88 A L Y N     .       100.60     83.12   15.485     25.36 -0.56791   7.9099
MAY88 A L N N     .       100.60     24.13  -23.180     19.76  0.33117  -0.3952
MAY88 A D N N     .        14.91     82.37  -61.845      4.94 -0.14127  -0.5168
MAY88 A D Y Y     .       100.60      1.71   18.715      7.89  0.23855   0.6748
MAY88 A L Y Y     .      -627.19    284.81   87.210     18.81  0.20615   0.0485
MAY88 A L N Y     .        15.01     91.58  -32.015    -59.47 -0.35216  -0.4864
MAY88 A D N Y     .       186.20     54.72  -34.295    -20.80 -0.29535  -0.7296
MAY88 B D Y N   -5.035   -336.58    -96.24   27.645     18.24 -0.19380   0.6776
MAY88 B L Y N  -53.675    117.04    -69.35   27.550     16.44 -0.07543  -4.1370
MAY88 B L N N  -18.240   -245.86    -79.71  -42.750      9.12 -0.51139  -2.9184
MAY88 B D N N  -17.195    -87.12     23.85  -52.155    -23.75 -0.36613  -1.1856
MAY88 B D Y Y    6.650    185.06     77.33  -11.495     -5.51  0.27484   0.3396
MAY88 B L Y Y   96.710    162.36     10.16   55.765     31.07  0.26581  10.2143
MAY88 B L N Y  -12.160   -268.56     -9.31  -45.885    -20.05 -0.39397  -2.4016
MAY88 B D N Y  -33.155    -78.56    -52.06  -56.810    -29.26 -0.45381  -2.3408
MAY88 D D Y N  -11.020     62.03      6.36    7.125    -16.24  0.74262   1.0032
MAY88 D L Y N   -0.570    107.45     16.34  -16.340    -16.25  0.83277   3.1283
MAY88 D L N N  -12.160    -28.60      0.76   -0.760      3.80 -0.01720  -0.1216
MAY88 D D N N   57.475    -51.40     -2.47    2.375     11.12 -0.18031  -0.1520
MAY88 D D Y Y    2.280     39.43     41.99   11.780      5.70  0.27104   0.0000
MAY88 D L Y Y    0.000     39.43     46.08   21.090      0.19  0.31302   0.1824
MAY88 D L N Y   40.375    -28.69     49.88    3.990    -10.74 -0.14649  -0.2128
MAY88 D D N Y   29.830     43.70     33.25    7.125      1.99 -0.22192  -0.2128
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N1NUFLUX.DAT NIPS-1 Nutrient flux data from San Antonio Bay.

Benthic chambers
were all clear, but stirred at different speeds to resuspend sediments.

DEPLOY= Order of deployment during the day, generally 1=AM, 2=noon, and 3=PM.
FLOW= Current speed in chamber in cm/sec.
CHAMBER= Replicate chamber number.
NUT=nutrient
FLUX=nutrient flux in umol/m^2/h, negative numbers indicate sediment uptake and positive numbers indicate sediment release.

DATE	STA	DEPLOY	FLOW	CHAMBER	NUT	FLUX
NOV86	A	1	8.4	1	NH4	34.42
NOV86	A	1	8.4	2	NH4	101.10
NOV86	A	1	19.5	3	NH4	-29.29
NOV86	A	1	19.5	4	NH4	129.59
NOV86	A	2	8.4	1	NH4	227.92
NOV86	A	2	8.4	2	NH4	431.15
NOV86	A	2	19.5	3	NH4	396.80
NOV86	A	2	19.5	4	NH4	573.32
NOV86	A	3	8.4	1	NH4	186.49
NOV86	A	3	8.4	2	NH4	-38.94
NOV86	A	3	19.5	3	NH4	96.96
NOV86	A	3	19.5	4	NH4	83.32
NOV86	C	1	8.4	1	NH4	-4.94
NOV86	C	1	8.4	2	NH4	8.93
NOV86	C	1	19.5	3	NH4	67.74
NOV86	C	1	19.5	4	NH4	86.36
NOV86	C	2	8.4	1	NH4	25.76
NOV86	C	2	8.4	2	NH4	-1.60
NOV86	C	2	19.5	3	NH4	61.13
NOV86	C	2	19.5	4	NH4	47.19
NOV86	C	3	8.4	1	NH4	27.09
NOV86	C	3	8.4	2	NH4	-8.28
NOV86	C	3	19.5	3	NH4	-33.17
NOV86	C	3	19.5	4	NH4	-27.17
JAN87	A	1	0.0	5	NH4	-201.80
JAN87	A	1	0.0	6	NH4	4.18
JAN87	A	1	0.1	1	NH4	1.20
JAN87	A	1	8.4	2	NH4	9.90
JAN87	A	1	19.5	3	NH4	159.59
JAN87	A	2	0.0	5	NH4	0.49
JAN87	A	2	0.0	6	NH4	-4.10
JAN87	A	2	0.1	1	NH4	-29.03
JAN87	A	2	8.4	2	NH4	34.55
JAN87	A	2	19.5	3	NH4	71.50
JAN87	C	1	0.0	5	NH4	25.51
JAN87	C	1	0.0	6	NH4	5.45
JAN87	C	1	0.1	1	NH4	10.33
JAN87	C	1	8.4	2	NH4	-11.08
JAN87	C	1	19.5	3	NH4	-25.70
JAN87	C	2	0.0	5	NH4	0.78
JAN87	C	2	0.0	6	NH4	-4.77
JAN87	C	2	0.1	1	NH4	13.68
JAN87	C	2	8.4	2	NH4	19.68
JAN87	C	2	19.5	3	NH4	26.16
APR87	A	1	0.0	1	NH4	-854.45
APR87	A	1	0.0	2	NH4	-878.76
APR87	A	1	0.1	6	NH4	-2569.46
APR87	A	1	8.4	7	NH4	-516.84
APR87	A	1	19.5	5	NH4	486.12
APR87	C	1	0.0	1	NH4	37.18
APR87	C	1	0.0	2	NH4	-20.17
APR87	C	1	0.1	6	NH4	-43.56

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APR87   C    1    8.4    7    NH4      -21.41
APR87   C    1   19.5    5    NH4        8.11
APR87   C    2    0.0    1    NH4     -225.72
APR87   C    2    0.0    2    NH4        4.64
APR87   C    2    0.1    6    NH4      -13.01
APR87   C    2    8.4    7    NH4       17.29
APR87   C    2   19.5    5    NH4       86.62
JUL87   A    1    0.0    5    NH4       78.21
JUL87   A    1    0.0    6    NH4      -43.67
JUL87   A    1    4.7    1    NH4      270.70
JUL87   A    1    8.4    2    NH4       96.56
JUL87   A    1   13.9    3    NH4      173.86
JUL87   A    1   19.5    4    NH4      181.97
JUL87   A    2    0.0    5    NH4        8.85
JUL87   A    2    0.0    6    NH4      -17.36
JUL87   A    2    4.7    1    NH4       21.37
JUL87   A    2    8.4    2    NH4       64.36
JUL87   A    2   13.9    3    NH4       37.82
JUL87   A    2   19.5    4    NH4      144.37
JUL87   C    1    0.0    5    NH4      -67.23
JUL87   C    1    0.0    6    NH4      -83.11
JUL87   C    1    4.7    1    NH4       25.55
JUL87   C    1    8.4    2    NH4      154.31
JUL87   C    1   13.9    3    NH4      188.05
JUL87   C    1   19.5    4    NH4       -5.68
JUL87   C    2    0.0    5    NH4       65.92
JUL87   C    2    0.0    6    NH4     -114.26
JUL87   C    2    4.7    1    NH4       83.30
JUL87   C    2    8.4    2    NH4      127.47
JUL87   C    2   13.9    3    NH4       13.87
JUL87   C    2   19.5    4    NH4      185.60
NOV86   A    1    8.4    1    NO2       11.44
NOV86   A    1    8.4    2    NO2       52.09
NOV86   A    1   19.5    3    NO2       86.17
NOV86   A    1   19.5    4    NO2      114.78
NOV86   A    2    8.4    1    NO2       41.60
NOV86   A    2    8.4    2    NO2       75.07
NOV86   A    2   19.5    3    NO2       31.72
NOV86   A    2   19.5    4    NO2      269.37
NOV86   A    3    8.4    1    NO2       45.13
NOV86   A    3    8.4    2    NO2      -41.41
NOV86   A    3   19.5    3    NO2       60.03
NOV86   A    3   19.5    4    NO2       69.38
NOV86   C    1    8.4    1    NO2      -46.16
NOV86   C    1    8.4    2    NO2       13.75
NOV86   C    1   19.5    3    NO2       16.03
NOV86   C    1   19.5    4    NO2       17.21
NOV86   C    2    8.4    1    NO2        4.79
NOV86   C    2    8.4    2    NO2       10.90
NOV86   C    2   19.5    3    NO2       44.45
NOV86   C    2   19.5    4    NO2       27.17
NOV86   C    3    8.4    1    NO2       -2.05
NOV86   C    3    8.4    2    NO2       45.59
NOV86   C    3   19.5    3    NO2       -4.71
NOV86   C    3   19.5    4    NO2        7.64
JAN87   A    1    0.0    5    NO2       -0.09
JAN87   A    1    0.0    6    NO2       -4.07
JAN87   A    1    0.1    1    NO2       -4.26
JAN87   A    1    8.4    2    NO2       -3.34
JAN87   A    1   19.5    3    NO2        2.03
JAN87   A    2    0.0    5    NO2       15.71
JAN87   A    2    0.0    6    NO2       -9.31
JAN87   A    2    0.1    1    NO2      -34.80
JAN87   A    2    8.4    2    NO2       -5.11
JAN87   A    2   19.5    3    NO2       40.28
JAN87   C    1    0.0    5    NO2      -21.30
JAN87   C    1    0.0    6    NO2      -26.58
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JAN87   C    1     0.1    1    NO2      24.37
JAN87   C    1     8.4    2    NO2     -13.77
JAN87   C    1    19.5    3    NO2     -13.34
JAN87   C    2     0.0    5    NO2      -1.92
JAN87   C    2     0.0    6    NO2      -8.93
JAN87   C    2     0.1    1    NO2      10.49
JAN87   C    2     8.4    2    NO2      -7.83
JAN87   C    2    19.5    3    NO2      13.37
APR87   A    1     0.0    1    NO2     -13.51
APR87   A    1     0.0    2    NO2      18.86
APR87   A    1     0.1    6    NO2     -78.49
APR87   A    1     8.4    7    NO2     -42.32
APR87   A    1    19.5    5    NO2     -85.86
APR87   C    1     0.0    1    NO2       3.70
APR87   C    1     0.0    2    NO2       1.58
APR87   C    1     0.1    6    NO2      -9.19
APR87   C    1     8.4    7    NO2       0.72
APR87   C    1    19.5    5    NO2      -4.84
APR87   C    2     0.0    1    NO2     -31.93
APR87   C    2     0.0    2    NO2     -15.29
APR87   C    2     0.1    6    NO2      -1.23
APR87   C    2     8.4    7    NO2      14.82
APR87   C    2    19.5    5    NO2      31.72
JUL87   A    1     0.0    5    NO2       6.12
JUL87   A    1     0.0    6    NO2     -44.83
JUL87   A    1     4.7    1    NO2     -13.98
JUL87   A    1     8.4    2    NO2      -0.11
JUL87   A    1    13.9    3    NO2       4.08
JUL87   A    1    19.5    4    NO2      51.25
JUL87   A    2     0.0    5    NO2     -15.75
JUL87   A    2     0.0    6    NO2     -15.92
JUL87   A    2     4.7    1    NO2      -9.99
JUL87   A    2     8.4    2    NO2     -21.96
JUL87   A    2    13.9    3    NO2      12.75
JUL87   A    2    19.5    4    NO2      43.90
JUL87   C    1     0.0    5    NO2     -29.50
JUL87   C    1     0.0    6    NO2     -36.02
JUL87   C    1     4.7    1    NO2      13.28
JUL87   C    1     8.4    2    NO2      50.40
JUL87   C    1    13.9    3    NO2      81.72
JUL87   C    1    19.5    4    NO2       7.98
JUL87   C    2     0.0    5    NO2      67.44
JUL87   C    2     0.0    6    NO2     -25.65
JUL87   C    2     4.7    1    NO2       9.12
JUL87   C    2     8.4    2    NO2      57.27
JUL87   C    2    13.9    3    NO2       8.17
JUL87   C    2    19.5    4    NO2      60.22
NOV86   A    1     8.4    1    NO3      31.19
NOV86   A    1     8.4    2    NO3     -25.61
NOV86   A    1    19.5    3    NO3     -31.19
NOV86   A    1    19.5    4    NO3     -33.28
NOV86   A    2     8.4    1    NO3     367.43
NOV86   A    2     8.4    2    NO3     -33.24
NOV86   A    2    19.5    3    NO3     -70.36
NOV86   A    2    19.5    4    NO3    -174.39
NOV86   A    3     8.4    1    NO3    -223.94
NOV86   A    3     8.4    2    NO3    -192.44
NOV86   A    3    19.5    3    NO3    -235.41
NOV86   A    3    19.5    4    NO3     -81.50
NOV86   C    1     8.4    1    NO3     141.52
NOV86   C    1     8.4    2    NO3    -137.99
NOV86   C    1    19.5    3    NO3     176.55
NOV86   C    1    19.5    4    NO3     -46.92
NOV86   C    2     8.4    1    NO3     -20.29
NOV86   C    2     8.4    2    NO3     -60.45
NOV86   C    2    19.5    3    NO3     -49.28
NOV86   C    2    19.5    4    NO3      16.38
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NOV86   C     3     8.4     1     NO3          54.56
NOV86   C     3     8.4     2     NO3          55.74
NOV86   C     3    19.5     3     NO3          69.41
NOV86   C     3    19.5     4     NO3          60.18
JAN87   A     1     0.0     5     NO3        1409.22
JAN87   A     1     0.0     6     NO3        1447.26
JAN87   A     1     0.1     1     NO3        1248.78
JAN87   A     1     8.4     2     NO3        1248.80
JAN87   A     1    19.5     3     NO3         231.68
JAN87   A     2     0.0     5     NO3          83.24
JAN87   A     2     0.0     6     NO3          20.67
JAN87   A     2     0.1     1     NO3        -339.70
JAN87   A     2     8.4     2     NO3        -146.81
JAN87   A     2    19.5     3     NO3        -159.06
JAN87   C     1     0.0     5     NO3           7.56
JAN87   C     1     0.0     6     NO3           5.66
JAN87   C     1     0.1     1     NO3        -248.04
JAN87   C     1     8.4     2     NO3           7.69
JAN87   C     1    19.5     3     NO3          13.43
JAN87   C     2     0.0     5     NO3         -20.78
JAN87   C     2     0.0     6     NO3         -18.29
JAN87   C     2     0.1     1     NO3         -96.08
JAN87   C     2     8.4     2     NO3          -7.29
JAN87   C     2    19.5     3     NO3         -30.03
APR87   A     1     0.0     1     NO3        1630.21
APR87   A     1     0.0     2     NO3        1122.51
APR87   A     1     0.1     6     NO3         781.84
APR87   A     1     8.4     7     NO3         692.27
APR87   A     1    19.5     5     NO3        1061.81
APR87   C     1     0.0     1     NO3         -50.68
APR87   C     1     0.0     2     NO3         -48.86
APR87   C     1     0.1     6     NO3         -74.69
APR87   C     1     8.4     7     NO3        -106.15
APR87   C     1    19.5     5     NO3         -75.23
APR87   C     2     0.0     1     NO3         -31.76
APR87   C     2     0.0     2     NO3          55.32
APR87   C     2     0.1     6     NO3          -1.33
APR87   C     2     8.4     7     NO3         -11.97
APR87   C     2    19.5     5     NO3          -8.17
JUL87   A     1     0.0     5     NO3         -12.20
JUL87   A     1     0.0     6     NO3         -19.17
JUL87   A     1     4.7     1     NO3          11.44
JUL87   A     1     8.4     2     NO3         -13.09
JUL87   A     1    13.9     3     NO3           9.76
JUL87   A     1    19.5     4     NO3         -64.19
JUL87   A     2     0.0     5     NO3         196.52
JUL87   A     2     0.0     6     NO3         188.64
JUL87   A     2     4.7     1     NO3          96.71
JUL87   A     2     8.4     2     NO3          79.08
JUL87   A     2    13.9     3     NO3          59.14
JUL87   A     2    19.5     4     NO3          26.65
JUL87   C     1     0.0     5     NO3          26.18
JUL87   C     1     0.0     6     NO3          20.38
JUL87   C     1     4.7     1     NO3          26.23
JUL87   C     1     8.4     2     NO3          53.36
JUL87   C     1    13.9     3     NO3         -25.23
JUL87   C     1    19.5     4     NO3          -6.88
JUL87   C     2     0.0     5     NO3         -29.63
JUL87   C     2     0.0     6     NO3         -11.49
JUL87   C     2     4.7     1     NO3           6.17
JUL87   C     2     8.4     2     NO3         -16.24
JUL87   C     2    13.9     3     NO3          -1.80
JUL87   C     2    19.5     4     NO3          25.74
NOV86   A     1     8.4     1     PO4          18.69
NOV86   A     1     8.4     2     PO4          36.17
NOV86   A     1    19.5     3     PO4         138.90
NOV86   A     1    19.5     4     PO4         192.51
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NOV86   A    2    8.4    1    P04     248.40
NOV86   A    2    8.4    2    P04     391.63
NOV86   A    2   19.5    3    P04     484.22
NOV86   A    2   19.5    4    P04    1662.20
NOV86   A    3    8.4    1    P04    -192.44
NOV86   A    3    8.4    2    P04     -59.84
NOV86   A    3   19.5    3    P04      73.63
NOV86   A    3   19.5    4    P04      67.74
NOV86   C    1    8.4    1    P04       5.32
NOV86   C    1    8.4    2    P04       1.29
NOV86   C    1   19.5    3    P04     -10.30
NOV86   C    1   19.5    4    P04      73.86
NOV86   C    2    8.4    1    P04     -23.21
NOV86   C    2    8.4    2    P04      30.36
NOV86   C    2   19.5    3    P04      69.49
NOV86   C    2   19.5    4    P04       3.57
NOV86   C    3    8.4    1    P04     185.29
NOV86   C    3    8.4    2    P04     133.11
NOV86   C    3   19.5    3    P04      80.24
NOV86   C    3   19.5    4    P04      58.85
JAN87   A    1    0.0    5    P04     -21.49
JAN87   A    1    0.0    6    P04     -15.35
JAN87   A    1    0.1    1    P04     -24.77
JAN87   A    1    8.4    2    P04     -23.21
JAN87   A    1   19.5    3    P04     -58.43
JAN87   A    2    0.0    5    P04      -3.44
JAN87   A    2    0.0    6    P04     -10.20
JAN87   A    2    0.1    1    P04     -24.64
JAN87   A    2    8.4    2    P04      -2.66
JAN87   A    2   19.5    3    P04      39.02
JAN87   C    1    0.0    5    P04       4.73
JAN87   C    1    0.0    6    P04       3.27
JAN87   C    1    0.1    1    P04      22.85
JAN87   C    1    8.4    2    P04       6.46
JAN87   C    1   19.5    3    P04      26.77
JAN87   C    2    0.0    5    P04       1.73
JAN87   C    2    0.0    6    P04      -0.80
JAN87   C    2    0.1    1    P04      16.09
JAN87   C    2    8.4    2    P04       7.29
JAN87   C    2   19.5    3    P04      17.12
APR87   A    1    0.0    1    P04     -14.00
APR87   A    1    0.0    2    P04       1.27
APR87   A    1    0.1    6    P04     -53.27
APR87   A    1    8.4    7    P04     -39.08
APR87   A    1   19.5    5    P04     -73.71
APR87   C    1    0.0    1    P04       8.72
APR87   C    1    0.0    2    P04      10.49
APR87   C    1    0.1    6    P04      17.53
APR87   C    1    8.4    7    P04      19.30
APR87   C    1   19.5    5    P04      15.73
APR87   C    2    0.0    1    P04      10.98
APR87   C    2    0.0    2    P04      10.35
APR87   C    2    0.1    6    P04      -1.90
APR87   C    2    8.4    7    P04      -1.90
APR87   C    2   19.5    5    P04      -1.90
JUL87   A    1    0.0    5    P04      13.70
JUL87   A    1    0.0    6    P04     -41.11
JUL87   A    1    4.7    1    P04       8.19
JUL87   A    1    8.4    2    P04       8.21
JUL87   A    1   13.9    3    P04       1.60
JUL87   A    1   19.5    4    P04      65.79
JUL87   A    2    0.0    5    P04      -0.68
JUL87   A    2    0.0    6    P04       1.58
JUL87   A    2    4.7    1    P04      16.83
JUL87   A    2    8.4    2    P04       9.33
JUL87   A    2   13.9    3    P04      36.59
JUL87   A    2   19.5    4    P04      46.14
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JUL87   C    1    0.0    5    PO4        14.30
JUL87   C    1    0.0    6    PO4       -20.52
JUL87   C    1    4.7    1    PO4        19.00
JUL87   C    1    8.4    2    PO4        65.77
JUL87   C    1   13.9    3    PO4        93.20
JUL87   C    1   19.5    4    PO4        11.17
JUL87   C    2    0.0    5    PO4        49.39
JUL87   C    2    0.0    6    PO4       -40.75
JUL87   C    2    4.7    1    PO4       -32.29
JUL87   C    2    8.4    2    PO4        33.24
JUL87   C    2   13.9    3    PO4         0.38
JUL87   C    2   19.5    4    PO4        65.92
NOV86   A    1    8.4    1    SIO4      370.74
NOV86   A    1    8.4    2    SIO4     -255.28
NOV86   A    1   19.5    3    SIO4     -187.95
NOV86   A    1   19.5    4    SIO4      -10.18
NOV86   A    2    8.4    1    SIO4     -510.10
NOV86   A    2    8.4    2    SIO4     -487.53
NOV86   A    2   19.5    3    SIO4    -1026.35
NOV86   A    2   19.5    4    SIO4    -2194.11
NOV86   A    3    8.4    1    SIO4     1119.96
NOV86   A    3    8.4    2    SIO4     1640.36
NOV86   A    3   19.5    3    SIO4      664.46
NOV86   A    3   19.5    4    SIO4     1242.23
NOV86   C    1    8.4    1    SIO4      155.20
NOV86   C    1    8.4    2    SIO4     -259.68
NOV86   C    1   19.5    3    SIO4      511.92
NOV86   C    1   19.5    4    SIO4     -214.09
NOV86   C    2    8.4    1    SIO4       95.63
NOV86   C    2    8.4    2    SIO4      -11.28
NOV86   C    2   19.5    3    SIO4      -65.99
NOV86   C    2   19.5    4    SIO4      -79.52
NOV86   C    3    8.4    1    SIO4      -90.08
NOV86   C    3    8.4    2    SIO4      169.78
NOV86   C    3   19.5    3    SIO4       71.16
NOV86   C    3   19.5    4    SIO4      -63.18
JAN87   A    1    0.0    5    SIO4     -128.27
JAN87   A    1    0.0    6    SIO4     -118.46
JAN87   A    1    0.1    1    SIO4     -167.42
JAN87   A    1    8.4    2    SIO4     -157.61
JAN87   A    1   19.5    3    SIO4     -147.81
JAN87   A    2    0.0    5    SIO4       -5.85
JAN87   A    2    0.0    6    SIO4       -5.85
JAN87   A    2    0.1    1    SIO4       -5.76
JAN87   A    2    8.4    2    SIO4       -5.22
JAN87   A    2   19.5    3    SIO4       23.95
JAN87   C    1    0.0    5    SIO4     -352.27
JAN87   C    1    0.0    6    SIO4     -350.89
JAN87   C    1    0.1    1    SIO4     -408.77
JAN87   C    1    8.4    2    SIO4     -227.07
JAN87   C    1   19.5    3    SIO4     -302.60
JAN87   C    2    0.0    5    SIO4     -397.77
JAN87   C    2    0.0    6    SIO4     -343.48
JAN87   C    2    0.1    1    SIO4     -308.47
JAN87   C    2    8.4    2    SIO4     -346.97
JAN87   C    2   19.5    3    SIO4     -298.85
APR87   A    1    0.0    1    SIO4   -11546.87
APR87   A    1    0.0    2    SIO4   -10873.01
APR87   A    1    0.1    6    SIO4   -12903.73
APR87   A    1    8.4    7    SIO4   -12101.40
APR87   A    1   19.5    5    SIO4   -12652.31
APR87   C    1    0.0    1    SIO4      327.48
APR87   C    1    0.0    2    SIO4      194.77
APR87   C    1    0.1    6    SIO4      147.01
APR87   C    1    8.4    7    SIO4     -300.58
APR87   C    1   19.5    5    SIO4      251.88
APR87   C    2    0.0    1    SIO4      -49.90
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APR87   C     2     0.0     2     SI04       -19.91
APR87   C     2     0.1     6     SI04       -41.70
APR87   C     2     8.4     7     SI04       177.24
APR87   C     2    19.5     5     SI04       153.87
JUL87   A     1     0.0     5     SI04     -3661.78
JUL87   A     1     0.0     6     SI04     -3323.08
JUL87   A     1     4.7     1     SI04     -3568.51
JUL87   A     1     8.4     2     SI04     -5310.69
JUL87   A     1    13.9     3     SI04     -3611.25
JUL87   A     1    19.5     4     SI04     -3528.81
JUL87   A     2     0.0     5     SI04       -34.76
JUL87   A     2     0.0     6     SI04      -104.48
JUL87   A     2     4.7     1     SI04        41.98
JUL87   A     2     8.4     2     SI04      -348.97
JUL87   A     2    13.9     3     SI04        10.83
JUL87   A     2    19.5     4     SI04      -206.87
JUL87   C     1     0.0     5     SI04      -143.61
JUL87   C     1     0.0     6     SI04      -354.97
JUL87   C     1     4.7     1     SI04      -204.44
JUL87   C     1     8.4     2     SI04      -224.44
JUL87   C     1    13.9     3     SI04      -175.79
JUL87   C     1    19.5     4     SI04      -257.19
JUL87   C     2     0.0     5     SI04      -293.21
JUL87   C     2     0.0     6     SI04      -296.63
JUL87   C     2     4.7     1     SI04        27.74
JUL87   C     2     8.4     2     SI04       -11.97
JUL87   C     2    13.9     3     SI04      -286.18
JUL87   C     2    19.5     4     SI04      -289.70
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N1OXFLUX.DAT NIPS-1 Oxygen flux data vs. current flow.

(mmolm/m^2/h). Chambers were set at different
current speeds (FLOW).

DATE STATION DEPLOY CHAMBER FLOW FLUX

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DATE  S D C FLOW  FLUX
JAN87 A 1 1 0.1  -0.57
JAN87 A 1 2 8.4  -4.33
JAN87 A 1 3 19.5 -5.37
JAN87 A 1 5 0    -0.90
JAN87 A 1 6 0    -1.34
JAN87 A 2 1 0.1  -9.86
JAN87 A 2 2 8.4   2.09
JAN87 A 2 3 19.5 -4.48
JAN87 A 2 5 0     0.60
JAN87 A 2 6 0    -3.79
JAN87 C 1 1 0.1  -2.90
JAN87 C 1 2 8.4  -2.03
JAN87 C 1 3 19.5  1.67
JAN87 C 1 5 0    -1.76
JAN87 C 1 6 0     5.32
JAN87 C 2 1 0.1  -9.47
JAN87 C 2 2 8.4   6.21
JAN87 C 2 3 19.5  5.08
JAN87 C 2 5 0    -3.76
JAN87 C 2 6 0     2.12
APR87 A 1 5 19.5 -1.97
APR87 A 1 6 0.1  -2.16
APR87 A 2 5 19.5 -2.01
APR87 A 2 6 0.1  -1.14
APR87 A 2 7 8.4  -1.26
JUL87 A 1 1 4.7  -3.69
JUL87 A 1 2 8.4  -1.20
JUL87 A 1 3 13.9 -1.71
JUL87 A 1 4 19.5 -1.44
JUL87 A 2 1 4.7  -2.22
JUL87 A 2 2 8.4  -3.45
JUL87 A 2 3 13.9 -1.76
JUL87 A 2 4 19.5 -1.26
JUL87 A 2 9 19.5 -2.59
JUL87 C 1 1 4.7   0.13
JUL87 C 1 2 8.4  -0.86
JUL87 C 1 3 13.9 -2.52
JUL87 C 1 4 19.5 -1.65
JUL87 C 2 1 4.7  -1.49
JUL87 C 2 2 8.4  -1.95
JUL87 C 2 3 13.9 -2.06
JUL87 C 2 4 19.5 -2.11
JUL87 C 2 9 19.5 -11.79
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N1CHLJTU.DAT NIPS-1 Chlorophyll and turbidity data from chambers.

Chlorophyll (CHLO) and Phaeophytin (PHAE) and turbidity (JTU).
From San Antonio bay chamber experiments. These are final concentrations in chambers after the incubation period in HR. Pigment concentrations in ug/l. On each date and station the chambers were deploy up to three times in one day (DEPLOY=1,2, OR 3). Current speed was set in chamber (FLOW in cm/sec) Sometimes more than one sample was withdrawn from a chamber (REP).

DATE	STA	DEPLOY	CHAMBER	FLOW	HR	REP	CHLO	PHAE	JTU
NOV86	A	1	1	8.4	1.5	1	9.86	3.24	29
NOV86	A	1	2	8.4	1.5	1	8.21	5.76	63
NOV86	A	1	3	19.5	1.5	1	11.56	18.47	320
NOV86	A	1	4	19.5	1.5	1	13.47	21.73	270
NOV86	A	2	1	8.4	1.5	1	17.08	10.57	78
NOV86	A	2	2	8.4	1.5	1	16.82	14.49	91
NOV86	A	2	3	19.5	1.5	1	27.44	31.00	390
NOV86	A	2	4	19.5	1.5	1	21.83	35.35	340
NOV86	A	3	1	8.4	1.5	1	5.52	5.43	54
NOV86	A	3	2	8.4	1.5	1	6.50	7.07	67
NOV86	A	3	3	19.5	1.5	1	10.58	25.66	470
NOV86	A	3	4	19.5	1.5	1	8.34	20.18	240
NOV86	C	1	1	8.4	1.5	1	10.51	8.22	52
NOV86	C	1	1	8.4	1.5	2	10.77	7.79	52
NOV86	C	1	2	8.4	1.5	1	10.77	9.54	57
NOV86	C	1	2	8.4	1.5	2	10.25	9.75	57
NOV86	C	1	3	19.5	1.5	1	28.91	20.50	135
NOV86	C	1	3	19.5	1.5	2	26.41	19.98	135
NOV86	C	1	4	19.5	1.5	1	25.49	22.17	175
NOV86	C	1	4	19.5	1.5	2	25.89	22.10	175
NOV86	C	2	1	8.4	1.5	1	15.24	5.07	22
NOV86	C	2	1	8.4	1.5	2	16.16	4.79	22
NOV86	C	2	2	8.4	1.5	1	20.76	13.87	77
NOV86	C	2	2	8.4	1.5	2	21.81	14.25	77
NOV86	C	2	3	19.5	1.5	1	53.23	32.96	188
NOV86	C	2	3	19.5	1.5	2	56.55	32.15	188
NOV86	C	2	4	19.5	1.5	1	44.08	20.48	125
NOV86	C	2	4	19.5	1.5	2	42.83	21.72	125
NOV86	C	3	1	8.4	1.5	1	15.39	39.61	561
NOV86	C	3	1	8.4	1.5	2	24.53	40.52	561
NOV86	C	3	2	8.4	1.5	1	18.71	57.92	611
NOV86	C	3	2	8.4	1.5	2	21.21	66.49	611
NOV86	C	3	3	19.5	1.5	1	35.34	51.85	488
NOV86	C	3	3	19.5	1.5	2	42.41	57.36	488
NOV86	C	3	4	19.5	1.5	1	91.90	132.15	949
NOV86	C	3	4	19.5	1.5	2	69.44	90.71	949
JAN87	A	1	1	0.1	3.0	1	2.00	1.70	41
JAN87	A	1	1	0.1	3.0	2	1.97	1.75	41
JAN87	A	1	2	8.4	3.0	1	1.45	1.27	34
JAN87	A	1	2	8.4	3.0	2	1.43	1.36	34
JAN87	A	1	3	19.5	3.0	1	4.91	14.21	370
JAN87	A	1	3	19.5	3.0	2	4.45	13.92	370
JAN87	A	1	4	8.4	3.0	1	2.89	1.94	41
JAN87	A	1	4	8.4	3.0	2	2.83	1.97	41
JAN87	A	1	5	0.0	3.0	1	1.55	1.63	30
JAN87	A	1	5	0.0	3.0	2	1.52	1.38	30
JAN87	A	1	6	0.0	3.0	1	1.55	1.26	31
JAN87	A	1	6	0.0	3.0	2	1.64	1.19	31
JAN87	A	1	7	0.0	3.0	1	1.67	0.79	21
JAN87	A	1	7	0.0	3.0	2	1.55	0.99	21
JAN87	A	1	8	0.0	3.0	1	1.66	1.00	25
JAN87	A	1	8	0.0	3.0	2	1.43	1.38	25
JAN87	A	2	1	0.1	3.0	1	3.66	3.03	67
JAN87	A	2	1	0.1	3.0	2	3 49	3.30	67

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JAN87   A   2   2    8.4  3.0  1   4.20   1.23   31
JAN87   A   2   2    8.4  3.0  2   4.24   2.30   31
JAN87   A   2   3   19.5  3.0  1   9.33  24.34  620
JAN87   A   2   3   19.5  3.0  2   7.75  24.97  620
JAN87   A   2   4    8.4  3.0  1   4.91   2.49   46
JAN87   A   2   4    8.4  3.0  2   4.87   2.43   46
JAN87   A   2   5    0.0  3.0  1   2.12   1.35   27
JAN87   A   2   5    0.0  3.0  2   2.04   1.43   27
JAN87   A   2   6    0.0  3.0  1   2.08   1.29   25
JAN87   A   2   6    0.0  3.0  2   2.04   2.04   25
JAN87   A   2   7    0.0  3.0  1   3.70   1.33   25
JAN87   A   2   7    0.0  3.0  2   3.08   2.11   25
JAN87   A   2   8    0.0  3.0  1   3.53   1.09   22
JAN87   A   2   8    0.0  3.0  2   3.66   1.17   22
JAN87   C   1   1    0.1  3.0  1  14.32   6.47   64
JAN87   C   1   1    0.1  3.0  2  13.14   5.75   64
JAN87   C   1   2    8.4  3.0  1  10.64   2.68   26
JAN87   C   1   2    8.4  3.0  2  14.59   4.62   26
JAN87   C   1   3   19.5  3.0  1  28.91  19.39  150
JAN87   C   1   3   19.5  3.0  2  24.70  15.33  150
JAN87   C   1   4    8.4  3.0  1  19.05   5.24   27
JAN87   C   1   4    8.4  3.0  2  19.18   4.63   27
JAN87   C   1   5    0.0  3.0  1   5.78   3.25   12
JAN87   C   1   5    0.0  3.0  2   6.83   3.47   12
JAN87   C   1   6    0.0  3.0  1   6.18   2.69   10
JAN87   C   1   6    0.0  3.0  2   6.83   2.83   10
JAN87   C   1   7    0.0  3.0  1  11.56   4.14   12
JAN87   C   1   7    0.0  3.0  2  13.14   3.68   12
JAN87   C   1   8    0.0  3.0  1  11.30   3.77   14
JAN87   C   1   8    0.0  3.0  2   9.46   3.86   14
JAN87   C   2   1    0.1  3.0  1   7.75   4.77   36
JAN87   C   2   1    0.1  3.0  2   8.41   3.80   36
JAN87   C   2   2    8.4  3.0  1  10.25   4.50   49
JAN87   C   2   2    8.4  3.0  2  10.77   4.45   49
JAN87   C   2   3   19.5  3.0  1  18.53  15.78  200
JAN87   C   2   3   19.5  3.0  2  18.26  15.09  200
JAN87   C   2   4    8.4  3.0  1  12.22   6.35   34
JAN87   C   2   4    8.4  3.0  2  13.14   5.59   34
JAN87   C   2   5    0.0  3.0  1   4.16   1.98   15
JAN87   C   2   5    0.0  3.0  2   4.12   2.12   15
JAN87   C   2   6    0.0  3.0  1   3.83   2.11   12
JAN87   C   2   6    0.0  3.0  2   4.28   2.56   12
JAN87   C   2   7    0.0  3.0  1   9.23   2.89   19
JAN87   C   2   7    0.0  3.0  2   8.32   4.06   19
JAN87   C   2   8    0.0  3.0  1   7.86   3.51   19
JAN87   C   2   8    0.0  3.0  2   8.19   4.19   19
APR87   A   1   1    0.0  3.0  1   8.73   5.51   62
APR87   A   1   1    0.0  3.0  2   9.72   4.37   62
APR87   A   1   2    0.0  3.0  1   7.07   3.12   26
APR87   A   1   2    0.0  3.0  2   6.31   1.41   26
APR87   A   1   3    0.0  3.0  1   4.37   2.30   13
APR87   A   1   3    0.0  3.0  2   4.00   1.60   13
APR87   A   1   4    0.0  3.0  1   3.79   2.31   22
APR87   A   1   4    0.0  3.0  2   3.64   1.58   22
APR87   A   1   5   19.5  3.0  1  13.88  13.48   50
APR87   A   1   5   19.5  3.0  2  14.24  12.99   50
APR87   A   1   6    0.1  3.0  1   5.09   2.64   49
APR87   A   1   6    0.1  3.0  2   5.56   1.80   49
APR87   A   1   7    8.4  3.0  1   6.19   2.37   23
APR87   A   1   7    8.4  3.0  2   6.08   2.09   23
APR87   A   1   8    0.0  3.0  1   8.47   4.17   42
APR87   A   1   8    0.0  3.0  2  10.60   4.74   42
APR87   A   2   1    0.0  3.0  1   6.97   2.53   28
APR87   A   2   1    0.0  3.0  2   6.91   1.89   28
APR87   A   2   2    0.0  3.0  1   8.06   2.45   24
APR87   A   2   2    0.0  3.0  2   7.80   1.95   24
APR87   A   2   3    0.0  3.0  1   2.96   2.45   22
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APR87    A    2    3     0.0   3.0   2    3.69    1.34    22
APR87    A    2    4     0.0   3.0   1    2.96    1.88    25
APR87    A    2    4     0.0   3.0   2    2.91    1.43    25
APR87    A    2    5    19.5   3.0   1   11.18    8.89    60
APR87    A    2    5    19.5   3.0   2   10.50    8.62    60
APR87    A    2    6     0.1   3.0   1    8.73    3.78    43
APR87    A    2    6     0.1   3.0   2   10.81    3.59    43
APR87    A    2    7     8.4   3.0   1   10.34    4.31    52
APR87    A    2    7     8.4   3.0   2   10.19    4.21    52
APR87    A    2    8     0.0   3.0   1    7.28    3.73    35
APR87    A    2    8     0.0   3.0   2    7.33    3.11    35
APR87    C    1    1     0.0   3.0   1    7.95    2.61     8
APR87    C    1    1     0.0   3.0   2    8.32    2.15     8
APR87    C    1    2     0.0   3.0   1    7.73    2.23     8
APR87    C    1    2     0.0   3.0   2    8.57    2.00     8
APR87    C    1    3     0.0   3.0   1    7.48    2.23     8
APR87    C    1    3     0.0   3.0   2    7.69    2.32     8
APR87    C    1    4     0.0   3.0   1    5.28    2.27    10
APR87    C    1    4     0.0   3.0   2    5.32    2.33    10
APR87    C    1    5    19.5   3.0   1   14.85   15.33   100
APR87    C    1    5    19.5   3.0   2   14.45   15.40   100
APR87    C    1    6     0.1   3.0   1    5.95    1.50     5
APR87    C    1    6     0.1   3.0   2    4.37    1.27     5
APR87    C    1    7     8.4   3.0   1   12.64    4.47    12
APR87    C    1    7     8.4   3.0   2   11.35    4.50    12
APR87    C    1    8     0.0   3.0   1    9.36    3.88    17
APR87    C    1    8     0.0   3.0   2    9.31    3.67    17
APR87    C    2    1     0.0   3.0   1    9.90    5.20    30
APR87    C    2    1     0.0   3.0   2    9.15    4.89    30
APR87    C    2    2     0.0   3.0   1    7.24    3.03     7
APR87    C    2    2     0.0   3.0   2    8.07    2.80     7
APR87    C    2    3     0.0   3.0   1    3.62    3.43    46
APR87    C    2    3     0.0   3.0   2    3.78    3.36    46
APR87    C    2    4     0.0   3.0   1   12.14    4.21     9
APR87    C    2    4     0.0   3.0   2   11.93    3.97     9
APR87    C    2    5    19.5   2.0   1   13.67   19.69   140
APR87    C    2    5    19.5   2.0   2   14.19   19.64   140
APR87    C    2    6     0.1   2.0   1    5.07    2.22     7
APR87    C    2    6     0.1   2.0   2    5.61    2.03     7
APR87    C    2    7     8.4   2.0   1    9.02    3.56    13
APR87    C    2    7     8.4   2.0   2    9.44    4.10    13
APR87    C    2    8     0.0   2.0   1    9.02    3.40     9
APR87    C    2    8     0.0   2.0   2    9.40    3.63     9
JUL87    A    1    1     4.7   3.0   1   10.06    5.53    15
JUL87    A    1    1     4.7   3.0   2    9.72    6.44    15
JUL87    A    1    2     8.4   3.0   1   18.23   10.37    34
JUL87    A    1    2     8.4   3.0   2   18.71   11.06    34
JUL87    A    1    3    13.9   3.0   1   17.46   16.41    65
JUL87    A    1    3    13.9   3.0   2   17.26   17.04    65
JUL87    A    1    4    19.5   3.0   1   22.56   25.34   100
JUL87    A    1    4    19.5   3.0   2   24.09   27.78   100
JUL87    A    1    5     0.0   3.0   1   10.51    4.79    14
JUL87    A    1    5     0.0   3.0   2   10.29    5.54    14
JUL87    A    1    6     0.0   3.0   1   12.70    4.98    14
JUL87    A    1    6     0.0   3.0   2   12.48    6.26    14
JUL87    A    1    7     0.0   3.0   1   11.61    5.55    13
JUL87    A    1    7     0.0   3.0   2   11.39    6.03    13
JUL87    A    1    8     0.0   3.0   1   10.51    5.32    12
JUL87    A    1    8     0.0   3.0   2   10.51    6.64    12
JUL87    A    2    1     4.7   3.0   1     .       .      18
JUL87    A    2    2     8.4   3.0   1     .       .      39
JUL87    A    2    3    13.9   3.0   1     .       .      78
JUL87    A    2    4    19.5   3.0   1     .       .      87
JUL87    A    2    5     0.0   3.0   1     .       .      12
JUL87    A    2    6     0.0   3.0   1     .       .      11
JUL87    A    2    7     0.0   2.0   1     .       .      13
JUL87    A    2    8     0.0   2.0   1     .       .      12
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JUL87     C        1        1         4.7   3.0    1         .         .        24
JUL87     C        1        2         8.4   3.0    1         .         .        37
JUL87     C        1        3        13.9   3.0    1         .         .        70
JUL87     C        1        4        19.5   3.0    1         .         .        60
JUL87     C        1        5         0.0   3.0    1         .         .        20
JUL87     C        1        6         0.0   3.0    1         .         .        15
JUL87     C        2        1         4.7   2.0    1         .         .        36
JUL87     C        2        2         8.4   2.0    1         .         .        53
JUL87     C        2        3        13.9   2.0    1         .         .       102
JUL87     C        2        4        19.5   2.0    1         .         .       136
JUL87     C        2        5         0.0   2.0    1         .         .        18
JUL87     C        2        6         0.0   2.0    1         .         .         .
JUL87     C        2        7         0.0   2.0    1         .         .        14
JUL87     C        2        8         0.0   2.0    1         .         .        16
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N1SSFLUX.DAT NIPS-1 Sediment resuspension in chambers.

(FLUX in g/m^2/h) from San Antonio Bay chamber experiments. This was performed in July 1987 at stations A and C only. On each date and station the chambers were deployed two times in one day (D=A for AM, or D=P for PM). Current speed was set in chamber (FLOW in cm/sec).

STA	D	FLOW	FLUX
A	A	0.0	-2.0188
A	A	4.7	-1.4250
A	A	8.4	-2.0188
A	A	13.9	9.3812
A	A	19.5	16.8625
A	P	0.0	-2.6719
A	P	4.7	-2.1375
A	P	8.4	-1.9594
A	P	13.9	14.9625
A	P	19.5	17.6344
C	A	0.0	-3.5625
C	A	4.7	-1.9594
C	A	8.4	-2.3156
C	A	13.9	6.5313
C	A	19.5	3.5031
C	P	0.0	-12.0234
C	P	4.7	-4.8984
C	P	8.4	-1.7812
C	P	13.9	10.6875
C	P	19.5	21.8203

N1SEDCHN.DAT NIPS-1 San Antonio Bay Sediment CHN data.

Cores (REP) were sectioned every
cm (Z), so Z=3 is the 2-3 cm section. %N and %C. Cores were acid
washed to take away carbonate, so C is Organic Carbon.

DATE	STA	REP	Z	N	C
JAN87	A	1	1	0.14	1.25
JAN87	A	1	2	0.114	1.084
JAN87	A	1	3	0.121	1.119
JAN87	A	1	4	0.112	1.083
JAN87	A	1	5	0.123	1.140
JAN87	A	1	6	0.127	1.161
JAN87	A	1	7	0.112	1.094
JAN87	A	1	8	0.123	1.137
JAN87	A	1	9	0.111	1.105
JAN87	A	1	10	0.115	1.091
JAN87	B	1	1	0.11	1.067
JAN87	B	1	2	0.110	1.590
JAN87	B	1	3	0.101	1.345
JAN87	B	1	4	0.083	1.266
JAN87	B	1	5	0.097	1.710
JAN87	B	1	6	0.079	1.988
JAN87	B	1	7	0.091	1.177
JAN87	B	1	7	0.081	0.899
JAN87	B	1	8	0.078	0.717
JAN87	B	1	9	0.096	1.762
JAN87	B	1	9	0.086	0.970
JAN87	B	1	10	0.097	0.982
JAN87	C	1	1	0.069	0.672
JAN87	C	1	2	0.087	0.753
JAN87	C	1	3	0.095	0.803
JAN87	C	1	4	0.092	0.844
JAN87	C	1	5	0.071	0.745
JAN87	C	1	6	0.088	0.889
JAN87	C	1	7	0.072	0.850
JAN87	C	1	8	0.075	0.843
JAN87	C	1	9	0.076	0.691
JAN87	C	1	10	0.071	0.732
JAN87	D	1	1	0.150	1.212
JAN87	D	1	1	0.14	1.11
JAN87	D	1	2	0.080	0.704
JAN87	D	1	3	0.14	0.88
JAN87	D	1	3	0.13	0.88
JAN87	D	1	4	0.09	0.80
JAN87	D	1	5	0.082	0.748
JAN87	D	1	5	0.09	0.85
JAN87	D	1	6	0.062	0.574
JAN87	D	1	7	0.078	0.700
JAN87	D	1	8	0.06	0.39
JAN87	D	1	9	0.047	0.414
JAN87	D	1	10	0.064	0.299
MAR87	C	1	1	0.057	0.539
APR87	B	1	1	0.13	1.10
APR87	C	1	1	0.07	0.61
APR87	D	1	1	0.087	0.796
JUN87	A	1	1	0.16	1.18
JUN87	B	1	1	0.084	0.771
JUN87	C	1	1	0.073	0.647
JUN87	D	1	1	0.05	0.31

N1MACCHN.DAT NIPS-1 San Antonio Bay Macrofauna CHN data.

Animals were extracted and grouped together. Jan 1987. %N and %C of dry weight. Cores were acid washed to take away carbonate, so C is Organic Carbon.

POLY=polychaete, NEMERT=nemertinea, MOLL=mollusk, CRUS=crustacea,
OPHI=ophiuroid pieces

id	taxa	mon	sta	n%	c%
1	POLY	JAN	A	9.411	41.742
42	NEMERT	JAN	B	10.491	44.211
28	MOLL	JAN	B	8.928	39.274
27	CRUS	JAN	B	9.017	41.778
53	POLY	JAN	B	6.781	28.831
94	MOLL	JAN	D	9.587	41.086
81	POLY	JAN	D	8.777	41.245
75	OPHI	JAN	C	3.495	20.820
67	MOLL	JAN	C	1.872	36.688
76	POLY	JAN	C	8.255	38.109
162	MOLL	APR	C	10.317	42.683
154	CRUS	APR	C	10.336	45.557
166	POLY	APR	C	7.488	32.696
189	PHORONID	APR	D	10.263	47.756
194	MOLL	APR	D	9.980	41.056
193	POLY	APR	D	6.292	30.832
142	MOLL	APR	B	11.134	48.093
144	POLY	APR	B	8.879	40.692
126	CRUS	APR	B	8.282	43.563
118	NEMERT	APR	B	8.587	42.865
112	OTHER	APR	A	9.036	47.681
102	MOLL	APR	A	1.297	31.237
105	MOLL	APR	A	8.919	40.905
98	MOLL	APR	A	7.941	37.656
121	POLY	APR	A	8.170	35.909
111	MOLL	APR	A	14.554	39.243

SEDGRAIN.DAT NIPS-1, NIPS-2, estuarine comparison sediment grain size data.

Percent sand, rubble, clay and silt. Each replicate core was
sectioned into a 0-3 cm and 3-10 cm section (SEC).
BAY codes: GE=Guadalupe, LP=Lavaca-Tres Palacios, NC=Nueces

DATE	BAY	STA	REP	SEC	SAND	RUBBLE	CLAY	SILT
JUN1987	GE	A	1	3	0.30197	0.09657	0.27417	0.32730
JUN1987	GE	A	1	10	0.24570	0.16680	0.28070	0.30680
JUN1987	GE	B	1	3	0.06710	0.13603	0.49307	0.30377
JUN1987	GE	B	1	10	0.02310	0.04770	0.62390	0.30520
JUN1987	GE	C	1	3	0.27697	0.03377	0.38337	0.30590
JUN1987	GE	C	1	10	0.19000	0.02280	0.48770	0.29960
JUN1987	GE	D	1	3	0.65227	0.05537	0.13683	0.15553
JUN1987	GE	D	1	10	0.77960	0.04420	0.08980	0.08640
JUL1987	GE	A	1	3	0.25883	0.06657	0.27713	0.39747
JUL1987	GE	A	1	10	0.26550	0.13050	0.32550	0.27850
JUL1987	GE	B	1	3	0.03037	0.06543	0.56857	0.33570
JUL1987	GE	B	1	10	0.04060	0.05380	0.56530	0.34030
JUL1987	GE	C	1	3	0.14713	0.01863	0.43187	0.40240
JUL1987	GE	C	1	10	0.23800	0.03210	0.34840	0.38160
JUL1987	GE	D	1	3	0.14687	0.00353	0.46967	0.37990
JUL1987	GE	D	1	10	0.18390	0.00410	0.48260	0.32950
APR1988	GE	A	1	3	0.31360	0.05210	0.24510	0.38930
APR1988	GE	A	1	10	0.25460	0.18470	0.27390	0.28670
APR1988	GE	A	2	3	0.12050	0.03020	0.38740	0.46190
APR1988	GE	A	2	10	0.39650	0.05940	0.28190	0.26220
APR1988	GE	A	3	3	0.18740	0.06140	0.34600	0.40520
APR1988	GE	A	3	10	0.26070	0.07060	0.33720	0.33150
APR1988	GE	B	1	3	0.04160	0.04210	0.54110	0.37520
APR1988	GE	B	1	10	0.02260	0.03620	0.53470	0.40660
APR1988	GE	B	2	3	0.05560	0.04830	0.53270	0.36340
APR1988	GE	B	2	10	0.02550	0.02040	0.58640	0.36770
APR1988	GE	B	3	3	0.04540	0.06040	0.54280	0.35140
APR1988	GE	B	3	10	0.01440	0.03050	0.60000	0.35510
APR1988	GE	C	1	3	0.44650	0.07160	0.22930	0.25260
APR1988	GE	C	1	10	0.15480	0.03260	0.48290	0.32980
APR1988	GE	C	2	3	0.34350	0.03920	0.29130	0.32610
APR1988	GE	C	2	10	0.16650	0.03220	0.49820	0.30310
APR1988	GE	C	3	3	0.38510	0.06040	0.26610	0.28840
APR1988	GE	C	3	10	0.16100	0.02930	0.47140	0.33830
APR1988	GE	D	1	3	0.34070	0.01560	0.21320	0.23040
APR1988	GE	D	1	10	0.36150	0.00840	0.37420	0.25590
APR1988	GE	D	2	3	0.50120	0.00700	0.22510	0.26680
APR1988	GE	D	2	10	0.39010	0.00620	0.36730	0.23650
APR1988	GE	D	3	3	0.36080	0.00870	0.34080	0.28970
APR1988	GE	D	3	10	0.40150	0.00850	0.37840	0.21170
JUL1988	GE	A	1	3	0.15200	0.11990	0.29680	0.43130
JUL1988	GE	A	1	10	0.08520	0.01480	0.41750	0.48240
JUL1988	GE	A	2	3	0.09410	0.06690	0.24090	0.59800
JUL1988	GE	A	2	10	0.08920	0.03220	0.45800	0.42050
JUL1988	GE	A	3	3	0.01690	0.00950	0.31400	0.65960
JUL1988	GE	A	3	10	0.12460	0.13110	0.42160	0.32260
JUL1988	GE	B	1	3	0.04660	0.13030	0.26720	0.55590
JUL1988	GE	B	1	10	0.04020	0.13830	0.19200	0.62960
JUL1988	GE	B	2	3	0.06400	0.22030	0.31780	0.39780
JUL1988	GE	B	2	10	0.04040	0.13940	0.36720	0.45310
JUL1988	GE	B	3	3	0.06930	0.37410	0.28630	0.27040
JUL1988	GE	B	3	10	0.04580	0.09860	0.26140	0.59420
JUL1988	GE	C	1	3	0.39040	0.08510	0.20890	0.31560
JUL1988	GE	C	1	10	0.34440	0.05460	0.19540	0.40550
JUL1988	GE	C	2	3	0.43870	0.02920	0.17140	0.36070
JUL1988	GE	C	2	10	0.25160	0.31030	0.16110	0.27690
JUL1988	GE	C	3	3	0.40610	0.10230	0.25190	0.23970

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JUL1988   GE   C   3   10   0.30860   0.12330   0.16570   0.40240
JUL1988   GE   D   1    3   0.52580   0.03790   0.09770   0.33860
JUL1988   GE   D   1   10   0.14750   0.01330   0.38550   0.45380
JUL1988   GE   D   2    3   0.54800   0.10010   0.18300   0.16880
JUL1988   GE   D   2   10   0.12990   0.13070   0.50870   0.23070
JUL1988   GE   D   3    3   0.50840   0.15060   0.13810   0.20290
JUL1988   GE   D   3   10   0.07620   0.15790   0.45540   0.31050
APR1988   LP   A   1    3   0.77710   0.01170   0.10410   0.10700
APR1988   LP   A   1   10   0.29230   0.00670   0.40580   0.29530
APR1988   LP   A   2    3   0.73540   0.04550   0.12070   0.09830
APR1988   LP   A   2   10   0.38260   0.01030   0.35220   0.25500
APR1988   LP   A   3    3   0.80900   0.01730   0.08320   0.09040
APR1988   LP   A   3   10   0.49800   0.01070   0.27210   0.21910
APR1988   LP   B   1    3   0.10830   0.00640   0.53140   0.35390
APR1988   LP   B   1   10   0.04930   0.00540   0.63870   0.30670
APR1988   LP   B   2    3   0.04750   0.00460   0.61020   0.33770
APR1988   LP   B   2   10   0.03970   0.00250   0.64430   0.31350
APR1988   LP   B   3    3   0.08280   0.00540   0.58070   0.33120
APR1988   LP   B   3   10   0.06850   0.00640   0.58730   0.33780
APR1988   LP   C   1    3   0.27750   0.03080   0.41720   0.27450
APR1988   LP   C   1   10   0.28910   0.01350   0.45950   0.23790
APR1988   LP   C   2    3   0.29770   0.08360   0.37010   0.24850
APR1988   LP   C   2   10   0.24990   0.01340   0.46760   0.26900
APR1988   LP   C   3    3   0.20670   0.04510   0.39770   0.35050
APR1988   LP   C   3   10   0.27780   0.02790   0.42690   0.26750
APR1988   LP   D   1    3   0.12290   0.00950   0.60450   0.26300
APR1988   LP   D   1   10   0.14840   0.01000   0.60930   0.23230
APR1988   LP   D   2    3   0.10480   0.00720   0.63390   0.25410
APR1988   LP   D   2   10   0.13680   0.01110   0.59610   0.25600
APR1988   LP   D   3    3   0.13660   0.01160   0.66990   0.18190
APR1988   LP   D   3   10   0.15100   0.01070   0.60530   0.23300
JUL1988   LP   A   1    3   0.57920   0.01670   0.22180   0.18240
JUL1988   LP   A   1   10   0.26210   0.00600   0.44970   0.28220
JUL1988   LP   A   2    3   0.56020   0.10720   0.21500   0.11770
JUL1988   LP   A   2   10   0.38280   0.00530   0.38960   0.22230
JUL1988   LP   A   3    3   0.50720   0.01710   0.32790   0.14780
JUL1988   LP   A   3   10   0.53380   0.01150   0.29690   0.15780
JUL1988   LP   B   1    3   0.30290   0.01310   0.44460   0.23940
JUL1988   LP   B   1   10   0.07560   0.00910   0.56620   0.34910
JUL1988   LP   B   2    3   0.35440   0.00590   0.41910   0.22060
JUL1988   LP   B   2   10   0.11190   0.00830   0.64790   0.23190
JUL1988   LP   B   3    3   0.36750   0.01050   0.44080   0.18120
JUL1988   LP   B   3   10   0.11390   0.01980   0.60900   0.25730
JUL1988   LP   C   1    3   0.33620   0.05320   0.43160   0.17910
JUL1988   LP   C   1   10   0.29930   0.01600   0.50000   0.18460
JUL1988   LP   C   2    3   0.31690   0.02410   0.44180   0.21720
JUL1988   LP   C   2   10   0.27240   0.00870   0.49660   0.22230
JUL1988   LP   C   3    3   0.34540   0.04140   0.42190   0.19130
JUL1988   LP   C   3   10   0.24570   0.01010   0.50700   0.23720
JUL1988   LP   D   1    3   0.13440   0.00270   0.60860   0.25430
JUL1988   LP   D   1   10   0.13070   0.01110   0.61140   0.24680
JUL1988   LP   D   2    3   0.14840   0.00520   0.61770   0.22870
JUL1988   LP   D   2   10   0.17250   0.00870   0.60430   0.21450
JUL1988   LP   D   3    3   0.14210   0.01110   0.60960   0.23710
JUL1988   LP   D   3   10   0.14090   0.03220   0.59330   0.23360
APR1988   NC   C   1    3   0.02930   0.29570   0.48050   0.19450
APR1988   NC   C   1   10   0.04010   0.35130   0.42590   0.18270
APR1988   NC   C   2    3   0.03480   0.35030   0.42810   0.18670
APR1988   NC   C   2   10   0.02080   0.32480   0.46210   0.19230
APR1988   NC   C   3    3   0.04130   0.37500   0.41240   0.17130
APR1988   NC   C   3   10   0.03080   0.28280   0.48240   0.20400
APR1988   NC   A   1    3   0.02370   0.00100   0.07360   0.90170
APR1988   NC   A   1   10   0.16920   0.00690   0.43370   0.39020
APR1988   NC   A   2    3   0.06830   0.00630   0.56060   0.36470
APR1988   NC   A   2   10   0.27480   0.00980   0.42500   0.29040
APR1988   NC   A   3    3   0.08260   0.00460   0.58510   0.32770
APR1988   NC   A   3   10   0.22950   0.01050   0.41980   0.34020
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APR1988	NC	B	1	3	0.85970	0.03800	0.06890	0.03340
APR1988	NC	B	1	10	0.82150	0.03260	0.11160	0.03430
APR1988	NC	B	2	3	0.90310	0.04050	0.03340	0.02290
APR1988	NC	B	2	10	0.76710	0.02070	0.06960	0.14260
APR1988	NC	B	3	3	0.89440	0.03540	0.04870	0.02150
APR1988	NC	B	3	10	0.76680	0.02770	0.15720	0.04830
APR1988	NC	D	1	3	0.81920	0.01200	0.13870	0.03000
APR1988	NC	D	1	10	0.79360	0.00820	0.16600	0.03230
APR1988	NC	D	2	3	0.82590	0.00800	0.13580	0.03030
APR1988	NC	D	2	10	0.78630	0.00940	0.17010	0.03420
APR1988	NC	D	3	3	0.82940	0.01160	0.12930	0.02970
APR1988	NC	D	3	10	0.80590	0.01370	0.15280	0.02760
APR1988	NC	C	1	3	0.00380	0.00440	0.77390	0.21790
APR1988	NC	C	1	10	0.01440	0.04150	0.66860	0.27550
APR1988	NC	C	2	3	0.00400	0.00480	0.77200	0.21930
APR1988	NC	C	2	10	0.03700	0.02430	0.66810	0.27060
APR1988	NC	C	3	3	0.00380	0.01340	0.73890	0.24390
APR1988	NC	C	3	10	0.03250	0.02500	0.64650	0.29590
JUL1988	NC	C	1	3	0.05280	0.00650	0.65080	0.28980
JUL1988	NC	C	1	10	0.05240	0.01120	0.63080	0.30560
JUL1988	NC	C	2	3	0.03090	0.01400	0.66470	0.29030
JUL1988	NC	C	2	10	0.06590	0.01420	0.64430	0.27560
JUL1988	NC	C	3	3	0.02790	0.00600	0.64610	0.32000
JUL1988	NC	C	3	10	0.03720	0.00250	0.66600	0.29430
JUL1988	NC	D	1	3	0.77580	0.01720	0.17820	0.02880
JUL1988	NC	D	1	10	0.69990	0.00830	0.24270	0.04920
JUL1988	NC	D	2	3	0.77530	0.02810	0.16410	0.03250
JUL1988	NC	D	2	10	0.73640	0.04240	0.18580	0.03550
JUL1988	NC	D	3	3	0.74660	0.02030	0.19780	0.03530
JUL1988	NC	D	3	10	0.71930	0.01190	0.22220	0.04660
JUL1988	NC	A	1	3	0.10360	0.00420	0.52860	0.36370
JUL1988	NC	A	1	10	0.11960	0.00220	0.52530	0.35280
JUL1988	NC	A	2	3	0.04570	0.00470	0.54310	0.40650
JUL1988	NC	A	2	10	0.05610	0.09130	0.50530	0.34720
JUL1988	NC	A	3	3	0.07090	0.00500	0.57940	0.34470
JUL1988	NC	A	3	10	0.16570	0.00730	0.47620	0.35080
JUL1988	NC	B	1	3	0.78000	0.04950	0.12800	0.04260
JUL1988	NC	B	1	10	0.69370	0.07630	0.13470	0.09530
JUL1988	NC	B	2	3	0.67840	0.01780	0.22290	0.08090
JUL1988	NC	B	2	10	0.72070	0.06000	0.16750	0.05170
JUL1988	NC	B	3	3	0.78920	0.02790	0.13180	0.05110
JUL1988	NC	B	3	10	0.57000	0.13160	0.23410	0.06430
OCT1988	NC	C	1	3	0.07810	0.02330	0.52120	0.37730
OCT1988	NC	C	1	10	0.21830	0.04540	0.35220	0.38400
OCT1988	NC	C	2	3	0.08270	0.00920	0.57200	0.33610
OCT1988	NC	C	2	10	0.30690	0.03830	0.36970	0.28500
OCT1988	NC	C	3	3	0.13750	0.00630	0.51020	0.34600
OCT1988	NC	C	3	10	0.23840	0.06490	0.38850	0.30820
OCT1988	NC	A	1	3	0.16650	0.04900	0.42310	0.36140
OCT1988	NC	A	1	10	0.22170	0.11090	0.34520	0.32220
OCT1988	NC	A	2	3	0.24930	0.04030	0.35640	0.35400
OCT1988	NC	A	2	10	0.15190	0.06430	0.38590	0.39790
OCT1988	NC	A	3	3	0.34100	0.12140	0.26770	0.26990
OCT1988	NC	A	3	10	0.19710	0.12270	0.34130	0.33900
OCT1988	NC	B	1	3	0.65010	0.00810	0.20340	0.13840
OCT1988	NC	B	1	10	0.65610	0.00710	0.19760	0.13920
OCT1988	NC	B	2	3	0.72650	0.01390	0.15440	0.10510
OCT1988	NC	B	2	10	0.70370	0.01370	0.16830	0.11440
OCT1988	NC	B	3	3	0.66010	0.00660	0.20330	0.12990
OCT1988	NC	B	3	10	0.62280	0.00820	0.22690	0.14210
OCT1988	NC	D	1	3	0.66110	0.00510	0.25630	0.07750
OCT1988	NC	D	1	10	0.72930	0.00260	0.20670	0.06140
OCT1988	NC	D	2	3	0.63230	0.00570	0.27300	0.08900
OCT1988	NC	D	2	10	0.70690	0.00580	0.22490	0.06250
OCT1988	NC	D	3	3	0.64570	0.00670	0.26730	0.08030
OCT1988	NC	D	3	10	0.71520	0.00610	0.22270	0.05600

GEMACMG.DAT Guadalupe Estuary Macrofauna biomass data (mg/m^2)

3 replicates (REP) were taken each time, N=n/section, MG=dry weight in mg/core, GM2=g/m^2, nm2=n/m^2.

DATE	STA	REP	SEC	TAXA	N	MG	GM2	NM2
28JAN87	A	1	0-3	Mollusca	5	1.20	0.3403	1418.0
28JAN87	A	1	0-3	Polychaeta	10	0.80	0.2269	2836.0
28JAN87	A	1	3-10	Polychaeta	31	4.40	1.2478	8791.6
28JAN87	A	2	0-3	Mollusca	12	2.50	0.7090	3403.2
28JAN87	A	2	0-3	Polychaeta	31	3.10	0.8792	8791.6
28JAN87	A	2	3-10	Polychaeta	27	4.30	1.2195	7657.2
28JAN87	A	3	0-3	Crustacea	1	0.30	0.0851	283.6
28JAN87	A	3	0-3	Mollusca	5	0.71	0.2014	1418.0
28JAN87	A	3	0-3	Polychaeta	6	1.20	0.3403	1701.6
28JAN87	A	3	3-10	Mollusca	1	0.30	0.0851	283.6
28JAN87	A	3	3-10	Polychaeta	18	2.60	0.7374	5104.8
28JAN87	B	1	0-3	Crustacea	2	0.10	0.0284	567.2
28JAN87	B	1	0-3	Mollusca	17	2.40	0.6806	4821.2
28JAN87	B	1	0-3	Nemertea	1	0.40	0.1134	283.6
28JAN87	B	1	0-3	Polychaeta	27	0.70	0.1985	7657.2
28JAN87	B	1	3-10	Mollusca	2	1.30	0.3687	567.2
28JAN87	B	1	3-10	Nemertea	1	0.10	0.0284	283.6
28JAN87	B	1	3-10	Polychaeta	50	4.40	1.2478	14180.0
28JAN87	B	2	0-3	Crustacea	7	0.20	0.0567	1985.2
28JAN87	B	2	0-3	Mollusca	7	4.30	1.2195	1985.2
28JAN87	B	2	0-3	Nemertea	1	0.10	0.0284	283.6
28JAN87	B	2	0-3	Polychaeta	37	1.80	0.5105	10493.2
28JAN87	B	2	3-10	Polychaeta	10	0.30	0.0851	2836.0
28JAN87	B	3	0-3	Mollusca	7	3.00	0.8508	1985.2
28JAN87	B	3	0-3	Nemertea	1	0.10	0.0284	283.6
28JAN87	B	3	0-3	Polychaeta	43	1.90	0.5388	12194.8
28JAN87	B	3	3-10	Mollusca	1	4.00	1.1344	283.6
28JAN87	B	3	3-10	Nemertea	1	5.00	1.4180	283.6
28JAN87	B	3	3-10	Polychaeta	19	2.00	0.5672	5388.4
30JAN87	C	1	0-3	Crustacea	3	0.16	0.0454	850.8
30JAN87	C	1	0-3	Mollusca	2	0.09	0.0255	567.2
30JAN87	C	1	0-3	Polychaeta	17	0.70	0.1985	4821.2
30JAN87	C	1	3-10	Nemertea	1	0.31	0.0879	283.6
30JAN87	C	1	3-10	Polychaeta	6	0.16	0.0454	1701.6
30JAN87	C	2	0-3	Crustacea	1	0.04	0.0113	283.6
30JAN87	C	2	0-3	Mollusca	2	13.37	3.7917	567.2
30JAN87	C	2	0-3	Polychaeta	25	0.61	0.1730	7090.0
30JAN87	C	2	3-10	Polychaeta	3	0.10	0.0284	850.8
30JAN87	C	3	0-3	Crustacea	1	0.05	0.0142	283.6
30JAN87	C	3	0-3	Mollusca	2	0.07	0.0199	567.2
30JAN87	C	3	0-3	Polychaeta	25	0.60	0.1702	7090.0
30JAN87	C	3	3-10	Polychaeta	3	3.05	0.8650	850.8
30JAN87	D	1	0-3	Mollusca	5	0.22	0.0624	1418.0
30JAN87	D	1	0-3	Polychaeta	4	0.30	0.0851	1134.4
30JAN87	D	1	3-10	Polychaeta	12	6.46	1.8321	3403.2
30JAN87	D	2	0-3	Mollusca	10	0.41	0.1163	2836.0
30JAN87	D	2	0-3	Polychaeta	6	0.13	0.0369	1701.6
30JAN87	D	2	3-10	Mollusca	1	0.03	0.0085	283.6
30JAN87	D	2	3-10	Polychaeta	8	0.78	0.2212	2268.8
30JAN87	D	3	0-3	Crustacea	4	0.05	0.0142	1134.4
30JAN87	D	3	0-3	Mollusca	4	0.37	0.1049	1134.4
30JAN87	D	3	0-3	Polychaeta	6	0.30	0.0851	1701.6
30JAN87	D	3	3-10	Crustacea	1	0.08	0.0227	283.6
30JAN87	D	3	3-10	Polychaeta	7	5.53	1.5683	1985.2
03MAR87	A	1	0-3	Mollusca	80	11.77	3.3380	22688.0
03MAR87	A	1	0-3	Nemertea	1	0.65	0.1843	283.6
03MAR87	A	1	0-3	Others	1	0.76	0.2155	283.6
03MAR87	A	1	0-3	Polychaeta	26	2.48	0.7033	7373.6
03MAR87	A	1	3-10	Polychaeta	8	2.12	0.6012	2268.8

03MAR87	A	2	0-3	Mollusca	105	9.03	2.5609	29778.0
03MAR87	A	2	0-3	Polychaeta	20	1.97	0.5587	5672.0
03MAR87	A	2	3-10	Mollusca	1	2.55	0.7232	283.6
03MAR87	A	2	3-10	Polychaeta	17	2.98	0.8451	4821.2
03MAR87	A	3	0-3	Mollusca	128	70.42	19.9711	36300.8
03MAR87	A	3	0-3	Polychaeta	20	1.12	0.3176	5672.0
03MAR87	A	3	3-10	Polychaeta	7	1.55	0.4396	1985.2
03MAR87	B	1	0-3	Mollusca	5	0.98	0.2779	1418.0
03MAR87	B	1	0-3	Polychaeta	24	1.88	0.5332	6806.4
03MAR87	B	1	3-10	Mollusca	4	12.27	3.4798	1134.4
03MAR87	B	1	3-10	Polychaeta	17	2.16	0.6126	4821.2
03MAR87	B	2	0-3	Crustacea	1	0.18	0.0510	283.6
03MAR87	B	2	0-3	Mollusca	28	2.85	0.8083	7940.8
03MAR87	B	2	0-3	Polychaeta	35	1.63	0.4623	9926.0
03MAR87	B	2	3-10	Mollusca	1	1.05	0.2978	283.6
03MAR87	B	2	3-10	Nemertea	1	0.49	0.1390	283.6
03MAR87	B	2	3-10	Polychaeta	27	5.53	1.5683	7657.2
03MAR87	B	3	0-3	Mollusca	15	1.55	0.4396	4254.0
03MAR87	B	3	0-3	Nemertea	1	0.34	0.0964	283.6
03MAR87	B	3	0-3	Polychaeta	23	1.39	0.3942	6522.8
03MAR87	B	3	3-10	Mollusca	3	16.31	4.6255	850.8
03MAR87	B	3	3-10	Polychaeta	16	2.22	0.6296	4537.6
03MAR87	C	1	0-3	Crustacea	4	0.12	0.0340	1134.4
03MAR87	C	1	0-3	Mollusca	10	2.93	0.8309	2836.0
03MAR87	C	1	0-3	Polychaeta	20	1.13	0.3205	5672.0
03MAR87	C	1	3-10	Mollusca	1	2.54	0.7203	283.6
03MAR87	C	1	3-10	Polychaeta	4	1.00	0.2836	1134.4
03MAR87	C	2	0-3	Crustacea	6	0.57	0.1617	1701.6
03MAR87	C	2	0-3	Polychaeta	23	2.04	0.5785	6522.8
03MAR87	C	2	3-10	Polychaeta	6	10.40	2.9494	1701.6
03MAR87	C	3	0-3	Crustacea	1	0.09	0.0255	283.6
03MAR87	C	3	0-3	Mollusca	11	5.88	1.6676	3119.6
03MAR87	C	3	0-3	Polychaeta	18	1.94	0.5502	5104.8
03MAR87	C	3	3-10	Mollusca	1	0.02	0.0057	283.6
03MAR87	C	3	3-10	Polychaeta	9	1.32	0.3744	2552.4
03MAR87	D	1	0-3	Mollusca	16	4.92	1.3953	4537.6
03MAR87	D	1	0-3	Polychaeta	14	0.72	0.2042	3970.4
03MAR87	D	1	3-10	Mollusca	3	7.92	2.2461	850.8
03MAR87	D	1	3-10	Polychaeta	8	1.28	0.3630	2268.8
03MAR87	D	2	0-3	Mollusca	11	3.65	1.0351	3119.6
03MAR87	D	2	0-3	Polychaeta	7	0.12	0.0340	1985.2
03MAR87	D	2	3-10	Mollusca	1	7.97	2.2603	283.6
03MAR87	D	2	3-10	Polychaeta	9	2.44	0.6920	2552.4
03MAR87	D	3	0-3	Mollusca	11	2.68	0.7600	3119.6
03MAR87	D	3	0-3	Polychaeta	11	0.38	0.1078	3119.6
03MAR87	D	3	3-10	Mollusca	3	2.45	0.6948	850.8
03MAR87	D	3	3-10	Polychaeta	17	4.45	1.2620	4821.2
08APR87	A	1	0-3	Mollusca	318	19.14	5.4281	90184.8
08APR87	A	1	0-3	Others	3	0.51	0.1446	850.8
08APR87	A	1	0-3	Polychaeta	46	2.13	0.6041	13045.6
08APR87	A	1	3-10	Nemertea	1	0.29	0.0822	283.6
08APR87	A	1	3-10	Polychaeta	12	1.40	0.3970	3403.2
08APR87	A	2	0-3	Mollusca	24	3.39	0.9614	6806.4
08APR87	A	2	0-3	Polychaeta	53	0.87	0.2467	15030.8
08APR87	A	2	3-10	Mollusca	1	1.94	0.5502	283.6
08APR87	A	2	3-10	Polychaeta	8	0.36	0.1021	2268.8
08APR87	A	3	0-3	Mollusca	88	8.59	2.4361	24956.8
08APR87	A	3	0-3	Polychaeta	54	0.98	0.2779	15314.4
08APR87	A	3	3-10	Polychaeta	15	1.17	0.3318	4254.0
08APR87	B	1	0-3	Crustacea	3	0.19	0.0539	850.8
08APR87	B	1	0-3	Mollusca	37	7.02	1.9909	10493.2
08APR87	B	1	0-3	Nemertea	1	0.23	0.0652	283.6
08APR87	B	1	0-3	Polychaeta	21	1.69	0.4793	5955.6
08APR87	B	1	3-10	Mollusca	1	0.11	0.0312	283.6
08APR87	B	1	3-10	Polychaeta	10	0.28	0.0794	2836.0
08APR87	B	2	0-3	Crustacea	1	0.25	0.0709	283.6
08APR87	B	2	0-3	Mollusca	16	20.60	5.8422	4537.6

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08APR87   B    2   0-3   Polychaeta          52   2.30   0.6523   14747.2
08APR87   B    2   3-10  Polychaeta           3   0.10   0.0284     850.8
08APR87   B    3   0-3   Mollusca            28  15.07   4.2739    7940.8
08APR87   B    3   0-3   Polychaeta          35   1.26   0.3573    9926.0
08APR87   B    3   3-10  Polychaeta           7   0.26   0.0737    1985.2
10APR87   C    1   0-3   Crustacea            6   0.25   0.0709    1701.6
10APR87   C    1   0-3   Mollusca             1   0.17   0.0482     283.6
10APR87   C    1   0-3   Polychaeta          31   1.30   0.3687    8791.6
10APR87   C    1   3-10  Mollusca             3  26.46   7.5041     850.8
10APR87   C    1   3-10  Others               5   0.19   0.0539    1418.0
10APR87   C    1   3-10  Polychaeta           3   0.48   0.1361     850.8
10APR87   C    2   0-3   Crustacea            3   0.13   0.0369     850.8
10APR87   C    2   0-3   Mollusca             4   9.28   2.6318    1134.4
10APR87   C    2   0-3   Polychaeta          17   0.80   0.2269    4821.2
10APR87   C    2   3-10  Mollusca             1   5.41   1.5343     283.6
10APR87   C    2   3-10  Polychaeta           8   1.22   0.3460    2268.8
10APR87   C    3   0-3   Polychaeta          20   0.75   0.2127    5672.0
10APR87   C    3   3-10  Mollusca             2   5.79   1.6420     567.2
10APR87   C    3   3-10  Others              11   0.35   0.0993    3119.6
10APR87   C    3   3-10  Polychaeta           5   0.53   0.1503    1418.0
10APR87   D    1   0-3   Crustacea            1   0.05   0.0142     283.6
10APR87   D    1   0-3   Mollusca             6  10.10   2.8644    1701.6
10APR87   D    1   0-3   Others               1   0.11   0.0312     283.6
10APR87   D    1   0-3   Polychaeta           8   0.36   0.1021    2268.8
10APR87   D    1   3-10  Mollusca             3   5.43   1.5399     850.8
10APR87   D    1   3-10  Others               3   3.69   1.0465     850.8
10APR87   D    1   3-10  Polychaeta           3   1.20   0.3403     850.8
10APR87   D    2   0-3   Crustacea            3   0.04   0.0113     850.8
10APR87   D    2   0-3   Mollusca             2   4.42   1.2535     567.2
10APR87   D    2   0-3   Others               1   0.14   0.0397     283.6
10APR87   D    2   0-3   Polychaeta          11   0.89   0.2524    3119.6
10APR87   D    2   3-10  Mollusca             1   2.16   0.6126     283.6
10APR87   D    2   3-10  Others               1   0.01   0.0028     283.6
10APR87   D    2   3-10  Polychaeta          28   4.71   1.3358    7940.8
10APR87   D    3   0-3   Mollusca             3   5.87   1.6647     850.8
10APR87   D    3   0-3   Others               1   0.01   0.0028     283.6
10APR87   D    3   0-3   Polychaeta           9   0.47   0.1333    2552.4
10APR87   D    3   3-10  Mollusca             1   2.15   0.6097     283.6
10APR87   D    3   3-10  Polychaeta          12   2.51   0.7118    3403.2
03JUN87   A    1   0-3   Chironomid larvae    1   0.09   0.0255     283.6
03JUN87   A    1   0-3   Mollusca           283  40.16  11.3894   80258.8
03JUN87   A    1   0-3   Polychaeta           4   0.13   0.0369    1134.4
03JUN87   A    1   3-10  Polychaeta           4   0.27   0.0766    1134.4
03JUN87   A    2   0-3   Chironomid larvae    3   0.14   0.0397     850.8
03JUN87   A    2   0-3   Mollusca           205  41.65  11.8119   58138.0
03JUN87   A    2   0-3   Polychaeta          10   0.52   0.1475    2836.0
03JUN87   A    2   3-10  Polychaeta           5   0.21   0.0596    1418.0
03JUN87   A    3   0-3   Chironomid larvae    1   0.43   0.1219     283.6
03JUN87   A    3   0-3   Mollusca            87  14.81   4.2001   24673.2
03JUN87   A    3   0-3   Polychaeta           6   0.27   0.0766    1701.6
03JUN87   A    3   3-10  Polychaeta           4   0.10   0.0284    1134.4
03JUN87   B    1   0-3   Mollusca            71  12.38   3.5110   20135.6
03JUN87   B    1   0-3   Polychaeta           6   0.36   0.1021    1701.6
03JUN87   B    1   3-10  Mollusca             2  14.32   4.0612     567.2
03JUN87   B    1   3-10  Polychaeta          21   2.62   0.7430    5955.6
03JUN87   B    2   0-3   Mollusca            52   9.48   2.6885   14747.2
03JUN87   B    2   0-3   Polychaeta          15   0.26   0.0737    4254.0
03JUN87   B    2   3-10  Mollusca             2  16.78   4.7588     567.2
03JUN87   B    2   3-10  Polychaeta          17   1.96   0.5559    4821.2
03JUN87   B    3   0-3   Mollusca            13   2.79   0.7912    3686.8
03JUN87   B    3   0-3   Polychaeta           8   0.37   0.1049    2268.8
03JUN87   B    3   3-10  Mollusca             3  19.46   5.5189     850.8
03JUN87   B    3   3-10  Polychaeta          18   1.25   0.3545    5104.8
03JUN87   C    1   0-3   Polychaeta          13   1.17   0.3318    3686.8
03JUN87   C    1   3-10  Mollusca             2  19.68   5.5812     567.2
03JUN87   C    1   3-10  Polychaeta          20   4.85   1.3755    5672.0
03JUN87   C    2   0-3   Nemertea             1   0.06   0.0170     283.6
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03JUN87   C   2   0-3   Polychaeta          10   1.07   0.3035    2836.0
03JUN87   C   2   3-10  Polychaeta          10   1.68   0.4764    2836.0
03JUN87   C   3   0-3   Polychaeta           7   0.81   0.2297    1985.2
03JUN87   C   3   3-10  Mollusca             1  13.68   3.8796     283.6
03JUN87   C   3   3-10  Polychaeta           4   1.26   0.3573    1134.4
03JUN87   D   1   0-3   Crustacea            1   0.01   0.0028     283.6
03JUN87   D   1   0-3   Mollusca             1   0.06   0.0170     283.6
03JUN87   D   1   0-3   Polychaeta           9   2.00   0.5672    2552.4
03JUN87   D   1   3-10  Nemertea             1   0.41   0.1163     283.6
03JUN87   D   1   3-10  Polychaeta          17   3.70   1.0493    4821.2
03JUN87   D   2   0-3   Crustacea            1   0.06   0.0170     283.6
03JUN87   D   2   0-3   Mollusca             4   1.58   0.4481    1134.4
03JUN87   D   2   0-3   Nemertea             1   0.08   0.0227     283.6
03JUN87   D   2   0-3   Polychaeta           8   1.85   0.5247    2268.8
03JUN87   D   2   3-10  Mollusca             2  18.96   5.3771     567.2
03JUN87   D   2   3-10  Polychaeta          10   2.41   0.6835    2836.0
03JUN87   D   3   0-3   Polychaeta          10   1.58   0.4481    2836.0
03JUN87   D   3   3-10  Crustacea            1   0.13   0.0369     283.6
03JUN87   D   3   3-10  Mollusca             3  31.57   8.9533     850.8
03JUN87   D   3   3-10  Nemertea             1   0.21   0.0596     283.6
03JUN87   D   3   3-10  Polychaeta          13   6.96   1.9739    3686.8
15JUL87   A   1   0-3   Chironomid larvae    2   0.12   0.0340     567.2
15JUL87   A   1   0-3   Mollusca           111  33.03   9.3673   31479.6
15JUL87   A   1   0-3   Polychaeta           3   0.30   0.0851     850.8
15JUL87   A   1   3-10  Polychaeta           2   0.20   0.0567     567.2
15JUL87   A   2   0-3   Chironomid larvae    5   0.30   0.0851    1418.0
15JUL87   A   2   0-3   Mollusca           102  33.33   9.4524   28927.2
15JUL87   A   2   0-3   Polychaeta           7   0.70   0.1985    1985.2
15JUL87   A   3   0-3   Chironomid larvae    6   0.36   0.1021    1701.6
15JUL87   A   3   0-3   Mollusca           141  42.77  12.1296   39987.6
15JUL87   A   3   0-3   Polychaeta           5   0.80   0.2269    1418.0
15JUL87   A   3   3-10  Polychaeta           2   0.80   0.2269     567.2
15JUL87   B   1   0-3   Chironomid larvae    1   0.02   0.0057     283.6
15JUL87   B   1   0-3   Mollusca            34   9.02   2.5581    9642.4
15JUL87   B   1   0-3   Polychaeta           6   0.47   0.1333    1701.6
15JUL87   B   1   3-10  Mollusca             1   0.92   0.2609     283.6
15JUL87   B   1   3-10  Polychaeta           4   0.25   0.0709    1134.4
15JUL87   B   2   0-3   Chironomid larvae    1   0.10   0.0284     283.6
15JUL87   B   2   0-3   Mollusca             8  10.58   3.0005    2268.8
15JUL87   B   2   0-3   Polychaeta           3   0.46   0.1305     850.8
15JUL87   B   2   3-10  Polychaeta           3   0.22   0.0624     850.8
15JUL87   B   3   0-3   Chironomid larvae    1   0.64   0.1815     283.6
15JUL87   B   3   0-3   Mollusca            48  13.83   3.9222   13612.8
15JUL87   B   3   0-3   Polychaeta           6   0.51   0.1446    1701.6
15JUL87   B   3   3-10  Polychaeta           6   0.30   0.0851    1701.6
15JUL87   C   1   0-3   Mollusca            12   2.27   0.6438    3403.2
15JUL87   C   1   0-3   Nemertea             1   0.47   0.1333     283.6
15JUL87   C   1   0-3   Polychaeta           6   0.61   0.1730    1701.6
15JUL87   C   1   3-10  Mollusca             1  10.00   2.8360     283.6
15JUL87   C   1   3-10  Polychaeta           0   0.09   0.0255       0.0
15JUL87   C   2   0-3   Chironomid larvae    2   0.30   0.0851     567.2
15JUL87   C   2   0-3   Mollusca            13   2.26   0.6409    3686.8
15JUL87   C   2   0-3   Polychaeta          10   0.64   0.1815    2836.0
15JUL87   C   2   3-10  Others               7   0.09   0.0255    1985.2
15JUL87   C   2   3-10  Polychaeta           9   0.43   0.1219    2552.4
15JUL87   C   3   0-3   Crustacea            1   0.21   0.0596     283.6
15JUL87   C   3   0-3   Mollusca            14   3.34   0.9472    3970.4
15JUL87   C   3   0-3   Polychaeta          12   0.86   0.2439    3403.2
15JUL87   C   3   3-10  Others               1   0.01   0.0028     283.6
15JUL87   C   3   3-10  Polychaeta           3   0.35   0.0993     850.8
15JUL87   D   1   0-3   Mollusca             4   3.77   1.0692    1134.4
15JUL87   D   1   0-3   Polychaeta           4   0.27   0.0766    1134.4
15JUL87   D   1   3-10  Polychaeta           7   1.47   0.4169    1985.2
15JUL87   D   2   0-3   Mollusca             2   0.33   0.0936     567.2
15JUL87   D   2   0-3   Polychaeta           9   0.15   0.0425    2552.4
15JUL87   D   2   3-10  Mollusca             2   9.37   2.6573     567.2
15JUL87   D   2   3-10  Polychaeta           3   0.65   0.1843     850.8
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15JUL87   D    3   0-3   Chironomid larvae   1   0.01   0.0028      283.6
15JUL87   D    3   0-3   Mollusca            1   0.70   0.1985      283.6
15JUL87   D    3   0-3   Polychaeta          3   0.21   0.0596      850.8
15JUL87   D    3   3-10  Polychaeta          2   0.27   0.0766      567.2
18APR88   A    1   0-3   Crustacea           3   0.14   0.0397      850.8
18APR88   A    1   0-3   Chironomid larvae   1   0.40   0.1134      283.6
18APR88   A    1   0-3   Mollusca           52  16.68   4.7304    14747.2
18APR88   A    1   0-3   Polychaeta        189  13.87   3.9335    53600.4
18APR88   A    1   3-10  Nemertea            1   0.77   0.2184      283.6
18APR88   A    1   3-10  Polychaeta          6   3.22   0.9132     1701.6
18APR88   A    2   0-3   Crustacea           4   0.03   0.0085     1134.4
18APR88   A    2   0-3   Mollusca          112  36.78  10.4308    31763.2
18APR88   A    2   0-3   Polychaeta        227  10.17   2.8842    64377.2
18APR88   A    2   3-10  Nemertea            1   0.66   0.1872      283.6
18APR88   A    2   3-10  Polychaeta          9   1.44   0.4084     2552.4
18APR88   A    3   0-3   Crustacea           3   0.34   0.0964      850.8
18APR88   A    3   0-3   Chironomid larvae   4   2.27   0.6438     1134.4
18APR88   A    3   0-3   Mollusca           99  36.88  10.4592    28076.4
18APR88   A    3   0-3   Polychaeta        176  10.40   2.9494    49913.6
18APR88   A    3   3-10  Polychaeta          5   3.29   0.9330     1418.0
18APR88   B    1   0-3   Crustacea          12   0.35   0.0993     3403.2
18APR88   B    1   0-3   Mollusca          150  25.82   7.3226    42540.0
18APR88   B    1   0-3   Polychaeta        395   9.79   2.7764   112022.0
18APR88   B    1   3-10  Crustacea           1   0.38   0.1078      283.6
18APR88   B    1   3-10  Nemertea            1   0.28   0.0794      283.6
18APR88   B    1   3-10  Polychaeta         53  14.85   4.2115    15030.8
18APR88   B    2   0-3   Crustacea           5   0.53   0.1503     1418.0
18APR88   B    2   0-3   Mollusca          141  15.89   4.5064    39987.6
18APR88   B    2   0-3   Nemertea            3   0.12   0.0340      850.8
18APR88   B    2   0-3   Polychaeta        305   9.47   2.6857    86498.0
18APR88   B    2   3-10  Chironomid larvae   1   0.60   0.1702      283.6
18APR88   B    2   3-10  Nemertea            2   0.38   0.1078      567.2
18APR88   B    2   3-10  Polychaeta         58  13.75   3.8995    16448.8
18APR88   B    3   0-3   Crustacea           8   0.76   0.2155     2268.8
18APR88   B    3   0-3   Mollusca          196  29.81   8.4541    55585.6
18APR88   B    3   0-3   Nemertea            2   0.04   0.0113      567.2
18APR88   B    3   0-3   Polychaeta        380  11.15   3.1621   107768.0
18APR88   B    3   3-10  Chironomid larvae   2   1.82   0.5162      567.2
18APR88   B    3   3-10  Mollusca            1   7.05   1.9994      283.6
18APR88   B    3   3-10  Nemertea            1   2.06   0.5842      283.6
18APR88   B    3   3-10  Polychaeta         67  17.60   4.9914    19001.2
18APR88   C    1   0-3   Crustacea           6   0.44   0.1248     1701.6
18APR88   C    1   0-3   Mollusca           86   7.79   2.2092    24389.6
18APR88   C    1   0-3   Polychaeta         96   5.94   1.6846    27225.6
18APR88   C    1   3-10  Nemertea            1   0.72   0.2042      283.6
18APR88   C    1   3-10  Polychaeta         42   4.83   1.3698    11911.2
18APR88   C    2   0-3   Crustacea           4   0.29   0.0822     1134.4
18APR88   C    2   0-3   Mollusca          156   9.40   2.6658    44241.6
18APR88   C    2   0-3   Nemertea            2   0.13   0.0369      567.2
18APR88   C    2   0-3   Others              1   0.37   0.1049      283.6
18APR88   C    2   0-3   Polychaeta         88   5.01   1.4208    24956.8
18APR88   C    2   3-10  Nemertea            1   0.19   0.0539      283.6
18APR88   C    2   3-10  Polychaeta         65   8.47   2.4021    18434.0
18APR88   C    3   0-3   Crustacea           4   0.21   0.0596     1134.4
18APR88   C    3   0-3   Mollusca          114   5.64   1.5995    32330.4
18APR88   C    3   0-3   Nemertea            1   0.18   0.0510      283.6
18APR88   C    3   0-3   Polychaeta        101   5.65   1.6023    28643.6
18APR88   C    3   3-10  Others              2   0.46   0.1305      567.2
18APR88   C    3   3-10  Polychaeta         26   8.61   2.4418     7373.6
18APR88   D    1   0-3   Crustacea           1   0.27   0.0766      283.6
18APR88   D    1   0-3   Mollusca           24   1.77   0.5020     6806.4
18APR88   D    1   0-3   Polychaeta         71   2.98   0.8451    20135.6
18APR88   D    1   3-10  Nemertea            1   0.49   0.1390      283.6
18APR88   D    1   3-10  Others              1   0.12   0.0340      283.6
18APR88   D    1   3-10  Polychaeta         20   2.10   0.5956     5672.0
18APR88   D    2   0-3   Crustacea           2   0.09   0.0255      567.2
18APR88   D    2   0-3   Mollusca           40   1.78   0.5048    11344.0
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18APR88   D   2   0-3    Polychaeta         84    2.90    0.8224    23822.4
18APR88   D   2   3-10   Polychaeta         18    2.36    0.6693     5104.8
18APR88   D   3   0-3    Crustacea           1    0.10    0.0284      283.6
18APR88   D   3   0-3    Mollusca           31    1.69    0.4793     8791.6
18APR88   D   3   0-3    Polychaeta         71    2.94    0.8338    20135.6
18APR88   D   3   3-10   Polychaeta         19    0.86    0.2439     5388.4
07JUL88   A   1   0-3    Crustacea           2    0.10    0.0284      567.2
07JUL88   A   1   0-3    Mollusca           70   43.53   12.3451    19852.0
07JUL88   A   1   0-3    Polychaeta        103    3.78    1.0720    29210.8
07JUL88   A   1   3-10   Nemertea            1    1.16    0.3290      283.6
07JUL88   A   1   3-10   Polychaeta         68   14.14    4.0101    19284.8
07JUL88   A   2   0-3    Crustacea           3    0.12    0.0340      850.8
07JUL88   A   2   0-3    Mollusca          101   41.85   11.8687    28643.6
07JUL88   A   2   0-3    Polychaeta         77    3.56    1.0096    21837.2
07JUL88   A   2   3-10   Mollusca            2    0.46    0.1305      567.2
07JUL88   A   2   3-10   Nemertea            2    2.57    0.7289      567.2
07JUL88   A   2   3-10   Polychaeta         83   18.80    5.3317    23538.8
07JUL88   A   3   0-3    Crustacea           5    0.04    0.0113     1418.0
07JUL88   A   3   0-3    Mollusca           87   42.49   12.0502    24673.2
07JUL88   A   3   0-3    Polychaeta         63    2.85    0.8083    17866.8
07JUL88   A   3   3-10   Nemertea            1    0.05    0.0142      283.6
07JUL88   A   3   3-10   Polychaeta         64   12.25    3.4741    18150.4
07JUL88   B   1   0-3    Crustacea           1    1.00    0.2836      283.6
07JUL88   B   1   0-3    Mollusca          108   36.61   10.3826    30628.8
07JUL88   B   1   0-3    Polychaeta         50    1.17    0.3318    14180.0
07JUL88   B   1   3-10   Polychaeta         33   10.00    2.8360     9358.8
07JUL88   B   2   0-3    Mollusca          114   39.12   11.0944    32330.4
07JUL88   B   2   0-3    Polychaeta         86    1.63    0.4623    24389.6
07JUL88   B   2   3-10   Mollusca            1   13.20    3.7435      283.6
07JUL88   B   2   3-10   Polychaeta         34    4.90    1.3896     9642.4
07JUL88   B   3   0-3    Crustacea           1    0.01    0.0028      283.6
07JUL88   B   3   0-3    Mollusca           98   34.82    9.8750    27792.8
07JUL88   B   3   0-3    Polychaeta         31    0.99    0.2808     8791.6
07JUL88   B   3   3-10   Polychaeta         30    5.05    1.4322     8508.0
08JUL88   C   1   0-3    Mollusca            7    0.23    0.0652     1985.2
08JUL88   C   1   0-3    Polychaeta         37    1.03    0.2921    10493.2
08JUL88   C   1   3-10   Polychaeta         29    2.09    0.5927     8224.4
08JUL88   C   2   0-3    Crustacea           1    0.01    0.0028      283.6
08JUL88   C   2   0-3    Mollusca            3    3.86    1.0947      850.8
08JUL88   C   2   0-3    Nemertea            1    0.05    0.0142      283.6
08JUL88   C   2   0-3    Polychaeta         27    0.72    0.2042     7657.2
08JUL88   C   2   3-10   Polychaeta         21    2.24    0.6353     5955.6
08JUL88   C   3   0-3    Mollusca            4    0.70    0.1985     1134.4
08JUL88   C   3   0-3    Nemertea            1    1.40    0.3970      283.6
08JUL88   C   3   0-3    Polychaeta         41    1.20    0.3403    11627.6
08JUL88   C   3   3-10   Polychaeta         19    1.13    0.3205     5388.4
08JUL88   D   1   0-3    Mollusca            2    0.11    0.0312      567.2
08JUL88   D   1   0-3    Polychaeta         35    2.66    0.7544     9926.0
08JUL88   D   1   3-10   Polychaeta          5    0.33    0.0936     1418.0
08JUL88   D   2   0-3    Polychaeta         26    0.97    0.2751     7373.6
08JUL88   D   2   3-10   Nemertea            1    0.10    0.0284      283.6
08JUL88   D   2   3-10   Polychaeta          3    0.18    0.0510      850.8
08JUL88   D   3   0-3    Crustacea           3    0.10    0.0284      850.8
08JUL88   D   3   0-3    Mollusca            3    0.05    0.0142      850.8
08JUL88   D   3   0-3    Polychaeta         34    0.96    0.2723     9642.4
08JUL88   D   3   3-10   Polychaeta          8    2.48    0.7033     2268.8
22NOV88   A   1   0-3    Crustacea           3    3.24    0.9189      850.8
22NOV88   A   1   0-3    Mollusca           21   30.77    8.7264     5955.6
22NOV88   A   1   0-3    Others              1    0.38    0.1078      283.6
22NOV88   A   1   0-3    Polychaeta         29    1.51    0.4282     8224.4
22NOV88   A   1   3-10   Nemertea            1    0.54    0.1531      283.6
22NOV88   A   1   3-10   Polychaeta         43    7.23    2.0504    12194.8
22NOV88   A   2   0-3    Crustacea           3    0.39    0.1106      850.8
22NOV88   A   2   0-3    Mollusca           25   35.16    9.9714     7090.0
22NOV88   A   2   0-3    Polychaeta         27    4.97    1.4095     7657.2
22NOV88   A   2   3-10   Nemertea            1    0.34    0.0964      283.6
22NOV88   A   2   3-10   Polychaeta         28    4.46    1.2649     7940.8
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22NOV88   A   3   0-3   Crustacea        4   6.35   1.8009    1134.4
22NOV88   A   3   0-3   Mollusca        11  15.58   4.4185    3119.6
22NOV88   A   3   0-3   Polychaeta      19   0.76   0.2155    5388.4
22NOV88   A   3   3-10  Crustacea        1   3.12   0.8848     283.6
22NOV88   A   3   3-10  Polychaeta      31   4.11   1.1656    8791.6
22NOV88   B   1   0-3   Crustacea        2   1.94   0.5502     567.2
22NOV88   B   1   0-3   Mollusca        83  71.65  20.3199   23538.8
22NOV88   B   1   0-3   Polychaeta      40   1.05   0.2978   11344.0
22NOV88   B   1   3-10  Mollusca         3   2.72   0.7714     850.8
22NOV88   B   1   3-10  Polychaeta      19   1.24   0.3517    5388.4
22NOV88   B   2   0-3   Crustacea        1   3.88   1.1004     283.6
22NOV88   B   2   0-3   Mollusca        63  81.64  23.1531   17866.8
22NOV88   B   2   0-3   Polychaeta      29   1.46   0.4141    8224.4
22NOV88   B   2   3-10  Polychaeta      20   2.19   0.6211    5672.0
22NOV88   B   3   0-3   Mollusca        55  77.18  21.8882   15598.0
22NOV88   B   3   0-3   Polychaeta      17   0.81   0.2297    4821.2
22NOV88   B   3   3-10  Mollusca         1   0.33   0.0936     283.6
22NOV88   B   3   3-10  Polychaeta      30   2.31   0.6551    8508.0
22NOV88   C   1   0-3   Nemertea         1   0.03   0.0085     283.6
22NOV88   C   1   0-3   Polychaeta      12   0.40   0.1134    3403.2
22NOV88   C   1   3-10  Nemertea         1   0.11   0.0312     283.6
22NOV88   C   1   3-10  Polychaeta      22   2.14   0.6069    6239.2
22NOV88   C   2   0-3   Nemertea         1   0.03   0.0085     283.6
22NOV88   C   2   0-3   Polychaeta      16   0.64   0.1815    4537.6
22NOV88   C   2   3-10  Polychaeta      17   1.14   0.3233    4821.2
22NOV88   C   3   0-3   Mollusca         2   0.16   0.0454     567.2
22NOV88   C   3   0-3   Nemertea         1   0.17   0.0482     283.6
22NOV88   C   3   0-3   Polychaeta      24   0.89   0.2524    6806.4
22NOV88   C   3   3-10  Polychaeta      18   1.57   0.4453    5104.8
22NOV88   D   1   0-3   Mollusca         1   0.49   0.1390     283.6
22NOV88   D   1   0-3   Polychaeta      23   1.07   0.3035    6522.8
22NOV88   D   1   3-10  Nemertea         1   0.24   0.0681     283.6
22NOV88   D   1   3-10  Polychaeta       6   2.26   0.6409    1701.6
22NOV88   D   2   0-3   Crustacea        1   0.19   0.0539     283.6
22NOV88   D   2   0-3   Mollusca         1   0.22   0.0624     283.6
22NOV88   D   2   0-3   Polychaeta      22   1.22   0.3460    6239.2
22NOV88   D   2   3-10  Polychaeta       4   1.61   0.4566    1134.4
22NOV88   D   3   0-3   Crustacea        1   0.17   0.0482     283.6
22NOV88   D   3   0-3   Nemertea         2   0.71   0.2014     567.2
22NOV88   D   3   0-3   Polychaeta      18   1.63   0.4623    5104.8
22NOV88   D   3   3-10  Nemertea         1   0.34   0.0964     283.6
22NOV88   D   3   3-10  Polychaeta       7   1.36   0.3857    1985.2
04APR89   A   1   0-3   Crustacea        4   0.21   0.0596    1134.4
04APR89   A   1   0-3   Mollusca        72   6.99   1.9824   20419.2
04APR89   A   1   0-3   Nemertea         5   0.25   0.0709    1418.0
04APR89   A   1   0-3   Polychaeta     188  11.18   3.1706   53316.8
04APR89   A   1   3-10  Mollusca         4   4.03   1.1429    1134.4
04APR89   A   1   3-10  Polychaeta      67   8.58   2.4333   19001.2
04APR89   A   2   0-3   Crustacea        7   0.35   0.0993    1985.2
04APR89   A   2   0-3   Mollusca        57   8.43   2.3907   16165.2
04APR89   A   2   0-3   Nemertea         2   0.25   0.0709     567.2
04APR89   A   2   0-3   Polychaeta     232  14.75   4.1831   65795.2
04APR89   A   2   3-10  Polychaeta      89  11.10   3.1480   25240.4
04APR89   A   3   0-3   Crustacea        2   0.24   0.0681     567.2
04APR89   A   3   0-3   Mollusca        93   7.36   2.0873   26374.8
04APR89   A   3   0-3   Nemertea         2   0.05   0.0142     567.2
04APR89   A   3   0-3   Polychaeta     209  13.56   3.8456   59272.4
04APR89   A   3   3-10  Mollusca         1   0.22   0.0624     283.6
04APR89   A   3   3-10  Polychaeta      43   6.37   1.8065   12194.8
04APR89   B   1   0-3   Crustacea        2   0.25   0.0709     567.2
04APR89   B   1   0-3   Mollusca        33   5.91   1.6761    9358.8
04APR89   B   1   0-3   Polychaeta     193   4.18   1.1854   54734.8
04APR89   B   1   3-10  Mollusca         3   5.58   1.5825     850.8
04APR89   B   1   3-10  Polychaeta      21   2.61   0.7402    5955.6
04APR89   B   2   0-3   Mollusca        28   6.53   1.8519    7940.8
04APR89   B   2   0-3   Polychaeta     146   5.80   1.6449   41405.6
04APR89   B   2   3-10  Polychaeta      42   6.62   1.8774   11911.2
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04APR89	B	3	0-3	Mollusca	31	7.37	2.0901	8791.6
04APR89	B	3	0-3	Nemertea	1	0.04	0.0113	283.6
04APR89	B	3	0-3	Polychaeta	179	9.56	2.7112	50764.4
04APR89	B	3	3-10	Mollusca	5	8.53	2.4191	1418.0
04APR89	B	3	3-10	Polychaeta	30	3.04	0.8621	8508.0
04APR89	C	1	0-3	Crustacea	28	1.12	0.3176	7940.8
04APR89	C	1	0-3	Polychaeta	39	1.21	0.3432	11060.4
04APR89	C	1	3-10	Polychaeta	8	0.26	0.0737	2268.8
04APR89	C	2	0-3	Crustacea	13	0.67	0.1900	3686.8
04APR89	C	2	0-3	Mollusca	3	0.42	0.1191	850.8
04APR89	C	2	0-3	Polychaeta	23	1.17	0.3318	6522.8
04APR89	C	2	3-10	Mollusca	1	5.32	1.5088	283.6
04APR89	C	2	3-10	Nemertea	1	0.36	0.1021	283.6
04APR89	C	2	3-10	Polychaeta	13	0.92	0.2609	3686.8
04APR89	C	3	0-3	Crustacea	12	0.22	0.0624	3403.2
04APR89	C	3	0-3	Mollusca	3	1.09	0.3091	850.8
04APR89	C	3	0-3	Polychaeta	44	1.64	0.4651	12478.4
04APR89	C	3	3-10	Polychaeta	9	9.50	2.6942	2552.4
04APR89	D	1	0-3	Crustacea	27	0.76	0.2155	7657.2
04APR89	D	1	0-3	Mollusca	12	4.37	1.2393	3403.2
04APR89	D	1	0-3	Polychaeta	39	30.76	8.7235	11060.4
04APR89	D	1	3-10	Mollusca	1	7.51	2.1298	283.6
04APR89	D	1	3-10	Polychaeta	12	3.53	1.0011	3403.2
04APR89	D	2	0-3	Crustacea	1	0.03	0.0085	283.6
04APR89	D	2	0-3	Mollusca	1	3.54	1.0039	283.6
04APR89	D	2	0-3	Polychaeta	23	2.33	0.6608	6522.8
04APR89	D	2	3-10	Nemertea	2	1.55	0.4396	567.2
04APR89	D	2	3-10	Polychaeta	5	15.92	4.5149	1418.0
04APR89	D	3	0-3	Crustacea	21	0.24	0.0681	5955.6
04APR89	D	3	0-3	Mollusca	3	0.48	0.1361	850.8
04APR89	D	3	0-3	Polychaeta	64	8.05	2.2830	18150.4
04APR89	D	3	3-10	Crustacea	1	0.05	0.0142	283.6
04APR89	D	3	3-10	Polychaeta	30	8.23	2.3340	8508.0
23JUL89	A	1	0-3	Crustacea	1	0.36	0.1021	283.6
23JUL89	A	1	0-3	Mollusca	19	3.81	1.0805	5388.4
23JUL89	A	1	0-3	Nemertea	1	0.16	0.0454	283.6
23JUL89	A	1	0-3	Polychaeta	19	3.81	1.0805	5388.4
23JUL89	A	1	3-10	Polychaeta	31	4.45	1.2620	8791.6
23JUL89	A	2	0-3	Crustacea	9	0.08	0.0227	2552.4
23JUL89	A	2	0-3	Mollusca	33	12.75	3.6159	9358.8
23JUL89	A	2	0-3	Polychaeta	20	1.14	0.3233	5672.0
23JUL89	A	2	3-10	Polychaeta	41	6.67	1.8916	11627.6
23JUL89	A	3	0-3	Crustacea	5	0.91	0.2581	1418.0
23JUL89	A	3	0-3	Mollusca	25	8.28	2.3482	7090.0
23JUL89	A	3	0-3	Nemertea	2	0.13	0.0369	567.2
23JUL89	A	3	0-3	Polychaeta	34	2.23	0.6324	9642.4
23JUL89	A	3	3-10	Polychaeta	37	5.79	1.6420	10493.2
23JUL89	C	1	0-3	Crustacea	10	0.41	0.1163	2836.0
23JUL89	C	1	0-3	Mollusca	3	0.20	0.0567	850.8
23JUL89	C	1	0-3	Nemertea	1	0.04	0.0113	283.6
23JUL89	C	1	0-3	Polychaeta	40	5.66	1.6052	11344.0
23JUL89	C	1	3-10	Crustacea	2	0.07	0.0199	567.2
23JUL89	C	1	3-10	Polychaeta	8	1.57	0.4453	2268.8
23JUL89	C	2	0-3	Crustacea	7	0.13	0.0369	1985.2
23JUL89	C	2	0-3	Mollusca	5	2.50	0.7090	1418.0
23JUL89	C	2	0-3	Nemertea	2	0.05	0.0142	567.2
23JUL89	C	2	0-3	Polychaeta	31	1.55	0.4396	8791.6
23JUL89	C	2	3-10	Crustacea	1	0.01	0.0028	283.6
23JUL89	C	2	3-10	Mollusca	1	0.01	0.0028	283.6
23JUL89	C	2	3-10	Polychaeta	4	5.56	1.5768	1134.4
23JUL89	C	3	0-3	Crustacea	1	0.02	0.0057	283.6
23JUL89	C	3	0-3	Mollusca	2	0.39	0.1106	567.2
23JUL89	C	3	0-3	Nemertea	1	0.01	0.0028	283.6
23JUL89	C	3	0-3	Polychaeta	40	2.72	0.7714	11344.0
23JUL89	C	3	3-10	Polychaeta	27	7.70	2.1837	7657.2

NCMACMG.DAT Nueces Estuary Macrofauna biomass data (mg/m^2)

3 replicates (REP) were taken each time, N=n/section, MG=dry weight in mg/core, GM2=g/m^2, nm2=n/m^2.

DATE	STA	REP	SEC	TAXA	N	MG	GM2	NM2
20OCT87	A	1	0-3	Polychaeta	17	0.32	0.0908	4821.2
20OCT87	A	2	0-3	Polychaeta	13	0.46	0.1305	3686.8
20OCT87	A	2	0-3	Mollusca	1	0.09	0.0255	283.6
20OCT87	A	3	0-3	Polychaeta	9	0.29	0.0822	2552.4
20OCT87	A	1	3-10	Polychaeta	3	0.60	0.1702	850.8
20OCT87	A	2	3-10	Polychaeta	6	0.63	0.1787	1701.6
20OCT87	A	3	3-10	Polychaeta	2	0.53	0.1503	567.2
20OCT87	A	3	3-10	Nemertea	1	0.37	0.1049	283.6
21OCT87	B	1	0-3	Polychaeta	2	0.01	0.0028	567.2
21OCT87	B	2	0-3	Polychaeta	6	0.30	0.0851	1701.6
21OCT87	B	3	0-3	Polychaeta	6	1.05	0.2978	1701.6
21OCT87	B	1	3-10	Polychaeta	6	1.68	0.4764	1701.6
21OCT87	B	1	3-10	Nemertea	1	0.25	0.0709	283.6
21OCT87	B	2	3-10	Polychaeta	4	0.25	0.0709	1134.4
21OCT87	B	3	3-10	Polychaeta	6	0.74	0.2099	1701.6
19OCT87	C	1	0-3	Polychaeta	14	0.11	0.0312	3970.4
19OCT87	C	2	0-3	Polychaeta	37	1.15	0.3261	10493.2
19OCT87	C	2	0-3	Crustacea	1	0.03	0.0085	283.6
19OCT87	C	3	0-3	Polychaeta	27	0.72	0.2042	7657.2
19OCT87	C	3	0-3	Crustacea	4	0.25	0.0709	1134.4
19OCT87	C	3	0-3	Mollusca	1	0.01	0.0028	283.6
19OCT87	C	1	3-10	Polychaeta	19	2.11	0.5984	5388.4
19OCT87	C	1	3-10	Nemertea	1	0.24	0.0681	283.6
19OCT87	C	1	3-10	Mollusca	1	13.38	3.7946	283.6
19OCT87	C	2	3-10	Polychaeta	8	9.64	2.7339	2268.8
19OCT87	C	2	3-10	Nemertea	1	3.29	0.9330	283.6
19OCT87	C	2	3-10	Others	1	0.05	0.0142	283.6
19OCT87	C	2	3-10	Crustacea	1	0.09	0.0255	283.6
19OCT87	C	3	3-10	Polychaeta	16	2.83	0.8026	4537.6
19OCT87	C	3	3-10	Nemertea	1	0.26	0.0737	283.6
19OCT87	C	3	3-10	Mollusca	2	22.84	6.4774	567.2
22OCT87	D	1	0-3	Polychaeta	24	2.11	0.5984	6806.4
22OCT87	D	1	0-3	Nemertea	2	0.25	0.0709	567.2
22OCT87	D	2	0-3	Polychaeta	35	1.43	0.4055	9926.0
22OCT87	D	2	0-3	Nemertea	1	0.08	0.0227	283.6
22OCT87	D	3	0-3	Polychaeta	33	1.43	0.4055	9358.8
22OCT87	D	1	3-10	Polychaeta	7	1.56	0.4424	1985.2
22OCT87	D	1	3-10	Nemertea	1	0.37	0.1049	283.6
22OCT87	D	2	3-10	Polychaeta	4	1.84	0.5218	1134.4
22OCT87	D	3	3-10	Polychaeta	5	1.78	0.5048	1418.0
08DEC87	A	1	0-3	Polychaeta	6	0.20	0.0567	1701.6
08DEC87	A	1	0-3	Mollusca	14	0.31	0.0879	3970.4
08DEC87	A	2	0-3	Polychaeta	9	0.44	0.1248	2552.4
08DEC87	A	2	0-3	Mollusca	10	0.14	0.0397	2836.0
08DEC87	A	2	0-3	Nemertea	1	0.01	0.0028	283.6
08DEC87	A	3	0-3	Polychaeta	3	0.16	0.0454	850.8
08DEC87	A	3	0-3	Mollusca	10	1.19	0.3375	2836.0
08DEC87	A	3	0-3	Crustacea	1	0.03	0.0085	283.6
08DEC87	A	1	3-10	Polychaeta	3	0.59	0.1673	850.8
08DEC87	A	2	3-10	Polychaeta	1	1.59	0.4509	283.6
08DEC87	A	3	3-10	Polychaeta	4	1.53	0.4339	1134.4
09DEC87	B	1	0-3	Polychaeta	8	0.21	0.0596	2268.8
09DEC87	B	1	0-3	Mollusca	4	0.43	0.1219	1134.4
09DEC87	B	1	0-3	Others	1	0.03	0.0085	283.6
09DEC87	B	2	0-3	Polychaeta	21	0.77	0.2184	5955.6
09DEC87	B	2	0-3	Mollusca	4	0.06	0.0170	1134.4
09DEC87	B	3	0-3	Polychaeta	14	0.48	0.1361	3970.4

09DEC87	B	3	0-3	Mollusca	4	0.06	0.0170	1134.4
09DEC87	B	1	3-10	Polychaeta	3	1.15	0.3261	850.8
09DEC87	B	1	3-10	Nemertea	1	0.39	0.1106	283.6
09DEC87	B	2	3-10	Polychaeta	7	0.43	0.1219	1985.2
09DEC87	B	3	3-10	Polychaeta	6	6.35	1.8009	1701.6
07DEC87	C	1	0-3	Polychaeta	5	0.06	0.0170	1418.0
07DEC87	C	1	0-3	Mollusca	1	0.03	0.0085	283.6
07DEC87	C	1	0-3	Crustacea	3	0.09	0.0255	850.8
07DEC87	C	2	0-3	Polychaeta	25	1.00	0.2836	7090.0
07DEC87	C	2	0-3	Crustacea	3	0.13	0.0369	850.8
07DEC87	C	3	0-3	Polychaeta	6	0.15	0.0425	1701.6
07DEC87	C	3	0-3	Mollusca	1	0.01	0.0028	283.6
07DEC87	C	3	0-3	Crustacea	4	0.38	0.1078	1134.4
07DEC87	C	1	3-10	Polychaeta	8	12.38	3.5110	2268.8
07DEC87	C	1	3-10	Crustacea	1	0.24	0.0681	283.6
07DEC87	C	1	3-10	Mollusca	1	7.08	2.0079	283.6
07DEC87	C	2	3-10	Polychaeta	8	2.40	0.6806	2268.8
07DEC87	C	2	3-10	Mollusca	1	10.92	3.0969	283.6
07DEC87	C	3	3-10	Polychaeta	5	0.63	0.1787	1418.0
10DEC87	D	1	0-3	Polychaeta	19	1.45	0.4112	5388.4
10DEC87	D	1	0-3	Crustacea	6	0.16	0.0454	1701.6
10DEC87	D	2	0-3	Polychaeta	32	3.30	0.9359	9075.2
10DEC87	D	2	0-3	Crustacea	1	0.08	0.0227	283.6
10DEC87	D	2	0-3	Nemertea	1	0.20	0.0567	283.6
10DEC87	D	3	0-3	Polychaeta	63	8.30	2.3539	17866.8
10DEC87	D	3	0-3	Nemertea	1	0.10	0.0284	283.6
10DEC87	D	3	0-3	Mollusca	1	0.02	0.0057	283.6
10DEC87	D	1	3-10	Polychaeta	19	2.45	0.6948	5388.4
10DEC87	D	1	3-10	Nemertea	1	0.42	0.1191	283.6
10DEC87	D	1	3-10	Crustacea	1	0.02	0.0057	283.6
10DEC87	D	1	3-10	Ophiuroidea	1	1.07	0.3035	283.6
10DEC87	D	2	3-10	Polychaeta	14	4.43	1.2563	3970.4
10DEC87	D	3	3-10	Polychaeta	685	52.11	14.7784	194266.0
16FEB88	A	1	0-3	Polychaeta	1	0.06	0.0170	283.6
16FEB88	A	1	0-3	Mollusca	21	2.08	0.5899	5955.6
16FEB88	A	2	0-3	Polychaeta	5	0.07	0.0199	1418.0
16FEB88	A	2	0-3	Mollusca	18	1.78	0.5048	5104.8
16FEB88	A	3	0-3	Polychaeta	6	0.39	0.1106	1701.6
16FEB88	A	3	0-3	Mollusca	11	0.58	0.1645	3119.6
16FEB88	A	1	3-10	Polychaeta	6	1.34	0.3800	1701.6
16FEB88	A	1	3-10	Mollusca	3	1.70	0.4821	850.8
16FEB88	A	2	3-10	Polychaeta	4	0.80	0.2269	1134.4
16FEB88	A	2	3-10	Nemertea	1	0.09	0.0255	283.6
16FEB88	A	3	3-10	Polychaeta	6	1.16	0.3290	1701.6
16FEB88	A	3	3-10	Mollusca	2	4.14	1.1741	567.2
17FEB88	B	1	0-3	Polychaeta	24	2.37	0.6721	6806.4
17FEB88	B	1	0-3	Crustacea	3	0.03	0.0085	850.8
17FEB88	B	1	0-3	Mollusca	26	5.31	1.5059	7373.6
17FEB88	B	2	0-3	Polychaeta	10	0.83	0.2354	2836.0
17FEB88	B	2	0-3	Mollusca	23	6.25	1.7725	6522.8
17FEB88	B	3	0-3	Polychaeta	17	0.55	0.1560	4821.2
17FEB88	B	3	0-3	Mollusca	23	2.16	0.6126	6522.8
17FEB88	B	3	0-3	Others	1	0.02	0.0057	283.6
17FEB88	B	1	3-10	Polychaeta	17	2.04	0.5785	4821.2
17FEB88	B	1	3-10	Mollusca	3	0.91	0.2581	850.8
17FEB88	B	2	3-10	Polychaeta	25	1.62	0.4594	7090.0
17FEB88	B	2	3-10	Mollusca	3	1.90	0.5388	850.8
17FEB88	B	2	3-10	Nemertea	1	0.58	0.1645	283.6
17FEB88	B	3	3-10	Polychaeta	34	4.01	1.1372	9642.4
17FEB88	B	3	3-10	Nemertea	1	0.35	0.0993	283.6
15FEB88	C	1	0-3	Polychaeta	16	0.70	0.1985	4537.6
15FEB88	C	1	0-3	Crustacea	1	0.17	0.0482	283.6
15FEB88	C	1	0-3	Sipunculida	2	1.77	0.5020	567.2
15FEB88	C	2	0-3	Polychaeta	10	2.02	0.5729	2836.0
15FEB88	C	2	0-3	Crustacea	2	0.23	0.0652	567.2
15FEB88	C	2	0-3	Mollusca	4	1.41	0.3999	1134.4
15FEB88	C	2	0-3	Others	1	0.03	0.0085	283.6

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15FEB88   C   3   0-3    Polychaeta     5    0.50   0.1418    1418.0
15FEB88   C   3   0-3    Mollusca       4    0.20   0.0567    1134.4
15FEB88   C   3   0-3    Nemertea       1    0.08   0.0227     283.6
15FEB88   C   1   3-10   Polychaeta     4    2.04   0.5785    1134.4
15FEB88   C   1   3-10   Nemertea       1    0.21   0.0596     283.6
15FEB88   C   2   3-10   Polychaeta     5    1.56   0.4424    1418.0
15FEB88   C   2   3-10   Nemertea       1    0.27   0.0766     283.6
15FEB88   C   3   3-10   Polychaeta     4    1.95   0.5530    1134.4
18FEB88   D   1   0-3    Polychaeta    29    2.71   0.7686    8224.4
18FEB88   D   1   0-3    Crustacea      2    0.05   0.0142     567.2
18FEB88   D   1   0-3    Nemertea       3    0.81   0.2297     850.8
18FEB88   D   1   0-3    Mollusca       5    0.84   0.2382    1418.0
18FEB88   D   1   0-3    Others         1    0.02   0.0057     283.6
18FEB88   D   2   0-3    Polychaeta    86   17.53   4.9715   24389.6
18FEB88   D   2   0-3    Crustacea     16    1.77   0.5020    4537.6
18FEB88   D   2   0-3    Nemertea       1    1.48   0.4197     283.6
18FEB88   D   2   0-3    Mollusca       3    0.24   0.0681     850.8
18FEB88   D   2   0-3    Sipunculida    1    2.23   0.6324     283.6
18FEB88   D   2   0-3    Others         3    0.06   0.0170     850.8
18FEB88   D   3   0-3    Polychaeta    39    3.87   1.0975   11060.4
18FEB88   D   3   0-3    Crustacea      2    0.04   0.0113     567.2
18FEB88   D   3   0-3    Nemertea       1    0.02   0.0057     283.6
18FEB88   D   3   0-3    Mollusca      14    3.09   0.8763    3970.4
18FEB88   D   3   0-3    Sipunculida    1    1.45   0.4112     283.6
18FEB88   D   3   0-3    Others         2    0.04   0.0113     567.2
18FEB88   D   1   3-10   Polychaeta    59   23.46   6.6533   16732.4
18FEB88   D   1   3-10   Nemertea       1    0.11   0.0312     283.6
18FEB88   D   1   3-10   Mollusca      17    7.30   2.0703    4821.2
18FEB88   D   2   3-10   Polychaeta   192   69.53  19.7187   54451.2
18FEB88   D   2   3-10   Mollusca       9    0.60   0.1702    2552.4
18FEB88   D   2   3-10   Crustacea      1    0.09   0.0255     283.6
18FEB88   D   3   3-10   Polychaeta    10   13.00   3.6868    2836.0
18FEB88   D   3   3-10   Mollusca       6    0.53   0.1503    1701.6
12APR88   A   1   0-3    Polychaeta     3    0.62   0.1758     850.8
12APR88   A   1   0-3    Mollusca       7    5.92   1.6789    1985.2
12APR88   A   2   0-3    Polychaeta     5    0.12   0.0340    1418.0
12APR88   A   2   0-3    Mollusca      11    1.51   0.4282    3119.6
12APR88   A   3   0-3    Polychaeta     5    0.15   0.0425    1418.0
12APR88   A   3   0-3    Mollusca      12    6.44   1.8264    3403.2
12APR88   A   1   3-10   Polychaeta     7    1.09   0.3091    1985.2
12APR88   A   1   3-10   Mollusca       4    5.51   1.5626    1134.4
12APR88   A   2   3-10   Polychaeta     1    0.38   0.1078     283.6
12APR88   A   2   3-10   Mollusca       3    9.02   2.5581     850.8
12APR88   A   3   3-10   Polychaeta     8    0.20   0.0567    2268.8
12APR88   A   3   3-10   Mollusca       2    5.80   1.6449     567.2
13APR88   B   1   0-3    Polychaeta    16    1.25   0.3545    4537.6
13APR88   B   1   0-3    Crustacea     10    0.15   0.0425    2836.0
13APR88   B   1   0-3    Mollusca       3   11.53   3.2699     850.8
13APR88   B   1   0-3    Nemertea       1    0.20   0.0567     283.6
13APR88   B   2   0-3    Polychaeta    11    7.54   2.1383    3119.6
13APR88   B   2   0-3    Crustacea      3    0.07   0.0199     850.8
13APR88   B   2   0-3    Mollusca       3    0.92   0.2609     850.8
13APR88   B   3   0-3    Polychaeta     8   29.30   8.3095    2268.8
13APR88   B   3   0-3    Crustacea      1    0.01   0.0028     283.6
13APR88   B   3   0-3    Mollusca       4    6.07   1.7215    1134.4
13APR88   B   1   3-10   Polychaeta     7   14.05   3.9846    1985.2
13APR88   B   1   3-10   Mollusca       4    1.23   0.3488    1134.4
13APR88   B   2   3-10   Polychaeta     2   34.90   9.8976     567.2
13APR88   B   3   3-10   Polychaeta     7   53.10  15.0592    1985.2
11APR88   C   1   0-3    Polychaeta    31    6.16   1.7470    8791.6
11APR88   C   1   0-3    Crustacea      1    2.65   0.7515     283.6
11APR88   C   1   0-3    Mollusca      26    3.75   1.0635    7373.6
11APR88   C   1   0-3    Nemertea       1    0.21   0.0596     283.6
11APR88   C   2   0-3    Polychaeta    21    4.38   1.2422    5955.6
11APR88   C   2   0-3    Crustacea      2    0.01   0.0028     567.2
11APR88   C   2   0-3    Mollusca      26    6.54   1.8547    7373.6
11APR88   C   2   0-3    Nemertea       2    0.57   0.1617     567.2
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11APR88	C	2	0-3	Sipunculida	1	0.12	0.0340	283.6
11APR88	C	3	0-3	Polychaeta	17	3.19	0.9047	4821.2
11APR88	C	3	0-3	Crustacea	3	0.19	0.0539	850.8
11APR88	C	3	0-3	Mollusca	29	7.61	2.1582	8224.4
11APR88	C	3	0-3	Nemertea	1	0.05	0.0142	283.6
11APR88	C	1	3-10	Polychaeta	5	17.93	5.0849	1418.0
11APR88	C	1	3-10	Crustacea	2	0.11	0.0312	567.2
11APR88	C	1	3-10	Mollusca	4	15.31	4.3419	1134.4
11APR88	C	2	3-10	Polychaeta	13	31.00	8.7916	3686.8
11APR88	C	2	3-10	Mollusca	3	0.65	0.1843	850.8
11APR88	C	3	3-10	Polychaeta	9	38.92	11.0377	2552.4
11APR88	C	3	3-10	Mollusca	1	5.60	1.5882	283.6
13APR88	C	1	0-3	Polychaeta	20	1.72	0.4878	5672.0
13APR88	C	1	0-3	Crustacea	4	0.02	0.0057	1134.4
13APR88	C	1	0-3	Others	1	0.03	0.0085	283.6
13APR88	C	1	0-3	Sipunculida	2	5.47	1.5513	567.2
13APR88	C	2	0-3	Polychaeta	15	2.45	0.6948	4254.0
13APR88	C	2	0-3	Crustacea	4	0.18	0.0510	1134.4
13APR88	C	2	0-3	Mollusca	5	0.29	0.0822	1418.0
13APR88	C	2	0-3	Nemertea	1	0.31	0.0879	283.6
13APR88	C	2	0-3	Sipunculida	2	2.99	0.8480	567.2
13APR88	C	3	0-3	Polychaeta	10	0.67	0.1900	2836.0
13APR88	C	3	0-3	Crustacea	5	0.18	0.0510	1418.0
13APR88	C	3	0-3	Mollusca	7	0.56	0.1588	1985.2
13APR88	C	3	0-3	Sipunculida	1	2.04	0.5785	283.6
13APR88	C	1	3-10	Polychaeta	6	5.65	1.6023	1701.6
13APR88	C	2	3-10	Polychaeta	6	4.75	1.3471	1701.6
13APR88	C	2	3-10	Nemertea	2	0.69	0.1957	567.2
13APR88	C	2	3-10	Ophiuroidea	1	7.83	2.2206	283.6
13APR88	C	3	3-10	Polychaeta	6	1.84	0.5218	1701.6
13APR88	C	3	3-10	Crustacea	1	0.36	0.1021	283.6
14APR88	D	1	0-3	Polychaeta	41	4.13	1.1713	11627.6
14APR88	D	1	0-3	Crustacea	1	0.13	0.0369	283.6
14APR88	D	1	0-3	Mollusca	10	1.84	0.5218	2836.0
14APR88	D	1	0-3	Nemertea	1	0.32	0.0908	283.6
14APR88	D	1	0-3	Others	8	1.01	0.2864	2268.8
14APR88	D	2	0-3	Polychaeta	51	7.80	2.2121	14463.6
14APR88	D	2	0-3	Crustacea	1	0.09	0.0255	283.6
14APR88	D	2	0-3	Mollusca	10	1.20	0.3403	2836.0
14APR88	D	2	0-3	Others	11	0.62	0.1758	3119.6
14APR88	D	3	0-3	Polychaeta	39	3.16	0.8962	11060.4
14APR88	D	3	0-3	Mollusca	3	0.19	0.0539	850.8
14APR88	D	3	0-3	Nemertea	2	2.43	0.6891	567.2
14APR88	D	3	0-3	Others	3	0.08	0.0227	850.8
14APR88	D	1	3-10	Polychaeta	25	7.24	2.0533	7090.0
14APR88	D	1	3-10	Nemertea	2	3.27	0.9274	567.2
14APR88	D	2	3-10	Polychaeta	15	11.76	3.3351	4254.0
14APR88	D	2	3-10	Mollusca	2	0.17	0.0482	567.2
14APR88	D	2	3-10	Nemertea	1	6.30	1.7867	283.6
14APR88	D	2	3-10	Others	3	0.75	0.2127	850.8
14APR88	D	3	3-10	Polychaeta	8	3.20	0.9075	2268.8
14APR88	D	3	3-10	Mollusca	1	1.45	0.4112	283.6
14APR88	D	3	3-10	Nemertea	1	0.18	0.0510	283.6
14APR88	D	3	3-10	Others	2	0.85	0.2411	567.2
10MAY88	A	1	0-3	Polychaeta	13	0.64	0.1815	3686.8
10MAY88	A	1	0-3	Mollusca	6	4.78	1.3556	1701.6
10MAY88	A	2	0-3	Polychaeta	4	0.28	0.0794	1134.4
10MAY88	A	2	0-3	Mollusca	6	3.24	0.9189	1701.6
10MAY88	A	3	0-3	Polychaeta	11	0.36	0.1021	3119.6
10MAY88	A	3	0-3	Mollusca	6	2.95	0.8366	1701.6
10MAY88	A	1	3-10	Polychaeta	10	1.09	0.3091	2836.0
10MAY88	A	1	3-10	Mollusca	1	3.49	0.9898	283.6
10MAY88	A	2	3-10	Polychaeta	11	1.00	0.2836	3119.6
10MAY88	A	2	3-10	Mollusca	2	7.55	2.1412	567.2
10MAY88	A	3	3-10	Polychaeta	12	1.20	0.3403	3403.2
10MAY88	A	3	3-10	Mollusca	1	2.28	0.6466	283.6
11MAY88	B	1	0-3	Polychaeta	19	1.25	0.3545	5388.4

11MAY88	B	1	0-3	Crustacea	12	0.36	0.1021	3403.2
11MAY88	B	1	0-3	Mollusca	4	26.80	7.6005	1134.4
11MAY88	B	2	0-3	Polychaeta	2	0.28	0.0794	567.2
11MAY88	B	2	0-3	Mollusca	3	7.97	2.2603	850.8
11MAY88	B	3	0-3	Polychaeta	9	2.71	0.7686	2552.4
11MAY88	B	3	0-3	Crustacea	4	0.03	0.0085	1134.4
11MAY88	B	3	0-3	Mollusca	7	47.48	13.4653	1985.2
11MAY88	B	1	3-10	Polychaeta	5	14.75	4.1831	1418.0
11MAY88	B	1	3-10	Crustacea	2	0.04	0.0113	567.2
11MAY88	B	2	3-10	Polychaeta	4	3.24	0.9189	1134.4
11MAY88	B	2	3-10	Mollusca	1	12.45	3.5308	283.6
11MAY88	B	3	3-10	Polychaeta	9	18.50	5.2466	2552.4
11MAY88	B	3	3-10	Mollusca	1	0.05	0.0142	283.6
11MAY88	B	3	3-10	Nemertea	1	0.29	0.0822	283.6
09MAY88	C	1	0-3	Polychaeta	24	0.79	0.2240	6806.4
09MAY88	C	1	0-3	Crustacea	12	0.45	0.1276	3403.2
09MAY88	C	1	0-3	Nemertea	1	0.09	0.0255	283.6
09MAY88	C	2	0-3	Polychaeta	20	1.08	0.3063	5672.0
09MAY88	C	2	0-3	Crustacea	6	0.36	0.1021	1701.6
09MAY88	C	2	0-3	Mollusca	1	0.02	0.0057	283.6
09MAY88	C	2	0-3	Nemertea	1	0.04	0.0113	283.6
09MAY88	C	3	0-3	Polychaeta	19	1.13	0.3205	5388.4
09MAY88	C	3	0-3	Crustacea	20	1.89	0.5360	5672.0
09MAY88	C	3	0-3	Mollusca	3	0.09	0.0255	850.8
09MAY88	C	3	0-3	Others	1	0.15	0.0425	283.6
09MAY88	C	1	3-10	Polychaeta	5	1.79	0.5076	1418.0
09MAY88	C	1	3-10	Nemertea	1	0.19	0.0539	283.6
09MAY88	C	2	3-10	Polychaeta	14	3.15	0.8933	3970.4
09MAY88	C	3	3-10	Polychaeta	11	5.60	1.5882	3119.6
09MAY88	C	3	3-10	Crustacea	5	0.27	0.0766	1418.0
09MAY88	C	3	3-10	Nemertea	1	2.68	0.7600	283.6
09MAY88	C	3	3-10	Ophiuroidea	1	3.52	0.9983	283.6
09MAY88	C	3	3-10	Others	1	0.17	0.0482	283.6
12MAY88	D	1	0-3	Polychaeta	6	2.19	0.6211	1701.6
12MAY88	D	1	0-3	Mollusca	5	0.19	0.0539	1418.0
12MAY88	D	1	0-3	Nemertea	1	2.21	0.6268	283.6
12MAY88	D	2	0-3	Polychaeta	18	0.65	0.1843	5104.8
12MAY88	D	2	0-3	Crustacea	1	0.04	0.0113	283.6
12MAY88	D	2	0-3	Mollusca	2	0.27	0.0766	567.2
12MAY88	D	2	0-3	Nemertea	3	0.14	0.0397	850.8
12MAY88	D	2	0-3	Others	1	0.09	0.0255	283.6
12MAY88	D	3	0-3	Polychaeta	10	1.52	0.4311	2836.0
12MAY88	D	3	0-3	Crustacea	2	0.03	0.0085	567.2
12MAY88	D	3	0-3	Mollusca	1	0.11	0.0312	283.6
12MAY88	D	3	0-3	Others	2	0.25	0.0709	567.2
12MAY88	D	1	3-10	Polychaeta	28	12.56	3.5620	7940.8
12MAY88	D	1	3-10	Crustacea	1	0.33	0.0936	283.6
12MAY88	D	1	3-10	Mollusca	5	0.46	0.1305	1418.0
12MAY88	D	2	3-10	Polychaeta	6	3.38	0.9586	1701.6
12MAY88	D	2	3-10	Others	1	0.03	0.0085	283.6
12MAY88	D	3	3-10	Polychaeta	20	6.65	1.8859	5672.0
12MAY88	D	3	3-10	Mollusca	2	0.44	0.1248	567.2
12MAY88	D	3	3-10	Others	1	0.44	0.1248	283.6
27JUL88	A	1	0-3	Polychaeta	5	0.20	0.0567	1418.0
27JUL88	A	1	0-3	Mollusca	5	4.46	1.2649	1418.0
27JUL88	A	2	0-3	Polychaeta	10	0.40	0.1134	2836.0
27JUL88	A	2	0-3	Crustacea	2	0.47	0.1333	567.2
27JUL88	A	2	0-3	Mollusca	5	14.38	4.0782	1418.0
27JUL88	A	3	0-3	Polychaeta	12	0.33	0.0936	3403.2
27JUL88	A	3	0-3	Mollusca	8	8.95	2.5382	2268.8
27JUL88	A	1	3-10	Polychaeta	2	0.15	0.0425	567.2
27JUL88	A	2	3-10	Polychaeta	2	0.47	0.1333	567.2
27JUL88	A	2	3-10	Mollusca	1	15.75	4.4667	283.6
27JUL88	A	3	3-10	Polychaeta	4	0.73	0.2070	1134.4
27JUL88	A	3	3-10	Mollusca	1	11.23	3.1848	283.6
27JUL88	A	3	3-10	Others	1	0.22	0.0624	283.6
27JUL88	B	1	0-3	Polychaeta	6	1.64	0.4651	1701.6

27JUL88	B	1	0-3	Crustacea	1	0.10	0.0284	283.6
27JUL88	B	1	0-3	Mollusca	11	14.84	4.2086	3119.6
27JUL88	B	2	0-3	Polychaeta	14	7.23	2.0504	3970.4
27JUL88	B	2	0-3	Crustacea	5	0.23	0.0652	1418.0
27JUL88	B	2	0-3	Mollusca	2	1.98	0.5615	567.2
27JUL88	B	3	0-3	Polychaeta	7	3.17	0.8990	1985.2
27JUL88	B	3	0-3	Crustacea	2	0.01	0.0028	567.2
27JUL88	B	3	0-3	Mollusca	7	16.09	4.5631	1985.2
27JUL88	B	1	3-10	Polychaeta	4	12.00	3.4032	1134.4
27JUL88	B	1	3-10	Nemertea	1	0.05	0.0142	283.6
27JUL88	B	2	3-10	Polychaeta	2	1.72	0.4878	567.2
27JUL88	B	3	3-10	Polychaeta	1	0.74	0.2099	283.6
26JUL88	C	1	0-3	Polychaeta	1	0.06	0.0170	283.6
26JUL88	C	1	0-3	Crustacea	8	0.21	0.0596	2268.8
26JUL88	C	2	0-3	Polychaeta	5	0.12	0.0340	1418.0
26JUL88	C	2	0-3	Crustacea	8	0.12	0.0340	2268.8
26JUL88	C	3	0-3	Polychaeta	1	0.01	0.0028	283.6
26JUL88	C	3	0-3	Crustacea	7	0.08	0.0227	1985.2
26JUL88	C	3	0-3	Sipunculida	1	0.10	0.0284	283.6
26JUL88	C	3	0-3	Nemertea	1	0.01	0.0028	283.6
26JUL88	C	1	3-10	Polychaeta	12	14.22	4.0328	3403.2
26JUL88	C	1	3-10	Mollusca	2	8.12	2.3028	567.2
26JUL88	C	1	3-10	Nemertea	3	2.06	0.5842	850.8
26JUL88	C	1	3-10	Ophiuroidea	1	1.15	0.3261	283.6
26JUL88	C	2	3-10	Polychaeta	5	6.25	1.7725	1418.0
26JUL88	C	2	3-10	Crustacea	1	0.01	0.0028	283.6
26JUL88	C	3	3-10	Polychaeta	8	0.99	0.2808	2268.8
26JUL88	C	3	3-10	Nemertea	2	0.13	0.0369	567.2
26JUL88	C	3	3-10	Ophiuroidea	1	6.13	1.7385	283.6
26JUL88	D	1	0-3	Polychaeta	7	0.23	0.0652	1985.2
26JUL88	D	1	0-3	Mollusca	3	0.15	0.0425	850.8
26JUL88	D	1	0-3	Sipunculida	3	2.47	0.7005	850.8
26JUL88	D	2	0-3	Polychaeta	6	0.35	0.0993	1701.6
26JUL88	D	2	0-3	Others	1	0.16	0.0454	283.6
26JUL88	D	2	0-3	Sipunculida	1	0.32	0.0908	283.6
26JUL88	D	3	0-3	Polychaeta	14	0.86	0.2439	3970.4
26JUL88	D	3	0-3	Crustacea	1	0.18	0.0510	283.6
26JUL88	D	3	0-3	Mollusca	1	0.10	0.0284	283.6
26JUL88	D	3	0-3	Sipunculida	1	0.23	0.0652	283.6
26JUL88	D	1	3-10	Polychaeta	5	2.33	0.6608	1418.0
26JUL88	D	1	3-10	Others	1	0.53	0.1503	283.6
26JUL88	D	2	3-10	Polychaeta	69	2.60	0.7374	19568.4
26JUL88	D	2	3-10	Others	1	0.46	0.1305	283.6
26JUL88	D	3	3-10	Polychaeta	9	1.69	0.4793	2552.4
26JUL88	D	3	3-10	Nemertea	2	13.31	3.7747	567.2

LPMACMG.DAT Lavaca-Tres Palacios Estuary Macrofauna biomass data (mg/m^2)

3 replicates (REP) were taken each time, N=n/section, MG=dry weight in mg/core, GM2=g/m^2, nm2=n/m^2.

DATE	STA	REP	SEC	TAXA	N	MG	GM2	NM2
18APR88	A	1	0-3	Crustacea	7	0.15	0.0425	1985.2
18APR88	A	1	0-3	Mollusca	5	0.20	0.0567	1418.0
18APR88	A	1	0-3	Polychaeta	85	3.69	1.0465	24106.0
18APR88	A	1	3-10	Crustacea	1	0.01	0.0028	283.6
18APR88	A	1	3-10	Mollusca	5	21.79	6.1796	1418.0
18APR88	A	1	3-10	Polychaeta	3	0.44	0.1248	850.8
18APR88	A	2	0-3	Crustacea	7	0.31	0.0879	1985.2
18APR88	A	2	0-3	Mollusca	20	0.49	0.1390	5672.0
18APR88	A	2	0-3	Polychaeta	75	4.80	1.3613	21270.0
18APR88	A	2	3-10	Mollusca	2	9.52	2.6999	567.2
18APR88	A	2	3-10	Polychaeta	5	0.64	0.1815	1418.0
18APR88	A	3	0-3	Crustacea	5	0.33	0.0936	1418.0
18APR88	A	3	0-3	Mollusca	12	0.37	0.1049	3403.2
18APR88	A	3	0-3	Nemertea	1	1.18	0.3346	283.6
18APR88	A	3	0-3	Polychaeta	67	3.23	0.9160	19001.2
18APR88	A	3	3-10	Mollusca	5	29.75	8.4371	1418.0
18APR88	A	3	3-10	Polychaeta	5	1.17	0.3318	1418.0
18APR88	B	1	0-3	Crustacea	3	0.02	0.0057	850.8
18APR88	B	1	0-3	Mollusca	7	2.01	0.5700	1985.2
18APR88	B	1	0-3	Polychaeta	33	1.20	0.3403	9358.8
18APR88	B	1	3-10	Polychaeta	22	3.95	1.1202	6239.2
18APR88	B	2	0-3	Crustacea	3	0.19	0.0539	850.8
18APR88	B	2	0-3	Mollusca	6	3.31	0.9387	1701.6
18APR88	B	2	0-3	Polychaeta	33	2.38	0.6750	9358.8
18APR88	B	2	3-10	Nemertea	1	0.49	0.1390	283.6
18APR88	B	2	3-10	Polychaeta	31	3.65	1.0351	8791.6
18APR88	B	3	0-3	Crustacea	2	0.29	0.0822	567.2
18APR88	B	3	0-3	Mollusca	8	4.49	1.2734	2268.8
18APR88	B	3	0-3	Polychaeta	23	1.05	0.2978	6522.8
18APR88	B	3	3-10	Polychaeta	24	4.52	1.2819	6806.4
18APR88	C	1	0-3	Crustacea	3	0.21	0.0596	850.8
18APR88	C	1	0-3	Mollusca	1	0.20	0.0567	283.6
18APR88	C	1	0-3	Nemertea	1	0.28	0.0794	283.6
18APR88	C	1	0-3	Others	1	0.23	0.0652	283.6
18APR88	C	1	0-3	Polychaeta	26	1.42	0.4027	7373.6
18APR88	C	1	3-10	Hemicordata	1	23.35	6.6221	283.6
18APR88	C	1	3-10	Nemertea	2	0.04	0.0113	567.2
18APR88	C	1	3-10	Polychaeta	37	11.29	3.2018	10493.2
18APR88	C	2	0-3	Crustacea	2	0.23	0.0652	567.2
18APR88	C	2	0-3	Mollusca	1	0.12	0.0340	283.6
18APR88	C	2	0-3	Nemertea	1	0.07	0.0199	283.6
18APR88	C	2	0-3	Polychaeta	57	1.79	0.5076	16165.2
18APR88	C	2	3-10	Hemicordata	5	81.06	22.9886	1418.0
18APR88	C	2	3-10	Mollusca	2	0.25	0.0709	567.2
18APR88	C	2	3-10	Nemertea	5	4.68	1.3272	1418.0
18APR88	C	2	3-10	Polychaeta	89	6.01	1.7044	25240.4
18APR88	C	3	0-3	Mollusca	2	2.18	0.6182	567.2
18APR88	C	3	0-3	Nemertea	3	0.22	0.0624	850.8
18APR88	C	3	0-3	Polychaeta	40	1.67	0.4736	11344.0
18APR88	C	3	3-10	Hemicordata	1	0.89	0.2524	283.6
18APR88	C	3	3-10	Mollusca	1	0.13	0.0369	283.6
18APR88	C	3	3-10	Nemertea	2	0.15	0.0425	567.2
18APR88	C	3	3-10	Others	1	0.47	0.1333	283.6
18APR88	C	3	3-10	Polychaeta	58	5.38	1.5258	16448.8

18APR88	D	1	0-3	Crustacea	48	0.76	0.2155	13612.8
18APR88	D	1	0-3	Mollusca	4	0.81	0.2297	1134.4
18APR88	D	1	0-3	Others	3	0.28	0.0794	850.8
18APR88	D	1	0-3	Ophiuroidea	1	0.15	0.0425	283.6
18APR88	D	1	0-3	Polychaeta	48	1.92	0.5445	13612.8
18APR88	D	1	3-10	Crustacea	14	6.50	1.8434	3970.4
18APR88	D	1	3-10	Mollusca	22	7.01	1.9880	6239.2
18APR88	D	1	3-10	Nemertea	1	0.92	0.2609	283.6
18APR88	D	1	3-10	Ophiuroidea	2	10.49	2.9750	567.2
18APR88	D	1	3-10	Polychaeta	40	3.51	0.9954	11344.0
18APR88	D	2	0-3	Crustacea	222	3.09	0.8763	62959.2
18APR88	D	2	0-3	Mollusca	4	1.40	0.3970	1134.4
18APR88	D	2	0-3	Polychaeta	27	1.59	0.4509	7657.2
18APR88	D	2	3-10	Crustacea	57	4.64	1.3159	16165.2
18APR88	D	2	3-10	Mollusca	13	3.06	0.8678	3686.8
18APR88	D	2	3-10	Nemertea	3	2.07	0.5871	850.8
18APR88	D	2	3-10	Ophiuroidea	3	30.06	8.5250	850.8
18APR88	D	2	3-10	Polychaeta	40	13.75	3.8995	11344.0
18APR88	D	3	0-3	Crustacea	329	5.41	1.5343	93304.4
18APR88	D	3	0-3	Mollusca	2	0.17	0.0482	567.2
18APR88	D	3	0-3	Nemertea	2	0.03	0.0085	567.2
18APR88	D	3	0-3	Others	1	0.12	0.0340	283.6
18APR88	D	3	0-3	Polychaeta	65	4.40	1.2478	18434.0
18APR88	D	3	3-10	Crustacea	43	7.92	2.2461	12194.8
18APR88	D	3	3-10	Mollusca	11	2.94	0.8338	3119.6
18APR88	D	3	3-10	Nemertea	1	0.59	0.1673	283.6
18APR88	D	3	3-10	Ophiuroidea	1	8.89	2.5212	283.6
18APR88	D	3	3-10	Polychaeta	65	7.08	2.0079	18434.0
19JUL88	A	1	0-3	Crustacea	1	0.07	0.0199	283.6
19JUL88	A	1	0-3	Mollusca	4	0.32	0.0908	1134.4
19JUL88	A	1	0-3	Polychaeta	20	0.81	0.2297	5672.0
19JUL88	A	1	3-10	Polychaeta	10	4.27	1.2110	2836.0
19JUL88	A	2	0-3	Crustacea	2	0.55	0.1560	567.2
19JUL88	A	2	0-3	Polychaeta	19	0.87	0.2467	5388.4
19JUL88	A	2	3-10	Polychaeta	3	0.41	0.1163	850.8
19JUL88	A	3	0-3	Crustacea	2	0.20	0.0567	567.2
19JUL88	A	3	0-3	Mollusca	1	0.18	0.0510	283.6
19JUL88	A	3	0-3	Polychaeta	22	1.03	0.2921	6239.2
19JUL88	B	1	0-3	Crustacea	2	0.16	0.0454	567.2
19JUL88	B	1	0-3	Mollusca	4	0.05	0.0142	1134.4
19JUL88	B	1	0-3	Polychaeta	17	0.68	0.1928	4821.2
19JUL88	B	1	3-10	Mollusca	2	0.02	0.0057	567.2
19JUL88	B	1	3-10	Polychaeta	2	3.72	1.0550	567.2
19JUL88	B	2	0-3	Crustacea	3	0.05	0.0142	850.8
19JUL88	B	2	0-3	Mollusca	1	0.04	0.0113	283.6
19JUL88	B	2	0-3	Polychaeta	32	0.88	0.2496	9075.2
19JUL88	B	2	3-10	Mollusca	1	0.02	0.0057	283.6
19JUL88	B	2	3-10	Polychaeta	8	1.39	0.3942	2268.8
19JUL88	B	3	0-3	Crustacea	1	0.01	0.0028	283.6
19JUL88	B	3	0-3	Mollusca	2	0.03	0.0085	567.2
19JUL88	B	3	0-3	Polychaeta	30	1.03	0.2921	8508.0
19JUL88	B	3	3-10	Mollusca	1	11.13	3.1565	283.6
19JUL88	B	3	3-10	Nemertea	2	0.21	0.0596	567.2
19JUL88	B	3	3-10	Polychaeta	11	0.53	0.1503	3119.6
19JUL88	C	1	0-3	Crustacea	1	0.01	0.0028	283.6
19JUL88	C	1	0-3	Hemicordata	1	1.28	0.3630	283.6
19JUL88	C	1	0-3	Mollusca	1	0.01	0.0028	283.6
19JUL88	C	1	0-3	Nemertea	2	0.04	0.0113	567.2
19JUL88	C	1	0-3	Polychaeta	7	0.10	0.0284	1985.2
19JUL88	C	1	3-10	Hemicordata	1	2.61	0.7402	283.6
19JUL88	C	1	3-10	Nemertea	2	0.16	0.0454	567.2
19JUL88	C	1	3-10	Polychaeta	79	9.75	2.7651	22404.4
19JUL88	C	2	0-3	Hemicordata	1	4.66	1.3216	283.6
19JUL88	C	2	0-3	Mollusca	1	0.02	0.0057	283.6
19JUL88	C	2	0-3	Others	1	0.04	0.0113	283.6
19JUL88	C	2	0-3	Polychaeta	16	1.85	0.5247	4537.6
19JUL88	C	2	3-10	Hemicordata	3	19.68	5.5812	850.8

19JUL88	C	2	3-10	Ophiuroidea	1	2.85	0.8083	283.6
19JUL88	C	2	3-10	Polychaeta	27	5.86	1.6619	7657.2
19JUL88	C	3	0-3	Nemertea	1	0.13	0.0369	283.6
19JUL88	C	3	0-3	Polychaeta	15	0.45	0.1276	4254.0
19JUL88	C	3	3-10	Hemicordata	2	5.62	1.5938	567.2
19JUL88	C	3	3-10	Mollusca	1	0.12	0.0340	283.6
19JUL88	C	3	3-10	Nemertea	1	0.02	0.0057	283.6
19JUL88	C	3	3-10	Polychaeta	26	8.08	2.2915	7373.6
19JUL88	D	1	0-3	Crustacea	5	1.10	0.3120	1418.0
19JUL88	D	1	0-3	Mollusca	1	0.12	0.0340	283.6
19JUL88	D	1	0-3	Nemertea	5	0.35	0.0993	1418.0
19JUL88	D	1	0-3	Polychaeta	10	0.92	0.2609	2836.0
19JUL88	D	1	0-3	Sipunculida	1	0.01	0.0028	283.6
19JUL88	D	1	3-10	Crustacea	36	13.84	3.9250	10209.6
19JUL88	D	1	3-10	Hemicordata	1	4.77	1.3528	283.6
19JUL88	D	1	3-10	Mollusca	3	0.03	0.0085	850.8
19JUL88	D	1	3-10	Nemertea	3	1.05	0.2978	850.8
19JUL88	D	1	3-10	Ophiuroidea	1	1.12	0.3176	283.6
19JUL88	D	1	3-10	Polychaeta	32	1.08	0.3063	9075.2
19JUL88	D	2	0-3	Crustacea	1	0.42	0.1191	283.6
19JUL88	D	2	0-3	Mollusca	2	0.01	0.0028	567.2
19JUL88	D	2	0-3	Nemertea	2	0.78	0.2212	567.2
19JUL88	D	2	0-3	Polychaeta	13	0.27	0.0766	3686.8
19JUL88	D	2	3-10	Crustacea	17	6.22	1.7640	4821.2
19JUL88	D	2	3-10	Mollusca	3	7.84	2.2234	850.8
19JUL88	D	2	3-10	Nemertea	3	0.73	0.2070	850.8
19JUL88	D	2	3-10	Others	1	1.81	0.5133	283.6
19JUL88	D	2	3-10	Ophiuroidea	3	1.77	0.5020	850.8
19JUL88	D	2	3-10	Polychaeta	33	6.77	1.9200	9358.8
19JUL88	D	3	0-3	Crustacea	1	0.67	0.1900	283.6
19JUL88	D	3	0-3	Mollusca	4	0.11	0.0312	1134.4
19JUL88	D	3	0-3	Nemertea	3	0.15	0.0425	850.8
19JUL88	D	3	0-3	Others	1	0.01	0.0028	283.6
19JUL88	D	3	0-3	Polychaeta	9	0.14	0.0397	2552.4
19JUL88	D	3	3-10	Crustacea	42	13.52	3.8343	11911.2
19JUL88	D	3	3-10	Mollusca	3	37.44	10.6180	850.8
19JUL88	D	3	3-10	Nemertea	3	0.03	0.0085	850.8
19JUL88	D	3	3-10	Ophiuroidea	1	5.73	1.6250	283.6
19JUL88	D	3	3-10	Polychaeta	30	3.08	0.8735	8508.0
11NOV88	A	1	0-3	Crustacea	2	0.09	0.0255	567.2
11NOV88	A	1	0-3	Polychaeta	14	0.93	0.2637	3970.4
11NOV88	A	1	3-10	Crustacea	1	0.27	0.0766	283.6
11NOV88	A	1	3-10	Nemertea	1	0.07	0.0199	283.6
11NOV88	A	1	3-10	Polychaeta	13	14.23	4.0356	3686.8
11NOV88	A	2	0-3	Polychaeta	14	7.16	2.0306	3970.4
11NOV88	A	2	3-10	Polychaeta	15	0.94	0.2666	4254.0
11NOV88	A	3	0-3	Crustacea	1	0.02	0.0057	283.6
11NOV88	A	3	0-3	Mollusca	2	0.13	0.0369	567.2
11NOV88	A	3	0-3	Nemertea	1	0.17	0.0482	283.6
11NOV88	A	3	0-3	Polychaeta	26	0.84	0.2382	7373.6
11NOV88	A	3	3-10	Polychaeta	7	3.57	1.0125	1985.2
11NOV88	B	1	0-3	Crustacea	1	0.07	0.0199	283.6
11NOV88	B	1	0-3	Mollusca	1	0.08	0.0227	283.6
11NOV88	B	1	0-3	Polychaeta	23	0.51	0.1446	6522.8
11NOV88	B	1	3-10	Polychaeta	4	1.06	0.3006	1134.4
11NOV88	B	2	0-3	Crustacea	1	0.17	0.0482	283.6
11NOV88	B	2	0-3	Polychaeta	26	1.14	0.3233	7373.6
11NOV88	B	2	3-10	Polychaeta	10	2.85	0.8083	2836.0
11NOV88	B	3	0-3	Crustacea	1	0.06	0.0170	283.6
11NOV88	B	3	0-3	Nemertea	1	0.08	0.0227	283.6
11NOV88	B	3	0-3	Polychaeta	19	0.72	0.2042	5388.4
11NOV88	B	3	3-10	Polychaeta	3	0.32	0.0908	850.8
11NOV88	C	1	0-3	Crustacea	1	0.13	0.0369	283.6
11NOV88	C	1	0-3	Mollusca	1	0.07	0.0199	283.6
11NOV88	C	1	0-3	Nemertea	1	0.05	0.0142	283.6
11NOV88	C	1	0-3	Polychaeta	13	3.55	1.0068	3686.8
11NOV88	C	1	3-10	Polychaeta	40	14.51	4.1150	11344.0

11NOV88	C	2	0-3	Hemicordata	1	0.21	0.0596	283.6
11NOV88	C	2	0-3	Mollusca	1	0.08	0.0227	283.6
11NOV88	C	2	0-3	Polychaeta	18	2.39	0.6778	5104.8
11NOV88	C	2	3-10	Hemicordata	1	1.32	0.3744	283.6
11NOV88	C	2	3-10	Mollusca	1	0.13	0.0369	283.6
11NOV88	C	2	3-10	Polychaeta	32	14.69	4.1661	9075.2
11NOV88	C	3	0-3	Crustacea	3	0.07	0.0199	850.8
11NOV88	C	3	0-3	Polychaeta	18	2.18	0.6182	5104.8
11NOV88	C	3	3-10	Hemicordata	1	1.11	0.3148	283.6
11NOV88	C	3	3-10	Polychaeta	20	6.35	1.8009	5672.0
11NOV88	D	1	0-3	Crustacea	33	1.37	0.3885	9358.8
11NOV88	D	1	0-3	Mollusca	6	0.46	0.1305	1701.6
11NOV88	D	1	0-3	Ophiuroidea	4	0.06	0.0170	1134.4
11NOV88	D	1	0-3	Polychaeta	22	2.19	0.6211	6239.2
11NOV88	D	1	3-10	Crustacea	51	4.82	1.3670	14463.6
11NOV88	D	1	3-10	Mollusca	4	0.51	0.1446	1134.4
11NOV88	D	1	3-10	Ophiuroidea	1	0.21	0.0596	283.6
11NOV88	D	1	3-10	Polychaeta	20	6.57	1.8633	5672.0
11NOV88	D	2	0-3	Crustacea	15	0.36	0.1021	4254.0
11NOV88	D	2	0-3	Mollusca	6	0.14	0.0397	1701.6
11NOV88	D	2	0-3	Others	2	0.19	0.0539	567.2
11NOV88	D	2	0-3	Ophiuroidea	3	0.14	0.0397	850.8
11NOV88	D	2	0-3	Polychaeta	21	2.10	0.5956	5955.6
11NOV88	D	2	3-10	Crustacea	29	1.11	0.3148	8224.4
11NOV88	D	2	3-10	Mollusca	12	0.20	0.0567	3403.2
11NOV88	D	2	3-10	Nemertea	6	7.71	2.1866	1701.6
11NOV88	D	2	3-10	Ophiuroidea	1	0.22	0.0624	283.6
11NOV88	D	2	3-10	Polychaeta	24	3.07	0.8707	6806.4
11NOV88	D	3	0-3	Crustacea	23	0.75	0.2127	6522.8
11NOV88	D	3	0-3	Mollusca	8	0.16	0.0454	2268.8
11NOV88	D	3	0-3	Ophiuroidea	1	0.09	0.0255	283.6
11NOV88	D	3	0-3	Polychaeta	20	0.26	0.0737	5672.0
11NOV88	D	3	3-10	Crustacea	64	1.55	0.4396	18150.4
11NOV88	D	3	3-10	Mollusca	18	0.68	0.1928	5104.8
11NOV88	D	3	3-10	Ophiuroidea	1	3.34	0.9472	283.6
11NOV88	D	3	3-10	Polychaeta	39	2.11	0.5984	11060.4
05APR89	A	1	0-3	Crustacea	68	1.32	0.3744	19284.8
05APR89	A	1	0-3	Mollusca	23	20.78	5.8932	6522.8
05APR89	A	1	0-3	Others	1	0.06	0.0170	283.6
05APR89	A	1	0-3	Polychaeta	13	0.36	0.1021	3686.8
05APR89	A	1	3-10	Mollusca	1	5.23	1.4832	283.6
05APR89	A	1	3-10	Polychaeta	8	1.41	0.3999	2268.8
05APR89	A	2	0-3	Crustacea	51	1.15	0.3261	14463.6
05APR89	A	2	0-3	Mollusca	22	21.84	6.1938	6239.2
05APR89	A	2	0-3	Polychaeta	14	36.96	10.4819	3970.4
05APR89	A	2	3-10	Crustacea	1	0.19	0.0539	283.6
05APR89	A	2	3-10	Mollusca	1	3.20	0.9075	283.6
05APR89	A	2	3-10	Polychaeta	10	2.54	0.7203	2836.0
05APR89	A	3	0-3	Crustacea	34	0.68	0.1928	9642.4
05APR89	A	3	0-3	Mollusca	15	10.97	3.1111	4254.0
05APR89	A	3	0-3	Polychaeta	10	0.41	0.1163	2836.0
05APR89	A	3	3-10	Mollusca	2	4.32	1.2252	567.2
05APR89	A	3	3-10	Polychaeta	9	1.52	0.4311	2552.4
05APR89	B	1	0-3	Crustacea	1	5.93	1.6817	283.6
05APR89	B	1	0-3	Mollusca	2	0.38	0.1078	567.2
05APR89	B	1	0-3	Polychaeta	12	0.74	0.2099	3403.2
05APR89	B	1	3-10	Crustacea	1	0.52	0.1475	283.6
05APR89	B	1	3-10	Mollusca	6	12.54	3.5563	1701.6
05APR89	B	1	3-10	Polychaeta	25	7.88	2.2348	7090.0
05APR89	B	2	0-3	Mollusca	2	0.88	0.2496	567.2
05APR89	B	2	0-3	Polychaeta	3	0.69	0.1957	850.8
05APR89	B	2	3-10	Mollusca	3	6.69	1.8973	850.8
05APR89	B	2	3-10	Polychaeta	21	5.83	1.6534	5955.6
05APR89	B	3	0-3	Crustacea	1	0.51	0.1446	283.6
05APR89	B	3	0-3	Mollusca	3	0.05	0.0142	850.8
05APR89	B	3	0-3	Polychaeta	6	1.16	0.3290	1701.6
05APR89	B	3	3-10	Crustacea	1	0.15	0.0425	283.6

05APR89	B	3	3-10	Mollusca	6	3.68	1.0436	1701.6
05APR89	B	3	3-10	Others	1	0.09	0.0255	283.6
05APR89	B	3	3-10	Polychaeta	28	10.83	3.0714	7940.8
05APR89	C	1	0-3	Crustacea	1	0.05	0.0142	283.6
05APR89	C	1	0-3	Mollusca	2	0.17	0.0482	567.2
05APR89	C	1	0-3	Polychaeta	8	1.25	0.3545	2268.8
05APR89	C	1	3-10	Mollusca	1	0.05	0.0142	283.6
05APR89	C	1	3-10	Nemertea	1	0.19	0.0539	283.6
05APR89	C	1	3-10	Polychaeta	21	5.44	1.5428	5955.6
05APR89	C	2	0-3	Crustacea	1	8.29	2.3510	283.6
05APR89	C	2	0-3	Mollusca	1	0.23	0.0652	283.6
05APR89	C	2	0-3	Polychaeta	3	0.76	0.2155	850.8
05APR89	C	2	3-10	Nemertea	2	2.32	0.6580	567.2
05APR89	C	2	3-10	Polychaeta	34	55.13	15.6349	9642.4
05APR89	C	3	0-3	Nemertea	1	0.47	0.1333	283.6
05APR89	C	3	0-3	Polychaeta	3	0.66	0.1872	850.8
05APR89	C	3	3-10	Crustacea	1	9.69	2.7481	283.6
05APR89	C	3	3-10	Polychaeta	7	0.50	0.1418	1985.2
05APR89	D	1	0-3	Crustacea	4	0.38	0.1078	1134.4
05APR89	D	1	0-3	Mollusca	10	6.52	1.8491	2836.0
05APR89	D	1	0-3	Nemertea	1	0.26	0.0737	283.6
05APR89	D	1	0-3	Ophiuroidea	1	0.39	0.1106	283.6
05APR89	D	1	0-3	Polychaeta	36	3.22	0.9132	10209.6
05APR89	D	1	3-10	Crustacea	6	4.67	1.3244	1701.6
05APR89	D	1	3-10	Mollusca	6	5.07	1.4379	1701.6
05APR89	D	1	3-10	Nemertea	3	2.85	0.8083	850.8
05APR89	D	1	3-10	Others	1	1.16	0.3290	283.6
05APR89	D	1	3-10	Ophiuroidea	1	0.81	0.2297	283.6
05APR89	D	1	3-10	Polychaeta	30	1.57	0.4453	8508.0
05APR89	D	2	0-3	Crustacea	4	0.85	0.2411	1134.4
05APR89	D	2	0-3	Mollusca	21	177.00	50.1972	5955.6
05APR89	D	2	0-3	Nemertea	2	0.14	0.0397	567.2
05APR89	D	2	0-3	Polychaeta	29	0.91	0.2581	8224.4
05APR89	D	2	0-3	Sipunculida	1	1.20	0.3403	283.6
05APR89	D	2	3-10	Crustacea	9	4.97	1.4095	2552.4
05APR89	D	2	3-10	Mollusca	16	2.50	0.7090	4537.6
05APR89	D	2	3-10	Nemertea	2	1.06	0.3006	567.2
05APR89	D	2	3-10	Ophiuroidea	1	5.20	1.4747	283.6
05APR89	D	2	3-10	Polychaeta	17	3.75	1.0635	4821.2
05APR89	D	3	0-3	Crustacea	10	4.53	1.2847	2836.0
05APR89	D	3	0-3	Mollusca	15	4.44	1.2592	4254.0
05APR89	D	3	0-3	Nemertea	3	0.18	0.0510	850.8
05APR89	D	3	0-3	Ophiuroidea	1	2.26	0.6409	283.6
05APR89	D	3	0-3	Polychaeta	38	1.43	0.4055	10776.8
05APR89	D	3	0-3	Sipunculida	1	4.47	1.2677	283.6
05APR89	D	3	3-10	Crustacea	17	8.27	2.3454	4821.2
05APR89	D	3	3-10	Mollusca	7	0.56	0.1588	1985.2
05APR89	D	3	3-10	Nemertea	1	0.47	0.1333	283.6
05APR89	D	3	3-10	Ophiuroidea	3	41.75	11.8403	850.8
05APR89	D	3	3-10	Polychaeta	22	3.74	1.0607	6239.2
22JUL89	A	1	0-3	Crustacea	1	0.02	0.0057	283.6
22JUL89	A	1	0-3	Mollusca	1	0.05	0.0142	283.6
22JUL89	A	1	0-3	Polychaeta	9	0.39	0.1106	2552.4
22JUL89	A	1	3-10	Mollusca	1	12.86	3.6471	283.6
22JUL89	A	1	3-10	Polychaeta	8	5.02	1.4237	2268.8
22JUL89	A	2	0-3	Mollusca	7	6.01	1.7044	1985.2
22JUL89	A	2	0-3	Polychaeta	15	0.42	0.1191	4254.0
22JUL89	A	2	3-10	Polychaeta	6	1.19	0.3375	1701.6
22JUL89	A	3	0-3	Crustacea	3	0.01	0.0028	850.8
22JUL89	A	3	0-3	Mollusca	6	4.75	1.3471	1701.6
22JUL89	A	3	0-3	Polychaeta	15	1.41	0.3999	4254.0
22JUL89	A	3	3-10	Mollusca	2	0.20	0.0567	567.2
22JUL89	A	3	3-10	Polychaeta	9	7.76	2.2007	2552.4
22JUL89	C	1	0-3	Crustacea	3	0.22	0.0624	850.8
22JUL89	C	1	0-3	Nemertea	1	4.34	1.2308	283.6
22JUL89	C	1	0-3	Polychaeta	5	0.09	0.0255	1418.0
22JUL89	C	1	3-10	Nemertea	1	0.07	0.0199	283.6

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22JUL89     C      1     3-10    Ophiuroidea      1       0.03       0.0085       283.6
22JUL89     C      1     3-10    Polychaeta      15       4.54       1.2875      4254.0
22JUL89     C      2     0-3     Crustacea        3       0.17       0.0482       850.8
22JUL89     C      2     0-3     Mollusca         1       0.01       0.0028       283.6
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GEMACSP.DAT Guadalupe Estuary Macrofauna species data.

3 replicates (REP) were taken each time, N=n/section (SEC)
nm2=n/m^2. Sections in cm.

SPNAME	DATE	STA	REP	SEC	N	NM2
Littoridina sphinctostoma	28JAN87	A	1	0-3	1	283.6
Mediomastus californiensis	28JAN87	A	1	0-3	1	283.6
Streblospio benedicti	28JAN87	A	1	0-3	9	2552.4
Mediomastus californiensis	28JAN87	A	1	3-10	30	8508.0
Oligochaeta	28JAN87	A	1	3-10	1	283.6
Hobsonia florida	28JAN87	A	2	0-3	1	283.6
Macoma mitchelli	28JAN87	A	2	0-3	12	3403.2
Mediomastus californiensis	28JAN87	A	2	0-3	11	3119.6
Streblospio benedicti	28JAN87	A	2	0-3	19	5388.4
Capitella capitata	28JAN87	A	2	3-10	1	283.6
Mediomastus californiensis	28JAN87	A	2	3-10	25	7090.0
Parandalia ocularis	28JAN87	A	2	3-10	1	283.6
Macoma mitchelli	28JAN87	A	3	0-3	5	1418.0
Mediomastus californiensis	28JAN87	A	3	0-3	1	283.6
Monoculoides sp.	28JAN87	A	3	0-3	1	283.6
Streblospio benedicti	28JAN87	A	3	0-3	5	1418.0
Capitella capitata	28JAN87	A	3	3-10	2	567.2
Macoma mitchelli	28JAN87	A	3	3-10	1	283.6
Mediomastus californiensis	28JAN87	A	3	3-10	15	4254.0
Streblospio benedicti	28JAN87	A	3	3-10	1	283.6
Truncatella caribaeensis	28JAN87	A	10	81	4	1134.4
Littoridina sphinctostoma	28JAN87	B	1	0-3	7	1985.2
Macoma mitchelli	28JAN87	B	1	0-3	7	1985.2
Mediomastus californiensis	28JAN87	B	1	0-3	10	2836.0
Monoculoides sp.	28JAN87	B	1	0-3	2	567.2
Mulinia lateralis	28JAN87	B	1	0-3	3	850.8
Polydora socialis	28JAN87	B	1	0-3	1	283.6
Rhynchocoels	28JAN87	B	1	0-3	1	283.6
Streblospio benedicti	28JAN87	B	1	0-3	16	4537.6
Capitella capitata	28JAN87	B	1	3-10	1	283.6
Macoma mitchelli	28JAN87	B	1	3-10	2	567.2
Mediomastus californiensis	28JAN87	B	1	3-10	48	13612.8
Oligochaeta	28JAN87	B	1	3-10	1	283.6
Rhynchocoels	28JAN87	B	1	3-10	1	283.6
Edotea montosa	28JAN87	B	2	0-3	1	283.6
Littoridina sphinctostoma	28JAN87	B	2	0-3	6	1701.6
Macoma mitchelli	28JAN87	B	2	0-3	1	283.6
Mediomastus californiensis	28JAN87	B	2	0-3	32	9075.2
Monoculoides sp.	28JAN87	B	2	0-3	6	1701.6
Rhynchocoels	28JAN87	B	2	0-3	1	283.6
Streblospio benedicti	28JAN87	B	2	0-3	5	1418.0
Capitella capitata	28JAN87	B	2	3-10	1	283.6
Mediomastus californiensis	28JAN87	B	2	3-10	9	2552.4
Littoridina sphinctostoma	28JAN87	B	3	0-3	1	283.6
Macoma mitchelli	28JAN87	B	3	0-3	6	1701.6
Mediomastus californiensis	28JAN87	B	3	0-3	29	8224.4
Rhynchocoels	28JAN87	B	3	0-3	1	283.6
Streblospio benedicti	28JAN87	B	3	0-3	13	3686.8
Capitella capitata	28JAN87	B	3	3-10	1	283.6
Macoma mitchelli	28JAN87	B	3	3-10	1	283.6
Mediomastus californiensis	28JAN87	B	3	3-10	18	5104.8
Rhynchocoels	28JAN87	B	3	3-10	1	283.6
Cyclaspis varians	30JAN87	C	1	0-3	1	283.6
Glycinde solitaria	30JAN87	C	1	0-3	1	283.6
Haploscoloplos foliosus	30JAN87	C	1	0-3	9	2552.4
Macoma mitchelli	30JAN87	C	1	0-3	2	567.2

Mediomastus californiensis	30JAN87	C	1	0-3	5	1418.0
Monoculoides sp.	30JAN87	C	1	0-3	2	567.2
Paraprionospio pinnata	30JAN87	C	1	0-3	1	283.6
Streblospio benedicti	30JAN87	C	1	0-3	1	283.6
Cossura delta	30JAN87	C	1	3-10	3	850.8
Mediomastus californiensis	30JAN87	C	1	3-10	3	850.8
Rhynchocoels	30JAN87	C	1	3-10	1	283.6
Cyclaspis varians	30JAN87	C	2	0-3	1	283.6
Glycinde solitaria	30JAN87	C	2	0-3	1	283.6
Haploscoloplos foliosus	30JAN87	C	2	0-3	6	1701.6
Macoma mitchelli	30JAN87	C	2	0-3	1	283.6
Mediomastus californiensis	30JAN87	C	2	0-3	16	4537.6
Mulinia lateralis	30JAN87	C	2	0-3	1	283.6
Paraprionospio pinnata	30JAN87	C	2	0-3	1	283.6
Streblospio benedicti	30JAN87	C	2	0-3	1	283.6
Gyptis vittata	30JAN87	C	2	3-10	1	283.6
Mediomastus californiensis	30JAN87	C	2	3-10	1	283.6
Polydora caulleryi	30JAN87	C	2	3-10	1	283.6
Ampelisca abdita	30JAN87	C	3	0-3	1	283.6
Haploscoloplos foliosus	30JAN87	C	3	0-3	4	1134.4
Macoma mitchelli	30JAN87	C	3	0-3	2	567.2
Mediomastus californiensis	30JAN87	C	3	0-3	18	5104.8
Paraprionospio pinnata	30JAN87	C	3	0-3	1	283.6
Streblospio benedicti	30JAN87	C	3	0-3	2	567.2
Clymenella mucosa	30JAN87	C	3	3-10	1	283.6
Cossura delta	30JAN87	C	3	3-10	1	283.6
Paraprionospio pinnata	30JAN87	C	3	3-10	1	283.6
Macoma mitchelli	30JAN87	D	1	0-3	3	850.8
Mediomastus californiensis	30JAN87	D	1	0-3	2	567.2
Paraprionospio pinnata	30JAN87	D	1	0-3	2	567.2
Pyramidella sp.	30JAN87	D	1	0-3	2	567.2
Haploscoloplos foliosus	30JAN87	D	1	3-10	1	283.6
Mediomastus californiensis	30JAN87	D	1	3-10	10	2836.0
Neanthes succinea	30JAN87	D	1	3-10	1	283.6
Macoma mitchelli	30JAN87	D	2	0-3	10	2836.0
Mediomastus californiensis	30JAN87	D	2	0-3	6	1701.6
Macoma mitchelli	30JAN87	D	2	3-10	1	283.6
Mediomastus californiensis	30JAN87	D	2	3-10	8	2268.8
Cyclaspis varians	30JAN87	D	3	0-3	4	1134.4
Macoma mitchelli	30JAN87	D	3	0-3	4	1134.4
Mediomastus californiensis	30JAN87	D	3	0-3	5	1418.0
Streblospio benedicti	30JAN87	D	3	0-3	1	283.6
Macoma mitchelli	30JAN87	D	3	3-10	1	283.6
Mediomastus californiensis	30JAN87	D	3	3-10	3	850.8
Polydora caulleryi	30JAN87	D	3	3-10	1	283.6
Xenanthura brevitelson	30JAN87	D	3	3-10	1	283.6
Hobsonia florida	03MAR87	A	1	0-3	3	850.8
Littoridina sphinctostoma	03MAR87	A	1	0-3	62	17583.2
Mediomastus californiensis	03MAR87	A	1	0-3	5	1418.0
Mulinia lateralis	03MAR87	A	1	0-3	18	5104.8
Rhynchocoels	03MAR87	A	1	0-3	1	283.6
Streblospio benedicti	03MAR87	A	1	0-3	18	5104.8
Turbellaria	03MAR87	A	1	0-3	1	283.6
Mediomastus californiensis	03MAR87	A	1	3-10	5	1418.0
Oligochaeta	03MAR87	A	1	3-10	1	283.6
Parandalia ocularis	03MAR87	A	1	3-10	1	283.6
Streblospio benedicti	03MAR87	A	1	3-10	1	283.6
Littoridina sphinctostoma	03MAR87	A	2	0-3	90	25524.0
Mulinia lateralis	03MAR87	A	2	0-3	15	4254.0
Streblospio benedicti	03MAR87	A	2	0-3	20	5672.0
Capitella capitata	03MAR87	A	2	3-10	1	283.6
Macoma mitchelli	03MAR87	A	2	3-10	1	283.6
Mediomastus californiensis	03MAR87	A	2	3-10	11	3119.6
Oligochaeta	03MAR87	A	2	3-10	3	850.8
Hobsonia florida	03MAR87	A	3	0-3	2	567.2
Littoridina sphinctostoma	03MAR87	A	3	0-3	108	30628.8
Macoma mitchelli	03MAR87	A	3	0-3	1	283.6

Mediomastus californiensis	03MAR87	A	3	0-3	4	1134.4
Mulinia lateralis	03MAR87	A	3	0-3	18	5104.8
Oligochaeta	03MAR87	A	3	0-3	2	567.2
Rangia cuneata	03MAR87	A	3	0-3	1	283.6
Streblospio benedicti	03MAR87	A	3	0-3	12	3403.2
Mediomastus californiensis	03MAR87	A	3	3-10	6	1701.6
Oligochaeta	03MAR87	A	3	3-10	1	283.6
Littoridina sphinctostoma	03MAR87	B	1	0-3	1	283.6
Macoma mitchelli	03MAR87	B	1	0-3	4	1134.4
Mediomastus californiensis	03MAR87	B	1	0-3	12	3403.2
Streblospio benedicti	03MAR87	B	1	0-3	12	3403.2
Macoma mitchelli	03MAR87	B	1	3-10	4	1134.4
Mediomastus californiensis	03MAR87	B	1	3-10	17	4821.2
Littoridina sphinctostoma	03MAR87	B	2	0-3	15	4254.0
Macoma mitchelli	03MAR87	B	2	0-3	5	1418.0
Mediomastus californiensis	03MAR87	B	2	0-3	19	5388.4
Monoculoides sp.	03MAR87	B	2	0-3	1	283.6
Mulinia lateralis	03MAR87	B	2	0-3	8	2268.8
Streblospio benedicti	03MAR87	B	2	0-3	16	4537.6
Capitella capitata	03MAR87	B	2	3-10	1	283.6
Macoma mitchelli	03MAR87	B	2	3-10	1	283.6
Mediomastus californiensis	03MAR87	B	2	3-10	26	7373.6
Rhynchocoels	03MAR87	B	2	3-10	1	283.6
Littoridina sphinctostoma	03MAR87	B	3	0-3	6	1701.6
Macoma mitchelli	03MAR87	B	3	0-3	3	850.8
Mediomastus californiensis	03MAR87	B	3	0-3	12	3403.2
Mulinia lateralis	03MAR87	B	3	0-3	6	1701.6
Rhynchocoels	03MAR87	B	3	0-3	1	283.6
Streblospio benedicti	03MAR87	B	3	0-3	11	3119.6
Macoma mitchelli	03MAR87	B	3	3-10	3	850.8
Mediomastus californiensis	03MAR87	B	3	3-10	16	4537.6
Glycinde solitaria	03MAR87	C	1	0-3	2	567.2
Haploscoloplos foliosus	03MAR87	C	1	0-3	4	1134.4
Mediomastus californiensis	03MAR87	C	1	0-3	13	3686.8
Monoculoides sp.	03MAR87	C	1	0-3	4	1134.4
Mulinia lateralis	03MAR87	C	1	0-3	10	2836.0
Streblospio benedicti	03MAR87	C	1	0-3	1	283.6
Clymenella mucosa	03MAR87	C	1	3-10	1	283.6
Cossura delta	03MAR87	C	1	3-10	1	283.6
Macoma mitchelli	03MAR87	C	1	3-10	1	283.6
Mediomastus californiensis	03MAR87	C	1	3-10	1	283.6
Ampelisca abdita	03MAR87	C	2	0-3	1	283.6
Gammarus mucronatus	03MAR87	C	2	0-3	3	850.8
Haploscoloplos foliosus	03MAR87	C	2	0-3	7	1985.2
Mediomastus californiensis	03MAR87	C	2	0-3	15	4254.0
Monoculoides sp.	03MAR87	C	2	0-3	2	567.2
Streblospio benedicti	03MAR87	C	2	0-3	1	283.6
Diopatra cuprea	03MAR87	C	2	3-10	1	283.6
Haploscoloplos foliosus	03MAR87	C	2	3-10	2	567.2
Mediomastus californiensis	03MAR87	C	2	3-10	3	850.8
Glycinde solitaria	03MAR87	C	3	0-3	2	567.2
Haploscoloplos foliosus	03MAR87	C	3	0-3	4	1134.4
Leucon sp.	03MAR87	C	3	0-3	1	283.6
Macoma mitchelli	03MAR87	C	3	0-3	2	567.2
Mediomastus californiensis	03MAR87	C	3	0-3	10	2836.0
Mulinia lateralis	03MAR87	C	3	0-3	9	2552.4
Pectinaria gouldii	03MAR87	C	3	0-3	1	283.6
Streblospio benedicti	03MAR87	C	3	0-3	1	283.6
Clymenella mucosa	03MAR87	C	3	3-10	1	283.6
Cossura delta	03MAR87	C	3	3-10	2	567.2
Glycinde solitaria	03MAR87	C	3	3-10	1	283.6
Haploscoloplos foliosus	03MAR87	C	3	3-10	1	283.6
Mediomastus californiensis	03MAR87	C	3	3-10	3	850.8
Mulinia lateralis	03MAR87	C	3	3-10	1	283.6
Macoma mitchelli	03MAR87	D	1	0-3	5	1418.0
Mediomastus californiensis	03MAR87	D	1	0-3	12	3403.2
Mulinia lateralis	03MAR87	D	1	0-3	11	3119.6

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Streblospio benedicti           03MAR87   D    1  0-3     2     567.2
Macoma mitchelli                03MAR87   D    1  3-10    3     850.8
Mediomastus californiensis      03MAR87   D    1  3-10    7    1985.2
Paraprionospio pinnata          03MAR87   D    1  3-10    1     283.6
Macoma mitchelli                03MAR87   D    2  0-3     3     850.8
Mediomastus californiensis      03MAR87   D    2  0-3     2     567.2
Mulinia lateralis               03MAR87   D    2  0-3     8    2268.8
Streblospio benedicti           03MAR87   D    2  0-3     5    1418.0
Capitella capitata              03MAR87   D    2  3-10    1     283.6
Haploscoloplos foliosus         03MAR87   D    2  3-10    1     283.6
Macoma mitchelli                03MAR87   D    2  3-10    1     283.6
Mediomastus californiensis      03MAR87   D    2  3-10    6    1701.6
Paraprionospio pinnata          03MAR87   D    2  3-10    1     283.6
Macoma mitchelli                03MAR87   D    3  0-3     3     850.8
Mediomastus californiensis      03MAR87   D    3  0-3     5    1418.0
Mulinia lateralis               03MAR87   D    3  0-3     7    1985.2
Pyramidella sp.                 03MAR87   D    3  0-3     1     283.6
Streblospio benedicti           03MAR87   D    3  0-3     6    1701.6
Cossura delta                   03MAR87   D    3  3-10    4    1134.4
Macoma mitchelli                03MAR87   D    3  3-10    3     850.8
Mediomastus californiensis      03MAR87   D    3  3-10   11    3119.6
Paraprionospio pinnata          03MAR87   D    3  3-10    2     567.2
Hobsonia florida                08APR87   A    1  0-3    25    7090.0
Littoridina sphinctostoma       08APR87   A    1  0-3   295   83662.0
Macoma mitchelli                08APR87   A    1  0-3     1     283.6
Mediomastus californiensis      08APR87   A    1  0-3     3     850.8
Mulinia lateralis               08APR87   A    1  0-3    23    6522.8
Oligochaeta                     08APR87   A    1  0-3     4    1134.4
Streblospio benedicti           08APR87   A    1  0-3    13    3686.8
Turbellaria                     08APR87   A    1  0-3     2     567.2
Hobsonia florida                08APR87   A    1  3-10    1     283.6
Mediomastus californiensis      08APR87   A    1  3-10    7    1985.2
Oligochaeta                     08APR87   A    1  3-10    2     567.2
Parandalia ocularis             08APR87   A    1  3-10    1     283.6
Rhynchocoels                    08APR87   A    1  3-10    1     283.6
Streblospio benedicti           08APR87   A    1  3-10    1     283.6
Hobsonia florida                08APR87   A    2  0-3    36   10209.6
Littoridina sphinctostoma       08APR87   A    2  0-3    15    4254.0
Macoma mitchelli                08APR87   A    2  0-3     1     283.6
Mediomastus californiensis      08APR87   A    2  0-3     6    1701.6
Mulinia lateralis               08APR87   A    2  0-3     8    2268.8
Oligochaeta                     08APR87   A    2  0-3     1     283.6
Streblospio benedicti           08APR87   A    2  0-3    10    2836.0
Macoma mitchelli                08APR87   A    2  3-10    1     283.6
Mediomastus californiensis      08APR87   A    2  3-10    6    1701.6
Oligochaeta                     08APR87   A    2  3-10    2     567.2
Hobsonia florida                08APR87   A    3  0-3    44   12478.4
Littoridina sphinctostoma       08APR87   A    3  0-3    74   20986.4
Macoma mitchelli                08APR87   A    3  0-3     5    1418.0
Mediomastus californiensis      08APR87   A    3  0-3     2     567.2
Mulinia lateralis               08APR87   A    3  0-3     9    2552.4
Oligochaeta                     08APR87   A    3  0-3     1     283.6
Streblospio benedicti           08APR87   A    3  0-3     7    1985.2
Hobsonia florida                08APR87   A    3  3-10    1     283.6
Mediomastus californiensis      08APR87   A    3  3-10    8    2268.8
Oligochaeta                     08APR87   A    3  3-10    6    1701.6
Brachidontes exustus            08APR87   B    1  0-3     2     567.2
Capitella capitata              08APR87   B    1  0-3     1     283.6
Cassidinidea lunifrons          08APR87   B    1  0-3     1     283.6
Corophium louisianum            08APR87   B    1  0-3     1     283.6
Hobsonia florida                08APR87   B    1  0-3     2     567.2
Littoridina sphinctostoma       08APR87   B    1  0-3    10    2836.0
Mediomastus californiensis      08APR87   B    1  0-3    15    4254.0
Monoculoides sp.                08APR87   B    1  0-3     1     283.6
Mulinia lateralis               08APR87   B    1  0-3    25    7090.0
Rhynchocoels                    08APR87   B    1  0-3     1     283.6
Streblospio benedicti           08APR87   B    1  0-3     3     850.8
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Littoridina sphinctostoma	08APR87	B	1	3-10	1	283.6
Mediomastus californiensis	08APR87	B	1	3-10	10	2836.0
Brachidontes exustus	08APR87	B	2	0-3	3	850.8
Edotea montosa	08APR87	B	2	0-3	1	283.6
Hobsonia florida	08APR87	B	2	0-3	4	1134.4
Littoridina sphinctostoma	08APR87	B	2	0-3	5	1418.0
Macoma mitchelli	08APR87	B	2	0-3	1	283.6
Mediomastus californiensis	08APR87	B	2	0-3	41	11627.6
Mulinia lateralis	08APR87	B	2	0-3	7	1985.2
Streblospio benedicti	08APR87	B	2	0-3	7	1985.2
Mediomastus californiensis	08APR87	B	2	3-10	3	850.8
Brachidontes exustus	08APR87	B	3	0-3	2	567.2
Hobsonia florida	08APR87	B	3	0-3	7	1985.2
Littoridina sphinctostoma	08APR87	B	3	0-3	16	4537.6
Mediomastus californiensis	08APR87	B	3	0-3	20	5672.0
Mulinia lateralis	08APR87	B	3	0-3	10	2836.0
Oligochaeta	08APR87	B	3	0-3	1	283.6
Streblospio benedicti	08APR87	B	3	0-3	7	1985.2
Mediomastus californiensis	08APR87	B	3	3-10	7	1985.2
Mediomastus californiensis	10APR87	C	1	0-3	24	6806.4
Monoculoides sp.	10APR87	C	1	0-3	6	1701.6
Polydora socialis	10APR87	C	1	0-3	3	850.8
Streblospio benedicti	10APR87	C	1	0-3	4	1134.4
Tagelus plebius	10APR87	C	1	0-3	1	283.6
Cossura delta	10APR87	C	1	3-10	2	567.2
Macoma mitchelli	10APR87	C	1	3-10	3	850.8
Mediomastus californiensis	10APR87	C	1	3-10	1	283.6
Turbellaria	10APR87	C	1	3-10	5	1418.0
Corophium louisianum	10APR87	C	2	0-3	1	283.6
Edotea montosa	10APR87	C	2	0-3	1	283.6
Mediomastus californiensis	10APR87	C	2	0-3	11	3119.6
Monoculoides sp.	10APR87	C	2	0-3	1	283.6
Mulinia lateralis	10APR87	C	2	0-3	2	567.2
Polydora socialis	10APR87	C	2	0-3	5	1418.0
Streblospio benedicti	10APR87	C	2	0-3	4	1134.4
Tagelus plebius	10APR87	C	2	0-3	2	567.2
Macoma mitchelli	10APR87	C	2	3-10	1	283.6
Mediomastus californiensis	10APR87	C	2	3-10	7	1985.2
Polydora socialis	10APR87	C	2	3-10	1	283.6
Mediomastus californiensis	10APR87	C	3	0-3	13	3686.8
Polydora socialis	10APR87	C	3	0-3	1	283.6
Streblospio benedicti	10APR87	C	3	0-3	6	1701.6
Macoma mitchelli	10APR87	C	3	3-10	2	567.2
Mediomastus californiensis	10APR87	C	3	3-10	5	1418.0
Turbellaria	10APR87	C	3	3-10	11	3119.6
Littoridina sphinctostoma	10APR87	D	1	0-3	1	283.6
Macoma mitchelli	10APR87	D	1	0-3	1	283.6
Monoculoides sp.	10APR87	D	1	0-3	1	283.6
Mulinia lateralis	10APR87	D	1	0-3	4	1134.4
Streblospio benedicti	10APR87	D	1	0-3	8	2268.8
Turbellaria	10APR87	D	1	0-3	1	283.6
Macoma mitchelli	10APR87	D	1	3-10	1	283.6
Mediomastus californiensis	10APR87	D	1	3-10	2	567.2
Paraprionospio pinnata	10APR87	D	1	3-10	1	283.6
Phoronis architecta	10APR87	D	1	3-10	3	850.8
Tagelus plebius	10APR87	D	1	3-10	2	567.2
Eteone heteropoda	10APR87	D	2	0-3	1	283.6
Mediomastus californiensis	10APR87	D	2	0-3	1	283.6
Monoculoides sp.	10APR87	D	2	0-3	3	850.8
Mulinia lateralis	10APR87	D	2	0-3	2	567.2
Streblospio benedicti	10APR87	D	2	0-3	9	2552.4
Turbellaria	10APR87	D	2	0-3	1	283.6
Cossura delta	10APR87	D	2	3-10	1	283.6
Macoma mitchelli	10APR87	D	2	3-10	1	283.6
Mediomastus californiensis	10APR87	D	2	3-10	27	7657.2
Turbellaria	10APR87	D	2	3-10	1	283.6
Mediomastus californiensis	10APR87	D	3	0-3	1	283.6

Mulinia lateralis	10APR87	D	3	0-3	3	850.8
Streblospio benedicti	10APR87	D	3	0-3	8	2268.8
Turbellaria	10APR87	D	3	0-3	1	283.6
Capitellidae	10APR87	D	3	3-10	3	850.8
Cossura delta	10APR87	D	3	3-10	1	283.6
Macoma mitchelli	10APR87	D	3	3-10	1	283.6
Mediomastus californiensis	10APR87	D	3	3-10	8	2268.8
Chironomidae	03JUN87	A	1	0-3	1	283.6
Littoridina sphinctostoma	03JUN87	A	1	0-3	270	76572.0
Mulinia lateralis	03JUN87	A	1	0-3	13	3686.8
Oligochaeta	03JUN87	A	1	0-3	1	283.6
Streblospio benedicti	03JUN87	A	1	0-3	3	850.8
Mediomastus californiensis	03JUN87	A	1	3-10	4	1134.4
Chironomidae	03JUN87	A	2	0-3	3	850.8
Littoridina sphinctostoma	03JUN87	A	2	0-3	192	54451.2
Mediomastus californiensis	03JUN87	A	2	0-3	6	1701.6
Mulinia lateralis	03JUN87	A	2	0-3	13	3686.8
Oligochaeta	03JUN87	A	2	0-3	3	850.8
Parandalia ocularis	03JUN87	A	2	0-3	1	283.6
Mediomastus californiensis	03JUN87	A	2	3-10	4	1134.4
Oligochaeta	03JUN87	A	2	3-10	1	283.6
Chironomidae	03JUN87	A	3	0-3	1	283.6
Hobsonia florida	03JUN87	A	3	0-3	1	283.6
Littoridina sphinctostoma	03JUN87	A	3	0-3	77	21837.2
Mediomastus californiensis	03JUN87	A	3	0-3	5	1418.0
Mulinia lateralis	03JUN87	A	3	0-3	10	2836.0
Mediomastus californiensis	03JUN87	A	3	3-10	4	1134.4
Littoridina sphinctostoma	03JUN87	B	1	0-3	63	17866.8
Mediomastus californiensis	03JUN87	B	1	0-3	3	850.8
Mulinia lateralis	03JUN87	B	1	0-3	8	2268.8
Streblospio benedicti	03JUN87	B	1	0-3	3	850.8
Macoma mitchelli	03JUN87	B	1	3-10	2	567.2
Mediomastus californiensis	03JUN87	B	1	3-10	21	5955.6
Littoridina sphinctostoma	03JUN87	B	2	0-3	47	13329.2
Mediomastus californiensis	03JUN87	B	2	0-3	4	1134.4
Mulinia lateralis	03JUN87	B	2	0-3	5	1418.0
Streblospio benedicti	03JUN87	B	2	0-3	11	3119.6
Macoma mitchelli	03JUN87	B	2	3-10	2	567.2
Mediomastus californiensis	03JUN87	B	2	3-10	17	4821.2
Littoridina sphinctostoma	03JUN87	B	3	0-3	12	3403.2
Mediomastus californiensis	03JUN87	B	3	0-3	5	1418.0
Mulinia lateralis	03JUN87	B	3	0-3	1	283.6
Streblospio benedicti	03JUN87	B	3	0-3	3	850.8
Macoma mitchelli	03JUN87	B	3	3-10	3	850.8
Mediomastus californiensis	03JUN87	B	3	3-10	18	5104.8
Mediomastus californiensis	03JUN87	C	1	0-3	8	2268.8
Neanthes succinea	03JUN87	C	1	0-3	1	283.6
Streblospio benedicti	03JUN87	C	1	0-3	4	1134.4
Cossura delta	03JUN87	C	1	3-10	4	1134.4
Macoma mitchelli	03JUN87	C	1	3-10	1	283.6
Mediomastus californiensis	03JUN87	C	1	3-10	15	4254.0
Neanthes succinea	03JUN87	C	1	3-10	1	283.6
Tagelus plebius	03JUN87	C	1	3-10	1	283.6
Mediomastus californiensis	03JUN87	C	2	0-3	8	2268.8
Rhynchocoels	03JUN87	C	2	0-3	1	283.6
Streblospio benedicti	03JUN87	C	2	0-3	2	567.2
Mediomastus californiensis	03JUN87	C	2	3-10	10	2836.0
Mediomastus californiensis	03JUN87	C	3	0-3	5	1418.0
Streblospio benedicti	03JUN87	C	3	0-3	2	567.2
Macoma mitchelli	03JUN87	C	3	3-10	1	283.6
Mediomastus californiensis	03JUN87	C	3	3-10	4	1134.4
Mediomastus californiensis	03JUN87	D	1	0-3	7	1985.2
Monoculoides sp.	03JUN87	D	1	0-3	1	283.6
Mulinia lateralis	03JUN87	D	1	0-3	1	283.6
Streblospio benedicti	03JUN87	D	1	0-3	2	567.2
Mediomastus californiensis	03JUN87	D	1	3-10	17	4821.2
Rhynchocoels	03JUN87	D	1	3-10	1	283.6

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Littoridina sphinctostoma          03JUN87   D     2  0-3     2     567.2
Mediomastus californiensis         03JUN87   D     2  0-3     7    1985.2
Monoculoides sp.                   03JUN87   D     2  0-3     1     283.6
Mulinia lateralis                  03JUN87   D     2  0-3     2     567.2
Rhynchocoels                       03JUN87   D     2  0-3     1     283.6
Streblospio benedicti              03JUN87   D     2  0-3     1     283.6
Glycinde solitaria                 03JUN87   D     2  3-10    1     283.6
Macoma mitchelli                   03JUN87   D     2  3-10    1     283.6
Mediomastus californiensis         03JUN87   D     2  3-10    9    2552.4
Tagelus plebius                    03JUN87   D     2  3-10    1     283.6
Capitella capitata                 03JUN87   D     3  0-3     1     283.6
Glycinde solitaria                 03JUN87   D     3  0-3     1     283.6
Mediomastus californiensis         03JUN87   D     3  0-3     5    1418.0
Pectinaria gouldii                 03JUN87   D     3  0-3     1     283.6
Streblospio benedicti              03JUN87   D     3  0-3     2     567.2
Callianassa sp. juvenile           03JUN87   D     3  3-10    1     283.6
Macoma mitchelli                   03JUN87   D     3  3-10    2     567.2
Mediomastus californiensis         03JUN87   D     3  3-10   12    3403.2
Parandalia ocularis                03JUN87   D     3  3-10    1     283.6
Rhynchocoels                       03JUN87   D     3  3-10    1     283.6
Tagelus plebius                    03JUN87   D     3  3-10    1     283.6
Chironomidae                       15JUL87   A     1  0-3     2     567.2
Littoridina sphinctostoma          15JUL87   A     1  0-3    96   27225.6
Mediomastus californiensis         15JUL87   A     1  0-3     2     567.2
Mulinia lateralis                  15JUL87   A     1  0-3    15    4254.0
Oligochaeta                        15JUL87   A     1  0-3     1     283.6
Mediomastus californiensis         15JUL87   A     1  3-10    1     283.6
Oligochaeta                        15JUL87   A     1  3-10    1     283.6
Chironomidae                       15JUL87   A     2  0-3     5    1418.0
Littoridina sphinctostoma          15JUL87   A     2  0-3    81   22971.6
Mediomastus californiensis         15JUL87   A     2  0-3     5    1418.0
Mulinia lateralis                  15JUL87   A     2  0-3    21    5955.6
Oligochaeta                        15JUL87   A     2  0-3     2     567.2
No species observed                15JUL87   A     2  3-10    0       0.0
Chironomidae                       15JUL87   A     3  0-3     6    1701.6
Littoridina sphinctostoma          15JUL87   A     3  0-3   119   33748.4
Mediomastus californiensis         15JUL87   A     3  0-3     4    1134.4
Mulinia lateralis                  15JUL87   A     3  0-3    22    6239.2
Parandalia ocularis                15JUL87   A     3  0-3     1     283.6
Parandalia ocularis                15JUL87   A     3  3-10    2     567.2
Chironomidae                       15JUL87   B     1  0-3     1     283.6
Littoridina sphinctostoma          15JUL87   B     1  0-3    29    8224.4
Mediomastus californiensis         15JUL87   B     1  0-3     4    1134.4
Mulinia lateralis                  15JUL87   B     1  0-3     5    1418.0
Streblospio benedicti              15JUL87   B     1  0-3     2     567.2
Littoridina sphinctostoma          15JUL87   B     1  3-10    1     283.6
Mediomastus californiensis         15JUL87   B     1  3-10    4    1134.4
Chironomidae                       15JUL87   B     2  0-3     1     283.6
Littoridina sphinctostoma          15JUL87   B     2  0-3     5    1418.0
Macoma mitchelli                   15JUL87   B     2  0-3     1     283.6
Mediomastus californiensis         15JUL87   B     2  0-3     2     567.2
Mulinia lateralis                  15JUL87   B     2  0-3     2     567.2
Streblospio benedicti              15JUL87   B     2  0-3     1     283.6
Mediomastus californiensis         15JUL87   B     2  3-10    3     850.8
Chironomidae                       15JUL87   B     3  0-3     1     283.6
Littoridina sphinctostoma          15JUL87   B     3  0-3    41   11627.6
Mediomastus californiensis         15JUL87   B     3  0-3     4    1134.4
Mulinia lateralis                  15JUL87   B     3  0-3     7    1985.2
Streblospio benedicti              15JUL87   B     3  0-3     2     567.2
Mediomastus californiensis         15JUL87   B     3  3-10    6    1701.6
Littoridina sphinctostoma          15JUL87   C     1  0-3    10    2836.0
Mediomastus californiensis         15JUL87   C     1  0-3     5    1418.0
Mulinia lateralis                  15JUL87   C     1  0-3     2     567.2
Rhynchocoels                       15JUL87   C     1  0-3     1     283.6
Streblospio benedicti              15JUL87   C     1  0-3     1     283.6
Macoma mitchelli                   15JUL87   C     1  3-10    1     283.6
Chironomidae                       15JUL87   C     2  0-3     2     567.2
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Littoridina sphinctostoma       15JUL87   C     2  0-3    13    3686.8
Mediomastus californiensis      15JUL87   C     2  0-3     4    1134.4
Streblospio benedicti           15JUL87   C     2  0-3     6    1701.6
Mediomastus californiensis      15JUL87   C     2  3-10    9    2552.4
Turbellaria                     15JUL87   C     2  3-10    7    1985.2
Callianassa sp. juvenile        15JUL87   C     3  0-3     1     283.6
Littoridina sphinctostoma       15JUL87   C     3  0-3    10    2836.0
Mediomastus californiensis      15JUL87   C     3  0-3     4    1134.4
Mulinia lateralis               15JUL87   C     3  0-3     4    1134.4
Streblospio benedicti           15JUL87   C     3  0-3     8    2268.8
Mediomastus californiensis      15JUL87   C     3  3-10    3     850.8
Turbellaria                     15JUL87   C     3  3-10    1     283.6
Mediomastus californiensis      15JUL87   D     1  0-3     1     283.6
Mulinia lateralis               15JUL87   D     1  0-3     4    1134.4
Streblospio benedicti           15JUL87   D     1  0-3     3     850.8
Capitella capitata              15JUL87   D     1  3-10    2     567.2
Mediomastus californiensis      15JUL87   D     1  3-10    5    1418.0
Littoridina sphinctostoma       15JUL87   D     2  0-3     1     283.6
Mediomastus californiensis      15JUL87   D     2  0-3     3     850.8
Mulinia lateralis               15JUL87   D     2  0-3     1     283.6
Streblospio benedicti           15JUL87   D     2  0-3     6    1701.6
Capitella capitata              15JUL87   D     2  3-10    1     283.6
Macoma mitchelli                15JUL87   D     2  3-10    1     283.6
Mediomastus californiensis      15JUL87   D     2  3-10    2     567.2
Parandalia ocularis             15JUL87   D     2  3-10    1     283.6
Chironomidae                    15JUL87   D     3  0-3     1     283.6
Mediomastus californiensis      15JUL87   D     3  0-3     1     283.6
Mulinia lateralis               15JUL87   D     3  0-3     1     283.6
Streblospio benedicti           15JUL87   D     3  0-3     5    1418.0
Mediomastus californiensis      15JUL87   D     3  3-10    2     567.2
Capitella capitata              18APR88   A     1  0-3     3     850.8
Chironomidae                    18APR88   A     1  0-3     1     283.6
Gammarus mucronatus             18APR88   A     1  0-3     1     283.6
Hobsonia florida                18APR88   A     1  0-3     2     567.2
Littoridina sphinctostoma       18APR88   A     1  0-3    40   11344.0
Mediomastus californiensis      18APR88   A     1  0-3     6    1701.6
Monoculoides sp.                18APR88   A     1  0-3     2     567.2
Mulinia lateralis               18APR88   A     1  0-3    12    3403.2
Polydora websteri               18APR88   A     1  0-3     1     283.6
Streblospio benedicti           18APR88   A     1  0-3   177   50197.2
Capitella capitata              18APR88   A     1  3-10    2     567.2
Hobsonia florida                18APR88   A     1  3-10    3     850.8
Mediomastus californiensis      18APR88   A     1  3-10    1     283.6
Rhynchocoels                    18APR88   A     1  3-10    1     283.6
Capitella capitata              18APR88   A     2  0-3     8    2268.8
Hobsonia florida                18APR88   A     2  0-3     2     567.2
Littoridina sphinctostoma       18APR88   A     2  0-3    71   20135.6
Mediomastus californiensis      18APR88   A     2  0-3     3     850.8
Monoculoides sp.                18APR88   A     2  0-3     4    1134.4
Mulinia lateralis               18APR88   A     2  0-3    41   11627.6
Polydora websteri               18APR88   A     2  0-3     2     567.2
Streblospio benedicti           18APR88   A     2  0-3   212   60123.2
Capitella capitata              18APR88   A     2  3-10    2     567.2
Hobsonia florida                18APR88   A     2  3-10    1     283.6
Mediomastus californiensis      18APR88   A     2  3-10    1     283.6
Rhynchocoels                    18APR88   A     2  3-10    1     283.6
Streblospio benedicti           18APR88   A     2  3-10    4    1134.4
Capitella capitata              18APR88   A     3  0-3     4    1134.4
Chironomidae                    18APR88   A     3  0-3     4    1134.4
Hobsonia florida                18APR88   A     3  0-3    10    2836.0
Littoridina sphinctostoma       18APR88   A     3  0-3    65   18434.0
Mediomastus californiensis      18APR88   A     3  0-3     1     283.6
Megalops                        18APR88   A     3  0-3     1     283.6
Monoculoides sp.                18APR88   A     3  0-3     2     567.2
Mulinia lateralis               18APR88   A     3  0-3    34    9642.4
Polydora websteri               18APR88   A     3  0-3     2     567.2
Streblospio benedicti           18APR88   A     3  0-3   159   45092.4
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Hobsonia florida	18APR88	A	3	3-10	3	850.8
Mediomastus californiensis	18APR88	A	3	3-10	2	567.2
Capitella capitata	18APR88	B	1	0-3	1	283.6
Glycinde solitaria	18APR88	B	1	0-3	1	283.6
Littoridina sphinctostoma	18APR88	B	1	0-3	59	16732.4
Mediomastus californiensis	18APR88	B	1	0-3	4	1134.4
Megalops	18APR88	B	1	0-3	1	283.6
Monoculoides sp.	18APR88	B	1	0-3	8	2268.8
Mulinia lateralis	18APR88	B	1	0-3	90	25524.0
Mysidopsis almyra	18APR88	B	1	0-3	1	283.6
Oxyurostylis smithi	18APR88	B	1	0-3	2	567.2
Rangia cuneata	18APR88	B	1	0-3	1	283.6
Streblospio benedicti	18APR88	B	1	0-3	389	110320.4
Capitella capitata	18APR88	B	1	3-10	5	1418.0
Eteone heteropoda	18APR88	B	1	3-10	1	283.6
Mediomastus californiensis	18APR88	B	1	3-10	46	13045.6
Mysidopsis almyra	18APR88	B	1	3-10	1	283.6
Oligochaeta	18APR88	B	1	3-10	1	283.6
Rhynchocoels	18APR88	B	1	3-10	1	283.6
Streblospio benedicti	18APR88	B	1	3-10	5	1418.0
Capitella capitata	18APR88	B	2	0-3	2	567.2
Eteone heteropoda	18APR88	B	2	0-3	1	283.6
Glycinde solitaria	18APR88	B	2	0-3	1	283.6
Hobsonia florida	18APR88	B	2	0-3	1	283.6
Littoridina sphinctostoma	18APR88	B	2	0-3	53	15030.8
Mediomastus californiensis	18APR88	B	2	0-3	10	2836.0
Monoculoides sp.	18APR88	B	2	0-3	4	1134.4
Mulinia lateralis	18APR88	B	2	0-3	87	24673.2
Mysidopsis almyra	18APR88	B	2	0-3	1	283.6
Rangia cuneata	18APR88	B	2	0-3	1	283.6
Rhynchocoels	18APR88	B	2	0-3	3	850.8
Streblospio benedicti	18APR88	B	2	0-3	290	82244.0
Capitella capitata	18APR88	B	2	3-10	3	850.8
Chironomidae	18APR88	B	2	3-10	1	283.6
Eteone heteropoda	18APR88	B	2	3-10	4	1134.4
Mediomastus californiensis	18APR88	B	2	3-10	47	13329.2
Rhynchocoels	18APR88	B	2	3-10	2	567.2
Streblospio benedicti	18APR88	B	2	3-10	4	1134.4
Capitella capitata	18APR88	B	3	0-3	1	283.6
Eteone heteropoda	18APR88	B	3	0-3	1	283.6
Glycinde solitaria	18APR88	B	3	0-3	1	283.6
Littoridina sphinctostoma	18APR88	B	3	0-3	88	24956.8
Mediomastus californiensis	18APR88	B	3	0-3	4	1134.4
Monoculoides sp.	18APR88	B	3	0-3	7	1985.2
Mulinia lateralis	18APR88	B	3	0-3	107	30345.2
Mysidopsis almyra	18APR88	B	3	0-3	1	283.6
Pectinaria gouldii	18APR88	B	3	0-3	1	283.6
Pyramidella sp.	18APR88	B	3	0-3	1	283.6
Rhynchocoels	18APR88	B	3	0-3	2	567.2
Streblospio benedicti	18APR88	B	3	0-3	372	105499.2
Capitella capitata	18APR88	B	3	3-10	4	1134.4
Chironomidae	18APR88	B	3	3-10	2	567.2
Eteone heteropoda	18APR88	B	3	3-10	4	1134.4
Macoma mitchelli	18APR88	B	3	3-10	1	283.6
Mediomastus californiensis	18APR88	B	3	3-10	52	14747.2
Oligochaeta	18APR88	B	3	3-10	1	283.6
Rhynchocoels	18APR88	B	3	3-10	1	283.6
Streblospio benedicti	18APR88	B	3	3-10	6	1701.6
Cyclaspis varians	18APR88	C	1	0-3	1	283.6
Glycinde solitaria	18APR88	C	1	0-3	4	1134.4
Littoridina sphinctostoma	18APR88	C	1	0-3	41	11627.6
Mediomastus californiensis	18APR88	C	1	0-3	73	20702.8
Monoculoides sp.	18APR88	C	1	0-3	2	567.2
Mulinia lateralis	18APR88	C	1	0-3	45	12762.0
Oxyurostylis smithi	18APR88	C	1	0-3	3	850.8
Scolelepis squamata	18APR88	C	1	0-3	2	567.2
Streblospio benedicti	18APR88	C	1	0-3	17	4821.2

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Glycinde solitaria                  18APR88   C     1  3-10    1     283.6
Mediomastus californiensis          18APR88   C     1  3-10   41   11627.6
Rhynchocoels                        18APR88   C     1  3-10    1     283.6
Glycinde solitaria                  18APR88   C     2  0-3     6    1701.6
Littoridina sphinctostoma           18APR88   C     2  0-3    78   22120.8
Mediomastus californiensis          18APR88   C     2  0-3    60   17016.0
Mulinia lateralis                   18APR88   C     2  0-3    78   22120.8
Nereidae                            18APR88   C     2  0-3     1     283.6
Oxyurostylis smithi                 18APR88   C     2  0-3     4    1134.4
Rhynchocoels                        18APR88   C     2  0-3     2     567.2
Scolelepis squamata                 18APR88   C     2  0-3     2     567.2
Streblospio benedicti               18APR88   C     2  0-3    19    5388.4
Turbellaria                         18APR88   C     2  0-3     1     283.6
Capitella capitata                  18APR88   C     2  3-10    4    1134.4
Glycinde solitaria                  18APR88   C     2  3-10    2     567.2
Mediomastus californiensis          18APR88   C     2  3-10   57   16165.2
Parandalia ocularis                 18APR88   C     2  3-10    1     283.6
Rhynchocoels                        18APR88   C     2  3-10    1     283.6
Scolelepis squamata                 18APR88   C     2  3-10    1     283.6
Capitella capitata                  18APR88   C     3  0-3     1     283.6
Cyclaspis varians                   18APR88   C     3  0-3     2     567.2
Diopatra cuprea                     18APR88   C     3  0-3     1     283.6
Glycinde solitaria                  18APR88   C     3  0-3     5    1418.0
Littoridina sphinctostoma           18APR88   C     3  0-3    55   15598.0
Mediomastus californiensis          18APR88   C     3  0-3    79   22404.4
Mulinia lateralis                   18APR88   C     3  0-3    59   16732.4
Nereidae                            18APR88   C     3  0-3     1     283.6
Oxyurostylis smithi                 18APR88   C     3  0-3     2     567.2
Rhynchocoels                        18APR88   C     3  0-3     1     283.6
Scolelepis squamata                 18APR88   C     3  0-3     2     567.2
Streblospio benedicti               18APR88   C     3  0-3    12    3403.2
Capitella capitata                  18APR88   C     3  3-10    1     283.6
Glycinde solitaria                  18APR88   C     3  3-10    2     567.2
Mediomastus californiensis          18APR88   C     3  3-10   23    6522.8
Turbellaria                         18APR88   C     3  3-10    2     567.2
Acteocina canaliculata              18APR88   D     1  0-3     1     283.6
Glycinde solitaria                  18APR88   D     1  0-3     9    2552.4
Littoridina sphinctostoma           18APR88   D     1  0-3    14    3970.4
Mediomastus californiensis          18APR88   D     1  0-3    58   16448.8
Mulinia lateralis                   18APR88   D     1  0-3    19    5388.4
Mysidopsis bahia                    18APR88   D     1  0-3     1     283.6
Streblospio benedicti               18APR88   D     1  0-3     4    1134.4
Glycinde solitaria                  18APR88   D     1  3-10    1     283.6
Haploscoloplos fragilis             18APR88   D     1  3-10    2     567.2
Mediomastus californiensis          18APR88   D     1  3-10   17    4821.2
Rhynchocoels                        18APR88   D     1  3-10    1     283.6
Turbellaria                         18APR88   D     1  3-10    1     283.6
Glycinde solitaria                  18APR88   D     2  0-3     5    1418.0
Hesionidae                          18APR88   D     2  0-3     1     283.6
Littoridina sphinctostoma           18APR88   D     2  0-3    18    5104.8
Mediomastus californiensis          18APR88   D     2  0-3    71   20135.6
Melita sp.                          18APR88   D     2  0-3     1     283.6
Mulinia lateralis                   18APR88   D     2  0-3    22    6239.2
Oxyurostylis smithi                 18APR88   D     2  0-3     1     283.6
Streblospio benedicti               18APR88   D     2  0-3     6    1701.6
Glycinde solitaria                  18APR88   D     2  3-10    4    1134.4
Mediomastus californiensis          18APR88   D     2  3-10   14    3970.4
Glycinde solitaria                  18APR88   D     3  0-3     6    1701.6
Littoridina sphinctostoma           18APR88   D     3  0-3     9    2552.4
Mediomastus californiensis          18APR88   D     3  0-3    57   16165.2
Mulinia lateralis                   18APR88   D     3  0-3    22    6239.2
Oxyurostylis smithi                 18APR88   D     3  0-3     1     283.6
Streblospio benedicti               18APR88   D     3  0-3     8    2268.8
Glycinde solitaria                  18APR88   D     3  3-10    2     567.2
Mediomastus californiensis          18APR88   D     3  3-10   17    4821.2
Hobsonia florida                    07JUL88   A     1  0-3     1     283.6
Littoridina sphinctostoma           07JUL88   A     1  0-3    22    6239.2
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Mediomastus californiensis	07JUL88	A	1	0-3	25	7090.0
Monoculoides sp.	07JUL88	A	1	0-3	1	283.6
Mulinia lateralis	07JUL88	A	1	0-3	48	13612.8
Mysidopsis sp.	07JUL88	A	1	0-3	1	283.6
Polydora sp.	07JUL88	A	1	0-3	1	283.6
Streblospio benedicti	07JUL88	A	1	0-3	76	21553.6
Capitella capitata	07JUL88	A	1	3-10	14	3970.4
Mediomastus californiensis	07JUL88	A	1	3-10	54	15314.4
Rhynchocoels	07JUL88	A	1	3-10	1	283.6
Littoridina sphinctostoma	07JUL88	A	2	0-3	40	11344.0
Mediomastus californiensis	07JUL88	A	2	0-3	17	4821.2
Monoculoides sp.	07JUL88	A	2	0-3	3	850.8
Mulinia lateralis	07JUL88	A	2	0-3	61	17299.6
Streblospio benedicti	07JUL88	A	2	0-3	60	17016.0
Capitella capitata	07JUL88	A	2	3-10	10	2836.0
Mediomastus californiensis	07JUL88	A	2	3-10	72	20419.2
Mulinia lateralis	07JUL88	A	2	3-10	2	567.2
Oligochaeta	07JUL88	A	2	3-10	1	283.6
Rhynchocoels	07JUL88	A	2	3-10	2	567.2
Capitella capitata	07JUL88	A	3	0-3	4	1134.4
Littoridina sphinctostoma	07JUL88	A	3	0-3	36	10209.6
Mediomastus californiensis	07JUL88	A	3	0-3	6	1701.6
Monoculoides sp.	07JUL88	A	3	0-3	5	1418.0
Mulinia lateralis	07JUL88	A	3	0-3	51	14463.6
Streblospio benedicti	07JUL88	A	3	0-3	53	15030.8
Capitella capitata	07JUL88	A	3	3-10	5	1418.0
Mediomastus californiensis	07JUL88	A	3	3-10	57	16165.2
Oligochaeta	07JUL88	A	3	3-10	2	567.2
Rhynchocoels	07JUL88	A	3	3-10	1	283.6
Capitella capitata	07JUL88	B	1	0-3	1	283.6
Littoridina sphinctostoma	07JUL88	B	1	0-3	37	10493.2
Mediomastus californiensis	07JUL88	B	1	0-3	20	5672.0
Mulinia lateralis	07JUL88	B	1	0-3	70	19852.0
Oxyurostylis smithi	07JUL88	B	1	0-3	1	283.6
Streblospio benedicti	07JUL88	B	1	0-3	29	8224.4
Tellina sp.	07JUL88	B	1	0-3	1	283.6
Glycinde solitaria	07JUL88	B	1	3-10	1	283.6
Mediomastus californiensis	07JUL88	B	1	3-10	29	8224.4
Oligochaeta	07JUL88	B	1	3-10	2	567.2
Paraprionospio pinnata	07JUL88	B	1	3-10	1	283.6
Littoridina sphinctostoma	07JUL88	B	2	0-3	45	12762.0
Mediomastus californiensis	07JUL88	B	2	0-3	48	13612.8
Mulinia lateralis	07JUL88	B	2	0-3	69	19568.4
Streblospio benedicti	07JUL88	B	2	0-3	38	10776.8
Glycinde solitaria	07JUL88	B	2	3-10	1	283.6
Macoma mitchelli	07JUL88	B	2	3-10	1	283.6
Mediomastus californiensis	07JUL88	B	2	3-10	31	8791.6
Oligochaeta	07JUL88	B	2	3-10	2	567.2
Cyclaspis varians	07JUL88	B	3	0-3	1	283.6
Littoridina sphinctostoma	07JUL88	B	3	0-3	25	7090.0
Mediomastus californiensis	07JUL88	B	3	0-3	23	6522.8
Mulinia lateralis	07JUL88	B	3	0-3	72	20419.2
Rangia cuneata	07JUL88	B	3	0-3	1	283.6
Streblospio benedicti	07JUL88	B	3	0-3	8	2268.8
Mediomastus californiensis	07JUL88	B	3	3-10	29	8224.4
Spionidae	07JUL88	B	3	3-10	1	283.6
Littoridina sphinctostoma	08JUL88	C	1	0-3	2	567.2
Mediomastus californiensis	08JUL88	C	1	0-3	29	8224.4
Mulinia lateralis	08JUL88	C	1	0-3	5	1418.0
Streblospio benedicti	08JUL88	C	1	0-3	8	2268.8
Glycinde solitaria	08JUL88	C	1	3-10	1	283.6
Mediomastus californiensis	08JUL88	C	1	3-10	27	7657.2
Scolelepis squamata	08JUL88	C	1	3-10	1	283.6
Edotea montosa	08JUL88	C	2	0-3	1	283.6
Mediomastus californiensis	08JUL88	C	2	0-3	21	5955.6
Mulinia lateralis	08JUL88	C	2	0-3	3	850.8
Rhynchocoels	08JUL88	C	2	0-3	1	283.6

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Streblospio benedicti           08JUL88   C     2  0-3      6    1701.6
Mediomastus californiensis      08JUL88   C     2  3-10    20    5672.0
Paraprionospio pinnata          08JUL88   C     2  3-10     1     283.6
Glycinde solitaria              08JUL88   C     3  0-3      2     567.2
Littoridina sphinctostoma       08JUL88   C     3  0-3      2     567.2
Mediomastus californiensis      08JUL88   C     3  0-3     34    9642.4
Mulinia lateralis               08JUL88   C     3  0-3      2     567.2
Rhynchocoels                    08JUL88   C     3  0-3      1     283.6
Streblospio benedicti           08JUL88   C     3  0-3      5    1418.0
Glycinde solitaria              08JUL88   C     3  3-10     1     283.6
Mediomastus californiensis      08JUL88   C     3  3-10    18    5104.8
Diopatra cuprea                 08JUL88   D     1  0-3      1     283.6
Glycinde solitaria              08JUL88   D     1  0-3      1     283.6
Haploscoloplos foliosus         08JUL88   D     1  0-3      1     283.6
Macoma mitchelli                08JUL88   D     1  0-3      1     283.6
Mediomastus californiensis      08JUL88   D     1  0-3     27    7657.2
Paraprionospio pinnata          08JUL88   D     1  0-3      1     283.6
Pyramidella sp.                 08JUL88   D     1  0-3      1     283.6
Streblospio benedicti           08JUL88   D     1  0-3      4    1134.4
Mediomastus californiensis      08JUL88   D     1  3-10     5    1418.0
Haploscoloplos foliosus         08JUL88   D     2  0-3      1     283.6
Mediomastus californiensis      08JUL88   D     2  0-3     23    6522.8
Streblospio benedicti           08JUL88   D     2  0-3      2     567.2
Glycinde solitaria              08JUL88   D     2  3-10     1     283.6
Mediomastus californiensis      08JUL88   D     2  3-10     2     567.2
Rhynchocoels                    08JUL88   D     2  3-10     1     283.6
Acteocina canaliculata          08JUL88   D     3  0-3      2     567.2
Cyclaspis varians               08JUL88   D     3  0-3      2     567.2
Glycinde solitaria              08JUL88   D     3  0-3      1     283.6
Macoma tenta                    08JUL88   D     3  0-3      1     283.6
Mediomastus californiensis      08JUL88   D     3  0-3     30    8508.0
Oxyurostylis salioni            08JUL88   D     3  0-3      1     283.6
Polydora websteri               08JUL88   D     3  0-3      1     283.6
Serpulidae                      08JUL88   D     3  0-3      2     567.2
Diopatra cuprea                 08JUL88   D     3  3-10     2     567.2
Glycinde solitaria              08JUL88   D     3  3-10     2     567.2
Mediomastus californiensis      08JUL88   D     3  3-10     4    1134.4
Anthozoa                        22NOV88   A     1  0-3      1     283.6
Capitella capitata              22NOV88   A     1  0-3      1     283.6
Cyclaspis varians               22NOV88   A     1  0-3      2     567.2
Littoridina sphinctostoma       22NOV88   A     1  0-3     10    2836.0
Mediomastus californiensis      22NOV88   A     1  0-3      7    1985.2
Monoculoides sp.                22NOV88   A     1  0-3      1     283.6
Mulinia lateralis               22NOV88   A     1  0-3     11    3119.6
Polydora sp.                    22NOV88   A     1  0-3      2     567.2
Streblospio benedicti           22NOV88   A     1  0-3     19    5388.4
Capitella capitata              22NOV88   A     1  3-10     1     283.6
Mediomastus californiensis      22NOV88   A     1  3-10    39   11060.4
Oligochaeta                     22NOV88   A     1  3-10     1     283.6
Parandalia ocularis             22NOV88   A     1  3-10     1     283.6
Rhynchocoels                    22NOV88   A     1  3-10     1     283.6
Scolelepis squamata             22NOV88   A     1  3-10     1     283.6
Capitella capitata              22NOV88   A     2  0-3      1     283.6
Caprellid a                     22NOV88   A     2  0-3      2     567.2
Littoridina sphinctostoma       22NOV88   A     2  0-3     14    3970.4
Mediomastus californiensis      22NOV88   A     2  0-3     14    3970.4
Mulinia lateralis               22NOV88   A     2  0-3     11    3119.6
Oxyurostylis smithi             22NOV88   A     2  0-3      1     283.6
Polydora sp.                    22NOV88   A     2  0-3      1     283.6
Streblospio benedicti           22NOV88   A     2  0-3     11    3119.6
Capitella capitata              22NOV88   A     2  3-10     2     567.2
Mediomastus californiensis      22NOV88   A     2  3-10    25    7090.0
Polydora sp.                    22NOV88   A     2  3-10     1     283.6
Rhynchocoels                    22NOV88   A     2  3-10     1     283.6
Balanus eburneus                22NOV88   A     3  0-3      3     850.8
Capitella capitata              22NOV88   A     3  0-3      3     850.8
Cyclaspis varians               22NOV88   A     3  0-3      1     283.6
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Littoridina sphinctostoma          22NOV88   A    3  0-3     4    1134.4
Macoma mitchelli                   22NOV88   A    3  0-3     1     283.6
Mediomastus californiensis         22NOV88   A    3  0-3     5    1418.0
Mulinia lateralis                  22NOV88   A    3  0-3     7    1985.2
Polydora sp.                       22NOV88   A    3  0-3     2     567.2
Streblospio benedicti              22NOV88   A    3  0-3     9    2552.4
Capitella capitata                 22NOV88   A    3  3-10    1     283.6
Mediomastus californiensis         22NOV88   A    3  3-10   30    8508.0
Oxyurostylis smithi                22NOV88   A    3  3-10    1     283.6
Balanus eburneus                   22NOV88   B    1  0-3     1     283.6
Cyclaspis varians                  22NOV88   B    1  0-3     1     283.6
Littoridina sphinctostoma          22NOV88   B    1  0-3    31    8791.6
Mediomastus californiensis         22NOV88   B    1  0-3     9    2552.4
Mulinia lateralis                  22NOV88   B    1  0-3    52   14747.2
Oligochaeta                        22NOV88   B    1  0-3    19    5388.4
Streblospio benedicti              22NOV88   B    1  0-3    12    3403.2
Mediomastus californiensis         22NOV88   B    1  3-10   18    5104.8
Mulinia lateralis                  22NOV88   B    1  3-10    3     850.8
Oligochaeta                        22NOV88   B    1  3-10    1     283.6
Balanus eburneus                   22NOV88   B    2  0-3     1     283.6
Littoridina sphinctostoma          22NOV88   B    2  0-3    31    8791.6
Mediomastus californiensis         22NOV88   B    2  0-3    10    2836.0
Mulinia lateralis                  22NOV88   B    2  0-3    32    9075.2
Oligochaeta                        22NOV88   B    2  0-3     9    2552.4
Streblospio benedicti              22NOV88   B    2  0-3    10    2836.0
Mediomastus californiensis         22NOV88   B    2  3-10   20    5672.0
Acteocina canaliculata             22NOV88   B    3  0-3     2     567.2
Littoridina sphinctostoma          22NOV88   B    3  0-3    24    6806.4
Mediomastus californiensis         22NOV88   B    3  0-3     7    1985.2
Mulinia lateralis                  22NOV88   B    3  0-3    29    8224.4
Oligochaeta                        22NOV88   B    3  0-3     4    1134.4
Streblospio benedicti              22NOV88   B    3  0-3     6    1701.6
Haploscoloplos foliosus            22NOV88   B    3  3-10    1     283.6
Littoridina sphinctostoma          22NOV88   B    3  3-10    1     283.6
Mediomastus californiensis         22NOV88   B    3  3-10   29    8224.4
Mediomastus californiensis         22NOV88   C    1  0-3     6    1701.6
Rhynchocoels                       22NOV88   C    1  0-3     1     283.6
Streblospio benedicti              22NOV88   C    1  0-3     6    1701.6
Gyptis vittata                     22NOV88   C    1  3-10    3     850.8
Haploscoloplos foliosus            22NOV88   C    1  3-10    1     283.6
Mediomastus californiensis         22NOV88   C    1  3-10   18    5104.8
Rhynchocoels                       22NOV88   C    1  3-10    1     283.6
Mediomastus californiensis         22NOV88   C    2  0-3    13    3686.8
Rhynchocoels                       22NOV88   C    2  0-3     1     283.6
Streblospio benedicti              22NOV88   C    2  0-3     3     850.8
Mediomastus californiensis         22NOV88   C    2  3-10   17    4821.2
Mediomastus californiensis         22NOV88   C    3  0-3    20    5672.0
Mulinia lateralis                  22NOV88   C    3  0-3     2     567.2
Rhynchocoels                       22NOV88   C    3  0-3     1     283.6
Streblospio benedicti              22NOV88   C    3  0-3     4    1134.4
Mediomastus californiensis         22NOV88   C    3  3-10   18    5104.8
Glycinde solitaria                 22NOV88   D    1  0-3     1     283.6
Haploscoloplos foliosus            22NOV88   D    1  0-3     2     567.2
Mediomastus californiensis         22NOV88   D    1  0-3    17    4821.2
Mulinia lateralis                  22NOV88   D    1  0-3     1     283.6
Streblospio benedicti              22NOV88   D    1  0-3     3     850.8
Mediomastus californiensis         22NOV88   D    1  3-10    6    1701.6
Rhynchocoels                       22NOV88   D    1  3-10    1     283.6
Glycinde solitaria                 22NOV88   D    2  0-3     1     283.6
Mediomastus californiensis         22NOV88   D    2  0-3    21    5955.6
Mysidopsis sp.                     22NOV88   D    2  0-3     1     283.6
Nuculana acuta                     22NOV88   D    2  0-3     1     283.6
Streblospio benedicti              22NOV88   D    2  0-3     4    1134.4
Haploscoloplos foliosus            22NOV88   D    2  3-10    1     283.6
Mediomastus californiensis         22NOV88   D    2  3-10    2     567.2
Paraprionospio pinnata             22NOV88   D    2  3-10    1     283.6
Glycinde solitaria                 22NOV88   D    3  0-3     1     283.6
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Gyptis vittata                 22NOV88   D     3  0-3     2     567.2
Haploscoloplos foliosus        22NOV88   D     3  0-3     1     283.6
Mediomastus californiensis     22NOV88   D     3  0-3    12    3403.2
Oxyurostylis smithi            22NOV88   D     3  0-3     1     283.6
Polydora websteri              22NOV88   D     3  0-3     1     283.6
Rhynchocoels                   22NOV88   D     3  0-3     2     567.2
Streblospio benedicti          22NOV88   D     3  0-3     1     283.6
Glycinde solitaria             22NOV88   D     3  3-10    1     283.6
Gyptis vittata                 22NOV88   D     3  3-10    2     567.2
Mediomastus californiensis     22NOV88   D     3  3-10    2     567.2
Polydora caulleryi             22NOV88   D     3  3-10    1     283.6
Rhynchocoels                   22NOV88   D     3  3-10    1     283.6
Streblospio benedicti          22NOV88   D     3  3-10    1     283.6
Acteocina canaliculata         04APR89   A     1  0-3     1     283.6
Capitella capitata             04APR89   A     1  0-3     4    1134.4
Gastropoda                     04APR89   A     1  0-3    43   12194.8
Littoridina sphinctostoma      04APR89   A     1  0-3    17    4821.2
Monoculoides sp.               04APR89   A     1  0-3     3     850.8
Mulinia lateralis              04APR89   A     1  0-3    10    2836.0
Mysidopsis bahia               04APR89   A     1  0-3     1     283.6
Pyramidella sp.                04APR89   A     1  0-3     1     283.6
Rhynchocoels                   04APR89   A     1  0-3     5    1418.0
Streblospio benedicti          04APR89   A     1  0-3   184   52182.4
Capitella capitata             04APR89   A     1  3-10    1     283.6
Littoridina sphinctostoma      04APR89   A     1  3-10    3     850.8
Macoma mitchelli               04APR89   A     1  3-10    1     283.6
Mediomastus californiensis     04APR89   A     1  3-10   29    8224.4
Parandalia ocularis            04APR89   A     1  3-10    1     283.6
Streblospio benedicti          04APR89   A     1  3-10   36   10209.6
Capitella capitata             04APR89   A     2  0-3     3     850.8
Gastropoda                     04APR89   A     2  0-3    23    6522.8
Littoridina sphinctostoma      04APR89   A     2  0-3    16    4537.6
Monoculoides sp.               04APR89   A     2  0-3     7    1985.2
Mulinia lateralis              04APR89   A     2  0-3    16    4537.6
Pyramidella sp.                04APR89   A     2  0-3     2     567.2
Rhynchocoels                   04APR89   A     2  0-3     2     567.2
Streblospio benedicti          04APR89   A     2  0-3   229   64944.4
Capitella capitata             04APR89   A     2  3-10    2     567.2
Mediomastus californiensis     04APR89   A     2  3-10   22    6239.2
Oligochaeta                    04APR89   A     2  3-10    1     283.6
Streblospio benedicti          04APR89   A     2  3-10   64   18150.4
Gastropoda                     04APR89   A     3  0-3    65   18434.0
Littoridina sphinctostoma      04APR89   A     3  0-3    18    5104.8
Mediomastus californiensis     04APR89   A     3  0-3     1     283.6
Monoculoides sp.               04APR89   A     3  0-3     2     567.2
Mulinia lateralis              04APR89   A     3  0-3     7    1985.2
Pyramidella sp.                04APR89   A     3  0-3     3     850.8
Rhynchocoels                   04APR89   A     3  0-3     2     567.2
Streblospio benedicti          04APR89   A     3  0-3   208   58988.8
Capitella capitata             04APR89   A     3  3-10    2     567.2
Gastropoda                     04APR89   A     3  3-10    1     283.6
Gyptis vittata                 04APR89   A     3  3-10    1     283.6
Mediomastus californiensis     04APR89   A     3  3-10   20    5672.0
Streblospio benedicti          04APR89   A     3  3-10   20    5672.0
Cyclaspis varians              04APR89   B     1  0-3     1     283.6
Littoridina sphinctostoma      04APR89   B     1  0-3    31    8791.6
Mediomastus californiensis     04APR89   B     1  0-3     5    1418.0
Mulinia lateralis              04APR89   B     1  0-3     2     567.2
Oxyurostylis smithi            04APR89   B     1  0-3     1     283.6
Streblospio benedicti          04APR89   B     1  0-3   146   41405.6
Acteocina canaliculata         04APR89   B     1  3-10    1     283.6
Haploscoloplos foliosus        04APR89   B     1  3-10    1     283.6
Macoma mitchelli               04APR89   B     1  3-10    2     567.2
Mediomastus californiensis     04APR89   B     1  3-10   12    3403.2
Streblospio benedicti          04APR89   B     1  3-10    9    2552.4
Acteocina canaliculata         04APR89   B     2  0-3     1     283.6
Haploscoloplos foliosus        04APR89   B     2  0-3     1     283.6
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Littoridina sphinctostoma	04APR89	B	2	0-3	26	7373.6
Mediomastus californiensis	04APR89	B	2	0-3	2	567.2
Mulinia lateralis	04APR89	B	2	0-3	1	283.6
Streblospio benedicti	04APR89	B	2	0-3	143	40554.8
Glycinde solitaria	04APR89	B	2	3-10	1	283.6
Mediomastus californiensis	04APR89	B	2	3-10	31	8791.6
Streblospio benedicti	04APR89	B	2	3-10	10	2836.0
Acteocina canaliculata	04APR89	B	3	0-3	1	283.6
Capitella capitata	04APR89	B	3	0-3	1	283.6
Haploscoloplos foliosus	04APR89	B	3	0-3	2	567.2
Littoridina sphinctostoma	04APR89	B	3	0-3	30	8508.0
Mediomastus californiensis	04APR89	B	3	0-3	5	1418.0
Oligochaeta	04APR89	B	3	0-3	1	283.6
Rhynchocoels	04APR89	B	3	0-3	1	283.6
Streblospio benedicti	04APR89	B	3	0-3	170	48212.0
Capitella capitata	04APR89	B	3	3-10	1	283.6
Haploscoloplos foliosus	04APR89	B	3	3-10	1	283.6
Littoridina sphinctostoma	04APR89	B	3	3-10	2	567.2
Macoma mitchelli	04APR89	B	3	3-10	3	850.8
Mediomastus californiensis	04APR89	B	3	3-10	19	5388.4
Streblospio benedicti	04APR89	B	3	3-10	9	2552.4
Cyclaspis varians	04APR89	C	1	0-3	9	2552.4
Mediomastus californiensis	04APR89	C	1	0-3	32	9075.2
Microprotopus spp.	04APR89	C	1	0-3	1	283.6
Monoculoides sp.	04APR89	C	1	0-3	6	1701.6
Oxyurostylis smithi	04APR89	C	1	0-3	12	3403.2
Streblospio benedicti	04APR89	C	1	0-3	7	1985.2
Mediomastus californiensis	04APR89	C	1	3-10	8	2268.8
Acteocina canaliculata	04APR89	C	2	0-3	2	567.2
Cyclaspis varians	04APR89	C	2	0-3	3	850.8
Glycinde solitaria	04APR89	C	2	0-3	1	283.6
Leucon sp.	04APR89	C	2	0-3	1	283.6
Macoma mitchelli	04APR89	C	2	0-3	1	283.6
Mediomastus californiensis	04APR89	C	2	0-3	16	4537.6
Monoculoides sp.	04APR89	C	2	0-3	2	567.2
Oxyurostylis smithi	04APR89	C	2	0-3	6	1701.6
Streblospio benedicti	04APR89	C	2	0-3	6	1701.6
Ensis minor	04APR89	C	2	3-10	1	283.6
Gyptis vittata	04APR89	C	2	3-10	1	283.6
Haploscoloplos foliosus	04APR89	C	2	3-10	1	283.6
Mediomastus californiensis	04APR89	C	2	3-10	11	3119.6
Rhynchocoels	04APR89	C	2	3-10	1	283.6
Acteocina canaliculata	04APR89	C	3	0-3	1	283.6
Cyclaspis varians	04APR89	C	3	0-3	3	850.8
Mediomastus californiensis	04APR89	C	3	0-3	42	11911.2
Monoculoides sp.	04APR89	C	3	0-3	2	567.2
Mulinia lateralis	04APR89	C	3	0-3	2	567.2
Oxyurostylis smithi	04APR89	C	3	0-3	7	1985.2
Streblospio benedicti	04APR89	C	3	0-3	2	567.2
Mediomastus californiensis	04APR89	C	3	3-10	8	2268.8
Paraprionospio pinnata	04APR89	C	3	3-10	1	283.6
Aligena texasiana	04APR89	D	1	0-3	1	283.6
Ampelisca abdita	04APR89	D	1	0-3	2	567.2
Batea catharinensis	04APR89	D	1	0-3	1	283.6
Capitella capitata	04APR89	D	1	0-3	1	283.6
Caprellid a	04APR89	D	1	0-3	2	567.2
Clymenella torquata calida	04APR89	D	1	0-3	1	283.6
Cyclaspis varians	04APR89	D	1	0-3	15	4254.0
Diopatra cuprea	04APR89	D	1	0-3	1	283.6
Ensis minor	04APR89	D	1	0-3	5	1418.0
Erichthonias brasiliensis	04APR89	D	1	0-3	7	1985.2
Glycera americana	04APR89	D	1	0-3	1	283.6
Gyptis vittata	04APR89	D	1	0-3	1	283.6
Haploscoloplos foliosus	04APR89	D	1	0-3	3	850.8
Mediomastus californiensis	04APR89	D	1	0-3	28	7940.8
Megalomma bioculatum	04APR89	D	1	0-3	1	283.6
Microprotopus spp.	04APR89	D	1	0-3	1	283.6

Monoculoides sp.	04APR89	D	1	0-3	1	283.6
Mulinia lateralis	04APR89	D	1	0-3	1	283.6
Mysella planulata	04APR89	D	1	0-3	4	1134.4
Oxyurostylis smithi	04APR89	D	1	0-3	8	2268.8
Polydora websteri	04APR89	D	1	0-3	1	283.6
Streblospio benedicti	04APR89	D	1	0-3	1	283.6
Tellina sp.	04APR89	D	1	0-3	1	283.6
Aligena texasiana	04APR89	D	1	3-10	1	283.6
Mediomastus californiensis	04APR89	D	1	3-10	11	3119.6
Neanthes succinea	04APR89	D	1	3-10	1	283.6
Acteocina canaliculata	04APR89	D	2	0-3	2	567.2
Ampelisca abdita	04APR89	D	2	0-3	1	283.6
Cyclaspis varians	04APR89	D	2	0-3	4	1134.4
Ensis minor	04APR89	D	2	0-3	2	567.2
Erichthonias brasiliensis	04APR89	D	2	0-3	1	283.6
Haploscoloplos foliosus	04APR89	D	2	0-3	1	283.6
Mediomastus californiensis	04APR89	D	2	0-3	22	6239.2
Mulinia lateralis	04APR89	D	2	0-3	1	283.6
Mysella planulata	04APR89	D	2	0-3	1	283.6
Oxyurostylis smithi	04APR89	D	2	0-3	7	1985.2
Pandora trilineata	04APR89	D	2	0-3	1	283.6
Pseudodiaptomus coronatus	04APR89	D	2	0-3	1	283.6
Mediomastus californiensis	04APR89	D	2	3-10	4	1134.4
Neanthes succinea	04APR89	D	2	3-10	1	283.6
Rhynchocoels	04APR89	D	2	3-10	2	567.2
Clymenella torquata calida	04APR89	D	3	0-3	2	567.2
Ensis minor	04APR89	D	3	0-3	2	567.2
Glycinde solitaria	04APR89	D	3	0-3	2	567.2
Haploscoloplos foliosus	04APR89	D	3	0-3	3	850.8
Isolda pulchella	04APR89	D	3	0-3	1	283.6
Mediomastus californiensis	04APR89	D	3	0-3	46	13045.6
Megalomma bioculatum	04APR89	D	3	0-3	3	850.8
Melinna maculata	04APR89	D	3	0-3	1	283.6
Monoculoides sp.	04APR89	D	3	0-3	1	283.6
Mulinia lateralis	04APR89	D	3	0-3	1	283.6
Mysella planulata	04APR89	D	3	0-3	1	283.6
Neanthes succinea	04APR89	D	3	0-3	1	283.6
Oxyurostylis smithi	04APR89	D	3	0-3	11	3119.6
Polydora caulleryi	04APR89	D	3	0-3	3	850.8
Polydora websteri	04APR89	D	3	0-3	1	283.6
Terebellidae	04APR89	D	3	0-3	1	283.6
Diopatra cuprea	04APR89	D	3	3-10	1	283.6
Mediomastus californiensis	04APR89	D	3	3-10	8	2268.8
Neanthes succinea	04APR89	D	3	3-10	1	283.6
Oxyurostylis smithi	04APR89	D	3	3-10	1	283.6
Parandalia ocularis	04APR89	D	3	3-10	2	567.2
Polydora caulleryi	04APR89	D	3	3-10	18	5104.8
Acteocina canaliculata	23JUL89	A	1	0-3	1	283.6
Glycinde solitaria	23JUL89	A	1	0-3	1	283.6
Littoridina sphinctostoma	23JUL89	A	1	0-3	17	4821.2
Mediomastus californiensis	23JUL89	A	1	0-3	3	850.8
Mysidopsis almyra	23JUL89	A	1	0-3	1	283.6
Pyramidella crenulata	23JUL89	A	1	0-3	1	283.6
Rhynchocoels	23JUL89	A	1	0-3	1	283.6
Streblospio benedicti	23JUL89	A	1	0-3	15	4254.0
Mediomastus californiensis	23JUL89	A	1	3-10	31	8791.6
Cyclaspis varians	23JUL89	A	2	0-3	2	567.2
Littoridina sphinctostoma	23JUL89	A	2	0-3	27	7657.2
Mediomastus californiensis	23JUL89	A	2	0-3	5	1418.0
Monoculoides sp.	23JUL89	A	2	0-3	4	1134.4
Mulinia lateralis	23JUL89	A	2	0-3	6	1701.6
Mysidopsis sp.	23JUL89	A	2	0-3	2	567.2
Pseudodiaptomus coronatus	23JUL89	A	2	0-3	1	283.6
Streblospio benedicti	23JUL89	A	2	0-3	15	4254.0
Mediomastus californiensis	23JUL89	A	2	3-10	40	11344.0
Streblospio benedicti	23JUL89	A	2	3-10	1	283.6
Bowmaniella sp.	23JUL89	A	3	0-3	1	283.6

Littoridina sphinctostoma	23JUL89	A	3	0-3	24	6806.4
Mediomastus californiensis	23JUL89	A	3	0-3	10	2836.0
Microprotopus spp.	23JUL89	A	3	0-3	1	283.6
Mulinia lateralis	23JUL89	A	3	0-3	1	283.6
Mysidopsis almyra	23JUL89	A	3	0-3	2	567.2
Mysidopsis sp.	23JUL89	A	3	0-3	1	283.6
Oligochaeta	23JUL89	A	3	0-3	1	283.6
Rhynchocoels	23JUL89	A	3	0-3	2	567.2
Streblospio benedicti	23JUL89	A	3	0-3	23	6522.8
Heteromastus filiformis	23JUL89	A	3	3-10	1	283.6
Mediomastus californiensis	23JUL89	A	3	3-10	35	9926.0
Oligochaeta	23JUL89	A	3	3-10	1	283.6
Anaitides erythrophyllus	23JUL89	C	1	0-3	2	567.2
Batea catharinensis	23JUL89	C	1	0-3	1	283.6
Bivalvia	23JUL89	C	1	0-3	2	567.2
Caprellid a	23JUL89	C	1	0-3	6	1701.6
Mediomastus californiensis	23JUL89	C	1	0-3	24	6806.4
Megalomma bioculatum	23JUL89	C	1	0-3	1	283.6
Melita sp.	23JUL89	C	1	0-3	3	850.8
Odostomia sp.	23JUL89	C	1	0-3	1	283.6
Oligochaeta	23JUL89	C	1	0-3	1	283.6
Pista palmata	23JUL89	C	1	0-3	7	1985.2
Polychaete juvenile (Unidentified)	23JUL89	C	1	0-3	1	283.6
Polydora caulleryi	23JUL89	C	1	0-3	1	283.6
Rhynchocoels	23JUL89	C	1	0-3	1	283.6
Streblospio benedicti	23JUL89	C	1	0-3	3	850.8
Caprellid a	23JUL89	C	1	3-10	2	567.2
Glycinde solitaria	23JUL89	C	1	3-10	1	283.6
Mediomastus californiensis	23JUL89	C	1	3-10	5	1418.0
Paraprionospio pinnata	23JUL89	C	1	3-10	1	283.6
Pista palmata	23JUL89	C	1	3-10	1	283.6
	23JUL89	C	2	0-3	1	283.6
Crepidula fornicata	23JUL89	C	2	0-3	1	283.6
Cyclaspis varians	23JUL89	C	2	0-3	5	1418.0
Diopatra cuprea	23JUL89	C	2	0-3	2	567.2
Lyonsia hyalina floridana	23JUL89	C	2	0-3	1	283.6
Macoma mitchelli	23JUL89	C	2	0-3	1	283.6
Mediomastus californiensis	23JUL89	C	2	0-3	20	5672.0
Oxyurostylis salioni	23JUL89	C	2	0-3	2	567.2
Periploma margaritaceum (=inequale)	23JUL89	C	2	0-3	1	283.6
Pista palmata	23JUL89	C	2	0-3	5	1418.0
Rhynchocoels	23JUL89	C	2	0-3	2	567.2
Streblospio benedicti	23JUL89	C	2	0-3	3	850.8
Turbonilla sp.	23JUL89	C	2	0-3	1	283.6
Caecum johnsoni	23JUL89	C	2	3-10	1	283.6
Cyclaspis varians	23JUL89	C	2	3-10	1	283.6
Mediomastus californiensis	23JUL89	C	2	3-10	3	850.8
Spiochaetopterus costarum	23JUL89	C	2	3-10	1	283.6
Littoridina sphinctostoma	23JUL89	C	3	0-3	1	283.6
Mediomastus californiensis	23JUL89	C	3	0-3	30	8508.0
Nereidae	23JUL89	C	3	0-3	1	283.6
Oxyurostylis salioni	23JUL89	C	3	0-3	1	283.6
Pista palmata	23JUL89	C	3	0-3	7	1985.2
Podarke obscura	23JUL89	C	3	0-3	1	283.6
Rhynchocoels	23JUL89	C	3	0-3	1	283.6

NCMACSP.DAT Nueces-Corpus Estuary Macrofauna species data.

3 replicates (REP) were taken each time, N=n/section (SEC)
nm2=n/m^2. Sections in cm.

SPNAME	DATE	STA	REP	SEC	N	NM2
Diopatra cuprea	19OCT87	C	1	0-3	2	567.2
Mediomastus californiensis	19OCT87	C	1	0-3	4	1134.4
Streblospio benedicti	19OCT87	C	1	0-3	8	2268.8
Cossura delta	19OCT87	C	1	3-10	2	567.2
Glycinde solitaria	19OCT87	C	1	3-10	1	283.6
Gyptis vittata	19OCT87	C	1	3-10	3	850.8
Lumbrineris parvapedata	19OCT87	C	1	3-10	1	283.6
Mediomastus californiensis	19OCT87	C	1	3-10	7	1985.2
Oligochaeta	19OCT87	C	1	3-10	1	283.6
Paleanotus heteroseta	19OCT87	C	1	3-10	1	283.6
Periploma cf. orbiculare	19OCT87	C	1	3-10	1	283.6
Rhynchocoels	19OCT87	C	1	3-10	1	283.6
Sigambra tentaculata	19OCT87	C	1	3-10	1	283.6
Streblospio benedicti	19OCT87	C	1	3-10	1	283.6
Tharyx setigera	19OCT87	C	1	3-10	1	283.6
Glycinde solitaria	19OCT87	C	2	0-3	3	850.8
Leucon sp.	19OCT87	C	2	0-3	1	283.6
Mediomastus californiensis	19OCT87	C	2	0-3	13	3686.8
Paraprionospio pinnata	19OCT87	C	2	0-3	2	567.2
Streblospio benedicti	19OCT87	C	2	0-3	19	5388.4
Clymenella mucosa	19OCT87	C	2	3-10	1	283.6
Listriella barnardi	19OCT87	C	2	3-10	1	283.6
Mediomastus californiensis	19OCT87	C	2	3-10	4	1134.4
Paraprionospio pinnata	19OCT87	C	2	3-10	2	567.2
Rhynchocoels	19OCT87	C	2	3-10	1	283.6
Streblospio benedicti	19OCT87	C	2	3-10	1	283.6
Turbellaria	19OCT87	C	2	3-10	1	283.6
Glycinde solitaria	19OCT87	C	3	0-3	1	283.6
Leucon sp.	19OCT87	C	3	0-3	3	850.8
Mediomastus californiensis	19OCT87	C	3	0-3	11	3119.6
Megalops	19OCT87	C	3	0-3	1	283.6
Nuculana acuta	19OCT87	C	3	0-3	1	283.6
Streblospio benedicti	19OCT87	C	3	0-3	15	4254.0
Glycinde solitaria	19OCT87	C	3	3-10	1	283.6
Gyptis vittata	19OCT87	C	3	3-10	3	850.8
Lumbrineris parvapedata	19OCT87	C	3	3-10	1	283.6
Mediomastus californiensis	19OCT87	C	3	3-10	7	1985.2
Paleanotus heteroseta	19OCT87	C	3	3-10	3	850.8
Periploma cf. orbiculare	19OCT87	C	3	3-10	2	567.2
Rhynchocoels	19OCT87	C	3	3-10	1	283.6
Tharyx setigera	19OCT87	C	3	3-10	1	283.6
Streblospio benedicti	20OCT87	A	1	0-3	17	4821.2
Mediomastus californiensis	20OCT87	A	1	3-10	3	850.8
Mediomastus californiensis	20OCT87	A	2	0-3	1	283.6
Mulinia lateralis	20OCT87	A	2	0-3	1	283.6
Streblospio benedicti	20OCT87	A	2	0-3	11	3119.6
Mediomastus californiensis	20OCT87	A	2	3-10	5	1418.0
Streblospio benedicti	20OCT87	A	2	3-10	1	283.6
Mediomastus californiensis	20OCT87	A	3	0-3	1	283.6
Streblospio benedicti	20OCT87	A	3	0-3	8	2268.8
Mediomastus californiensis	20OCT87	A	3	3-10	1	283.6
Rhynchocoels	20OCT87	A	3	3-10	1	283.6
Streblospio benedicti	20OCT87	A	3	3-10	1	283.6
Mediomastus californiensis	21OCT87	B	1	0-3	1	283.6
Streblospio benedicti	21OCT87	B	1	0-3	1	283.6
Cossura delta	21OCT87	B	1	3-10	3	850.8

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Mediomastus californiensis        21OCT87   B    1   3-10    2     567.2
Paraprionospio pinnata            21OCT87   B    1   3-10    1     283.6
Rhynchocoels                      21OCT87   B    1   3-10    1     283.6
Glycinde solitaria                21OCT87   B    2   0-3     1     283.6
Mediomastus californiensis        21OCT87   B    2   0-3     1     283.6
Streblospio benedicti             21OCT87   B    2   0-3     4    1134.4
Mediomastus californiensis        21OCT87   B    2   3-10    4    1134.4
Glycinde solitaria                21OCT87   B    3   0-3     1     283.6
Mediomastus californiensis        21OCT87   B    3   0-3     1     283.6
Streblospio benedicti             21OCT87   B    3   0-3     4    1134.4
Cossura delta                     21OCT87   B    3   3-10    1     283.6
Glycinde solitaria                21OCT87   B    3   3-10    1     283.6
Mediomastus californiensis        21OCT87   B    3   3-10    2     567.2
Paraprionospio pinnata            21OCT87   B    3   3-10    1     283.6
Streblospio benedicti             21OCT87   B    3   3-10    1     283.6
Mediomastus californiensis        22OCT87   D    1   0-3    11    3119.6
Paraprionospio pinnata            22OCT87   D    1   0-3     1     283.6
Rhynchocoels                      22OCT87   D    1   0-3     2     567.2
Streblospio benedicti             22OCT87   D    1   0-3    12    3403.2
Cossura delta                     22OCT87   D    1   3-10    1     283.6
Mediomastus californiensis        22OCT87   D    1   3-10    4    1134.4
Paraprionospio pinnata            22OCT87   D    1   3-10    2     567.2
Rhynchocoels                      22OCT87   D    1   3-10    1     283.6
Mediomastus californiensis        22OCT87   D    2   0-3    20    5672.0
Minuspio cirrifera                22OCT87   D    2   0-3     1     283.6
Paraprionospio pinnata            22OCT87   D    2   0-3     1     283.6
Rhynchocoels                      22OCT87   D    2   0-3     1     283.6
Streblospio benedicti             22OCT87   D    2   0-3    13    3686.8
Mediomastus californiensis        22OCT87   D    2   3-10    2     567.2
Paraprionospio pinnata            22OCT87   D    2   3-10    2     567.2
Glycinde solitaria                22OCT87   D    3   0-3     1     283.6
Mediomastus californiensis        22OCT87   D    3   0-3    20    5672.0
Sabellidae                        22OCT87   D    3   0-3     1     283.6
Streblospio benedicti             22OCT87   D    3   0-3    11    3119.6
Mediomastus californiensis        22OCT87   D    3   3-10    1     283.6
Oligochaeta                       22OCT87   D    3   3-10    1     283.6
Paraonidae grp. A                 22OCT87   D    3   3-10    1     283.6
Spiochaetopterus costarum         22OCT87   D    3   3-10    1     283.6
Streblospio benedicti             22OCT87   D    3   3-10    1     283.6
Eudorella monodon                 07DEC87   C    1   0-3     2     567.2
Leucon sp.                        07DEC87   C    1   0-3     1     283.6
Mediomastus californiensis        07DEC87   C    1   0-3     4    1134.4
Mulinia lateralis                 07DEC87   C    1   0-3     1     283.6
Streblospio benedicti             07DEC87   C    1   0-3     1     283.6
Ampelisca sp. B (=amphipod A)     07DEC87   C    1   3-10    1     283.6
Clymenella mucosa                 07DEC87   C    1   3-10    1     283.6
Drilonereis magna                 07DEC87   C    1   3-10    1     283.6
Mediomastus californiensis        07DEC87   C    1   3-10    2     567.2
Paleanotus heteroseta             07DEC87   C    1   3-10    2     567.2
Paraprionospio pinnata            07DEC87   C    1   3-10    2     567.2
Periploma cf. orbiculare          07DEC87   C    1   3-10    1     283.6
Ampelisca abdita                  07DEC87   C    2   0-3     1     283.6
Glycinde solitaria                07DEC87   C    2   0-3     1     283.6
Gyptis vittata                    07DEC87   C    2   0-3     1     283.6
Leucon sp.                        07DEC87   C    2   0-3     2     567.2
Mediomastus californiensis        07DEC87   C    2   0-3    15    4254.0
Paraprionospio pinnata            07DEC87   C    2   0-3     4    1134.4
Streblospio benedicti             07DEC87   C    2   0-3     3     850.8
Tharyx setigera                   07DEC87   C    2   0-3     1     283.6
Cossura delta                     07DEC87   C    2   3-10    2     567.2
Drilonereis magna                 07DEC87   C    2   3-10    1     283.6
Glycinde solitaria                07DEC87   C    2   3-10    1     283.6
Gyptis vittata                    07DEC87   C    2   3-10    1     283.6
Mediomastus californiensis        07DEC87   C    2   3-10    1     283.6
Oligochaeta                       07DEC87   C    2   3-10    1     283.6
Paraprionospio pinnata            07DEC87   C    2   3-10    1     283.6
Periploma cf. orbiculare          07DEC87   C    2   3-10    1     283.6
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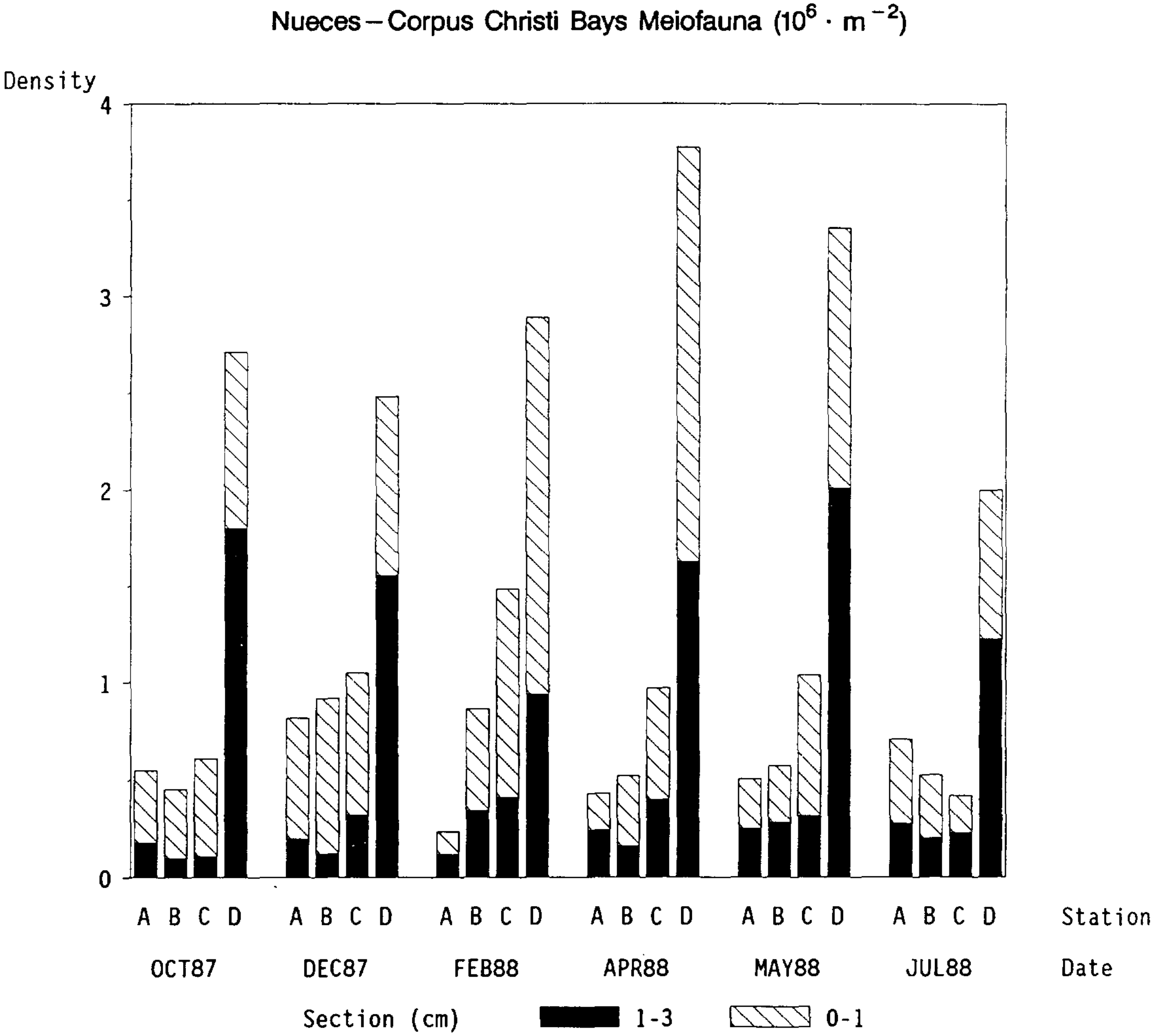

Figure 13. Vertical distribution of meiofaunal density (mean $\times 10^6 \cdot m^{-2}$) in Nueces and Corpus Christi Bays for each station and sampling period. Sediment cores were vertically sectioned at 0-1 cm and 1-3 cm intervals.

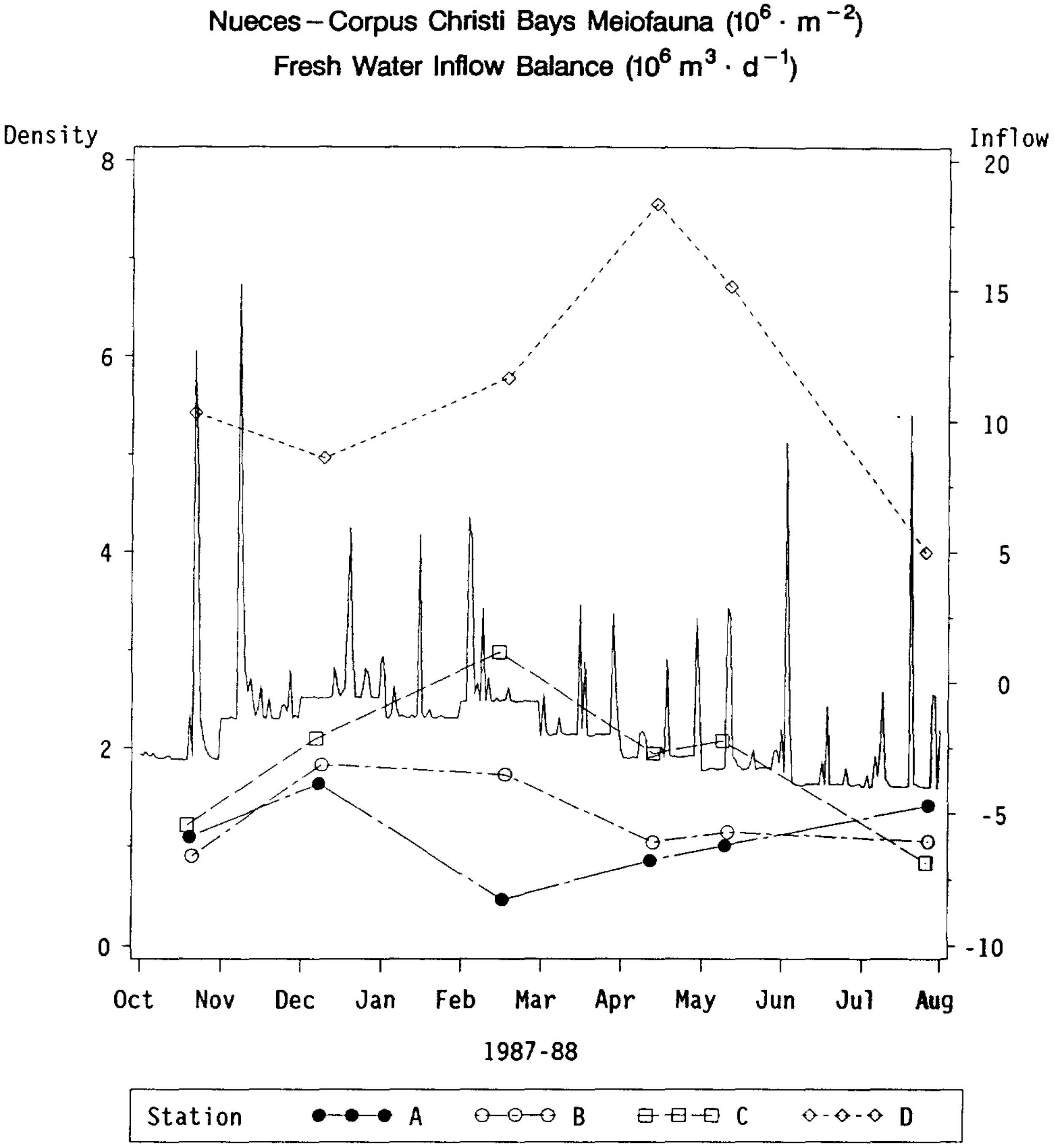

Figure 14. Meiofaunal density (mean ×$10^6 \cdot m^{-2}$ to a depth of 3 cm) and freshwater inflow balance in Nueces and Corpus Christi Bays. Daily inflow balance is for the entire Nueces Estuary system.

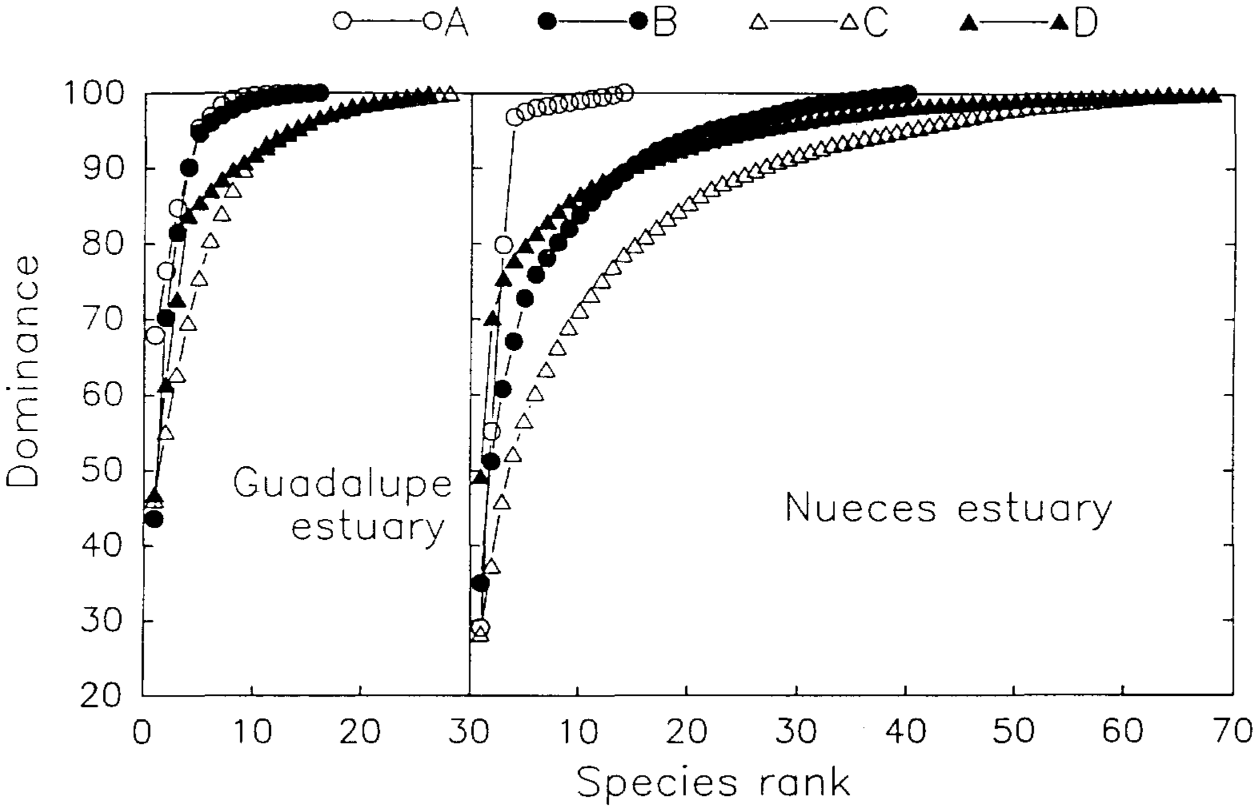

Figure 15. Species dominance curves for macrofaunal density in the Guadalupe and Nueces estuaries. Per cent dominance vs. species rank for all samples combined.

A Synoptic Comparison of Benthic Communities and Processes in the Guadalupe and Lavaca-Tres Palacios Estuaries, Texas

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ABSTRACT

Water use planning and management in Texas requires that we understand the effect of freshwater inflow on ecological processes which control and maintain productivity in our bays and estuaries. However, a large gap in our knowledge exists. We don't know if generalizations gathered in one estuary are applicable to another. This is not only true in Texas but in the nation as a whole. We in Texas are fortunate because, within short distances we have access to bays which are very different in the amount of freshwater input, and salinity. Thus, we have at our disposal a unique "natural experiment". That is, we can compare parameters across different systems synoptically. Two estuaries, the Guadalupe and the Lavaca-Tres Palacios, with similar historical inflow patterns were compared. Since the Guadalupe is smaller in area salinities are generally lower. Benthic processes lend themselves well to a comparative approach because: benthic communities are relatively sessile, reproductive events often have regular timing, sediments are sinks for many nutrients, and sediments are active sites of nutrient regeneration. Sediment oxygen uptake and nutrient regeneration are a good general measures of benthic community metabolism. The head of the Guadalupe Estuary generally had higher macrofaunal and bacterial densities and biomasses than the Lavaca Estuary. Macrofauna generally had a stimulatory effect of benthic metabolism. An important distinction between these two particular estuaries is that the Lavaca has direct exchange with the Gulf of Mexico, and the Guadalupe does not.

INTRODUCTION

The bays and estuaries of Texas are remarkably diverse. This is due in part to physiography, but differences in freshwater inflow play the largest role. A gradient of decreasing freshwater inflow, from north to south, is the most distinctive feature of our coastline. The inflow patterns appear to group into three distinct types which vary by about an order of magnitude each. Each type also has a distinctly different timing of peak inflow events. The northern estuaries receive peak inflow during the spring, the central estuaries are bimodal receiving peak inflows during the spring and fall, and the southern most estuaries receive peak inflows during the fall. These distinct patterns are very important, since growth, reproduction, and migration of many species is keyed to seasonal events. Current dogma dictates that estuarine productivity is based upon freshwater inundation and resulting nutrient enhancement. The timing and magnitude of inundation is believed to regulate finfish and shellfish production (Texas Department Water Resources (TDWR), 1982).

That Texas bays and estuaries differ in this key component of freshwater inflow provides us with a unique opportunity to perform "natural experiments". One could not hope to manipulate such environmental parameters such as salinity, or nutrient concentrations on large scales. But, within the same geographic location we have bays exposed to the same long-term climatic influences and geological history, yet different in precisely what makes an estuary an estuary: freshwater inflow.

When performing field experiments, the design must avoid confounding factors and pseudoreplication (*sensu* Hurlbert, 1984). Questions, such as: "what effect would increased inflow have on recruitment or productivity?", cannot be answered by short-term studies at a given site. Year-to-year variability is a confounding factor when comparing differences among bays sampled in different years. If only one "wet" year and one "dry" year are sampled then inflow is pseudoreplicated because of year-to-year variability, regardless of large differences in the amount of rainfall in each year. We can only separate differences due to effects freshwater inflow and salinity by comparing key processes synoptically among estuaries over several years.

Historical data indicates that finfish and shellfish harvest are inversely correlated; with harvest of more finfish in saltier estuaries, and more shellfish in fresher estuaries (Table 1; TDWR, 1982). However, our two-year study of Lavaca Bay benthos, indicated that increased biomass, particularly mollusk biomass, was correlated with increased salinity over time (Jones et al., 1986). The first year (1985) was "wet" with heavy freshwater inflow. The next year (1986) was "dry", inflow decreased by 300%, but biomass increased by 300%. Regardless of the difference in rainfall between years, we cannot conclude that there is higher benthic production in dry years than in wet years, because we don't know anything about year-to-year variability, and the bays were sampled during different time frames. In this study, benthic biomass might have increased in the second year anyway. This is a good example of pseudoreplication. The main effect, which is annual variation in precipitation, was only sampled once (i.e., one dry, and one wet year). So far, we can only hypothesize (based on the data) that: if there are high rates of freshwater inflow during periods of recruitment (the spring), then that will result in less benthic productivity (lower benthic standing stocks in the summer).

Another measure of secondary benthic production is metabolism. Oxygen uptake at the sediment surface is a good overall indicator of total benthic metabolism and carbon flow (Patching and Raine, 1983; Howes et al., 1984). Thus the hypothesis, that high rates of freshwater inflow during periods of recruitment (the spring) will result in less benthic productivity, can be tested using two indicators of productivity (changes in biomass and oxygen consumption).

Two estuarine systems were studied (Table 1). They receive similar amounts of freshwater inflow, but because the surface area of the Guadalupe is smaller it has lower salinity regimes. Previous intensive surveys in San Antonio and Lavaca Bays indicate that there are two zoogeographic zones in Lavaca and San Antonio Bays (our own unpublished data; Gilmore et al., 1976; Harper, 1973; Mackin, 1971; Matthews et al., 1983). One zone (in the upper reaches of the bays) is characterized by brackish water species such as the mollusks *Mulinia lateralis*, and *Littoridina sphinctosoma*. The second zone (more seaward) is characterized by marine species, predominantly polychaetes. Therefore, only four stations are required to characterize each bay. Two stations must be located in each of the two zones to avoid pseudoreplication of the effect of freshwater influence. Thus, there will be two stations at the head of the system to represent high impact of freshwater inflow, and two at the seaward end of the system to represent little or no freshwater impact.

Previous intensive surveys in San Antonio and Lavaca Bays indicate peak benthic abundances in the spring, sharp decreases in late summer, and lows in winter (our own unpublished data; Gilmore et al., 1976; Harper, 1973; Mackin, 1971; Matthews et al., 1983). These studies indicate that it is necessary to have at least three sampling periods per year. We sampled peak abundance periods in April, declining abundance periods in July, and the low abundance periods in November.

MATERIALS AND METHODS

Study design. In order to distinguish between freshwater influence and marine influence four stations were always chosen. Two stations which replicate each of the two treatment effects (freshwater and marine). Generally these stations were along the major axis of the estuarine system leading from river mouth to the foot of the estuary near the barrier islands. This design avoids pseudoreplication, where only one station has the characteristic of the main effect, and it is not possible to distinguish between station differences and treatment differences.

Two riverine systems were studied in detail (Figure 1). The Guadalupe and San Antonio Rivers empty into San Antonio Bay. Four stations were occupied: a freshwater station at the head of the Bay (station A) and at mid-bay (station B), and two saltwater influenced stations near the Intracoastal Waterway, one at the southwestern foot of the bay (station C) and one at the southeastern foot of the bay (station D).

The Lavaca River empties into Lavaca Bay, which is connected to Matagorda Bay. Matagorda Bay also has freshwater input from the Tres Palacios River. Four Stations were occupied along the axis of the system. Two stations were in Lavaca Bay (A and B), and two stations were in Matagorda Bay (C and D) (Figure 1). Five field trips were performed. Station A in Lavaca Bay was the same station 85 sampled in 1984-1986 (Jones et al., 1986).

Sampling and analyses. Sediment was sampled with core tubes by divers. The macrofauna was sampled with a tube 6.7 cm in diameter, and subsampled at depth intervals of 0-3 cm and 3-10 cm deep. The meiofauna was sampled with a tube 1.8 cm in diameter, and subsampled at depth intervals of 0-1 cm and 1-3 cm. Samples were preserved with 5% buffered formalin, sorted (on 63 μm sieves for meiofauna, and 0.5 mm sieves for macrofauna), identified, and counted. Biomass of macrofauna was also measured. Mollusk shells are removed and placed in 1 N HCl for 1 min to 8 h to dissolve the carbonate shells by the acidic vaporization technique (Hedges and Stern, 1984). Samples are then washed, and dried at 55 °C for 24 hours before being weighed. Dry weight biomass was converted to carbon (C) biomass by using a conversion factor (40% dry weight is C) derived for San Antonio Bay macrofauna (Montagna and Kalke, 1989).

Measurement of bacterial biomass. One cm^3 samples for bacterial enumeration were taken with soda straws. Samples were preserved in 4% buffered formalin that had been filtered through a 0.2 mm filter and refrigerated until processing. Bacterial cell counts were measured using the acridine orange direct count (AODC) technique (Daley and Hobbie, 1975) as modified by Montagna (1982). Direct count techniques, which use light microscopy, can lead to systematic errors in estimating bacterial abundance (Brock, 1984). However, they are also the easiest techniques to use that measure only bacterial-sized organisms and will yield relative results which will allow for station comparison (Montagna, 1982). Photographs of bacteria were used to estimate cell biovolumes (Fuhrman, 1981). Biovolumes were converted to biomass assuming 3.8×10^{-13} g C$\cdot\mu m^{-3}$ cell volume (Lee and Fuhrman, 1987). Estimates and variances of bacterial biomass were calculated by formulas given in Montagna (1984).

Chemical measurements. Oxygen concentration changes were measured using electrodes. Four cores were outfitted with pulsed oxygen electrodes (Endeco, Inc., Marion, MA). These electrodes are of a new design in which the measurement of oxygen concentration is flow-insensitive (Langdon, 1984). The four electrodes are then connected to a Pulsed D.O. Sensor (T.M.) which controls the timing of the electrical pulses sent to each probe. These pulses are the sampling times. Data is interpreted by the Pulsed D.O. Sensor and logged automatically on a portable computer. In this way oxygen concentrations can be monitored continuously in four cores. Three sediment samples, and one bottom water control are incubated in each sample run. The samples were incubated in the dark at *in situ* temperatures in a water bath. By measuring the changes in oxygen concentration over time, and adjusting for the area of sediment covered by the core and the volume of water contained in the core, the rates of benthic respiration were calculated. The flux rate in the bottom water is subtracted from the flux in the sediment core, therefore the fluxes are for sediment only. Carbon flux is estimated from the oxygen uptake data assuming a respiration quotient of 1.0 (Nixon et al., 1980).

Subsamples were taken from the overlying water in the sediment core tube at the beginning and end of the incubation period. From the water subsamples, the concentrations of ammonia, nitrate, nitrite, phosphate and silicate in fresh samples using highly precise techniques (Whitledge et al., 1986). Flux of nutrients were calculated in the same manner as for oxygen flux.

RESULTS

Physical factors. Freshwater inflow balance was very similar in both bays during the study (Figure 2). Unfortunately, data for the entire study period is not yet available. Temperature in both estuaries was very similar (Figure 3). The average temperature in the Guadalupe (24.3 °C) was not statistically different from that in the Lavaca (23.8 °C). The Guadalupe was slightly fresher during the study (Figure 4). The overall mean in the Guadalupe was 22.0 ppt, and the overall mean was 28.8 ppt in the Lavaca estuary. These were different (P=0.0001). The freshest was stations A and B in San Antonio Bays at the head of the estuary. Stations C and D in San Antonio Bay were similar to all station in the Lavaca-Matagorda system. (Figure 4).

Microbial and meiofaunal factors. Bacterial biomass for the bays sampled in April 1988 is shown in Table 2. Bacterial samples were also taken in Nueces Bay (Montagna and Kalke, 1989). Bacterial density was significantly less in Lavaca Bay than in Corpus-Nueces and San Antonio Bays which were the same. However, cell biovolumes were larger in Corpus-Nueces Bays compared to Lavaca and San Antonio. The net result was that there was a gradient in bacterial biomass (a function of cell abundance volume) where San Antonio Bay was much greater in Nueces-Corpus Bay, which was much greater than Lavaca Bay.

Meiofauna was only sampled three times in 1987 in the Guadalupe (Montagna and Yoon, 1989). At A and B densities stayed relatively low ($0.251\times10^6\cdot m^{-2}$) and did not change over time. Nor were the densities at A and B significantly different from each other (Tukey multiple comparison test). In contrast, densities decreased over time at stations C and D and were on average about double that of the fresh stations ($0.512\times10^6\cdot m^{-2}$). Station C ($1.361\times10^6\cdot m^{-2}$) was always slightly more dense than station D ($0.887\times10^6\cdot m^{-2}$) (Tukey multiple comparison test). Taxa composition of the meiofauna was similar to other marine environments at the stations C and D, but depauperate in nematodes at stations A and B (Table 3). The meiofauna densities covaried with salinity differences (Montagna and Yoon, 1989). Staying low at A and B when salinity was low, and decreasing at C and D as salinity decreased. Meiofauna densities were originally four times greater in marine stations than freshwater stations when salinity was high, but densities at C and D went down to the level of A and B when salinities became similar and fresh.

In Lavaca the meiofaunal density was highest at station D ($7.30\times10^6\cdot m^{-2}$), but the other three stations were not significantly different (Tukey test). Density at station A was $4.53\times10^6\cdot m^{-2}$, at station B $4.69\times10^6\cdot m^{-2}$, and at station C $3.63\times10^6\cdot m^{-2}$. Community composition was dominated by nematodes at all stations (Table 3).

Macrofauna. Densities were significantly higher in the Guadalupe ($47{,}200 \cdot m^{-2}$) than in the Lavaca ($22{,}600 \cdot m^{-2}$) (Figure 5). Densities peaked in the spring and dropped in summer and fall.

In the Guadalupe, densities were three times higher at the freshwater stations ($71.2\times10^3\cdot m^{-2}$) than at the marine stations ($23.9\times10^3\cdot m^{-2}$). The average densities at stations A was $61.0\times10^3\cdot m^{-2}$, at B $81.5\times10^3\cdot m^{-2}$, at C $28.1\times10^3\cdot m^{-2}$, and at D $19.7\times10^3\cdot m^{-2}$. However, densities were uniformly greater in 1988 than in 1989 at all stations in the Guadalupe, when salinities were lowerer. Biomass followed the same trends (Figure 6). Average biomass at station A was $11.13\ g\cdot m^{-2}$, at B $14.78\ g\cdot m^{-2}$, at C $2.62\ g\cdot m^{-2}$, and at D $3.01\ g\cdot m^{-2}$. The biomass in the freshwater stations was 4.6 times higher than in the marine stations (Figure 6).

In the Lavaca-Tres Palacios Estuary the macrofaunal density was highest at station D, but was not significantly different from the other stations (Figure 5). The average density at station A was $16.2\times10^3\cdot m^{-2}$, at station B $12.4\times10^3\cdot m^{-2}$, at station C $15.5\times10^3\cdot m^{-2}$, and at station D $49.6\times10^3\cdot m^{-2}$. Biomass showed the same trend (Figure 6); the average at was 5.07 $g\cdot m^{-2}$ at station A, 2.67 $g\cdot m^{-2}$ at station B, 6.60 $g\cdot m^{-2}$ at station C, and 13.67 $g\cdot m^{-2}$ at station D.

Nueces and Corpus Christi Bays were sampled in conjunction with Lavaca Bay only in April and July 1988. Four stations were sampled: A and B in Lavaca Bay an upper enclosed secondary bay in close proximity to freshwater inflow from the Lavaca River and C and D in Matagorda Bay, an open primary bay. Freshwater inflow during this sampling period was low. The mean salinities at stations A, B, C and D were 26.7, 28.4, 30.2 and 30.4 ppt, respectively (Table 4). The Guadalupe was thus sampled during a wet-dry cycle (Table 5). There was an increase in species number and diversity during the dryer part of the cycle (Table 6). The general trend is for species numbers, abundance and biomass is to increase from upper Lavaca Bay to lower Matagorda Bay (Table 7). This gradient is not as pronounced as that found in Nueces-Corpus Christi Bay (Table 7). The species composition in Lavaca and Matagorda Bays is similar to the Nueces-Corpus Christi Bay system but the mean numerical abundance is higher than those found in Nueces and Corpus Christi Bays. The polychaetes *Mediomastus californiensis*, *Streblospio benedicti* and *Glycinde solitaria*, the amphipod *Ampelisca abdita*, and the mollusk *Mulinia lateralis* comprise 82% of the total abundance at station A and 18% of the total abundance at station D. Dominant species in the lower primary bay were the polychaetes, *Mediomastus californiensis*, *Polydora caulleryi*, *Brania clavata*, *Gyptis vittata*, *Glycinde solitaria*, *Tharyx setigera*, *Drilonereis magna* and *Minuspio cirrifera;* the tanaidacean *Apseudes* sp A., the mollusks *Corbula contracta* and *Periploma cf. orbiculare*, a hemichordate, *Schizocardium* sp., and rhyncocoels. The mollusk biomass was highest at stations A (57%) and B (40%) decreasing at stations C (1%) and D (17%). Polychaetes accounted for approximately 50% of the biomass at all stations. At station B the hemichordate, *Schizocardium* sp. made up 42% of the biomass. This species was dominant in biomass in Corpus Christi Bay in 1981-1984 (Flint and Kalke, 1986a; 1986b). The ophuiroid, *Amphiodia limbata* occurred in Matagorda Bay accounted for 20 percent of the biomass at station D. Crustaceans contributed a notable percent of the biomass in the secondary and primary bay. *Ampelisca abdita* was most abundant at stations A and B, *Pinnixa chacei* was found at stations C and D and *Apseudes* sp A was dominant at station D (Montagna & Kalke, 1989).

Effect of macrofaunal biomass on oxygen and nutrient flux. There was a positive relationship between macrofaunal biomass and sediment oxygen consumption (Figure 7) (P=0.0007). There was one outlier, but when it is removed the relationship is still significant (P=0.0139). The intercept of the curve implies that when macrofauna are not present, bacteria and meiofauna are responsible for oxygen consumption at a rate of 8.73 mg C $\cdot$ m^{-2} $\cdot$ h^{-1}. The slope of the curve represents a C turnover time of 0.00101 h^{-1}, which is equivalent to 41 days. This number includes chemical as well as biological oxygen demand. Replicates had a tendency to cluster together (Figure 7). Summer generally had low biomasses, but uptake in the freshwater zones of the Lavaca were high reflecting temperature effects. Ironically temperature had an inverse correlation with oxygen consumption, because biomass was inversely correlated with temperature (Table 9).

Ammonia flux was not related to macrofauna biomass (Figure 8). Ammonia was correlated to silicate (P=0.0102) and nitrate (P=0.0377) flux. There were differences in ammonia flux between stations (P=0.0010), but not bays (P=0.6788). Replicates had a tendency to clump together. There was net uptake of ammonia at stations A in Lavaca, and C in the Guadalupe. There was release at stations A and D in the Guadalupe. The overall average was -1.06 mmol $\cdot$ m^{-2} $\cdot$ h^{-1}.

Nitrite regeneration was strong correlated with biomass (Figure 9). There was generally release in the uptake in the marine stations, and release in the freshwater stations. The overall average nitrite flux was -0.114 mmol $\cdot$ m^{-2} $\cdot$ h^{-1}. In contrast, Nitrate was negatively correlated with biomass, but this was not significant (Figure 10). The overall average nitrate flux was 0.134 mmol $\cdot$ m^{-2} $\cdot$ h^{-1}. Phosphate was not correlated with biomass either (Figure 11). The overall average phosphate flux was -0.582 mmol $\cdot$ m^{-2} $\cdot$ h^{-1}. Phosphate flux was positively correlated with salinity (Table 9) and nitrate flux (P=0.0001). Silicate release had a weak correlation with increasing macrofaunal biomass

(Figure 12). The overall average silicate flux was -12.0 mmol • m^{-2} • h^{-1}.

DISCUSSION

Prior to this study, in the spring of 1987, there was a very large inflow event. Salinities in the Guadalupe were down to 1 ppt in most parts of the estuary by July 1987 (Montagna and Kalke, 1989). This had a depressing effect on macrofauna densities. By the summer of 1988, and through 1989 there was a drought period, where rainfall was about 40% less than historical averages. The densities in the first dry year (1988) were almost double that of the wet (1987) year. But after two years of drought and rising salinities, densities fell back to levels comparable to the wet year. This implies that the pulse of nutrients brought into the bay has a stimulatory effect on benthic productivity during the first year of an inflow event. These nutrients are depleted if inflow decreases dramatically, as it does during a drought, and might limit productivity. Another implication of this result is that the freshwater inflow has a larger effect on smaller area bays, like San Antonio Bay, than on other bays. There is something about the stations at the head of San Antonio Bay (A and B) which yields higher macrofaunal abundances. In Nueces - Corpus Christi Bays the trend is the opposite. Higher densities were found in saline stations (Montagna and Kalke, 1989). However, when salinity increased during the summer, densities generally decreased. Lavaca Bay exhibited the same trends.

The higher productivity in San Antonio bay is evident since there is also higher bacterial biomass in there than in the more saline Nueces, and Lavaca systems. This is not reflected in oxygen consumption. The overall average oxygen flux (in carbon equivalents) for the Guadalupe is 9.24 mg C • m^{-2} • h^{-1}, whereas it is 13.7 mg C • m^{-2} • h^{-1} in the Lavaca Estuary. This is in spite of the lower density and biomass of bacteria and macrofauna in the Lavaca Estuary.

A confounding factor in the comparison of the Guadalupe and the Lavaca is influence from the Gulf of Mexico. The Lavaca is an open system with exchange through Pass Cavallo and a ship channel, whereas the Guadalupe is a closed system. The largest effect of Gulf influence is on community structure, especially in Matagorda Bay where oceanic species are found. These species can be numerous, large sized, and apparently can stimulate productivity (i.e., oxygen uptake).

Macrofauna have a stimulatory effect on the uptake of oxygen, nitrite, and silicate. The lack of a correlation with ammonia could be due to uptake by the sediment and release by macrofauna being counterbalanced.

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Table 1. Average annual freshwater inflow (for the period 1941-1976; Texas Department of Water Resources, 1982) and average annual harvest in Texas estuaries (for the period 1962-1987; Texas Parks and Wildlife Department, 1988). Commercial netting for redfish and trout was banned in 1981. In 1988 all gill-netting was banned.

			Harvest	
Estuary	Area[1]	Inflow[2]	Finfish[3]	Shellfish[3]
Lavaca-Tres Palacios	910	2,628	220	4,576
Guadalupe	579	2,063	177	3,406

[1] Mean tide (km^2)

[2] Net inflow includes gaged and ungaged inflows, diversions and return flow, and precipitation and evaporation (in thousands of acre-feet).

[3] Average annual commercial harvest during 1962-1976 (in thousands of pounds).

Table 2. Bacterial biomass parameters from three Texas bays (samples taken April 1988). Cell numbers and volume are Log_{10} transformed. Bacterial biomass is calculated by adding the log of numbers plus the log of volume then detransformed and multiplied by the conversion factor given in Lee and Fuhrman (1987).

Bay	Station	Cells $Log(n) \cdot cm^{-3}$	Volume $Log(\mu m^3)$	Biomass $\mu g\ C \cdot cm^{-3}$
Corpus-Nueces	A	8.04428	-1.40944	1.63919
Corpus-Nueces	B	7.68682	-1.43272	0.68216
Corpus-Nueces	C	8.21550	-1.58435	1.62530
Corpus-Nueces	D	7.71671	-1.84129	0.28524
Lavaca	A	5.88186	-2.26226	0.00158
Lavaca	B	6.51046	-1.54446	0.03514
Lavaca	C	7.23300	-1.74345	0.11731
Lavaca	D	7.63457	-2.48952	0.05307
San Antonio	A	8.31421	-1.69123	1.59503
San Antonio	B	8.69570	-1.71729	3.61574
San Antonio	C	8.60585	-1.88824	1.98330
San Antonio	D	8.95520	-1.86361	4.69222

Table 3. Average percentage composition of meiofauna taxa.

	San Antonio Bay				Lavaca-Matagorda			
Taxa	A	B	C	D	A	B	C	D
Nematoda	31.9	38.4	67.9	56.2	82.2	77.3	55.9	78.4
Copepoda	15.2	30.4	22.7	19.6	7.0	14.2	13.2	9.4
Others	52.9	31.2	9.4	24.2	10.8	8.5	30.9	12.2

Table 4. Comparison of macrofaunal abundance and salinity in three estuaries. Mean total abundance ($n \cdot m^{-2}$), and mean salinities (ppt) at freshwater zone stations (A and B) and marine zone stations (C and D) over time in San Antonio, Nueces, Corpus Christi, Lavaca, and Matagorda Bays. Nueces Estuary data from Montagna and Kalke (1989).

		Stations			
Bay and Dates	Parameters	A	B	C	D
San Antonio Bay	Abundance	41,217	18,887	9,189	7,544
Jan - Jul 1987	Salinity	0.5	2.4	5.6	8.1
San Antonio Bay	Abundance	69,695	80,637	30,676	20,514
Apr 1988 - Apr 1989	Salinity	13.3	19.4	26.0	28.4
Nueces-Corpus Christi Bays	Abundance	6,397	8,555	10,714	30,629
Oct 1987 - Jul 1988	Salinity	31.2	32.7	32.5	34.2
Lavaca-Matagorda Bays	Abundance	18,340	12,478	18,244	49,536
Apr 1988 - Apr 1989	Salinity	26.7	28.4	30.2	30.4

Table 5. Change in biomass and salinities between and wet and dry cycle in the Guadalupe Estuary, Texas. Average salinities (ppt) and average biomass (g · m^{-2} to a depth of 10 cm for the entire community) at freshwater stations (A and B) and marine stations (C and D) over time in San Antonio Bay. Also presented is the percent of the total biomass represented by the two dominant taxa (mollusks and polychaetes).

		Stations			
Date	Parameters	A	B	C	D
Jan - Jul 1987	Salinity	0.5	2.4	5.6	8.1
	Biomass	7.2	4.8	3.2	3.5
	Mollusks	89%	80%	73%	68%
	Polychaetes	11%	16%	25%	29%
	TOTAL	99%	96%	98%	97%
Apr 1988 - Apr 1989	Salinity	13.3	19.4	26.0	28.4
	Biomass	12.7	14.8	2.6	3.0
	Mollusks	61%	75%	31%	17%
	Polychaetes	35%	23%	62%	78%
	TOTAL	96%	98%	93%	95%

Table 6. Species dominance and diversity in the Guadalupe Estuary in a wet and dry cycle. Dominant species are listed with the average total abundance for the species list (percent composition of total). The overall species number, and mean salinities (ppt) at freshwater stations (A and B) and marine stations (C and D) over time in San Antonio Bay (1987 data from Montagna and Kalke, 1989).

Dates and Dominant Species	Parameters	Stations A	B	C	D
Jan - Jul 1987					
Littoridina sphinctostoma	Salinity	0.5	2.4	5.6	8.1
Mediomastus californiensis	Abundance	97%	96%	72%	84%
Mulinia lateralis	Species	14	16	28	26
Streblospio benedicti					
Macoma mitchelli					
Apr 1988 - Apr 1989					
Streblospio benedicti	Salinity	13.3	19.4	26.0	28.4
Mediomastus californiensis	Abundance	94%	96%	89%	74%
Mulinia lateralis	Species	28	26	24	48
Littoridina sphinctostom					
Gastropod (*Littoridina*? juv)					

Table 7. Species dominance and diversity in the Nueces and Lavaca-Tres Palacios Estuaries. Dominant species are listed with the average total abundance for the species list (percent composition of total). The overall species number, and mean salinities (ppt) at freshwater stations (A and B) and marine stations (C and D) over time in Nueces, Corpus Christi, Lavaca, and Matagorda Bays. (Nueces data from Montagna and Kalke, 1989).

Bays, Dates and Dominant Species	Parameters	Stations A	B	C	D
Nueces-Corpus Christi Oct 1987 - Jul 1988					
Streblospio benedicti	Salinity	31.2	32.7	32.5	34.2
Mediomastus californiensis	Abundance	97%	63%	38%	24%
Mulinia lateralis	Species	14	40	64	68
Macoma mitchelli					
Lavaca-Matagorda Apr 1988 - Apr 1989					
Mediomastus californiensis	Salinity	26.7	28.4	30.2	30.4
Ampelisca abdita	Abundance	82%	77%	40%	18%
Mulinia lateralis	Species	41	34	52	69
Streblospio benedicti					
Glycinde solitaria					

Table 8. Difference in biomass and salinities between two open estuaries. Average salinities (ppt) and average biomass ($g \cdot m^{-2}$ to a depth of 10 cm for the entire community) at freshwater stations (A and B) and marine stations (C and D) over time in Nueces, Corpus Christi, Lavaca, and Matagorda Bays. Also presented is the percent of the total biomass represented by the two dominant taxa (mollusks and polychaetes). (Nueces data from Montagna and Kalke, 1989).

		Stations			
Bays and Dates	Parameters	A	B	C	D
Nueces-Corpus Christi	Salinity	31.2	32.7	32.5	34.2
Oct 1987 - Jul 1988	Biomass	2.3	6.3	5.5	5.5
	Mollusks	85%	41%	30%	6%
	Polychaetes	14%	58%	56%	81%
	TOTAL	99%	99%	86%	87%
Lavaca-Matagorda	Salinity	26.7	28.4	30.2	30.4
Apr 1988 - Apr 1989	Biomass	5.4	2.7	8.0	13.7
	Mollusks	57%	40%	1%	17%
	Polychaetes	40%	52%	48%	45%
	Crustacea	2%	7%	6%	13%
	Hemichordata			42%	1%
	Ophiuroids	____	____	1%	20%
	TOTAL	99%	99%	98%	96%

Table 9. Correlation coefficients for physical, chemical and biological factors in both estuaries. Pearson correlation coefficients, the probability that *r*=0, and number of Observations. Abbreviations: SAL = salinity, TEMP = temperature, O2FLUX = oxygen consumption, GCM2 = macrofaunal biomass, PO4 = phosphate, SIO4 = silicate, NO3 = nitrate, NO2 = nitrite, NH4 = ammonia,

	SAL	TEMP	O2FLUX	GCM2
TEMP	0.16231	1.00000	-0.30732	-0.38272
	0.2704	0.0	0.0336	0.0073
	48	48	48	48
O2FLUX	-0.22912	-0.30732	1.00000	0.47339
	0.1172	0.0336	0.0	0.0007
	48	48	48	48
GCM2	-0.15959	-0.38272	0.47339	1.00000
	0.2786	0.0073	0.0007	0.0
	48	48	48	48
PO4	0.70747	-0.07676	-0.21012	0.07034
	0.0001	0.7215	0.3244	0.7440
	24	24	24	24
SIO4	-0.07787	0.11490	0.28493	0.43527
	0.7176	0.5929	0.1772	0.0335
	24	24	24	24
NO3	0.43143	0.23788	-0.32456	-0.11923
	0.0353	0.2630	0.1218	0.5790
	24	24	24	24
NO2	-0.03213	-0.13574	0.20699	0.69571
	0.8815	0.5271	0.3318	0.0002
	24	24	24	24
NH4	-0.21683	0.21207	-0.02812	0.21672
	0.3088	0.3198	0.8962	0.3091
	24	24	24	24

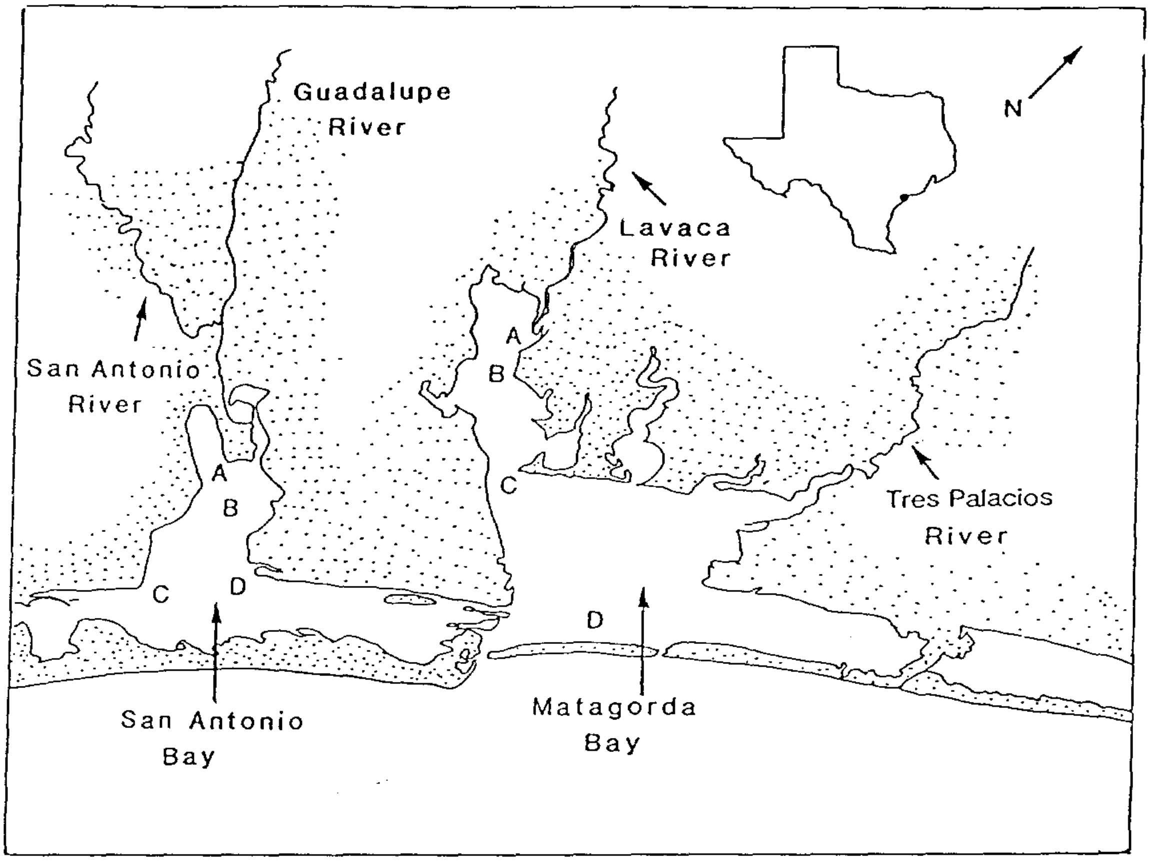


Figure 1. Study area. Four stations were studied in two estuaries. San Antonio Bay is in the Guadalupe Estuary, and Lavaca and Matagorda Bays are in the Lavaca-Tres Palacios Estuary.

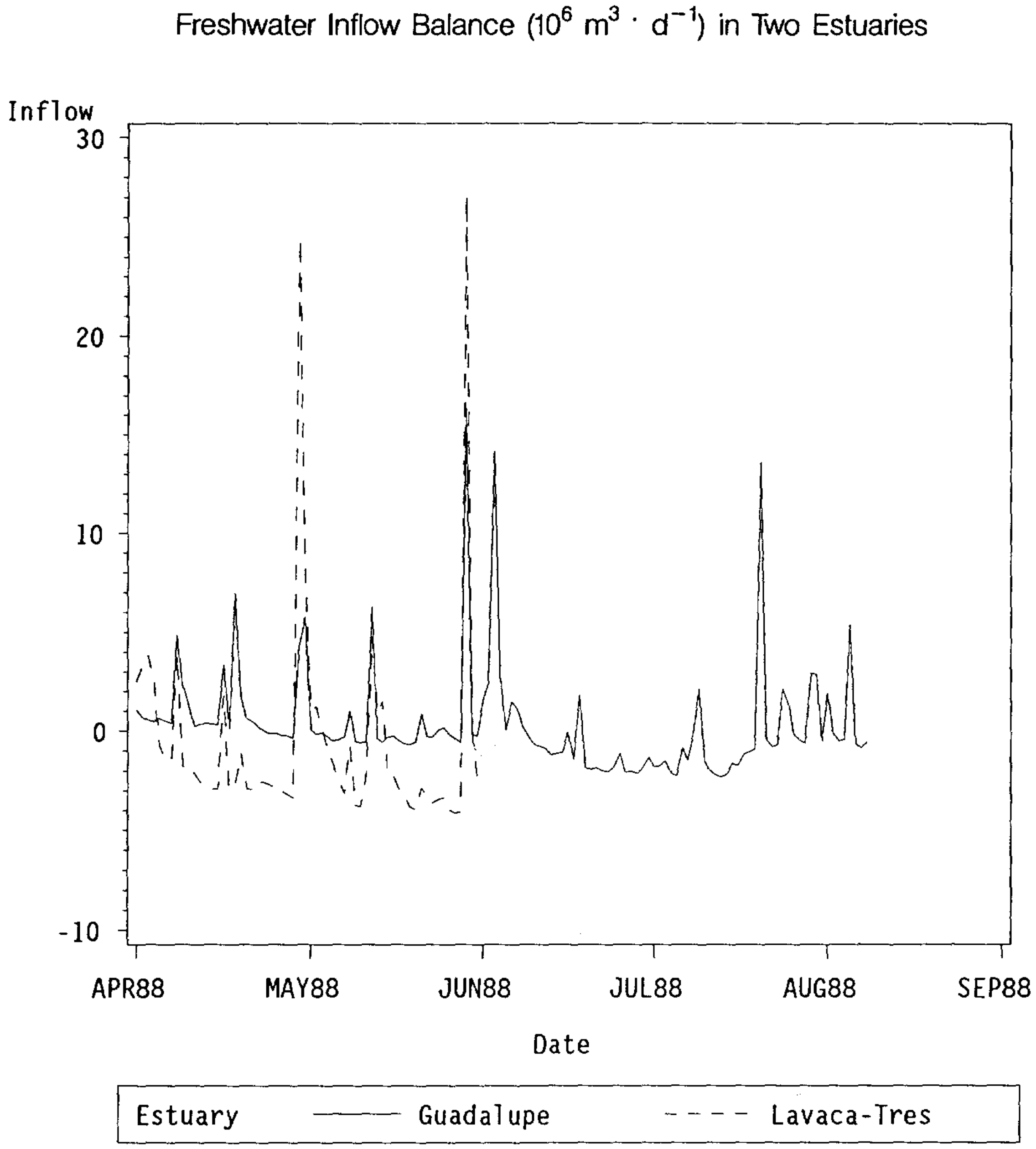


Figure 2. Freshwater inflow balance (gain minus losses) in two estuaries during the study period.

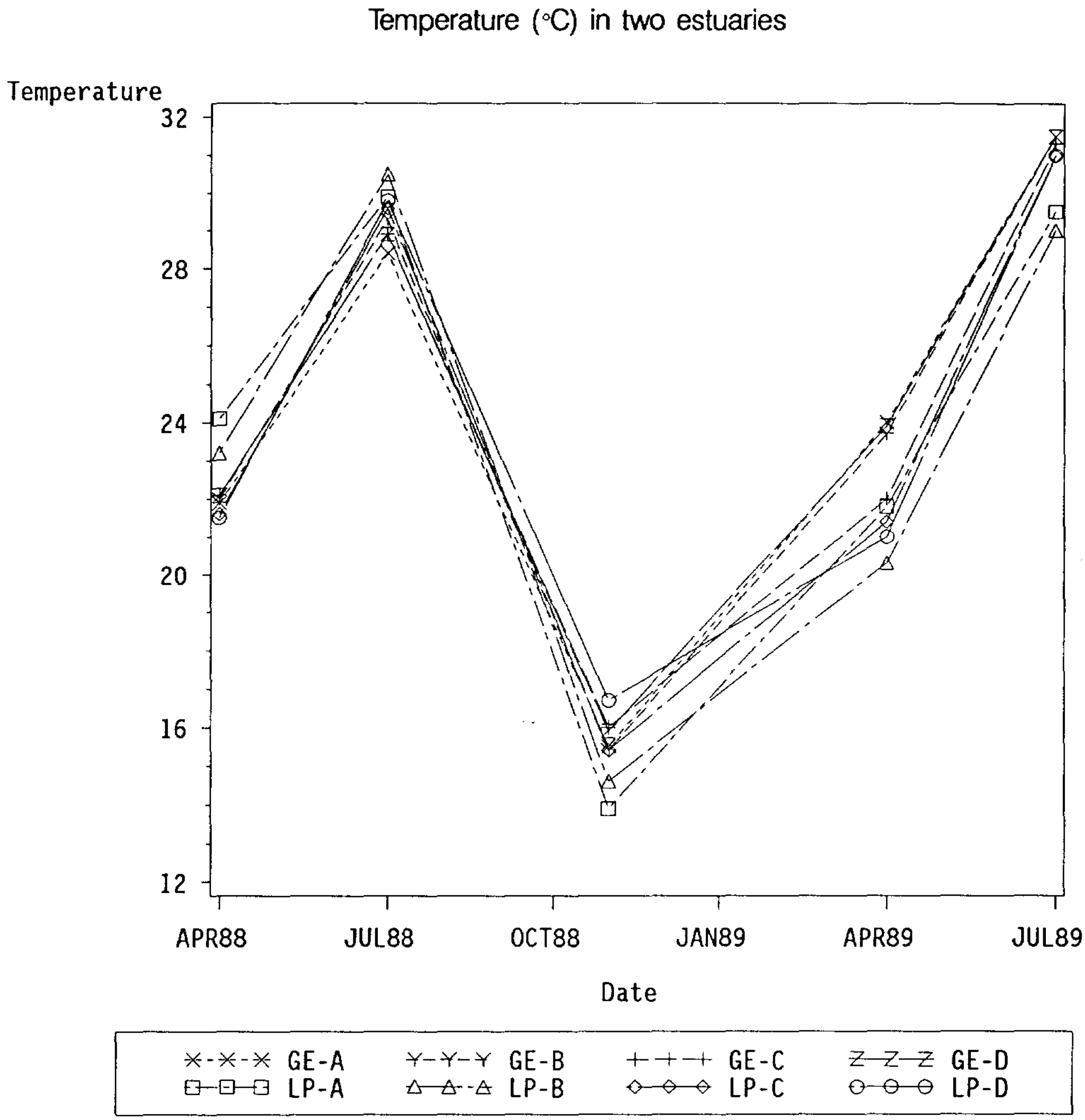


Figure 3. Temperature in the two estuaries during the study period.

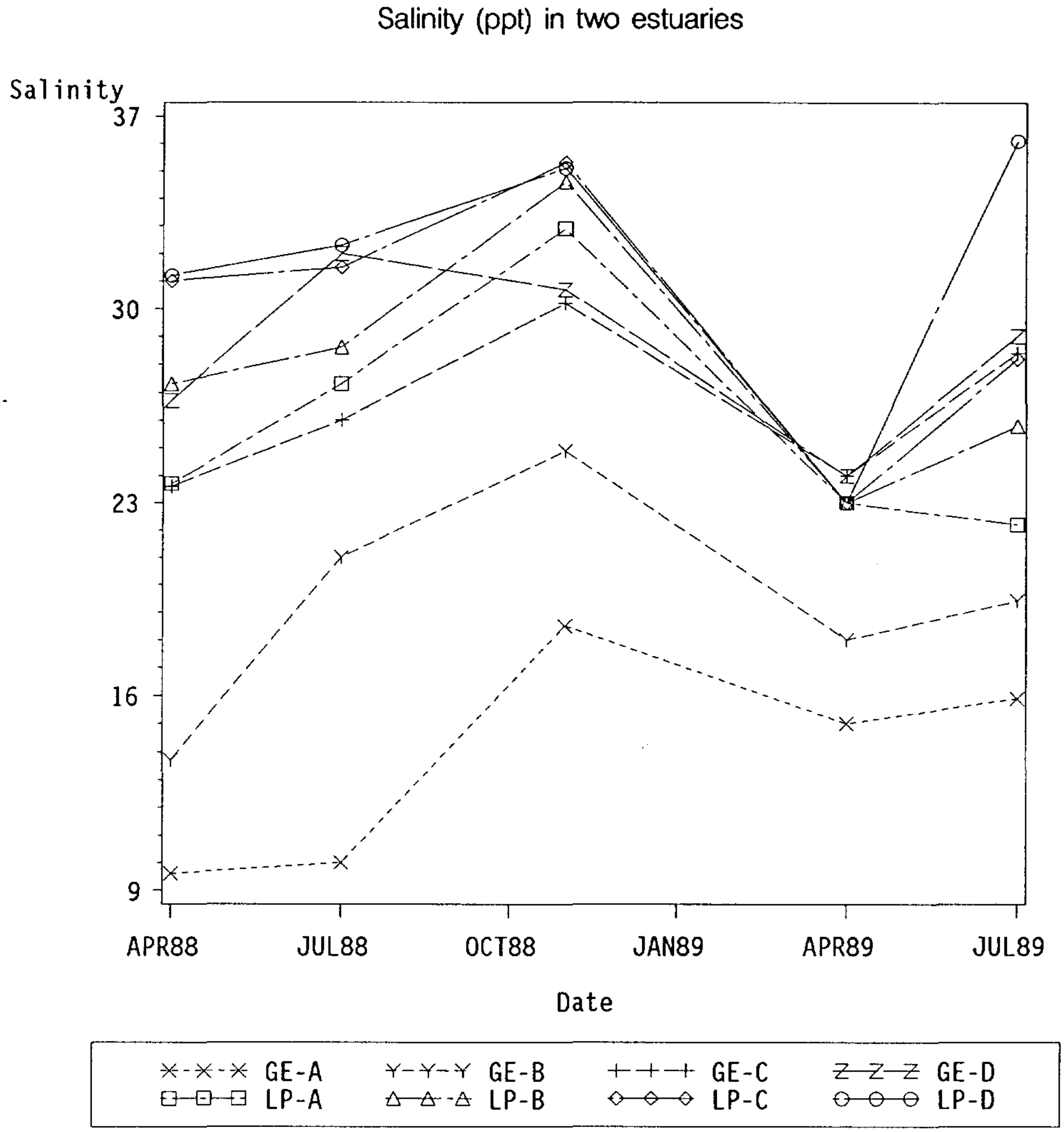
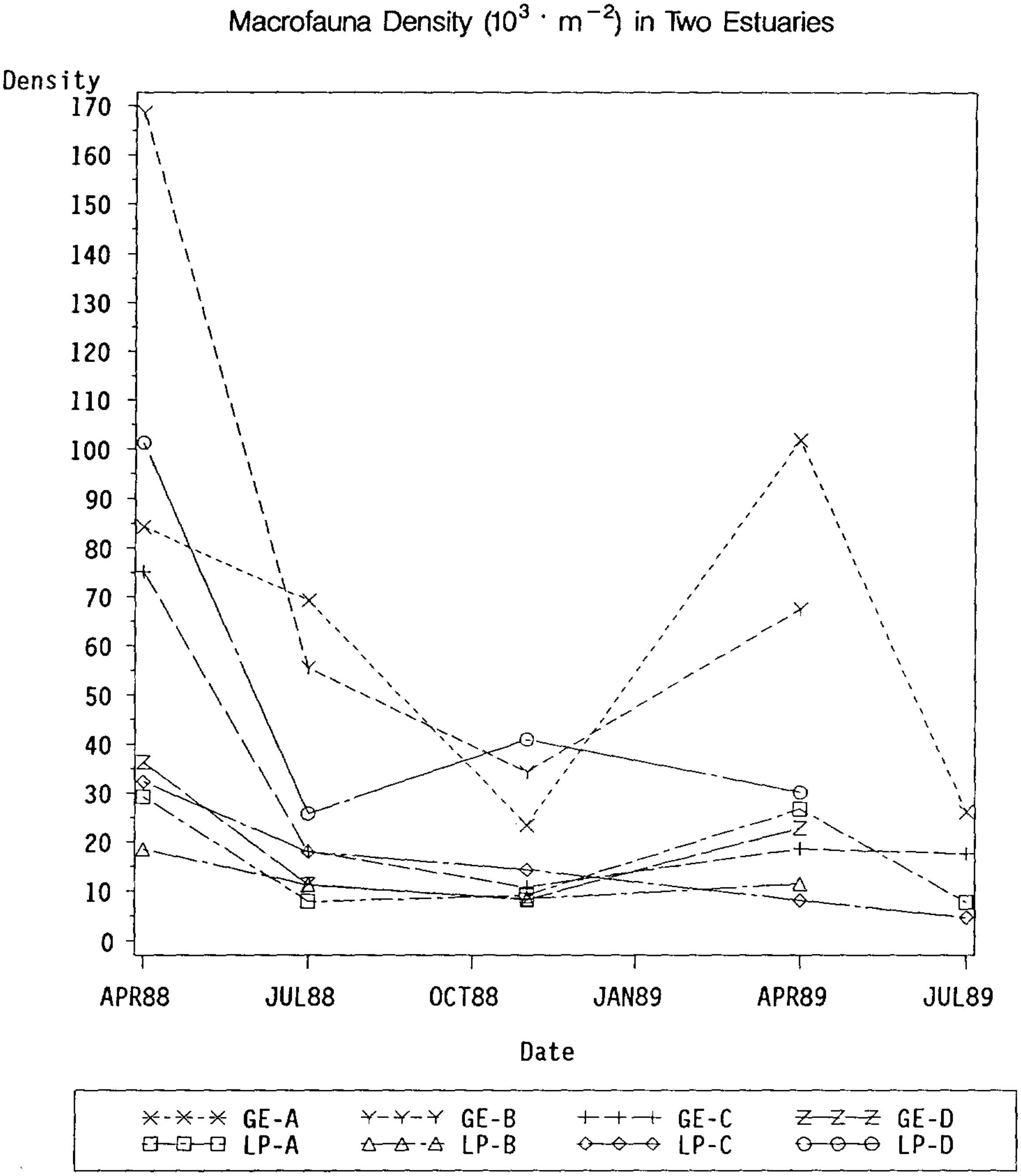


Figure 4. Salinity in the two estuaries during the study period.



Macrofauna Density ($10^3 \cdot m^{-2}$) in Two Estuaries

Figure 5. Macrofauna density to a depth of 10 cm in the two estuaries during the study period.

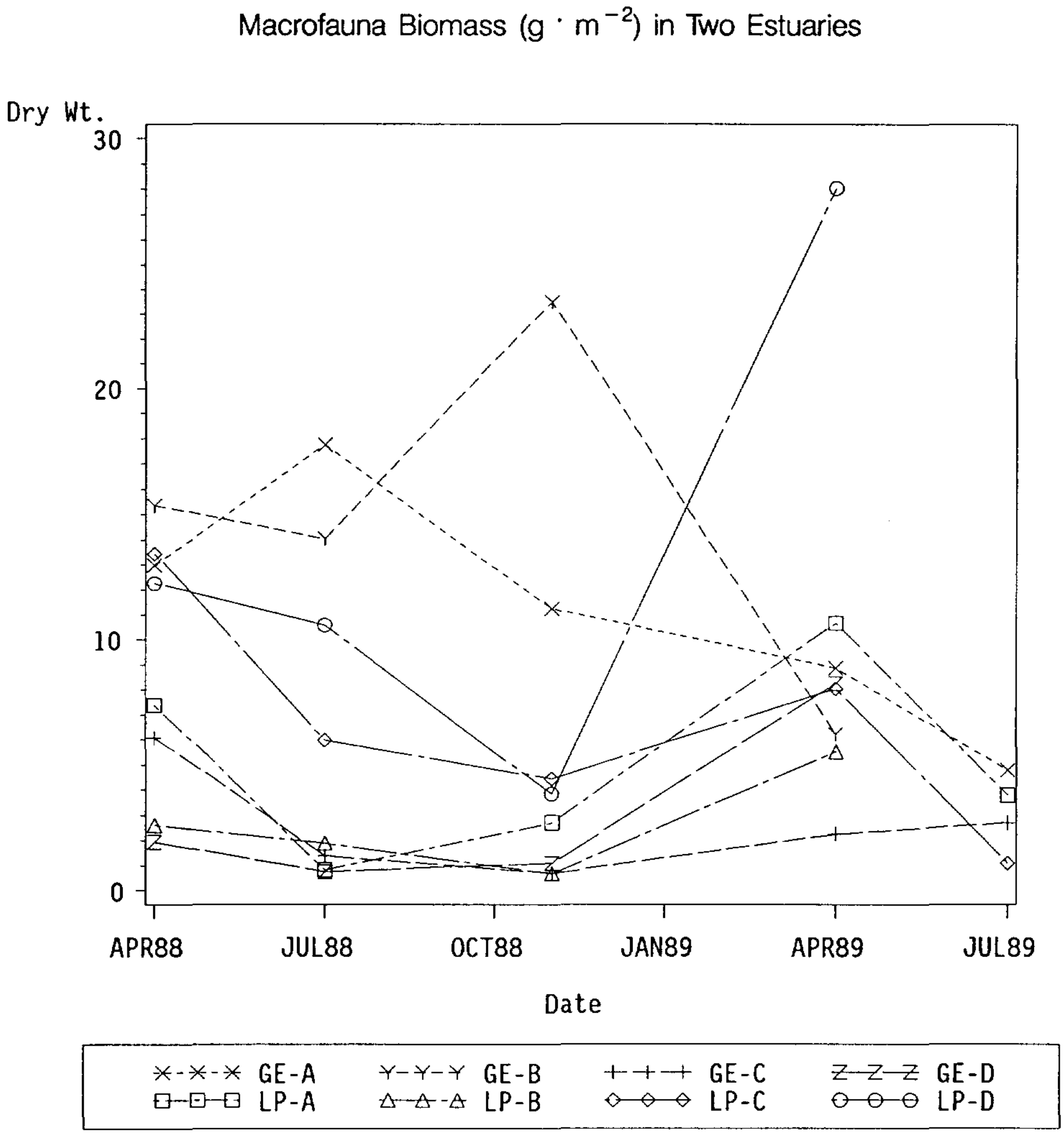


Figure 6. Macrofauna biomass to a depth of 10 cm in the two estuaries during the study period.

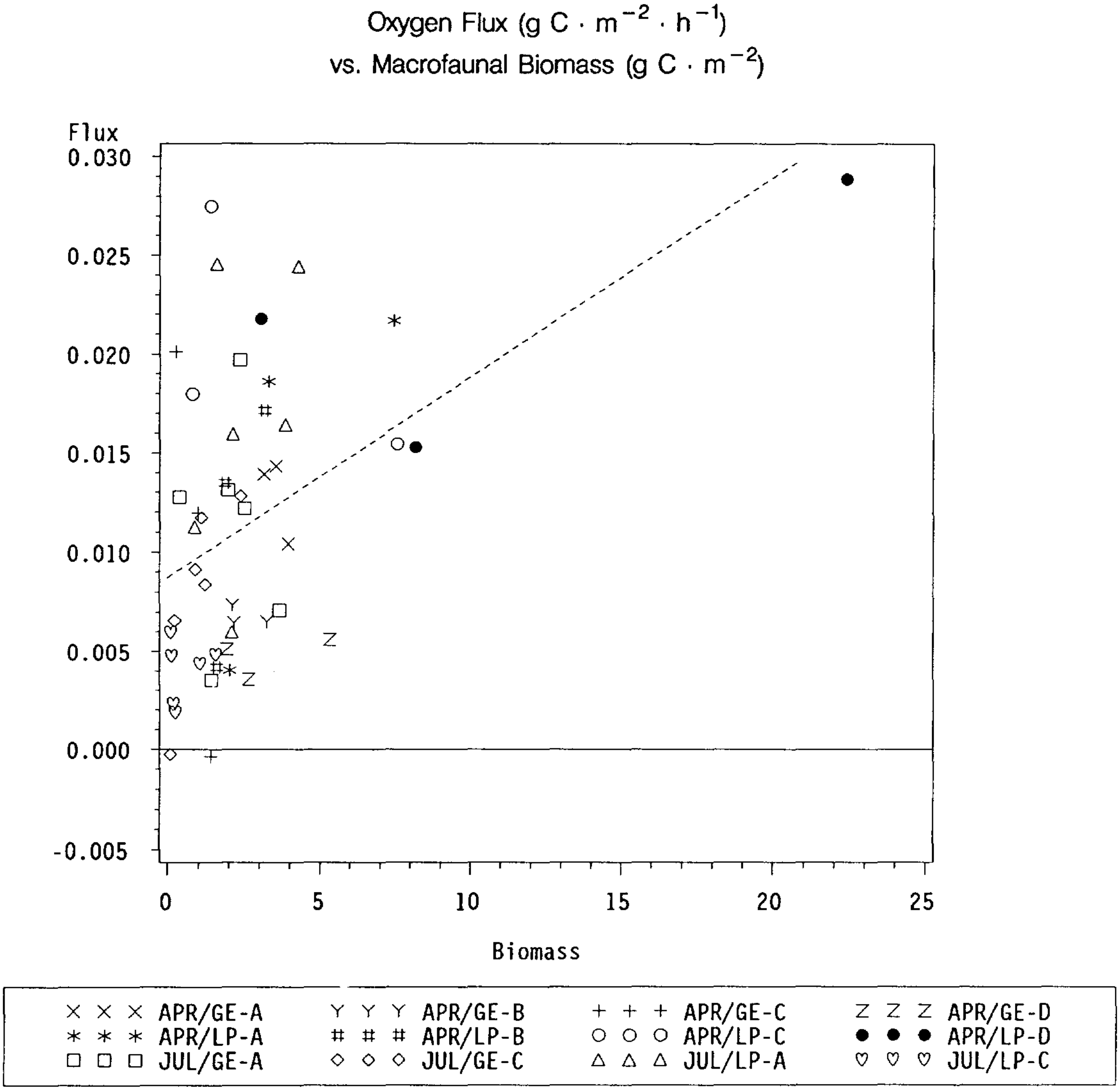


Figure 7. The effect of macrofaunal biomass on oxygen flux during 1989. The dotted line is from a linear regression, where flux (g C • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×0.00101 + 0.00873, P for H_0 the slope is zero=0.0007, and R^2=0.22.

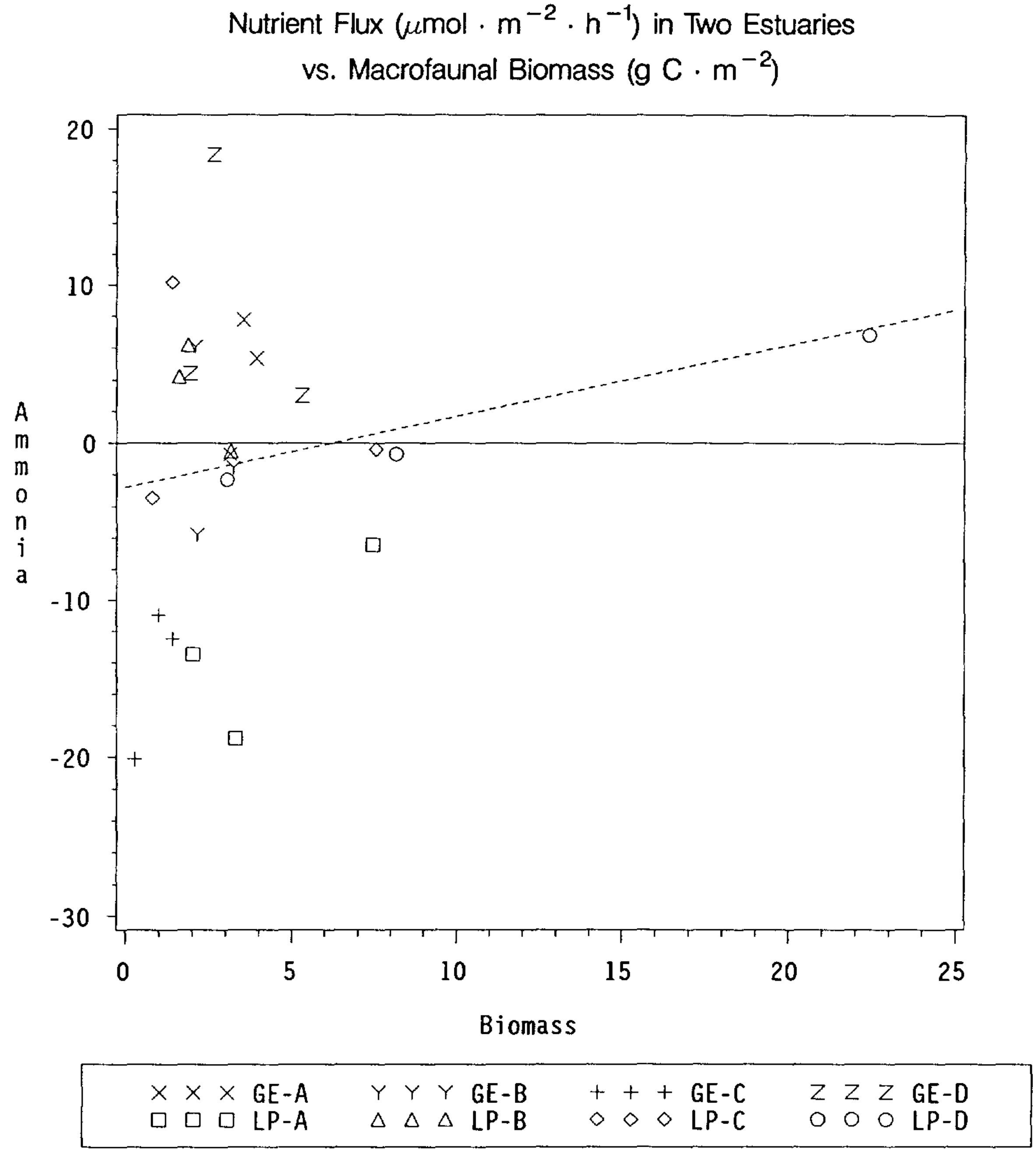


Figure 8. The effect of macrofaunal biomass on ammonia flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×0.450 - 2.819, P for H_0 the slope is zero=0.3091, and R^2=0.05.

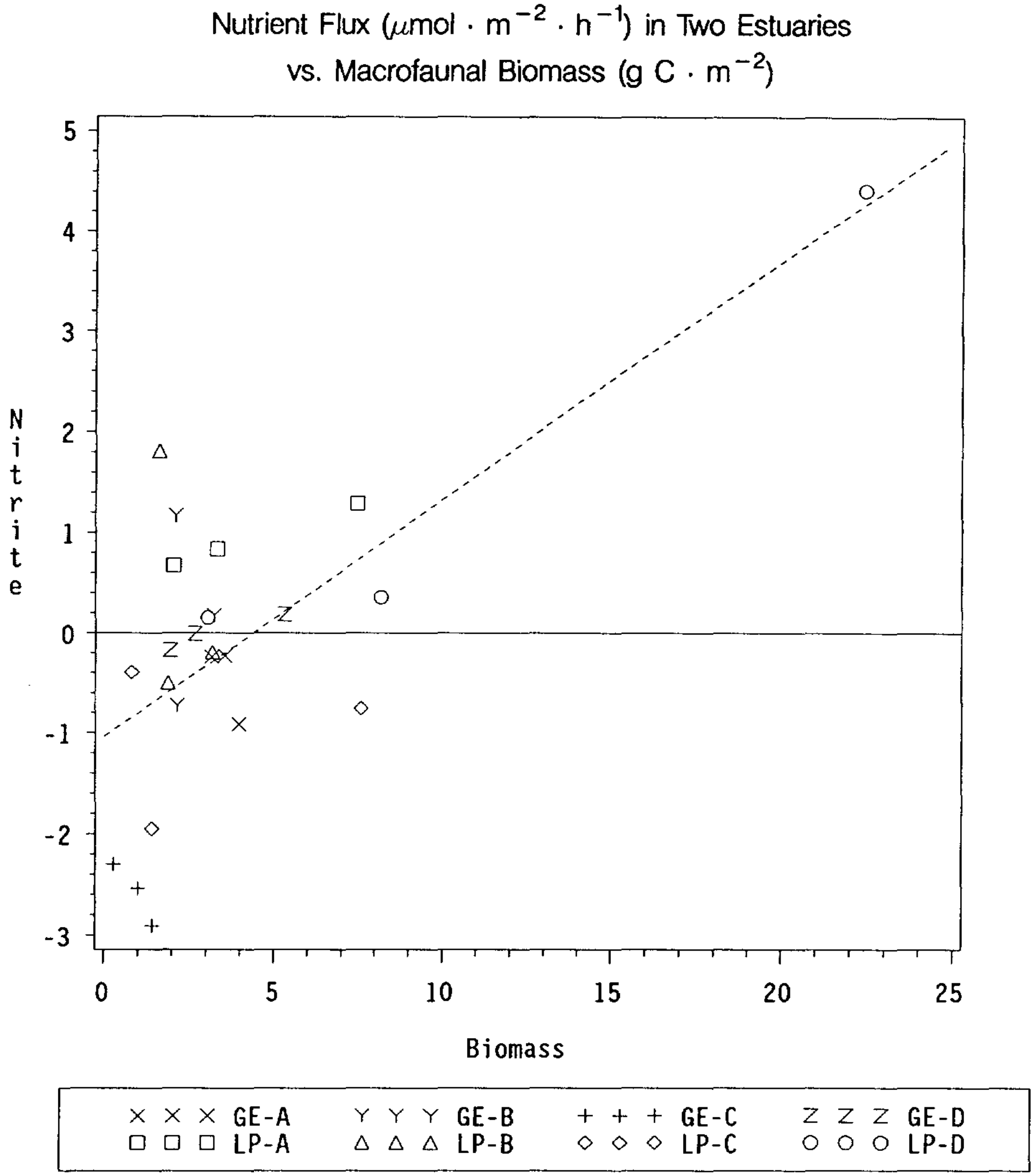


Figure 9. The effect of macrofaunal biomass on nitrite flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×0.237 - 1.038, *P* for H_0 the slope is zero=0.0002, and R^2=0.48.

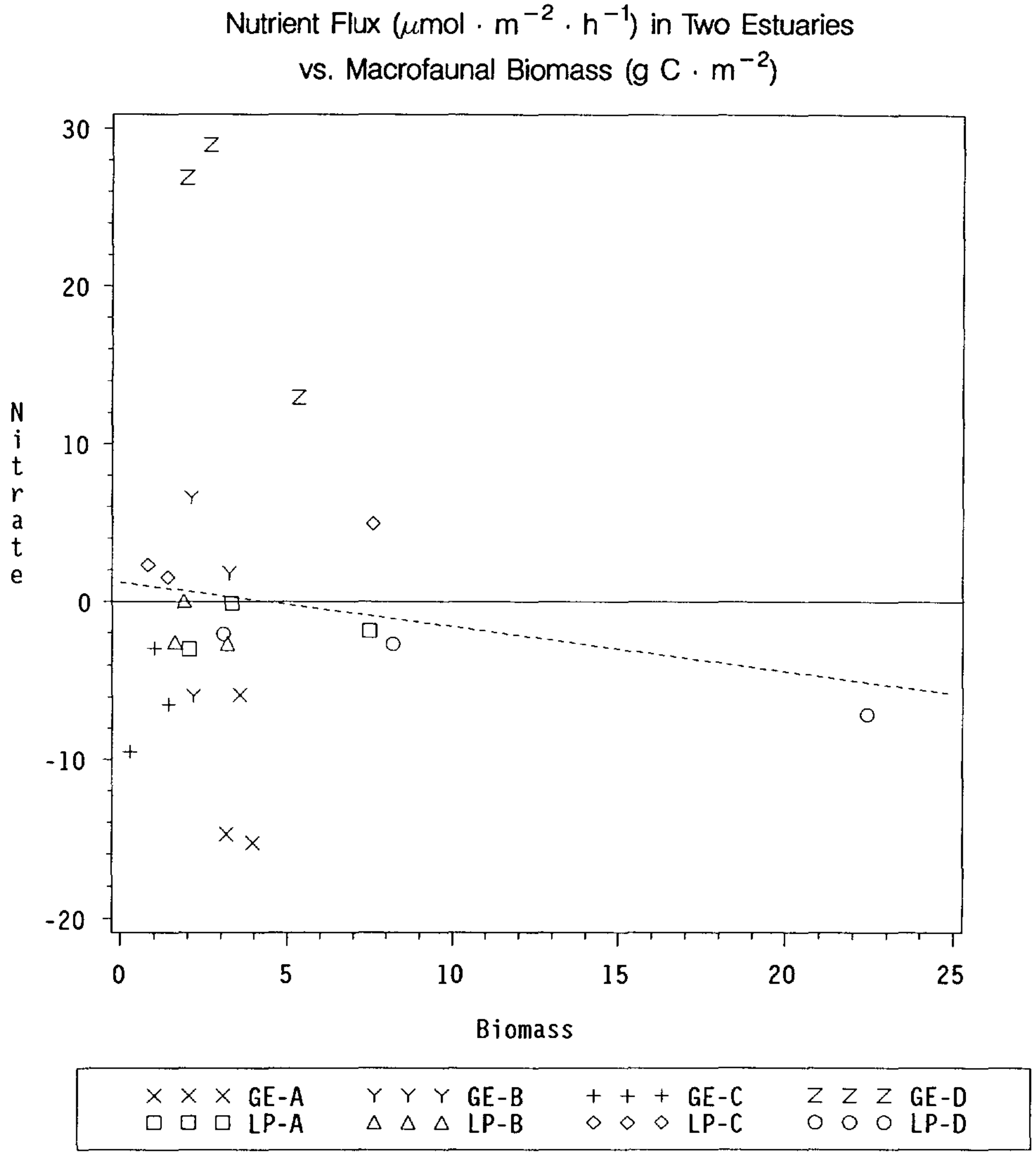


Figure 10. The effect of macrofaunal biomass on nitrate flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})x-0.281 + 1.230, *P* for H_0 the slope is zero=0.5790, and R^2=0.01.

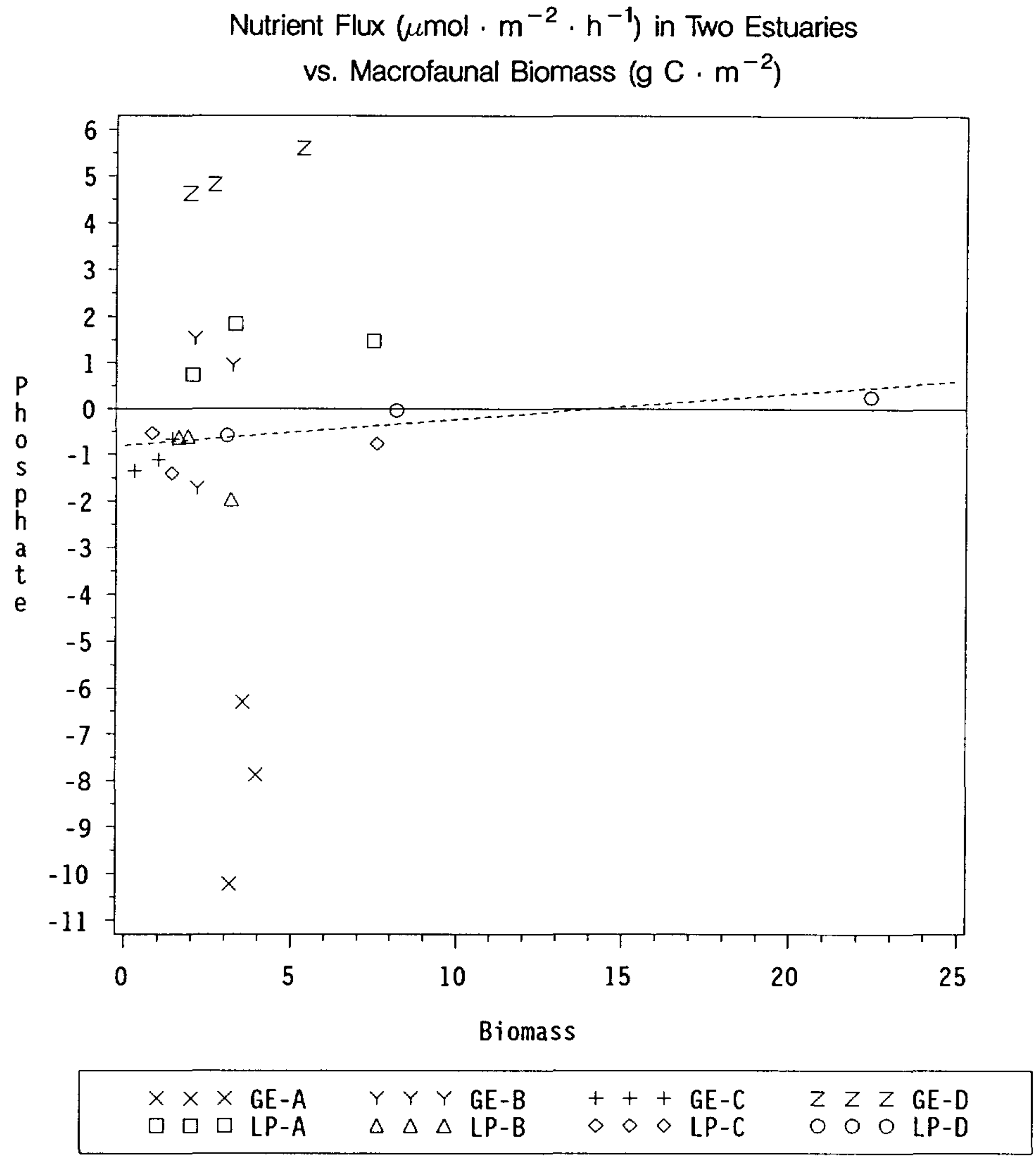


Figure 11. The effect of macrofaunal biomass on phosphate flux during April 1989. The dotted line is a linear regression, where flux ($\text{mmol}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$) = Biomass ($\text{g C}\cdot\text{m}^{-2}$)$\times 0.0566-0.8030$, P for H_0 the slope is zero=0.7440, $R^2=0.01$.

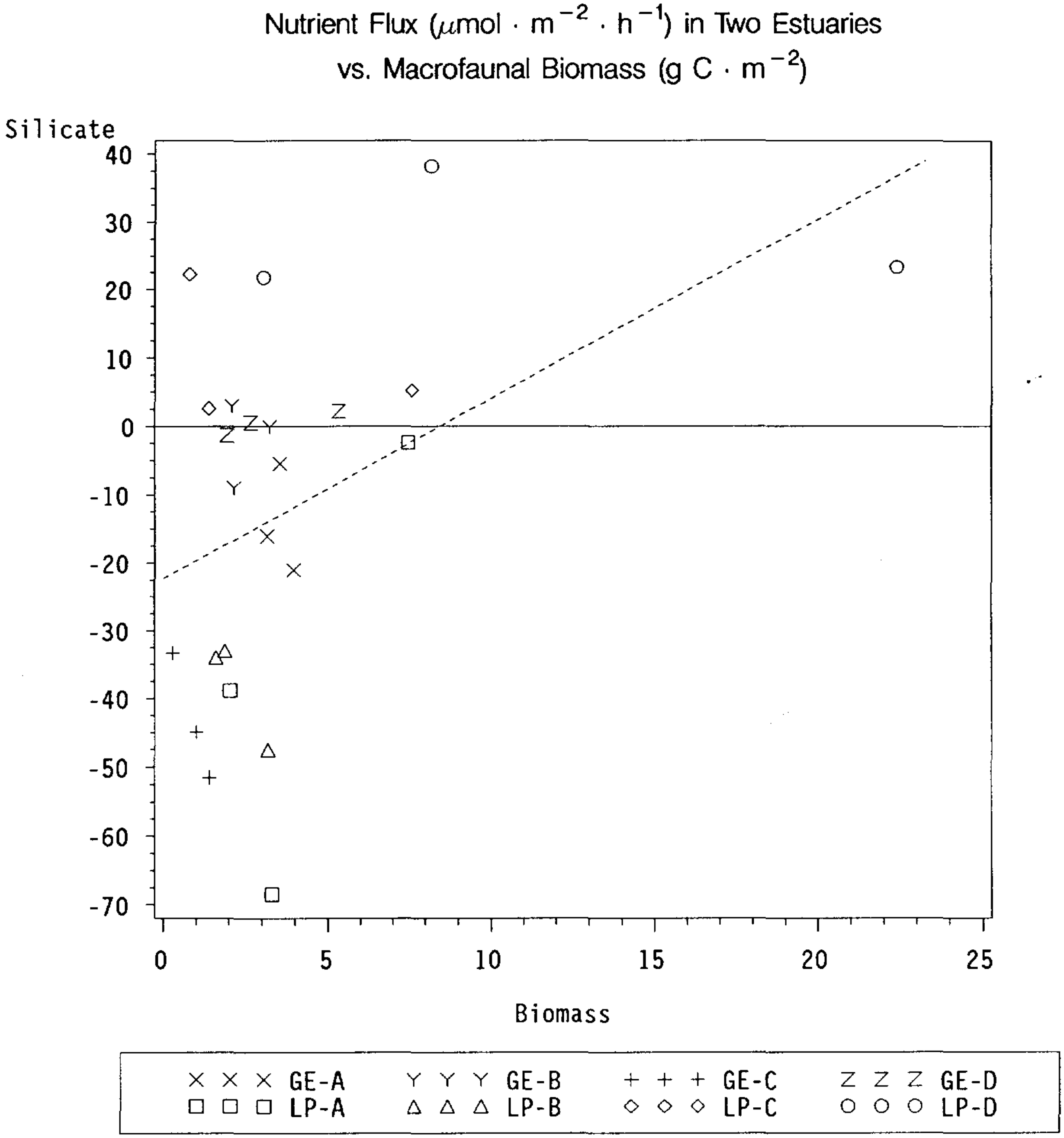


Figure 12. The effect of macrofaunal biomass on silicate flux during April 1989. The dotted line is a linear regression, where flux (mmol • m^{-2} • h^{-1}) = Biomass (g C • m^{-2})×2.63 - 22.31, *P* for H_0 the slope is zero=0.0335, and R^2=0.19.

A Review: The Effect of Freshwater Inflow on the Benthos of Three Texas Estuaries

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ABSTRACT

The effect of freshwater inflow on benthic community structure in three Texas estuaries is the subject of a literature review. The Lavaca-Tres Palacios Estuary is fed by the Lavaca, Navidad and Tres Palacios Rivers, which empty into Lavaca and Matagorda Bays. The Guadalupe Estuary is fed by the San Antonio and Guadalupe Rivers which empty into San Antonio Bay. The Nueces Estuary is composed of the Nueces River which empty into the Nueces and Corpus Christi Bays. All three estuaries can be divided into marine, estuarine, and freshwater zoogeographic zones. But the boundaries of the zones are regulated by three factors. First, is the location of the estuary. There are four climatic zones on the Gulf coast of Texas, with a concomitant gradient of decreasing rainfall and freshwater inflow from north to south. Second, is whether the bay has an direct opening to the Gulf of Mexico. Third, is the interannual variability in rainfall and freshwater inflow. In general, species diversity increases with increasing salinity at the marine parts of the estuaries. The trends for biomass and abundance are not so clearly distinct. In an open system, like the Lavaca-Tres Palacios and Nueces Estuaries, biomass and abundance typically increase near the opening to the Gulf, but in a closed system, like the Guadalupe Estuary, abundance and biomass usually decrease toward the marine influenced zone. This indicates that the estuaries must be treated independently when making management decisions, but that we can develop a generic model which describes the effect of freshwater inflow on estuarine benthic dynamics.

INTRODUCTION

The Texas coastal region is an important natural resource to the economy of this state and nation. This region is composed of seven major estuarine systems and extends for approximately 370 linear miles. The Texas coastline encompasses four climatic types described by Thornwaite (1948): (1) Semi-arid regions from the Rio Grande to 30°3'N just south of Corpus Christi, (2) Dry subhumid region from Corpus Christi to the lower shores of Matagorda Bay (Port Lavaca), (3) Moist subhumid zone from Port Lavaca to Galveston and (4) Humid climate from Galveston to the Mississippi Delta. These climate zones are roughly correlated with rain fall, with their boundaries corresponding with the 25, 30, 40, and 50 inch average annual precipitation from the lower to the upper coast (Hedgepeth, 1953). There is also a concomitant gradient of decreasing freshwater inflow from north to south corresponding to these climatic boundaries. Fluctuations of the climatic boundaries are common. For example, Price (1949) determined that the expected dry-subhumid climate occurred less than 50 percent of the time for a hundred year period in the Corpus Christi zone.

Although there is an obvious difference between the estuarine systems in regards to climate and freshwater inflow they have one feature in common, both seasonal and year-to-year variation in rainfall. This variation is characteristic of estuaries, but it is extreme on the northwestern Gulf coast, and can have radical effects on the estuaries (Hedgepeth, 1953). Flooding can change the salinity of a bay from 15 ppt (parts per thousand) to nearly zero in a few days, or periods of drought with high temperatures may raise salinities to hypersaline conditions. For example, drought conditions from 1948 to 1956 resulted in low freshwater inflow, and caused salinities in Texas bays to increase to record highs with little variation between years. This was followed by a sudden change in the spring of 1957 in Mesquite and Aransas Bays where the salinities dropped from 40 ppt to 2-4 ppt in less than 3 weeks (Parker, 1959; TDWR, 1980b). From September 11 to 15, 1951 precipitation lowered salinity at the head of Alazan Bay from 55.3 to 1.4 ppt changing the average salinity in Alazan from 54.7 to 11.5 ppt (Breuer, 1957). Sudden changes in salinity following long term stable conditions can cause mass mortality (Parker, 1959; Stone and Reish 1965; Wells, 1961; Thomas and White, 1969).

Temperature is another important climatic factor. Temperature changes associated with cold weather fronts are often severe enough to cause mortality to fish and some invertebrates (Hedgepeth, 1953). Mass mortality following freezes along the Texas coast occur approximately every six to fourteen years, averaging one every ten years (Hedgepeth, 1953 cited in Gunter, 1947). In January-February, 1951, 60 to 90 million pounds of fish were killed, mainly in the Laguna Madre (Gunter and Hildebrand, 1951; Breuer, 1957). The most recent cold related fish kills occurred in the winters of 1983 and 1989.

Each estuarine system has its own hydrographic characteristics dependent on interactions between river inflows, climatic factors and tides and each needs to be studied in detail (Hedgepeth, 1953). Multidisciplinary inter-bay studies are important to understand each estuary and how they relate to each other. This review attempts to establish the relationship between benthic community structure and variations among Texas estuaries due to inter- and intra-annual climatic affects.

PHYSIOGRAPHY OF TEXAS ESTUARIES

The bays in the Texas estuarine system can be classified by structure into tertiary, secondary and primary bays (Texas Department of Water Resources, 1982). The tertiary bays are the lakes associated with the head waters of the estuary and are typically low salinity areas due to their proximity to freshwater inflow. The secondary bays are semi-enclosed bays of low to moderate salinities connected to the lower primary bays, which are the central part of the estuary with moderate to high salinities. Numerous oyster reefs are usually associated with the low to moderate salinity secondary bays. Texas estuaries are also classified based on their location and in relation to the Gulf of Mexico. Open bays are those with direct access to the Gulf, ie. Lavaca-Matagorda and Nueces-Corpus Christi bays and closed bays are those without direct access to the Gulf, ie. San Antonio Bay.

The physiography of the Texas estuarine systems results in a salinity gradient from low salinity in the upper estuary near freshwater inflow to higher salinity in the lower estuary near marine influence. This salinity gradient ultimately effects the zoogeographical distribution of benthic organisms and enables us to divide the estuarine system into three major zones ie. (1) a freshwater influenced zone in the upper bay, (2) an estuarine zone mid-bay, and (3) a marine zone in the lower bay. Species composition of these zones are freshwater species, brackish or estuarine species, and marine species as you go from fresh to marine water (TDWR, 1980a). Although most benthic studies reviewed describe faunal and salinity differences which relate to the zones we use, various terminology is used to describe these zones (Table 1).

GENERAL SALINITY EFFECTS ON BENTHOS

Ecological studies over the years have demonstrated the importance of salinity as a factor in affecting the distribution of marine and estuarine organisms. The number of species, but not necessarily the observed total biomass increases as one proceeds along a salinity gradient from the freshwater side of a large estuary to the open sea (Springer and Woodburn, 1960; Gunter, 1961). Sessile and non-motile organisms have optimum salinities at which they grow best and variations from the optimum inhibit growth (Gunter, 1961). The life histories of many motile species, i.e., commercially important penaeid shrimps and menhaden, are migratory. Spawning occurs offshore, followed by the migration of larvae and juveniles to low salinity nursery areas at the heads of estuaries (Gunter, 1957; Baldauf *et al*., 1970). Individuals of marine species of fishes that invade freshwater are predominantly the juveniles (Gunter, 1957).

Some of these trends change when the estuary becomes hypersaline. For example, in the Laguna Madre when the salinity increases (1) there are fewer species, (2) the number of individuals of each species increases, (3) the average individual of each vertebrate species is larger (4) the average individual of many invertebrate species, ie., blue crabs and barnacles decreases (Simmons, 1957). When salinity and temperature are variable and extreme in the Laguna (1) only a few species of marine invertebrates and individuals of each species may survive, (2) but when hydrographic conditions are stable and salinities and temperature are in the extreme range, a few tolerant species may become extremely abundant, (3) When physical conditions are stable and within the normal range for marine environments there will be many species but fewer individuals of each species (Parker, 1959).

Variations in salinity may be adverse for some organisms and beneficial for others. In general, when salinity changes within limits, the biomass remains fairly constant while the diversity or number of species changes (Hopkins *et al.*, 1973). Salinity changes may add or eliminate species from an environment. This may be considered beneficial or detrimental, depending on ones interest and point of view.

GUADALUPE ESTUARY

The Guadalupe Estuarine system, located between 28°10′ and 28°28′ North latitudes and between 96°36′ and 96°50′ West longitudes, is a shallow coastal plain estuary adjoining Mission Lake, Guadalupe Bay and Hynes Bay and San Antonio Bay. Approximately 4,856 ha (12,000 ac) of marshes and vegetated wetlands borders the bay system (Matthews *et al.*, 1974). The total system covers 52,609 ha (130,000 ac) and receives freshwater from the San Antonio and Guadalupe Rivers, Coleto Creek, and several small streams. San Antonio Bay is a shallow estuary with a mean depth of 2.5 feet (0.76 m). The Intracoastal Waterway traverses the lower bay from northeast to southwest and varies in depth from 12 to 15 feet (3.7 to 4.5 m) with a bottom width of about 125 feet (38.1 m) (TDWR, 1980b). San Antonio Bay is separated by a chain of islands (reefs) from Mesquite Bay on the west and Espiritu Santo Bay on the east. The bay extends 14 miles (25 km) in meridional direction, and is from 5 to 14 miles (9-25 km) wide. The bottom is covered with a network of oyster reefs built on soft mud; of which Panther Reef is the longest, extending over 4 miles north from Panther Point on Matagorda Island (Galtsoff, 1931). Oyster reefs are most numerous in the central portion of the bay where they rise almost to or actually to the surface (Shepard and Rusnak, 1957). In the narrow northern section of the bay the reefs form almost a continuous network of ridges, making navigation very difficult (Galtsoff 1931, and Captain John Turany, R/V KATY, personal communication).

Historical Salinity Regimes. Historically San Antonio Bay is a low salinity bay characterized by a well defined salinity gradient. On February 2-3, 1926 Galtsoff (1931) reported salinities of 4 ppt at the mouth of Guadalupe and Hynes Bay to 14 ppt at Panther Reef, and 17.7 ppt at First Chain of Islands at the entrance of Espiritu Santo Bay. The distribution of salinity indicates that fresh water from the Guadalupe River under most conditions flows down the west side of the bay to Mesquite Bay while higher salinity Gulf water enters the bay from the east through Pass Cavallo and Espiritu Santo Bay (Galtsoff, 1931; Shepard and Rusnak, 1957; Parker, 1959; Ladd, 1951).

Faunal distributions can also be used as an indicator of salinity regimes in the past and present. In San Antonio Bay most living freshwater species are found in the upper bay and along the west shoreline being conspicuously absent from the eastern shore (Parker, 1959). The distribution of *Rangia cuneata* in upper San Antonio Bay and along the west shoreline conforms with the dominant freshwater flow pattern (Ladd, 1951). Sediment distribution is also indicative of the flow pattern of low salinity, sediment laden water. The sediments in the San Antonio Bay delta extending down the bay center and west side are predominantly silt and clay while the sediment associated with Mesquite Bay to the southwest and Espiritu Santo Bay to the southeast where sediments are very sandy (Shepard and Rusnak, 1957).

Extreme flood conditions occurred on July 14, 1936 resulted in salinities ranging between 3 ppt and 5 ppt throughout Aransas Bay, and San Antonio and Copano Bays were virtually fresh (Collier and Hedgepeth, 1950). Parker (1959) cites similar conditions in May 1938, June 1941, October 1946 and June 1957.

Drought conditions from 1948 to 1953 with corresponding low river runoff caused salinities in the central bays of Texas to increase to record highs with little variation between maximum and minimum. Annual freshwater inflow data for the Guadalupe estuary indicates that drought conditions occurred from 1948 to 1956 (TDWR, 1980b). Gradual increases in salinity were noted since 1950 in spite of heavy discharge from the Guadalupe River in June, September and October 1951 (Parker, 1955). Salinities in lower San Antonio Bay in 1950 reported by Baker (1950) were 13.1 ppt to 24.4 ppt and by Parker (1955) in lower San Antonio and Mesquite Bays in 1951 were 23.9 ppt and 41.42 ppt. The API field party from Scripps Institution measured salinities from 23.9 ppt in the upper bay to 41.42 ppt in the lower bay in July and August 1951 (Parker, 1955). In January - February 1952 lower bay salinities were 27.39 ppt to 31.16 ppt in July - August 1952 salinities were from 14 ppt in Mission Bay to 42 ppt where San Antonio connects with Mesquite Bay (Parker, 1955; 1959; Williams and Whitehouse, 1952).

In late 1953 salinities were still above the "normal" salinity of 10 ppt to 17 ppt as suggested for San Antonio Bay by Ladd (1951). In November 1954 salinities ranged from 24 ppt at the river mouth to 36.8 ppt in Mesquite Bay with a 2 ppt salinity difference from central San Antonio Bay to the Gulf of Mexico (Parker, 1955; Phleger and Lankford, 1957). In the spring of 1957 the salinities in Aransas and Mesquite bays dropped from over 40 ppt to as low as 2-4 ppt in less than 3 weeks (Parker, 1959). Conditions described above would have resulted in low salinity conditions throughout San Antonio Bay. The average salinity ranges from the upper bay (Hynes Bay) to lower bay (Panther Point Reef and Intracoastal Waterway markers 21 & 31) from 1959 through 1964 and 1966 were as follows: 3.8-14.7 ppt, 4.1-16.4 ppt, 3.9- 7.8 ppt, 13.1-26.9 ppt, 24.6-31.21 ppt, 16.7-28.8 ppt and 5.1-15.6 ppt respectively (Childress, 1966; Martinez, 1966). Salinity increases from 1962 to 1964 correspond to declines in freshwater inflow for 1962 through 1964 (Childress, 1966; TDWR, 1980a). An average salinity of 5.7 ppt in the upper bay (station 243-4) and 17.3 ppt in the lower bay (291-1) occurred from April 1972 through February 1973 (Harper 1973). During this period freshwater inflow was 49% greater than the average inflow for the 35 year period of 1935-1970. In another study during this same period salinity averaged 4.1 ppt in the upper bay (station 243-4) and 13.2 ppt in the lower bay (station 291-1) (Matthews *et al.*, 1974).

From January through July 1987 high freshwater inflow resulted in an average upper bay salinity of 0.5 ppt and average lower bay salinities ranging from 5.6 to 8.1 ppt (Montagna and Kalke, 1989a). The period from April 1988 through April 1989 had less inflow which increased the upper bay average salinity to 13.3 ppt and the lower bay average salinities to 26.0 and 28.4 ppt (Montagna and Kalke, 1989b).

Faunal Assemblages. Authors of ecological surveys in the bay systems of Texas have tended to divide these systems into zoogeographic zones dependent upon faunal assemblages associated with the salinity gradients (Ladd, 1951; Parker, 1955; 1959; Harper, 1973; Matthews *et al.*, 1974; Phleger and Lankford, 1957; Parker *et al.*, 1953; Phleger 1956).

San Antonio Bay can be referred to as a closed bay, i.e., it is not open to direct Gulf influence. Ladd (1951) divided it into three zoogeographic zones characterized by distinct sediment, fauna, and salinity distributions: the bay head, inter-reef, and reef zones.

The first zone occurs in the upper bays near the mouth of streams or rivers in 2 to 5 feet water depth and the bottom is usually soft mud. Salinities typically range from 0 ppt to 9 ppt. Ladd (1951) characterized the fauna by a dominance of the mollusks *Rangia, Littoridina sphinctostoma, Tellina texana* (corrected as *Macoma mitchelli* by Parker, 1955), an abundance of 3 genera of foraminifera, and ostracods. *Mulinia lateralis, Ensis minor*, and barnacles also are found in this zone but they may be equally or more abundant in other areas.

Below the bay heads are the inter-reef and reef zones. The inter-reef areas are more like the bay-heads in regards to sediment with a bottom of gray or bluish mud in bay centers with some sand near shore. The average depth is 5 to 10 feet. Ladd (1951) states that no particular fauna inhabits this area, but his reference was mainly in regard to mollusks. *Rangia* and *Littoridina* are absent in most inter-reef areas.

The reef areas are dominated by oysters, *Crassostrea virginica*, mussels, bryozoans, crepidulas, barnacles, and serpulid worms. Also found are the gastropods, *Odostomia* sp. and *Anachis*, and the boring clam *Martesia*. Changes in fauna from the heads of the bay to the Gulf are correalated with the changes in the salinity gradient, and they may be gradual or abrupt as demonstrated by the distribution of *Rangia* and *Littoridina* (Ladd, 1951).

A shift in salinity and in the distribution of fauna during the drought of 1948 to 1953 was described by Parker (1955). High salinities resulted in the introduction of Gulf forms into Aransas Bay. New occurrences of twenty-three mollusc species were observed, and an increase in abundance of *Callinectes danae*. A decline of the white shrimp production occurred and in 1951 no living examples of *Rangia* or *Littoridina sphinctostoma* were found in San Antonio Bay.

Benthic foraminifera were studied at 32 stations in Aransas, Mesquite and San Antonio Bays for six seasons from August 1954 through June 1955. An upper and lower bay faunal assemblage was described in San Antonio Bay based on species distributions and numbers of individuals per sample. Patterns were similar to macrofauna distributions, i.e., there were fewer species and higher standing crop in the upper bay (Phleger, 1956; Phleger and Lankford, 1957).

Large scale climatic changes result in boundary changes of these salinity zones and the associated fauna making it necessary to construct two zoogeographic maps to describe San Antonio Bay during prolonged low and high salinity regimes (Parker, 1959). Parker (1959) characterized San Antonio Bay based on the occurrence of distinct species and salinity regimes. He reasoned that salinity is one of the more important factors influencing fauna distribution, while noting that river related nutrient input and high turbidity may also be important. Parker's two zones include: (1) river influenced, low salinity zone and (2) an enclosed bay zone of variable low to intermediate salinities characterized by soft bottom benthic communities and low salinity oyster reefs. This environment corresponds to Ladd's (1951) reef and inter reef zones. Drought periods may result in a shift to a high salinity oyster reef community. The extent of areal coverage of these proposed zones is dependent on the stability or variability of annual climatic conditions. For example, during dry years the river-influenced areas are reduced in size and during periods of high inflow their areal coverage is expanded.

The typical fauna in San Antonio Bay associated with Parker's (1959) zones are (1) River influenced - *Littoridina sphinctostoma*, *Macoma mitchelli*, and *Rangia cuneata*, (2) enclosed bay - *Retusa canaliculata*, *Nuculana concentrica*, *Nuculana acuta*, *Mulinia lateralis*, *Tagelas plebius*, *Ensis minor*, and *Amphiodia limbata*, and (3) low-salinity oyster reef - *Crepidula plana*, *Brachidontes recurvis*, *Crassostrea virginica*, and *Balanus eburneus*.

A study to determine the effects of shell dredging on the environment of San Antonio Bay was conducted from March 1972 through February 1973 (Harper, 1973). A low salinity zone averaging 5 to 12 ppt and a higher salinity zone averaging 15 to 18 ppt were defined for San Antonio Bay during this period. Species listed with the low salinity group were *Littoridina sphinctostoma*, *Hypaniola gunneri floridus*, and *Rangia flexiosa*. Species of the higher salinity zone were *Nereis succinea*, *Oxyurostylis salinoi*, *Ensis minor*, *Cumacea A*, *Glycinde solitaria*, *Cossura delta* and *Prionospio pinnata*. *Mediomastus californiensis*, *Streblospio benedicti*, and *Mulinia lateralis* were found throughout the study area. The total annual populations of benthic organisms were computed for each salinity group indicating an almost logarithmic decrease in benthic populations with increasing salinity. Harper (1973) states that this trend is probably only indirectly related to salinity and that the lowest salinity zone is closest to the mouth of the Guadalupe River which supplies much of the nutrient material to the bay.

The Texas Water Development Board funded a study of plankton and benthos in San Antonio Bay from March 1972 through July 1974 (Matthews *et al.*, 1974). The bay was divided into 3 zones along a salinity gradient with zone 1 located in the lower salinity upper bay, zone 2 located mid-bay and zone 3 located in higher salinity water south of the intracoastal waterway. Species numbers declined and standing crop increased with low salinity in zone 1. Species most common in zone 1 and the line of stations directly adjacent from zone 2 were *Hypaniola gunneri floridus*, Chironomid larvae, *Rangia cuneata* and *Littoridina sphinctostoma. Mediomastus californiensis* occurred throughout mid and lower bay while *Streblespio benedicti* occurred only in zone 2. *Mulinia lateralis* was absent from zone 1, with a patchy distribution in zone 2, increasing in abundance in zone 3. The complete absence of *M. lateralis* from zone 1 may have been the result of misidentifying *M. lateralis* for *Rangia cuneata*.

The University of Texas Bureau of Economic Geology sampled the benthic fauna in San Antonio, Hynes, and Guadalupe Bays and Mission Lake in 1975 (White *et al.*, 1985). Much of San Antonio Bay north of the Intracoastal Waterway contained a river influenced assemblage characterized by the mollusks *Rangia cuneata*, *Rangia flexuosa*, *Mulinia lateralis*, and *Texadina sphinctostoma* (White *et al.*, 1985). *Hobsonia florida*, a low salinity polychaete, and the amphipod *Corophium acherusicum* were reported as abundant in Guadalupe Bay and Mission Lake. Extensive oyster reefs were reported throughout San Antonio Bay. A bay margin assemblage included a group of bay species, including *Mulinia lateralis*, *Streblospio benedicti*, and *Mediomastus califoriensis*.

The Texas Water Development Board funded a multidisciplinary freshwater inflow study in San Antonio Bay through The University of Texas Marine Science Institute from November 1986 through July 1987. Four stations (A, B, C & D) were sampled to distinguish between freshwater influence near the head of the bay and marine influence in the lower bay. During this study San Antonio Bay received the largest annual freshwater inflow in 47 years resulting in salinities ranging from 0.2 to 1 at Station A near freshwater inflow and in salinities ranging from 1.1 to 9.2 at station C and 0.9 to 13.2 at Station D in the lower bay. Additional sampling trips were made in April, July and November 1988, and April 1989, a low freshwater inflow period, as part of an estuarine comparison effort. Salinities during this period ranged from 9.6 to 18.5 ppt at station A and from

26.7 to 32 ppt at station D. During both study periods total species number increased from the lower salinity upper bay to the higher salinity lower bay. Mean abundance and biomass were highest at stations A and B in the wet year decreasing at stations C and D in the lower bay (Tables 1 and 2). As salinity increased during the dry period total species, abundance and biomass increased at all stations with the distribution trend remaining similar to the wet year ie., high abundance and biomass in the upper to middle bay decreasing in the lower bay. The highest number of species at station D was indicative of marine input from Espiritu Santo Bay. The polychaetes *Mediomastus californiensis* and *Streblospio benedicti*, and the mollusks *Mulinia lateralis* and *Littoridina sphinctostoma* were the dominant species in the upper and lower bay (Table 3). The species associated mainly with low salinity were *Littoridina sphinctostoma, Rangia cuneata, Hobsonia florida* and chironomid larvae. The bivalve *Rangia cuneata* was common at stations A and B but was never collected in high abundance. One 25 mm *Rangia* was picked up at station C while diving but no specimens were found in samples from the lower bay. Some species associated with the higher salinity lower bay were *Glycinde solitaria, Polydora caulleryi, Haploscoloplos foliosus, Gyptis vittata, Diopatra cuprea, Neanthes succinea, Megalomma bioculatum, Clymenella torquata calida, Paraprionospio pinnata, Mellina maculata, Isolda pulchella, Ensis minor, Aligena texasigna* and *Nuculana acuta*.

Biology of Dominant Species. The dominant benthic macrofauna species collected from San Antonio Bay in quantitative studies were the gastropod, *Littoridina sphinctostoma*, the bivalves, *Rangia cuneata* and *Mulinia lateralis*, and the polychaetes, *Mediomastus californiensis, Streblospio benedicti* and *Hypaniola gunneri floridus* (Harper, 1973; Matthews *et al.*, 1974). The distribution of these species is strongly linked to long term environmental conditions, although responses to flood conditions may result in rapid population changes.

Littoridina sphinctostoma, a gastropod, populations increase following peaks in freshwater inflow (Harper, 1973; Matthews *et al.*, 1974). This is apparently a breeding response caused by a salinity decline (Harper, 1973). *Littoridina* carries its eggs on the shell and undergoes direct development with the young ready to assume adult existence upon emerging from the egg. *Littoridina* *sphinctostoma* is commonly reported as one of the most dominant gastropod inhabitants of the river influenced upper bays of the Texas coast (Ladd, 1951; Ladd et al., 1957; Parker, 1955; 1959; Harper, 1973; Matthews *et al.*, 1974; Gilmore *et al.*, 1976; White *et al.*, 1983; 1989; Staff *et al.*, 1985; Cummins et al. 1986).

Rangia cuneata, a brackish water clam in the family Mactridae, is an excellent indicator of ecological effects of salinity changes in coastal waters and has been comprehensively studied by Hopkins *et al.* (1973). It is commonly the dominant species on the 0-15 ppt salinity zone and since 1955 its range has extended from along the Gulf of Mexico coastal estuaries to along the Atlantic coast from Georgia to Maryland. The well being of the species is not dependent on the physiology of the adult, since the adults can tolerate salinities from 0 to 38 ppt and temperatures from 10 to 35°C. Spawning is induced by a change in salinity either up from near 0 ppt or down from 15 ppt (Hopkins *et al.*, 1973). The embryos and early larvae can survive only in salinities between 2 and 15 ppt. *Rangia* is not only a species for which low salinity, in the range of 1 to 15 ppt is optimal, it is a species which evidently cannot maintain a population outside this range (Hopkins & Andrews, 1970). It is most abundant far up tidal rivers where salinity may stay below 1 ppt continuously for months or even years. No living *Rangia* were found in San Antonio Bay in the drought summer of 1951 and spring 1952 although extensive collections were made throughout the bay (Parker, 1955). Individuals of *Rangia* get progressively larger in size from the center of San Antonio Bay to the Guadalupe River delta, into the mouth of the river and Mission Lake (Ladd, 1951).

Mulinia lateralis, another bivalve of the family Mactridae, is an extremely hardy species, ranging from Prince Edward Island, Canada to Yucatan, Mexico and in salinities from 5 ppt to 80 ppt (Parker, 1975). It has been considered as an opportunist of adversity because it can colonize rapidly after a disturbance event such as dredging or heavy rain (Flint and Younk, 1983; Flint *et al.*, 1981). It is one of the more abundant mollusks in the low salinity bay heads of the Gulf coast (Hopkins *et al.*, 1973). In San Antonio Bay Matthews *et al.* (1974) reported *Mulinia* widely distributed from their brackish water Zone 2 to their higher salinity Zone 3 and Harper (1973) reported it as one of his abundant species. Both indicated that the close resemblance of *Rangia* juveniles and *Mulinia* *lateralis* may have resulted in numerous misidentifications at the low salinity stations. In the Laguna Madre (Alazan Bay) *Mulinia lateralis* was the most abundant and widespread mollusc (Martin 1979, Cornelius 1984).

Mulinia lateralis is widely reported from other bays around the globe. Spawning was observed in the Tred Avon River, Maryland and Chesapeake Bay where it was observed to have a continuous period of setting from a single spawning cycle from May through November (Shaw, 1965; Holland *et al.*, 1977). In Alazan Bay, Texas Cornelius (1984) observed juveniles in all months except December, and Poff (1973) observed year round spawning in Trinity Bay, Texas. *Mulinia lateralis* has a very short generation time and is capable of successfully spawning at 3 mm in length which is approximately 60 days old (Calabrese, 1969a). Embryo survival and development for *Mulinia* as it is with *Rangia cuneata* is dependent on certain salinity and temperature ranges. *Mulinia lateralis* developed into normal larvae throughout the salinity range of 15 to 35 ppt and the temperature range of 10 to 30°C (Calabrese, 1969b). This clam is an important food item to bottom feeding organisms, i.e., the black drum (Pearson, 1929; Breuer, 1957; Simmons and Breuer, 1962; Martin, 1979) and to the greater and lesser scaup ducks (Cronan, 1957). Large rafts of scaup ducks were observed in upper San Antonio Bay in November 1988 corresponding to high densities of *Mulinia lateralis* (personal observation).

The polychaete, *Mediomastus californiensis* is a euryhaline species reaching peak abundance in San Antonio Bay at 12.5 ppt and gradually declining at higher and lower salinities. Population densities were not affected by flood conditions (Harper, 1973). Matthews *et al.* (1974), collected *M. californiensis* in brackish to higher salinity waters of 6 to 16 ppt.

Streblospio benedicti, a polychaete, preferred the salinity range of 10-12 ppt according to Harper (1973). It was restricted by higher salinities and virtually disappeared from upper San Antonio Bay following the flood. It was described as a brackish water species by Matthews *et al.* (1974), being associated only with the mid-bay zone.

Populations of the polychaete, *Hypaniola gunneri floridus*, were highest in the upper bay from June through August 1972 when the salinity was lowest. This species was not common above 10 ppt (Harper, 1973). Increased abundance of *H. gunneri floridus* was attributed to freshwater inflow by Matthews *et al.* (1974).

LAVACA - TRES PALACIOS ESTUARY

Lavaca Bay and Matagorda Bay are located at latitude 28°40′ North and longitude 96°36′ West. A detailed description of the upper Lavaca and Matagorda Bays is given by Gilmore *et al.* (1976). Lavaca Bay is a shallow estuary with a maximum natural depth of about 2.4 m and a surface area of about 16,576 ha. (40,959 acres). The perimeter of the upper bay shoreline is lined with patchy *Spartina*, and the surrounding low salinity marshes are vegetated mainly with *Juncus* downriver and *Phragmites* upriver. The majority of freshwater inflow into upper Lavaca Bay comes from the Lavaca and Navidad Rivers, while lesser contributions come from Venada, Garcitas and Placedo creeks. Circulation between the upper and lower bay is modified by the presence of the state highway 35 causeway, the remains of the old causeway, and Chicken Reef which extends from the northeast and southwest side of the bay parallel with the causeway. Marine influence enters through Pass Cavallo and the Matagorda ship channel.

Two tertiary bays or lakes are associated with the Lavaca River. Redfish Lake is approximately 4.8 km (3 miles) and Swan Lake is approximately 1.6 km (1 mile) north of Lavaca Bay. Redfish Lake is about 194 ha (479 acres) and Swan Lake is about 259 ha (640 acres). The salinity of Redfish Lake is usually similar to the rivers while the salinity in Swan Lake is more estuarine due to its proximity to and its connection to Lavaca Bay via Catfish Bayou.

The forty-nine year daily flow average (1939-1987) for the Lavaca River is 9.35 $m^3 \cdot s^{-1}$ (334 cubic feet/second) and the forty-year daily flow average (1939-1980) for the Navidad River is 16.0 $m^3 \cdot s^{-1}$ (572 cubic feet/second) into Lavaca Bay (USGS, 1980; Buckner *et al.*, 1987).

During a multi-disciplinary study of the effects of freshwater on the Lavaca Bay System, from January, 1973 to June, 1975, Gilmore *et al.* (1976), reported about 59 percent above normal inflow conditions. Percentages were based on inflow from the Lavaca and Navidad Rivers, and Garcitas Creek gauging. Inflow was greater than 112 $m^3 \cdot s^{-1}$ (4,000 cubic feet/second) during 10 percent of the study and daily inflow ranged from 3-2658 $m^3 \cdot s^{-1}$ (100 cubic feet/second).

A two year study to monitor the effects of freshwater inflow on selected sites in the upper portion of Lavaca Bay was conducted from November 1984 through

August 1986 (Jones *et al.*, 1986). Daily average inflow from the Lavaca River prior to this study from January through November 1984 was 3.3 $m^3 \cdot s^{-1}$ (118 cubic feet/second) (65 percent below normal). Average daily inflow increased 70 percent to 10.9 $m^3 \cdot s^{-1}$ (389 cubic feet/second) (16 percent above normal) for November 1984 through August 1985 and decreased to 5.0 $m^3 \cdot s^{-1}$ (177 cubic feet/second) (47 percent below normal) for September 1985 through August 1986.

Since the closing of the dam on the Navidad river in May 1980 the freshwater inflow pattern has been altered; however, it has not deviated much from the historic flow rate of 16 $m^3 \cdot s^{-1}$ (572 cubic feet/second). The Palmetto Bend reservoir project on the Navidad river was designed to supply water for industrial and municipal use and was not intended for flood control. Major floods are allowed to pass through the flood gates and inundate the marsh system associated with the Lavaca-Navidad River delta. Initial filling of Lake Texana from May 1980 to December 1982 resulted in negligible inflow from the Navidad. Freshwater releases beginning in December 1982 through December 1983 on a monthly basis resulted in a daily mean flow of approximately 35 $m^3 \cdot s^{-1}$ (1,250 cubic feet/second) which is above average. January 1984 through December 1985 was a drier period averaging 9.5 $m^3 \cdot s^{-1}$ (340 cubic feet/day). The daily average flow rate from January 1985 through December 1985 increased to 18.5 $m^3 \cdot s^{-1}$ (662 cubic feet/second). Daily flow rates decreased from January through December 1986 averaging 7.9 $m^3 \cdot s^{-1}$ (282 cubic feet/second).

Gilmore *et al.* (1976) correlated mean daily river discharge from the Lavaca and Navidad Rivers plus Garcitas Creek for 4,6,9,15 and 30 day periods ending two days prior to a salinity determination with mean salinity data to test for salinity and freshwater inflows relationships. The nine day inflow had the highest correlation with salinity data ($r = -0.59$, $P \leq 0.01$).

Similar correlations were calculated for Lavaca River stream flow for 14 and 28 days prior to and including the first sampling day of each trip and the mean salinity data for upper Lavaca Bay stations. The 14 day mean inflow was significantly correlated with salinity ($r = -0.55$, $P \leq 0.05$) while the 28 day mean inflow was not significant (Jones *et al.*, 1986).

Historical Salinity Regimes. Galtsoff (1931) during a survey of oysters in Texas measured salinity from 4 ppt at the mouth of the Lavaca River to 20 ppt at Sand Point, to 24 ppt in lower Matagorda Bay on February 4-7, 1926. The salinity gradient at the time of these observations was 1.3 ppt per mile. Salinity was measured at two stations in Lavaca Bay from July 26 through April, 1927. The lowest salinity, 4.5 ppt, occurred in June and July and the highest salinity, 24.5 ppt, was recorded on September 9, 1926. Salinities for January 1966 to December 1966 in Lavaca Bay at channel marker #60 averaged 20.3 ppt and in lower matagorda Bay at buoy #68 averaged 28.2 ppt (Martinez, 1966). Variation between surface and bottom salinity indicates that stratification often occurs, especially in the deeper areas, e.g., the river channel and Matagorda Ship Channel. Salinity at the Lavaca River mouth varied from surface to bottom from 2.7 to 10.7 ppt and 8.2 to 16.0 ppt on February 20 and May 8, 1968 respectively (Hahl and Ratzlaff, 1970). On June 12 and July 18, 1968 surface and bottom salinities were 0.6 to 2.5 and 0.1 to 4 ppt at the river and 13.3 to 24.9 ppt and 12.0 to 26.3 ppt in the ship channel near Port O'Connor indicating mixing in the river and stratification in the ship channel. On April 9, 1969 surface salinity at the river was 8.8 ppt and surface salinity in the lower Matagorda Ship Channel was 28.5 (Hahl and Ratzlaff, 1972). Salinity decreased to 0.6 ppt at the river mouth on April 23, 1969 and increased only to 5.0 ppt by June 19, 1969.

Mackin (1971) studied the effects of oilfield brine effluents on biotic communities in Texas estuaries from September 1970 through June 1971. Although his sampling stations were designed to study oilfield brine, they were established in areas from up river near freshwater influence along a gradient to higher salinity estuarine sites. Areas sampled included the Menefee Lakes 1 and 2 associated with the upper river marsh system, the Lavaca River and Redfish Lake and the junction of Lavaca Bay and Matagorda Bay at the Magnolia Beach area. Menefee Lake 1 was in close proximity to the Lavaca River while Menefee Lake 2 was upstream from the head of Menefee Lake 1.

The Menefee Lakes in September 1970 had a salinity range of 1 to 4 ppt. The average salinity in Menefee 1 increased to 12.5 to 13.3 ppt in February and March, 1971 and decreased to 4 ppt in June 1971. Menefee 2 remained a fresh to brackish lake while Menefee 1 changed from a brackish pond to a moderately saline mini-bay.

In Redfish Lake salinities ranged from 1 to 7 ppt from September to December

1970 increasing to a high of 17 ppt in May, 1971.

The up-river station ranged from 0 ppt in September, 1970 to 13 ppt in May 1971 and the lower river station ranged from 0 ppt to 22 ppt for the same period. Low inflow periods obviously resulted in the movement of higher salinity bay waters up-river.

Mackin (1971) stated that the stations at the junction of Lavaca and Matagorda Bays, excepting for the Baffin Bay area, were the highest salinity areas studied. In October 1970 the salinity range from Station 1 to Station 10 was 20 to 26 ppt and in June 1971 all of the stations were approximately 29 to 30 ppt.

Salinities at the mouth of the Lavaca River from March 1970 to February 1971 ranged from 0.24 to 20.0 ppt and averaged 10.8 ppt (Blanton *et al.*, 1971). In lower Lavaca Bay for the same period salinities ranged from 10.9 to 28.4, averaging 20.4 for the year.

Freshwater inflow from Garcitas, Venado Creek and Chocolate Bayou primarily influences the bay area near the creeks while inflow from the Lavaca and Navidad Rivers influences the whole bay (Gilmore *et al.*, 1976). There is evidence that freshwater inflow tends to flow to the west side of Lavaca Bay with salinities averaging about 2 ppt lower than salinities on the east side. Gilmore *et al.* (1976), reported salinities ranging from 0 ppt at upper bay sites to 33 ppt in the lower bay with an overall average of 10 ppt for the period of January 1973 through June 1975.

A study of the freshwater inflow effects on the Lavaca River delta and Lavaca Bay was conducted from November 1984 to August 1986 (Jones *et al.*, 1986). The average salinity from up-river to the Lavaca River delta from November 1984 to August 1985 ranged from 1.4 to 8.0 ppt with an overall mean of 4.5 ppt. The period from October 1985 to August 1986 had an average salinity range from 4.3 to 14.8 ppt with an overall average of 13.5 ppt for the same area.

Faunal Assemblages. The distribution and abundance of benthic fauna in the Lavaca Bay system are associated with salinity zones within a salinity gradient from fresh to higher salinity waters. Studies on benthos in Lavaca Bay which related species distributions to salinity are Blanton *et al.* (1971), Mackin (1971), Gilmore *et al.* (1976), and Jones *et al.* (1986).

Three distinct habitats were sampled by Mackin (1971) in the Lavaca Bay system. Menefee Lakes and Redfish Lake are connected to the Lavaca River by bayous and are surrounded by marsh. The river stations were in the Lavaca River and the bay stations were located in lower Lavaca Bay. Menefee 2 remained as a freshwater zone throughout Mackin's study while Menefee 1, Redfish Lake and the river stations changed from a low salinity zone to a moderate salinity zone as the study progressed. A higher salinity zone was associated with lower Lavaca Bay.

The most abundant species in Menefee 1 were the oligochaetes *Limnodrilus* sp. and *Peloscolex gabriellae*, insect larvae *Tendipes*, the polychaetes *Polydora socialis* and *Streblospio benedicti* and the mollusc *Mulinia lateralis*. The fauna changed from a freshwater community to a marine community at about the same rate salinity increased. Total abundance increased with increasing salinity with peaks in April and May in both abundance and salinity. Mackin (1971) states that according to most studies the fauna of the transitional zone between the freshwater habitat of lakes and the higher salinity of estuaries should be the least productive of species and individuals. In Menefee Lakes variations in salinity result in sums of freshwater, brackish water and higher salinity species which results in total production far in excess of a permanent brackish water habitat. Changes in salinity gradients results in the movement of brackish water communities up and down the estuary.

The salinity at Menefee Lake 2 was low throughout the study with little variation (1-6 ppt). The dominance of *Tendipes* sp. throughout the year corresponds to the low salinity conditions.

The fauna of Redfish Lake was almost identical to Menefee Lakes. The main differences were the absence of the mollusks *Probythinella protera, Congeria leucophaeta* and *Rangia cuneata* from the Menefee Lakes and the greater number of insect species and greater number of crustaceans in the Menefee Lakes. *Streblospio benedicti*, *Polydora socialis, Mulinia lateralis*, were species which had a positive response to increased salinity at the lake stations. *Tendipes* was not collected in June 1971 following high salinities.

Intermittent high freshwater inflow in Lavaca River and incursions of higher salinity estuarine water caused salinity fluctuations from 0 ppt to 22 ppt at the river stations. The most dominant species in the river were *Tendipes* sp., *Mulinia lateralis*, *Mediomastus californiensis*, *Streblospio benedicti*, and harpacticoid copepods (most likely *Scottolana canadensis*). Responses to higher salinities were increases in *Mulinia lateralis*, *Streblospio benedicti*, *Mediomastus californiensis*, and the absence of Tendipes in June 1971.

Higher salinities with little variation between stations was characteristic of the stations in lower Lavaca Bay. The higher salinity zone was characterized by *Prionospio pinnata, Mediomastus californiensis, Glycinde solitaria, Cumacea* sp., *Mulinia lateralis, Nuculana concentrica, Retusa canaliculata, Nuculana acuta*, and *Pandora trilineata*. Mackin (1971) described the Lavaca Bay area as comparable to an oligotrophic lake, i.e., a high number of species with low individual productivity. This supports a statement by Parker (1959), i.e., when physical conditions are stable and within the normal range for marine environments there will be many species but fewer individuals per species.

A total of 150 species was collected from the bottom samples during Mackin's study. Slightly over half of the species were polychaetes, eight of which were numerically dominant. The mollusk, *Mulinia lateralis*, was the most dominant species reaching peak abundance in February and March, maintaining high numbers through June 1971. Total abundance was low in the summer through fall and high in the winter and spring.

The ecology of Lavaca Bay was studied by Blanton *et al.* (1971), from March 1970 through February 1971. A total of 60 taxa was reported for the benthos of which the dominant were polychaetes. No individual species abundance data was given. Most of the species from their species list were those with a preference for moderate salinities. Chironomid larvae were the only low salinity species reported.

Blanton *et al.* (1971) described upper Matagorda (Lower Lavaca Bay), Galveston, and Copano Bays as low energy estuaries with an average benthic abundance of approximately 3000 individuals/m^2. When comparing density abundance among some Texas estuaries and Hadley Harbor near Woods Hole, Massachusetts densities ranged from highs of 115,000$\cdot m^2$ in grass flats and 15,000$\cdot m^2$ in a silty clay bottom in Hadley Harbor to a low of less than 1000$\cdot m^2$ in Corpus Christi Bay, Texas. The average density for Lavaca Bay for this comparison was 3,500$\cdot m^2$. Blanton *et al.* (1971), found considerable variation in abundance at stations in lower Lavaca Bay but most months were near or exceeding 3,000$\cdot m^2$. Lower abundance in the ship channel ranging from 0 to 2,075$\cdot m^2$ was attributed to dredging and ship traffic.

The maximum density, 60,000$\cdot$m^2, occurred near Mitchell Reef and averaged 11,895$\cdot$m^2 for the year.

Moseley and Copeland (1974) and Moseley *et al.* (1975), studied the ecology of Cox Bay, and from November 1973 through November 1974, a tertiary bay adjacent to Lavaca Bay, for the period of August 1969 to June 1973. They studied Cox Bay before and during initial operation of Central Power and Light's power plant operation.

A total of 80 species were collected from Cox and Keller Bay and the Matagorda Ship Channel from August 1969 to June 1973. The dominant species were *Prionospio, Glycinde, Mulinia and Macoma.* Species numbers and individuals were low making analysis of patterns impossible (Moseley and Copeland, 1974). The use of a 1 mm sieve was probably their problem for obtaining low numbers. They concluded that the benthos was randomly distributed and power plant operation did not change random distribution in any significant way. Thirty-six species were collected from November 1973 through November 1974 of which 95 percent were mollusks and polychaetes. The most common species were the mollusc *Mulinia lateralis* and the polychaete *Mediomastus californiensis.* Other species were *Cossura delta, Glycera americana, Glycinde solitaria* and *Prinospio pinnata.* Analysis of the seasonal distribution of the benthos was not performed due to loss of data in computer analysis; however, species diversity was lowest during the warmer months of the year.

A study of the effects of freshwater on the benthic communities of Lavaca Bay was conducted for a 30 month study from January 1973 through June 1975 (Gilmore, 1974; Gilmore *et al.*, 1975; Gilmore *et al.*, 1976). Monthly samples were collected from the river area including the lower Lavaca River and Swan and Redfish Lakes and from Lavaca Bay. Freshwater inflow for the first 8 months of this study was 300 percent above normal.

The dominant species from the river area were *Rangia cuneata*, Chironomid larvae, *Hypaniola gunneri*, and *Littoridina sphinctostoma.* These species conform to those found in upper San Antonio Bay which is influenced by freshwater inflow from the Guadalupe River (Harper, 1973; Matthews *et al.*, 1974).

The upper and lower parts of Lavaca Bay were characterized by different species groups. The dominant species in the upper bay were *Littoridina sphinctostoma, Mulinia lateralis, Mediomastus californiensis, Streblospio* *benedicti*, and *Rangia cuneata*. Within this group, *L. sphinctostoma* and *R. cuneata* are restricted to low salinities while the other dominant species are generally found in moderate salinities with the exception of *M. lateralis* which can thrive in low or high salinities (Parker, 1975). The higher salinity lower bay was characterized by a dominance of the polychaetes, *Cossura delta, Nereis succinea, Glycinde solitaria* and a nemertean (Gilmore *et al.*, 1976).

Species diversity declined from the high salinity lower bay to the low salinity upper bay and river area (Gilmore *et al.*, 1976). The highest species diversity occurred in the late winter and early spring when sustained freshwater inflow were generally low (Gilmore *et al.*, 1976).

Lavaca Bay benthic populations increased as salinity decreased and organic carbon increased. Population increases were due to *M. californiensis, L. sphinctostoma* and *R. cuneata* at stations already occupied and their dispersion to lower bay stations occurred as salinity decreased (Gilmore, 1974).

Seasonal patterns varied over the 30 month study period. High summer and low winter populations were reported from January through August 1973 (Gilmore, 1974). Densities were low in late summer, high in the winter and spring followed by a decline in early summer during the period of September 1973 through July 1974 (Gilmore *et al.*, 1975). Densities remained low until early fall when they increased, decreased and remained low through the winter and spring and increased in the summer (Gilmore *et al.*, 1976).

Mean standing crop values from benthic studies in Lavaca Bay by Mackin (1971) ($1809 \cdot m^{-2}$) and Gilmore *et al.* (1976) ($1801 \cdot m^{-2}$) are similar to values reported by Matthews *et al.* (1974) ($1450 \cdot m^{-2}$) for San Antonio Bay. Higher mean densities were reported by Blanton *et al.* (1971) for March 1970 to February 1971 ($3500 \cdot m^{-2}$) and by Kalke in Jones *et al.* (1986) for the periods of November 1984 to August 1985 ($5320 \cdot m^{-2}$) and October 1985 to August 1986 ($6790 \cdot m^{-2}$) in upper Lavaca Bay. These differences can be attributed to collecting techniques, station locations, and inter-annual variability.

Reduction of inflow resulting from the Palmetto Dam will result in increased bay salinities and the range expansion of lower by species into the upper bay. *Rangia cuneata* and *Littoridina* having low salinity requirements would be restricted to areas farther upstream (Gilmore *et al.*, 1976).

The Lavaca and Matagorda Bay benthos was sampled in 1975 by the University of Texas Bureau of Economic Geology (White *et al.*, 1985). Lavaca Bay was characterized by a river influenced, an open bay center and an oyster reef assemblage. The river influenced area was represented by the brackish water species *Rangia cuneata*, *Texadina sphinctostoma*, and *Parandalia fauveli* and the ubiquitous bay species *Mulinia lateralis*, *Mediomastus califoriensis*, and *Ampelisca abdita*. This zone was described as being subjected to greater salinity fluctuation than other environments (White *et al.*, 1985). Species common to the Lavaca Bay open bay center were the polychaete *Paraprionospio pinnata* and *Cossura delta*, the mollusks *Acteocina canaliculata* and the crustacean *Ampelisca abdita*.

Mollusks dominated the oyster reef assemblage, i.e., *Crepidula plana*, *Diplothyra smithii*, and *Crassostrea virginica* along with the polychaete *Nereis succinea*.

The open bay center assemblage in Matagorda Bay was dominated by the mollusk *Nuculana concentrica* and the polychaete *Lumbrinereis verilli* and *Paraprionospio pinnata* which are also found on the inner shelf in the Gulf (White *et al.*, 1985). They found the highest number of species and individuals at an inlet influenced area near Pass Cavallo. Species from the pass were *Natica pusilla*, *Abra equalis*, *Tellina versicolor*, *Parviculina multilineata*, *Armandia agilis* and *Phyllodoce arenae*.

A two year study of freshwater inflow effects on the benthos of the Lavaca River Delta and the upper Lavaca Bay was conducted from November 1984 through August 1986 (Jones *et al.*, 1986). The first year followed a dry period of low inflow through most of 1984 and was characterized as a wet period with inflows 18 percent above normal. Inflow decreased in the second year to approximately 54 percent less than the first year.

The benthic macrofauna in the upper Lavaca Bay was limited to a few dominant organisms consisting of the polychaetes, *Mediomastus californiensis* and *Streblospio benedicti*, Chironomid midge fly larvae, and the mollusks *Macoma mitchelli* and *Mulinia lateralis* (Jones *et al.*, 1986).

The abundance of macrofauna was highest in the winter-spring period and lowest in the summer. These seasonal trends in abundance were inversely correlated with river inflow, i.e., the greatest abundance of macrofauna occurring when the river inflow was the lowest (Jones *et al.*, 1986).

The distribution of infauna by depth in the sediment was observed by sectioning sediment core samples at 0-3, 3-10 and 10-20 cm. The infaunal abundance decreased with depth and biomass increased with depth (Jones *et al.*, 1986).

There were only two species which had an obvious response to increased freshwater influence. Chironomid insect larvae and the polychaete *Hobsonia florida* had a positive lag response to freshwater inflow (Jones *et al.*, 1986).

No *Littoridina sphinctostoma* were reported and only a few individuals of *Rangia cuneata* were collected. This is contrary to the distribution of *L. sphinctostoma* and *R. cuneata* from January 1973 through June 1975 (Gilmore, 1974; Gilmore *et al.*, 1976). Low inflow during most of 1984 probably caused salinity increases above the tolerance limits for these species, causing their distribution to be limited to areas other than our sample sites. Large numbers of dead *Rangia cuneata* shells were found in Redfish and Swan Lakes but no live specimens were collected from these areas. It is possible that a few specimens of *L. sphinctostoma* were misidentified as *Odostomia* sp. (personal observation).

To compare estuarine benthic communities in relation to freshwater inflow between different bay systems The University of Texas Marine Science benthic group sampled the benthos in Lavaca and Matagorda Bays in April, July and November, 1988 and April 1989 in conjunction with sampling in San Antonio Bay and Laguna Madre (Montagna & Kalke, 1989b). Nueces and Corpus Christi Bays were sampled in conjunction with Lavaca Bay only in April and July 1988. Four stations were sampled: A and B in Lavaca Bay an upper enclosed secondary bay in close proximity to freshwater inflow from the Lavaca River and C and D in Matagorda Bay, an open primary bay. Freshwater inflow during this sampling period was low. The mean salinities at stations A, B, C and D were 26.7, 28.4, 30.2 and 30.4 ppt, respectively. The species composition in Lavaca and Matagorda Bays is similar to the Nueces-Corpus Christi Bay system but the mean numerical abundance is higher than those found in Nueces and Corpus Christi Bays. The general trend for species numbers, abundance and biomass is to increase from upper Lavaca Bay to lower Matagorda Bay. This gradient is not as pronounced as that found in Nueces-Corpus Christi Bay. The polychaetes *Mediomastus californiensis*, *Streblospio benedicti* and *Glycinde solitaria*, the amphipod *Ampelisca abdita*, and the mollusk *Mulinia lateralis* comprise 82% of the total abundance at station A and 18% of the total abundance at station D. Dominant species in the lower primary bay were the polychaetes, *Mediomastus californiensis, Polydora caulleryi, Brania clavata, Gyptis vittata, Glycinde solitaria, Tharyx setigera, Drilonereis magna* and *Minuspio cirrifera;* the tanaidacean *Apseudes* sp A., the mollusks *Corbula contracta* and *Periploma cf. orbiculare*, a hemichordate, *Schizocardium* sp., and rhyncocoels. The mollusk biomass was highest at stations A (57%) and B (40%) decreasing at stations C (1%) and D (17%). Polychaetes accounted for approximately 50% of the biomass at all stations. At station B the hemichordate, *Schizocardium* sp. made up 42% of the biomass. This species was dominant in biomass in Corpus Christi Bay in 1981-1984 (Flint and Kalke, 1986). The ophuiroid, *Amphiodia limbata* occurred in Matagorda Bay accounted for 20 percent of the biomass at station D. Crustaceans contributed a notable percent of the biomass in the secondary and primary bay. *Ampelisca abdita* was most abundant at stations A and B, *Pinnixa chacei* was found at stations C and D and *Apseudes* sp A was dominant at station D (Montagna & Kalke, 1989b).

NUECES ESTUARY

Freshwater inflow into the Nueces estuary is primarily from the Nueces River. The combined gaged and ungaged freshwater inflow from the Nueces River averaged 682,000 acre feet per year for the period of 1941 through 1976 (TDWR, 1982). The Nueces River delta is a marsh system covering an area of approximately 3,845 hectares (9,500 acres). Historically two annual flood events, approximately in May and September, result in the inundation of the deltaic marsh. Water depth at mean low water in Nueces Bay is less than three feet to less than 13 feet in Corpus Christi Bay.

Corpus Christi Bay is composed of Nueces, Oso and Corpus Christi Bays with a surface area of approximately 54,230 hectares (134,000 acres). It is located between 27°40′ and 27°55′ North latitudes and 97°10′ and 97°30′ West longitudes. Corpus Christi Bay borders between a semi-arid climatic zone to the south and a dry sub-humid zone to the north (Hedgepeth, 1953). This area has very sharp gradients of climatological and meteorlogical factors (Hood, 1953).

Historical Salinity Regimes. The intrusion of Laguna Madre waters into Corpus Christi Bay is evident from salinity gradients as reported in June and August

1952 (Hood, 1953). In August 1952, Hood measured bottom water salinities from 56 ppt near the entrance to upper Laguna Madre to 46 ppt near Shamrock Island. The overlying surface water during this period was 45 ppt.

Low salinities in Nueces Bay from June through December 1973 and in August and September 1974 were correlated with periods of high inflow from the Nueces River in June, September and October 1973, and August through September 1974 (Kalke, 1981). Salinity decreases in Corpus Christi Bay in June, September and October 1973 were correlated with high inflow from from Oso Creek however, increased inflow in June and September 1974 were not correlated with lower salinities. Higher salinity water associated with Corpus Christi Bay readily mixes with freshwater from the Oso resulting in a short term residence time for this freshwater source while the larger volume freshwater input from the Nueces River was more persistent.

Salinity patterns from October 1972 through May 1975 exhibited a great deal of variability. Freshwater inflow from the Nueces River and Oso Creek was considerable at times. Sources of high salinity waters were the Aransas Pass, the Fish Pass (currently silted over) and periodically Oso Bay. Occasionally, lower salinity water (20-25 ppt) from along the Gulf shore enters lower Corpus Christi Bay pushing higher salinity (25-30 ppt) bay water up the estuary (Holland *et al*., 1975). The presence of low salinity coastal waters adjacent to Corpus Christi Bay occurred during the period from July 1981 to October 1983 was reported by Flint *et al*. 1986). Surface and bottom salinities, as with temperatures, were generally similar indicating wind mixing (Holland *et al*., 1975). The most obvious salinity gradients occurred in channel areas.

Faunal Assemblages. Corpus Christi, lower Matagorda, Aransas and west Galveston Bays are characterized as large open bays with direct access to the Gulf of Mexico (Blanton *et al*., 1971). The bay centers of these bay systems typically have soft surface sediments composed of fine clay and silt with high organic content. Sediment type is important in determining the type of fauna which inhabit different areas for example the soft bottom bay center usually have a low species diversity of mainly deposit feeders (Parker, 1959). Blanton *et al*. (1971) compared the benthic standing crop of Corpus Christi Bay ($500 \cdot m^{-2}$) with similar bays and determined that it was lower than other bays sampled.

Benthic collected in the early 1950's in Corpus Christi Bay had few or no organisms (Parker & Blanton, 1970; Blanton et al., 1971).

The bay margins of large open bays are characterized by sandy sediments, ranging from sand-silt-clay to almost pure sand (Parker, 1959). Larger clams, i.e., *Mercenaria* and *Cyrtopleura* are characteristic of this assemblage. The fine silty clays of the bay centers will not support the weight of these large clams. In contrast the fine well sorted sands next to the shorelines are too dense for these animals to penetrate (Parker, 1959).

The benthos of Corpus Christi, Copano and Aransas Bays was studied from October 1972 through May 1975 (Holland *et al.*, 1975). A total of three hundred and ninety five taxa were found during this period. The polychaetes were the most dominant of organisms numerically, spatially, and temporaly. Only two *Rangia flexuosa* and one chironomid larvae were collected from Nueces Bay during this study (Holland *et al.*, 1975). This indicates that the freshwater influenced area in upper Nueces Bay is minimal compared to other Texas bays i.e., upper San Antonio and Lavaca Bays. The polychaete *Mediomastus californiensis* was the most numerically abundant species along with *Streblospio benedicti*, *Prionospio pinnata*, *Cossura delta*, *Glycinde solitaria*, and *Gyptis vittata*. These are typical estuarine species associated with moderate to high salinities.

Mollusks were the second most common group of which the most abundant species were *Mulinia lateralis*, *Lyonsia hyalina florida* and *Macoma mitchelli*. Less abundant species collected were *Aligena texasiana*, *Mysella planulata*, *Tellina iris* and *Tellina alternata*.

The overall average standing crop for Nueces Bay 830 • 0.5 ft^3, S.D. = 744, was higher than standing crops in Corpus Christi Bay, 432 • 0.5 ft^3,S.D. = 432 (Holland *et al.*, 1975). Fluctuations in standing crop were variable in Nueces Bay between months and stations. Increases in populations of *Streblospio benedicti*, *Mediomastus californiensis*, *Corophium louisianum*, and *Mulinia lateralis* at various times caused major changes in standing crops in Nueces Bay. In general the mean standing crop values for Corpus Christi Bay were very stable during the entire study. Variations in densities between stations were attributed to sediment type, salinity and station location in relation to Aransas Pass.

A 4.5 year study of the benthic communities in Corpus Christi Bay was conducted between September 1974 and February 1976 (Flint and Younk, 1983). The sampling site was located near Sun Oil Docks, Port Ingleside, with three stations in the channel and three stations in the shoal waters parallel with the channel sites. Salinity was different between the bottom water, the channel, and shoal water stations. The salinity at the shoal water sites was usually lower than the channel waters due to the effect of offshore water following the bottom of the channel.

A total of 313 taxa were collected during this study, of which the most abundant were the polychaetes *Mediomastus californiensis*, *Paraprionospio pinnata*, *Streblospio benedicti* and *Aricidea jeffreysii*. The most abundant molluscs were *Mulinia lateralis*, *Lyonsia hyalina floridana*, and *Abra aequalis*.

The number of species were much greater at the shoal stations (mean = 55.5) than at the channel sites (mean = 21.6). Peaks in abundance occurred in the winters of 1975, 1977 and 1979. These winter peaks were associated with increased densities of the mollusks *M. lateralis* and *A. aequalis*.

Densities at the shoal stations averaged between 2,000 and 18,890 animals • m^{-2} with a mean species diversity of 3.76 compared to a comparable area in the Corpus Christi Bay study by Holland *et al*. (1975), where the densities ranged between 1,770 and 8,600 animals • m^{-2} with an annual mean species diversity of 3.61 (Flint and Younk, 1983).

Channel station mean densities between 390 and 6,440 animals • m^{-2} with a mean diversity of 2.96 compared favorably to a similar station sampled during the Holland *et al*. (1975) study where densities were between 870 and 8,580 animals • m^{-2} with an annual mean species diversity of 1.84.

Dredging of the channel during their study resulted in a decrease in population densities. The highest densities of *M. lateralis* for the study period occurred during the later stages of dredging probably as a result of minimal competition from other species disrupted during dredging. *Mulinia* densitites declined after the recolonization by *Paraprionospio pinnata* and *Mediomastus californiensis*.

Species and total density increased at the shoal sites during the winter periods of 1974-75 and 1976-77 which corresponded to the two lowest salinity periods during the entire study (Flint and Younk, 1983).

On September 18, 1979 during a 24 hour period a low pressure system impacted the Texas coast resulting in precipitation measuring as much as 33 cm in the Corpus Christi Bay area (Flint *et al.*, 1981; Flint and Rabalais, 1981). The benthic study reported by Flint and Younk (1983) was continued from October 1979 to July 1981 to document changes in the benthic habitat resulting from excessive riverine input and local runoff.

This freshwater inflow event resulted in a relative long term period of low salinities measured in the Corpus Bay system. The salinity decreased from approximately 32 ppt to 18 ppt from September 20 to September 27, 1979. Salinities remained below historic seasonal levels through the middle of October 1979 (Flint and Rabalais, 1981). This freshwater inflow event was unique to the area since such inflow had not occurred since Hurricane Beulah in 1967.

A list of the ten most abundant species for seven years of sampling from this area comprised 85% of the total fauna collected from the ship channel. The channel species in order of dominance were *Abra aequalis*, *Mediomastus californiensis*, *Oligochaetes*, *Balanoglossus* sp. (*Schizocardium n* sp), *Streblospio benedicti*, *Paraprionospio pinnata*, *Rhyncocoels*, *Mulinia lateralis*, *Sigambra tentaculata* and *Cossura delta*. The ten most dominant shoal species for the same period made up 70% of the total fauna collected. The shoal species in order of dominance were *Mediomastus*, *californiensis*, *Paraonidae* spp A, *Lyonsia hyalina floridana*, *Mulina lateralis*, *Abra aequalis*, *Balanoglossus* sp (*Schizocardium* n sp), *Streblospio benedicti*, *Oligochaete*, *Rhyncocoels*, and *Paraonidae* spp. B.

During the winter-spring of 1980 (January-May) following the September 1979 storm, the total mean infaunal density was greater than had ever been recorded in the bay before as indicated by the data from Flint *et al.* (1981) as well as data from (Holland *et al.*, 1975).

The fauna responsible for the majority of the post-storm increase in biomass were *Abra aequalis*, *Lyonsia hyalina floridana*, *Lucina multilineata*, and *Mulinia lateralis*, and *Rhyncocoels*. After the 1980 increase in benthic production infaunal biomass in 1981 returned to levels calculated for previous years (Flint *et al.*, 1983). The 1979 storm inflow event had a positive impact on the benthic productivity of the Corpus Christi Bay ecosystem (Flint *et al.*, 1981).

The Nueces estuary's benthic community structure, biomass, benthic metabolism and benthic nutrient regeneration were studied by scientists from the University of Texas Marine Science Institute from July 1981 through July 1983 (Flint *et al.*

1983). Sampling sites were established along a salinity gradient from upper Nueces Bay to the middle of Corpus Christi Bay. Salinities ranged from 5 to 34 ppt in Nueces Bay to 22 to 32 ppt in Corpus Christi Bay. The macroinfauna in Nueces Bay was dominated by *Mulinia lateralis, Streblospio benedictii* and *Mediomastis californienses* and was distinct from the rest of the study area. Species representative of the middle portion of Corpus Christi Bay were *Mediomastus californiensis*, *Polydora caulleryii, Paraprionospio pinnata, Gyptis vittata* and *Schizocardium* sp. A station along the ship channel, near Sun Oil Docks, had the highest species diversity and had similar community structure to coastal Gulf of Mexico stations indicating a strong Gulf influence in the Channel area (Flint *et al*. 1983).

The total number of species increased from upper to lower bay but abundance and biomass were lowest near the ship channel and Gulf waters. The highest abundance and biomass were found in the center of Corpus Christi Bay and was attributed to the stability of the environment (Flint *et al*. 1983). Infaunal biomass appeared to peak between January and July reaching a low usually in fall and early winter. In April 1982 colonization of the mid-Corpus Christi Bay area by the acorn worm *Schizocardium* sp resulted in an increase in biomass and abundance which remained high throughout the study.

Sediment composition in Nueces Bay was 50% sand with shell, 70% clay in middle Corpus Christi Bay, and 90% sand near the Aransas Pass Ship Channel. There was very little difference observed in overall sediment metabolism from upper Nueces Bay to Corpus Christi Bay, however; there was a general decrease in benthic nutrient regeneration from the upper Nueces Bay toward the Gulf influence at the channel site.

The University of Texas Bureau of Economic Geology in 1975 sampled the submerged lands of Texas to characterize these lands in terms of sediment distribution, selected trace and major element concentrations and benthic macroinvertebrate populations (White *et al*., 1983). The purpose of their study was to identify and enumerate the macrofauna, identify and characterize faunal assemblages and to correlate sediment faunal relationships. Temporal data was not taken during their study. Eight faunal assemblages were determined to characterize the bays and lagoons around the Corpus Christi area which includes the following: open bay center, open bay center depauperate, oyster reef, inter-reef, grass flat, bay margin, inlet influenced, and river influenced assemblages.

Nueces Bay is characterized by a river influenced assemblage where salinity is probably the most important environmental variable influencing species (White *et al.* 1983). The most common species collected in Nueces Bay were *Mulinia lateralis, Mediomastus californiensis,* and *Paraprionospio pinnata*. *Texadina (Littoridina) sphinctostoma*, characteristic of low salinity river influenced areas was not collected from Nueces Bay.

The largest area of Corpus Christi Bay was characterized by the open bay center depauperate assemblage and covers approximately half of the bay. The rest of the bay was comprised of inlet influenced, bay margin and open bay center assemblages. Species composition of the open bay center assemblage was dominated by *Mulinia lateralis*, *Paraprionospio pinnata*, and other deposit feeding polychaetes while the depauperate assemblages were populated mainly by *M. lateralis* and *P. pinnata*. The highest species counts in Corpus Christi Bay were associated with the area around the Corpus Christi Ship Channel.

The inlet influenced assemblage was composed primarily of molluscs with some species representatives being restricted to the inlet while some were also found on the inner shelf. The sediment at the inlet sites was sandy and the species diversity was high.

Oyster reefs in Corpus Christi Bay are not as extensive as in Copano Bay and the characteristic associated fauna are different (White *et al.* 1983).

The shallow bay margin assemblages were composed of the polychaete *Paraprionospio pinnata*, ubiquitous bivalves, and one dominant crustacean.

The University of Texas Marine Science Institute was contracted by the Texas Water Development Board to continue freshwater inflow work in Nueces/Corpus Christi Bay from October 1987 through July 1988. Four stations were sampled: A and B in Nueces Bay, an upper enclosed secondary bay and C and D in Corpus Christi Bay, an open primary bay influenced by Gulf of Mexico waters through Aransas Pass. Freshwater inflow was low during this study period resulting in high salinities, ranging from a mean of 31.2 ppt at station A to a mean of 34.2 ppt at station D. There was an absence of low salinity species, ie. *Littoridina sphinctostoma* and *Hobsonia florida* associated with lower salinity stations in San Antonio Bay. The species collected in Nueces/Corpus Christi Bay were similar to those found in Lavaca/Matagorda Bay, however, their total density was usually lower in the Nueces/Corpus Christi estuary. Species numbers, abundance and biomass increased from upper Nueces Bay to lower Corpus Christi Bay. *Streblospio benedicti*, *Mediomastus californiensis*, *Mulinia lateralis* and *Macoma mitchelli* accounted for 97% of the total abundance at station A and for only 24% of the total abundance at station D, due to a low abundance of *Mulinia lateralis* and *Macoma mitchelli* in the lower bay. Species common to lower Corpus Christi Bay were the polychaetes *Polydora caulleryi*, *Mediomastus californiensis*, *Tharyx setigera*, *Streblospio benedicti*, *Paraprionospio pinnata*, *Cossura delta*, *Clymenella torquata calida*, and *Gyptis vittata*; a phoronid *Phoronis architecta*, the mollusk *Aligena texasiana* and rhyncocoels. The mollusks dominated the biomass at stations A (85%) and B (41%) in Nueces Bay decreasing at stations C (30%) and D (6%) in Corpus Christi Bay. Polychaetes comprised only 14% of the biomass at station A increasing at stations B (58%), C (56%) and D (81%). The mollusk *Periploma cf. orbiculare* and the brittle star *Amphiodia limbata*, were common, although never abundant in Corpus Christi Bay. These species seem to prefer the soft sediment, high salinity environment found in open bay systems, i.e., Corpus Christi and Matagorda Bays.

SUMMARY

Benthic community studies over the years have produced variable results ie., differences in densitities, biomass and temporal distributions of benthic fauna. Physical factors that control benthic community structure in Texas estuaries are salinity, temperature, sediment type, waves and currents, radiant energy from the sun, and sediment chemistry. Salinity is most often used by authors to relate to the spatial distribution of species, abundance and biomass.

Most authors have organized Texas estuaries into zoogeographic zones which we have outlined in Table 1 (Ladd, 1951; Parker, 1959; Mackin, 1971; Blanton *et al*., 1971; Harper, 1973; Matthews *et al*., 1974; Gilmore *et al*., 1976; White *et al*., 1983; Jones *et al*., 1986; White *et al*., 1985; Montagna and Kalke 1989a; 1989b). Typically, these zones ranged from the freshwater influenced, upper or secondary bays, along a gradient to marine influence in the lower or primary bays. The authors have either defined their own, or used different terms which describe the zones and their associated fauna from the upper to lower bay. We recognize three generic zones in Texas estuaries in regard to a salinity gradient and the benthic communities along this gradient (Tables 2-4). These are a freshwater zone, an estuarine zone and a marine zone. The estuarine zone is where fresh and salt water are mixed, and salinities are intermediate. The boundaries of the estuarine zone are the most susceptible to intra- and inter-annual climatic variations. Since our studies have dealt with only the open bay, soft bottom communities we are not referring to zones or sub-zones, i.e. oyster reefs, bay margins and inlets in this summary which have been introduced in other studies.

Community differences were found between the open bays, e.g. Lavaca-Tres Palacios (Table 3) and Nueces Estuaries (Table 4), and the closed bay, i.e. the Guadalupe Estuary (Table 2). Although separated geographically the Lavaca-Tres Palacios Estuary and the Nueces Estuary are more similar to each other than each is to the Guadalupe Estuary. Both the Lavaca and Nueces estuaries have an upper secondary bay and a large open primary bay directly connected to the Gulf of Mexico via passes. The Guadalupe Estuary is very different. San Antonio Bay is divided into upper and lower San Antonio Bay and does not have direct access to the Gulf. Species occurrence and abundance data from the studies reviewed have made it possible to construct tables which summarize the species and average infaunal densities in relation to the three proposed zoogeographical zones (Tables 5-7).

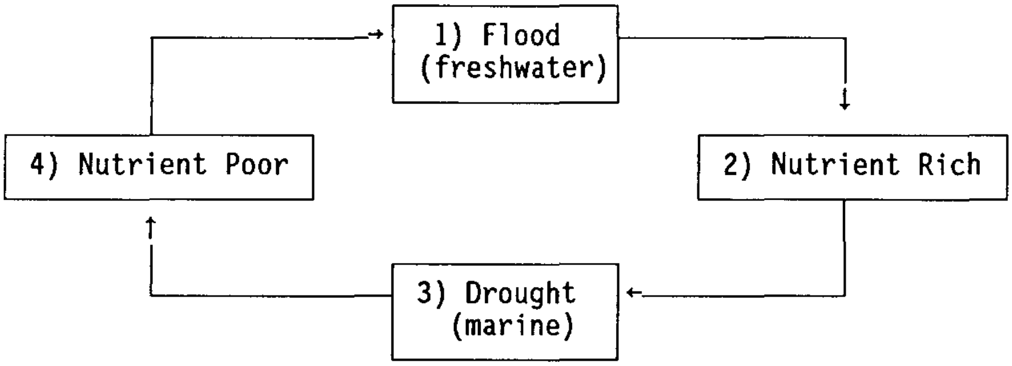
The total number of species in both open and closed systems increases along a salinity gradient from the freshwater influenced upper bay to the marine influenced lower bay (Tables 5-7). In the open estuarine system (Tables 6 and 7) species common to the upper secondary bay are usually replaced by more marine tolerant species in the lower bay. Total abundance and biomass also normally increase from upper to the lower bay.

Dominant species in the upper bay of the closed estuarine system (San Antonio Bay) are typically part of the dominant fauna in the lower bay during flood years but can be replaced by marine fauna in the lower bay during drought years. Infaunal density and biomass are usually higher in the upper San Antonio Bay and decrease in lower San Antonio Bay. This response is most likely due to nutrient input and sediment loading during periodic flooding.

CONCLUSION

When a benthic sample is collected in conjunction with hydrographic data, a record of the benthic community structure with known environmental factors can be compiled. Estuarine benthic organisms are mainly sessile, can tolerate some environmental fluctuations, and are relatively long-lived, therefore the benthic communities represent a good, long-term indicator of environmental conditions. However, seasonal patterns of reproduction and growth do exist, and there are limits to tolerance. So, environmental changes over time can have an effect on community structure. It is important to keep this in mind when sampling the benthos. It is important to look at the environmental data collected at the time of sampling, but also the historic data, i.e., freshwater inflow patterns prior to sampling, must be considered when analyzing benthic community structure.

The environment associated with the Texas estuaries is subject to hurricanes, inland flooding, droughts, and temperature extremes, which result in an esturine environment which is variable. However, the extremes are cyclical in a chaotic fashion, i.e., storms occurr at predictable intervals over the long term. The most important effect of these events is on the variability of freshwater inflow. Which in turn effects the salinity, nutrients, and sediment-load input to the estuary. This controls the ultimate effect on the benthic communities. The variability in freshwater inflow cycle results in predictable changes in the estuary, which are diagrammed in this temporal model:



Flood conditions introduce nutrient rich waters into the estuary which result in lower salinity. This usually happens very rapidly. During these periods the spatial extent of the freshwater fauna is increased. The estuarine fauna may even replace the marine fauna. The high level of nutrients can stimulate a burst of benthic productivity of predominantely freshwater and estuarine communities. This is followed by a transition to low inflow resulting in higher salinities, lower nutrient, marine fauna, and drought conditions. At first, the marine fauna may respond with a burst of productivity as the remaining nutrients are utilized, but eventually nutrients are depleted. The cycle is repeated with flooding and high freshwater inflow.

This model is supported by the data in the Guadalupe Estuary (Table 5). During successive wet years, densities decrease (stages 1, and 4 to 1). When a dry year follows a wet year the densities increase (stages 1 to 2). The same pattern also occurs in the Lavaca-Tres Palacios Estuary (Table 6) and the Nueces Estuary (Table 7). Other aspects of the model are supported by the Nueces Estuary data (Table 7). Although, there was intervening wet years, densities decreased during successive dry years (stages 3 to 4).

The results of benthic sampling depend on what state this cycle is in during the study. For example, benthic studies in Texas estuaries have often reported a response following a flood period which results in higher abundance and biomass of particular estuarine species (Mackin, 1971; Harper, 1973; Matthews *et al.*, 1974; Gilmore *et al.*, 1976; Kalke in Jones *et al.*, 1986; Flint *et al.*, 1981; Flint and Rabalais, 1981; Montagna and Kalke, 1989a, 1989b). The boundaries that authors draw on the various zones will also be a function on the state of the cycle that the estuary is in. The length of time that the estuaries are maintained in any given state will be a function of the periodicity of storms, floods, and droughts.

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Table 1. Estuarine zoogeographical zones defined by the occurrence and abundance of estuarine benthic infauna. The terminology used in this study is compared with the terminology used by other authors to define similar zones.

	Low Salinity	Moderate Salinity	High Salinity
Montagna & Kalke, 1989a	Freshwater	Estuarine	Marine
	Guadalupe Estuary (closed bay)		
Ladd, 1951	Bay-head facies	Reef and Inter-reef facies	
Parker, 1959	River influenced	Enclosed Bay-low and high salinity oyster reefs	
Harper, 1973	Low salinity group	---	High salinity group
Matthews *et al.*, 1974	Zone 1 (freshwater)	Zone 2 (brackish water)	Zone 3 (high salinity)
White *et al.*, 1985	River influenced	Enclosed bay centers and oyster reefs	
	Lavaca Tres-Palacios Estuary (open bay)		
Mackin, 1971	Freshwater Zone (lakes & rivers)	Moderate salinity (Redfish Lake & river)	High salinity (lower Lavaca Bay)
Blanton *et al.* 1971	---	Upper secondary (enclosed bay)	Large open bay
Gilmore *et al.* 1976	River Area	Low salinity upper bay	High salinity lower bay
Jones *et al.*, 1986	River & lake area	Low to moderate salinity upper bay	---
White *et al.*, 1985	River influenced assemblage	Open bay and oyster reef assemblage	Open bay center assemblage
	Nueces Estuary (open bay)		
Blanton *et al.*, 1971	---	Upper secondary enclosed bay	Large open bay
White *et al.*, 1983	River influenced assemblage	Open bay center assemblage	Open bay center, and depauperate assemblage

Ampelisca abdita	07DEC87	C	3	0-3	1	283.6
Eudorella monodon	07DEC87	C	3	0-3	2	567.2
Leucon sp.	07DEC87	C	3	0-3	1	283.6
Macoma mitchelli	07DEC87	C	3	0-3	1	283.6
Mediomastus californiensis	07DEC87	C	3	0-3	4	1134.4
Paraprionospio pinnata	07DEC87	C	3	0-3	1	283.6
Streblospio benedicti	07DEC87	C	3	0-3	1	283.6
Drilonereis magna	07DEC87	C	3	3-10	1	283.6
Mediomastus californiensis	07DEC87	C	3	3-10	4	1134.4
Macoma mitchelli	08DEC87	A	1	0-3	14	3970.4
Mediomastus californiensis	08DEC87	A	1	0-3	1	283.6
Streblospio benedicti	08DEC87	A	1	0-3	5	1418.0
Mediomastus californiensis	08DEC87	A	1	3-10	2	567.2
Streblospio benedicti	08DEC87	A	1	3-10	1	283.6
Macoma mitchelli	08DEC87	A	2	0-3	10	2836.0
Mediomastus californiensis	08DEC87	A	2	0-3	1	283.6
Rhynchocoels	08DEC87	A	2	0-3	1	283.6
Streblospio benedicti	08DEC87	A	2	0-3	8	2268.8
Mediomastus californiensis	08DEC87	A	2	3-10	1	283.6
Macoma mitchelli	08DEC87	A	3	0-3	8	2268.8
Mulinia lateralis	08DEC87	A	3	0-3	2	567.2
Mysidopsis sp.	08DEC87	A	3	0-3	1	283.6
Streblospio benedicti	08DEC87	A	3	0-3	3	850.8
Mediomastus californiensis	08DEC87	A	3	3-10	3	850.8
Streblospio benedicti	08DEC87	A	3	3-10	1	283.6
Haploscoloplos foliosus	09DEC87	B	1	0-3	1	283.6
Hydrozoa	09DEC87	B	1	0-3	1	283.6
Macoma mitchelli	09DEC87	B	1	0-3	3	850.8
Mediomastus californiensis	09DEC87	B	1	0-3	6	1701.6
Mulinia lateralis	09DEC87	B	1	0-3	1	283.6
Streblospio benedicti	09DEC87	B	1	0-3	1	283.6
Glycinde solitaria	09DEC87	B	1	3-10	1	283.6
Mediomastus californiensis	09DEC87	B	1	3-10	1	283.6
Paraprionospio pinnata	09DEC87	B	1	3-10	1	283.6
Rhynchocoels	09DEC87	B	1	3-10	1	283.6
Clymenella mucosa	09DEC87	B	2	0-3	1	283.6
Glycinde solitaria	09DEC87	B	2	0-3	4	1134.4
Haploscoloplos foliosus	09DEC87	B	2	0-3	1	283.6
Macoma mitchelli	09DEC87	B	2	0-3	4	1134.4
Mediomastus californiensis	09DEC87	B	2	0-3	16	4537.6
Streblospio benedicti	09DEC87	B	2	0-3	1	283.6
Cossura delta	09DEC87	B	2	3-10	1	283.6
Glycinde solitaria	09DEC87	B	2	3-10	1	283.6
Mediomastus californiensis	09DEC87	B	2	3-10	5	1418.0
Haploscoloplos foliosus	09DEC87	B	3	0-3	1	283.6
Macoma mitchelli	09DEC87	B	3	0-3	4	1134.4
Mediomastus californiensis	09DEC87	B	3	0-3	12	3403.2
Streblospio benedicti	09DEC87	B	3	0-3	1	283.6
Cossura delta	09DEC87	B	3	3-10	1	283.6
Glycinde solitaria	09DEC87	B	3	3-10	1	283.6
Mediomastus californiensis	09DEC87	B	3	3-10	2	567.2
Paraprionospio pinnata	09DEC87	B	3	3-10	2	567.2
Caprellid a	10DEC87	D	1	0-3	2	567.2
Erichthonias brasiliensis	10DEC87	D	1	0-3	3	850.8
Gyptis vittata	10DEC87	D	1	0-3	1	283.6
Lembos sp.	10DEC87	D	1	0-3	1	283.6
Mediomastus californiensis	10DEC87	D	1	0-3	18	5104.8
Ancistrosyllis papillosa	10DEC87	D	1	3-10	2	567.2
Caprellid a	10DEC87	D	1	3-10	1	283.6
Gyptis vittata	10DEC87	D	1	3-10	1	283.6
Mediomastus californiensis	10DEC87	D	1	3-10	3	850.8
Ophiuroidea	10DEC87	D	1	3-10	1	283.6
Paleanotus heteroseta	10DEC87	D	1	3-10	1	283.6
Parahesione luteola	10DEC87	D	1	3-10	4	1134.4
Polydora caulleryi	10DEC87	D	1	3-10	7	1985.2
Rhynchocoels	10DEC87	D	1	3-10	1	283.6
Tharyx setigera	10DEC87	D	1	3-10	1	283.6

Clymenella mucosa	10DEC87	D	2	0-3	3	850.8
Listriella barnardi	10DEC87	D	2	0-3	1	283.6
Mediomastus californiensis	10DEC87	D	2	0-3	21	5955.6
Paleanotus heteroseta	10DEC87	D	2	0-3	1	283.6
Paraonidae grp. A	10DEC87	D	2	0-3	1	283.6
Paraonidae grp. B	10DEC87	D	2	0-3	1	283.6
Paraprionospio pinnata	10DEC87	D	2	0-3	2	567.2
Polydora caulleryi	10DEC87	D	2	0-3	3	850.8
Rhynchocoels	10DEC87	D	2	0-3	1	283.6
Drilonereis magna	10DEC87	D	2	3-10	1	283.6
Magelona phyllisae	10DEC87	D	2	3-10	1	283.6
Mediomastus californiensis	10DEC87	D	2	3-10	1	283.6
Paleanotus heteroseta	10DEC87	D	2	3-10	5	1418.0
Paraonidae grp. A	10DEC87	D	2	3-10	2	567.2
Polydora caulleryi	10DEC87	D	2	3-10	4	1134.4
Bivalvia	10DEC87	D	3	0-3	1	283.6
Clymenella torquata calida	10DEC87	D	3	0-3	1	283.6
Drilonereis magna	10DEC87	D	3	0-3	1	283.6
Eteone heteropoda	10DEC87	D	3	0-3	1	283.6
Mediomastus californiensis	10DEC87	D	3	0-3	28	7940.8
Paraonidae grp. A	10DEC87	D	3	0-3	1	283.6
Paraprionospio pinnata	10DEC87	D	3	0-3	5	1418.0
Polydora caulleryi	10DEC87	D	3	0-3	21	5955.6
Rhynchocoels	10DEC87	D	3	0-3	1	283.6
Streblospio benedicti	10DEC87	D	3	0-3	1	283.6
Tharyx setigera	10DEC87	D	3	0-3	4	1134.4
Mediomastus californiensis	10DEC87	D	3	3-10	7	1985.2
Nereidae	10DEC87	D	3	3-10	1	283.6
Oligochaeta	10DEC87	D	3	3-10	1	283.6
Podarke obscura	10DEC87	D	3	3-10	2	567.2
Polydora caulleryi	10DEC87	D	3	3-10	637	180653.2
Tharyx setigera	10DEC87	D	3	3-10	37	10493.2
Glycinde solitaria	15FEB88	C	1	0-3	2	567.2
Leucon sp.	15FEB88	C	1	0-3	1	283.6
Mediomastus californiensis	15FEB88	C	1	0-3	11	3119.6
Oligochaeta	15FEB88	C	1	0-3	1	283.6
Phascolion strombi	15FEB88	C	1	0-3	2	567.2
Streblospio benedicti	15FEB88	C	1	0-3	2	567.2
Cossura delta	15FEB88	C	1	3-10	2	567.2
Mediomastus californiensis	15FEB88	C	1	3-10	2	567.2
Rhynchocoels	15FEB88	C	1	3-10	1	283.6
Clymenella mucosa	15FEB88	C	2	0-3	2	567.2
Eudorella monodon	15FEB88	C	2	0-3	1	283.6
Glycinde solitaria	15FEB88	C	2	0-3	2	567.2
Macoma tenta	15FEB88	C	2	0-3	1	283.6
Mediomastus californiensis	15FEB88	C	2	0-3	3	850.8
Monoculoides sp.	15FEB88	C	2	0-3	1	283.6
Mulinia lateralis	15FEB88	C	2	0-3	2	567.2
Nuculana acuta	15FEB88	C	2	0-3	1	283.6
Paraprionospio pinnata	15FEB88	C	2	0-3	2	567.2
Streblospio benedicti	15FEB88	C	2	0-3	1	283.6
Turbellaria	15FEB88	C	2	0-3	1	283.6
Gyptis vittata	15FEB88	C	2	3-10	2	567.2
Mediomastus californiensis	15FEB88	C	2	3-10	2	567.2
Rhynchocoels	15FEB88	C	2	3-10	1	283.6
Sigambra tentaculata	15FEB88	C	2	3-10	1	283.6
Clymenella mucosa	15FEB88	C	3	0-3	1	283.6
Macoma tenta	15FEB88	C	3	0-3	1	283.6
Mediomastus californiensis	15FEB88	C	3	0-3	2	567.2
Mulinia lateralis	15FEB88	C	3	0-3	1	283.6
Nuculana acuta	15FEB88	C	3	0-3	2	567.2
Paleanotus heteroseta	15FEB88	C	3	0-3	1	283.6
Rhynchocoels	15FEB88	C	3	0-3	1	283.6
Streblospio benedicti	15FEB88	C	3	0-3	1	283.6
Drilonereis magna	15FEB88	C	3	3-10	1	283.6
Mediomastus californiensis	15FEB88	C	3	3-10	3	850.8
Macoma mitchelli	16FEB88	A	1	0-3	4	1134.4

Mediomastus californiensis	16FEB88	A	1	0-3	1	283.6
Mulinia lateralis	16FEB88	A	1	0-3	17	4821.2
Glycinde solitaria	16FEB88	A	1	3-10	1	283.6
Macoma mitchelli	16FEB88	A	1	3-10	3	850.8
Mediomastus californiensis	16FEB88	A	1	3-10	5	1418.0
Haploscoloplos foliosus	16FEB88	A	2	0-3	1	283.6
Macoma mitchelli	16FEB88	A	2	0-3	9	2552.4
Mediomastus californiensis	16FEB88	A	2	0-3	2	567.2
Mulinia lateralis	16FEB88	A	2	0-3	9	2552.4
Streblospio benedicti	16FEB88	A	2	0-3	2	567.2
Capitella capitata	16FEB88	A	2	3-10	1	283.6
Mediomastus californiensis	16FEB88	A	2	3-10	3	850.8
Rhynchocoels	16FEB88	A	2	3-10	1	283.6
Haploscoloplos foliosus	16FEB88	A	3	0-3	1	283.6
Macoma mitchelli	16FEB88	A	3	0-3	5	1418.0
Mediomastus californiensis	16FEB88	A	3	0-3	3	850.8
Mulinia lateralis	16FEB88	A	3	0-3	6	1701.6
Streblospio benedicti	16FEB88	A	3	0-3	2	567.2
Macoma mitchelli	16FEB88	A	3	3-10	2	567.2
Mediomastus californiensis	16FEB88	A	3	3-10	6	1701.6
Acteocina canaliculata	17FEB88	B	1	0-3	1	283.6
Ampelisca abdita	17FEB88	B	1	0-3	1	283.6
Caprellid a	17FEB88	B	1	0-3	1	283.6
Cossura delta	17FEB88	B	1	0-3	1	283.6
Diopatra cuprea	17FEB88	B	1	0-3	1	283.6
Macoma mitchelli	17FEB88	B	1	0-3	2	567.2
Mediomastus californiensis	17FEB88	B	1	0-3	16	4537.6
Mulinia lateralis	17FEB88	B	1	0-3	23	6522.8
Oxyurostylis salioni	17FEB88	B	1	0-3	1	283.6
Streblospio benedicti	17FEB88	B	1	0-3	6	1701.6
Cossura delta	17FEB88	B	1	3-10	6	1701.6
Glycinde solitaria	17FEB88	B	1	3-10	1	283.6
Haploscoloplos foliosus	17FEB88	B	1	3-10	2	567.2
Macoma mitchelli	17FEB88	B	1	3-10	2	567.2
Mediomastus californiensis	17FEB88	B	1	3-10	8	2268.8
Mulinia lateralis	17FEB88	B	1	3-10	1	283.6
Diopatra cuprea	17FEB88	B	2	0-3	1	283.6
Macoma mitchelli	17FEB88	B	2	0-3	5	1418.0
Mediomastus californiensis	17FEB88	B	2	0-3	5	1418.0
Mulinia lateralis	17FEB88	B	2	0-3	17	4821.2
Pyramidella crenulata	17FEB88	B	2	0-3	1	283.6
Streblospio benedicti	17FEB88	B	2	0-3	4	1134.4
Cossura delta	17FEB88	B	2	3-10	17	4821.2
Glycinde solitaria	17FEB88	B	2	3-10	2	567.2
Haploscoloplos foliosus	17FEB88	B	2	3-10	1	283.6
Macoma mitchelli	17FEB88	B	2	3-10	3	850.8
Mediomastus californiensis	17FEB88	B	2	3-10	5	1418.0
Rhynchocoels	17FEB88	B	2	3-10	1	283.6
Cossura delta	17FEB88	B	3	0-3	1	283.6
Glycinde solitaria	17FEB88	B	3	0-3	1	283.6
Macoma mitchelli	17FEB88	B	3	0-3	7	1985.2
Mediomastus californiensis	17FEB88	B	3	0-3	11	3119.6
Mulinia lateralis	17FEB88	B	3	0-3	16	4537.6
Streblospio benedicti	17FEB88	B	3	0-3	4	1134.4
Turbellaria	17FEB88	B	3	0-3	1	283.6
Cossura delta	17FEB88	B	3	3-10	21	5955.6
Glycinde solitaria	17FEB88	B	3	3-10	1	283.6
Haploscoloplos foliosus	17FEB88	B	3	3-10	2	567.2
Mediomastus californiensis	17FEB88	B	3	3-10	9	2552.4
Paraprionospio pinnata	17FEB88	B	3	3-10	1	283.6
Rhynchocoels	17FEB88	B	3	3-10	1	283.6
Aligena texasiana	18FEB88	D	1	0-3	1	283.6
Caprellid a	18FEB88	D	1	0-3	2	567.2
Clymenella mucosa	18FEB88	D	1	0-3	1	283.6
Haploscoloplos foliosus	18FEB88	D	1	0-3	2	567.2
Maldane sarsi	18FEB88	D	1	0-3	3	850.8
Mediomastus californiensis	18FEB88	D	1	0-3	16	4537.6

Nuculana acuta	18FEB88	D	1	0-3	1	283.6
Oligochaeta	18FEB88	D	1	0-3	1	283.6
Paleanotus heteroseta	18FEB88	D	1	0-3	2	567.2
Phoronis architecta	18FEB88	D	1	0-3	1	283.6
Polydora caulleryi	18FEB88	D	1	0-3	2	567.2
Rhynchocoels	18FEB88	D	1	0-3	3	850.8
Streblospio benedicti	18FEB88	D	1	0-3	1	283.6
Tharyx setigera	18FEB88	D	1	0-3	1	283.6
Turbonilla sp.	18FEB88	D	1	0-3	3	850.8
Aligena texasiana	18FEB88	D	1	3-10	9	2552.4
Caecum glabrum	18FEB88	D	1	3-10	4	1134.4
Clymenella torquata calida	18FEB88	D	1	3-10	6	1701.6
Gyptis vittata	18FEB88	D	1	3-10	3	850.8
Mediomastus californiensis	18FEB88	D	1	3-10	6	1701.6
Notomastus cf. latericeus	18FEB88	D	1	3-10	1	283.6
Paraprionospio pinnata	18FEB88	D	1	3-10	3	850.8
Polydora caulleryi	18FEB88	D	1	3-10	33	9358.8
Rhynchocoels	18FEB88	D	1	3-10	1	283.6
Tharyx setigera	18FEB88	D	1	3-10	7	1985.2
Vitrinellidae	18FEB88	D	1	3-10	4	1134.4
Batea catharinensis	18FEB88	D	2	0-3	5	1418.0
Caprellid a	18FEB88	D	2	0-3	3	850.8
Clymenella torquata calida	18FEB88	D	2	0-3	2	567.2
Corophium acherusicum	18FEB88	D	2	0-3	2	567.2
Crepidula plana	18FEB88	D	2	0-3	1	283.6
Cyclaspis varians	18FEB88	D	2	0-3	1	283.6
Diopatra cuprea	18FEB88	D	2	0-3	2	567.2
Erichthonias brasiliensis	18FEB88	D	2	0-3	2	567.2
Haploscoloplos foliosus	18FEB88	D	2	0-3	1	283.6
Lembos sp.	18FEB88	D	2	0-3	3	850.8
Lyonsia hyalina floridana	18FEB88	D	2	0-3	1	283.6
Maldane sarsi	18FEB88	D	2	0-3	1	283.6
Mediomastus californiensis	18FEB88	D	2	0-3	42	11911.2
Paraonidae grp. A	18FEB88	D	2	0-3	2	567.2
Phascolion strombi	18FEB88	D	2	0-3	1	283.6
Phoronis architecta	18FEB88	D	2	0-3	3	850.8
Polydora caulleryi	18FEB88	D	2	0-3	27	7657.2
Rhynchocoels	18FEB88	D	2	0-3	1	283.6
Spiophanes bombyx	18FEB88	D	2	0-3	1	283.6
Streblospio benedicti	18FEB88	D	2	0-3	1	283.6
Tharyx setigera	18FEB88	D	2	0-3	7	1985.2
Turbonilla sp.	18FEB88	D	2	0-3	1	283.6
Aligena texasiana	18FEB88	D	2	3-10	5	1418.0
Caecum glabrum	18FEB88	D	2	3-10	1	283.6
Clymenella torquata calida	18FEB88	D	2	3-10	2	567.2
Gyptis vittata	18FEB88	D	2	3-10	1	283.6
Listriella clymenellae	18FEB88	D	2	3-10	1	283.6
Mediomastus californiensis	18FEB88	D	2	3-10	8	2268.8
Nereidae	18FEB88	D	2	3-10	1	283.6
Paraonidae grp. A	18FEB88	D	2	3-10	1	283.6
Paraprionospio pinnata	18FEB88	D	2	3-10	1	283.6
Podarke obscura	18FEB88	D	2	3-10	5	1418.0
Polydora caulleryi	18FEB88	D	2	3-10	166	47077.6
Tharyx setigera	18FEB88	D	2	3-10	7	1985.2
Vitrinellidae	18FEB88	D	2	3-10	3	850.8
Acteocina canaliculata	18FEB88	D	3	0-3	1	283.6
Aligena texasiana	18FEB88	D	3	0-3	3	850.8
Caprellid a	18FEB88	D	3	0-3	2	567.2
Clymenella torquata calida	18FEB88	D	3	0-3	3	850.8
Cossura delta	18FEB88	D	3	0-3	1	283.6
Glycinde solitaria	18FEB88	D	3	0-3	1	283.6
Lyonsia hyalina floridana	18FEB88	D	3	0-3	1	283.6
Mediomastus californiensis	18FEB88	D	3	0-3	30	8508.0
Mulinia lateralis	18FEB88	D	3	0-3	6	1701.6
Nuculana acuta	18FEB88	D	3	0-3	1	283.6
Paraprionospio pinnata	18FEB88	D	3	0-3	1	283.6
Phascolion strombi	18FEB88	D	3	0-3	1	283.6

Phoronis architecta	18FEB88	D	3	0-3	2	567.2
Podarke obscura	18FEB88	D	3	0-3	1	283.6
Rhynchocoels	18FEB88	D	3	0-3	1	283.6
Spiophanes bombyx	18FEB88	D	3	0-3	1	283.6
Streblospio benedicti	18FEB88	D	3	0-3	1	283.6
Tharyx setigera	18FEB88	D	3	0-3	1	283.6
Turbonilla sp.	18FEB88	D	3	0-3	2	567.2
Aligena texasiana	18FEB88	D	3	3-10	3	850.8
Caecum glabrum	18FEB88	D	3	3-10	3	850.8
Clymenella torquata calida	18FEB88	D	3	3-10	2	567.2
Cossura delta	18FEB88	D	3	3-10	2	567.2
Gyptis vittata	18FEB88	D	3	3-10	1	283.6
Mediomastus californiensis	18FEB88	D	3	3-10	2	567.2
Paraprionospio pinnata	18FEB88	D	3	3-10	2	567.2
Polydora caulleryi	18FEB88	D	3	3-10	1	283.6
Brada cf. villosa capensis	11APR88	C	1	0-3	1	283.6
Euceramus praelongus	11APR88	C	1	0-3	1	283.6
Gyptis vittata	11APR88	C	1	0-3	5	1418.0
Lyonsia hyalina floridana	11APR88	C	1	0-3	1	283.6
Maldane sarsi	11APR88	C	1	0-3	1	283.6
Mediomastus californiensis	11APR88	C	1	0-3	6	1701.6
Melinna maculata	11APR88	C	1	0-3	4	1134.4
Mulinia lateralis	11APR88	C	1	0-3	2	567.2
Mysella planulata	11APR88	C	1	0-3	2	567.2
Nereidae	11APR88	C	1	0-3	1	283.6
Nuculana acuta	11APR88	C	1	0-3	19	5388.4
Polychaete juvenile (Unidentified)	11APR88	C	1	0-3	1	283.6
Rhynchocoels	11APR88	C	1	0-3	1	283.6
Serpulidae	11APR88	C	1	0-3	4	1134.4
Syllidae	11APR88	C	1	0-3	4	1134.4
Tellina sp.	11APR88	C	1	0-3	2	567.2
Tharyx setigera	11APR88	C	1	0-3	3	850.8
Amphilochus sp.	11APR88	C	1	3-10	1	283.6
Drilonereis magna	11APR88	C	1	3-10	1	283.6
Melinna maculata	11APR88	C	1	3-10	2	567.2
Nuculana acuta	11APR88	C	1	3-10	2	567.2
Sagelus divisus	11APR88	C	1	3-10	2	567.2
Sarsiella texana	11APR88	C	1	3-10	1	283.6
Tharyx setigera	11APR88	C	1	3-10	2	567.2
Amphilochus sp.	11APR88	C	2	0-3	1	283.6
Armandia maculata	11APR88	C	2	0-3	2	567.2
Dorvilleidae	11APR88	C	2	0-3	1	283.6
Gyptis vittata	11APR88	C	2	0-3	2	567.2
Maldane sarsi	11APR88	C	2	0-3	2	567.2
Mediomastus californiensis	11APR88	C	2	0-3	2	567.2
Melinna maculata	11APR88	C	2	0-3	7	1985.2
Mysella planulata	11APR88	C	2	0-3	1	283.6
Mysidopsis bahia	11APR88	C	2	0-3	1	283.6
Nassarius acutus	11APR88	C	2	0-3	1	283.6
Nuculana acuta	11APR88	C	2	0-3	16	4537.6
Paraonidae grp. A	11APR88	C	2	0-3	1	283.6
Periploma cf. orbiculare	11APR88	C	2	0-3	3	850.8
Phascolion strombi	11APR88	C	2	0-3	1	283.6
Rhynchocoels	11APR88	C	2	0-3	2	567.2
Spiophanes bombyx	11APR88	C	2	0-3	1	283.6
Syllidae	11APR88	C	2	0-3	2	567.2
Tellina sp.	11APR88	C	2	0-3	5	1418.0
Tharyx setigera	11APR88	C	2	0-3	1	283.6
Mediomastus californiensis	11APR88	C	2	3-10	3	850.8
Melinna maculata	11APR88	C	2	3-10	5	1418.0
Nuculana acuta	11APR88	C	2	3-10	3	850.8
Paraprionospio pinnata	11APR88	C	2	3-10	1	283.6
Tharyx setigera	11APR88	C	2	3-10	4	1134.4
Amphilochus sp.	11APR88	C	3	0-3	2	567.2
Anachis obesa	11APR88	C	3	0-3	1	283.6
Dorvilleidae	11APR88	C	3	0-3	1	283.6
Drilonereis magna	11APR88	C	3	0-3	2	567.2

Lembos sp.	11APR88	C	3	0-3	1	283.6
Mediomastus californiensis	11APR88	C	3	0-3	1	283.6
Melinna maculata	11APR88	C	3	0-3	8	2268.8
Mysella planulata	11APR88	C	3	0-3	3	850.8
Nassarius acutus	11APR88	C	3	0-3	1	283.6
Nuculana acuta	11APR88	C	3	0-3	18	5104.8
Paraonidae grp. A	11APR88	C	3	0-3	1	283.6
Paraprionospio pinnata	11APR88	C	3	0-3	1	283.6
Periploma cf. orbiculare	11APR88	C	3	0-3	5	1418.0
Rhynchocoels	11APR88	C	3	0-3	1	283.6
Schistomeringos spa	11APR88	C	3	0-3	2	567.2
Syllidae	11APR88	C	3	0-3	1	283.6
Tellina sp.	11APR88	C	3	0-3	1	283.6
Gyptis vittata	11APR88	C	3	3-10	1	283.6
Mediomastus californiensis	11APR88	C	3	3-10	1	283.6
Megalops	11APR88	C	3	3-10	1	283.6
Melinna maculata	11APR88	C	3	3-10	3	850.8
Sagelus divisus	11APR88	C	3	3-10	1	283.6
Syllidae	11APR88	C	3	3-10	1	283.6
Tharyx setigera	11APR88	C	3	3-10	2	567.2
Macoma mitchelli	12APR88	A	1	0-3	1	283.6
Mediomastus californiensis	12APR88	A	1	0-3	2	567.2
Mulinia lateralis	12APR88	A	1	0-3	6	1701.6
Streblospio benedicti	12APR88	A	1	0-3	1	283.6
Macoma mitchelli	12APR88	A	1	3-10	2	567.2
Mediomastus californiensis	12APR88	A	1	3-10	7	1985.2
Mulinia lateralis	12APR88	A	1	3-10	2	567.2
Macoma mitchelli	12APR88	A	2	0-3	1	283.6
Mediomastus californiensis	12APR88	A	2	0-3	3	850.8
Mulinia lateralis	12APR88	A	2	0-3	10	2836.0
Streblospio benedicti	12APR88	A	2	0-3	2	567.2
Macoma mitchelli	12APR88	A	2	3-10	3	850.8
Mediomastus californiensis	12APR88	A	2	3-10	1	283.6
Macoma mitchelli	12APR88	A	3	0-3	1	283.6
Mediomastus californiensis	12APR88	A	3	0-3	1	283.6
Mulinia lateralis	12APR88	A	3	0-3	11	3119.6
Streblospio benedicti	12APR88	A	3	0-3	4	1134.4
Macoma mitchelli	12APR88	A	3	3-10	2	567.2
Mediomastus californiensis	12APR88	A	3	3-10	8	2268.8
Caprellid a	13APR88	B	1	0-3	1	283.6
Cyclaspis varians	13APR88	B	1	0-3	2	567.2
Cyclopoid copepod	13APR88	B	1	0-3	2	567.2
Mediomastus californiensis	13APR88	B	1	0-3	15	4254.0
Microprotopus spp.	13APR88	B	1	0-3	4	1134.4
Mulinia lateralis	13APR88	B	1	0-3	3	850.8
Oxyurostylis salioni	13APR88	B	1	0-3	1	283.6
Rhynchocoels	13APR88	B	1	0-3	1	283.6
Streblospio benedicti	13APR88	B	1	0-3	1	283.6
Clymenella torquata calida	13APR88	B	1	3-10	2	567.2
Ensis minor	13APR88	B	1	3-10	1	283.6
Gyptis vittata	13APR88	B	1	3-10	2	567.2
Haploscoloplos foliosus	13APR88	B	1	3-10	1	283.6
Marphysa sanguinea	13APR88	B	1	3-10	1	283.6
Mediomastus californiensis	13APR88	B	1	3-10	1	283.6
Melinna maculata	13APR88	B	1	3-10	1	283.6
Mysella planulata	13APR88	B	1	3-10	1	283.6
Tharyx setigera	13APR88	B	1	3-10	1	283.6
Acteocina canaliculata	13APR88	B	2	0-3	1	283.6
Caprellid a	13APR88	B	2	0-3	1	283.6
Clymenella torquata calida	13APR88	B	2	0-3	1	283.6
Cyclaspis varians	13APR88	B	2	0-3	1	283.6
Diopatra cuprea	13APR88	B	2	0-3	1	283.6
Erichthonias brasiliensis	13APR88	B	2	0-3	1	283.6
Mediomastus californiensis	13APR88	B	2	0-3	8	2268.8
Melinna maculata	13APR88	B	2	0-3	1	283.6
Mulinia lateralis	13APR88	B	2	0-3	2	567.2
Haploscoloplos foliosus	13APR88	B	2	3-10	1	283.6

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Mediomastus californiensis      13APR88   B    2    3-10    1      283.6
Clymenella mucosa               13APR88   B    3    0-3     2      567.2
Clymenella torquata calida      13APR88   B    3    0-3     1      283.6
Cyclaspis varians               13APR88   B    3    0-3     1      283.6
Lyonsia hyalina floridana       13APR88   B    3    0-3     2      567.2
Mediomastus californiensis      13APR88   B    3    0-3     4     1134.4
Megalomma bioculatum            13APR88   B    3    0-3     1      283.6
Mulinia lateralis               13APR88   B    3    0-3     2      567.2
Clymenella torquata calida      13APR88   B    3    3-10    2      567.2
Gyptis vittata                  13APR88   B    3    3-10    2      567.2
Mediomastus californiensis      13APR88   B    3    3-10    3      850.8
Amphilochus sp.                 13APR88   C    1    0-3     1      283.6
Cyclaspis varians               13APR88   C    1    0-3     1      283.6
Drilonereis magna               13APR88   C    1    0-3     1      283.6
Eudorella monodon               13APR88   C    1    0-3     1      283.6
Leucon sp.                      13APR88   C    1    0-3     1      283.6
Mediomastus californiensis      13APR88   C    1    0-3    15     4254.0
Paraprionospio pinnata          13APR88   C    1    0-3     3      850.8
Phascolion strombi              13APR88   C    1    0-3     2      567.2
Phoronis architecta             13APR88   C    1    0-3     1      283.6
Streblospio benedicti           13APR88   C    1    0-3     1      283.6
Cossura delta                   13APR88   C    1    3-10    1      283.6
Haploscoloplos foliosus         13APR88   C    1    3-10    1      283.6
Mediomastus californiensis      13APR88   C    1    3-10    2      567.2
Paraprionospio pinnata          13APR88   C    1    3-10    1      283.6
Sigambra tentaculata            13APR88   C    1    3-10    1      283.6
Cossura delta                   13APR88   C    2    0-3     1      283.6
Drilonereis magna               13APR88   C    2    0-3     1      283.6
Eudorella monodon               13APR88   C    2    0-3     1      283.6
Glycinde solitaria              13APR88   C    2    0-3     1      283.6
Leucon sp.                      13APR88   C    2    0-3     3      850.8
Maldane sarsi                   13APR88   C    2    0-3     1      283.6
Mediomastus californiensis      13APR88   C    2    0-3     9     2552.4
Mulinia lateralis               13APR88   C    2    0-3     2      567.2
Nuculana acuta                  13APR88   C    2    0-3     1      283.6
Nuculana concentrica            13APR88   C    2    0-3     2      567.2
Phascolion strombi              13APR88   C    2    0-3     2      567.2
Rhynchocoels                    13APR88   C    2    0-3     1      283.6
Streblospio benedicti           13APR88   C    2    0-3     1      283.6
Syllidae                        13APR88   C    2    0-3     1      283.6
Cossura delta                   13APR88   C    2    3-10    1      283.6
Drilonereis magna               13APR88   C    2    3-10    1      283.6
Mediomastus californiensis      13APR88   C    2    3-10    4     1134.4
Ophiuroidea                     13APR88   C    2    3-10    1      283.6
Rhynchocoels                    13APR88   C    2    3-10    2      567.2
Diopatra cuprea                 13APR88   C    3    0-3     2      567.2
Eudorella monodon               13APR88   C    3    0-3     2      567.2
Leucon sp.                      13APR88   C    3    0-3     3      850.8
Mediomastus californiensis      13APR88   C    3    0-3     5     1418.0
Mulinia lateralis               13APR88   C    3    0-3     3      850.8
Nuculana concentrica            13APR88   C    3    0-3     3      850.8
Paraprionospio pinnata          13APR88   C    3    0-3     1      283.6
Phascolion strombi              13APR88   C    3    0-3     1      283.6
Streblospio benedicti           13APR88   C    3    0-3     2      567.2
Turbonilla sp.                  13APR88   C    3    0-3     1      283.6
Maldane sarsi                   13APR88   C    3    3-10    1      283.6
Mediomastus californiensis      13APR88   C    3    3-10    4     1134.4
Oxyurostylis smithi             13APR88   C    3    3-10    1      283.6
Sigambra tentaculata            13APR88   C    3    3-10    1      283.6
Bivalvia                        14APR88   D    1    0-3     1      283.6
Crepidula plana                 14APR88   D    1    0-3     1      283.6
Diopatra cuprea                 14APR88   D    1    0-3     1      283.6
Epitonium sp.                   14APR88   D    1    0-3     1      283.6
Erichthonias brasiliensis       14APR88   D    1    0-3     2      567.2
Lyonsia hyalina floridana       14APR88   D    1    0-3     2      567.2
Macoma tenta                    14APR88   D    1    0-3     1      283.6
Mediomastus californiensis      14APR88   D    1    0-3    30     8508.0
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Microprotopus spp.               14APR88   D    1    0-3     1      283.6
Mulinia lateralis                14APR88   D    1    0-3     1      283.6
Nereidae                         14APR88   D    1    0-3     1      283.6
Nuculana acuta                   14APR88   D    1    0-3     1      283.6
Paraprionospio pinnata           14APR88   D    1    0-3     2      567.2
Phoronis architecta              14APR88   D    1    0-3     8     2268.8
Polydora caulleryi               14APR88   D    1    0-3     1      283.6
Rhynchocoels                     14APR88   D    1    0-3     1      283.6
Spiophanes bombyx                14APR88   D    1    0-3     3      850.8
Streblospio benedicti            14APR88   D    1    0-3     1      283.6
Terebellidae                     14APR88   D    1    0-3     1      283.6
Tharyx setigera                  14APR88   D    1    0-3     1      283.6
Anaitides erythrophyllus         14APR88   D    1    3-10    1      283.6
Cossura delta                    14APR88   D    1    3-10    6     1701.6
Haploscoloplos foliosus          14APR88   D    1    3-10    1      283.6
Maldane sarsi                    14APR88   D    1    3-10    1      283.6
Mediomastus californiensis       14APR88   D    1    3-10   10     2836.0
Notomastus latericeus            14APR88   D    1    3-10    2      567.2
Paraonidae grp. A                14APR88   D    1    3-10    1      283.6
Phoronis architecta              14APR88   D    1    3-10    1      283.6
Rhynchocoels                     14APR88   D    1    3-10    2      567.2
Spiophanes bombyx                14APR88   D    1    3-10    2      567.2
Tharyx setigera                  14APR88   D    1    3-10    1      283.6
Aligena texasiana                14APR88   D    2    0-3     1      283.6
Ampelisca abdita                 14APR88   D    2    0-3     1      283.6
Cossura delta                    14APR88   D    2    0-3     1      283.6
Eteone heteropoda                14APR88   D    2    0-3     1      283.6
Glycinde solitaria               14APR88   D    2    0-3     3      850.8
Haploscoloplos foliosus          14APR88   D    2    0-3     1      283.6
Maldane sarsi                    14APR88   D    2    0-3     1      283.6
Mediomastus californiensis       14APR88   D    2    0-3    34     9642.4
Mulinia lateralis                14APR88   D    2    0-3     4     1134.4
Nereidae                         14APR88   D    2    0-3     2      567.2
Notomastus latericeus            14APR88   D    2    0-3     1      283.6
Nuculana acuta                   14APR88   D    2    0-3     3      850.8
Paraprionospio pinnata           14APR88   D    2    0-3     3      850.8
Phoronis architecta              14APR88   D    2    0-3     9     2552.4
Polydora caulleryi               14APR88   D    2    0-3     1      283.6
Spiophanes bombyx                14APR88   D    2    0-3     1      283.6
Streblospio benedicti            14APR88   D    2    0-3     1      283.6
Syllidae                         14APR88   D    2    0-3     1      283.6
Tellina sp.                      14APR88   D    2    0-3     2      567.2
Turbellaria                      14APR88   D    2    0-3     2      567.2
Aligena texasiana                14APR88   D    2    3-10    2      567.2
Mediomastus californiensis       14APR88   D    2    3-10    8     2268.8
Notomastus latericeus            14APR88   D    2    3-10    2      567.2
Phoronis architecta              14APR88   D    2    3-10    3      850.8
Rhynchocoels                     14APR88   D    2    3-10    1      283.6
Spiophanes bombyx                14APR88   D    2    3-10    2      567.2
Tharyx setigera                  14APR88   D    2    3-10    3      850.8
Bivalvia                         14APR88   D    3    0-3     2      567.2
Glycinde solitaria               14APR88   D    3    0-3     3      850.8
Maldane sarsi                    14APR88   D    3    0-3     1      283.6
Mediomastus californiensis       14APR88   D    3    0-3    31     8791.6
Mulinia lateralis                14APR88   D    3    0-3     1      283.6
Paraprionospio pinnata           14APR88   D    3    0-3     1      283.6
Phoronis architecta              14APR88   D    3    0-3     3      850.8
Polydora caulleryi               14APR88   D    3    0-3     2      567.2
Rhynchocoels                     14APR88   D    3    0-3     2      567.2
Tharyx setigera                  14APR88   D    3    0-3     1      283.6
Macoma tenta                     14APR88   D    3    3-10    1      283.6
Mediomastus californiensis       14APR88   D    3    3-10    4     1134.4
Notomastus latericeus            14APR88   D    3    3-10    1      283.6
Phoronis architecta              14APR88   D    3    3-10    2      567.2
Polydora caulleryi               14APR88   D    3    3-10    1      283.6
Rhynchocoels                     14APR88   D    3    3-10    1      283.6
Spiochaetopterus costarum        14APR88   D    3    3-10    1      283.6
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Tharyx setigera	14APR88	D	3	3-10	1	283.6
Cyclaspis varians	09MAY88	C	1	0-3	1	283.6
Diopatra cuprea	09MAY88	C	1	0-3	1	283.6
Eudorella monodon	09MAY88	C	1	0-3	1	283.6
Glycinde solitaria	09MAY88	C	1	0-3	1	283.6
Leucon sp.	09MAY88	C	1	0-3	7	1985.2
Mediomastus californiensis	09MAY88	C	1	0-3	20	5672.0
Microprotopus spp.	09MAY88	C	1	0-3	1	283.6
Monoculoides sp.	09MAY88	C	1	0-3	1	283.6
Oxyurostylis smithi	09MAY88	C	1	0-3	1	283.6
Paraprionospio pinnata	09MAY88	C	1	0-3	1	283.6
Rhynchocoels	09MAY88	C	1	0-3	1	283.6
Streblospio benedicti	09MAY88	C	1	0-3	1	283.6
Mediomastus californiensis	09MAY88	C	1	3-10	3	850.8
Paraprionospio pinnata	09MAY88	C	1	3-10	1	283.6
Rhynchocoels	09MAY88	C	1	3-10	1	283.6
Tharyx setigera	09MAY88	C	1	3-10	1	283.6
Cossura delta	09MAY88	C	2	0-3	1	283.6
Diopatra cuprea	09MAY88	C	2	0-3	3	850.8
Eudorella monodon	09MAY88	C	2	0-3	4	1134.4
Leucon sp.	09MAY88	C	2	0-3	2	567.2
Mediomastus californiensis	09MAY88	C	2	0-3	14	3970.4
Mulinia lateralis	09MAY88	C	2	0-3	1	283.6
Paraprionospio pinnata	09MAY88	C	2	0-3	1	283.6
Rhynchocoels	09MAY88	C	2	0-3	1	283.6
Streblospio benedicti	09MAY88	C	2	0-3	1	283.6
Cossura delta	09MAY88	C	2	3-10	1	283.6
Glycinde solitaria	09MAY88	C	2	3-10	2	567.2
Mediomastus californiensis	09MAY88	C	2	3-10	6	1701.6
Oligochaeta	09MAY88	C	2	3-10	1	283.6
Paraprionospio pinnata	09MAY88	C	2	3-10	4	1134.4
Anaitides erythrophyllus	09MAY88	C	3	0-3	1	283.6
Batea catharinensis	09MAY88	C	3	0-3	9	2552.4
Bivalvia	09MAY88	C	3	0-3	2	567.2
Caprellid a	09MAY88	C	3	0-3	2	567.2
Crepidula plana	09MAY88	C	3	0-3	1	283.6
Cyclaspis varians	09MAY88	C	3	0-3	2	567.2
Diopatra cuprea	09MAY88	C	3	0-3	2	567.2
Eudorella monodon	09MAY88	C	3	0-3	1	283.6
Leucon sp.	09MAY88	C	3	0-3	2	567.2
Mediomastus californiensis	09MAY88	C	3	0-3	13	3686.8
Megalops	09MAY88	C	3	0-3	1	283.6
Nereidae	09MAY88	C	3	0-3	1	283.6
Oxyurostylis smithi	09MAY88	C	3	0-3	3	850.8
Paraprionospio pinnata	09MAY88	C	3	0-3	1	283.6
Phoronis architecta	09MAY88	C	3	0-3	1	283.6
Sarsiella texana	09MAY88	C	3	0-3	1	283.6
Streblospio benedicti	09MAY88	C	3	0-3	1	283.6
Batea catharinensis	09MAY88	C	3	3-10	3	850.8
Caprellid a	09MAY88	C	3	3-10	1	283.6
Cossura delta	09MAY88	C	3	3-10	1	283.6
Drilonereis magna	09MAY88	C	3	3-10	1	283.6
Maldane sarsi	09MAY88	C	3	3-10	1	283.6
Mediomastus californiensis	09MAY88	C	3	3-10	7	1985.2
Ophiuroidea	09MAY88	C	3	3-10	1	283.6
Parametopella sp.	09MAY88	C	3	3-10	1	283.6
Phoronis architecta	09MAY88	C	3	3-10	1	283.6
Rhynchocoels	09MAY88	C	3	3-10	1	283.6
Tharyx setigera	09MAY88	C	3	3-10	1	283.6
Mediomastus californiensis	10MAY88	A	1	0-3	1	283.6
Mulinia lateralis	10MAY88	A	1	0-3	6	1701.6
Streblospio benedicti	10MAY88	A	1	0-3	12	3403.2
Mediomastus californiensis	10MAY88	A	1	3-10	10	2836.0
Mulinia lateralis	10MAY88	A	1	3-10	1	283.6
Mulinia lateralis	10MAY88	A	2	0-3	6	1701.6
Streblospio benedicti	10MAY88	A	2	0-3	4	1134.4
Macoma mitchelli	10MAY88	A	2	3-10	2	567.2

Mediomastus californiensis	10MAY88	A	2	3-10	10	2836.0
Streblospio benedicti	10MAY88	A	2	3-10	1	283.6
Mulinia lateralis	10MAY88	A	3	0-3	6	1701.6
Streblospio benedicti	10MAY88	A	3	0-3	11	3119.6
Mediomastus californiensis	10MAY88	A	3	3-10	12	3403.2
Mulinia lateralis	10MAY88	A	3	3-10	1	283.6
Batea catharinensis	11MAY88	B	1	0-3	2	567.2
Clymenella torquata calida	11MAY88	B	1	0-3	1	283.6
Cyclaspis varians	11MAY88	B	1	0-3	1	283.6
Erichthonias brasiliensis	11MAY88	B	1	0-3	5	1418.0
Mediomastus californiensis	11MAY88	B	1	0-3	14	3970.4
Microprotopus spp.	11MAY88	B	1	0-3	3	850.8
Mulinia lateralis	11MAY88	B	1	0-3	4	1134.4
Streblospio benedicti	11MAY88	B	1	0-3	4	1134.4
Xenanthura brevitelson	11MAY88	B	1	0-3	1	283.6
Clymenella torquata calida	11MAY88	B	1	3-10	1	283.6
Erichthonias brasiliensis	11MAY88	B	1	3-10	2	567.2
Gyptis vittata	11MAY88	B	1	3-10	1	283.6
Mediomastus californiensis	11MAY88	B	1	3-10	3	850.8
Acteocina canaliculata	11MAY88	B	2	0-3	1	283.6
Mediomastus californiensis	11MAY88	B	2	0-3	2	567.2
Mulinia lateralis	11MAY88	B	2	0-3	1	283.6
Nuculana acuta	11MAY88	B	2	0-3	1	283.6
Ensis minor	11MAY88	B	2	3-10	1	283.6
Mediomastus californiensis	11MAY88	B	2	3-10	2	567.2
Sabellidae	11MAY88	B	2	3-10	1	283.6
Tharyx setigera	11MAY88	B	2	3-10	1	283.6
Acteocina canaliculata	11MAY88	B	3	0-3	1	283.6
Ampelisca abdita	11MAY88	B	3	0-3	1	283.6
Batea catharinensis	11MAY88	B	3	0-3	1	283.6
Cyclaspis varians	11MAY88	B	3	0-3	1	283.6
Erichthonias brasiliensis	11MAY88	B	3	0-3	1	283.6
Maldane sarsi	11MAY88	B	3	0-3	2	567.2
Mediomastus californiensis	11MAY88	B	3	0-3	5	1418.0
Mulinia lateralis	11MAY88	B	3	0-3	6	1701.6
Streblospio benedicti	11MAY88	B	3	0-3	2	567.2
Aligena texasiana	11MAY88	B	3	3-10	1	283.6
Clymenella torquata calida	11MAY88	B	3	3-10	1	283.6
Mediomastus californiensis	11MAY88	B	3	3-10	8	2268.8
Rhynchocoels	11MAY88	B	3	3-10	1	283.6
Acteocina canaliculata	12MAY88	D	1	0-3	1	283.6
Gastropoda	12MAY88	D	1	0-3	1	283.6
Mediomastus californiensis	12MAY88	D	1	0-3	5	1418.0
Nereidae	12MAY88	D	1	0-3	1	283.6
Pyramidella sp.	12MAY88	D	1	0-3	2	567.2
Rhynchocoels	12MAY88	D	1	0-3	1	283.6
Turbonilla sp.	12MAY88	D	1	0-3	1	283.6
Aligena texasiana	12MAY88	D	1	3-10	4	1134.4
Ancistrosyllis papillosa	12MAY88	D	1	3-10	2	567.2
Caecum glabrum	12MAY88	D	1	3-10	1	283.6
Clymenella mucosa	12MAY88	D	1	3-10	1	283.6
Clymenella torquata calida	12MAY88	D	1	3-10	1	283.6
Cossura delta	12MAY88	D	1	3-10	4	1134.4
Glycinde solitaria	12MAY88	D	1	3-10	2	567.2
Gyptis vittata	12MAY88	D	1	3-10	6	1701.6
Mediomastus californiensis	12MAY88	D	1	3-10	6	1701.6
Megalops	12MAY88	D	1	3-10	1	283.6
Nereidae	12MAY88	D	1	3-10	1	283.6
Paleanotus heteroseta	12MAY88	D	1	3-10	2	567.2
Paraprionospio pinnata	12MAY88	D	1	3-10	1	283.6
Spiophanes bombyx	12MAY88	D	1	3-10	1	283.6
Cossura delta	12MAY88	D	2	0-3	2	567.2
Glycinde solitaria	12MAY88	D	2	0-3	1	283.6
Mediomastus californiensis	12MAY88	D	2	0-3	13	3686.8
Paraprionospio pinnata	12MAY88	D	2	0-3	1	283.6
Pinnixa	12MAY88	D	2	0-3	1	283.6
Polydora caulleryi	12MAY88	D	2	0-3	1	283.6

Pyramidella sp.	12MAY88	D	2	0-3	1	283.6
Rhynchocoels	12MAY88	D	2	0-3	3	850.8
Tellina sp.	12MAY88	D	2	0-3	1	283.6
Turbellaria	12MAY88	D	2	0-3	1	283.6
Cossura delta	12MAY88	D	2	3-10	1	283.6
Gyptis vittata	12MAY88	D	2	3-10	1	283.6
Maldane sarsi	12MAY88	D	2	3-10	1	283.6
Mediomastus californiensis	12MAY88	D	2	3-10	1	283.6
Nereidae	12MAY88	D	2	3-10	1	283.6
Phoronis architecta	12MAY88	D	2	3-10	1	283.6
Spiophanes bombyx	12MAY88	D	2	3-10	1	283.6
Callianassa sp. juvenile	12MAY88	D	3	0-3	1	283.6
Glycinde solitaria	12MAY88	D	3	0-3	1	283.6
Mediomastus californiensis	12MAY88	D	3	0-3	5	1418.0
Microprotopus spp.	12MAY88	D	3	0-3	1	283.6
Nereidae	12MAY88	D	3	0-3	1	283.6
Paraprionospio pinnata	12MAY88	D	3	0-3	1	283.6
Phoronis architecta	12MAY88	D	3	0-3	1	283.6
Spiophanes bombyx	12MAY88	D	3	0-3	1	283.6
Tharyx setigera	12MAY88	D	3	0-3	1	283.6
Turbellaria	12MAY88	D	3	0-3	1	283.6
Turbonilla sp.	12MAY88	D	3	0-3	1	283.6
Aligena texasiana	12MAY88	D	3	3-10	2	567.2
Clymenella torquata calida	12MAY88	D	3	3-10	1	283.6
Cossura delta	12MAY88	D	3	3-10	4	1134.4
Maldane sarsi	12MAY88	D	3	3-10	2	567.2
Mediomastus californiensis	12MAY88	D	3	3-10	6	1701.6
Oligochaeta	12MAY88	D	3	3-10	1	283.6
Paraprionospio pinnata	12MAY88	D	3	3-10	1	283.6
Phoronis architecta	12MAY88	D	3	3-10	1	283.6
Spiophanes bombyx	12MAY88	D	3	3-10	3	850.8
Tharyx setigera	12MAY88	D	3	3-10	2	567.2
Leucon sp.	26JUL88	C	1	0-3	8	2268.8
Mediomastus californiensis	26JUL88	C	1	0-3	1	283.6
Caecum johnsoni	26JUL88	C	1	3-10	1	283.6
Cossura delta	26JUL88	C	1	3-10	2	567.2
Gyptis vittata	26JUL88	C	1	3-10	3	850.8
Maldane sarsi	26JUL88	C	1	3-10	2	567.2
Mediomastus californiensis	26JUL88	C	1	3-10	4	1134.4
Melinna maculata	26JUL88	C	1	3-10	1	283.6
Ophiuroidea	26JUL88	C	1	3-10	1	283.6
Periploma cf. orbiculare	26JUL88	C	1	3-10	1	283.6
Rhynchocoels	26JUL88	C	1	3-10	3	850.8
Leucon sp.	26JUL88	C	2	0-3	8	2268.8
Mediomastus californiensis	26JUL88	C	2	0-3	3	850.8
Streblospio benedicti	26JUL88	C	2	0-3	1	283.6
Tharyx setigera	26JUL88	C	2	0-3	1	283.6
Cossura delta	26JUL88	C	2	3-10	1	283.6
Maldane sarsi	26JUL88	C	2	3-10	1	283.6
Mediomastus californiensis	26JUL88	C	2	3-10	1	283.6
Microprotopus spp.	26JUL88	C	2	3-10	1	283.6
Paraprionospio pinnata	26JUL88	C	2	3-10	1	283.6
Streblospio benedicti	26JUL88	C	2	3-10	1	283.6
Leucon sp.	26JUL88	C	3	0-3	7	1985.2
Mediomastus californiensis	26JUL88	C	3	0-3	1	283.6
Phascolion strombi	26JUL88	C	3	0-3	1	283.6
Rhynchocoels	26JUL88	C	3	0-3	1	283.6
Cossura delta	26JUL88	C	3	3-10	1	283.6
Mediomastus californiensis	26JUL88	C	3	3-10	7	1985.2
Ophiuroidea	26JUL88	C	3	3-10	1	283.6
Rhynchocoels	26JUL88	C	3	3-10	2	567.2
Cossura delta	26JUL88	D	1	0-3	1	283.6
Mediomastus californiensis	26JUL88	D	1	0-3	4	1134.4
Nassarius acutus	26JUL88	D	1	0-3	1	283.6
Paraprionospio pinnata	26JUL88	D	1	0-3	1	283.6
Phascolion strombi	26JUL88	D	1	0-3	3	850.8
Pyramidella sp.	26JUL88	D	1	0-3	1	283.6

Streblospio benedicti	26JUL88	D	1	0-3	1	283.6
Turbonilla sp.	26JUL88	D	1	0-3	1	283.6
Nereidae	26JUL88	D	1	3-10	1	283.6
Oligochaeta	26JUL88	D	1	3-10	1	283.6
Paleanotus heteroseta	26JUL88	D	1	3-10	1	283.6
Phoronis architecta	26JUL88	D	1	3-10	1	283.6
Tharyx setigera	26JUL88	D	1	3-10	2	567.2
Glycinde solitaria	26JUL88	D	2	0-3	1	283.6
Mediomastus californiensis	26JUL88	D	2	0-3	3	850.8
Phascolion strombi	26JUL88	D	2	0-3	1	283.6
Phoronis architecta	26JUL88	D	2	0-3	1	283.6
Polydora caulleryi	26JUL88	D	2	0-3	1	283.6
Streblospio benedicti	26JUL88	D	2	0-3	1	283.6
Cossura delta	26JUL88	D	2	3-10	4	1134.4
Gyptis vittata	26JUL88	D	2	3-10	1	283.6
Mediomastus californiensis	26JUL88	D	2	3-10	1	283.6
Phoronis architecta	26JUL88	D	2	3-10	1	283.6
Polydora caulleryi	26JUL88	D	2	3-10	47	13329.2
Tharyx setigera	26JUL88	D	2	3-10	16	4537.6
Gyptis vittata	26JUL88	D	3	0-3	1	283.6
Leucon sp.	26JUL88	D	3	0-3	1	283.6
Mediomastus californiensis	26JUL88	D	3	0-3	7	1985.2
Paraonidae grp. A	26JUL88	D	3	0-3	1	283.6
Phascolion strombi	26JUL88	D	3	0-3	1	283.6
Polydora caulleryi	26JUL88	D	3	0-3	2	567.2
Pyramidella sp.	26JUL88	D	3	0-3	1	283.6
Streblospio benedicti	26JUL88	D	3	0-3	1	283.6
Tharyx setigera	26JUL88	D	3	0-3	2	567.2
Cossura delta	26JUL88	D	3	3-10	1	283.6
Gyptis vittata	26JUL88	D	3	3-10	2	567.2
Rhynchocoels	26JUL88	D	3	3-10	2	567.2
Tharyx setigera	26JUL88	D	3	3-10	6	1701.6
Mulinia lateralis	27JUL88	A	1	0-3	5	1418.0
Streblospio benedicti	27JUL88	A	1	0-3	5	1418.0
Mediomastus californiensis	27JUL88	A	1	3-10	2	567.2
Mediomastus californiensis	27JUL88	A	2	0-3	2	567.2
Mulinia lateralis	27JUL88	A	2	0-3	5	1418.0
Mysidopsis bahia	27JUL88	A	2	0-3	1	283.6
Oxyurostylis salioni	27JUL88	A	2	0-3	1	283.6
Streblospio benedicti	27JUL88	A	2	0-3	8	2268.8
Macoma mitchelli	27JUL88	A	2	3-10	1	283.6
Mediomastus californiensis	27JUL88	A	2	3-10	2	567.2
Acteocina canaliculata	27JUL88	A	3	0-3	1	283.6
Mediomastus californiensis	27JUL88	A	3	0-3	2	567.2
Mulinia lateralis	27JUL88	A	3	0-3	6	1701.6
Pyramidella sp.	27JUL88	A	3	0-3	1	283.6
Streblospio benedicti	27JUL88	A	3	0-3	10	2836.0
Macoma mitchelli	27JUL88	A	3	3-10	1	283.6
Mediomastus californiensis	27JUL88	A	3	3-10	4	1134.4
Phoronis architecta	27JUL88	A	3	3-10	1	283.6
Acteocina canaliculata	27JUL88	B	1	0-3	6	1701.6
Macoma mitchelli	27JUL88	B	1	0-3	1	283.6
Mediomastus californiensis	27JUL88	B	1	0-3	4	1134.4
Megalomma bioculatum	27JUL88	B	1	0-3	2	567.2
Microprotopus spp.	27JUL88	B	1	0-3	1	283.6
Mulinia lateralis	27JUL88	B	1	0-3	4	1134.4
Clymenella mucosa	27JUL88	B	1	3-10	2	567.2
Haploscoloplos foliosus	27JUL88	B	1	3-10	1	283.6
Maldane sarsi	27JUL88	B	1	3-10	1	283.6
Rhynchocoels	27JUL88	B	1	3-10	1	283.6
Asychis sp.	27JUL88	B	2	0-3	2	567.2
Clymenella torquata calida	27JUL88	B	2	0-3	1	283.6
Cyclaspis varians	27JUL88	B	2	0-3	2	567.2
Mediomastus californiensis	27JUL88	B	2	0-3	9	2552.4
Megalomma bioculatum	27JUL88	B	2	0-3	2	567.2
Microprotopus spp.	27JUL88	B	2	0-3	2	567.2
Mulinia lateralis	27JUL88	B	2	0-3	2	567.2

Mysidopsis bahia	27JUL88	B	2	0-3	1	283.6
Dorvilleidae	27JUL88	B	2	3-10	1	283.6
Marphysa sanguinea	27JUL88	B	2	3-10	1	283.6
Glycinde solitaria	27JUL88	B	3	0-3	2	567.2
Mediomastus californiensis	27JUL88	B	3	0-3	4	1134.4
Megalomma bioculatum	27JUL88	B	3	0-3	1	283.6
Microprotopus spp.	27JUL88	B	3	0-3	2	567.2
Mulinia lateralis	27JUL88	B	3	0-3	6	1701.6
Mysella planulata	27JUL88	B	3	0-3	1	283.6
Melinna maculata	27JUL88	B	3	3-10	1	283.6

LPMACSP.DAT Lavaca-Tres Palacios Estuary Macrofauna species data.

3 replicates (REP) were taken each time, N=n/section (SEC)
nm2=n/m^2. Sections in cm.

SPNAME	DATE	STA	REP	SEC	N	NM2
Ampelisca abdita	18APR88	A	1	0-3	2	567.2
Cyclaspis varians	18APR88	A	1	0-3	2	567.2
Eteone heteropoda	18APR88	A	1	0-3	1	283.6
Glycinde solitaria	18APR88	A	1	0-3	9	2552.4
Mediomastus californiensis	18APR88	A	1	0-3	68	19284.8
Mulinia lateralis	18APR88	A	1	0-3	5	1418.0
Nereidae	18APR88	A	1	0-3	1	283.6
Oxyurostylis smithi	18APR88	A	1	0-3	3	850.8
Phyllodocidae	18APR88	A	1	0-3	1	283.6
Scolelepis squamata	18APR88	A	1	0-3	1	283.6
Streblospio benedicti	18APR88	A	1	0-3	4	1134.4
Ensis minor	18APR88	A	1	3-10	3	850.8
Gammarus mucronatus	18APR88	A	1	3-10	1	283.6
Mediomastus californiensis	18APR88	A	1	3-10	3	850.8
Tagelus plebius	18APR88	A	1	3-10	2	567.2
Ampelisca abdita	18APR88	A	2	0-3	2	567.2
Capitella capitata	18APR88	A	2	0-3	1	283.6
Cyclaspis varians	18APR88	A	2	0-3	4	1134.4
Glycinde solitaria	18APR88	A	2	0-3	11	3119.6
Littoridina sphinctostoma	18APR88	A	2	0-3	1	283.6
Mediomastus californiensis	18APR88	A	2	0-3	60	17016.0
Mulinia lateralis	18APR88	A	2	0-3	19	5388.4
Oxyurostylis smithi	18APR88	A	2	0-3	1	283.6
Scolelepis squamata	18APR88	A	2	0-3	1	283.6
Streblospio benedicti	18APR88	A	2	0-3	2	567.2
Cossura delta	18APR88	A	2	3-10	1	283.6
Ensis minor	18APR88	A	2	3-10	2	567.2
Mediomastus californiensis	18APR88	A	2	3-10	3	850.8
Nereidae	18APR88	A	2	3-10	1	283.6
Capitella capitata	18APR88	A	3	0-3	1	283.6
Cyclaspis varians	18APR88	A	3	0-3	1	283.6
Edotea montosa	18APR88	A	3	0-3	1	283.6
Glycinde solitaria	18APR88	A	3	0-3	4	1134.4
Littoridina sphinctostoma	18APR88	A	3	0-3	1	283.6
Mediomastus californiensis	18APR88	A	3	0-3	53	15030.8
Monoculoides sp.	18APR88	A	3	0-3	1	283.6
Mulinia lateralis	18APR88	A	3	0-3	11	3119.6
Nereidae	18APR88	A	3	0-3	1	283.6
Oxyurostylis smithi	18APR88	A	3	0-3	2	567.2
Rhynchocoels	18APR88	A	3	0-3	1	283.6
Streblospio benedicti	18APR88	A	3	0-3	7	1985.2
Mediomastus californiensis	18APR88	A	3	3-10	5	1418.0
Parandalia ocularis	18APR88	A	3	3-10	3	850.8
Tagelus plebius	18APR88	A	3	3-10	5	1418.0
Cossura delta	18APR88	B	1	0-3	2	567.2
Cyclaspis varians	18APR88	B	1	0-3	1	283.6
Cyclopoid copepod	18APR88	B	1	0-3	1	283.6
Mediomastus californiensis	18APR88	B	1	0-3	27	7657.2
Melinna maculata	18APR88	B	1	0-3	1	283.6
Mulinia lateralis	18APR88	B	1	0-3	6	1701.6
Oxyurostylis smithi	18APR88	B	1	0-3	1	283.6
Polychaete juvenile (Unidentified)	18APR88	B	1	0-3	1	283.6
Pyramidella sp.	18APR88	B	1	0-3	1	283.6
Streblospio benedicti	18APR88	B	1	0-3	2	567.2
Cossura delta	18APR88	B	1	3-10	9	2552.4
Glycinde solitaria	18APR88	B	1	3-10	2	567.2

Mediomastus californiensis	18APR88	B	1	3-10	11	3119.6
Cossura delta	18APR88	B	2	0-3	3	850.8
Cyclaspis varians	18APR88	B	2	0-3	1	283.6
Cyclopoid copepod	18APR88	B	2	0-3	1	283.6
Glycinde solitaria	18APR88	B	2	0-3	1	283.6
Haploscoloplos foliosus	18APR88	B	2	0-3	1	283.6
Mediomastus californiensis	18APR88	B	2	0-3	24	6806.4
Mulinia lateralis	18APR88	B	2	0-3	6	1701.6
Oxyurostylis smithi	18APR88	B	2	0-3	1	283.6
Streblospio benedicti	18APR88	B	2	0-3	4	1134.4
Cossura delta	18APR88	B	2	3-10	10	2836.0
Glycinde solitaria	18APR88	B	2	3-10	2	567.2
Mediomastus californiensis	18APR88	B	2	3-10	19	5388.4
Rhynchocoels	18APR88	B	2	3-10	1	283.6
Ampelisca abdita	18APR88	B	3	0-3	1	283.6
Glycinde solitaria	18APR88	B	3	0-3	2	567.2
Mediomastus californiensis	18APR88	B	3	0-3	20	5672.0
Microprotopus spp.	18APR88	B	3	0-3	1	283.6
Mulinia lateralis	18APR88	B	3	0-3	8	2268.8
Streblospio benedicti	18APR88	B	3	0-3	1	283.6
Cossura delta	18APR88	B	3	3-10	11	3119.6
Haploscoloplos foliosus	18APR88	B	3	3-10	1	283.6
Maldane sarsi	18APR88	B	3	3-10	1	283.6
Mediomastus californiensis	18APR88	B	3	3-10	11	3119.6
Brania clavata	18APR88	C	1	0-3	6	1701.6
Drilonereis magna	18APR88	C	1	0-3	2	567.2
Glycinde solitaria	18APR88	C	1	0-3	3	850.8
Mediomastus californiensis	18APR88	C	1	0-3	11	3119.6
Nuculana acuta	18APR88	C	1	0-3	1	283.6
Oligochaeta	18APR88	C	1	0-3	2	567.2
Oxyurostylis smithi	18APR88	C	1	0-3	2	567.2
Polydora caulleryi	18APR88	C	1	0-3	2	567.2
Rhynchocoels	18APR88	C	1	0-3	1	283.6
Sarsiella texana	18APR88	C	1	0-3	1	283.6
Turbellaria	18APR88	C	1	0-3	1	283.6
Bivalvia	18APR88	C	1	3-10	2	567.2
Clymenella mucosa	18APR88	C	1	3-10	2	567.2
Cossura delta	18APR88	C	1	3-10	1	283.6
Gyptis vittata	18APR88	C	1	3-10	1	283.6
Maldane sarsi	18APR88	C	1	3-10	1	283.6
Mediomastus californiensis	18APR88	C	1	3-10	17	4821.2
Oligochaeta	18APR88	C	1	3-10	2	567.2
Paraprionospio pinnata	18APR88	C	1	3-10	1	283.6
Polydora caulleryi	18APR88	C	1	3-10	11	3119.6
Rhynchocoels	18APR88	C	1	3-10	2	567.2
Schizocardium sp.	18APR88	C	1	3-10	1	283.6
Spionidae	18APR88	C	1	3-10	1	283.6
Acteocina canaliculata	18APR88	C	2	0-3	1	283.6
Brania clavata	18APR88	C	2	0-3	31	8791.6
Drilonereis magna	18APR88	C	2	0-3	1	283.6
Glycinde solitaria	18APR88	C	2	0-3	7	1985.2
Gyptis vittata	18APR88	C	2	0-3	1	283.6
Mediomastus californiensis	18APR88	C	2	0-3	15	4254.0
Oxyurostylis smithi	18APR88	C	2	0-3	2	567.2
Polydora caulleryi	18APR88	C	2	0-3	1	283.6
Rhynchocoels	18APR88	C	2	0-3	1	283.6
Streblospio benedicti	18APR88	C	2	0-3	1	283.6
Brania clavata	18APR88	C	2	3-10	1	283.6
Cossura delta	18APR88	C	2	3-10	1	283.6
Drilonereis magna	18APR88	C	2	3-10	2	567.2
Glycinde solitaria	18APR88	C	2	3-10	1	283.6
Gyptis vittata	18APR88	C	2	3-10	4	1134.4
Haploscoloplos foliosus	18APR88	C	2	3-10	2	567.2
Mediomastus californiensis	18APR88	C	2	3-10	28	7940.8
Notomastus cf. latericeus	18APR88	C	2	3-10	1	283.6
Oligochaeta	18APR88	C	2	3-10	1	283.6
Paleanotus heteroseta	18APR88	C	2	3-10	1	283.6

Polydora caulleryi	18APR88	C	2	3-10	44	12478.4
Rhynchocoels	18APR88	C	2	3-10	5	1418.0
Schizocardium sp.	18APR88	C	2	3-10	5	1418.0
Spionidae	18APR88	C	2	3-10	3	850.8
Brania clavata	18APR88	C	3	0-3	15	4254.0
Clymenella torquata calida	18APR88	C	3	0-3	1	283.6
Drilonereis magna	18APR88	C	3	0-3	2	567.2
Glycinde solitaria	18APR88	C	3	0-3	1	283.6
Gyptis vittata	18APR88	C	3	0-3	1	283.6
Haploscoloplos foliosus	18APR88	C	3	0-3	1	283.6
Mediomastus californiensis	18APR88	C	3	0-3	11	3119.6
Nassarius acutus	18APR88	C	3	0-3	1	283.6
Nuculana concentrica	18APR88	C	3	0-3	1	283.6
Polydora caulleryi	18APR88	C	3	0-3	7	1985.2
Rhynchocoels	18APR88	C	3	0-3	3	850.8
Streblospio benedicti	18APR88	C	3	0-3	1	283.6
Caecum johnsoni	18APR88	C	3	3-10	1	283.6
Drilonereis magna	18APR88	C	3	3-10	1	283.6
Gyptis vittata	18APR88	C	3	3-10	4	1134.4
Haploscoloplos foliosus	18APR88	C	3	3-10	1	283.6
Maldane sarsi	18APR88	C	3	3-10	1	283.6
Mediomastus californiensis	18APR88	C	3	3-10	27	7657.2
Paraonidae grp. A	18APR88	C	3	3-10	1	283.6
Phoronis architecta	18APR88	C	3	3-10	1	283.6
Polydora caulleryi	18APR88	C	3	3-10	20	5672.0
Rhynchocoels	18APR88	C	3	3-10	2	567.2
Schizocardium sp.	18APR88	C	3	3-10	1	283.6
Spionidae	18APR88	C	3	3-10	2	567.2
Tharyx setigera	18APR88	C	3	3-10	1	283.6
Anthozoa	18APR88	D	1	0-3	2	567.2
Apseudes sp. A	18APR88	D	1	0-3	47	13329.2
Bivalvia	18APR88	D	1	0-3	1	283.6
Corbula contracta	18APR88	D	1	0-3	3	850.8
Diopatra cuprea	18APR88	D	1	0-3	1	283.6
Glycera americana	18APR88	D	1	0-3	2	567.2
Glycinde solitaria	18APR88	D	1	0-3	2	567.2
Gyptis vittata	18APR88	D	1	0-3	2	567.2
Mediomastus californiensis	18APR88	D	1	0-3	38	10776.8
Notomastus cf. latericeus	18APR88	D	1	0-3	1	283.6
Ophiuroidea	18APR88	D	1	0-3	1	283.6
Oxyurostylis smithi	18APR88	D	1	0-3	1	283.6
Phoronis architecta	18APR88	D	1	0-3	1	283.6
Polydora caulleryi	18APR88	D	1	0-3	1	283.6
Polydora sp.	18APR88	D	1	0-3	1	283.6
Apseudes sp. A	18APR88	D	1	3-10	14	3970.4
Bivalvia	18APR88	D	1	3-10	15	4254.0
Corbula contracta	18APR88	D	1	3-10	2	567.2
Cossura delta	18APR88	D	1	3-10	2	567.2
Gyptis vittata	18APR88	D	1	3-10	3	850.8
Mediomastus californiensis	18APR88	D	1	3-10	16	4537.6
Oligochaeta	18APR88	D	1	3-10	4	1134.4
Ophiuroidea	18APR88	D	1	3-10	2	567.2
Paraonidae grp. B	18APR88	D	1	3-10	1	283.6
Periploma cf. orbiculare	18APR88	D	1	3-10	5	1418.0
Polydora caulleryi	18APR88	D	1	3-10	5	1418.0
Rhynchocoels	18APR88	D	1	3-10	1	283.6
Spionidae	18APR88	D	1	3-10	9	2552.4
Apseudes sp. A	18APR88	D	2	0-3	222	62959.2
Bivalvia	18APR88	D	2	0-3	1	283.6
Caecum johnsoni	18APR88	D	2	0-3	1	283.6
Corbula contracta	18APR88	D	2	0-3	1	283.6
Cossura delta	18APR88	D	2	0-3	1	283.6
Diopatra cuprea	18APR88	D	2	0-3	1	283.6
Glycera americana	18APR88	D	2	0-3	1	283.6
Glycinde solitaria	18APR88	D	2	0-3	1	283.6
Mediomastus californiensis	18APR88	D	2	0-3	23	6522.8
Periploma cf. orbiculare	18APR88	D	2	0-3	1	283.6

Apseudes sp. A	18APR88	D	2	3-10	57	16165.2
Bivalvia	18APR88	D	2	3-10	10	2836.0
Clymenella mucosa	18APR88	D	2	3-10	1	283.6
Corbula contracta	18APR88	D	2	3-10	1	283.6
Cossura delta	18APR88	D	2	3-10	6	1701.6
Drilonereis magna	18APR88	D	2	3-10	1	283.6
Eunoe cf nodulosa	18APR88	D	2	3-10	1	283.6
Glycinde solitaria	18APR88	D	2	3-10	1	283.6
Gyptis vittata	18APR88	D	2	3-10	1	283.6
Haploscoloplos foliosus	18APR88	D	2	3-10	2	567.2
Mediomastus californiensis	18APR88	D	2	3-10	14	3970.4
Notomastus latericeus	18APR88	D	2	3-10	1	283.6
Oligochaeta	18APR88	D	2	3-10	5	1418.0
Ophiuroidea	18APR88	D	2	3-10	3	850.8
Paraonidae grp. B	18APR88	D	2	3-10	2	567.2
Periploma cf. orbiculare	18APR88	D	2	3-10	2	567.2
Polychaete juvenile (Unidentified)	18APR88	D	2	3-10	3	850.8
Polydora caulleryi	18APR88	D	2	3-10	1	283.6
Rhynchocoels	18APR88	D	2	3-10	3	850.8
Terebellidae	18APR88	D	2	3-10	1	283.6
Anthozoa	18APR88	D	3	0-3	1	283.6
Apseudes sp. A	18APR88	D	3	0-3	329	93304.4
Armandia maculata	18APR88	D	3	0-3	1	283.6
Bivalvia	18APR88	D	3	0-3	2	567.2
Brania clavata	18APR88	D	3	0-3	1	283.6
Cossura delta	18APR88	D	3	0-3	2	567.2
Glycinde solitaria	18APR88	D	3	0-3	4	1134.4
Mediomastus californiensis	18APR88	D	3	0-3	53	15030.8
Paraonidae grp. B	18APR88	D	3	0-3	1	283.6
Paraprionospio pinnata	18APR88	D	3	0-3	1	283.6
Rhynchocoels	18APR88	D	3	0-3	2	567.2
Spionidae	18APR88	D	3	0-3	2	567.2
Apseudes sp. A	18APR88	D	3	3-10	43	12194.8
Bivalvia	18APR88	D	3	3-10	5	1418.0
Corbula contracta	18APR88	D	3	3-10	4	1134.4
Cossura delta	18APR88	D	3	3-10	2	567.2
Gyptis vittata	18APR88	D	3	3-10	2	567.2
Mediomastus californiensis	18APR88	D	3	3-10	22	6239.2
Oligochaeta	18APR88	D	3	3-10	9	2552.4
Ophiuroidea	18APR88	D	3	3-10	1	283.6
Paleanotus heteroseta	18APR88	D	3	3-10	1	283.6
Periploma cf. orbiculare	18APR88	D	3	3-10	2	567.2
Polydora caulleryi	18APR88	D	3	3-10	3	850.8
Rhynchocoels	18APR88	D	3	3-10	1	283.6
Spionidae	18APR88	D	3	3-10	26	7373.6
Acteocina canaliculata	07JUL88	A	1	0-3	1	283.6
Ampelisca abdita	07JUL88	A	1	0-3	1	283.6
Macoma mitchelli	07JUL88	A	1	0-3	1	283.6
Mediomastus californiensis	07JUL88	A	1	0-3	16	4537.6
Mulinia lateralis	07JUL88	A	1	0-3	1	283.6
Pyramidella sp.	07JUL88	A	1	0-3	1	283.6
Streblospio benedicti	07JUL88	A	1	0-3	4	1134.4
Cossura delta	07JUL88	A	1	3-10	2	567.2
Mediomastus californiensis	07JUL88	A	1	3-10	7	1985.2
Paraprionospio pinnata	07JUL88	A	1	3-10	1	283.6
Ampelisca abdita	07JUL88	A	2	0-3	1	283.6
Cossura delta	07JUL88	A	2	0-3	1	283.6
Glycinde solitaria	07JUL88	A	2	0-3	1	283.6
Mediomastus californiensis	07JUL88	A	2	0-3	14	3970.4
Mysidopsis bahia	07JUL88	A	2	0-3	1	283.6
Streblospio benedicti	07JUL88	A	2	0-3	3	850.8
Cossura delta	07JUL88	A	2	3-10	1	283.6
Mediomastus californiensis	07JUL88	A	2	3-10	2	567.2
Ampelisca abdita	07JUL88	A	3	0-3	1	283.6
Diopatra cuprea	07JUL88	A	3	0-3	1	283.6
Mediomastus californiensis	07JUL88	A	3	0-3	17	4821.2
Mysidopsis bahia	07JUL88	A	3	0-3	1	283.6

Pyramidella sp.	07JUL88	A	3	0-3	1	283.6
Streblospio benedicti	07JUL88	A	3	0-3	4	1134.4
No species observed	07JUL88	A	3	3-10	0	0.0
Ampelisca abdita	07JUL88	B	1	0-3	1	283.6
Bivalvia	07JUL88	B	1	0-3	1	283.6
Glycinde solitaria	07JUL88	B	1	0-3	1	283.6
Leucon sp.	07JUL88	B	1	0-3	1	283.6
Mediomastus californiensis	07JUL88	B	1	0-3	15	4254.0
Mulinia lateralis	07JUL88	B	1	0-3	2	567.2
Paraprionospio pinnata	07JUL88	B	1	0-3	1	283.6
Pyramidella sp.	07JUL88	B	1	0-3	1	283.6
Cossura delta	07JUL88	B	1	3-10	1	283.6
Odostomia sp.	07JUL88	B	1	3-10	2	567.2
Paraprionospio pinnata	07JUL88	B	1	3-10	1	283.6
Ampelisca abdita	07JUL88	B	2	0-3	2	567.2
Cyclaspis varians	07JUL88	B	2	0-3	1	283.6
Mediomastus californiensis	07JUL88	B	2	0-3	31	8791.6
Mulinia lateralis	07JUL88	B	2	0-3	1	283.6
Streblospio benedicti	07JUL88	B	2	0-3	1	283.6
Bivalvia	07JUL88	B	2	3-10	1	283.6
Clymenella mucosa	07JUL88	B	2	3-10	2	567.2
Cossura delta	07JUL88	B	2	3-10	1	283.6
Mediomastus californiensis	07JUL88	B	2	3-10	5	1418.0
Leucon sp.	07JUL88	B	3	0-3	1	283.6
Mediomastus californiensis	07JUL88	B	3	0-3	29	8224.4
Mulinia lateralis	07JUL88	B	3	0-3	1	283.6
Paraprionospio pinnata	07JUL88	B	3	0-3	1	283.6
Pyramidella sp.	07JUL88	B	3	0-3	1	283.6
Cossura delta	07JUL88	B	3	3-10	1	283.6
Glycinde solitaria	07JUL88	B	3	3-10	4	1134.4
Gyptis vittata	07JUL88	B	3	3-10	1	283.6
Macoma mitchelli	07JUL88	B	3	3-10	1	283.6
Mediomastus californiensis	07JUL88	B	3	3-10	5	1418.0
Rhynchocoels	07JUL88	B	3	3-10	2	567.2
Mediomastus californiensis	08JUL88	C	1	0-3	3	850.8
Monoculoides sp.	08JUL88	C	1	0-3	1	283.6
Paraprionospio pinnata	08JUL88	C	1	0-3	1	283.6
Periploma cf. orbiculare	08JUL88	C	1	0-3	1	283.6
Polydora caulleryi	08JUL88	C	1	0-3	2	567.2
Rhynchocoels	08JUL88	C	1	0-3	2	567.2
Schizocardium sp.	08JUL88	C	1	0-3	1	283.6
Syllidae	08JUL88	C	1	0-3	1	283.6
Clymenella mucosa	08JUL88	C	1	3-10	1	283.6
Gyptis vittata	08JUL88	C	1	3-10	1	283.6
Maldane sarsi	08JUL88	C	1	3-10	1	283.6
Mediomastus californiensis	08JUL88	C	1	3-10	15	4254.0
Oligochaeta	08JUL88	C	1	3-10	2	567.2
Paraonidae grp. B	08JUL88	C	1	3-10	1	283.6
Polydora caulleryi	08JUL88	C	1	3-10	54	15314.4
Rhynchocoels	08JUL88	C	1	3-10	2	567.2
Schizocardium sp.	08JUL88	C	1	3-10	1	283.6
Spiochaetopterus costarum	08JUL88	C	1	3-10	1	283.6
Tharyx setigera	08JUL88	C	1	3-10	3	850.8
Drilonereis magna	08JUL88	C	2	0-3	1	283.6
Glycinde solitaria	08JUL88	C	2	0-3	1	283.6
Maldane sarsi	08JUL88	C	2	0-3	1	283.6
Mediomastus californiensis	08JUL88	C	2	0-3	6	1701.6
Minuspio cirrifera	08JUL88	C	2	0-3	1	283.6
Oligochaeta	08JUL88	C	2	0-3	1	283.6
Paraprionospio pinnata	08JUL88	C	2	0-3	1	283.6
Polydora caulleryi	08JUL88	C	2	0-3	3	850.8
Schizocardium sp.	08JUL88	C	2	0-3	1	283.6
Syllidae	08JUL88	C	2	0-3	1	283.6
Turbellaria	08JUL88	C	2	0-3	1	283.6
Turbonilla sp.	08JUL88	C	2	0-3	1	283.6
Cossura delta	08JUL88	C	2	3-10	3	850.8
Drilonereis magna	08JUL88	C	2	3-10	1	283.6

Glycinde solitaria	08JUL88	C	2	3-10	1	283.6
Gyptis vittata	08JUL88	C	2	3-10	2	567.2
Maldane sarsi	08JUL88	C	2	3-10	1	283.6
Mediomastus californiensis	08JUL88	C	2	3-10	19	5388.4
Ophiuroidea	08JUL88	C	2	3-10	1	283.6
Schizocardium sp.	08JUL88	C	2	3-10	3	850.8
Maldane sarsi	08JUL88	C	3	0-3	1	283.6
Mediomastus californiensis	08JUL88	C	3	0-3	4	1134.4
Minuspio cirrifera	08JUL88	C	3	0-3	1	283.6
Paraonidae grp. B	08JUL88	C	3	0-3	1	283.6
Polydora caulleryi	08JUL88	C	3	0-3	3	850.8
Rhynchocoels	08JUL88	C	3	0-3	1	283.6
Syllidae	08JUL88	C	3	0-3	5	1418.0
Bivalvia	08JUL88	C	3	3-10	1	283.6
Clymenella mucosa	08JUL88	C	3	3-10	1	283.6
Maldane sarsi	08JUL88	C	3	3-10	1	283.6
Mediomastus californiensis	08JUL88	C	3	3-10	19	5388.4
Minuspio cirrifera	08JUL88	C	3	3-10	1	283.6
Paraonidae grp. B	08JUL88	C	3	3-10	1	283.6
Polydora caulleryi	08JUL88	C	3	3-10	1	283.6
Rhynchocoels	08JUL88	C	3	3-10	1	283.6
Schizocardium sp.	08JUL88	C	3	3-10	2	567.2
Tharyx setigera	08JUL88	C	3	3-10	2	567.2
Apseudes sp. A	08JUL88	D	1	0-3	3	850.8
Armandia maculata	08JUL88	D	1	0-3	1	283.6
Gyptis vittata	08JUL88	D	1	0-3	1	283.6
Listriella barnardi	08JUL88	D	1	0-3	1	283.6
Mediomastus californiensis	08JUL88	D	1	0-3	6	1701.6
Periploma cf. orbiculare	08JUL88	D	1	0-3	1	283.6
Phascolion strombi	08JUL88	D	1	0-3	1	283.6
Pinnixa chacei	08JUL88	D	1	0-3	1	283.6
Polydora caulleryi	08JUL88	D	1	0-3	1	283.6
Rhynchocoels	08JUL88	D	1	0-3	5	1418.0
Sigambra tentaculata	08JUL88	D	1	0-3	1	283.6
Apseudes sp. A	08JUL88	D	1	3-10	35	9926.0
Armandia maculata	08JUL88	D	1	3-10	1	283.6
Bivalvia	08JUL88	D	1	3-10	1	283.6
Mediomastus californiensis	08JUL88	D	1	3-10	7	1985.2
Oligochaeta	08JUL88	D	1	3-10	10	2836.0
Ophiuroidea	08JUL88	D	1	3-10	1	283.6
Paraonidae grp. A	08JUL88	D	1	3-10	1	283.6
Paraonidae grp. B	08JUL88	D	1	3-10	3	850.8
Periploma cf. orbiculare	08JUL88	D	1	3-10	2	567.2
Pinnixa chacei	08JUL88	D	1	3-10	1	283.6
Polydora caulleryi	08JUL88	D	1	3-10	5	1418.0
Rhynchocoels	08JUL88	D	1	3-10	3	850.8
Schizocardium sp.	08JUL88	D	1	3-10	1	283.6
Spionidae	08JUL88	D	1	3-10	5	1418.0
Dentalium texasianum	08JUL88	D	2	0-3	1	283.6
Gyptis vittata	08JUL88	D	2	0-3	1	283.6
Mediomastus californiensis	08JUL88	D	2	0-3	6	1701.6
Nuculana concentrica	08JUL88	D	2	0-3	1	283.6
Paleanotus heteroseta	08JUL88	D	2	0-3	1	283.6
Pinnixa chacei	08JUL88	D	2	0-3	1	283.6
Polydora caulleryi	08JUL88	D	2	0-3	3	850.8
Rhynchocoels	08JUL88	D	2	0-3	2	567.2
Spionidae	08JUL88	D	2	0-3	2	567.2
Anthozoa	08JUL88	D	2	3-10	1	283.6
Apseudes sp. A	08JUL88	D	2	3-10	17	4821.2
Bivalvia	08JUL88	D	2	3-10	1	283.6
Caecum johnsoni	08JUL88	D	2	3-10	1	283.6
Cossura delta	08JUL88	D	2	3-10	3	850.8
Eunoe cf nodulosa	08JUL88	D	2	3-10	3	850.8
Mediomastus californiensis	08JUL88	D	2	3-10	9	2552.4
Oligochaeta	08JUL88	D	2	3-10	9	2552.4
Ophiuroidea	08JUL88	D	2	3-10	3	850.8
Paleanotus heteroseta	08JUL88	D	2	3-10	1	283.6

Paraonidae grp. A	08JUL88	D	2	3-10	1	283.6
Paraonidae grp. B	08JUL88	D	2	3-10	1	283.6
Periploma cf. orbiculare	08JUL88	D	2	3-10	1	283.6
Polydora caulleryi	08JUL88	D	2	3-10	3	850.8
Rhynchocoels	08JUL88	D	2	3-10	3	850.8
Spionidae	08JUL88	D	2	3-10	3	850.8
Abra aequalis	08JUL88	D	3	0-3	1	283.6
Bivalvia	08JUL88	D	3	0-3	1	283.6
Glycinde solitaria	08JUL88	D	3	0-3	1	283.6
Mediomastus californiensis	08JUL88	D	3	0-3	8	2268.8
Periploma cf. orbiculare	08JUL88	D	3	0-3	1	283.6
Pinnixa chacei	08JUL88	D	3	0-3	1	283.6
Rhynchocoels	08JUL88	D	3	0-3	3	850.8
Turbellaria	08JUL88	D	3	0-3	1	283.6
Turbonilla sp.	08JUL88	D	3	0-3	1	283.6
Ampelisca sp. B (=amphipod A)	08JUL88	D	3	3-10	1	283.6
Apseudes sp. A	08JUL88	D	3	3-10	40	11344.0
Cossura delta	08JUL88	D	3	3-10	2	567.2
Gyptis vittata	08JUL88	D	3	3-10	2	567.2
Mediomastus californiensis	08JUL88	D	3	3-10	5	1418.0
Megalops	08JUL88	D	3	3-10	1	283.6
Notomastus latericeus	08JUL88	D	3	3-10	2	567.2
Oligochaeta	08JUL88	D	3	3-10	7	1985.2
Ophiuroidea	08JUL88	D	3	3-10	1	283.6
Paleanotus heteroseta	08JUL88	D	3	3-10	4	1134.4
Paraonidae grp. B	08JUL88	D	3	3-10	1	283.6
Periploma cf. orbiculare	08JUL88	D	3	3-10	3	850.8
Polydora caulleryi	08JUL88	D	3	3-10	1	283.6
Rhynchocoels	08JUL88	D	3	3-10	3	850.8
Sigambra tentaculata	08JUL88	D	3	3-10	1	283.6
Spionidae	08JUL88	D	3	3-10	4	1134.4
Syllidae	08JUL88	D	3	3-10	1	283.6
Ampelisca abdita	22NOV88	A	1	0-3	1	283.6
Edotea montosa	22NOV88	A	1	0-3	1	283.6
Haploscoloplos foliosus	22NOV88	A	1	0-3	3	850.8
Mediomastus californiensis	22NOV88	A	1	0-3	10	2836.0
Streblospio benedicti	22NOV88	A	1	0-3	1	283.6
Cossura delta	22NOV88	A	1	3-10	1	283.6
Glycinde solitaria	22NOV88	A	1	3-10	1	283.6
Haploscoloplos foliosus	22NOV88	A	1	3-10	2	567.2
Hemicyclops sp.	22NOV88	A	1	3-10	1	283.6
Heteromastus filiformis	22NOV88	A	1	3-10	2	567.2
Mediomastus californiensis	22NOV88	A	1	3-10	6	1701.6
Rhynchocoels	22NOV88	A	1	3-10	1	283.6
Spiochaetopterus costarum	22NOV88	A	1	3-10	1	283.6
Glycinde solitaria	22NOV88	A	2	0-3	1	283.6
Haploscoloplos foliosus	22NOV88	A	2	0-3	1	283.6
Mediomastus californiensis	22NOV88	A	2	0-3	11	3119.6
Paraprionospio pinnata	22NOV88	A	2	0-3	1	283.6
Cossura delta	22NOV88	A	2	3-10	5	1418.0
Gyptis vittata	22NOV88	A	2	3-10	1	283.6
Mediomastus californiensis	22NOV88	A	2	3-10	9	2552.4
Ampelisca abdita	22NOV88	A	3	0-3	1	283.6
Bivalvia	22NOV88	A	3	0-3	1	283.6
Gastropoda	22NOV88	A	3	0-3	1	283.6
Glycinde solitaria	22NOV88	A	3	0-3	1	283.6
Mediomastus californiensis	22NOV88	A	3	0-3	21	5955.6
Mediomastus californiensis	22NOV88	A	3	0-3	3	850.8
Rhynchocoels	22NOV88	A	3	0-3	1	283.6
Streblospio benedicti	22NOV88	A	3	0-3	4	1134.4
Cossura delta	22NOV88	A	3	3-10	3	850.8
Parandalia ocularis	22NOV88	A	3	3-10	1	283.6
Ampelisca abdita	22NOV88	B	1	0-3	1	283.6
Gastropoda	22NOV88	B	1	0-3	1	283.6
Mediomastus californiensis	22NOV88	B	1	0-3	2	567.2
Streblospio benedicti	22NOV88	B	1	0-3	21	5955.6
Cossura delta	22NOV88	B	1	3-10	2	567.2

Streblospio benedicti	22NOV88	B	1	3-10	2	567.2
Ampelisca abdita	22NOV88	B	2	0-3	1	283.6
Mediomastus californiensis	22NOV88	B	2	0-3	4	1134.4
Paraprionospio pinnata	22NOV88	B	2	0-3	1	283.6
Streblospio benedicti	22NOV88	B	2	0-3	21	5955.6
Cossura delta	22NOV88	B	2	3-10	2	567.2
Mediomastus californiensis	22NOV88	B	2	3-10	6	1701.6
Paraprionospio pinnata	22NOV88	B	2	3-10	2	567.2
Leucon sp.	22NOV88	B	3	0-3	1	283.6
Maldanidae	22NOV88	B	3	0-3	1	283.6
Paraprionospio pinnata	22NOV88	B	3	0-3	1	283.6
Rhynchocoels	22NOV88	B	3	0-3	1	283.6
Streblospio benedicti	22NOV88	B	3	0-3	17	4821.2
Cossura delta	22NOV88	B	3	3-10	1	283.6
Mediomastus californiensis	22NOV88	B	3	3-10	2	567.2
Bivalvia	22NOV88	C	1	0-3	1	283.6
Drilonereis magna	22NOV88	C	1	0-3	1	283.6
Glycinde solitaria	22NOV88	C	1	0-3	1	283.6
Listriella barnardi	22NOV88	C	1	0-3	1	283.6
Maldanidae	22NOV88	C	1	0-3	1	283.6
Mediomastus californiensis	22NOV88	C	1	0-3	7	1985.2
Paraonidae grp. B	22NOV88	C	1	0-3	1	283.6
Paraprionospio pinnata	22NOV88	C	1	0-3	1	283.6
Rhynchocoels	22NOV88	C	1	0-3	1	283.6
Spiochaetopterus costarum	22NOV88	C	1	0-3	1	283.6
Capitellidae	22NOV88	C	1	3-10	1	283.6
Cossura delta	22NOV88	C	1	3-10	1	283.6
Drilonereis magna	22NOV88	C	1	3-10	1	283.6
Glycinde solitaria	22NOV88	C	1	3-10	1	283.6
Mediomastus californiensis	22NOV88	C	1	3-10	19	5388.4
Paraonidae grp. B	22NOV88	C	1	3-10	9	2552.4
Polydora caulleryi	22NOV88	C	1	3-10	4	1134.4
Tharyx setigera	22NOV88	C	1	3-10	4	1134.4
Clymenella torquata calida	22NOV88	C	2	0-3	1	283.6
Maldane sarsi	22NOV88	C	2	0-3	2	567.2
Maldanidae	22NOV88	C	2	0-3	2	567.2
Mediomastus californiensis	22NOV88	C	2	0-3	11	3119.6
Polydora caulleryi	22NOV88	C	2	0-3	1	283.6
Polydora ligni	22NOV88	C	2	0-3	1	283.6
Schizocardium sp.	22NOV88	C	2	0-3	1	283.6
Turbonilla sp.	22NOV88	C	2	0-3	1	283.6
Cossura delta	22NOV88	C	2	3-10	2	567.2
Gyptis vittata	22NOV88	C	2	3-10	4	1134.4
Maldane sarsi	22NOV88	C	2	3-10	3	850.8
Maldanidae	22NOV88	C	2	3-10	1	283.6
Mediomastus californiensis	22NOV88	C	2	3-10	11	3119.6
Minuspio cirrifera	22NOV88	C	2	3-10	1	283.6
Parandalia ocularis	22NOV88	C	2	3-10	1	283.6
Paraonidae grp. B	22NOV88	C	2	3-10	3	850.8
Polydora caulleryi	22NOV88	C	2	3-10	1	283.6
Rhynchocoels	22NOV88	C	2	3-10	1	283.6
Schizocardium sp.	22NOV88	C	2	3-10	1	283.6
Tharyx setigera	22NOV88	C	2	3-10	5	1418.0
Cossura delta	22NOV88	C	3	0-3	1	283.6
Glycinde solitaria	22NOV88	C	3	0-3	1	283.6
Gyptis vittata	22NOV88	C	3	0-3	1	283.6
Listriella barnardi	22NOV88	C	3	0-3	2	567.2
Maldanidae	22NOV88	C	3	0-3	7	1985.2
Mediomastus californiensis	22NOV88	C	3	0-3	8	2268.8
Monoculoides sp.	22NOV88	C	3	0-3	1	283.6
Drilonereis magna	22NOV88	C	3	3-10	2	567.2
Gyptis vittata	22NOV88	C	3	3-10	4	1134.4
Maldane sarsi	22NOV88	C	3	3-10	1	283.6
Mediomastus californiensis	22NOV88	C	3	3-10	10	2836.0
Paraonidae grp. A	22NOV88	C	3	3-10	1	283.6
Paraonidae grp. B	22NOV88	C	3	3-10	1	283.6
Paraprionospio pinnata	22NOV88	C	3	3-10	1	283.6

Schizocardium sp.	22NOV88	C	3	3-10	1	283.6
Apseudes sp. A	22NOV88	D	1	0-3	33	9358.8
Armandia maculata	22NOV88	D	1	0-3	1	283.6
Corbula contracta	22NOV88	D	1	0-3	2	567.2
Cossura delta	22NOV88	D	1	0-3	1	283.6
Diopatra cuprea	22NOV88	D	1	0-3	2	567.2
Maldanidae	22NOV88	D	1	0-3	2	567.2
Mediomastus californiensis	22NOV88	D	1	0-3	12	3403.2
Minuspio cirrifera	22NOV88	D	1	0-3	2	567.2
Nuculana acuta	22NOV88	D	1	0-3	3	850.8
Ophiuroidea	22NOV88	D	1	0-3	4	1134.4
Paraprionospio pinnata	22NOV88	D	1	0-3	1	283.6
Periploma cf. orbiculare	22NOV88	D	1	0-3	1	283.6
Sphaerosyllis spa	22NOV88	D	1	0-3	1	283.6
Apseudes sp. A	22NOV88	D	1	3-10	51	14463.6
Bivalvia	22NOV88	D	1	3-10	3	850.8
Corbula contracta	22NOV88	D	1	3-10	1	283.6
Diopatra cuprea	22NOV88	D	1	3-10	1	283.6
Drilonereis magna	22NOV88	D	1	3-10	1	283.6
Gyptis vittata	22NOV88	D	1	3-10	2	567.2
Mediomastus californiensis	22NOV88	D	1	3-10	2	567.2
Minuspio cirrifera	22NOV88	D	1	3-10	10	2836.0
Ophiuroidea	22NOV88	D	1	3-10	1	283.6
Paraprionospio pinnata	22NOV88	D	1	3-10	2	567.2
Terebellidae	22NOV88	D	1	3-10	1	283.6
Tharyx setigera	22NOV88	D	1	3-10	1	283.6
Apseudes sp. A	22NOV88	D	2	0-3	13	3686.8
Corbula contracta	22NOV88	D	2	0-3	2	567.2
Maldanidae	22NOV88	D	2	0-3	2	567.2
Maldanidae	22NOV88	D	2	0-3	2	567.2
Mediomastus californiensis	22NOV88	D	2	0-3	10	2836.0
Mercenaria campechiensis	22NOV88	D	2	0-3	1	283.6
Minuspio cirrifera	22NOV88	D	2	0-3	6	1701.6
Nuculana acuta	22NOV88	D	2	0-3	2	567.2
Ophiuroidea	22NOV88	D	2	0-3	3	850.8
Periploma cf. orbiculare	22NOV88	D	2	0-3	1	283.6
Phoronis architecta	22NOV88	D	2	0-3	1	283.6
Pinnixa chacei	22NOV88	D	2	0-3	2	567.2
Polychaete juvenile (Unidentified)	22NOV88	D	2	0-3	1	283.6
Sphaerosyllis spa	22NOV88	D	2	0-3	1	283.6
Terebellidae	22NOV88	D	2	0-3	1	283.6
Turbellaria	22NOV88	D	2	0-3	1	283.6
Ancistrosyllis cf. falcata	22NOV88	D	2	3-10	1	283.6
Apseudes sp. A	22NOV88	D	2	3-10	28	7940.8
Bivalvia	22NOV88	D	2	3-10	4	1134.4
Corbula contracta	22NOV88	D	2	3-10	6	1701.6
Gyptis vittata	22NOV88	D	2	3-10	1	283.6
Haploscoloplos foliosus	22NOV88	D	2	3-10	6	1701.6
Listriella barnardi	22NOV88	D	2	3-10	1	283.6
Mediomastus californiensis	22NOV88	D	2	3-10	7	1985.2
Nereidae	22NOV88	D	2	3-10	1	283.6
Oligochaeta	22NOV88	D	2	3-10	2	567.2
Ophiuroidea	22NOV88	D	2	3-10	1	283.6
Paraonidae grp. B	22NOV88	D	2	3-10	3	850.8
Paraprionospio pinnata	22NOV88	D	2	3-10	1	283.6
Periploma cf. orbiculare	22NOV88	D	2	3-10	2	567.2
Polydora caulleryi	22NOV88	D	2	3-10	2	567.2
Rhynchocoels	22NOV88	D	2	3-10	6	1701.6
Apseudes sp. A	22NOV88	D	3	0-3	23	6522.8
Armandia maculata	22NOV88	D	3	0-3	2	567.2
Bivalvia	22NOV88	D	3	0-3	1	283.6
Corbula contracta	22NOV88	D	3	0-3	2	567.2
Cossura delta	22NOV88	D	3	0-3	1	283.6
Drilonereis magna	22NOV88	D	3	0-3	1	283.6
Glycinde solitaria	22NOV88	D	3	0-3	1	283.6
Macoma tenta	22NOV88	D	3	0-3	1	283.6
Mediomastus californiensis	22N	D	3	0-3	11	3119.6

Minuspio cirrifera	22NOV88	D	3	0-3	1	283.6
Nuculana acuta	22NOV88	D	3	0-3	1	283.6
Ophiuroidea	22NOV88	D	3	0-3	1	283.6
Periploma cf. orbiculare	22NOV88	D	3	0-3	2	567.2
Sphaerosyllis spa	22NOV88	D	3	0-3	3	850.8
Tellina sp.	22NOV88	D	3	0-3	1	283.6
Apseudes sp. A	22NOV88	D	3	3-10	62	17583.2
Bivalvia	22NOV88	D	3	3-10	8	2268.8
Corbula contracta	22NOV88	D	3	3-10	5	1418.0
Cossura delta	22NOV88	D	3	3-10	1	283.6
Gyptis vittata	22NOV88	D	3	3-10	1	283.6
Haploscoloplos foliosus	22NOV88	D	3	3-10	3	850.8
Listriella barnardi	22NOV88	D	3	3-10	1	283.6
Mediomastus californiensis	22NOV88	D	3	3-10	9	2552.4
Minuspio cirrifera	22NOV88	D	3	3-10	14	3970.4
Nereidae	22NOV88	D	3	3-10	1	283.6
Oligochaeta	22NOV88	D	3	3-10	4	1134.4
Ophiuroidea	22NOV88	D	3	3-10	1	283.6
Paraonidae grp. B	22NOV88	D	3	3-10	1	283.6
Periploma cf. orbiculare	22NOV88	D	3	3-10	5	1418.0
Pinnixa chacei	22NOV88	D	3	3-10	1	283.6
Polychaete juvenile (Unidentified)	22NOV88	D	3	3-10	3	850.8
Polydora caulleryi	22NOV88	D	3	3-10	2	567.2
Acteocina canaliculata	05APR89	A	1	0-3	1	283.6
Ampelisca abdita	05APR89	A	1	0-3	62	17583.2
Cyclopoid copepod	05APR89	A	1	0-3	6	1701.6
Diopatra cuprea	05APR89	A	1	0-3	1	283.6
Glyceridae	05APR89	A	1	0-3	3	850.8
Mediomastus californiensis	05APR89	A	1	0-3	7	1985.2
Mulinia lateralis	05APR89	A	1	0-3	18	5104.8
Mysella planulata	05APR89	A	1	0-3	2	567.2
Pyramidella sp.	05APR89	A	1	0-3	1	283.6
Spiochaetopterus costarum	05APR89	A	1	0-3	1	283.6
Streblospio benedicti	05APR89	A	1	0-3	1	283.6
Tagelus plebius	05APR89	A	1	0-3	1	283.6
Turbellaria	05APR89	A	1	0-3	1	283.6
Ensis minor	05APR89	A	1	3-10	1	283.6
Mediomastus californiensis	05APR89	A	1	3-10	7	1985.2
Parandalia ocularis	05APR89	A	1	3-10	1	283.6
Ampelisca abdita	05APR89	A	2	0-3	40	11344.0
Anaitides erythrophyllus	05APR89	A	2	0-3	1	283.6
Caprellid a	05APR89	A	2	0-3	1	283.6
Cyclaspis varians	05APR89	A	2	0-3	3	850.8
Cyclopoid copepod	05APR89	A	2	0-3	5	1418.0
Ensis minor	05APR89	A	2	0-3	1	283.6
Glyceridae	05APR89	A	2	0-3	2	567.2
Haploscoloplos foliosus	05APR89	A	2	0-3	1	283.6
Mediomastus californiensis	05APR89	A	2	0-3	7	1985.2
Monoculoides sp.	05APR89	A	2	0-3	1	283.6
Mulinia lateralis	05APR89	A	2	0-3	19	5388.4
Mysella planulata	05APR89	A	2	0-3	2	567.2
Oxyurostylis smithi	05APR89	A	2	0-3	1	283.6
Paraprionospio pinnata	05APR89	A	2	0-3	1	283.6
Streblospio benedicti	05APR89	A	2	0-3	2	567.2
Ampelisca abdita	05APR89	A	2	3-10	1	283.6
Clymenella torquata calida	05APR89	A	2	3-10	1	283.6
Cossura delta	05APR89	A	2	3-10	2	567.2
Ensis minor	05APR89	A	2	3-10	1	283.6
Gyptis vittata	05APR89	A	2	3-10	1	283.6
Mediomastus californiensis	05APR89	A	2	3-10	6	1701.6
Acteocina canaliculata	05APR89	A	3	0-3	1	283.6
Ampelisca abdita	05APR89	A	3	0-3	28	7940.8
Cyclaspis varians	05APR89	A	3	0-3	1	283.6
Edotea montosa	05APR89	A	3	0-3	1	283.6
Ensis minor	05APR89	A	3	0-3	3	850.8
Mediomastus californiensis	05APR89	A	3	0-3	9	2552.4
Monoculoides sp.	05APR89	A	3	0-3	1	283.6

Mulinia lateralis	05APR89	A	3	0-3	11	3119.6
Oxyurostylis smithi	05APR89	A	3	0-3	3	850.8
Streblospio benedicti	05APR89	A	3	0-3	1	283.6
Cossura delta	05APR89	A	3	3-10	1	283.6
Ensis minor	05APR89	A	3	3-10	2	567.2
Haploscoloplos foliosus	05APR89	A	3	3-10	1	283.6
Mediomastus californiensis	05APR89	A	3	3-10	7	1985.2
Cossura delta	05APR89	B	1	0-3	1	283.6
Haploscoloplos foliosus	05APR89	B	1	0-3	1	283.6
Mediomastus californiensis	05APR89	B	1	0-3	10	2836.0
Mulinia lateralis	05APR89	B	1	0-3	1	283.6
Nuculana concentrica	05APR89	B	1	0-3	1	283.6
Ogyrides limicola	05APR89	B	1	0-3	1	283.6
Acteocina canaliculata	05APR89	B	1	3-10	1	283.6
Ampelisca abdita	05APR89	B	1	3-10	1	283.6
Diopatra cuprea	05APR89	B	1	3-10	1	283.6
Haploscoloplos foliosus	05APR89	B	1	3-10	1	283.6
Macoma mitchelli	05APR89	B	1	3-10	2	567.2
Mediomastus californiensis	05APR89	B	1	3-10	21	5955.6
Mulinia lateralis	05APR89	B	1	3-10	2	567.2
Mysella planulata	05APR89	B	1	3-10	1	283.6
Paraprionospio pinnata	05APR89	B	1	3-10	2	567.2
Mediomastus californiensis	05APR89	B	2	0-3	3	850.8
Mulinia lateralis	05APR89	B	2	0-3	2	567.2
Acteocina canaliculata	05APR89	B	2	3-10	1	283.6
Clymenella mucosa	05APR89	B	2	3-10	1	283.6
Cossura delta	05APR89	B	2	3-10	1	283.6
Gyptis vittata	05APR89	B	2	3-10	1	283.6
Macoma mitchelli	05APR89	B	2	3-10	1	283.6
Mediomastus californiensis	05APR89	B	2	3-10	17	4821.2
Mulinia lateralis	05APR89	B	2	3-10	1	283.6
Paraprionospio pinnata	05APR89	B	2	3-10	1	283.6
Cossura delta	05APR89	B	3	0-3	2	567.2
Glyceridae	05APR89	B	3	0-3	1	283.6
Haploscoloplos foliosus	05APR89	B	3	0-3	2	567.2
Leucon sp.	05APR89	B	3	0-3	1	283.6
Mediomastus californiensis	05APR89	B	3	0-3	1	283.6
Mulinia lateralis	05APR89	B	3	0-3	1	283.6
Nuculana concentrica	05APR89	B	3	0-3	1	283.6
Pandora trilineata	05APR89	B	3	0-3	1	283.6
Schizocardium sp.	05APR89	B	3	0-3	1	283.6
Acteocina canaliculata	05APR89	B	3	3-10	2	567.2
Cyclopoid copepod	05APR89	B	3	3-10	1	283.6
Diopatra cuprea	05APR89	B	3	3-10	1	283.6
Glycinde solitaria	05APR89	B	3	3-10	1	283.6
Haploscoloplos foliosus	05APR89	B	3	3-10	3	850.8
Macoma mitchelli	05APR89	B	3	3-10	1	283.6
Maldanidae	05APR89	B	3	3-10	1	283.6
Mediomastus californiensis	05APR89	B	3	3-10	19	5388.4
Mulinia lateralis	05APR89	B	3	3-10	3	850.8
Paraprionospio pinnata	05APR89	B	3	3-10	1	283.6
Streblospio benedicti	05APR89	B	3	3-10	2	567.2
Turbellaria	05APR89	B	3	3-10	1	283.6
Clymenella mucosa	05APR89	C	1	0-3	1	283.6
Drilonereis magna	05APR89	C	1	0-3	1	283.6
Maldane sarsi	05APR89	C	1	0-3	1	283.6
Mediomastus californiensis	05APR89	C	1	0-3	1	283.6
Mediomastus californiensis	05APR89	C	1	0-3	18	5104.8
Oxyurostylis smithi	05APR89	C	1	0-3	1	283.6
Paraprionospio pinnata	05APR89	C	1	0-3	2	567.2
Pyramidella sp.	05APR89	C	1	0-3	1	283.6
Streblospio benedicti	05APR89	C	1	0-3	2	567.2
Turbonilla sp.	05APR89	C	1	0-3	1	283.6
Macoma mitchelli	05APR89	C	1	3-10	1	283.6
Paraonidae grp. A	05APR89	C	1	3-10	1	283.6
Paraprionospio pinnata	05APR89	C	1	3-10	1	283.6
Polychaete juvenile (Unidentified)	05APR89	C	1	3-10	1	283.6

Rhynchocoels	05APR89	C	1	3-10	1	283.6
Callinectes similis	05APR89	C	2	0-3	1	283.6
Glycinde solitaria	05APR89	C	2	0-3	1	283.6
Glycinde solitaria	05APR89	C	2	0-3	1	283.6
Mediomastus californiensis	05APR89	C	2	0-3	1	283.6
Mulinia lateralis	05APR89	C	2	0-3	1	283.6
Streblospio benedicti	05APR89	C	2	0-3	1	283.6
Ceratonereis irritabilis	05APR89	C	2	3-10	1	283.6
Clymenella mucosa	05APR89	C	2	3-10	6	1701.6
Drilonereis magna	05APR89	C	2	3-10	2	567.2
Glycinde solitaria	05APR89	C	2	3-10	1	283.6
Gyptis vittata	05APR89	C	2	3-10	1	283.6
Mediomastus californiensis	05APR89	C	2	3-10	16	4537.6
Minuspio cirrifera	05APR89	C	2	3-10	1	283.6
Oligochaeta	05APR89	C	2	3-10	1	283.6
Paraonidae grp. A	05APR89	C	2	3-10	1	283.6
Rhynchocoels	05APR89	C	2	3-10	2	567.2
Tharyx setigera	05APR89	C	2	3-10	4	1134.4
Gyptis vittata	05APR89	C	3	0-3	1	283.6
Mediomastus californiensis	05APR89	C	3	0-3	2	567.2
Rhynchocoels	05APR89	C	3	0-3	1	283.6
Drilonereis magna	05APR89	C	3	3-10	1	283.6
Mediomastus californiensis	05APR89	C	3	3-10	5	1418.0
Pinnixa chacei	05APR89	C	3	3-10	1	283.6
Sphaerosyllis erinaceus	05APR89	C	3	3-10	1	283.6
Ampelisca sp. B (=amphipod A)	05APR89	D	1	0-3	2	567.2
Amphipoda	05APR89	D	1	0-3	1	283.6
Corbula contracta	05APR89	D	1	0-3	3	850.8
Cossura delta	05APR89	D	1	0-3	1	283.6
Drilonereis magna	05APR89	D	1	0-3	1	283.6
Gyptis vittata	05APR89	D	1	0-3	1	283.6
Mediomastus californiensis	05APR89	D	1	0-3	22	6239.2
Minuspio cirrifera	05APR89	D	1	0-3	4	1134.4
Nassarius vibex	05APR89	D	1	0-3	1	283.6
Nereidae	05APR89	D	1	0-3	1	283.6
Nuculana concentrica	05APR89	D	1	0-3	1	283.6
Ophiuroidea	05APR89	D	1	0-3	1	283.6
Paleanotus heteroseta	05APR89	D	1	0-3	1	283.6
Periploma cf. orbiculare	05APR89	D	1	0-3	4	1134.4
Pseudodiaptomus coronatus	05APR89	D	1	0-3	1	283.6
Rhynchocoels	05APR89	D	1	0-3	1	283.6
Sigambra tentaculata	05APR89	D	1	0-3	1	283.6
Sphaerosyllis cf. sublaevis	05APR89	D	1	0-3	1	283.6
Sphaerosyllis erinaceus	05APR89	D	1	0-3	1	283.6
Sphaerosyllis spa	05APR89	D	1	0-3	1	283.6
Tellina texana	05APR89	D	1	0-3	1	283.6
Terebellidae	05APR89	D	1	0-3	1	283.6
Anthozoa	05APR89	D	1	3-10	1	283.6
Apseudes sp. A	05APR89	D	1	3-10	6	1701.6
Corbula contracta	05APR89	D	1	3-10	2	567.2
Cossura delta	05APR89	D	1	3-10	2	567.2
Drilonereis magna	05APR89	D	1	3-10	1	283.6
Haploscoloplos foliosus	05APR89	D	1	3-10	1	283.6
Mediomastus californiensis	05APR89	D	1	3-10	16	4537.6
Minuspio cirrifera	05APR89	D	1	3-10	2	567.2
Ophiuroidea	05APR89	D	1	3-10	1	283.6
Paleanotus heteroseta	05APR89	D	1	3-10	1	283.6
Paraonidae grp. B	05APR89	D	1	3-10	3	850.8
Periploma cf. orbiculare	05APR89	D	1	3-10	4	1134.4
Polydora caulleryi	05APR89	D	1	3-10	4	1134.4
Rhynchocoels	05APR89	D	1	3-10	3	850.8
Abra aequalis	05APR89	D	2	0-3	2	567.2
Acteocina canaliculata	05APR89	D	2	0-3	1	283.6
Ampelisca sp. B (=amphipod A)	05APR89	D	2	0-3	1	283.6
Anadara ovalis	05APR89	D	2	0-3	1	283.6
Apseudes sp. A	05APR89	D	2	0-3	2	567.2
Bivalvia	05APR89	D	2	0-3	1	283.6

Corbula contracta	05APR89	D	2	0-3	9	2552.4
Drilonereis magna	05APR89	D	2	0-3	1	283.6
Glycinde solitaria	05APR89	D	2	0-3	1	283.6
Listriella barnardi	05APR89	D	2	0-3	1	283.6
Maldane sarsi	05APR89	D	2	0-3	1	283.6
Mediomastus californiensis	05APR89	D	2	0-3	15	4254.0
Minuspio cirrifera	05APR89	D	2	0-3	3	850.8
Mulinia lateralis	05APR89	D	2	0-3	1	283.6
Notomastus cf. latericeus	05APR89	D	2	0-3	1	283.6
Nuculana concentrica	05APR89	D	2	0-3	2	567.2
Paleanotus heteroseta	05APR89	D	2	0-3	1	283.6
Paraprionospio pinnata	05APR89	D	2	0-3	1	283.6
Periploma cf. orbiculare	05APR89	D	2	0-3	2	567.2
Phascolion strombi	05APR89	D	2	0-3	1	283.6
Rhynchocoels	05APR89	D	2	0-3	2	567.2
Sphaerosyllis spa	05APR89	D	2	0-3	4	1134.4
Apseudes sp. A	05APR89	D	2	3-10	9	2552.4
Corbula contracta	05APR89	D	2	3-10	8	2268.8
Drilonereis magna	05APR89	D	2	3-10	1	283.6
Mediomastus californiensis	05APR89	D	2	3-10	11	3119.6
Minuspio cirrifera	05APR89	D	2	3-10	1	283.6
Mysella planulata	05APR89	D	2	3-10	1	283.6
Notomastus cf. latericeus	05APR89	D	2	3-10	1	283.6
Ophiuroidea	05APR89	D	2	3-10	1	283.6
Paleanotus heteroseta	05APR89	D	2	3-10	2	567.2
Periploma cf. orbiculare	05APR89	D	2	3-10	7	1985.2
Rhynchocoels	05APR89	D	2	3-10	2	567.2
Sigambra tentaculata	05APR89	D	2	3-10	1	283.6
Acteocina canaliculata	05APR89	D	3	0-3	1	283.6
Ampelisca sp. B (=amphipod A)	05APR89	D	3	0-3	1	283.6
Apseudes sp. A	05APR89	D	3	0-3	8	2268.8
Corbula contracta	05APR89	D	3	0-3	7	1985.2
Gyptis vittata	05APR89	D	3	0-3	1	283.6
Macoma tenta	05APR89	D	3	0-3	1	283.6
Mediomastus californiensis	05APR89	D	3	0-3	21	5955.6
Melinna maculata	05APR89	D	3	0-3	1	283.6
Minuspio cirrifera	05APR89	D	3	0-3	6	1701.6
Nassarius vibex	05APR89	D	3	0-3	1	283.6
Oligochaeta	05APR89	D	3	0-3	1	283.6
Ophiuroidea	05APR89	D	3	0-3	1	283.6
Paraonidae grp. B	05APR89	D	3	0-3	1	283.6
Periploma cf. orbiculare	05APR89	D	3	0-3	5	1418.0
Phascolion strombi	05APR89	D	3	0-3	4	1134.4
Polydora caulleryi	05APR89	D	3	0-3	2	567.2
Pseudodiaptomus coronatus	05APR89	D	3	0-3	1	283.6
Rhynchocoels	05APR89	D	3	0-3	3	850.8
Sphaerosyllis spa	05APR89	D	3	0-3	1	283.6
Apseudes sp. A	05APR89	D	3	3-10	17	4821.2
Corbula contracta	05APR89	D	3	3-10	2	567.2
Drilonereis magna	05APR89	D	3	3-10	1	283.6
Mediomastus californiensis	05APR89	D	3	3-10	14	3970.4
Minuspio cirrifera	05APR89	D	3	3-10	2	567.2
Ophiuroidea	05APR89	D	3	3-10	3	850.8
Paleanotus heteroseta	05APR89	D	3	3-10	3	850.8
Periploma cf. orbiculare	05APR89	D	3	3-10	5	1418.0
Polychaete juvenile (Unidentified)	05APR89	D	3	3-10	1	283.6
Polydora caulleryi	05APR89	D	3	3-10	1	283.6
Rhynchocoels	05APR89	D	3	3-10	1	283.6
Bivalvia	22JUL89	A	1	0-3	1	283.6
Glycinde solitaria	22JUL89	A	1	0-3	1	283.6
Mediomastus californiensis	22JUL89	A	1	0-3	8	2268.8
Microprotopus spp.	22JUL89	A	1	0-3	1	283.6
Macoma mitchelli	22JUL89	A	1	3-10	1	283.6
Mediomastus californiensis	22JUL89	A	1	3-10	6	1701.6
Melinna maculata	22JUL89	A	1	3-10	1	283.6
Parandalia ocularis	22JUL89	A	1	3-10	1	283.6
Acteocina canaliculata	22JUL89	A	2	0-3	3	850.8

Glycinde solitaria	22JUL89	A	2	0-3	1	283.6
Mediomastus californiensis	22JUL89	A	2	0-3	9	2552.4
Mulinia lateralis	22JUL89	A	2	0-3	3	850.8
Nassarius acutus	22JUL89	A	2	0-3	1	283.6
Streblospio benedicti	22JUL89	A	2	0-3	5	1418.0
Mediomastus californiensis	22JUL89	A	2	3-10	5	1418.0
Paraprionospio pinnata	22JUL89	A	2	3-10	1	283.6
Acteocina canaliculata	22JUL89	A	3	0-3	2	567.2
Ampelisca abdita	22JUL89	A	3	0-3	1	283.6
Bivalvia	22JUL89	A	3	0-3	1	283.6
Diopatra cuprea	22JUL89	A	3	0-3	1	283.6
Glycinde solitaria	22JUL89	A	3	0-3	1	283.6
Mediomastus californiensis	22JUL89	A	3	0-3	6	1701.6
Microprotopus spp.	22JUL89	A	3	0-3	2	567.2
Mulinia lateralis	22JUL89	A	3	0-3	4	1134.4
Odostomia sp.	22JUL89	A	3	0-3	1	283.6
Streblospio benedicti	22JUL89	A	3	0-3	7	1985.2
Clymenella mucosa	22JUL89	A	3	3-10	1	283.6
Cossura delta	22JUL89	A	3	3-10	3	850.8
Glycinde solitaria	22JUL89	A	3	3-10	1	283.6
Mediomastus californiensis	22JUL89	A	3	3-10	2	567.2
Odostomia sp.	22JUL89	A	3	3-10	2	567.2
Paraprionospio pinnata	22JUL89	A	3	3-10	1	283.6
Streblospio benedicti	22JUL89	A	3	3-10	1	283.6
Cossura delta	22JUL89	C	1	0-3	1	283.6
Glycinde solitaria	22JUL89	C	1	0-3	1	283.6
Gyptis vittata	22JUL89	C	1	0-3	1	283.6
Listriella barnardi	22JUL89	C	1	0-3	1	283.6
Mediomastus californiensis	22JUL89	C	1	0-3	2	567.2
Mysidopsis bahia	22JUL89	C	1	0-3	1	283.6
Mysidopsis sp.	22JUL89	C	1	0-3	1	283.6
Rhynchocoels	22JUL89	C	1	0-3	1	283.6
Cossura delta	22JUL89	C	1	3-10	1	283.6
Maldane sarsi	22JUL89	C	1	3-10	1	283.6
Mediomastus californiensis	22JUL89	C	1	3-10	12	3403.2
Ophiuroidea	22JUL89	C	1	3-10	1	283.6
Rhynchocoels	22JUL89	C	1	3-10	1	283.6
Tharyx setigera	22JUL89	C	1	3-10	1	283.6
Acteocina canaliculata	22JUL89	C	2	0-3	1	283.6
Glycinde solitaria	22JUL89	C	2	0-3	2	567.2
Listriella barnardi	22JUL89	C	2	0-3	1	283.6
Mediomastus californiensis	22JUL89	C	2	0-3	3	850.8
Mysidopsis bahia	22JUL89	C	2	0-3	1	283.6
Ogyrides limicola	22JUL89	C	2	0-3	1	283.6
Mediomastus californiensis	22JUL89	C	2	3-10	6	1701.6
Paraprionospio pinnata	22JUL89	C	2	3-10	1	283.6
Glycinde solitaria	22JUL89	C	3	0-3	1	283.6
Mediomastus californiensis	22JUL89	C	3	0-3	1	283.6
Megalomma bioculatum	22JUL89	C	3	0-3	1	283.6
Nassarius acutus	22JUL89	C	3	0-3	1	283.6
Pseudodiaptomus coronatus	22JUL89	C	3	0-3	1	283.6
Mediomastus californiensis	22JUL89	C	3	3-10	3	850.8
Paraonidae grp. B	22JUL89	C	3	3-10	1	283.6

GEMEIOSP.DAT Guadalupe Estuary Meiofauna species data.
3 replicates (REP) were taken each time, N=n/section (SEC)
nm2=n/m^2. Sections in cm. 1=0-1 cm.

SPNAME	STA	REP	N	DATE	SEC	NM2
Amphipoda	A	1	1	28JAN87	1	1243.0
Harpacticoida	A	1	19	28JAN87	1	23617.0
Nematoda	A	1	41	28JAN87	1	11627.6
Polychaete larvae	A	1	1	28JAN87	1	1243.0
Unidentified (Miscellaneous)	A	1	28	28JAN87	1	34804.0
Harpacticoida	A	2	11	28JAN87	1	13673.0
Mollusca	A	2	2	28JAN87	1	2486.0
Nematoda	A	2	30	28JAN87	1	37290.0
Polychaete larvae	A	2	2	28JAN87	1	2486.0
Unidentified (Miscellaneous)	A	2	36	28JAN87	1	44748.0
Harpacticoida	A	3	24	28JAN87	1	29832.0
Nematoda	A	3	46	28JAN87	1	57178.0
Unidentified (Miscellaneous)	A	3	32	28JAN87	1	39776.0
Harpacticoida	A	4	7	28JAN87	1	8701.0
Mollusca	A	4	1	28JAN87	1	1243.0
Nematoda	A	4	58	28JAN87	1	72094.0
Polychaete larvae	A	4	1	28JAN87	1	1243.0
Unidentified (Miscellaneous)	A	4	11	28JAN87	1	13673.0
Harpacticoida	A	5	24	28JAN87	1	29832.0
Nematoda	A	5	66	28JAN87	1	82038.0
Polychaete larvae	A	5	2	28JAN87	1	2486.0
Unidentified (Miscellaneous)	A	5	32	28JAN87	1	39776.0
Harpacticoida	A	6	11	28JAN87	1	13673.0
Nematoda	A	6	63	28JAN87	1	78309.0
Polychaete larvae	A	6	3	28JAN87	1	3729.0
Unidentified (Miscellaneous)	A	6	24	28JAN87	1	29832.0
Harpacticoida	A	7	29	28JAN87	1	36047.0
Mollusca	A	7	1	28JAN87	1	1243.0
Nematoda	A	7	79	28JAN87	1	98197.0
Unidentified (Miscellaneous)	A	7	34	28JAN87	1	42262.0
Harpacticoida	A	8	20	28JAN87	1	24860.0
Nematoda	A	8	63	28JAN87	1	78309.0
Polychaete larvae	A	8	2	28JAN87	1	2486.0
Unidentified (Miscellaneous)	A	8	48	28JAN87	1	59664.0
Harpacticoida	A	9	17	28JAN87	1	21131.0
Mollusca	A	9	6	28JAN87	1	7458.0
Nematoda	A	9	52	28JAN87	1	64636.0
Unidentified (Miscellaneous)	A	9	46	28JAN87	1	57178.0
Amphipoda	B	1	1	28JAN87	1	1243.0
Harpacticoida	B	1	65	28JAN87	1	80795.0
Mollusca	B	1	4	28JAN87	1	4972.0
Nematoda	B	1	196	28JAN87	1	243628.0
Polychaete larvae	B	1	4	28JAN87	1	4972.0
Unidentified (Miscellaneous)	B	1	66	28JAN87	1	82038.0
Harpacticoida	B	2	49	28JAN87	1	60907.0
Mollusca	B	2	45	28JAN87	1	55935.0
Nematoda	B	2	65	28JAN87	1	80795.0
Polychaete larvae	B	2	5	28JAN87	1	6215.0
Unidentified (Miscellaneous)	B	2	69	28JAN87	1	85767.0
Harpacticoida	B	3	63	28JAN87	1	78309.0
Mollusca	B	3	48	28JAN87	1	59664.0
Nematoda	B	3	165	28JAN87	1	205095.0
Polychaete larvae	B	3	4	28JAN87	1	4972.0
Unidentified (Miscellaneous)	B	3	72	28JAN87	1	89496.0
Harpacticoida	B	4	64	28JAN87	1	79552.0
Mollusca	B	4	3	28JAN87	1	3729.0
Nematoda	B	4	95	28JAN87	1	118085.0
Polychaete larvae	B	4	10	28JAN87	1	12430.0
Unidentified (Miscellaneous)	B	4	61	28JAN87	1	75823.0
Harpacticoida	B	5	76	28JAN87	1	94468.0

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Mollusca                             B     5    52  28JAN87      1     64636.0
Nematoda                             B     5   137  28JAN87      1    170291.0
Polychaete larvae                    B     5     4  28JAN87      1      4972.0
Unidentified (Miscellaneous)         B     5    59  28JAN87      1     73337.0
Harpacticoida                        B     6    43  28JAN87      1     53449.0
Mollusca                             B     6    28  28JAN87      1     34804.0
Nematoda                             B     6   122  28JAN87      1    151646.0
Polychaete larvae                    B     6     2  28JAN87      1      2486.0
Unidentified (Miscellaneous)         B     6   155  28JAN87      1    192665.0
Amphipoda                            B     7     1  28JAN87      1      1243.0
Harpacticoida                        B     7    55  28JAN87      1     68365.0
Mollusca                             B     7    22  28JAN87      1     27346.0
Nematoda                             B     7   151  28JAN87      1    187693.0
Polychaete larvae                    B     7     2  28JAN87      1      2486.0
Unidentified (Miscellaneous)         B     7    45  28JAN87      1     55935.0
Amphipoda                            B     8     1  28JAN87      1      1243.0
Harpacticoida                        B     8    47  28JAN87      1     58421.0
Mollusca                             B     8    34  28JAN87      1     42262.0
Nematoda                             B     8   127  28JAN87      1    157861.0
Polychaete larvae                    B     8     1  28JAN87      1      1243.0
Unidentified (Miscellaneous)         B     8    74  28JAN87      1     91982.0
Harpacticoida                        B     9    47  28JAN87      1     58421.0
Mollusca                             B     9    21  28JAN87      1     26103.0
Nematoda                             B     9   133  28JAN87      1    165319.0
Polychaete larvae                    B     9     8  28JAN87      1      9944.0
Unidentified (Miscellaneous)         B     9    61  28JAN87      1     75823.0
Amphipoda                            C     1     1  30JAN87      1      1243.0
Harpacticoida                        C     1   396  30JAN87      1    492228.0
Mollusca                             C     1     4  30JAN87      1      4972.0
Nematoda                             C     1  1213  30JAN87      1   1507759.0
Polychaete larvae                    C     1     2  30JAN87      1      2486.0
Unidentified (Miscellaneous)         C     1   180  30JAN87      1    223740.0
Amphipoda                            C     2     1  30JAN87      1      1243.0
Harpacticoida                        C     2   745  30JAN87      1    926035.0
Mollusca                             C     2     3  30JAN87      1      3729.0
Nematoda                             C     2  1609  30JAN87      1   1999987.0
Polychaete larvae                    C     2     5  30JAN87      1      6215.0
Unidentified (Miscellaneous)         C     2   245  30JAN87      1    304535.0
Harpacticoida                        C     3   489  30JAN87      1    607827.0
Mollusca                             C     3     1  30JAN87      1      1243.0
Nematoda                             C     3  1181  30JAN87      1   1467983.0
Polychaete larvae                    C     3     8  30JAN87      1      9944.0
Unidentified (Miscellaneous)         C     3   219  30JAN87      1    272217.0
Cumacea (unidentified or damaged)    C     4     1  30JAN87      1      1243.0
Harpacticoida                        C     4   340  30JAN87      1    422620.0
Mollusca                             C     4     8  30JAN87      1      9944.0
Nematoda                             C     4  1116  30JAN87      1   1387188.0
Polychaete larvae                    C     4     2  30JAN87      1      2486.0
Unidentified (Miscellaneous)         C     4   182  30JAN87      1    226226.0
Harpacticoida                        C     5   413  30JAN87      1    513359.0
Mollusca                             C     5     1  30JAN87      1      1243.0
Nematoda                             C     5  1085  30JAN87      1   1348655.0
Polychaete larvae                    C     5     5  30JAN87      1      6215.0
Unidentified (Miscellaneous)         C     5   177  30JAN87      1    220011.0
Harpacticoida                        C     6   370  30JAN87      1    459910.0
Mollusca                             C     6     2  30JAN87      1      2486.0
Nematoda                             C     6  1231  30JAN87      1   1530133.0
Polychaete larvae                    C     6     5  30JAN87      1      6215.0
Unidentified (Miscellaneous)         C     6   188  30JAN87      1    233684.0
Harpacticoida                        C     7   228  30JAN87      1    283404.0
Mollusca                             C     7     2  30JAN87      1      2486.0
Nematoda                             C     7  1323  30JAN87      1   1644489.0
Polychaete larvae                    C     7     9  30JAN87      1     11187.0
Unidentified (Miscellaneous)         C     7   164  30JAN87      1    203852.0
Harpacticoida                        C     8   323  30JAN87      1    401489.0
Mollusca                             C     8     1  30JAN87      1      1243.0
Nematoda                             C     8  1060  30JAN87      1   1317580.0
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Polychaete larvae                C    8    11   30JAN87     1     13673.0
Unidentified (Miscellaneous)     C    8   141   30JAN87     1    175263.0
Harpacticoida                    C    9   292   30JAN87     1    362956.0
Mollusca                         C    9     4   30JAN87     1      4972.0
Nematoda                         C    9  1310   30JAN87     1   1628330.0
Polychaete larvae                C    9    15   30JAN87     1     18645.0
Unidentified (Miscellaneous)     C    9   169   30JAN87     1    210067.0
Harpacticoida                    D    1   121   30JAN87     1    150403.0
Nematoda                         D    1  1223   30JAN87     1   1520189.0
Polychaete larvae                D    1     3   30JAN87     1      3729.0
Unidentified (Miscellaneous)     D    1   166   30JAN87     1    206338.0
Amphipoda                        D    2     1   30JAN87     1      1243.0
Harpacticoida                    D    2   113   30JAN87     1    140459.0
Mollusca                         D    2     3   30JAN87     1      3729.0
Nematoda                         D    2   850   30JAN87     1   1056550.0
Polychaete larvae                D    2     3   30JAN87     1      3729.0
Unidentified (Miscellaneous)     D    2   496   30JAN87     1    616528.0
Harpacticoida                    D    3   138   30JAN87     1    171534.0
Mollusca                         D    3     2   30JAN87     1      2486.0
Nematoda                         D    3   684   30JAN87     1    850212.0
Unidentified (Miscellaneous)     D    3   582   30JAN87     1    723426.0
Harpacticoida                    D    4   143   30JAN87     1    177749.0
Mollusca                         D    4     1   30JAN87     1      1243.0
Nematoda                         D    4  1076   30JAN87     1   1337468.0
Polychaete larvae                D    4     4   30JAN87     1      4972.0
Unidentified (Miscellaneous)     D    4   238   30JAN87     1    295834.0
Harpacticoida                    D    5    80   30JAN87     1     99440.0
Mollusca                         D    5     4   30JAN87     1      4972.0
Nematoda                         D    5   759   30JAN87     1    943437.0
Polychaete larvae                D    5     3   30JAN87     1      3729.0
Unidentified (Miscellaneous)     D    5   693   30JAN87     1    861399.0
Harpacticoida                    D    6   111   30JAN87     1    137973.0
Nematoda                         D    6   849   30JAN87     1   1055307.0
Polychaete larvae                D    6     2   30JAN87     1      2486.0
Unidentified (Miscellaneous)     D    6   475   30JAN87     1    590425.0
Harpacticoida                    D    7   168   30JAN87     1    208824.0
Nematoda                         D    7  1138   30JAN87     1   1414534.0
Polychaete larvae                D    7     1   30JAN87     1      1243.0
Unidentified (Miscellaneous)     D    7   346   30JAN87     1    430078.0
Harpacticoida                    D    8   100   30JAN87     1    124300.0
Mollusca                         D    8     3   30JAN87     1      3729.0
Nematoda                         D    8   712   30JAN87     1    885016.0
Polychaete larvae                D    8     3   30JAN87     1      3729.0
Unidentified (Miscellaneous)     D    8   545   30JAN87     1    677435.0
Cumacea (unidentified or damaged) D   9     1   30JAN87     1      1243.0
Harpacticoida                    D    9   168   30JAN87     1    208824.0
Nematoda                         D    9  1037   30JAN87     1   1288991.0
Polychaete larvae                D    9     7   30JAN87     1      8701.0
Unidentified (Miscellaneous)     D    9   241   30JAN87     1    299563.0
Harpacticoida                    A    1    47   09APR87     1     58421.0
Mollusca                         A    1    42   09APR87     1     52206.0
Nematoda                         A    1     4   09APR87     1      4972.0
Polychaete larvae                A    1    15   09APR87     1     18645.0
Unidentified (Miscellaneous)     A    1    36   09APR87     1     44748.0
Harpacticoida                    A    2    73   09APR87     1     90739.0
Mollusca                         A    2    34   09APR87     1     42262.0
Nematoda                         A    2    11   09APR87     1     13673.0
Polychaete larvae                A    2    41   09APR87     1     50963.0
Unidentified (Miscellaneous)     A    2    76   09APR87     1     94468.0
Harpacticoida                    A    3    58   09APR87     1     72094.0
Mollusca                         A    3    31   09APR87     1     38533.0
Nematoda                         A    3    20   09APR87     1     24860.0
Polychaete larvae                A    3    18   09APR87     1     22374.0
Unidentified (Miscellaneous)     A    3    54   09APR87     1     67122.0
Harpacticoida                    A    4    72   09APR87     1     89496.0
Mollusca                         A    4    35   09APR87     1     43505.0
Nematoda                         A    4   128   09APR87     1    159104.0
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Polychaete larvae               A    4    7  09APR87    1     8701.0
Unidentified (Miscellaneous)    A    4   64  09APR87    1    79552.0
Harpacticoida                   A    5   31  09APR87    1    38533.0
Mollusca                        A    5   66  09APR87    1    82038.0
Nematoda                        A    5   23  09APR87    1    28589.0
Polychaete larvae               A    5   11  09APR87    1    13673.0
Unidentified (Miscellaneous)    A    5   44  09APR87    1    54692.0
Harpacticoida                   A    6   61  09APR87    1    75823.0
Mollusca                        A    6   41  09APR87    1    50963.0
Nematoda                        A    6   25  09APR87    1    31075.0
Polychaete larvae               A    6   19  09APR87    1    23617.0
Unidentified (Miscellaneous)    A    6   54  09APR87    1    67122.0
Harpacticoida                   A    7   43  09APR87    1    53449.0
Mollusca                        A    7    1  09APR87    1     1243.0
Nematoda                        A    7   67  09APR87    1    83281.0
Polychaete larvae               A    7   19  09APR87    1    23617.0
Unidentified (Miscellaneous)    A    7   35  09APR87    1    43505.0
Harpacticoida                   A    8   59  09APR87    1    73337.0
Mollusca                        A    8   24  09APR87    1    29832.0
Nematoda                        A    8   28  09APR87    1    34804.0
Polychaete larvae               A    8   21  09APR87    1    26103.0
Unidentified (Miscellaneous)    A    8   46  09APR87    1    57178.0
Harpacticoida                   A    9   27  09APR87    1    33561.0
Mollusca                        A    9   38  09APR87    1    47234.0
Nematoda                        A    9    8  09APR87    1     9944.0
Polychaete larvae               A    9    5  09APR87    1     6215.0
Unidentified (Miscellaneous)    A    9   54  09APR87    1    67122.0
Harpacticoida                   A   10   61  09APR87    1    75823.0
Mollusca                        A   10   53  09APR87    1    65879.0
Nematoda                        A   10   46  09APR87    1    57178.0
Polychaete larvae               A   10    3  09APR87    1     3729.0
Unidentified (Miscellaneous)    A   10   58  09APR87    1    72094.0
Harpacticoida                   A   11   50  09APR87    1    62150.0
Mollusca                        A   11   52  09APR87    1    64636.0
Nematoda                        A   11   44  09APR87    1    54692.0
Polychaete larvae               A   11    8  09APR87    1     9944.0
Unidentified (Miscellaneous)    A   11   60  09APR87    1    74580.0
Harpacticoida                   A   12   72  09APR87    1    89496.0
Mollusca                        A   12   23  09APR87    1    28589.0
Nematoda                        A   12  258  09APR87    1   320694.0
Polychaete larvae               A   12   16  09APR87    1    19888.0
Unidentified (Miscellaneous)    A   12   43  09APR87    1    53449.0
Harpacticoida                   B    1   73  09APR87    1    90739.0
Mollusca                        B    1    6  09APR87    1     7458.0
Nematoda                        B    1  110  09APR87    1   136730.0
Polychaete larvae               B    1    7  09APR87    1     8701.0
Unidentified (Miscellaneous)    B    1   46  09APR87    1    57178.0
Harpacticoida                   B    2   68  09APR87    1    84524.0
Mollusca                        B    2   24  09APR87    1    29832.0
Nematoda                        B    2   54  09APR87    1    67122.0
Polychaete larvae               B    2    8  09APR87    1     9944.0
Unidentified (Miscellaneous)    B    2   33  09APR87    1    41019.0
Harpacticoida                   B    3   78  09APR87    1    96954.0
Mollusca                        B    3   20  09APR87    1    24860.0
Nematoda                        B    3  126  09APR87    1   156618.0
Polychaete larvae               B    3   13  09APR87    1    16159.0
Unidentified (Miscellaneous)    B    3   43  09APR87    1    53449.0
Amphipoda                       B    4    1  09APR87    1     1243.0
Harpacticoida                   B    4  129  09APR87    1   160347.0
Mollusca                        B    4   30  09APR87    1    37290.0
Nematoda                        B    4   37  09APR87    1    45991.0
Polychaete larvae               B    4    6  09APR87    1     7458.0
Tanaidacea                      B    4    1  09APR87    1     1243.0
Unidentified (Miscellaneous)    B    4   40  09APR87    1    49720.0
Harpacticoida                   B    5   53  09APR87    1    65879.0
Mollusca                        B    5    5  09APR87    1     6215.0
Nematoda                        B    5   74  09APR87    1    91982.0
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Polychaete larvae               B    5      8  09APR87    1      9944.0
Unidentified (Miscellaneous)    B    5     26  09APR87    1     32318.0
Harpacticoida                   B    6     41  09APR87    1     50963.0
Mollusca                        B    6      4  09APR87    1      4972.0
Nematoda                        B    6     30  09APR87    1     37290.0
Polychaete larvae               B    6      4  09APR87    1      4972.0
Unidentified (Miscellaneous)    B    6     18  09APR87    1     22374.0
Harpacticoida                   B    7    104  09APR87    1    129272.0
Mollusca                        B    7     14  09APR87    1     17402.0
Nematoda                        B    7    103  09APR87    1    128029.0
Polychaete larvae               B    7      8  09APR87    1      9944.0
Unidentified (Miscellaneous)    B    7     61  09APR87    1     75823.0
Harpacticoida                   B    8     50  09APR87    1     62150.0
Mollusca                        B    8     20  09APR87    1     24860.0
Nematoda                        B    8     36  09APR87    1     44748.0
Polychaete larvae               B    8      5  09APR87    1      6215.0
Unidentified (Miscellaneous)    B    8     15  09APR87    1     18645.0
Harpacticoida                   B    9     83  09APR87    1    103169.0
Mollusca                        B    9     18  09APR87    1     22374.0
Nematoda                        B    9    139  09APR87    1    172777.0
Polychaete larvae               B    9     13  09APR87    1     16159.0
Unidentified (Miscellaneous)    B    9     41  09APR87    1     50963.0
Harpacticoida                   B   10    116  09APR87    1    144188.0
Mollusca                        B   10      6  09APR87    1      7458.0
Nematoda                        B   10    101  09APR87    1    125543.0
Polychaete larvae               B   10      3  09APR87    1      3729.0
Unidentified (Miscellaneous)    B   10     39  09APR87    1     48477.0
Harpacticoida                   B   11    132  09APR87    1    164076.0
Mollusca                        B   11     12  09APR87    1     14916.0
Nematoda                        B   11     99  09APR87    1    123057.0
Polychaete larvae               B   11      8  09APR87    1      9944.0
Unidentified (Miscellaneous)    B   11     52  09APR87    1     64636.0
Harpacticoida                   B   12     91  09APR87    1    113113.0
Mollusca                        B   12     13  09APR87    1     16159.0
Nematoda                        B   12     33  09APR87    1     41019.0
Polychaete larvae               B   12      9  09APR87    1     11187.0
Unidentified (Miscellaneous)    B   12     39  09APR87    1     48477.0
Harpacticoida                   C    1    344  09APR87    1    427592.0
Mollusca                        C    1      2  09APR87    1      2486.0
Nematoda                        C    1    919  09APR87    1   1142317.0
Polychaete larvae               C    1     10  09APR87    1     12430.0
Unidentified (Miscellaneous)    C    1     89  09APR87    1    110627.0
Harpacticoida                   C    2    235  09APR87    1    292105.0
Nematoda                        C    2    694  09APR87    1    862642.0
Polychaete larvae               C    2     10  09APR87    1     12430.0
Unidentified (Miscellaneous)    C    2     54  09APR87    1     67122.0
Harpacticoida                   C    3    332  09APR87    1    412676.0
Nematoda                        C    3    534  09APR87    1    663762.0
Polychaete larvae               C    3      6  09APR87    1      7458.0
Unidentified (Miscellaneous)    C    3     39  09APR87    1     48477.0
Amphipoda                       C    4      2  09APR87    1      2486.0
Harpacticoida                   C    4    333  09APR87    1    413919.0
Nematoda                        C    4    781  09APR87    1    970783.0
Polychaete larvae               C    4      5  09APR87    1      6215.0
Unidentified (Miscellaneous)    C    4     87  09APR87    1    108141.0
Amphipoda                       C    5      1  09APR87    1      1243.0
Harpacticoida                   C    5    357  09APR87    1    443751.0
Mollusca                        C    5      1  09APR87    1      1243.0
Nematoda                        C    5   1369  09APR87    1   1701667.0
Polychaete larvae               C    5      5  09APR87    1      6215.0
Unidentified (Miscellaneous)    C    5     69  09APR87    1     85767.0
Harpacticoida                   C    6    141  09APR87    1    175263.0
Nematoda                        C    6    820  09APR87    1   1019260.0
Polychaete larvae               C    6     43  09APR87    1     53449.0
Unidentified (Miscellaneous)    C    6     78  09APR87    1     96954.0
Harpacticoida                   C    7    401  09APR87    1    498443.0
Mollusca                        C    7      2  09APR87    1      2486.0
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Nematoda                        C    7   566  09APR87     1   703538.0
Polychaete larvae               C    7     5  09APR87     1     6215.0
Unidentified (Miscellaneous)    C    7    44  09APR87     1    54692.0
Amphipoda                       C    8     1  09APR87     1     1243.0
Harpacticoida                   C    8   223  09APR87     1   277189.0
Mollusca                        C    8     1  09APR87     1     1243.0
Nematoda                        C    8   681  09APR87     1   846483.0
Polychaete larvae               C    8     9  09APR87     1    11187.0
Unidentified (Miscellaneous)    C    8    38  09APR87     1    47234.0
Amphipoda                       C    9     1  09APR87     1     1243.0
Harpacticoida                   C    9   382  09APR87     1   474826.0
Mollusca                        C    9     4  09APR87     1     4972.0
Nematoda                        C    9  1079  09APR87     1  1341197.0
Polychaete larvae               C    9    12  09APR87     1    14916.0
Unidentified (Miscellaneous)    C    9    91  09APR87     1   113113.0
Amphipoda                       C   10     1  09APR87     1     1243.0
Harpacticoida                   C   10   197  09APR87     1   244871.0
Mollusca                        C   10     2  09APR87     1     2486.0
Nematoda                        C   10   589  09APR87     1   732127.0
Polychaete larvae               C   10    10  09APR87     1    12430.0
Unidentified (Miscellaneous)    C   10    34  09APR87     1    42262.0
Amphipoda                       C   11     1  09APR87     1     1243.0
Harpacticoida                   C   11   394  09APR87     1   489742.0
Mollusca                        C   11     1  09APR87     1     1243.0
Nematoda                        C   11   463  09APR87     1   575509.0
Polychaete larvae               C   11     2  09APR87     1     2486.0
Unidentified (Miscellaneous)    C   11    50  09APR87     1    62150.0
Harpacticoida                   C   12   195  09APR87     1   242385.0
Nematoda                        C   12   578  09APR87     1   718454.0
Polychaete larvae               C   12     7  09APR87     1     8701.0
Unidentified (Miscellaneous)    C   12    47  09APR87     1    58421.0
Harpacticoida                   D    1   202  09APR87     1   251086.0
Nematoda                        D    1   280  09APR87     1   348040.0
Polychaete larvae               D    1     3  09APR87     1     3729.0
Unidentified (Miscellaneous)    D    1    45  09APR87     1    55935.0
Harpacticoida                   D    2   213  09APR87     1   264759.0
Nematoda                        D    2   150  09APR87     1   186450.0
Polychaete larvae               D    2     1  09APR87     1     1243.0
Unidentified (Miscellaneous)    D    2    71  09APR87     1    88253.0
Harpacticoida                   D    3   169  09APR87     1   210067.0
Mollusca                        D    3     4  09APR87     1     4972.0
Nematoda                        D    3   242  09APR87     1   300806.0
Unidentified (Miscellaneous)    D    3    98  09APR87     1   121814.0
Harpacticoida                   D    4   168  09APR87     1   208824.0
Nematoda                        D    4    94  09APR87     1   116842.0
Unidentified (Miscellaneous)    D    4   132  09APR87     1   164076.0
Harpacticoida                   D    5   263  09APR87     1   326909.0
Nematoda                        D    5   403  09APR87     1   500929.0
Polychaete larvae               D    5     7  09APR87     1     8701.0
Unidentified (Miscellaneous)    D    5   119  09APR87     1   147917.0
Harpacticoida                   D    6   226  09APR87     1   280918.0
Nematoda                        D    6   119  09APR87     1   147917.0
Polychaete larvae               D    6     2  09APR87     1     2486.0
Unidentified (Miscellaneous)    D    6    66  09APR87     1    82038.0
Amphipoda                       D    7     1  09APR87     1     1243.0
Harpacticoida                   D    7   236  09APR87     1   293348.0
Nematoda                        D    7   111  09APR87     1   137973.0
Polychaete larvae               D    7     1  09APR87     1     1243.0
Unidentified (Miscellaneous)    D    7    40  09APR87     1    49720.0
Harpacticoida                   D    8   214  09APR87     1   266002.0
Nematoda                        D    8   298  09APR87     1   370414.0
Polychaete larvae               D    8     7  09APR87     1     8701.0
Unidentified (Miscellaneous)    D    8    64  09APR87     1    79552.0
Harpacticoida                   D    9   231  09APR87     1   287133.0
Mollusca                        D    9     1  09APR87     1     1243.0
Nematoda                        D    9   147  09APR87     1   182721.0
Unidentified (Miscellaneous)    D    9    43  09APR87     1    53449.0
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Harpacticoida                 D  10  221  09APR87   1  274703.0
Mollusca                      D  10    2  09APR87   1    2486.0
Nematoda                      D  10  229  09APR87   1  284647.0
Polychaete larvae             D  10    4  09APR87   1    4972.0
Unidentified (Miscellaneous)  D  10   82  09APR87   1  101926.0
Harpacticoida                 D  11  240  09APR87   1  298320.0
Nematoda                      D  11  148  09APR87   1  183964.0
Polychaete larvae             D  11    1  09APR87   1    1243.0
Unidentified (Miscellaneous)  D  11   41  09APR87   1   50963.0
Amphipoda                     D  12    1  09APR87   1    1243.0
Harpacticoida                 D  12  248  09APR87   1  308264.0
Nematoda                      D  12  176  09APR87   1  218768.0
Polychaete larvae             D  12    2  09APR87   1    2486.0
Unidentified (Miscellaneous)  D  12   70  09APR87   1   87010.0
Mollusca                      A   1    2  15JUL87   1    2486.0
Nematoda                      A   1   33  15JUL87   1   41019.0
Unidentified (Miscellaneous)  A   1    5  15JUL87   1    6215.0
Harpacticoida                 A   2    2  15JUL87   1    2486.0
Mollusca                      A   2   43  15JUL87   1   53449.0
Nematoda                      A   2  111  15JUL87   1  137973.0
Polychaete larvae             A   2    1  15JUL87   1    1243.0
Unidentified (Miscellaneous)  A   2  188  15JUL87   1  233684.0
Harpacticoida                 A   3    3  15JUL87   1    3729.0
Mollusca                      A   3   52  15JUL87   1   64636.0
Nematoda                      A   3   40  15JUL87   1   49720.0
Polychaete larvae             A   3    1  15JUL87   1    1243.0
Unidentified (Miscellaneous)  A   3  133  15JUL87   1  165319.0
Harpacticoida                 A   4    6  15JUL87   1    7458.0
Mollusca                      A   4   29  15JUL87   1   36047.0
Nematoda                      A   4   72  15JUL87   1   89496.0
Polychaete larvae             A   4    5  15JUL87   1    6215.0
Unidentified (Miscellaneous)  A   4  106  15JUL87   1  131758.0
Harpacticoida                 A   5    9  15JUL87   1   11187.0
Mollusca                      A   5   55  15JUL87   1   68365.0
Nematoda                      A   5   60  15JUL87   1   74580.0
Polychaete larvae             A   5    2  15JUL87   1    2486.0
Unidentified (Miscellaneous)  A   5  156  15JUL87   1  193908.0
Harpacticoida                 A   6    8  15JUL87   1    9944.0
Mollusca                      A   6   51  15JUL87   1   63393.0
Nematoda                      A   6  148  15JUL87   1  183964.0
Polychaete larvae             A   6    3  15JUL87   1    3729.0
Unidentified (Miscellaneous)  A   6  166  15JUL87   1  206338.0
Harpacticoida                 A   7    4  15JUL87   1    4972.0
Mollusca                      A   7   56  15JUL87   1   69608.0
Nematoda                      A   7   90  15JUL87   1  111870.0
Polychaete larvae             A   7    4  15JUL87   1    4972.0
Unidentified (Miscellaneous)  A   7  109  15JUL87   1  135487.0
Harpacticoida                 A   8   10  15JUL87   1   12430.0
Mollusca                      A   8   38  15JUL87   1   47234.0
Nematoda                      A   8   83  15JUL87   1  103169.0
Polychaete larvae             A   8    5  15JUL87   1    6215.0
Unidentified (Miscellaneous)  A   8  186  15JUL87   1  231198.0
Harpacticoida                 A   9    7  15JUL87   1    8701.0
Mollusca                      A   9   46  15JUL87   1   57178.0
Nematoda                      A   9   84  15JUL87   1  104412.0
Polychaete larvae             A   9    1  15JUL87   1    1243.0
Unidentified (Miscellaneous)  A   9  140  15JUL87   1  174020.0
Harpacticoida                 B   1   33  15JUL87   1   41019.0
Mollusca                      B   1   13  15JUL87   1   16159.0
Nematoda                      B   1   25  15JUL87   1   31075.0
Polychaete larvae             B   1    1  15JUL87   1    1243.0
Unidentified (Miscellaneous)  B   1   22  15JUL87   1   27346.0
Harpacticoida                 B   2   32  15JUL87   1   39776.0
Mollusca                      B   2   19  15JUL87   1   23617.0
Nematoda                      B   2   30  15JUL87   1   37290.0
Polychaete larvae             B   2    3  15JUL87   1    3729.0
Unidentified (Miscellaneous)  B   2   21  15JUL87   1   26103.0
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Harpacticoida                    B     3    39  15JUL87      1     48477.0
Mollusca                         B     3    12  15JUL87      1     14916.0
Nematoda                         B     3    27  15JUL87      1     33561.0
Polychaete larvae                B     3     1  15JUL87      1      1243.0
Unidentified (Miscellaneous)     B     3    18  15JUL87      1     22374.0
Harpacticoida                    B     4    51  15JUL87      1     63393.0
Mollusca                         B     4    11  15JUL87      1     13673.0
Nematoda                         B     4    13  15JUL87      1     16159.0
Unidentified (Miscellaneous)     B     4    22  15JUL87      1     27346.0
Harpacticoida                    B     5    38  15JUL87      1     47234.0
Mollusca                         B     5     4  15JUL87      1      4972.0
Nematoda                         B     5    50  15JUL87      1     62150.0
Polychaete larvae                B     5     2  15JUL87      1      2486.0
Unidentified (Miscellaneous)     B     5     9  15JUL87      1     11187.0
Harpacticoida                    B     6    40  15JUL87      1     49720.0
Mollusca                         B     6     6  15JUL87      1      7458.0
Nematoda                         B     6    36  15JUL87      1     44748.0
Unidentified (Miscellaneous)     B     6    22  15JUL87      1     27346.0
Harpacticoida                    B     7    36  15JUL87      1     44748.0
Mollusca                         B     7     6  15JUL87      1      7458.0
Nematoda                         B     7    20  15JUL87      1     24860.0
Polychaete larvae                B     7     2  15JUL87      1      2486.0
Unidentified (Miscellaneous)     B     7    20  15JUL87      1     24860.0
Harpacticoida                    B     8    35  15JUL87      1     43505.0
Mollusca                         B     8     5  15JUL87      1      6215.0
Nematoda                         B     8    34  15JUL87      1     42262.0
Polychaete larvae                B     8     1  15JUL87      1      1243.0
Unidentified (Miscellaneous)     B     8     6  15JUL87      1      7458.0
Harpacticoida                    B     9    53  15JUL87      1     65879.0
Mollusca                         B     9    23  15JUL87      1     28589.0
Nematoda                         B     9    12  15JUL87      1     14916.0
Polychaete larvae                B     9     3  15JUL87      1      3729.0
Unidentified (Miscellaneous)     B     9     8  15JUL87      1      9944.0
Harpacticoida                    C     1    44  17JUL87      1     54692.0
Mollusca                         C     1     4  17JUL87      1      4972.0
Nematoda                         C     1   225  17JUL87      1    279675.0
Polychaete larvae                C     1     1  17JUL87      1      1243.0
Unidentified (Miscellaneous)     C     1    52  17JUL87      1     64636.0
Harpacticoida                    C     2    44  17JUL87      1     54692.0
Mollusca                         C     2     3  17JUL87      1      3729.0
Nematoda                         C     2   309  17JUL87      1    384087.0
Polychaete larvae                C     2     2  17JUL87      1      2486.0
Unidentified (Miscellaneous)     C     2    30  17JUL87      1     37290.0
Harpacticoida                    C     3    37  17JUL87      1     45991.0
Mollusca                         C     3     2  17JUL87      1      2486.0
Nematoda                         C     3   135  17JUL87      1    167805.0
Polychaete larvae                C     3     2  17JUL87      1      2486.0
Unidentified (Miscellaneous)     C     3    64  17JUL87      1     79552.0
Harpacticoida                    C     4    30  17JUL87      1     37290.0
Mollusca                         C     4     5  17JUL87      1      6215.0
Nematoda                         C     4   261  17JUL87      1    324423.0
Polychaete larvae                C     4     3  17JUL87      1      3729.0
Unidentified (Miscellaneous)     C     4    33  17JUL87      1     41019.0
Harpacticoida                    C     5    13  17JUL87      1     16159.0
Mollusca                         C     5     3  17JUL87      1      3729.0
Nematoda                         C     5   326  17JUL87      1    405218.0
Polychaete larvae                C     5     3  17JUL87      1      3729.0
Unidentified (Miscellaneous)     C     5    23  17JUL87      1     28589.0
Harpacticoida                    C     6    67  17JUL87      1     83281.0
Mollusca                         C     6     8  17JUL87      1      9944.0
Nematoda                         C     6   306  17JUL87      1    380358.0
Polychaete larvae                C     6     4  17JUL87      1      4972.0
Unidentified (Miscellaneous)     C     6    73  17JUL87      1     90739.0
Harpacticoida                    C     7    39  17JUL87      1     48477.0
Nematoda                         C     7   159  17JUL87      1    197637.0
Polychaete larvae                C     7     5  17JUL87      1      6215.0
Unidentified (Miscellaneous)     C     7    27  17JUL87      1     33561.0
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Harpacticoida                    C    8    45  17JUL87    1     55935.0
Mollusca                         C    8     9  17JUL87    1     11187.0
Nematoda                         C    8   244  17JUL87    1    303292.0
Polychaete larvae                C    8     3  17JUL87    1      3729.0
Unidentified (Miscellaneous)     C    8    67  17JUL87    1     83281.0
Harpacticoida                    C    9    26  17JUL87    1     32318.0
Nematoda                         C    9   116  17JUL87    1    144188.0
Polychaete larvae                C    9     4  17JUL87    1      4972.0
Unidentified (Miscellaneous)     C    9    33  17JUL87    1     41019.0
Harpacticoida                    D    1    45  17JUL87    1     55935.0
Mollusca                         D    1     1  17JUL87    1      1243.0
Nematoda                         D    1   179  17JUL87    1    222497.0
Polychaete larvae                D    1     2  17JUL87    1      2486.0
Unidentified (Miscellaneous)     D    1    65  17JUL87    1     80795.0
Harpacticoida                    D    2    51  17JUL87    1     63393.0
Mollusca                         D    2     2  17JUL87    1      2486.0
Nematoda                         D    2    55  17JUL87    1     68365.0
Polychaete larvae                D    2     2  17JUL87    1      2486.0
Unidentified (Miscellaneous)     D    2    40  17JUL87    1     49720.0
Harpacticoida                    D    3    36  17JUL87    1     44748.0
Mollusca                         D    3     8  17JUL87    1      9944.0
Nematoda                         D    3   122  17JUL87    1    151646.0
Polychaete larvae                D    3     3  17JUL87    1      3729.0
Unidentified (Miscellaneous)     D    3    39  17JUL87    1     48477.0
Harpacticoida                    D    4    52  17JUL87    1     64636.0
Mollusca                         D    4     3  17JUL87    1      3729.0
Nematoda                         D    4   109  17JUL87    1    135487.0
Polychaete larvae                D    4     4  17JUL87    1      4972.0
Unidentified (Miscellaneous)     D    4    35  17JUL87    1     43505.0
Harpacticoida                    D    5    31  17JUL87    1     38533.0
Mollusca                         D    5     1  17JUL87    1      1243.0
Nematoda                         D    5   145  17JUL87    1    180235.0
Polychaete larvae                D    5     1  17JUL87    1      1243.0
Unidentified (Miscellaneous)     D    5    39  17JUL87    1     48477.0
Harpacticoida                    D    6    60  17JUL87    1     74580.0
Mollusca                         D    6     7  17JUL87    1      8701.0
Nematoda                         D    6   139  17JUL87    1    172777.0
Polychaete larvae                D    6     3  17JUL87    1      3729.0
Unidentified (Miscellaneous)     D    6    62  17JUL87    1     77066.0
Harpacticoida                    D    7    40  17JUL87    1     49720.0
Mollusca                         D    7     3  17JUL87    1      3729.0
Nematoda                         D    7   113  17JUL87    1    140459.0
Polychaete larvae                D    7     3  17JUL87    1      3729.0
Unidentified (Miscellaneous)     D    7    30  17JUL87    1     37290.0
Harpacticoida                    D    8    56  17JUL87    1     69608.0
Mollusca                         D    8     5  17JUL87    1      6215.0
Nematoda                         D    8   160  17JUL87    1    198880.0
Polychaete larvae                D    8     1  17JUL87    1      1243.0
Unidentified (Miscellaneous)     D    8    35  17JUL87    1     43505.0
Harpacticoida                    D    9    42  17JUL87    1     52206.0
Mollusca                         D    9     3  17JUL87    1      3729.0
Nematoda                         D    9   285  17JUL87    1    354255.0
Polychaete larvae                D    9     5  17JUL87    1      6215.0
Unidentified (Miscellaneous)     D    9    58  17JUL87    1     72094.0
Capitella capitata               A    1     1  18APR88    1      3602.0
Copepod nauplii                  A    1     4  18APR88    1     14408.0
Enhydrosoma spp.                 A    1     2  18APR88    1      7204.0
Halacaridae (Hydracarina)        A    1     5  18APR88    1     18010.0
Laophonte spp.                   A    1     1  18APR88    1      3602.0
Littoridina sphinctostoma        A    1     3  18APR88    1     10806.0
Monoculoides sp.                 A    1     1  18APR88    1      3602.0
Mulinia lateralis                A    1     2  18APR88    1      7204.0
Nematoda                         A    1   134  18APR88    1    482668.0
Ostracoda                        A    1    13  18APR88    1     46826.0
Polydora sp.                     A    1     1  18APR88    1      3602.0
Schizopera sp.                   A    1     4  18APR88    1     14408.0
Scottolana canadensis            A    1    25  18APR88    1     90050.0
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Streblospio benedicti           A    1    19  18APR88     1    68438.0
Unidentified (Miscellaneous)    A    1     5  18APR88     1    18010.0
Capitella capitata              A    1     1  18APR88   1-3     3602.0
Harpacticoida                   A    1     2  18APR88   1-3     7204.0
Littoridina sphinctostoma       A    1     1  18APR88   1-3     3602.0
Mediomastus californiensis      A    1     1  18APR88   1-3     3602.0
Nematoda                        A    1    87  18APR88   1-3   313374.0
Oligochaeta                     A    1     1  18APR88   1-3     3602.0
Ostracoda                       A    1     1  18APR88   1-3     3602.0
Rhynchocoels                    A    1     1  18APR88   1-3     3602.0
Scottolana canadensis           A    1     4  18APR88   1-3    14408.0
Unidentified (Miscellaneous)    A    1     8  18APR88   1-3    28816.0
Capitella capitata              A    2     3  18APR88     1    10806.0
Enhydrosoma spp.                A    2     1  18APR88     1     3602.0
Halacaridae (Hydracarina)       A    2     5  18APR88     1    18010.0
Laophonte spp.                  A    2     5  18APR88     1    18010.0
Littoridina sphinctostoma       A    2     3  18APR88     1    10806.0
Mulinia lateralis               A    2     1  18APR88     1     3602.0
Nematoda                        A    2   180  18APR88     1   648360.0
Ostracoda                       A    2    14  18APR88     1    50428.0
Rhynchocoels                    A    2     1  18APR88     1     3602.0
Schizopera sp.                  A    2    14  18APR88     1    50428.0
Scottolana canadensis           A    2    20  18APR88     1    72040.0
Streblospio benedicti           A    2    29  18APR88     1   104458.0
Unidentified (Miscellaneous)    A    2     4  18APR88     1    14408.0
Capitella capitata              A    2     1  18APR88   1-3     3602.0
Nematoda                        A    2   105  18APR88   1-3   378210.0
Rhynchocoels                    A    2     1  18APR88   1-3     3602.0
Scottolana canadensis           A    2     1  18APR88   1-3     3602.0
Streblospio benedicti           A    2     4  18APR88   1-3    14408.0
Unidentified (Miscellaneous)    A    2     3  18APR88   1-3    10806.0
Copepod nauplii                 A    3     2  18APR88     1     7204.0
Laophonte spp.                  A    3     1  18APR88     1     3602.0
Littoridina sphinctostoma       A    3     2  18APR88     1     7204.0
Monoculoides sp.                A    3     1  18APR88     1     3602.0
Mulinia lateralis               A    3     2  18APR88     1     7204.0
Nematoda                        A    3   221  18APR88     1   796042.0
Ostracoda                       A    3     9  18APR88     1    32418.0
Scottolana canadensis           A    3    30  18APR88     1   108060.0
Streblospio benedicti           A    3    25  18APR88     1    90050.0
Unidentified (Miscellaneous)    A    3     7  18APR88     1    25214.0
Littoridina sphinctostoma       A    3     1  18APR88   1-3     3602.0
Mediomastus californiensis      A    3     1  18APR88   1-3     3602.0
Nematoda                        A    3   137  18APR88   1-3   493474.0
Ostracoda                       A    3     1  18APR88   1-3     3602.0
Rhynchocoels                    A    3     2  18APR88   1-3     7204.0
Scottolana canadensis           A    3     7  18APR88   1-3    25214.0
Streblospio benedicti           A    3     1  18APR88   1-3     3602.0
Unidentified (Miscellaneous)    A    3     9  18APR88   1-3    32418.0
Bivalvia                        B    1     1  18APR88     1     3602.0
Copepod nauplii                 B    1    12  18APR88     1    43224.0
Cyclopoida                      B    1     1  18APR88     1     3602.0
Dioasaccidae nauplii            B    1    10  18APR88     1    36020.0
Ectinosomidae                   B    1     1  18APR88     1     3602.0
Enhydrosoma spp.                B    1     5  18APR88     1    18010.0
Halacaridae (Hydracarina)       B    1     8  18APR88     1    28816.0
Halicyclops sp.                 B    1     1  18APR88     1     3602.0
Kinoryncha                      B    1     1  18APR88     1     3602.0
Laophonte spp.                  B    1    16  18APR88     1    57632.0
Mulinia lateralis               B    1     1  18APR88     1     3602.0
Nematoda                        B    1    62  18APR88     1   223324.0
Ostracoda                       B    1    21  18APR88     1    75642.0
Rhynchocoels                    B    1     1  18APR88     1     3602.0
Saphirella sp.                  B    1     1  18APR88     1     3602.0
Schizopera sp.                  B    1    33  18APR88     1   118866.0
Scottolana canadensis           B    1     8  18APR88     1    28816.0
Streblospio benedicti           B    1    35  18APR88     1   126070.0
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Unidentified (Miscellaneous)    B    1     9  18APR88     1    32418.0
Capitella capitata              B    1     1  18APR88   1-3     3602.0
Enhydrosoma spp.                B    1     1  18APR88   1-3     3602.0
Laophonte spp.                  B    1     1  18APR88   1-3     3602.0
Littoridina sphinctostoma       B    1     4  18APR88   1-3    14408.0
Mediomastus californiensis      B    1     1  18APR88   1-3     3602.0
Mulinia lateralis               B    1     4  18APR88   1-3    14408.0
Nematoda                        B    1   360  18APR88   1-3  1296720.0
Ostracoda                       B    1     3  18APR88   1-3    10806.0
Rhynchocoels                    B    1     2  18APR88   1-3     7204.0
Schizopera sp.                  B    1     1  18APR88   1-3     3602.0
Scottolana canadensis           B    1     1  18APR88   1-3     3602.0
Streblospio benedicti           B    1    17  18APR88   1-3    61234.0
Copepod nauplii                 B    2    40  18APR88     1   144080.0
Dioasaccidae nauplii            B    2    11  18APR88     1    39622.0
Ectinosomidae                   B    2     1  18APR88     1     3602.0
Enhydrosoma spp.                B    2     5  18APR88     1    18010.0
Halacaridae (Hydracarina)       B    2     1  18APR88     1     3602.0
Halicyclops sp.                 B    2     1  18APR88     1     3602.0
Laophonte spp.                  B    2    15  18APR88     1    54030.0
Littoridina sphinctostoma       B    2     4  18APR88     1    14408.0
Mediomastus californiensis      B    2     5  18APR88     1    18010.0
Mulinia lateralis               B    2     3  18APR88     1    10806.0
Nematoda                        B    2    76  18APR88     1   273752.0
Ostracoda                       B    2    19  18APR88     1    68438.0
Rangia cuneata                  B    2     1  18APR88     1     3602.0
Rhynchocoels                    B    2     2  18APR88     1     7204.0
Schizopera sp.                  B    2    14  18APR88     1    50428.0
Scottolana canadensis           B    2    29  18APR88     1   104458.0
Streblospio benedicti           B    2    80  18APR88     1   288160.0
Unidentified (Miscellaneous)    B    2     7  18APR88     1    25214.0
Capitella capitata              B    2     1  18APR88   1-3     3602.0
Dioasaccidae nauplii            B    2     1  18APR88   1-3     3602.0
Littoridina sphinctostoma       B    2     2  18APR88   1-3     7204.0
Mulinia lateralis               B    2     2  18APR88   1-3     7204.0
Nematoda                        B    2   314  18APR88   1-3  1131028.0
Ostracoda                       B    2     1  18APR88   1-3     3602.0
Rhynchocoels                    B    2     4  18APR88   1-3    14408.0
Scottolana canadensis           B    2    10  18APR88   1-3    36020.0
Streblospio benedicti           B    2    21  18APR88   1-3    75642.0
Unidentified (Miscellaneous)    B    2     4  18APR88   1-3    14408.0
Argulus sp.                     B    3     1  18APR88     1     3602.0
Capitella capitata              B    3     3  18APR88     1    10806.0
Copepod nauplii                 B    3    13  18APR88     1    46826.0
Cyclopoida                      B    3     1  18APR88     1     3602.0
Dioasaccidae nauplii            B    3     7  18APR88     1    25214.0
Ectinosomidae                   B    3     1  18APR88     1     3602.0
Enhydrosoma spp.                B    3     3  18APR88     1    10806.0
Halacaridae (Hydracarina)       B    3     5  18APR88     1    18010.0
Halicyclops sp.                 B    3     2  18APR88     1     7204.0
Laophonte spp.                  B    3    12  18APR88     1    43224.0
Mediomastus californiensis      B    3     2  18APR88     1     7204.0
Monoculoides sp.                B    3     1  18APR88     1     3602.0
Mulinia lateralis               B    3     4  18APR88     1    14408.0
Nematoda                        B    3   100  18APR88     1   360200.0
Ostracoda                       B    3    20  18APR88     1    72040.0
Rhynchocoels                    B    3     2  18APR88     1     7204.0
Saphirella sp.                  B    3     1  18APR88     1     3602.0
Schizopera sp.                  B    3    21  18APR88     1    75642.0
Scottolana canadensis           B    3     3  18APR88     1    10806.0
Streblospio benedicti           B    3    46  18APR88     1   165692.0
Unidentified (Miscellaneous)    B    3     7  18APR88     1    25214.0
Copepod nauplii                 B    3     1  18APR88   1-3     3602.0
Cyclopoida                      B    3     1  18APR88   1-3     3602.0
Littoridina sphinctostoma       B    3     1  18APR88   1-3     3602.0
Mediomastus californiensis      B    3     1  18APR88   1-3     3602.0
Mulinia lateralis               B    3     3  18APR88   1-3    10806.0
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Nematoda                        B    3   560  18APR88  1-3  2017120.0
Oligochaeta                     B    3     1  18APR88  1-3     3602.0
Rhynchocoels                    B    3     1  18APR88  1-3     3602.0
Scottolana canadensis           B    3     1  18APR88  1-3     3602.0
Streblospio benedicti           B    3    25  18APR88  1-3    90050.0
Unidentified (Miscellaneous)    B    3     6  18APR88  1-3    21612.0
Copepod nauplii                 C    1    14  18APR88    1    50428.0
Dioasaccidae nauplii            C    1     3  18APR88    1    10806.0
Ectinosomidae                   C    1     1  18APR88    1     3602.0
Enhydrosoma spp.                C    1     1  18APR88    1     3602.0
Laophonte spp.                  C    1     1  18APR88    1     3602.0
Littoridina sphinctostoma       C    1     5  18APR88    1    18010.0
Mediomastus californiensis      C    1     3  18APR88    1    10806.0
Mulinia lateralis               C    1     5  18APR88    1    18010.0
Nematoda                        C    1    83  18APR88    1   298966.0
Ostracoda                       C    1    12  18APR88    1    43224.0
Schizopera sp.                  C    1    10  18APR88    1    36020.0
Scottolana canadensis           C    1     7  18APR88    1    25214.0
Streblospio benedicti           C    1    19  18APR88    1    68438.0
Unidentified (Miscellaneous)    C    1     4  18APR88    1    14408.0
Copepod nauplii                 C    1     2  18APR88  1-3     7204.0
Ectinosomidae                   C    1     1  18APR88  1-3     3602.0
Haploscoloplos foliosus         C    1     1  18APR88  1-3     3602.0
Kinoryncha                      C    1     1  18APR88  1-3     3602.0
Macoma mitchelli                C    1     1  18APR88  1-3     3602.0
Mediomastus californiensis      C    1     9  18APR88  1-3    32418.0
Nematoda                        C    1   258  18APR88  1-3   929316.0
Rhynchocoels                    C    1     1  18APR88  1-3     3602.0
Scottolana canadensis           C    1     1  18APR88  1-3     3602.0
Streblospio benedicti           C    1     3  18APR88  1-3    10806.0
Unidentified (Miscellaneous)    C    1     1  18APR88  1-3     3602.0
Copepod nauplii                 C    2    22  18APR88    1    79244.0
Cyclaspis varians               C    2     1  18APR88    1     3602.0
Cyclopoida                      C    2     1  18APR88    1     3602.0
Diastylis sp.                   C    2     1  18APR88    1     3602.0
Dioasaccidae nauplii            C    2     2  18APR88    1     7204.0
Enhydrosoma spp.                C    2     7  18APR88    1    25214.0
Littoridina sphinctostoma       C    2     5  18APR88    1    18010.0
Mulinia lateralis               C    2     4  18APR88    1    14408.0
Nematoda                        C    2    82  18APR88    1   295364.0
Ostracoda                       C    2    16  18APR88    1    57632.0
Schizopera sp.                  C    2    19  18APR88    1    68438.0
Scottolana canadensis           C    2     1  18APR88    1     3602.0
Streblospio benedicti           C    2    17  18APR88    1    61234.0
Unidentified (Miscellaneous)    C    2     4  18APR88    1    14408.0
Capitella capitata              C    2     1  18APR88  1-3     3602.0
Copepod nauplii                 C    2     3  18APR88  1-3    10806.0
Cyclopoida                      C    2     1  18APR88  1-3     3602.0
Enhydrosoma spp.                C    2     3  18APR88  1-3    10806.0
Kinoryncha                      C    2     1  18APR88  1-3     3602.0
Longipedia americana            C    2     1  18APR88  1-3     3602.0
Mediomastus californiensis      C    2     8  18APR88  1-3    28816.0
Mulinia lateralis               C    2     1  18APR88  1-3     3602.0
Nematoda                        C    2   330  18APR88  1-3  1188660.0
Schizopera sp.                  C    2     8  18APR88  1-3    28816.0
Scottolana canadensis           C    2     2  18APR88  1-3     7204.0
Streblospio benedicti           C    2     4  18APR88  1-3    14408.0
Unidentified (Miscellaneous)    C    2     1  18APR88  1-3     3602.0
Copepod nauplii                 C    3    64  18APR88    1   230528.0
Cyclopoida                      C    3     2  18APR88    1     7204.0
Dioasaccidae nauplii            C    3     8  18APR88    1    28816.0
Ectinosomidae                   C    3     5  18APR88    1    18010.0
Enhydrosoma spp.                C    3     7  18APR88    1    25214.0
Glycinde solitaria              C    3     1  18APR88    1     3602.0
Halicyclops sp.                 C    3     1  18APR88    1     3602.0
Kinoryncha                      C    3     9  18APR88    1    32418.0
Laophonte spp.                  C    3     1  18APR88    1     3602.0
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Littoridina sphinctostoma      C   3    2  18APR88     1     7204.0
Longipedia americana           C   3    4  18APR88     1    14408.0
Mediomastus californiensis     C   3    1  18APR88     1     3602.0
Mulinia lateralis              C   3    5  18APR88     1    18010.0
Nematoda                       C   3  188  18APR88     1   677176.0
Ostracoda                      C   3   44  18APR88     1   158488.0
Oxyurostylis smithi            C   3    1  18APR88     1     3602.0
Rhynchocoels                   C   3    1  18APR88     1     3602.0
Saphirella sp.                 C   3    1  18APR88     1     3602.0
Schizopera sp.                 C   3   40  18APR88     1   144080.0
Scottolana canadensis          C   3    4  18APR88     1    14408.0
Streblospio benedicti          C   3   46  18APR88     1   165692.0
Unidentified (Miscellaneous)   C   3   10  18APR88     1    36020.0
Copepod nauplii                C   3    5  18APR88  1-3     18010.0
Cyclopoida                     C   3    1  18APR88  1-3      3602.0
Diopatra cuprea                C   3    1  18APR88  1-3      3602.0
Enhydrosoma spp.               C   3    1  18APR88  1-3      3602.0
Halacaridae (Hydracarina)      C   3    2  18APR88  1-3      7204.0
Kinoryncha                     C   3    1  18APR88  1-3      3602.0
Mediomastus californiensis     C   3    3  18APR88  1-3     10806.0
Mulinia lateralis              C   3    1  18APR88  1-3      3602.0
Nematoda                       C   3  276  18APR88  1-3    994152.0
Schizopera sp.                 C   3    5  18APR88  1-3     18010.0
Scottolana canadensis          C   3    1  18APR88  1-3      3602.0
Streblospio benedicti          C   3    2  18APR88  1-3      7204.0
Unidentified (Miscellaneous)   C   3    1  18APR88  1-3      3602.0
Copepod nauplii                D   1   34  18APR88     1   122468.0
Cyclopoida                     D   1    1  18APR88     1     3602.0
Dioasaccidae nauplii           D   1   21  18APR88     1    75642.0
Ectinosomidae                  D   1    1  18APR88     1     3602.0
Enhydrosoma spp.               D   1   22  18APR88     1    79244.0
Gastropoda                     D   1    1  18APR88     1     3602.0
Halacaridae (Hydracarina)      D   1   11  18APR88     1    39622.0
Halicyclops sp.                D   1    5  18APR88     1    18010.0
Harpacticoida                  D   1   17  18APR88     1    61234.0
Kinoryncha                     D   1   77  18APR88     1   277354.0
Laophonte spp.                 D   1    1  18APR88     1     3602.0
Longipedia americana           D   1    1  18APR88     1     3602.0
Mediomastus californiensis     D   1   26  18APR88     1    93652.0
Mulinia lateralis              D   1    1  18APR88     1     3602.0
Nematoda                       D   1  397  18APR88     1  1429994.0
Ostracoda                      D   1   31  18APR88     1   111662.0
Schizopera sp.                 D   1   27  18APR88     1    97254.0
Scottolana canadensis          D   1    3  18APR88     1    10806.0
Streblospio benedicti          D   1    6  18APR88     1    21612.0
Unidentified (Miscellaneous)   D   1   11  18APR88     1    39622.0
Copepod nauplii                D   1    1  18APR88  1-3      3602.0
Glycinde solitaria             D   1    2  18APR88  1-3      7204.0
Halacaridae (Hydracarina)      D   1    1  18APR88  1-3      3602.0
Mediomastus californiensis     D   1    6  18APR88  1-3     21612.0
Nematoda                       D   1  443  18APR88  1-3   1595686.0
Scottolana canadensis          D   1    1  18APR88  1-3      3602.0
Unidentified (Miscellaneous)   D   1    3  18APR88  1-3     10806.0
Copepod nauplii                D   2    7  18APR88     1    25214.0
Dioasaccidae nauplii           D   2    5  18APR88     1    18010.0
Enhydrosoma spp.               D   2   11  18APR88     1    39622.0
Gastropoda                     D   2    3  18APR88     1    10806.0
Halacaridae (Hydracarina)      D   2    7  18APR88     1    25214.0
Harpacticoida                  D   2   12  18APR88     1    43224.0
Kinoryncha                     D   2   53  18APR88     1   190906.0
Laophonte spp.                 D   2    6  18APR88     1    21612.0
Mediomastus californiensis     D   2   10  18APR88     1    36020.0
Mulinia lateralis              D   2    1  18APR88     1     3602.0
Nematoda                       D   2  392  18APR88     1  1411984.0
Ostracoda                      D   2   19  18APR88     1    68438.0
Schizopera sp.                 D   2   25  18APR88     1    90050.0
Scottolana canadensis          D   2    4  18APR88     1    14408.0
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Streblospio benedicti          D   2    9  18APR88     1     32418.0
Unidentified (Miscellaneous)   D   2    4  18APR88     1     14408.0
Copepod nauplii                D   2    2  18APR88   1-3      7204.0
Halacaridae (Hydracarina)      D   2    1  18APR88   1-3      3602.0
Mulinia lateralis              D   2    1  18APR88   1-3      3602.0
Nematoda                       D   2  479  18APR88   1-3   1725358.0
Schizopera sp.                 D   2    1  18APR88   1-3      3602.0
Streblospio benedicti          D   2    5  18APR88   1-3     18010.0
Unidentified (Miscellaneous)   D   2    1  18APR88   1-3      3602.0
Copepod nauplii                D   3   22  18APR88     1     79244.0
Dioasaccidae nauplii           D   3   12  18APR88     1     43224.0
Ectinosomidae                  D   3    3  18APR88     1     10806.0
Enhydrosoma spp.               D   3   14  18APR88     1     50428.0
Halacaridae (Hydracarina)      D   3    4  18APR88     1     14408.0
Halicyclops sp.                D   3    6  18APR88     1     21612.0
Harpacticoida                  D   3   15  18APR88     1     54030.0
Kinoryncha                     D   3   65  18APR88     1    234130.0
Laophonte spp.                 D   3    3  18APR88     1     10806.0
Longipedia americana           D   3    1  18APR88     1      3602.0
Mediomastus californiensis     D   3   10  18APR88     1     36020.0
Mulinia lateralis              D   3    9  18APR88     1     32418.0
Nematoda                       D   3  325  18APR88     1   1170650.0
Ostracoda                      D   3   25  18APR88     1     90050.0
Schizopera sp.                 D   3   22  18APR88     1     79244.0
Scottolana canadensis          D   3    4  18APR88     1     14408.0
Streblospio benedicti          D   3    6  18APR88     1     21612.0
Unidentified (Miscellaneous)   D   3    8  18APR88     1     28816.0
Mediomastus californiensis     D   3    6  18APR88   1-3     21612.0
Nematoda                       D   3  290  18APR88   1-3   1044580.0
Scottolana canadensis          D   3    1  18APR88   1-3      3602.0
Unidentified (Miscellaneous)   D   3    4  18APR88   1-3     14408.0
Capitella capitata             A   1    1  07JUL88     1      3602.0
Copepod nauplii                A   1    2  07JUL88     1      7204.0
Halacaridae (Hydracarina)      A   1    3  07JUL88     1     10806.0
Littoridina sphinctostoma      A   1   41  07JUL88     1    147682.0
Mediomastus californiensis     A   1    3  07JUL88     1     10806.0
Mulinia lateralis              A   1    1  07JUL88     1      3602.0
Nematoda                       A   1   62  07JUL88     1    223324.0
Ostracoda                      A   1   34  07JUL88     1    122468.0
Scottolana canadensis          A   1   17  07JUL88     1     61234.0
Streblospio benedicti          A   1   23  07JUL88     1     82846.0
Unidentified (Miscellaneous)   A   1   24  07JUL88     1     86448.0
Capitella capitata             A   1    1  07JUL88   1-3      3602.0
Copepod nauplii                A   1    2  07JUL88   1-3      7204.0
Littoridina sphinctostoma      A   1    1  07JUL88   1-3      3602.0
Mediomastus californiensis     A   1    4  07JUL88   1-3     14408.0
Nematoda                       A   1  298  07JUL88   1-3   1073396.0
Ostracoda                      A   1    5  07JUL88   1-3     18010.0
Streblospio benedicti          A   1    4  07JUL88   1-3     14408.0
Unidentified (Miscellaneous)   A   1    1  07JUL88   1-3      3602.0
Copepod nauplii                A   2    7  07JUL88     1     25214.0
Dioasaccidae nauplii           A   2    1  07JUL88     1      3602.0
Halacaridae (Hydracarina)      A   2    1  07JUL88     1      3602.0
Halicyclops sp.                A   2    2  07JUL88     1      7204.0
Littoridina sphinctostoma      A   2   65  07JUL88     1    234130.0
Mediomastus californiensis     A   2    3  07JUL88     1     10806.0
Monoculoides sp.               A   2    2  07JUL88     1      7204.0
Mulinia lateralis              A   2    2  07JUL88     1      7204.0
Nematoda                       A   2   45  07JUL88     1    162090.0
Ostracoda                      A   2   42  07JUL88     1    151284.0
Polychaete larvae              A   2    1  07JUL88     1      3602.0
Scottolana canadensis          A   2   24  07JUL88     1     86448.0
Streblospio benedicti          A   2    7  07JUL88     1     25214.0
Unidentified (Miscellaneous)   A   2   45  07JUL88     1    162090.0
Capitella capitata             A   2    1  07JUL88   1-3      3602.0
Copepod nauplii                A   2    1  07JUL88   1-3      3602.0
Littoridina sphinctostoma      A   2    1  07JUL88   1-3      3602.0
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Mediomastus californiensis       A   2     4  07JUL88  1-3      14408.0
Mulinia lateralis                A   2     1  07JUL88  1-3       3602.0
Nematoda                         A   2   192  07JUL88  1-3     691584.0
Ostracoda                        A   2     1  07JUL88  1-3       3602.0
Streblospio benedicti            A   2     2  07JUL88  1-3       7204.0
Unidentified (Miscellaneous)     A   2     7  07JUL88  1-3      25214.0
Capitella capitata               A   3     1  07JUL88    1       3602.0
Copepod nauplii                  A   3     2  07JUL88    1       7204.0
Littoridina sphinctostoma        A   3    33  07JUL88    1     118866.0
Mediomastus californiensis       A   3     5  07JUL88    1      18010.0
Mulinia lateralis                A   3     1  07JUL88    1       3602.0
Nematoda                         A   3    52  07JUL88    1     187304.0
Ostracoda                        A   3    33  07JUL88    1     118866.0
Scottolana canadensis            A   3     8  07JUL88    1      28816.0
Streblospio benedicti            A   3    16  07JUL88    1      57632.0
Unidentified (Miscellaneous)     A   3    19  07JUL88    1      68438.0
Copepod nauplii                  A   3     1  07JUL88  1-3       3602.0
Halicyclops sp.                  A   3     1  07JUL88  1-3       3602.0
Mediomastus californiensis       A   3     1  07JUL88  1-3       3602.0
Mulinia lateralis                A   3     1  07JUL88  1-3       3602.0
Nematoda                         A   3   345  07JUL88  1-3    1242690.0
Streblospio benedicti            A   3     2  07JUL88  1-3       7204.0
Unidentified (Miscellaneous)     A   3     4  07JUL88  1-3      14408.0
Bivalvia                         B   1     1  07JUL88    1       3602.0
Copepod nauplii                  B   1    11  07JUL88    1      39622.0
Dioasaccidae nauplii             B   1     9  07JUL88    1      32418.0
Ectinosomidae                    B   1     7  07JUL88    1      25214.0
Enhydrosoma spp.                 B   1    13  07JUL88    1      46826.0
Halacaridae (Hydracarina)        B   1    14  07JUL88    1      50428.0
Halicyclops sp.                  B   1     2  07JUL88    1       7204.0
Harpacticoida                    B   1    27  07JUL88    1      97254.0
Kinoryncha                       B   1     3  07JUL88    1      10806.0
Laophonte spp.                   B   1     1  07JUL88    1       3602.0
Littoridina sphinctostoma        B   1     6  07JUL88    1      21612.0
Mediomastus californiensis       B   1    16  07JUL88    1      57632.0
Mulinia lateralis                B   1     5  07JUL88    1      18010.0
Nematoda                         B   1    85  07JUL88    1     306170.0
Ostracoda                        B   1    28  07JUL88    1     100856.0
Schizopera sp.                   B   1     5  07JUL88    1      18010.0
Scottolana canadensis            B   1    10  07JUL88    1      36020.0
Streblospio benedicti            B   1    15  07JUL88    1      54030.0
Unidentified (Miscellaneous)     B   1    44  07JUL88    1     158488.0
Dioasaccidae nauplii             B   1     1  07JUL88  1-3       3602.0
Halacaridae (Hydracarina)        B   1     1  07JUL88  1-3       3602.0
Mediomastus californiensis       B   1     9  07JUL88  1-3      32418.0
Mulinia lateralis                B   1     1  07JUL88  1-3       3602.0
Nematoda                         B   1   157  07JUL88  1-3     565514.0
Ostracoda                        B   1     1  07JUL88  1-3       3602.0
Rhynchocoels                     B   1     1  07JUL88  1-3       3602.0
Unidentified (Miscellaneous)     B   1     1  07JUL88  1-3       3602.0
Bivalvia                         B   2     3  07JUL88    1      10806.0
Copepod nauplii                  B   2     8  07JUL88    1      28816.0
Dioasaccidae nauplii             B   2     3  07JUL88    1      10806.0
Ectinosomidae                    B   2     7  07JUL88    1      25214.0
Enhydrosoma spp.                 B   2    12  07JUL88    1      43224.0
Halacaridae (Hydracarina)        B   2    10  07JUL88    1      36020.0
Harpacticoida                    B   2    12  07JUL88    1      43224.0
Littoridina sphinctostoma        B   2     2  07JUL88    1       7204.0
Mediomastus californiensis       B   2    24  07JUL88    1      86448.0
Mulinia lateralis                B   2     7  07JUL88    1      25214.0
Nematoda                         B   2    48  07JUL88    1     172896.0
Ostracoda                        B   2    31  07JUL88    1     111662.0
Polychaete larvae                B   2     1  07JUL88    1       3602.0
Schizopera sp.                   B   2     4  07JUL88    1      14408.0
Scolelepis squamata              B   2     1  07JUL88    1       3602.0
Scottolana canadensis            B   2    11  07JUL88    1      39622.0
Streblospio benedicti            B   2    20  07JUL88    1      72040.0
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Unidentified (Miscellaneous)     B   2   43  07JUL88     1   154886.0
Copepod nauplii                  B   2    2  07JUL88   1-3     7204.0
Mediomastus californiensis       B   2    5  07JUL88   1-3    18010.0
Nematoda                         B   2  238  07JUL88   1-3   857276.0
Ostracoda                        B   2    2  07JUL88   1-3     7204.0
Streblospio benedicti            B   2    2  07JUL88   1-3     7204.0
Unidentified (Miscellaneous)     B   2    1  07JUL88   1-3     3602.0
Bivalvia                         B   3    3  07JUL88     1    10806.0
Copepod nauplii                  B   3   11  07JUL88     1    39622.0
Dioasaccidae nauplii             B   3   10  07JUL88     1    36020.0
Ectinosomidae                    B   3    6  07JUL88     1    21612.0
Enhydrosoma spp.                 B   3    6  07JUL88     1    21612.0
Halacaridae (Hydracarina)        B   3   11  07JUL88     1    39622.0
Halicyclops sp.                  B   3    1  07JUL88     1     3602.0
Harpacticoida                    B   3   17  07JUL88     1    61234.0
Laophonte spp.                   B   3    1  07JUL88     1     3602.0
Littoridina sphinctostoma        B   3    6  07JUL88     1    21612.0
Mediomastus californiensis       B   3   15  07JUL88     1    54030.0
Mulinia lateralis                B   3    5  07JUL88     1    18010.0
Nematoda                         B   3   67  07JUL88     1   241334.0
Ostracoda                        B   3   28  07JUL88     1   100856.0
Pseudodiaptomus coronatus        B   3    1  07JUL88     1     3602.0
Schizopera sp.                   B   3    5  07JUL88     1    18010.0
Scottolana canadensis            B   3    4  07JUL88     1    14408.0
Streblospio benedicti            B   3    8  07JUL88     1    28816.0
Unidentified (Miscellaneous)     B   3   33  07JUL88     1   118866.0
Copepod nauplii                  B   3    3  07JUL88   1-3    10806.0
Mediomastus californiensis       B   3    5  07JUL88   1-3    18010.0
Nematoda                         B   3  314  07JUL88   1-3  1131028.0
Unidentified (Miscellaneous)     B   3    3  07JUL88   1-3    10806.0
Bivalvia                         C   1   14  08JUL88     1    50428.0
Copepod nauplii                  C   1   19  08JUL88     1    68438.0
Cyclaspis varians                C   1    1  08JUL88     1     3602.0
Dioasaccidae nauplii             C   1    3  08JUL88     1    10806.0
Enhydrosoma spp.                 C   1    6  08JUL88     1    21612.0
Gastropoda                       C   1    2  08JUL88     1     7204.0
Halacaridae (Hydracarina)        C   1   12  08JUL88     1    43224.0
Halicyclops sp.                  C   1   17  08JUL88     1    61234.0
Harpacticoida                    C   1   11  08JUL88     1    39622.0
Kinoryncha                       C   1   49  08JUL88     1   176498.0
Mediomastus californiensis       C   1   22  08JUL88     1    79244.0
Mulinia lateralis                C   1    6  08JUL88     1    21612.0
Nematoda                         C   1  188  08JUL88     1   677176.0
Ostracoda                        C   1   28  08JUL88     1   100856.0
Paraprionospio pinnata           C   1    1  08JUL88     1     3602.0
Pseudodiaptomus coronatus        C   1    2  08JUL88     1     7204.0
Rhynchocoels                     C   1    1  08JUL88     1     3602.0
Schizopera sp.                   C   1   38  08JUL88     1   136876.0
Scottolana canadensis            C   1    4  08JUL88     1    14408.0
Streblospio benedicti            C   1   11  08JUL88     1    39622.0
Unidentified (Miscellaneous)     C   1   65  08JUL88     1   234130.0
Mediomastus californiensis       C   1    6  08JUL88   1-3    21612.0
Nematoda                         C   1  398  08JUL88   1-3  1433596.0
Ostracoda                        C   1    2  08JUL88   1-3     7204.0
Schizopera sp.                   C   1    2  08JUL88   1-3     7204.0
Scottolana canadensis            C   1    1  08JUL88   1-3     3602.0
Streblospio benedicti            C   1    1  08JUL88   1-3     3602.0
Unidentified (Miscellaneous)     C   1    4  08JUL88   1-3    14408.0
Bivalvia                         C   2   10  08JUL88     1    36020.0
Copepod nauplii                  C   2    6  08JUL88     1    21612.0
Cyclaspis varians                C   2    1  08JUL88     1     3602.0
Diopatra cuprea                  C   2    1  08JUL88     1     3602.0
Enhydrosoma spp.                 C   2   13  08JUL88     1    46826.0
Gastropoda                       C   2    2  08JUL88     1     7204.0
Halacaridae (Hydracarina)        C   2    4  08JUL88     1    14408.0
Halicyclops sp.                  C   2    9  08JUL88     1    32418.0
Harpacticoida                    C   2    4  08JUL88     1    14408.0
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Kinoryncha                     C   2    25  08JUL88      1     90050.0
Mediomastus californiensis     C   2    23  08JUL88      1     82846.0
Monoculoides sp.               C   2     1  08JUL88      1      3602.0
Mulinia lateralis              C   2     2  08JUL88      1      7204.0
Nematoda                       C   2   133  08JUL88      1    479066.0
Ostracoda                      C   2    18  08JUL88      1     64836.0
Schizopera sp.                 C   2    29  08JUL88      1    104458.0
Scottolana canadensis          C   2     5  08JUL88      1     18010.0
Streblospio benedicti          C   2     7  08JUL88      1     25214.0
Unidentified (Miscellaneous)   C   2    47  08JUL88      1    169294.0
Copepod nauplii                C   2     1  08JUL88    1-3      3602.0
Enhydrosoma spp.               C   2     3  08JUL88    1-3     10806.0
Halicyclops sp.                C   2     1  08JUL88    1-3      3602.0
Kinoryncha                     C   2     1  08JUL88    1-3      3602.0
Mediomastus californiensis     C   2    13  08JUL88    1-3     46826.0
Nematoda                       C   2   507  08JUL88    1-3   1826214.0
Ostracoda                      C   2     2  08JUL88    1-3      7204.0
Schizopera sp.                 C   2     6  08JUL88    1-3     21612.0
Streblospio benedicti          C   2     5  08JUL88    1-3     18010.0
Unidentified (Miscellaneous)   C   2     6  08JUL88    1-3     21612.0
Bivalvia                       C   3     6  08JUL88      1     21612.0
Copepod nauplii                C   3    11  08JUL88      1     39622.0
Dioasaccidae nauplii           C   3     2  08JUL88      1      7204.0
Ectinosomidae                  C   3     1  08JUL88      1      3602.0
Enhydrosoma spp.               C   3     4  08JUL88      1     14408.0
Gastropoda                     C   3     1  08JUL88      1      3602.0
Halacaridae (Hydracarina)      C   3     4  08JUL88      1     14408.0
Halicyclops sp.                C   3     4  08JUL88      1     14408.0
Harpacticoida                  C   3     6  08JUL88      1     21612.0
Kinoryncha                     C   3    21  08JUL88      1     75642.0
Mediomastus californiensis     C   3     6  08JUL88      1     21612.0
Mulinia lateralis              C   3     3  08JUL88      1     10806.0
Nematoda                       C   3    47  08JUL88      1    169294.0
Ostracoda                      C   3    23  08JUL88      1     82846.0
Schizopera sp.                 C   3    15  08JUL88      1     54030.0
Scottolana canadensis          C   3     3  08JUL88      1     10806.0
Streblospio benedicti          C   3     2  08JUL88      1      7204.0
Unidentified (Miscellaneous)   C   3    42  08JUL88      1    151284.0
Copepod nauplii                C   3     1  08JUL88    1-3      3602.0
Enhydrosoma spp.               C   3     2  08JUL88    1-3      7204.0
Kinoryncha                     C   3     4  08JUL88    1-3     14408.0
Mediomastus californiensis     C   3    14  08JUL88    1-3     50428.0
Nematoda                       C   3   479  08JUL88    1-3   1725358.0
Ostracoda                      C   3     1  08JUL88    1-3      3602.0
Schizopera sp.                 C   3     2  08JUL88    1-3      7204.0
Streblospio benedicti          C   3     2  08JUL88    1-3      7204.0
Unidentified (Miscellaneous)   C   3     1  08JUL88    1-3      3602.0
Bivalvia                       D   1     8  08JUL88      1     28816.0
Copepod nauplii                D   1    31  08JUL88      1    111662.0
Dioasaccidae nauplii           D   1     4  08JUL88      1     14408.0
Ectinosomidae                  D   1     8  08JUL88      1     28816.0
Enhydrosoma spp.               D   1    17  08JUL88      1     61234.0
Halacaridae (Hydracarina)      D   1     9  08JUL88      1     32418.0
Harpacticoida                  D   1    10  08JUL88      1     36020.0
Kinoryncha                     D   1    31  08JUL88      1    111662.0
Laophonte spp.                 D   1    12  08JUL88      1     43224.0
Mediomastus californiensis     D   1     8  08JUL88      1     28816.0
Nematoda                       D   1   192  08JUL88      1    691584.0
Ostracoda                      D   1    37  08JUL88      1    133274.0
Polychaete larvae              D   1     1  08JUL88      1      3602.0
Pseudodiaptomus coronatus      D   1     2  08JUL88      1      7204.0
Schizopera sp.                 D   1     6  08JUL88      1     21612.0
Scottolana canadensis          D   1     2  08JUL88      1      7204.0
Streblospio benedicti          D   1     2  08JUL88      1      7204.0
Unidentified (Miscellaneous)   D   1    57  08JUL88      1    205314.0
Zausodes arenicolus            D   1     1  08JUL88      1      3602.0
Enhydrosoma spp.               D   1     1  08JUL88    1-3      3602.0
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Glycinde solitaria                   D     1      1  08JUL88  1-3       3602.0
Haploscoloplos foliosus              D     1      1  08JUL88  1-3       3602.0
Kinoryncha                           D     1      1  08JUL88  1-3       3602.0
Longipedia americana                 D     1      1  08JUL88  1-3       3602.0
Mediomastus californiensis           D     1      2  08JUL88  1-3       7204.0
Nematoda                             D     1    309  08JUL88  1-3    1113018.0
Schizopera sp.                       D     1      1  08JUL88  1-3       3602.0
Unidentified (Miscellaneous)         D     1      5  08JUL88  1-3      18010.0
Bivalvia                             D     2      1  08JUL88    1       3602.0
Copepod nauplii                      D     2     13  08JUL88    1      46826.0
Dioasaccidae nauplii                 D     2      8  08JUL88    1      28816.0
Ectinosomidae                        D     2     10  08JUL88    1      36020.0
Enhydrosoma spp.                     D     2     19  08JUL88    1      68438.0
Halacaridae (Hydracarina)            D     2     11  08JUL88    1      39622.0
Halicyclops sp.                      D     2      1  08JUL88    1       3602.0
Harpacticoida                        D     2     11  08JUL88    1      39622.0
Kinoryncha                           D     2     33  08JUL88    1     118866.0
Laophonte spp.                       D     2     19  08JUL88    1      68438.0
Mediomastus californiensis           D     2      3  08JUL88    1      10806.0
Nematoda                             D     2    172  08JUL88    1     619544.0
Ostracoda                            D     2     34  08JUL88    1     122468.0
Schizopera sp.                       D     2      1  08JUL88    1       3602.0
Scottolana canadensis                D     2      7  08JUL88    1      25214.0
Streblospio benedicti                D     2      1  08JUL88    1       3602.0
Unidentified (Miscellaneous)         D     2     34  08JUL88    1     122468.0
Zausodes arenicolus                  D     2      3  08JUL88    1      10806.0
Halacaridae (Hydracarina)            D     2      1  08JUL88  1-3       3602.0
Mediomastus californiensis           D     2      2  08JUL88  1-3       7204.0
Nematoda                             D     2    244  08JUL88  1-3     878888.0
Schizopera sp.                       D     2      3  08JUL88  1-3      10806.0
Unidentified (Miscellaneous)         D     2      5  08JUL88  1-3      18010.0
Bivalvia                             D     3      5  08JUL88    1      18010.0
Copepod nauplii                      D     3     34  08JUL88    1     122468.0
Dioasaccidae nauplii                 D     3      7  08JUL88    1      25214.0
Ectinosomidae                        D     3      1  08JUL88    1       3602.0
Enhydrosoma spp.                     D     3     13  08JUL88    1      46826.0
Glycinde solitaria                   D     3      1  08JUL88    1       3602.0
Halacaridae (Hydracarina)            D     3      5  08JUL88    1      18010.0
Harpacticoida                        D     3     10  08JUL88    1      36020.0
Kinoryncha                           D     3     70  08JUL88    1     252140.0
Laophonte spp.                       D     3      3  08JUL88    1      10806.0
Mediomastus californiensis           D     3      6  08JUL88    1      21612.0
Nematoda                             D     3    308  08JUL88    1    1109416.0
Ostracoda                            D     3     23  08JUL88    1      82846.0
Polychaete larvae                    D     3      1  08JUL88    1       3602.0
Schizopera sp.                       D     3      2  08JUL88    1       7204.0
Scottolana canadensis                D     3      7  08JUL88    1      25214.0
Streblospio benedicti                D     3      2  08JUL88    1       7204.0
Turbellaria                          D     3      1  08JUL88    1       3602.0
Unidentified (Miscellaneous)         D     3     56  08JUL88    1     201712.0
Copepod nauplii                      D     3      1  08JUL88  1-3       3602.0
Halacaridae (Hydracarina)            D     3      1  08JUL88  1-3       3602.0
Kinoryncha                           D     3      3  08JUL88  1-3      10806.0
Mediomastus californiensis           D     3      7  08JUL88  1-3      25214.0
Nematoda                             D     3    486  08JUL88  1-3    1750572.0
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NCMEIOSP.DAT
Nueces Estuary Meiofauna species data.
3 replicates (REP) were taken each time, N=n/section (SEC)
nm2=n/m^2. Sections in cm. SEC: 1=0-1 cm and 3=1-3 cm.

SPNAME	DATE	STA	REP	SEC	N	NM2
Bivalvia	19OCT87	C	1	1	8	28816
Copepod nauplii	19OCT87	C	1	1	37	133274
Cossura delta	19OCT87	C	1	1	1	3602
Dioasaccidae nauplii	19OCT87	C	1	1	33	118866
Enhydrosoma spp.	19OCT87	C	1	1	23	82846
Halicyclops sp.	19OCT87	C	1	1	1	3602
Harpacticoida	19OCT87	C	1	1	29	104458
Kinoryncha	19OCT87	C	1	1	47	169294
Leucon sp.	19OCT87	C	1	1	1	3602
Mediomastus californiensis	19OCT87	C	1	1	17	61234
Microarthridion sp.	19OCT87	C	1	1	9	32418
Nematoda	19OCT87	C	1	1	71	255742
Ostracoda	19OCT87	C	1	1	2	7204
Stenhelia sp.	19OCT87	C	1	1	28	100856
Streblospio benedicti	19OCT87	C	1	1	3	10806
Unidentified (Miscellaneous)	19OCT87	C	1	1	34	122468
Copepod nauplii	19OCT87	C	1	3	2	7204
Dioasaccidae nauplii	19OCT87	C	1	3	1	3602
Glycinde solitaria	19OCT87	C	1	3	1	3602
Harpacticoida	19OCT87	C	1	3	1	3602
Kinoryncha	19OCT87	C	1	3	2	7204
Mediomastus californiensis	19OCT87	C	1	3	2	7204
Microarthridion sp.	19OCT87	C	1	3	1	3602
Nematoda	19OCT87	C	1	3	24	86448
Stenhelia sp.	19OCT87	C	1	3	1	3602
Bivalvia	19OCT87	C	2	1	6	21612
Copepod nauplii	19OCT87	C	2	1	40	144080
Dioasaccidae nauplii	19OCT87	C	2	1	26	93652
Enhydrosoma spp.	19OCT87	C	2	1	11	39622
Halicyclops sp.	19OCT87	C	2	1	3	10806
Harpacticoida	19OCT87	C	2	1	9	32418
Kinoryncha	19OCT87	C	2	1	7	25214
Longipedia americana	19OCT87	C	2	1	1	3602
Mediomastus californiensis	19OCT87	C	2	1	5	18010
Microarthridion sp.	19OCT87	C	2	1	5	18010
Nassarius acutus	19OCT87	C	2	1	1	3602
Nematoda	19OCT87	C	2	1	24	86448
Ophiuroidea	19OCT87	C	2	1	1	3602
Ostracoda	19OCT87	C	2	1	8	28816
Parametopella sp.	19OCT87	C	2	1	1	3602
Stenhelia sp.	19OCT87	C	2	1	17	61234
Streblospio benedicti	19OCT87	C	2	1	1	3602
Unidentified (Miscellaneous)	19OCT87	C	2	1	21	75642
Kinoryncha	19OCT87	C	2	3	1	3602
Nematoda	19OCT87	C	2	3	52	187304
Streblospio benedicti	19OCT87	C	2	3	2	7204
Tharyx setigera	19OCT87	C	2	3	1	3602
Bivalvia	19OCT87	C	3	1	8	28816
Copepod nauplii	19OCT87	C	3	1	46	165692
Cossura delta	19OCT87	C	3	1	1	3602
Dioasaccidae nauplii	19OCT87	C	3	1	53	190906
Enhydrosoma spp.	19OCT87	C	3	1	19	68438
Halicyclops sp.	19OCT87	C	3	1	6	21612
Harpacticoida	19OCT87	C	3	1	26	93652
Kinoryncha	19OCT87	C	3	1	13	46826
Leucon sp.	19OCT87	C	3	1	1	3602
Longipedia americana	19OCT87	C	3	1	2	7204
Mediomastus californiensis	19OCT87	C	3	1	8	28816

Microarthridion sp.	19OCT87	C	3	1	10	36020
Nematoda	19OCT87	C	3	1	53	190906
Ophiuroidea	19OCT87	C	3	1	1	3602
Ostracoda	19OCT87	C	3	1	4	14408
Stenhelia sp.	19OCT87	C	3	1	33	118866
Unidentified (Miscellaneous)	19OCT87	C	3	1	16	57632
Enhydrosoma spp.	19OCT87	C	3	3	1	3602
Harpacticoida	19OCT87	C	3	3	6	21612
Mediomastus californiensis	19OCT87	C	3	3	3	10806
Nematoda	19OCT87	C	3	3	77	277354
Stenhelia sp.	19OCT87	C	3	3	2	7204
Bivalvia	20OCT87	A	1	1	22	79244
Copepod nauplii	20OCT87	A	1	1	25	90050
Enhydrosoma spp.	20OCT87	A	1	1	1	3602
Halicyclops sp.	20OCT87	A	1	1	5	18010
Harpacticoida	20OCT87	A	1	1	16	57632
Mediomastus californiensis	20OCT87	A	1	1	6	21612
Nematoda	20OCT87	A	1	1	20	72040
Ostracoda	20OCT87	A	1	1	30	108060
Polychaete larvae	20OCT87	A	1	1	1	3602
Scottolana canadensis	20OCT87	A	1	1	8	28816
Streblospio benedicti	20OCT87	A	1	1	4	14408
Unidentified (Miscellaneous)	20OCT87	A	1	1	22	79244
Bivalvia	20OCT87	A	1	3	2	7204
Enhydrosoma spp.	20OCT87	A	1	3	1	3602
Halicyclops sp.	20OCT87	A	1	3	1	3602
Harpacticoida	20OCT87	A	1	3	2	7204
Mediomastus californiensis	20OCT87	A	1	3	6	21612
Nematoda	20OCT87	A	1	3	60	216120
Scottolana canadensis	20OCT87	A	1	3	2	7204
Streblospio benedicti	20OCT87	A	1	3	2	7204
Unidentified (Miscellaneous)	20OCT87	A	1	3	6	21612
Bivalvia	20OCT87	A	2	1	25	90050
Copepod nauplii	20OCT87	A	2	1	18	64836
Enhydrosoma spp.	20OCT87	A	2	1	10	36020
Halicyclops sp.	20OCT87	A	2	1	8	28816
Harpacticoida	20OCT87	A	2	1	18	64836
Laophonte spp.	20OCT87	A	2	1	1	3602
Mediomastus californiensis	20OCT87	A	2	1	4	14408
Nematoda	20OCT87	A	2	1	31	111662
Ostracoda	20OCT87	A	2	1	29	104458
Scottolana canadensis	20OCT87	A	2	1	2	7204
Streblospio benedicti	20OCT87	A	2	1	5	18010
Unidentified (Miscellaneous)	20OCT87	A	2	1	12	43224
Bivalvia	20OCT87	A	2	3	6	21612
Copepod nauplii	20OCT87	A	2	3	1	3602
Dioasaccidae nauplii	20OCT87	A	2	3	2	7204
Enhydrosoma spp.	20OCT87	A	2	3	6	21612
Laophonte spp.	20OCT87	A	2	3	2	7204
Mediomastus californiensis	20OCT87	A	2	3	19	68438
Nematoda	20OCT87	A	2	3	40	144080
Ostracoda	20OCT87	A	2	3	4	14408
Streblospio benedicti	20OCT87	A	2	3	2	7204
Unidentified (Miscellaneous)	20OCT87	A	2	3	10	36020
Bivalvia	20OCT87	A	3	1	30	108060
Copepod nauplii	20OCT87	A	3	1	38	136876
Enhydrosoma spp.	20OCT87	A	3	1	4	14408
Gastropoda	20OCT87	A	3	1	1	3602
Halicyclops sp.	20OCT87	A	3	1	10	36020
Harpacticoida	20OCT87	A	3	1	77	277354
Laophonte spp.	20OCT87	A	3	1	10	36020
Mediomastus californiensis	20OCT87	A	3	1	18	64836
Nematoda	20OCT87	A	3	1	17	61234
Ostracoda	20OCT87	A	3	1	60	216120
Scottolana canadensis	20OCT87	A	3	1	3	10806
Streblospio benedicti	20OCT87	A	3	1	5	18010
Unidentified (Miscellaneous)	20OCT87	A	3	1	17	61234

Bivalvia	20OCT87	A	3	3	3	10806
Mediomastus californiensis	20OCT87	A	3	3	10	36020
Nematoda	20OCT87	A	3	3	101	363802
Ostracoda	20OCT87	A	3	3	2	7204
Streblospio benedicti	20OCT87	A	3	3	1	3602
Unidentified (Miscellaneous)	20OCT87	A	3	3	8	28816
Bivalvia	21OCT87	B	1	1	7	25214
Capitellides jonesi	21OCT87	B	1	1	1	3602
Copepod nauplii	21OCT87	B	1	1	18	64836
Cossura delta	21OCT87	B	1	1	1	3602
Dioasaccidae nauplii	21OCT87	B	1	1	2	7204
Enhydrosoma spp.	21OCT87	B	1	1	12	43224
Harpacticoida	21OCT87	B	1	1	47	169294
Mediomastus californiensis	21OCT87	B	1	1	2	7204
Nematoda	21OCT87	B	1	1	71	255742
Ostracoda	21OCT87	B	1	1	1	3602
Unidentified (Miscellaneous)	21OCT87	B	1	1	51	183702
Bivalvia	21OCT87	B	1	3	1	3602
Copepod nauplii	21OCT87	B	1	3	2	7204
Enhydrosoma spp.	21OCT87	B	1	3	1	3602
Glycinde solitaria	21OCT87	B	1	3	1	3602
Harpacticoida	21OCT87	B	1	3	4	14408
Mediomastus californiensis	21OCT87	B	1	3	1	3602
Nematoda	21OCT87	B	1	3	34	122468
Ostracoda	21OCT87	B	1	3	1	3602
Streblospio benedicti	21OCT87	B	1	3	1	3602
Unidentified (Miscellaneous)	21OCT87	B	1	3	12	43224
Bivalvia	21OCT87	B	2	1	3	10806
Copepod nauplii	21OCT87	B	2	1	31	111662
Dioasaccidae nauplii	21OCT87	B	2	1	2	7204
Enhydrosoma spp.	21OCT87	B	2	1	11	39622
Halicyclops sp.	21OCT87	B	2	1	2	7204
Harpacticoida	21OCT87	B	2	1	53	190906
Laophonte spp.	21OCT87	B	2	1	5	18010
Mediomastus californiensis	21OCT87	B	2	1	9	32418
Nematoda	21OCT87	B	2	1	34	122468
Ostracoda	21OCT87	B	2	1	2	7204
Scottolana canadensis	21OCT87	B	2	1	5	18010
Unidentified (Miscellaneous)	21OCT87	B	2	1	47	169294
Mediomastus californiensis	21OCT87	B	2	3	3	10806
Nematoda	21OCT87	B	2	3	51	183702
Unidentified (Miscellaneous)	21OCT87	B	2	3	16	57632
Bivalvia	21OCT87	B	3	1	3	10806
Copepod nauplii	21OCT87	B	3	1	15	54030
Cossura delta	21OCT87	B	3	1	1	3602
Dioasaccidae nauplii	21OCT87	B	3	1	1	3602
Enhydrosoma spp.	21OCT87	B	3	1	11	39622
Glycinde solitaria	21OCT87	B	3	1	1	3602
Halicyclops sp.	21OCT87	B	3	1	2	7204
Harpacticoida	21OCT87	B	3	1	49	176498
Laophonte spp.	21OCT87	B	3	1	2	7204
Mediomastus californiensis	21OCT87	B	3	1	10	36020
Nematoda	21OCT87	B	3	1	48	172896
Ostracoda	21OCT87	B	3	1	1	3602
Scottolana canadensis	21OCT87	B	3	1	1	3602
Streblospio benedicti	21OCT87	B	3	1	2	7204
Unidentified (Miscellaneous)	21OCT87	B	3	1	21	75642
Enhydrosoma spp.	21OCT87	B	3	3	2	7204
Harpacticoida	21OCT87	B	3	3	2	7204
Laophonte spp.	21OCT87	B	3	3	1	3602
Nematoda	21OCT87	B	3	3	19	68438
Unidentified (Miscellaneous)	21OCT87	B	3	3	16	57632
Bivalvia	22OCT87	D	1	1	1	3602
Copepod nauplii	22OCT87	D	1	1	11	39622
Enhydrosoma spp.	22OCT87	D	1	1	2	7204
Halicyclops sp.	22OCT87	D	1	1	1	3602
Harpacticoida	22OCT87	D	1	1	3	10806

Mediomastus californiensis	22OCT87	D	1	1	4	14408
Nematoda	22OCT87	D	1	1	428	1541656
Ostracoda	22OCT87	D	1	1	13	46826
Polychaete larvae	22OCT87	D	1	1	1	3602
Streblospio benedicti	22OCT87	D	1	1	1	3602
Unidentified (Miscellaneous)	22OCT87	D	1	1	61	219722
Enhydrosoma spp.	22OCT87	D	1	3	1	3602
Nematoda	22OCT87	D	1	3	836	3011272
Unidentified (Miscellaneous)	22OCT87	D	1	3	22	79244
Copepod nauplii	22OCT87	D	2	1	5	18010
Cossura delta	22OCT87	D	2	1	2	7204
Enhydrosoma spp.	22OCT87	D	2	1	5	18010
Halicyclops sp.	22OCT87	D	2	1	5	18010
Harpacticoida	22OCT87	D	2	1	3	10806
Laophonte spp.	22OCT87	D	2	1	1	3602
Mediomastus californiensis	22OCT87	D	2	1	4	14408
Mysidopsis sp.	22OCT87	D	2	1	1	3602
Nematoda	22OCT87	D	2	1	392	1411984
Ostracoda	22OCT87	D	2	1	10	36020
Photis sp.	22OCT87	D	2	1	1	3602
Polychaete larvae	22OCT87	D	2	1	1	3602
Streblospio benedicti	22OCT87	D	2	1	4	14408
Terebellidae	22OCT87	D	2	1	1	3602
Unidentified (Miscellaneous)	22OCT87	D	2	1	64	230528
Mediomastus californiensis	22OCT87	D	2	3	2	7204
Nematoda	22OCT87	D	2	3	468	1685736
Ostracoda	22OCT87	D	2	3	1	3602
Unidentified (Miscellaneous)	22OCT87	D	2	3	33	118866
Bivalvia	22OCT87	D	3	1	4	14408
Copepod nauplii	22OCT87	D	3	1	17	61234
Cossura delta	22OCT87	D	3	1	1	3602
Enhydrosoma spp.	22OCT87	D	3	1	2	7204
Halicyclops sp.	22OCT87	D	3	1	4	14408
Harpacticoida	22OCT87	D	3	1	4	14408
Mediomastus californiensis	22OCT87	D	3	1	5	18010
Nematoda	22OCT87	D	3	1	304	1095008
Ostracoda	22OCT87	D	3	1	27	97254
Polychaete larvae	22OCT87	D	3	1	1	3602
Streblospio benedicti	22OCT87	D	3	1	8	28816
Tardigrade	22OCT87	D	3	1	1	3602
Terebellidae	22OCT87	D	3	1	1	3602
Unidentified (Miscellaneous)	22OCT87	D	3	1	109	392618
Asychis sp.	22OCT87	D	3	3	1	3602
Bivalvia	22OCT87	D	3	3	1	3602
Enhydrosoma spp.	22OCT87	D	3	3	1	3602
Mediomastus californiensis	22OCT87	D	3	3	1	3602
Nematoda	22OCT87	D	3	3	1611	5802822
Streblospio benedicti	22OCT87	D	3	3	1	3602
Unidentified (Miscellaneous)	22OCT87	D	3	3	23	82846
Bivalvia	07DEC87	C	1	1	18	64836
Clymenella mucosa	07DEC87	C	1	1	1	3602
Copepod nauplii	07DEC87	C	1	1	84	302568
Cyclopoida	07DEC87	C	1	1	1	3602
Dioasaccidae nauplii	07DEC87	C	1	1	45	162090
Enhydrosoma spp.	07DEC87	C	1	1	23	82846
Harpacticoida	07DEC87	C	1	1	50	180100
Kinoryncha	07DEC87	C	1	1	29	104458
Longipedia americana	07DEC87	C	1	1	1	3602
Mediomastus californiensis	07DEC87	C	1	1	8	28816
Microarthridion sp.	07DEC87	C	1	1	29	104458
Nematoda	07DEC87	C	1	1	109	392618
Ostracoda	07DEC87	C	1	1	10	36020
Stenhelia sp.	07DEC87	C	1	1	35	126070
Streblospio benedicti	07DEC87	C	1	1	1	3602
Unidentified (Miscellaneous)	07DEC87	C	1	1	22	79244
Zausodes arenicolus	07DEC87	C	1	1	1	3602
Bivalvia	07DEC87	C	1	3	1	3602

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Dioasaccidae nauplii          07DEC87    C    1    3      1     3602
Enhydrosoma spp.              07DEC87    C    1    3      3    10806
Kinoryncha                    07DEC87    C    1    3      2     7204
Maldanidae                    07DEC87    C    1    3      1     3602
Mediomastus californiensis    07DEC87    C    1    3      3    10806
Nematoda                      07DEC87    C    1    3    163   587126
Oligochaeta                   07DEC87    C    1    3      2     7204
Streblospio benedicti         07DEC87    C    1    3      1     3602
Unidentified (Miscellaneous)  07DEC87    C    1    3      2     7204
Bivalvia                      07DEC87    C    2    1     10    36020
Copepod nauplii               07DEC87    C    2    1     44   158488
Dioasaccidae nauplii          07DEC87    C    2    1     22    79244
Enhydrosoma spp.              07DEC87    C    2    1     17    61234
Harpacticoida                 07DEC87    C    2    1     11    39622
Kinoryncha                    07DEC87    C    2    1     10    36020
Longipedia americana          07DEC87    C    2    1      2     7204
Mediomastus californiensis    07DEC87    C    2    1      3    10806
Microarthridion sp.           07DEC87    C    2    1     33   118866
Nematoda                      07DEC87    C    2    1     77   277354
Ostracoda                     07DEC87    C    2    1     21    75642
Stenhelia sp.                 07DEC87    C    2    1     22    79244
Streblospio benedicti         07DEC87    C    2    1      3    10806
Unidentified (Miscellaneous)  07DEC87    C    2    1     17    61234
Bivalvia                      07DEC87    C    2    3      1     3602
Copepod nauplii               07DEC87    C    2    3      1     3602
Dioasaccidae nauplii          07DEC87    C    2    3      3    10806
Enhydrosoma spp.              07DEC87    C    2    3      2     7204
Harpacticoida                 07DEC87    C    2    3      2     7204
Nematoda                      07DEC87    C    2    3    167   601534
Phascolion strombi            07DEC87    C    2    3      1     3602
Stenhelia sp.                 07DEC87    C    2    3      2     7204
Streblospio benedicti         07DEC87    C    2    3      1     3602
Unidentified (Miscellaneous)  07DEC87    C    2    3      3    10806
Bivalvia                      07DEC87    C    3    1     13    46826
Copepod nauplii               07DEC87    C    3    1     89   320578
Dioasaccidae nauplii          07DEC87    C    3    1     67   241334
Diopatra cuprea               07DEC87    C    3    1      1     3602
Enhydrosoma spp.              07DEC87    C    3    1     10    36020
Halicyclops sp.               07DEC87    C    3    1      1     3602
Harpacticoida                 07DEC87    C    3    1     21    75642
Kinoryncha                    07DEC87    C    3    1     42   151284
Longipedia americana          07DEC87    C    3    1      1     3602
Mediomastus californiensis    07DEC87    C    3    1      4    14408
Microarthridion sp.           07DEC87    C    3    1     53   190906
Nematoda                      07DEC87    C    3    1     60   216120
Ostracoda                     07DEC87    C    3    1     23    82846
Stenhelia sp.                 07DEC87    C    3    1     37   133274
Streblospio benedicti         07DEC87    C    3    1      1     3602
Unidentified (Miscellaneous)  07DEC87    C    3    1     28   100856
Bivalvia                      07DEC87    C    3    3      2     7204
Cossura delta                 07DEC87    C    3    3      1     3602
Enhydrosoma spp.              07DEC87    C    3    3      6    21612
Harpacticoida                 07DEC87    C    3    3      4    14408
Kinoryncha                    07DEC87    C    3    3      4    14408
Mediomastus californiensis    07DEC87    C    3    3      3    10806
Nematoda                      07DEC87    C    3    3    145   522290
Stenhelia sp.                 07DEC87    C    3    3      3    10806
Streblospio benedicti         07DEC87    C    3    3      1     3602
Unidentified (Miscellaneous)  07DEC87    C    3    3      8    28816
Bivalvia                      08DEC87    A    1    1      4    14408
Enhydrosoma spp.              08DEC87    A    1    1      3    10806
Halicyclops sp.               08DEC87    A    1    1      4    14408
Harpacticoida                 08DEC87    A    1    1     11    39622
Nematoda                      08DEC87    A    1    1     55   198110
Ostracoda                     08DEC87    A    1    1      7    25214
Rhynchocoels                  08DEC87    A    1    1      1     3602
Scottolana canadensis         08DEC87    A    1    1      1     3602
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Unidentified (Miscellaneous)	08DEC87	A	1	1	88	316976
Copepod nauplii	08DEC87	A	1	3	1	3602
Nematoda	08DEC87	A	1	3	87	313374
Stenhelia sp.	08DEC87	A	1	3	1	3602
Unidentified (Miscellaneous)	08DEC87	A	1	3	26	93652
Bivalvia	08DEC87	A	2	1	3	10806
Copepod nauplii	08DEC87	A	2	1	1	3602
Enhydrosoma spp.	08DEC87	A	2	1	4	14408
Halicyclops sp.	08DEC87	A	2	1	2	7204
Harpacticoida	08DEC87	A	2	1	31	111662
Nematoda	08DEC87	A	2	1	65	234130
Ostracoda	08DEC87	A	2	1	14	50428
Scottolana canadensis	08DEC87	A	2	1	5	18010
Stenhelia sp.	08DEC87	A	2	1	1	3602
Streblospio benedicti	08DEC87	A	2	1	1	3602
Unidentified (Miscellaneous)	08DEC87	A	2	1	194	698788
Nematoda	08DEC87	A	2	3	49	176498
Stenhelia sp.	08DEC87	A	2	3	4	14408
Unidentified (Miscellaneous)	08DEC87	A	2	3	39	140478
Bivalvia	08DEC87	A	3	1	3	10806
Copepod nauplii	08DEC87	A	3	1	4	14408
Enhydrosoma spp.	08DEC87	A	3	1	2	7204
Halicyclops sp.	08DEC87	A	3	1	2	7204
Harpacticoida	08DEC87	A	3	1	58	208916
Mediomastus californiensis	08DEC87	A	3	1	1	3602
Nematoda	08DEC87	A	3	1	96	345792
Ostracoda	08DEC87	A	3	1	9	32418
Scottolana canadensis	08DEC87	A	3	1	1	3602
Streblospio benedicti	08DEC87	A	3	1	1	3602
Unidentified (Miscellaneous)	08DEC87	A	3	1	355	1278710
Bivalvia	08DEC87	A	3	3	2	7204
Harpacticoida	08DEC87	A	3	3	4	14408
Mediomastus californiensis	08DEC87	A	3	3	1	3602
Nematoda	08DEC87	A	3	3	96	345792
Scottolana canadensis	08DEC87	A	3	3	3	10806
Stenhelia sp.	08DEC87	A	3	3	1	3602
Streblospio benedicti	08DEC87	A	3	3	1	3602
Unidentified (Miscellaneous)	08DEC87	A	3	3	18	64836
Bivalvia	09DEC87	B	1	1	3	10806
Copepod nauplii	09DEC87	B	1	1	41	147682
Cossura delta	09DEC87	B	1	1	1	3602
Dioasaccidae nauplii	09DEC87	B	1	1	13	46826
Enhydrosoma spp.	09DEC87	B	1	1	27	97254
Halicyclops sp.	09DEC87	B	1	1	7	25214
Harpacticoida	09DEC87	B	1	1	150	540300
Kinoryncha	09DEC87	B	1	1	1	3602
Laophonte spp.	09DEC87	B	1	1	6	21612
Mediomastus californiensis	09DEC87	B	1	1	5	18010
Nematoda	09DEC87	B	1	1	189	680778
Ostracoda	09DEC87	B	1	1	29	104458
Scottolana canadensis	09DEC87	B	1	1	1	3602
Stenhelia sp.	09DEC87	B	1	1	1	3602
Streblospio benedicti	09DEC87	B	1	1	4	14408
Unidentified (Miscellaneous)	09DEC87	B	1	1	56	201712
Zausodes arenicolus	09DEC87	B	1	1	1	3602
Enhydrosoma spp.	09DEC87	B	1	3	1	3602
Harpacticoida	09DEC87	B	1	3	3	10806
Mediomastus californiensis	09DEC87	B	1	3	2	7204
Nematoda	09DEC87	B	1	3	19	68438
Scottolana canadensis	09DEC87	B	1	3	1	3602
Unidentified (Miscellaneous)	09DEC87	B	1	3	31	111662
Copepod nauplii	09DEC87	B	2	1	3	10806
Cossura delta	09DEC87	B	2	1	1	3602
Dioasaccidae nauplii	09DEC87	B	2	1	2	7204
Enhydrosoma spp.	09DEC87	B	2	1	6	21612
Halicyclops sp.	09DEC87	B	2	1	3	10806
Harpacticoida	09DEC87	B	2	1	111	399822

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Laophonte spp.                  09DEC87    B     2     1       3      10806
Microarthridion sp.             09DEC87    B     2     1       2       7204
Nematoda                        09DEC87    B     2     1      99     356598
Ostracoda                       09DEC87    B     2     1       4      14408
Scottolana canadensis           09DEC87    B     2     1       1       3602
Streblospio benedicti           09DEC87    B     2     1       2       7204
Unidentified (Miscellaneous)    09DEC87    B     2     1      29     104458
Cossura delta                   09DEC87    B     2     3       2       7204
Harpacticoida                   09DEC87    B     2     3       3      10806
Mediomastus californiensis      09DEC87    B     2     3       1       3602
Nematoda                        09DEC87    B     2     3      17      61234
Scottolana canadensis           09DEC87    B     2     3       1       3602
Unidentified (Miscellaneous)    09DEC87    B     2     3      13      46826
Zausodes arenicolus             09DEC87    B     2     3       1       3602
Bivalvia                        09DEC87    B     3     1       2       7204
Copepod nauplii                 09DEC87    B     3     1      53     190906
Dioasaccidae nauplii            09DEC87    B     3     1       1       3602
Enhydrosoma spp.                09DEC87    B     3     1      43     154886
Gastropoda                      09DEC87    B     3     1       1       3602
Harpacticoida                   09DEC87    B     3     1     192     691584
Kinoryncha                      09DEC87    B     3     1       1       3602
Laophonte spp.                  09DEC87    B     3     1       8      28816
Nematoda                        09DEC87    B     3     1     181     651962
Ostracoda                       09DEC87    B     3     1       4      14408
Scottolana canadensis           09DEC87    B     3     1       2       7204
Stenhelia sp.                   09DEC87    B     3     1       2       7204
Streblospio benedicti           09DEC87    B     3     1       3      10806
Unidentified (Miscellaneous)    09DEC87    B     3     1      27      97254
Zausodes arenicolus             09DEC87    B     3     1       1       3602
Copepod nauplii                 09DEC87    B     3     3       1       3602
Enhydrosoma spp.                09DEC87    B     3     3       1       3602
Haploscoloplos foliosus         09DEC87    B     3     3       1       3602
Harpacticoida                   09DEC87    B     3     3       1       3602
Nematoda                        09DEC87    B     3     3      84     302568
Streblospio benedicti           09DEC87    B     3     3       1       3602
Unidentified (Miscellaneous)    09DEC87    B     3     3      20      72040
Bivalvia                        10DEC87    D     1     1       2       7204
Copepod nauplii                 10DEC87    D     1     1       9      32418
Cossura delta                   10DEC87    D     1     1       1       3602
Enhydrosoma spp.                10DEC87    D     1     1       6      21612
Halicyclops sp.                 10DEC87    D     1     1       4      14408
Harpacticoida                   10DEC87    D     1     1       2       7204
Kinoryncha                      10DEC87    D     1     1       2       7204
Mysidopsis sp.                  10DEC87    D     1     1       1       3602
Nematoda                        10DEC87    D     1     1     518    1865836
Ostracoda                       10DEC87    D     1     1       3      10806
Polychaete larvae               10DEC87    D     1     1       2       7204
Rhynchocoels                    10DEC87    D     1     1       1       3602
Unidentified (Miscellaneous)    10DEC87    D     1     1      49     176498
Copepod nauplii                 10DEC87    D     1     3       1       3602
Dorvilleidae                    10DEC87    D     1     3       1       3602
Enhydrosoma spp.                10DEC87    D     1     3       4      14408
Kinoryncha                      10DEC87    D     1     3       1       3602
Mediomastus californiensis      10DEC87    D     1     3       2       7204
Nematoda                        10DEC87    D     1     3    1355    4880710
Polychaete larvae               10DEC87    D     1     3       1       3602
Polydora caulleryi              10DEC87    D     1     3      12      43224
Rhynchocoels                    10DEC87    D     1     3       2       7204
Schistomeringos spa             10DEC87    D     1     3       3      10806
Tharyx setigera                 10DEC87    D     1     3       2       7204
Unidentified (Miscellaneous)    10DEC87    D     1     3      36     129672
Bivalvia                        10DEC87    D     2     1       3      10806
Copepod nauplii                 10DEC87    D     2     1      20      72040
Enhydrosoma spp.                10DEC87    D     2     1      16      57632
Halicyclops sp.                 10DEC87    D     2     1       2       7204
Harpacticoida                   10DEC87    D     2     1       8      28816
Kinoryncha                      10DEC87    D     2     1      10      36020
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Longipedia americana	10DEC87	D	2	1	1	3602
Mediomastus californiensis	10DEC87	D	2	1	1	3602
Nematoda	10DEC87	D	2	1	454	1635308
Ostracoda	10DEC87	D	2	1	3	10806
Unidentified (Miscellaneous)	10DEC87	D	2	1	52	187304
Zausodes arenicolus	10DEC87	D	2	1	3	10806
Bivalvia	10DEC87	D	2	3	1	3602
Enhydrosoma spp.	10DEC87	D	2	3	1	3602
Longipedia americana	10DEC87	D	2	3	1	3602
Mediomastus californiensis	10DEC87	D	2	3	2	7204
Nematoda	10DEC87	D	2	3	577	2078354
Rhynchocoels	10DEC87	D	2	3	1	3602
Tharyx setigera	10DEC87	D	2	3	1	3602
Unidentified (Miscellaneous)	10DEC87	D	2	3	11	39622
Bivalvia	10DEC87	D	3	1	5	18010
Copepod nauplii	10DEC87	D	3	1	23	82846
Drilonereis magna	10DEC87	D	3	1	1	3602
Enhydrosoma spp.	10DEC87	D	3	1	16	57632
Harpacticoida	10DEC87	D	3	1	7	25214
Kinoryncha	10DEC87	D	3	1	3	10806
Longipedia americana	10DEC87	D	3	1	1	3602
Mediomastus californiensis	10DEC87	D	3	1	1	3602
Nematoda	10DEC87	D	3	1	263	947326
Ostracoda	10DEC87	D	3	1	6	21612
Turbonilla sp.	10DEC87	D	3	1	1	3602
Unidentified (Miscellaneous)	10DEC87	D	3	1	38	136876
Bivalvia	10DEC87	D	3	3	1	3602
Enhydrosoma spp.	10DEC87	D	3	3	1	3602
Nematoda	10DEC87	D	3	3	568	2045936
Unidentified (Miscellaneous)	10DEC87	D	3	3	8	28816
Bivalvia	15FEB88	C	1	1	3	10806
Copepod nauplii	15FEB88	C	1	1	78	280956
Dioasaccidae nauplii	15FEB88	C	1	1	10	36020
Enhydrosoma spp.	15FEB88	C	1	1	25	90050
Halicyclops sp.	15FEB88	C	1	1	2	7204
Harpacticoida	15FEB88	C	1	1	37	133274
Kinoryncha	15FEB88	C	1	1	70	252140
Laophonte spp.	15FEB88	C	1	1	1	3602
Mediomastus californiensis	15FEB88	C	1	1	1	3602
Microarthridion sp.	15FEB88	C	1	1	133	479066
Nematoda	15FEB88	C	1	1	119	428638
Ostracoda	15FEB88	C	1	1	9	32418
Stenhelia sp.	15FEB88	C	1	1	10	36020
Unidentified (Miscellaneous)	15FEB88	C	1	1	48	172896
Zausodes arenicolus	15FEB88	C	1	1	1	3602
Copepod nauplii	15FEB88	C	1	3	5	18010
Enhydrosoma spp.	15FEB88	C	1	3	14	50428
Harpacticoida	15FEB88	C	1	3	1	3602
Kinoryncha	15FEB88	C	1	3	10	36020
Mediomastus californiensis	15FEB88	C	1	3	5	18010
Nematoda	15FEB88	C	1	3	211	760022
Streblospio benedicti	15FEB88	C	1	3	1	3602
Unidentified (Miscellaneous)	15FEB88	C	1	3	10	36020
Bivalvia	15FEB88	C	2	1	8	28816
Copepod nauplii	15FEB88	C	2	1	193	695186
Cossura delta	15FEB88	C	2	1	1	3602
Dioasaccidae nauplii	15FEB88	C	2	1	38	136876
Enhydrosoma spp.	15FEB88	C	2	1	27	97254
Harpacticoida	15FEB88	C	2	1	64	230528
Kinoryncha	15FEB88	C	2	1	99	356598
Leucon sp.	15FEB88	C	2	1	1	3602
Mediomastus californiensis	15FEB88	C	2	1	6	21612
Microarthridion sp.	15FEB88	C	2	1	112	403424
Nematoda	15FEB88	C	2	1	136	489872
Ostracoda	15FEB88	C	2	1	8	28816
Stenhelia sp.	15FEB88	C	2	1	16	57632
Unidentified (Miscellaneous)	15FEB88	C	2	1	35	126070

Copepod nauplii	15FEB88	C	2	3	4	14408
Cossura delta	15FEB88	C	2	3	1	3602
Enhydrosoma spp.	15FEB88	C	2	3	3	10806
Harpacticoida	15FEB88	C	2	3	2	7204
Kinoryncha	15FEB88	C	2	3	15	54030
Mediomastus californiensis	15FEB88	C	2	3	6	21612
Nematoda	15FEB88	C	2	3	240	864480
Unidentified (Miscellaneous)	15FEB88	C	2	3	2	7204
Bivalvia	15FEB88	C	3	1	6	21612
Copepod nauplii	15FEB88	C	3	1	74	266548
Dioasaccidae nauplii	15FEB88	C	3	1	16	57632
Enhydrosoma spp.	15FEB88	C	3	1	36	129672
Harpacticoida	15FEB88	C	3	1	38	136876
Kinoryncha	15FEB88	C	3	1	58	208916
Longipedia americana	15FEB88	C	3	1	1	3602
Mediomastus californiensis	15FEB88	C	3	1	3	10806
Microarthridion sp.	15FEB88	C	3	1	86	309772
Nematoda	15FEB88	C	3	1	110	396220
Ostracoda	15FEB88	C	3	1	8	28816
Stenhelia sp.	15FEB88	C	3	1	8	28816
Streblospio benedicti	15FEB88	C	3	1	1	3602
Unidentified (Miscellaneous)	15FEB88	C	3	1	56	201712
Bivalvia	15FEB88	C	3	3	2	7204
Copepod nauplii	15FEB88	C	3	3	3	10806
Dioasaccidae nauplii	15FEB88	C	3	3	1	3602
Enhydrosoma spp.	15FEB88	C	3	3	2	7204
Kinoryncha	15FEB88	C	3	3	1	3602
Maldanidae	15FEB88	C	3	3	1	3602
Nematoda	15FEB88	C	3	3	130	468260
Unidentified (Miscellaneous)	15FEB88	C	3	3	16	57632
Bivalvia	16FEB88	A	1	1	1	3602
Enhydrosoma spp.	16FEB88	A	1	1	2	7204
Harpacticoida	16FEB88	A	1	1	4	14408
Nematoda	16FEB88	A	1	1	11	39622
Ostracoda	16FEB88	A	1	1	1	3602
Scottolana canadensis	16FEB88	A	1	1	1	3602
Unidentified (Miscellaneous)	16FEB88	A	1	1	30	108060
Enhydrosoma spp.	16FEB88	A	1	3	1	3602
Harpacticoida	16FEB88	A	1	3	1	3602
Nematoda	16FEB88	A	1	3	21	75642
Stenhelia sp.	16FEB88	A	1	3	1	3602
Unidentified (Miscellaneous)	16FEB88	A	1	3	31	111662
Enhydrosoma spp.	16FEB88	A	2	1	1	3602
Halicyclops sp.	16FEB88	A	2	1	2	7204
Harpacticoida	16FEB88	A	2	1	12	43224
Laophonte spp.	16FEB88	A	2	1	3	10806
Nematoda	16FEB88	A	2	1	46	165692
Ostracoda	16FEB88	A	2	1	4	14408
Scottolana canadensis	16FEB88	A	2	1	1	3602
Stenhelia sp.	16FEB88	A	2	1	4	14408
Unidentified (Miscellaneous)	16FEB88	A	2	1	51	183702
Nematoda	16FEB88	A	2	3	81	291762
Stenhelia sp.	16FEB88	A	2	3	1	3602
Unidentified (Miscellaneous)	16FEB88	A	2	3	58	208916
Harpacticoida	16FEB88	A	3	1	1	3602
Nematoda	16FEB88	A	3	1	8	28816
Unidentified (Miscellaneous)	16FEB88	A	3	1	9	32418
Nematoda	16FEB88	A	3	3	3	10806
Unidentified (Miscellaneous)	16FEB88	A	3	3	1	3602
Bivalvia	17FEB88	B	1	1	2	7204
Copepod nauplii	17FEB88	B	1	1	87	313374
Enhydrosoma spp.	17FEB88	B	1	1	9	32418
Halicyclops sp.	17FEB88	B	1	1	1	3602
Harpacticoida	17FEB88	B	1	1	79	284558
Laophonte spp.	17FEB88	B	1	1	1	3602
Mediomastus californiensis	17FEB88	B	1	1	4	14408
Microarthridion sp.	17FEB88	B	1	1	15	54030

Nematoda	17FEB88	B	1	1	144	518688
Ostracoda	17FEB88	B	1	1	2	7204
Stenhelia sp.	17FEB88	B	1	1	3	10806
Unidentified (Miscellaneous)	17FEB88	B	1	1	40	144080
Zausodes arenicolus	17FEB88	B	1	1	1	3602
Bivalvia	17FEB88	B	1	3	1	3602
Copepod nauplii	17FEB88	B	1	3	3	10806
Cossura delta	17FEB88	B	1	3	1	3602
Enhydrosoma spp.	17FEB88	B	1	3	1	3602
Haploscoloplos foliosus	17FEB88	B	1	3	1	3602
Harpacticoida	17FEB88	B	1	3	5	18010
Mediomastus californiensis	17FEB88	B	1	3	4	14408
Nematoda	17FEB88	B	1	3	168	605136
Scottolana canadensis	17FEB88	B	1	3	3	10806
Streblospio benedicti	17FEB88	B	1	3	2	7204
Unidentified (Miscellaneous)	17FEB88	B	1	3	32	115264
Bivalvia	17FEB88	B	2	1	4	14408
Copepod nauplii	17FEB88	B	2	1	75	270150
Enhydrosoma spp.	17FEB88	B	2	1	4	14408
Harpacticoida	17FEB88	B	2	1	86	309772
Leucon sp.	17FEB88	B	2	1	1	3602
Microarthridion sp.	17FEB88	B	2	1	8	28816
Nematoda	17FEB88	B	2	1	64	230528
Scottolana canadensis	17FEB88	B	2	1	2	7204
Stenhelia sp.	17FEB88	B	2	1	1	3602
Unidentified (Miscellaneous)	17FEB88	B	2	1	13	46826
Zausodes arenicolus	17FEB88	B	2	1	1	3602
Bivalvia	17FEB88	B	2	3	3	10806
Copepod nauplii	17FEB88	B	2	3	2	7204
Enhydrosoma spp.	17FEB88	B	2	3	2	7204
Harpacticoida	17FEB88	B	2	3	22	79244
Mediomastus californiensis	17FEB88	B	2	3	3	10806
Nematoda	17FEB88	B	2	3	120	432240
Scottolana canadensis	17FEB88	B	2	3	3	10806
Streblospio benedicti	17FEB88	B	2	3	1	3602
Unidentified (Miscellaneous)	17FEB88	B	2	3	45	162090
Bivalvia	17FEB88	B	3	1	1	3602
Copepod nauplii	17FEB88	B	3	1	50	180100
Dioasaccidae nauplii	17FEB88	B	3	1	1	3602
Enhydrosoma spp.	17FEB88	B	3	1	2	7204
Harpacticoida	17FEB88	B	3	1	42	151284
Mediomastus californiensis	17FEB88	B	3	1	1	3602
Microarthridion sp.	17FEB88	B	3	1	11	39622
Nematoda	17FEB88	B	3	1	79	284558
Ostracoda	17FEB88	B	3	1	1	3602
Scottolana canadensis	17FEB88	B	3	1	1	3602
Stenhelia sp.	17FEB88	B	3	1	2	7204
Unidentified (Miscellaneous)	17FEB88	B	3	1	24	86448
Enhydrosoma spp.	17FEB88	B	3	3	1	3602
Harpacticoida	17FEB88	B	3	3	2	7204
Mediomastus californiensis	17FEB88	B	3	3	5	18010
Nematoda	17FEB88	B	3	3	96	345792
Streblospio benedicti	17FEB88	B	3	3	1	3602
Unidentified (Miscellaneous)	17FEB88	B	3	3	49	176498
Bivalvia	18FEB88	D	1	1	1	3602
Copepod nauplii	18FEB88	D	1	1	9	32418
Enhydrosoma spp.	18FEB88	D	1	1	13	46826
Haploscoloplos foliosus	18FEB88	D	1	1	1	3602
Harpacticoida	18FEB88	D	1	1	8	28816
Kinoryncha	18FEB88	D	1	1	5	18010
Laophonte spp.	18FEB88	D	1	1	1	3602
Longipedia americana	18FEB88	D	1	1	1	3602
Mediomastus californiensis	18FEB88	D	1	1	2	7204
Nematoda	18FEB88	D	1	1	751	2705102
Notomastus cf. latericeus	18FEB88	D	1	1	1	3602
Ostracoda	18FEB88	D	1	1	4	14408
Polydora caulleryi	18FEB88	D	1	1	1	3602

Turbonilla sp.	18FEB88	D	1	1	1	3602
Unidentified (Miscellaneous)	18FEB88	D	1	1	68	244936
Cossura delta	18FEB88	D	1	3	2	7204
Enhydrosoma spp.	18FEB88	D	1	3	1	3602
Harpacticoida	18FEB88	D	1	3	3	10806
Mediomastus californiensis	18FEB88	D	1	3	2	7204
Nematoda	18FEB88	D	1	3	348	1253496
Unidentified (Miscellaneous)	18FEB88	D	1	3	21	75642
Bivalvia	18FEB88	D	2	1	7	25214
Copepod nauplii	18FEB88	D	2	1	27	97254
Enhydrosoma spp.	18FEB88	D	2	1	38	136876
Harpacticoida	18FEB88	D	2	1	10	36020
Kinoryncha	18FEB88	D	2	1	27	97254
Laophonte spp.	18FEB88	D	2	1	6	21612
Longipedia americana	18FEB88	D	2	1	1	3602
Mediomastus californiensis	18FEB88	D	2	1	4	14408
Nematoda	18FEB88	D	2	1	1419	5111238
Notomastus cf. latericeus	18FEB88	D	2	1	1	3602
Ostracoda	18FEB88	D	2	1	7	25214
Polychaete larvae	18FEB88	D	2	1	1	3602
Unidentified (Miscellaneous)	18FEB88	D	2	1	60	216120
Zausodes arenicolus	18FEB88	D	2	1	1	3602
Copepod nauplii	18FEB88	D	2	3	2	7204
Enhydrosoma spp.	18FEB88	D	2	3	2	7204
Kinoryncha	18FEB88	D	2	3	2	7204
Mediomastus californiensis	18FEB88	D	2	3	5	18010
Nematoda	18FEB88	D	2	3	494	1779388
Unidentified (Miscellaneous)	18FEB88	D	2	3	21	75642
Bivalvia	18FEB88	D	3	1	3	10806
Copepod nauplii	18FEB88	D	3	1	15	54030
Enhydrosoma spp.	18FEB88	D	3	1	23	82846
Halicyclops sp.	18FEB88	D	3	1	1	3602
Harpacticoida	18FEB88	D	3	1	15	54030
Kinoryncha	18FEB88	D	3	1	5	18010
Laophonte spp.	18FEB88	D	3	1	11	39622
Longipedia americana	18FEB88	D	3	1	1	3602
Mediomastus californiensis	18FEB88	D	3	1	9	32418
Nematoda	18FEB88	D	3	1	631	2272862
Ostracoda	18FEB88	D	3	1	6	21612
Spiophanes bombyx	18FEB88	D	3	1	1	3602
Unidentified (Miscellaneous)	18FEB88	D	3	1	44	158488
Zausodes arenicolus	18FEB88	D	3	1	1	3602
Copepod nauplii	18FEB88	D	3	3	2	7204
Enhydrosoma spp.	18FEB88	D	3	3	1	3602
Glycinde solitaria	18FEB88	D	3	3	1	3602
Kinoryncha	18FEB88	D	3	3	2	7204
Mediomastus californiensis	18FEB88	D	3	3	1	3602
Nematoda	18FEB88	D	3	3	621	2236842
Unidentified (Miscellaneous)	18FEB88	D	3	3	35	126070
Bivalvia	11APR88	C	1	1	6	21612
Dioasaccidae nauplii	11APR88	C	1	1	3	10806
Enhydrosoma spp.	11APR88	C	1	1	12	43224
Glycinde solitaria	11APR88	C	1	1	1	3602
Halacaridae (Hydracarina)	11APR88	C	1	1	4	14408
Harpacticoida	11APR88	C	1	1	2	7204
Harpacticoida	11APR88	C	1	1	29	104458
Kinoryncha	11APR88	C	1	1	30	108060
Laophonte spp.	11APR88	C	1	1	2	7204
Longipedia americana	11APR88	C	1	1	4	14408
Mediomastus californiensis	11APR88	C	1	1	3	10806
Melinna maculata	11APR88	C	1	1	1	3602
Microarthridion sp.	11APR88	C	1	1	7	25214
Nematoda	11APR88	C	1	1	75	270150
Nuculana acuta	11APR88	C	1	1	2	7204
Ophiuroidea	11APR88	C	1	1	1	3602
Ostracoda	11APR88	C	1	1	7	25214
Polychaete larvae	11APR88	C	1	1	10	36020

Pseudodiaptomus coronatus	11APR88	C	1	1	2	7204
Rhynchocoels	11APR88	C	1	1	1	3602
Schizopera sp.	11APR88	C	1	1	8	28816
Stenhelia sp.	11APR88	C	1	1	1	3602
Unidentified (Miscellaneous)	11APR88	C	1	1	17	61234
Zausodes arenicolus	11APR88	C	1	1	10	36020
Copepod nauplii	11APR88	C	1	3	2	7204
Cyclopoida	11APR88	C	1	3	1	3602
Dioasaccidae nauplii	11APR88	C	1	3	1	3602
Kinoryncha	11APR88	C	1	3	3	10806
Melinna maculata	11APR88	C	1	3	1	3602
Nematoda	11APR88	C	1	3	26	93652
Tharyx setigera	11APR88	C	1	3	1	3602
Unidentified (Miscellaneous)	11APR88	C	1	3	4	14408
Bivalvia	11APR88	C	2	1	7	25214
Dioasaccidae nauplii	11APR88	C	2	1	5	18010
Drilonereis magna	11APR88	C	2	1	1	3602
Enhydrosoma spp.	11APR88	C	2	1	6	21612
Erichthonias brasiliensis	11APR88	C	2	1	1	3602
Halacaridae (Hydracarina)	11APR88	C	2	1	1	3602
Harpacticoida	11APR88	C	2	1	25	90050
Kinoryncha	11APR88	C	2	1	41	147682
Laophonte spp.	11APR88	C	2	1	2	7204
Longipedia americana	11APR88	C	2	1	6	21612
Mediomastus californiensis	11APR88	C	2	1	3	10806
Melinna maculata	11APR88	C	2	1	1	3602
Microarthridion sp.	11APR88	C	2	1	12	43224
Mulinia lateralis	11APR88	C	2	1	1	3602
Nematoda	11APR88	C	2	1	82	295364
Ostracoda	11APR88	C	2	1	4	14408
Polychaete larvae	11APR88	C	2	1	6	21612
Polydora caulleryi	11APR88	C	2	1	1	3602
Pseudodiaptomus coronatus	11APR88	C	2	1	2	7204
Schistomeringos rudolphi	11APR88	C	2	1	1	3602
Schizopera sp.	11APR88	C	2	1	15	54030
Sphaerosyllis erinaceus	11APR88	C	2	1	2	7204
Stenhelia sp.	11APR88	C	2	1	1	3602
Unidentified (Miscellaneous)	11APR88	C	2	1	18	64836
Zausodes arenicolus	11APR88	C	2	1	5	18010
Bivalvia	11APR88	C	2	3	1	3602
Copepod nauplii	11APR88	C	2	3	1	3602
Dioasaccidae nauplii	11APR88	C	2	3	2	7204
Enhydrosoma spp.	11APR88	C	2	3	1	3602
Halacaridae (Hydracarina)	11APR88	C	2	3	1	3602
Kinoryncha	11APR88	C	2	3	3	10806
Mediomastus californiensis	11APR88	C	2	3	3	10806
Microarthridion sp.	11APR88	C	2	3	1	3602
Nematoda	11APR88	C	2	3	18	64836
Unidentified (Miscellaneous)	11APR88	C	2	3	3	10806
Zausodes arenicolus	11APR88	C	2	3	1	3602
Bivalvia	11APR88	C	3	1	4	14408
Dioasaccidae nauplii	11APR88	C	3	1	2	7204
Enhydrosoma spp.	11APR88	C	3	1	3	10806
Harpacticoida	11APR88	C	3	1	21	75642
Kinoryncha	11APR88	C	3	1	26	93652
Maldane sarsi	11APR88	C	3	1	1	3602
Mediomastus californiensis	11APR88	C	3	1	4	14408
Nematoda	11APR88	C	3	1	82	295364
Oligochaeta	11APR88	C	3	1	1	3602
Ostracoda	11APR88	C	3	1	8	28816
Schizopera sp.	11APR88	C	3	1	4	14408
Sphaerosyllis erinaceus	11APR88	C	3	1	3	10806
Unidentified (Miscellaneous)	11APR88	C	3	1	9	32418
Zausodes arenicolus	11APR88	C	3	1	3	10806
Bivalvia	11APR88	C	3	3	1	3602
Copepod nauplii	11APR88	C	3	3	2	7204
Dioasaccidae nauplii	11APR88	C	3	3	1	3602

Diopatra cuprea	11APR88	C	3	3	1	3602
Drilonereis magna	11APR88	C	3	3	1	3602
Enhydrosoma spp.	11APR88	C	3	3	2	7204
Kinoryncha	11APR88	C	3	3	5	18010
Mysella planulata	11APR88	C	3	3	6	21612
Nematoda	11APR88	C	3	3	13	46826
Podarke obscura	11APR88	C	3	3	1	3602
Rhynchocoels	11APR88	C	3	3	1	3602
Schizopera sp.	11APR88	C	3	3	1	3602
Unidentified (Miscellaneous)	11APR88	C	3	3	1	3602
Copepod nauplii	12APR88	A	1	1	5	18010
Ectinosoma sp.	12APR88	A	1	1	10	36020
Enhydrosoma spp.	12APR88	A	1	1	2	7204
Harpacticoida	12APR88	A	1	1	2	7204
Microarthridion sp.	12APR88	A	1	1	1	3602
Mulinia lateralis	12APR88	A	1	1	1	3602
Mysidopsis sp.	12APR88	A	1	1	1	3602
Nematoda	12APR88	A	1	1	54	194508
Ostracoda	12APR88	A	1	1	2	7204
Schizopera sp.	12APR88	A	1	1	2	7204
Stenhelia sp.	12APR88	A	1	1	1	3602
Streblospio benedicti	12APR88	A	1	1	1	3602
Unidentified (Miscellaneous)	12APR88	A	1	1	11	39622
Enhydrosoma spp.	12APR88	A	1	3	1	3602
Mediomastus californiensis	12APR88	A	1	3	1	3602
Nematoda	12APR88	A	1	3	135	486270
Schizopera sp.	12APR88	A	1	3	1	3602
Streblospio benedicti	12APR88	A	1	3	1	3602
Unidentified (Miscellaneous)	12APR88	A	1	3	15	54030
Copepod nauplii	12APR88	A	2	1	5	18010
Dioasaccidae nauplii	12APR88	A	2	1	2	7204
Ectinosoma sp.	12APR88	A	2	1	21	75642
Enhydrosoma spp.	12APR88	A	2	1	4	14408
Harpacticoida	12APR88	A	2	1	4	14408
Mediomastus californiensis	12APR88	A	2	1	1	3602
Mulinia lateralis	12APR88	A	2	1	1	3602
Nematoda	12APR88	A	2	1	99	356598
Stenhelia sp.	12APR88	A	2	1	3	10806
Unidentified (Miscellaneous)	12APR88	A	2	1	14	50428
Enhydrosoma spp.	12APR88	A	2	3	1	3602
Mediomastus californiensis	12APR88	A	2	3	2	7204
Nematoda	12APR88	A	2	3	78	280956
Unidentified (Miscellaneous)	12APR88	A	2	3	7	25214
Copepod nauplii	12APR88	A	3	1	3	10806
Dioasaccidae nauplii	12APR88	A	3	1	1	3602
Ectinosoma sp.	12APR88	A	3	1	6	21612
Enhydrosoma spp.	12APR88	A	3	1	3	10806
Halacaridae (Hydracarina)	12APR88	A	3	1	1	3602
Halicyclops sp.	12APR88	A	3	1	2	7204
Harpacticoida	12APR88	A	3	1	1	3602
Nematoda	12APR88	A	3	1	35	126070
Ostracoda	12APR88	A	3	1	1	3602
Scottolana canadensis	12APR88	A	3	1	1	3602
Streblospio benedicti	12APR88	A	3	1	1	3602
Unidentified (Miscellaneous)	12APR88	A	3	1	9	32418
Ectinosoma sp.	12APR88	A	3	3	1	3602
Nematoda	12APR88	A	3	3	146	525892
Schizopera sp.	12APR88	A	3	3	1	3602
Streblospio benedicti	12APR88	A	3	3	1	3602
Unidentified (Miscellaneous)	12APR88	A	3	3	15	54030
Bivalvia	13APR88	B	1	1	3	10806
Copepod nauplii	13APR88	B	1	1	4	14408
Dioasaccidae nauplii	13APR88	B	1	1	3	10806
Ectinosoma sp.	13APR88	B	1	1	1	3602
Ectinosomidae	13APR88	B	1	1	3	10806
Longipedia americana	13APR88	B	1	1	3	10806
Mediomastus californiensis	13APR88	B	1	1	1	3602

Microarthridion sp.	13APR88	B	1	1	1	3602
Mulinia lateralis	13APR88	B	1	1	1	3602
Nematoda	13APR88	B	1	1	142	511484
Ostracoda	13APR88	B	1	1	3	10806
Schizopera sp.	13APR88	B	1	1	2	7204
Stenhelia sp.	13APR88	B	1	1	1	3602
Unidentified (Miscellaneous)	13APR88	B	1	1	7	25214
Nematoda	13APR88	B	1	3	58	208916
Rhynchocoels	13APR88	B	1	3	1	3602
Schizopera sp.	13APR88	B	1	3	1	3602
Unidentified (Miscellaneous)	13APR88	B	1	3	14	50428
Bivalvia	13APR88	B	2	1	5	18010
Copepod nauplii	13APR88	B	2	1	6	21612
Dioasaccidae nauplii	13APR88	B	2	1	3	10806
Ectinosoma sp.	13APR88	B	2	1	2	7204
Ectinosomidae	13APR88	B	2	1	15	54030
Enhydrosoma spp.	13APR88	B	2	1	3	10806
Harpacticoida	13APR88	B	2	1	2	7204
Laophonte spp.	13APR88	B	2	1	1	3602
Longipedia americana	13APR88	B	2	1	3	10806
Mediomastus californiensis	13APR88	B	2	1	2	7204
Microarthridion sp.	13APR88	B	2	1	1	3602
Microprotopus spp.	13APR88	B	2	1	1	3602
Nematoda	13APR88	B	2	1	126	453852
Ostracoda	13APR88	B	2	1	3	10806
Oxyurostylis smithi	13APR88	B	2	1	1	3602
Schizopera sp.	13APR88	B	2	1	4	14408
Stenhelia sp.	13APR88	B	2	1	1	3602
Unidentified (Miscellaneous)	13APR88	B	2	1	6	21612
Zausodes arenicolus	13APR88	B	2	1	8	28816
Bivalvia	13APR88	B	2	3	1	3602
Copepod nauplii	13APR88	B	2	3	2	7204
Mediomastus californiensis	13APR88	B	2	3	1	3602
Nematoda	13APR88	B	2	3	49	176498
Ostracoda	13APR88	B	2	3	1	3602
Unidentified (Miscellaneous)	13APR88	B	2	3	12	43224
Bivalvia	13APR88	B	3	1	14	50428
Copepod nauplii	13APR88	B	3	1	17	61234
Dioasaccidae nauplii	13APR88	B	3	1	2	7204
Ectinosomidae	13APR88	B	3	1	3	10806
Enhydrosoma spp.	13APR88	B	3	1	1	3602
Harpacticoida	13APR88	B	3	1	1	3602
Laophonte spp.	13APR88	B	3	1	3	10806
Longipedia americana	13APR88	B	3	1	2	7204
Mulinia lateralis	13APR88	B	3	1	2	7204
Nematoda	13APR88	B	3	1	171	615942
Ostracoda	13APR88	B	3	1	9	32418
Polychaete larvae	13APR88	B	3	1	2	7204
Unidentified (Miscellaneous)	13APR88	B	3	1	2	7204
Zausodes arenicolus	13APR88	B	3	1	1	3602
Cyclopoid copepod	13APR88	B	3	3	1	3602
Mediomastus californiensis	13APR88	B	3	3	1	3602
Microarthridion sp.	13APR88	B	3	3	1	3602
Microprotopus spp.	13APR88	B	3	3	1	3602
Nematoda	13APR88	B	3	3	96	345792
Polychaete larvae	13APR88	B	3	3	1	3602
Streblospio benedicti	13APR88	B	3	3	1	3602
Unidentified (Miscellaneous)	13APR88	B	3	3	27	97254
Zausodes arenicolus	13APR88	B	3	3	2	7204
Ascidiacea larvae	13APR88	C	1	1	1	3602
Bivalvia	13APR88	C	1	1	2	7204
Copepod nauplii	13APR88	C	1	1	46	165692
Dioasaccidae nauplii	13APR88	C	1	1	3	10806
Diopatra cuprea	13APR88	C	1	1	1	3602
Ectinosoma sp.	13APR88	C	1	1	1	3602
Enhydrosoma spp.	13APR88	C	1	1	10	36020
Harpacticoida	13APR88	C	1	1	1	3602

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Kinoryncha                      13APR88    C     1     1      6    21612
Laophonte spp.                  13APR88    C     1     1      1     3602
Leucon sp.                      13APR88    C     1     1      1     3602
Longipedia americana            13APR88    C     1     1      2     7204
Mediomastus californiensis      13APR88    C     1     1      4    14408
Microarthridion sp.             13APR88    C     1     1     16    57632
Nematoda                        13APR88    C     1     1     85   306170
Nuculana acuta                  13APR88    C     1     1      1     3602
Ostracoda                       13APR88    C     1     1      7    25214
Schizopera sp.                  13APR88    C     1     1      4    14408
Stenhelia sp.                   13APR88    C     1     1      2     7204
Unidentified (Miscellaneous)    13APR88    C     1     1     18    64836
Copepod nauplii                 13APR88    C     1     3      1     3602
Longipedia americana            13APR88    C     1     3      1     3602
Nematoda                        13APR88    C     1     3    264   950928
Schizopera sp.                  13APR88    C     1     3      1     3602
Unidentified (Miscellaneous)    13APR88    C     1     3      4    14408
Bivalvia                        13APR88    C     2     1      7    25214
Copepod nauplii                 13APR88    C     2     1     87   313374
Dioasaccidae nauplii            13APR88    C     2     1     10    36020
Diopatra cuprea                 13APR88    C     2     1      3    10806
Ectinosoma sp.                  13APR88    C     2     1      1     3602
Ectinosomidae                   13APR88    C     2     1      3    10806
Enhydrosoma spp.                13APR88    C     2     1     15    54030
Harpacticoida                   13APR88    C     2     1      1     3602
Kinoryncha                      13APR88    C     2     1     13    46826
Longipedia americana            13APR88    C     2     1      4    14408
Mediomastus californiensis      13APR88    C     2     1      4    14408
Microarthridion sp.             13APR88    C     2     1     34   122468
Nematoda                        13APR88    C     2     1    144   518688
Ostracoda                       13APR88    C     2     1     12    43224
Schizopera sp.                  13APR88    C     2     1     13    46826
Syllidae                        13APR88    C     2     1      1     3602
Unidentified (Miscellaneous)    13APR88    C     2     1     22    79244
Copepod nauplii                 13APR88    C     2     3      1     3602
Microarthridion sp.             13APR88    C     2     3      2     7204
Nematoda                        13APR88    C     2     3    262   943724
Unidentified (Miscellaneous)    13APR88    C     2     3      1     3602
Bivalvia                        13APR88    C     3     1      2     7204
Copepod nauplii                 13APR88    C     3     1     50   180100
Dioasaccidae nauplii            13APR88    C     3     1      8    28816
Diopatra cuprea                 13APR88    C     3     1      1     3602
Ectinosoma sp.                  13APR88    C     3     1      2     7204
Ectinosomidae                   13APR88    C     3     1      3    10806
Enhydrosoma spp.                13APR88    C     3     1      9    32418
Halicyclops sp.                 13APR88    C     3     1      1     3602
Kinoryncha                      13APR88    C     3     1     23    82846
Longipedia americana            13APR88    C     3     1      3    10806
Mediomastus californiensis      13APR88    C     3     1      5    18010
Microarthridion sp.             13APR88    C     3     1     24    86448
Nematoda                        13APR88    C     3     1    186   669972
Ostracoda                       13APR88    C     3     1     10    36020
Paraprionospio pinnata          13APR88    C     3     1      1     3602
Schizopera sp.                  13APR88    C     3     1     14    50428
Scottolana canadensis           13APR88    C     3     1      2     7204
Stenhelia sp.                   13APR88    C     3     1      3    10806
Unidentified (Miscellaneous)    13APR88    C     3     1     15    54030
Zausodes arenicolus             13APR88    C     3     1      1     3602
Canthocamptidae                 13APR88    C     3     3      2     7204
Mediomastus californiensis      13APR88    C     3     3      5    18010
Microarthridion sp.             13APR88    C     3     3      2     7204
Nematoda                        13APR88    C     3     3    124   446648
Unidentified (Miscellaneous)    13APR88    C     3     3      1     3602
Bivalvia                        14APR88    D     1     1      5    18010
Copepod nauplii                 14APR88    D     1     1    177   637554
Ectinosoma sp.                  14APR88    D     1     1      3    10806
Ectinosomidae                   14APR88    D     1     1     21    75642
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Enhydrosoma spp.	14APR88	D	1	1	52	187304
Harpacticoida	14APR88	D	1	1	176	633952
Kinoryncha	14APR88	D	1	1	19	68438
Laophonte spp.	14APR88	D	1	1	119	428638
Longipedia americana	14APR88	D	1	1	6	21612
Mediomastus californiensis	14APR88	D	1	1	20	72040
Nematoda	14APR88	D	1	1	534	1923468
Ostracoda	14APR88	D	1	1	5	18010
Polychaete larvae	14APR88	D	1	1	2	7204
Pseudodiaptomus coronatus	14APR88	D	1	1	1	3602
Saphirella sp.	14APR88	D	1	1	1	3602
Schizopera sp.	14APR88	D	1	1	1	3602
Scottolana canadensis	14APR88	D	1	1	1	3602
Thompsonula sp.	14APR88	D	1	1	5	18010
Unidentified (Miscellaneous)	14APR88	D	1	1	62	223324
Zausodes arenicolus	14APR88	D	1	1	4	14408
Bivalvia	14APR88	D	1	3	1	3602
Copepod nauplii	14APR88	D	1	3	19	68438
Dioasaccidae nauplii	14APR88	D	1	3	1	3602
Enhydrosoma spp.	14APR88	D	1	3	7	25214
Halacaridae (Hydracarina)	14APR88	D	1	3	1	3602
Harpacticoida	14APR88	D	1	3	6	21612
Laophonte spp.	14APR88	D	1	3	1	3602
Mediomastus californiensis	14APR88	D	1	3	18	64836
Nematoda	14APR88	D	1	3	935	3367870
Phoronis architecta	14APR88	D	1	3	1	3602
Unidentified (Miscellaneous)	14APR88	D	1	3	17	61234
Bivalvia	14APR88	D	2	1	8	28816
Copepod nauplii	14APR88	D	2	1	50	180100
Dioasaccidae nauplii	14APR88	D	2	1	1	3602
Ectinosoma sp.	14APR88	D	2	1	4	14408
Ectinosomidae	14APR88	D	2	1	16	57632
Ectinosomidae sp. A	14APR88	D	2	1	2	7204
Enhydrosoma spp.	14APR88	D	2	1	48	172896
Harpacticoida	14APR88	D	2	1	112	403424
Kinoryncha	14APR88	D	2	1	34	122468
Laophonte spp.	14APR88	D	2	1	29	104458
Longipedia americana	14APR88	D	2	1	1	3602
Mediomastus californiensis	14APR88	D	2	1	24	86448
Mulinia lateralis	14APR88	D	2	1	1	3602
Nematoda	14APR88	D	2	1	885	3187770
Ostracoda	14APR88	D	2	1	3	10806
Polychaete larvae	14APR88	D	2	1	3	10806
Polydora sp.	14APR88	D	2	1	1	3602
Pseudodiaptomus coronatus	14APR88	D	2	1	1	3602
Thompsonula sp.	14APR88	D	2	1	4	14408
Unidentified (Miscellaneous)	14APR88	D	2	1	51	183702
Zausodes arenicolus	14APR88	D	2	1	2	7204
Copepod nauplii	14APR88	D	2	3	2	7204
Enhydrosoma spp.	14APR88	D	2	3	2	7204
Halacaridae (Hydracarina)	14APR88	D	2	3	6	21612
Mediomastus californiensis	14APR88	D	2	3	3	10806
Nematoda	14APR88	D	2	3	856	3083312
Nereidae	14APR88	D	2	3	1	3602
Spiophanes bombyx	14APR88	D	2	3	1	3602
Unidentified (Miscellaneous)	14APR88	D	2	3	22	79244
Bivalvia	14APR88	D	3	1	3	10806
Copepod nauplii	14APR88	D	3	1	106	381812
Cyclopoida	14APR88	D	3	1	1	3602
Dioasaccidae nauplii	14APR88	D	3	1	1	3602
Ectinosoma sp.	14APR88	D	3	1	1	3602
Ectinosomidae	14APR88	D	3	1	13	46826
Enhydrosoma spp.	14APR88	D	3	1	19	68438
Gastropoda	14APR88	D	3	1	3	10806
Halicyclops sp.	14APR88	D	3	1	1	3602
Harpacticoida	14APR88	D	3	1	128	461056
Harpacticus sp.	14APR88	D	3	1	1	3602

Kinoryncha	14APR88	D	3	1	13	46826
Laophonte spp.	14APR88	D	3	1	79	284558
Longipedia americana	14APR88	D	3	1	3	10806
Mediomastus californiensis	14APR88	D	3	1	16	57632
Mulinia lateralis	14APR88	D	3	1	1	3602
Nematoda	14APR88	D	3	1	612	2204424
Ostracoda	14APR88	D	3	1	8	28816
Polychaete larvae	14APR88	D	3	1	4	14408
Pseudodiaptomus coronatus	14APR88	D	3	1	1	3602
Schizopera sp.	14APR88	D	3	1	2	7204
Thompsonula sp.	14APR88	D	3	1	6	21612
Unidentified (Miscellaneous)	14APR88	D	3	1	59	212518
Zausodes arenicolus	14APR88	D	3	1	1	3602
Copepod nauplii	14APR88	D	3	3	3	10806
Ectinosomidae	14APR88	D	3	3	2	7204
Enhydrosoma spp.	14APR88	D	3	3	2	7204
Halacaridae (Hydracarina)	14APR88	D	3	3	1	3602
Harpacticoida	14APR88	D	3	3	1	3602
Mediomastus californiensis	14APR88	D	3	3	4	14408
Nematoda	14APR88	D	3	3	773	2784346
Phoronis architecta	14APR88	D	3	3	2	7204
Polychaete larvae	14APR88	D	3	3	2	7204
Spiophanes bombyx	14APR88	D	3	3	1	3602
Unidentified (Miscellaneous)	14APR88	D	3	3	21	75642
Bivalvia	09MAY88	C	1	1	2	7204
Copepod nauplii	09MAY88	C	1	1	20	72040
Dioasaccidae nauplii	09MAY88	C	1	1	9	32418
Diopatra cuprea	09MAY88	C	1	1	1	3602
Ectinosoma sp.	09MAY88	C	1	1	2	7204
Ectinosomidae	09MAY88	C	1	1	2	7204
Enhydrosoma spp.	09MAY88	C	1	1	14	50428
Halicyclops sp.	09MAY88	C	1	1	1	3602
Harpacticoida	09MAY88	C	1	1	1	3602
Kinoryncha	09MAY88	C	1	1	25	90050
Mediomastus californiensis	09MAY88	C	1	1	3	10806
Microarthridion sp.	09MAY88	C	1	1	13	46826
Nematoda	09MAY88	C	1	1	186	669972
Ostracoda	09MAY88	C	1	1	3	10806
Polychaete larvae	09MAY88	C	1	1	2	7204
Schizopera sp.	09MAY88	C	1	1	13	46826
Stenhelia sp.	09MAY88	C	1	1	1	3602
Streblospio benedicti	09MAY88	C	1	1	1	3602
Unidentified (Miscellaneous)	09MAY88	C	1	1	12	43224
Enhydrosoma spp.	09MAY88	C	1	3	2	7204
Mediomastus californiensis	09MAY88	C	1	3	1	3602
Microarthridion sp.	09MAY88	C	1	3	1	3602
Nematoda	09MAY88	C	1	3	227	817654
Tharyx setigera	09MAY88	C	1	3	1	3602
Unidentified (Miscellaneous)	09MAY88	C	1	3	1	3602
Bivalvia	09MAY88	C	2	1	4	14408
Copepod nauplii	09MAY88	C	2	1	35	126070
Dioasaccidae nauplii	09MAY88	C	2	1	29	104458
Ectinosomidae	09MAY88	C	2	1	6	21612
Enhydrosoma spp.	09MAY88	C	2	1	12	43224
Harpacticoida	09MAY88	C	2	1	3	10806
Kinoryncha	09MAY88	C	2	1	55	198110
Leucon sp.	09MAY88	C	2	1	3	10806
Mediomastus californiensis	09MAY88	C	2	1	6	21612
Microarthridion sp.	09MAY88	C	2	1	25	90050
Nematoda	09MAY88	C	2	1	222	799644
Ostracoda	09MAY88	C	2	1	10	36020
Paraprionospio pinnata	09MAY88	C	2	1	1	3602
Pseudodiaptomus coronatus	09MAY88	C	2	1	1	3602
Schizopera sp.	09MAY88	C	2	1	20	72040
Stenhelia sp.	09MAY88	C	2	1	7	25214
Unidentified (Miscellaneous)	09MAY88	C	2	1	12	43224
Copepod nauplii	09MAY88	C	2	3	5	18010

Cossura delta	09MAY88	C	2	3	1	3602
Dioasaccidae nauplii	09MAY88	C	2	3	2	7204
Ectinosomidae	09MAY88	C	2	3	1	3602
Enhydrosoma spp.	09MAY88	C	2	3	1	3602
Halacaridae (Hydracarina)	09MAY88	C	2	3	1	3602
Microarthridion sp.	09MAY88	C	2	3	1	3602
Nematoda	09MAY88	C	2	3	137	493474
Stenhelia sp.	09MAY88	C	2	3	1	3602
Unidentified (Miscellaneous)	09MAY88	C	2	3	13	46826
Bivalvia	09MAY88	C	3	1	5	18010
Copepod nauplii	09MAY88	C	3	1	35	126070
Dioasaccidae nauplii	09MAY88	C	3	1	16	57632
Ectinosoma sp.	09MAY88	C	3	1	3	10806
Ectinosomidae	09MAY88	C	3	1	2	7204
Enhydrosoma spp.	09MAY88	C	3	1	23	82846
Harpacticoida	09MAY88	C	3	1	3	10806
Kinoryncha	09MAY88	C	3	1	33	118866
Leucon sp.	09MAY88	C	3	1	1	3602
Mediomastus californiensis	09MAY88	C	3	1	5	18010
Microarthridion sp.	09MAY88	C	3	1	73	262946
Nematoda	09MAY88	C	3	1	179	644758
Ostracoda	09MAY88	C	3	1	7	25214
Phascolion strombi	09MAY88	C	3	1	1	3602
Polychaete larvae	09MAY88	C	3	1	2	7204
Schizopera sp.	09MAY88	C	3	1	24	86448
Stenhelia sp.	09MAY88	C	3	1	10	36020
Streblospio benedicti	09MAY88	C	3	1	1	3602
Unidentified (Miscellaneous)	09MAY88	C	3	1	16	57632
Mediomastus californiensis	09MAY88	C	3	3	3	10806
Nematoda	09MAY88	C	3	3	129	464658
Schizopera sp.	09MAY88	C	3	3	1	3602
Copepod nauplii	10MAY88	A	1	1	74	266548
Dioasaccidae nauplii	10MAY88	A	1	1	7	25214
Ectinosomidae	10MAY88	A	1	1	5	18010
Halicyclops sp.	10MAY88	A	1	1	3	10806
Harpacticoida	10MAY88	A	1	1	4	14408
Kinoryncha	10MAY88	A	1	1	5	18010
Mulinia lateralis	10MAY88	A	1	1	4	14408
Nematoda	10MAY88	A	1	1	52	187304
Ostracoda	10MAY88	A	1	1	5	18010
Schizopera sp.	10MAY88	A	1	1	1	3602
Stenhelia sp.	10MAY88	A	1	1	1	3602
Streblospio benedicti	10MAY88	A	1	1	2	7204
Unidentified (Miscellaneous)	10MAY88	A	1	1	14	50428
Ectinosomidae	10MAY88	A	1	3	1	3602
Nematoda	10MAY88	A	1	3	152	547504
Stenhelia sp.	10MAY88	A	1	3	1	3602
Streblospio benedicti	10MAY88	A	1	3	2	7204
Unidentified (Miscellaneous)	10MAY88	A	1	3	29	104458
Copepod nauplii	10MAY88	A	2	1	56	201712
Dioasaccidae nauplii	10MAY88	A	2	1	5	18010
Ectinosomidae	10MAY88	A	2	1	21	75642
Halicyclops sp.	10MAY88	A	2	1	3	10806
Harpacticoida	10MAY88	A	2	1	2	7204
Mulinia lateralis	10MAY88	A	2	1	4	14408
Nematoda	10MAY88	A	2	1	21	75642
Ostracoda	10MAY88	A	2	1	3	10806
Streblospio benedicti	10MAY88	A	2	1	3	10806
Unidentified (Miscellaneous)	10MAY88	A	2	1	6	21612
Nematoda	10MAY88	A	2	3	98	352996
Schizopera sp.	10MAY88	A	2	3	1	3602
Stenhelia sp.	10MAY88	A	2	3	1	3602
Streblospio benedicti	10MAY88	A	2	3	2	7204
Unidentified (Miscellaneous)	10MAY88	A	2	3	4	14408
Copepod nauplii	10MAY88	A	3	1	40	144080
Dioasaccidae nauplii	10MAY88	A	3	1	9	32418
Ectinosomidae	10MAY88	A	3	1	10	36020

Enhydrosoma spp.	10MAY88	A	3	1	1	3602
Halicyclops sp.	10MAY88	A	3	1	2	7204
Harpacticoida	10MAY88	A	3	1	1	3602
Mulinia lateralis	10MAY88	A	3	1	4	14408
Nematoda	10MAY88	A	3	1	31	111662
Ostracoda	10MAY88	A	3	1	14	50428
Streblospio benedicti	10MAY88	A	3	1	3	10806
Unidentified (Miscellaneous)	10MAY88	A	3	1	6	21612
Nematoda	10MAY88	A	3	3	120	432240
Stenhelia sp.	10MAY88	A	3	3	1	3602
Streblospio benedicti	10MAY88	A	3	3	1	3602
Unidentified (Miscellaneous)	10MAY88	A	3	3	7	25214
Copepod nauplii	11MAY88	B	1	1	6	21612
Dioasaccidae nauplii	11MAY88	B	1	1	1	3602
Ectinosomidae	11MAY88	B	1	1	1	3602
Laophonte spp.	11MAY88	B	1	1	1	3602
Longipedia americana	11MAY88	B	1	1	1	3602
Mediomastus californiensis	11MAY88	B	1	1	1	3602
Mulinia lateralis	11MAY88	B	1	1	1	3602
Nematoda	11MAY88	B	1	1	90	324180
Ostracoda	11MAY88	B	1	1	2	7204
Stenhelia sp.	11MAY88	B	1	1	1	3602
Streblospio benedicti	11MAY88	B	1	1	1	3602
Unidentified (Miscellaneous)	11MAY88	B	1	1	3	10806
Copepod nauplii	11MAY88	B	1	3	4	14408
Mediomastus californiensis	11MAY88	B	1	3	3	10806
Nematoda	11MAY88	B	1	3	62	223324
Unidentified (Miscellaneous)	11MAY88	B	1	3	5	18010
Copepod nauplii	11MAY88	B	2	1	4	14408
Cyclaspis varians	11MAY88	B	2	1	1	3602
Ectinosomidae	11MAY88	B	2	1	8	28816
Enhydrosoma spp.	11MAY88	B	2	1	8	28816
Longipedia americana	11MAY88	B	2	1	2	7204
Mulinia lateralis	11MAY88	B	2	1	11	39622
Nematoda	11MAY88	B	2	1	123	443046
Ostracoda	11MAY88	B	2	1	1	3602
Pseudodiaptomus coronatus	11MAY88	B	2	1	1	3602
Schizopera sp.	11MAY88	B	2	1	1	3602
Streblospio benedicti	11MAY88	B	2	1	2	7204
Unidentified (Miscellaneous)	11MAY88	B	2	1	8	28816
Zausodes arenicolus	11MAY88	B	2	1	2	7204
Copepod nauplii	11MAY88	B	2	3	5	18010
Mediomastus californiensis	11MAY88	B	2	3	3	10806
Nematoda	11MAY88	B	2	3	234	842868
Unidentified (Miscellaneous)	11MAY88	B	2	3	7	25214
Copepod nauplii	11MAY88	B	3	1	13	46826
Dioasaccidae nauplii	11MAY88	B	3	1	5	18010
Ectinosomidae	11MAY88	B	3	1	2	7204
Enhydrosoma spp.	11MAY88	B	3	1	13	46826
Laophonte spp.	11MAY88	B	3	1	2	7204
Mediomastus californiensis	11MAY88	B	3	1	1	3602
Mulinia lateralis	11MAY88	B	3	1	6	21612
Nematoda	11MAY88	B	3	1	137	493474
Ostracoda	11MAY88	B	3	1	3	10806
Schizopera sp.	11MAY88	B	3	1	4	14408
Stenhelia sp.	11MAY88	B	3	1	2	7204
Streblospio benedicti	11MAY88	B	3	1	1	3602
Unidentified (Miscellaneous)	11MAY88	B	3	1	9	32418
Bivalvia	11MAY88	B	3	3	2	7204
Copepod nauplii	11MAY88	B	3	3	2	7204
Dioasaccidae nauplii	11MAY88	B	3	3	2	7204
Enhydrosoma spp.	11MAY88	B	3	3	2	7204
Mediomastus californiensis	11MAY88	B	3	3	1	3602
Nematoda	11MAY88	B	3	3	133	479066
Unidentified (Miscellaneous)	11MAY88	B	3	3	11	39622
Bivalvia	12MAY88	D	1	1	5	18010
Copepod nauplii	12MAY88	D	1	1	18	64836

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Cyclopoida                      12MAY88   D   1   1     1     3602
Ectinosomidae                   12MAY88   D   1   1    64   230528
Enhydrosoma spp.                12MAY88   D   1   1    20    72040
Gastropoda                      12MAY88   D   1   1     3    10806
Halicyclops sp.                 12MAY88   D   1   1     2     7204
Harpacticoida                   12MAY88   D   1   1    50   180100
Kinoryncha                      12MAY88   D   1   1    17    61234
Laophonte spp.                  12MAY88   D   1   1    74   266548
Longipedia americana            12MAY88   D   1   1     2     7204
Mediomastus californiensis      12MAY88   D   1   1    16    57632
Nematoda                        12MAY88   D   1   1   397  1429994
Nuculana acuta                  12MAY88   D   1   1     1     3602
Ostracoda                       12MAY88   D   1   1     4    14408
Polychaete larvae               12MAY88   D   1   1     2     7204
Schizopera sp.                  12MAY88   D   1   1     1     3602
Turbellaria                     12MAY88   D   1   1     1     3602
Unidentified (Miscellaneous)    12MAY88   D   1   1    41   147682
Enhydrosoma spp.                12MAY88   D   1   3     1     3602
Mediomastus californiensis      12MAY88   D   1   3     7    25214
Nematoda                        12MAY88   D   1   3  1118  4027036
Nereidae                        12MAY88   D   1   3     1     3602
Polydora caulleryi              12MAY88   D   1   3     2     7204
Unidentified (Miscellaneous)    12MAY88   D   1   3    24    86448
Bivalvia                        12MAY88   D   2   1     7    25214
Copepod nauplii                 12MAY88   D   2   1    17    61234
Ectinosomidae                   12MAY88   D   2   1    61   219722
Enhydrosoma spp.                12MAY88   D   2   1    16    57632
Gastropoda                      12MAY88   D   2   1     1     3602
Harpacticoida                   12MAY88   D   2   1    27    97254
Kinoryncha                      12MAY88   D   2   1    30   108060
Laophonte spp.                  12MAY88   D   2   1    65   234130
Mediomastus californiensis      12MAY88   D   2   1    19    68438
Nematoda                        12MAY88   D   2   1   482  1736164
Ostracoda                       12MAY88   D   2   1    10    36020
Polychaete larvae               12MAY88   D   2   1     1     3602
Pseudodiaptomus coronatus       12MAY88   D   2   1     1     3602
Unidentified (Miscellaneous)    12MAY88   D   2   1    67   241334
Zausodes arenicolus             12MAY88   D   2   1     3    10806
Copepod nauplii                 12MAY88   D   2   3     5    18010
Mediomastus californiensis      12MAY88   D   2   3     6    21612
Nematoda                        12MAY88   D   2   3   786  2831172
Unidentified (Miscellaneous)    12MAY88   D   2   3    36   129672
Bivalvia                        12MAY88   D   3   1     6    21612
Copepod nauplii                 12MAY88   D   3   1    11    39622
Ectinosomidae                   12MAY88   D   3   1    34   122468
Enhydrosoma spp.                12MAY88   D   3   1    21    75642
Gastropoda                      12MAY88   D   3   1     1     3602
Glycinde solitaria              12MAY88   D   3   1     1     3602
Halicyclops sp.                 12MAY88   D   3   1     1     3602
Harpacticoida                   12MAY88   D   3   1    34   122468
Kinoryncha                      12MAY88   D   3   1    27    97254
Laophonte spp.                  12MAY88   D   3   1    44   158488
Longipedia americana            12MAY88   D   3   1     3    10806
Mediomastus californiensis      12MAY88   D   3   1    17    61234
Microarthridion sp.             12MAY88   D   3   1     1     3602
Nematoda                        12MAY88   D   3   1   443  1595686
Ophiuroidea                     12MAY88   D   3   1     1     3602
Ostracoda                       12MAY88   D   3   1     8    28816
Polychaete larvae               12MAY88   D   3   1     1     3602
Turbellaria                     12MAY88   D   3   1     3    10806
Unidentified (Miscellaneous)    12MAY88   D   3   1    54   194508
Zausodes arenicolus             12MAY88   D   3   1     3    10806
Copepod nauplii                 12MAY88   D   3   3     1     3602
Mediomastus californiensis      12MAY88   D   3   3     2     7204
Nematoda                        12MAY88   D   3   3  1318  4747436
Nereidae                        12MAY88   D   3   3     1     3602
Spiochaetopterus costarum       12MAY88   D   3   3     1     3602
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Unidentified (Miscellaneous)	12MAY88	D	3	3	39	140478
Bivalvia	26JUL88	C	1	1	13	46826
Copepod nauplii	26JUL88	C	1	1	20	72040
Dioasaccidae nauplii	26JUL88	C	1	1	3	10806
Ectinosoma sp.	26JUL88	C	1	1	3	10806
Ectinosomidae	26JUL88	C	1	1	3	10806
Enhydrosoma spp.	26JUL88	C	1	1	2	7204
Halicyclops sp.	26JUL88	C	1	1	1	3602
Kinoryncha	26JUL88	C	1	1	22	79244
Longipedia americana	26JUL88	C	1	1	1	3602
Microarthridion sp.	26JUL88	C	1	1	3	10806
Nematoda	26JUL88	C	1	1	43	154886
Nuculana acuta	26JUL88	C	1	1	1	3602
Ostracoda	26JUL88	C	1	1	4	14408
Polychaete larvae	26JUL88	C	1	1	1	3602
Schizopera sp.	26JUL88	C	1	1	4	14408
Stenhelia sp.	26JUL88	C	1	1	4	14408
Unidentified (Miscellaneous)	26JUL88	C	1	1	13	46826
Copepod nauplii	26JUL88	C	1	3	1	3602
Cossura delta	26JUL88	C	1	3	1	3602
Ectinosoma sp.	26JUL88	C	1	3	1	3602
Kinoryncha	26JUL88	C	1	3	2	7204
Mediomastus californiensis	26JUL88	C	1	3	2	7204
Nematoda	26JUL88	C	1	3	86	309772
Schizopera sp.	26JUL88	C	1	3	1	3602
Unidentified (Miscellaneous)	26JUL88	C	1	3	1	3602
Bivalvia	26JUL88	C	2	1	7	25214
Copepod nauplii	26JUL88	C	2	1	29	104458
Dioasaccidae nauplii	26JUL88	C	2	1	1	3602
Ectinosoma sp.	26JUL88	C	2	1	1	3602
Ectinosomidae	26JUL88	C	2	1	7	25214
Enhydrosoma spp.	26JUL88	C	2	1	1	3602
Halicyclops sp.	26JUL88	C	2	1	2	7204
Kinoryncha	26JUL88	C	2	1	1	3602
Mediomastus californiensis	26JUL88	C	2	1	3	10806
Microarthridion sp.	26JUL88	C	2	1	5	18010
Nematoda	26JUL88	C	2	1	19	68438
Ostracoda	26JUL88	C	2	1	1	3602
Polychaete larvae	26JUL88	C	2	1	1	3602
Sabellidae	26JUL88	C	2	1	1	3602
Stenhelia sp.	26JUL88	C	2	1	1	3602
Unidentified (Miscellaneous)	26JUL88	C	2	1	8	28816
Bivalvia	26JUL88	C	2	3	2	7204
Cossura delta	26JUL88	C	2	3	1	3602
Enhydrosoma spp.	26JUL88	C	2	3	4	14408
Kinoryncha	26JUL88	C	2	3	4	14408
Mediomastus californiensis	26JUL88	C	2	3	1	3602
Microarthridion sp.	26JUL88	C	2	3	3	10806
Nematoda	26JUL88	C	2	3	131	471862
Schizopera sp.	26JUL88	C	2	3	2	7204
Unidentified (Miscellaneous)	26JUL88	C	2	3	4	14408
Bivalvia	26JUL88	C	3	1	10	36020
Copepod nauplii	26JUL88	C	3	1	13	46826
Ectinosoma sp.	26JUL88	C	3	1	2	7204
Enhydrosoma spp.	26JUL88	C	3	1	5	18010
Halicyclops sp.	26JUL88	C	3	1	4	14408
Kinoryncha	26JUL88	C	3	1	11	39622
Leucon sp.	26JUL88	C	3	1	1	3602
Longipedia americana	26JUL88	C	3	1	2	7204
Mediomastus californiensis	26JUL88	C	3	1	1	3602
Microarthridion sp.	26JUL88	C	3	1	5	18010
Nematoda	26JUL88	C	3	1	23	82846
Ostracoda	26JUL88	C	3	1	1	3602
Schizopera sp.	26JUL88	C	3	1	1	3602
Stenhelia sp.	26JUL88	C	3	1	1	3602
Unidentified (Miscellaneous)	26JUL88	C	3	1	8	28816
Copepod nauplii	26JUL88	C	3	3	2	7204

Cossura delta	26JUL88	C	3	3	1	3602
Enhydrosoma spp.	26JUL88	C	3	3	9	32418
Kinoryncha	26JUL88	C	3	3	9	32418
Mediomastus californiensis	26JUL88	C	3	3	1	3602
Nematoda	26JUL88	C	3	3	108	389016
Paraprionospio pinnata	26JUL88	C	3	3	1	3602
Stenhelia sp.	26JUL88	C	3	3	1	3602
Unidentified (Miscellaneous)	26JUL88	C	3	3	3	10806
Bivalvia	26JUL88	D	1	1	3	10806
Copepod nauplii	26JUL88	D	1	1	16	57632
Ectinosomidae	26JUL88	D	1	1	2	7204
Enhydrosoma spp.	26JUL88	D	1	1	2	7204
Glycinde solitaria	26JUL88	D	1	1	1	3602
Halicyclops sp.	26JUL88	D	1	1	2	7204
Kinoryncha	26JUL88	D	1	1	6	21612
Mediomastus californiensis	26JUL88	D	1	1	4	14408
Nematoda	26JUL88	D	1	1	156	561912
Polydora caulleryi	26JUL88	D	1	1	1	3602
Turbonilla sp.	26JUL88	D	1	1	1	3602
Unidentified (Miscellaneous)	26JUL88	D	1	1	91	327782
Halicyclops sp.	26JUL88	D	1	3	1	3602
Harpacticoida	26JUL88	D	1	3	1	3602
Kinoryncha	26JUL88	D	1	3	1	3602
Mediomastus californiensis	26JUL88	D	1	3	2	7204
Nematoda	26JUL88	D	1	3	1086	3911772
Polydora caulleryi	26JUL88	D	1	3	6	21612
Tharyx setigera	26JUL88	D	1	3	2	7204
Unidentified (Miscellaneous)	26JUL88	D	1	3	7	25214
Copepod nauplii	26JUL88	D	2	1	5	18010
Ectinosomidae	26JUL88	D	2	1	4	14408
Enhydrosoma spp.	26JUL88	D	2	1	1	3602
Halicyclops sp.	26JUL88	D	2	1	1	3602
Kinoryncha	26JUL88	D	2	1	5	18010
Mediomastus californiensis	26JUL88	D	2	1	3	10806
Microarthridion sp.	26JUL88	D	2	1	1	3602
Nematoda	26JUL88	D	2	1	501	1804602
Polydora caulleryi	26JUL88	D	2	1	1	3602
Saphirella sp.	26JUL88	D	2	1	1	3602
Scottolana canadensis	26JUL88	D	2	1	3	10806
Turbonilla sp.	26JUL88	D	2	1	2	7204
Unidentified (Miscellaneous)	26JUL88	D	2	1	104	374608
Ectinosomidae	26JUL88	D	2	3	1	3602
Mediomastus californiensis	26JUL88	D	2	3	1	3602
Nematoda	26JUL88	D	2	3	556	2002712
Paraonidae grp. A	26JUL88	D	2	3	1	3602
Polychaete larvae	26JUL88	D	2	3	1	3602
Tharyx setigera	26JUL88	D	2	3	3	10806
Unidentified (Miscellaneous)	26JUL88	D	2	3	12	43224
Bivalvia	26JUL88	D	3	1	1	3602
Copepod nauplii	26JUL88	D	3	1	8	28816
Enhydrosoma spp.	26JUL88	D	3	1	2	7204
Halicyclops sp.	26JUL88	D	3	1	3	10806
Kinoryncha	26JUL88	D	3	1	7	25214
Mediomastus californiensis	26JUL88	D	3	1	1	3602
Nematoda	26JUL88	D	3	1	233	839266
Scottolana canadensis	26JUL88	D	3	1	2	7204
Unidentified (Miscellaneous)	26JUL88	D	3	1	110	396220
Mediomastus californiensis	26JUL88	D	3	3	1	3602
Nematoda	26JUL88	D	3	3	352	1267904
Paraprionospio pinnata	26JUL88	D	3	3	1	3602
Unidentified (Miscellaneous)	26JUL88	D	3	3	13	46826
Copepod nauplii	27JUL88	A	1	1	23	82846
Ectinosomidae	27JUL88	A	1	1	29	104458
Enhydrosoma spp.	27JUL88	A	1	1	1	3602
Halicyclops sp.	27JUL88	A	1	1	6	21612
Kinoryncha	27JUL88	A	1	1	1	3602
Nematoda	27JUL88	A	1	1	81	291762

Ostracoda	27JUL88	A	1	1	10	36020
Streblospio benedicti	27JUL88	A	1	1	1	3602
Unidentified (Miscellaneous)	27JUL88	A	1	1	13	46826
Ectinosomidae	27JUL88	A	1	3	1	3602
Nematoda	27JUL88	A	1	3	230	828460
Streblospio benedicti	27JUL88	A	1	3	1	3602
Bivalvia	27JUL88	A	2	1	1	3602
Copepod nauplii	27JUL88	A	2	1	11	39622
Cyclopoid copepod	27JUL88	A	2	1	1	3602
Dioasaccidae nauplii	27JUL88	A	2	1	3	10806
Ectinosoma sp.	27JUL88	A	2	1	2	7204
Ectinosomidae	27JUL88	A	2	1	10	36020
Enhydrosoma spp.	27JUL88	A	2	1	2	7204
Halicyclops sp.	27JUL88	A	2	1	7	25214
Mediomastus californiensis	27JUL88	A	2	1	2	7204
Nematoda	27JUL88	A	2	1	146	525892
Ostracoda	27JUL88	A	2	1	24	86448
Schizopera sp.	27JUL88	A	2	1	2	7204
Streblospio benedicti	27JUL88	A	2	1	2	7204
Unidentified (Miscellaneous)	27JUL88	A	2	1	6	21612
Cyclopoid copepod	27JUL88	A	2	3	2	7204
Mulinia lateralis	27JUL88	A	2	3	1	3602
Nematoda	27JUL88	A	2	3	149	536698
Streblospio benedicti	27JUL88	A	2	3	1	3602
Unidentified (Miscellaneous)	27JUL88	A	2	3	1	3602
Copepod nauplii	27JUL88	A	3	1	14	50428
Dioasaccidae nauplii	27JUL88	A	3	1	2	7204
Ectinosoma sp.	27JUL88	A	3	1	2	7204
Ectinosomidae	27JUL88	A	3	1	7	25214
Enhydrosoma spp.	27JUL88	A	3	1	2	7204
Nematoda	27JUL88	A	3	1	250	900500
Ostracoda	27JUL88	A	3	1	28	100856
Schizopera sp.	27JUL88	A	3	1	2	7204
Streblospio benedicti	27JUL88	A	3	1	3	10806
Unidentified (Miscellaneous)	27JUL88	A	3	1	19	68438
Harpacticoida	27JUL88	A	3	3	1	3602
Nematoda	27JUL88	A	3	3	78	280956
Unidentified (Miscellaneous)	27JUL88	A	3	3	1	3602
Bivalvia	27JUL88	B	1	1	2	7204
Copepod nauplii	27JUL88	B	1	1	15	54030
Dioasaccidae nauplii	27JUL88	B	1	1	9	32418
Ectinosomidae	27JUL88	B	1	1	4	14408
Enhydrosoma spp.	27JUL88	B	1	1	5	18010
Harpacticoida	27JUL88	B	1	1	2	7204
Kinoryncha	27JUL88	B	1	1	3	10806
Laophonte spp.	27JUL88	B	1	1	1	3602
Longipedia americana	27JUL88	B	1	1	7	25214
Maldanidae	27JUL88	B	1	1	1	3602
Mediomastus californiensis	27JUL88	B	1	1	5	18010
Nematoda	27JUL88	B	1	1	111	399822
Ostracoda	27JUL88	B	1	1	2	7204
Polychaete larvae	27JUL88	B	1	1	1	3602
Sphaerosyllis erinaceus	27JUL88	B	1	1	1	3602
Stenhelia sp.	27JUL88	B	1	1	3	10806
Unidentified (Miscellaneous)	27JUL88	B	1	1	18	64836
Copepod nauplii	27JUL88	B	1	3	1	3602
Dioasaccidae nauplii	27JUL88	B	1	3	1	3602
Nematoda	27JUL88	B	1	3	84	302568
Stenhelia sp.	27JUL88	B	1	3	2	7204
Unidentified (Miscellaneous)	27JUL88	B	1	3	4	14408
Bivalvia	27JUL88	B	2	1	1	3602
Copepod nauplii	27JUL88	B	2	1	6	21612
Dioasaccidae nauplii	27JUL88	B	2	1	4	14408
Ectinosoma sp.	27JUL88	B	2	1	2	7204
Ectinosomidae	27JUL88	B	2	1	1	3602
Enhydrosoma spp.	27JUL88	B	2	1	5	18010
Halicyclops sp.	27JUL88	B	2	1	2	7204

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Mediomastus californiensis      27JUL88    B    2    1      3     10806
Nematoda                        27JUL88    B    2    1    102    367404
Ostracoda                       27JUL88    B    2    1      4     14408
Stenhelia sp.                   27JUL88    B    2    1      6     21612
Unidentified (Miscellaneous)    27JUL88    B    2    1     11     39622
Dioasaccidae nauplii            27JUL88    B    2    3      1      3602
Enhydrosoma spp.                27JUL88    B    2    3      1      3602
Halicyclops sp.                 27JUL88    B    2    3      1      3602
Mediomastus californiensis      27JUL88    B    2    3      2      7204
Nematoda                        27JUL88    B    2    3     95    342190
Bivalvia                        27JUL88    B    3    1      4     14408
Copepod nauplii                 27JUL88    B    3    1      9     32418
Dioasaccidae nauplii            27JUL88    B    3    1      7     25214
Ectinosomidae                   27JUL88    B    3    1      7     25214
Ectinosomidae sp. A             27JUL88    B    3    1      2      7204
Enhydrosoma spp.                27JUL88    B    3    1      4     14408
Harpacticoida                   27JUL88    B    3    1      1      3602
Longipedia americana            27JUL88    B    3    1      2      7204
Mediomastus californiensis      27JUL88    B    3    1      3     10806
Nematoda                        27JUL88    B    3    1    142    511484
Ostracoda                       27JUL88    B    3    1      1      3602
Polychaete larvae               27JUL88    B    3    1      1      3602
Stenhelia sp.                   27JUL88    B    3    1      3     10806
Unidentified (Miscellaneous)    27JUL88    B    3    1     15     54030
Copepod nauplii                 27JUL88    B    3    3      1      3602
Dioasaccidae nauplii            27JUL88    B    3    3      1      3602
Mediomastus californiensis      27JUL88    B    3    3      1      3602
Nematoda                        27JUL88    B    3    3    144    518688
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COMPFLUX.DAT
Estuarine comparison experiment:
BAY codes: GE=Guadalupe, and LP=Lavaca-Tres Palcios Estuaries
TEMP=temperature, CORE=replicate core (each was also incubated for O2
flux and Nutrient flux.
GM2=g drywt macrofauna/m^2, FLUX=mmol O2/m^2/h, GCM2=g C macrofauna/m^,
FLUXC=g C respiration/m^2/h, all nutrients in mmol/m^2/h


   S
   T
   A                                        F
   T   T   C                D     F         L        G                  S
B  I   E   O     G          A     L         U        C        P         I        N         N        N
A  O   M   R     M          T     U         X        M        O         O        O         O        H
Y  N   P   E     2          E     X         C        2        4         4        2         3        4

GE A 25.00 1  8.8597 04APR89 -1.19470  0.014336  3.5439  -6.2991  -5.5134 -0.22487  -5.8631   7.7819
GE A 25.00 2  9.8920 04APR89 -0.86802  0.010416  3.9568  -7.8809 -21.0870 -0.91648 -15.2667   5.3562
GE A 25.00 3  7.8841 04APR89 -1.15976  0.013917  3.1536 -10.2237 -16.0738 -0.23643 -14.7302  -0.7181
GE B 24.70 1  5.2551 04APR89 -0.61304  0.007356  2.1020   1.5223   2.8787  1.16881   6.5583   6.0749
GE B 24.70 2  5.3742 04APR89 -0.53969  0.006476  2.1497  -1.7275  -9.0931 -0.72900  -5.9551  -5.7889
GE B 24.70 3  8.0939 04APR89 -0.54467  0.006536  3.2376   0.9504  -0.1005  0.17966   1.8089  -1.5807
GE C 23.10 1  0.7345 04APR89 -1.67602  0.020112  0.2938  -1.3488 -33.3360 -2.29427  -9.5068 -20.1298
GE C 23.10 2  2.5127 04APR89 -0.99674  0.011961  1.0051  -1.1128 -44.9818 -2.53665  -2.9577 -10.9503
GE C 23.10 3  3.5308 04APR89  0.03170 -0.000380  1.4123  -0.6650 -51.5470 -2.90488  -6.4874 -12.4648
GE D 24.80 1 13.3093 04APR89 -0.46884  0.005626  5.3237   5.5944   2.1261  0.19098  12.9597   3.0030
GE D 24.80 2  6.6277 04APR89 -0.29775  0.003573  2.6511   4.8181   0.4887 -0.00441  28.9676  18.3589
GE D 24.80 3  4.8354 04APR89 -0.42888  0.005147  1.9342   4.6303  -1.3508 -0.16739  26.8660   4.3969
LP A 21.70 1  8.2698 05APR89 -1.55171  0.018621  3.3079   1.8360 -68.4866  0.83780  -0.1049 -18.8375
LP A 21.70 2 18.6836 05APR89 -1.80557  0.021667  7.4734   1.4794  -2.4916  1.29171  -1.8555  -6.4182
LP A 21.70 3  5.0764 05APR89 -0.33609  0.004033  2.0306   0.7388 -38.8842  0.67587  -3.0036 -13.4950
LP B 21.20 1  7.9380 05APR89 -1.42850  0.017142  3.1752  -1.9639 -47.5339 -0.19203  -2.6439  -0.5237
LP B 21.20 2  3.9959 05APR89 -0.35000  0.004200  1.5984  -0.6283 -33.9954  1.81183  -2.5787   4.1892
LP B 21.20 3  4.6709 05APR89 -1.12201  0.013464  1.8684  -0.6115 -33.0176 -0.50188   0.0370   6.1809
LP C 22.40 1  2.0277 05APR89 -1.49841  0.017981  0.8111  -0.5320  22.2516 -0.39212   2.3405  -3.4582
LP C 22.40 2 18.9246 05APR89 -1.28814  0.015458  7.5698  -0.7646   5.2279 -0.75851   4.9379  -0.4176
LP C 22.40 3  3.4940 05APR89 -2.29087  0.027490  1.3976  -1.4103   2.5957 -1.94967   1.5324  10.1929
LP D 22.20 1  7.6288 05APR89 -1.81371  0.021765  3.0515  -0.5882  21.7385  0.15439  -2.0510  -2.3593
LP D 22.20 2 56.0337 05APR89 -2.40642  0.028877 22.4135   0.2552  23.3213  4.41253  -7.1035   6.8350
LP D 22.20 3 20.4476 05APR89 -1.27463  0.015296  8.1790  -0.0406  38.1704  0.35952  -2.6839  -0.7255
LP A 29.03 1  5.2012 22JUL89 -0.50079  0.006009  2.0805      .         .       .         .         .
LP A 29.03 2  2.1610 22JUL89 -0.93796  0.011256  0.8644      .         .       .         .         .
LP A 29.03 3  4.0073 22JUL89 -2.04666  0.024560  1.6029      .         .       .         .         .
LP A 29.48 4 10.7343 22JUL89 -2.03557  0.024427  4.2937      .         .       .         .         .
LP A 29.48 5  9.6424 22JUL89 -1.36932  0.016432  3.8570      .         .       .         .         .
LP A 29.48 6  5.3175 22JUL89 -1.33101  0.015972  2.1270      .         .       .         .         .
LP C 31.00 1  2.6346 22JUL89 -0.36626  0.004395  1.0539      .         .       .         .         .
LP C 31.00 2  0.2637 22JUL89 -0.49942  0.005993  0.1055      .         .       .         .         .
LP C 31.00 3  0.3687 22JUL89 -0.39702  0.004764  0.1475      .         .       .         .         .
LP C 30.82 4  0.4679 22JUL89 -0.19246  0.002310  0.1872      .         .       .         .         .
LP C 30.82 5  3.9279 22JUL89 -0.40486  0.004858  1.5712      .         .       .         .         .
LP C 30.82 6  0.6523 22JUL89 -0.15602  0.001872  0.2609      .         .       .         .         .
GE A 31.52 1  3.5705 23JUL89 -0.29444  0.003533  1.4282      .         .       .         .         .
GE A 31.52 2  5.8535 23JUL89 -1.64213  0.019706  2.3414      .         .       .         .         .
GE A 31.52 3  4.9176 23JUL89 -1.09270  0.013112  1.9670      .         .       .         .         .
GE A 31.54 4  9.1319 23JUL89 -0.59126  0.007095  3.6528      .         .       .         .         .
GE A 31.54 5  0.9926 23JUL89 -1.06273  0.012753  0.3970      .         .       .         .         .
GE A 31.54 6  6.2959 23JUL89 -1.01583  0.012190  2.5184      .         .       .         .         .
GE C 31.34 1  2.2546 23JUL89 -0.76148  0.009138  0.9018      .         .       .         .         .
GE C 31.34 2  2.7821 23JUL89 -0.97650  0.011718  1.1128      .         .       .         .         .
GE C 31.34 3  3.0742 23JUL89 -0.69805  0.008377  1.2297      .         .       .         .         .
GE C 30.62 4  0.2552 23JUL89  0.02277 -0.000273  0.1021      .         .       .         .         .
GE C 30.62 5  5.9698 23JUL89 -1.06640  0.012797  2.3879      .         .       .         .         .
GE C 30.62 6  0.5814 23JUL89 -0.54900  0.006588  0.2326      .         .       .         .         .
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