PRELIMINARY ANALYSIS OF SEAGRASS AND BENTHIC INFAUNA IN JOHNSON AND CLAM BAYS. COLLIER COUNTY, FL

1987

Coastal Zone Management Program

Florida

NATURAL RESOURCES OF COLLIER COUNTY FLORIDA

PRELIMINARY ANALYSES OF SEAGRASS AND BENTHIC INFAUNA IN JOHNSON AND CLAM BAYS, COLLIER COUNTY, FLORIDA

NOV 1987

1987

Research supported in part by the
Florida Department of Environmental Regulation and the
Coastal Zone Management Act of 1972, as amended, Administered by the
Office of Coastal Zone Management, National Oceanic and Atmospheric Administration

Technical Report No. 87-2

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CM-169

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"I HATE AS A BIOLOGIST HAVING TO REDUCE THE BEHAVIOR OF ANIMALS TO NUMBERS. I HATE IT. BUT IF WE ARE GOING TO STAND OUR GROUND AGAINST (HEAD-LONG DEVELOPMENT) WE MUST PRODUCE NUMBERS, BECAUSE THAT'S ALL THEY WILL LISTEN TO. I AM SPENDING MY WHOLE LIFE TO ANSWER THESE QUESTIONS--THEY WANT AN ANSWER IN TWO MONTHS. AND ANYTHING A NATIVE SAYS ABOUT ANIMALS, WELL, THAT COUNTS FOR NOTHING WITH THEM. USELESS ANECDOTES."

BARRY LOPEZ
ARCTIC DREAMS

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INTRODUCTION

Historically, the southwestern estuarine coastline of Collier County was comprised of an extensive series of mangrove deltaic islands and overwash fans, coastal mainland mangrove forests and salt marshes, and shallow, low wave energy bays often protected by sandy or mangrove lined barrier islands.

The productive fisheries and magnificent wading birds associated with these biotopes are among the most visible symbols of the state of Florida. Local residents and tourists alike have traditionally enjoyed swimming, line-fishing, shellfishing, bird-watching, and just plain relaxing in Florida's estuaries.

Each estuary is a unique product of many hundreds of years of runoff, riverine input, and wind and wave action. Because estuaries on the southwestern coast are also low energy sites, separated from the open ocean by a series of barrier or deltaic islands, their most important physical aspect is the mixing of saline ocean water with fresh water runoff from the land.

The low salinity, low energy, high nutrient waters of estuaries are utilized by the developmental stages of many important game and commercial fish, shrimp, and crabs. Many estuaries contain mudflats, and oyster and seagrass beds which enhance biological productivity and serve as a habitat for other species. The seagrass beds provide food, habitat, and refuge for many commercially valuable fin, game and shell fish. The shallow waters and mudflats serve as feeding grounds for wading birds as well as for raptors such as the osprey and bald eagle.

These areas also serve as a habitat for adults of many vertebrate and invertebrate species which utiliize the high biological productivity. Leaves that fall from the surrounding mangrove trees, salt marsh grass stems, seagrass blades, and planktonic plants form most of the basis of the food chain. The importance of seagrasses both in primary production and as nursery and feeding grounds for fish has been demonstrated world wide, (McRoy, 1973).

The importance of estuarine systems in Collier County has been repeatably emphasized in previous Coastal Zone Management Technical Reports. In the past, Naples Bay was considered to be a fisherman's paradise, "every variety of fish can be captured in abundance, viz: sea bass, black bass, trout, sheepshead, redfish and red snappers, pompano, jewfish, tarpon etc.", (Robinson, 1888). Long-time resident fishermen claim that thirty years ago the bottom of Naples Bay was covered with lush grass beds, and commercial shrimpers trawled the bay.

The productivity of the Naples Bay described above no longer exists. The bottom no longer supports lush seagrass beds, most of the benthos is covered with muck, and parts of the inland waterway, especially those adjacent to heavily developed areas, are virtually non-productive.

THE PROBLEM

Recently, development and proposed development has sparked complaints among concerned citizens and environmental factions worried about the declining fishing industry and nonproductive waters within the county. To address these concerns, the Natural Resources Management Department of Collier County has initiated seagrass and infauna studies, and required baseline impact statements on seagrass and estuarine communities from developers proposing planned unit developments (PUD) adjacent to estuarine areas.

Comparisons between a grassbed existing in a recently developed (potentially stressed) area with one in an undeveloped (potentially less stressed) area could provide valuable data on the health of estuarine and nearshore environments. Seagrass macroinvertebates can serve as an indicator of the health of the environment, since they: (1) are effected by changes in the sediment, water column, and in the grassbed; (2) are less mobile than fish and so are less able to emigrate away from stressful situations, and (3) have short generation times and life histories, thereby allowing assessment of community change over a fairly short period.

In order to assess and compare the two ecosystems, the macroinvertebrate communities associated with the seagrass were chosen as a biological "yardstick" for measurement. Two major grassbed areas were studied (Figures 1 and 2). The first was in Clam Bay, a stressed bay in a developed area in north Naples, surrounded by small single family residences. This bay has received freshwater input from a drainage canal for twenty years, and more recently, has been surrounded by a huge PUD/DRI named Pelican Bay.

The second was Johnson Bay, an unstressed embayment southeast of Rookery Bay National Estuarine Research Reserve, in an area relatively far removed from development both on the mainland and on Marco Island to the south. The hypothesis for the stressed Bay was that runoff from previously existing single family residential homes also draining into Clam Bay via a canal at the southern end, and the Pelican Bay PUD, have significantly modified the natural freshwater flow into the bay.

Both areas studied had monospecific grassbeds, consisting of the thin-bladed shoal grass, *Halodule wrightii* Ascherson. Of all of the seagrasses that occur in the Gulf of Mexico, *H. wrightii* exhibits the greatest environmental tolerance, (Humm, 1973). It is the most abundant seagrass between neap high and neap low tide lines (Phillips 1962), probably because it can withstand higher temperatures and a greater degree of exposure than other seagrasses (Humm 1956, Lewis et al. 1985). *H. wrightii* can tolerate a greater range of salinities than any other seagrass except *Ruppia*. It has been observed to occur in turbid waters (Livingston,1980), where the light is probably too low for *Thalassia* and *Syringodium* to survive (Lewis et al. 1985).

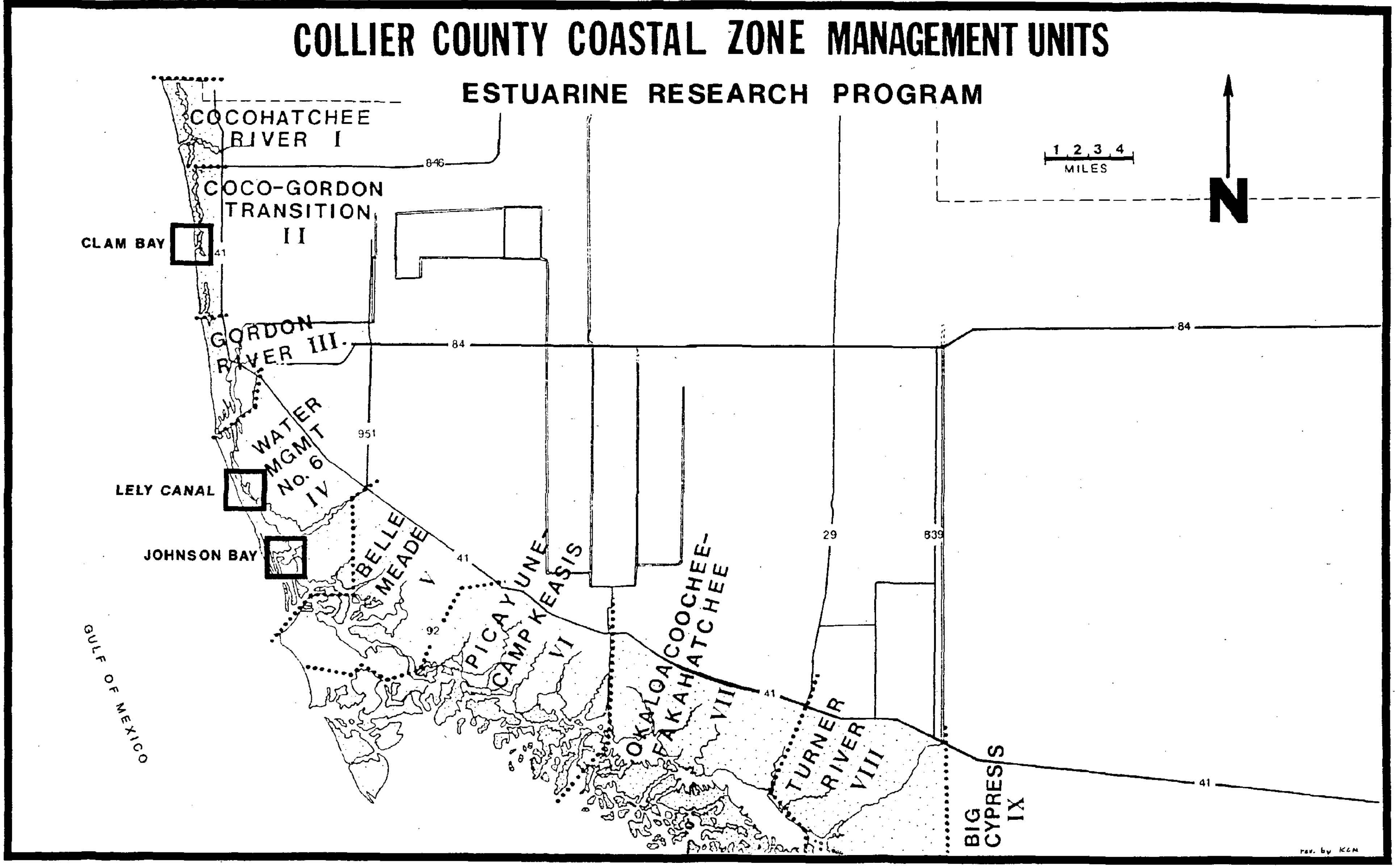

Figure 1. Estuarine sampling areas along the Collier County Coastline.

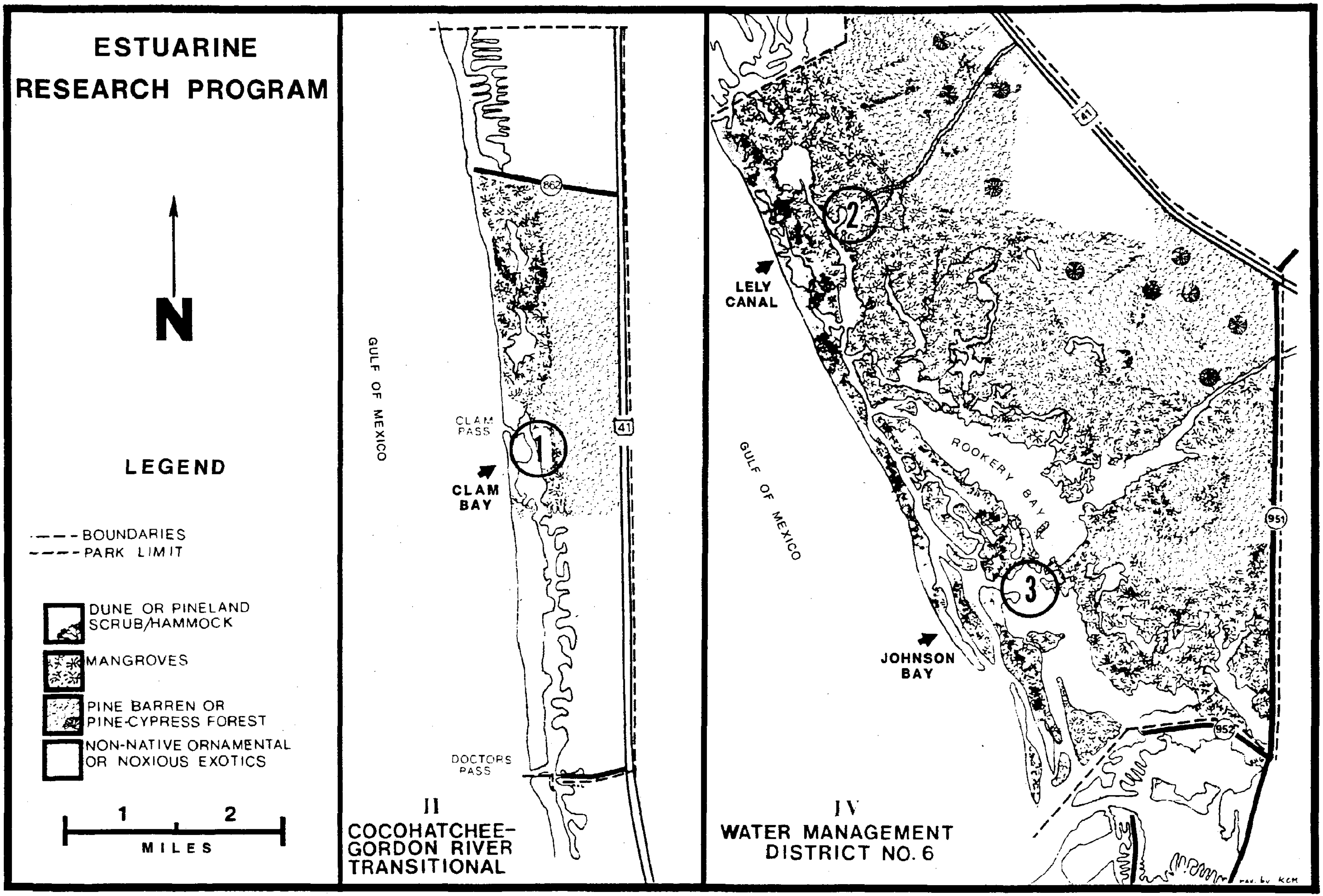

Figure 2. Detail of estuarine sampling areas along the Collier County Coastline.

MATERIALS AND METHODS

Plots were established which encompassed most of the grassbeds in both bays. In Johnson Bay, the plot was 30 x 30 meters, and in Clam Bay the plot was 15 x 15 meters. Samples were collected randomly from within each plot via a gridded matrix using a random number table from Zar (1974), and collected every two months, beginning in October, 1986 through August, 1987.

Two types of hand held samplers were employed: 1) A benthic corer 4 in. (10.16 centimeters) in diameter and; 2) a 1 m. sq. drop net, 1/2 m. deep, constructed with a PVC pipe frame and nylon window screen (1/16 inch mesh). The sediment was cored to a depth of 15 cm. Samples were seived in the field through a 0.5 mm. screen. Material retained on the screen was rinsed with seawater into pre-labeled 16 oz. polypropylene bottles, to which three drops of clove oil were added as a relaxant. Samples were allowed to set for at least fifteen minutes, and then preserved in enough formaldehyde buffered with Borax ($Na_2B_3O_4$) to bring the final solution to 10 percent formaldehyde in seawater. Rose bengal, a vital stain, was added to allow easier separation of fauna from the sediment. Samples were then transported to the laboratory. Approximately 48 hours after collection the formaldehyde was decanted and replaced with either 70% isopropyl alcohol or 70% denatured ethyl alcohol. Samples were sorted under a dissecting microscope, and identified to the lowest practical taxon. A voucher collection was prepared.

Three drop net samples were collected via random cast at each site. Sweep nets of the same mesh size were used after each cast to remove the epifauna. Net samples were swept in one direction and then in a direction perpendicular to the first to ensure that all animals captured within the net were collected. Collected epifauna were transferred to 32 ounce polypropylene bottles and preserved either in 70% isopropyl alcohol or 70% denatured ethyl alcohol. Identifications were to the lowest practical taxon.

RESULTS

A comparison of the fauna from the seagrass bed at stations in Johnson Bay and one in Clam Bay showed that, in general, within station variation was high in both stations. However, the communities were dominated by different groups of animals: Johnson Bay by tube building worms and crustaceans; Clam Bay by interstitial non-tubiculous fauna. All reduced data are presented in Appendix 1.

DECEMBER 1986

At the first collection, mean numbers of individuals and species per core were lower at both stations than in subsequent collections. The mean number of species and individuals was greater at Johnson Bay (19.4; 91.7) as compared to Clam Bay (9.5; 3.1), (Table 1).

FEBRUARY 1987

The mean number of species per core increased at both grass bed stations by approximately four new species. Both stations also had increases in mean numbers of individuals, although the increase in Johnson Bay was much greater than that in Clam Bay.

APRIL 1987

Mean numbers of species per core were the same as in February, with Johnson Bay still containing approximately twice as many species as Clam Bay. Numbers of individuals increased substantially at Johnnson Bay, with an influx of both juveniles and adults of Fabricia trilobata, a polychaete worm, and Ampelisca holmesi, an amphipod crustacean.

JUNE 1987

Numbers of species increased slightly at the Johnson Bay Station, but almost doubled at the Clam Bay Station. Although mean numbers of individuals per core decreased by a factor of about 4x at the Johnson Bay Station, they more than doubled at the Clam Bay Station. The net effect, however, of these changes in infaunal species and individual abundances was that both bays had similar densities and numbers of species per core.

Species Composition

In Clam Bay dominant species were small, interstitial members of the community, primarily oligochaete and nematode worms. These animals do not build tubes, nor do they rework the sediment to the degree that larger animals (polychaetes, crustaceans, and mollusks) do.

At all collection times oligochaete and nematode worms were two of the three most dominant taxa in Clam Bay; Tharyx dorsobranchialis, a cirratulid polychaete, ranked third. In December the spionid polychaete, Prionospio heterobranchia was also important.

At the Johnson Bay site the dominant taxa varied with collection times, but were always tube builders. Colonization was by juveniles, and perhaps by some adults. Dominant species switched from the medium-sized tube building onuphid polychaete Kinbergonuphis simoni in December to the small tube building sabellid polychaete, Fabricia trilobata, in February. Highest mean number was 1102 Fabricia trilobata per benthic core in April, and most were a cohort of juveniles, This number dropped in to 231 per core in June and was accompanied by an increase in number of the tube building amphipod, Ampelisca holmesi.

DISCUSSION

Pristine versus Developed Bays

Both Clam and Johnson Bays consisted of similar sandflat and seagrass habitats. The areal extent and density of seagrass beds (*Halodule wrightii*) increased in both bays from December 1986 through June 1987. Sediment samples have not been subjected to detailed grain size analysis. Microscopic analysis indicated that the sediment in both bays is fairly well sorted sand ranging in size from very fine sand to medium sand, with some shell hash. The dominant sediment is fine sand. Foraminifera are present in large numbers and are approximately 0.6 mm in diameter.

The data reported herein indicate that a pronounced difference in numbers of individuals and species exists between the *Halodule wrightii* beds of Johnson Bay and Clam Bay. Johnson Bay, a component of the relatively pristine Rookery Bay National Estuarine Research Reserve system, contained more individuals and species per core sample than did Clam Bay. It will be recalled that the latter bay is ringed on the landward side by the Pelican Bay PUD/DRI.

The infauna of Johnson Bay was numerically dominated by polychaetes and amphipods, whereas nematodes and oligochaetes were generally the most abundant taxa in Clam Bay. Dominance by oligochaetes and nematodes is often characteristic of stressful conditions. However, many taxa co-occurred in the two bays, indicating that some causative factors influenced the composition of the dominance suite by affecting the capacity of the species to colonize, survive, and/or reproduce.

Possible causative factors include the following. First, the volume of water entering Clam Bay may be substantially less than that entering Johnson Bay because of the narrow single entrance to Clam Bay via Clam Pass. This could affect the numbers and variety of colonizers available to Clam Bay benthic habitats. Second, some unmeasured natural feature of the physical environment, such as sedimentation or wave/current energy, may influence survival or settlement of larvae. Third, the effects of natural biological activities such as predation or competition, may differ in the two bays. Fourth, some unnatural factor created by the proximity of human development, such as pollution or interruption of overland sheet flow of fresh water, may adversely affect Clam Bay.

The causative factors influencing the differences in infauna between the bays is not yet discernable from our results. We have no historical information on the numbers and species of infauna that inhabited Clam Bay prior to construction of the Pelican Bay development berm that prohibits overland sheet flow of fresh water. However, it is clear from our findings, and those of other studies in Florida, that the infaunal community dominance pattern in Clam Bay grass beds is not typical of other south Florida estuaries. This suggests that further work is required to discern whether Clam Bay differs naturally from other nearby estuarine systems, or if the deviation is man-induced.

Biogeography of Soutwest Florida Estuaries

Many authors, using a variety of taxa, have tried to locate a biogeographic boundary between the warm-temperate Carolinian Province and the tropical Caribbean Province along the Gulf coast of Florida, (Pulley 1952; Hedgpeth 1953; Rehder 1954; Warmke and Abbott 1961; Coomans 1962; Earle 1969; Humm 1969; Briggs 1974). Previous reports have proposed that this boundary occurs at one of the following: Cedar Key, Cape Romano, or Tampa Bay. Lyons and Collard (1974) consider the Florida Gulf coast as a transition zone between these two provinces.

Johnson Bay is located only 8 miles north of Cape Romano, and therefore presents an excellent opportunity to examine the possibility that a biogeographical boundary occurs, if it can be taxonomically discerned. A comparison of the infaunal species composition of Collier County estuaries, (Gyorkos, unpublished data), and our study, with that of Charlotte Harbor estuary (Estevez (1984), and Biscayne Bay (O'gower & Wacasey 1967), reveals that the species composition is similar. In addition, the infaunal community of Charlotte Harbor, with the exception of gastropods, is not different from the species assemblage found in the more northern Tampa and Sarasota Bays. McCoy & Bell (1985). Hence, if Cape Romano is a biogeographic boundary between Caribbean and Carolinian fauna, then either: (1) the generality does not include benthic infauna, or (2) the boundary is very distinct and Johnson Bay is clearly dominated by Carolinian fauna with little tropical Caribbean influence. Samples from areas between Johnson Bay and Cape Romano are neccessary to completely ascertain the possibility of such a boundary at Cape Romano.

Infauna as a Component of the Estuarine Food Web

The quality, quantity, and availability of the macrofauna as a food source in the trophic web of Johnson Bay is probably superior to that of Clam Bay. Not only are there larger food items available, but they are more readily consumed by a greater variety of predator types, because tube builders remain in contact with the sediment surface.

Drop Net Epifaunal Data

Because of time constraints, drop net samples have been analyzed only for the first sampling period (December 1986). Samples from other dates have been stored and will be analyzed as time permits. Hence, no epifaunal discussion is warranted, although the data for December 1986 are presented in Appendix Table 8.

SYNTHESIS

Unfortunately, there is little baseline data available for comparisons before and after development at Clam Bay. This study points out the need for such studies in areas slated for development so that Collier County's fragile estuarine systems can be protected. It must be emphasized that the data and results presented in this report are preliminary, and that more work is being done.

Physical Data

Twelve years of physical data for an area in Clam Bay near our study site indicate that little net change has occurred in salinity, nitrogen nutrients (nitrate, nitrite, total kjeldhal nitrogen), phosphorus nutrients (total phosphate, ortho phosphate), pH, dissolved oxygen, biological oxygen demand, and suspended solids These data, provided by Westinghouse Communities of Naples, Inc. and the Pelican Bay Improvement District, show seasonal fluctuations but no extensive between-year variability. Salinities generally range from about 15 to 35 ppt.

Comparable long-term data from undeveloped Johnson Bay do not exist. However, salinity monitoring in the adjacent Rookery Bay National Estuarine Research Reserve suggests that a similar annual pattern to that noted in Clam Bay exists near and probably in, Johnson Bay (Gyorkos, personal communication).

ACKNOWLEDGEMENTS

We thank the diligent assistance of Ms. Maura Curran and Mr. Kris Matson, Professor Linda Weinland, and Ms. Maria Fernandez in field work and benthic sample sorting on this project. Westinghouse Communities of Naples, Inc. and the Collier County Youth Guidance Department generously permitted us to use their boat for a couple of the field trips. Westinghouse Communities of Naples, Inc. and the Pelican Bay Improvement District, Inc. also provided an enormous service to us by allowing us to use their unpublished physical-chemical data from Clam Bay. The Conservancy, Inc. and the Florida Department of Natural Resources provided laboratory facilities at Rookery Bay National Estuarine Research Reserve.

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APPENDIX

APPENDIX TABLE 1

Comparison of mean organism densities and sieve sizes from selected benthic faunal studies.
Asterisk - p = polychaetes only. a = amphipods only.

Location	Mean Density (per m2)	Seagrass present	Sieve (mm)	Reference
Apalachicola Bay, Fla. (1)	38,780	Halodule wrightii	0.5	Sheridan & Livingston (1983)
	17,815p	Halodule wrightii	0.5	
Apalachee Bay, Fla. (2)	6,453	Halodule wrightii	0.5	Lewis, III (1984)
Tampa Bay, Fla. (3)	13,313p	Halodule wrightii	0.5	Santos and Simon (1974)
Indian River, Fla. (3)	8,291	Halodule wrightii	1.0	Young and Young (1977)
Indian River, Fla. (3)	714 a	Halodule wrightii	0.5	Stoner (1983)
	432 a			
Biscayne Bay, Fla. (3)	5,000	Halodule wrightii	1.6	Moore et al. (1968)
Biscayne Bay, Fla. (3)	1,113	Halodule wrightii	3.0	O'Gowar and Wacasey (1967)
Charlotte Harbor, Fla. (4)	6,453	Halodule wrightii	0.5	Estevez (1984)
Clam Bay, Fla. (5)	23,013	Halodule wrightii	0.5	This study
	7,147p			
Johnson Bay, Fla. (5)	65,902	Halodule wrightii	0.5	This study
	55,257p			

(1) indicates samples collected at least monthly for at least 12 months
(2) indicates samples collected in September, May and the following September
(3) indicates samples collected seasonally
(4) indicates samples collected May-June and September
(5) indicates samples collected bimonthly for 6 mos.

Modified from Sheridan & Livingston (1983)

APPENDIX TABLE 2

TOTAL FAUNA

Station		12/86		2/87		4/87	
JG	Den.	91.6 (27.79)		520.2 (104.00)		1042.3 (715.36)	
	S.R.	19.3 (2.75)		23.0 (2.00)		24.3 (4.50)	
	Div.	H'= 3.0197 e= 0.7643		H'= 2.4287 e= 0.7008		H'= 1.2349 e= 0.3348	
	Dom.	Laeonereis culveri	13.7 (7.04)	Fabricia trilobata	145.5 (9.19)	F. trilobata	793.0 (706.37)
		Kinbergonuphis simoni	11.8 (5.77)	Aricidea philbinae	61.5 (28.99)	Nematoda	58.7 (28.29)
		Prionospio heterobranchia	10.0 (5.35)	Nematoda	58.0 (5.66)	Ampelisca holmesi	58.3 (33.18)
		Cirratulidae	5.3 (6.63)	Oligochaeta	58.0 (5.66)	K. simoni	34.7 (11.06)
		Nemertea	3.2 (3.16)	Tharyx dorsobranchialis	30.5 (21.92)	A. philbinae	12.3 (11.37)
CG	Den.	41.0 (35.32)		197.4 (116.38)		135.8 (197.46)	
	S.R.	10.8 (2.77)		19.4 (4.93)		12.0 (4.93)	
	Div.	H'= 2.3993 e= 0.6987		H'= 2.2747 e= 0.6253		H'= 1.7925 e= 0.5220	
	Dom.	Oligochaeta	14.6 (23.37)	Nematoda	58.6 (49.63)	Nematoda	61.8 (120.19)
		A. philbinae	5.0 (2.55)	Oligochaeta	38.6 (37.60)	T. dorsobranchialis	29.2 (26.36)
		P. heterobranchia	4.0 (4.95)	T. dorsobranchialis	29.4 (12.93)	Oligochaeta	15.4 (27.75)
		T. dorsobranchialis	3.8 (1.48)	Capitella capitata	14.8 (17.74)	Mediomastus spp.	10.6 (10.81)
		Nematoda	2.8 (2.77)	F. trilobata	12.2 (14.65)	F. trilobata	3.2 (6.61)

Den. = Mean number of individuals per core (81.03 sq. cm.)
S.R. = Mean number of species per core
Div. = Shannon-Weiner diversity (base e)
e = Eveness of distribution
Dom. = List of the 5 most abundant species

* Numbers in parentheses are 1 standard error

TOTAL FAUNA (CONT'D)

Station		6/87		Frequency of dominance	
JG	Den.	482.2 (193.31)		F. trilobata	0.75
	S.R.	20.4 (3.36)		K. Simoni	0.75
	Div.	H'= 1.8466 e= 0.5153		Nematoda	0.75
	Dom.	F. trilobata	231.0 (93.94)	A. holmesi	0.50
		A. holmesi	95.8 (109.60)	T. dorsobranchialis	0.50
		Nematoda	32.8 (26.58)	A. philbinae	0.50
		T. dorsobranchialis	27.6 (13.28)	Oligochaeta	0.25
		K. simoni	24.0 (21.38)	L. culveri	0.25
				P. heterobranchia	0.25
				Cirratulidae	0.25
				Nemertea	0.25
CG	Den.	362.5 (4.35)		Nematoda	1.00
	S.R.	24.5 (3.54)		Oligochaeta	1.00
	Div.	H'= 2.0090 e= 0.6322		T. dorsobranchialis	1.00
	Dom.	Nematoda	81.5 (115.26)	F. trilobata	0.75
		T. dorsobranchialis	20.0 (28.28)	Haplocytherida spp.	0.25
		F. trilobata	19.5 (27.58)	Mediomastus spp.	0.25
		Oligochaeta	19.5 (27.58)	C. capitala	0.25
		Haplocytherida spp.	7.0 (9.90)	A. philbinae	0.25
				P. heterobranchia	0.25

APPENDIX TABLE 3

CRUSTACEANS

Station		12/86		2/87		4/87	
JG	Den.	4.4 (6.67)		43.8 (13.14)		89.5 (41.32)	
	S.R.	2.0 (2.58)		6.6 (2.30)		10.0 (3.16)	
	Div.	H'= 1.6490 e= 0.7505		H'= 1.4775 e= 0.5599		H'= 1.4410 e= 0.4894	
	Dom.	Ampelisca holmesi	1.9 (4.01)	A. holmesi	21.8 (10.66)	A. holmesi	58.3 (33.18)
		Xanthura brevitelson	1.0 (1.33)	G. bonnieroides	12.4 (11.97)	C. tubularis	7.8 (13.57)
		Ampelisca abdita	0.5 (1.08)	Cerapus tubularis	3.6 (4.83)	G. bonnieroides	7.5 (6.45)
		Grandiderella bonnieroides	0.4 (0.52)	Oxyurostylis smithi	1.4 (1.67)	Cymadusa compta	2.5 (2.65)
		Ambidexter symmetricus	0.2 (0.42)	A. abdita	1.2 (0.84)	A. abdita	2.3 (1.50)
CG	Den.	1.6 (6.67)		3.8 (1.79)		2.4 (2.07)	
	S.R.	1.0 (1.22)		2.4 (1.14)		2.0 (1.73)	
	Div.	H'= 1.4942 e= 0.9284		H'= 1.5709 e= 0.8767		H'= 1.3498 e= 0.7533	
	Dom.	Leander tenuicornis	0.6 (1.34)	Hayplocytherida	1.4 (0.89)	A. abdita	1.4 (0.55)
		Alpheus normanni	0.4 (0.89)	Cyathura polita	0.8 (1.10)	A. holmesi	0.2 (0.45)
		Neopanope texana	0.2 (0.45)	A. abdita	0.8 (0.84)	Alymyracuma sp.	0.2 (0.45)
		Hayplocytherida	0.2 (0.45)	Corophium tuberculatum	0.4 (0.89)	Cyathura sp.	0.2 (0.45)
		Periclimenes sp.	0.2 (0.45)	A. holmesi	0.2 (0.45)	Neopanope sp.	0.2 (0.45)
						Hayplocytherida	0.2 (0.45)

Den. = Mean number of individuals per core (81.03 sq. cm.)
S.R. = Mean number of species per core
Div. = Shannon-Weiner diversity (base e)
e = Eveness of distribution
Dom. = List of the 5 most abundant species

* Numbers in parentheses are 1 standard error

CRUSTACEANS (CONT'D)

Station		6/87		Frequency of dominance	
JG	Den.	115.4 (130.95)		A. holmesi	1.00
	S.R.	5.2 (1.92)		G. bonnieroides	0.75
	Div.	H'= 0.7147 e= 0.3104		C. tubularis	0.75
	Dom.	A. holmesi	95.8 (109.60)	A. abdita	0.25
		C. tubularis	10.4 (17.42)	X. brevitelson	0.25
		G. bonnieroides	2.6 (3.13)	H. rapax	0.25
		Hargeria rapax	2.2 (2.28)	C. compta	0.25
				C. polita	0.25
				O. smithi	0.25
				A. symmetricus	0.25
				Nemertea	0.25
CG	Den.	14.5 (10.61)		A. abdita	0.75
	S.R.	5.5 (0.71)		N. texana	0.75
	Div.	H'= 1.5611 e= 0.7507		Hayplocytherida spp.	0.50
	Dom.	Hayplocytherida spp.	7.05 (9.90)	G. bonnieroides	0.25
		G. bonnieroides	3.00 (1.41)	C. compta	0.25
		A. abdita	1.50 (0.71)	L. tenuicornis	0.25
		H. rapax	1.00 (0)	A. normani	0.25
		N. texana	0.50 (0.71)	H. rapax	0.25
		A. holmesi	0.50 (0.71)	X. brevitelson	0.25
		X. brevitelson	0.50 (0.71)	T. bowmani	0.25
		Taphromysis bowmani	0.50 (0.71)	Alymyrcuma spp.	0.25
				A. holmesi	0.25
				C. tuberculatum	0.25
				Periclimes sp.	0.25

APPENDIX TABLE 4

POLYCHAETES

Station		12/86		2/87		4/87	
JG	Den.	79.1 (20.37)		470.0 (73.53)		893.0 (686.3)	
	S.R.	14.6 (2.76)		23.0 (1.41)		10.7 (11.55)	
	Div.	H'= 2.7162 e= 0.7414		H'= 1.6723 e= 0.6175		H'= 0.5631 e= 0.2031	
	Dom.	Laeonereis culveri	13.7 (7.04)	F. trilobata	145.5 (9.19)	F. trilobata	793.0 (706.37)
		Kinbergonuphis simoni	11.8 (5.77)	Aricidea philbinae	61.5 (28.99)	K. simoni	34.7 (11.06)
		Prionospio heterobranchia	10.0 (5.35)	Tharyx dorsobranchialis	30.5 (21.92)	Axiothella mucosa	20.3 (9.71)
		Neanthes acuminata	7.2 (4.08)	K. simoni	18.0 (5.66)	A. philbinae	12.3 (11.37)
		Fabricia trilobata	2.5 (3.60)	P. heterobranchia	11.5 (4.95)	P. heterobranchia	12.0 (13.00)
CG	Den.	20.6 (11.39)		93.4 (38.19)		53.8 (49.06)	
	S.R.	7.4 (2.30)		13.0 (3.61)		7.4 (1.67)	
	Div.	H'= 2.3523 e= 0.7610		H'= 2.2170 e= 0.6976		H'= 1.6187 e= 0.5403	
	Dom.	Aricidea philbinae	5.0 (2.55)	T. dorsobranchialis	29.4 (12.93)	T. dorsobranchialis	29.2 (26.36)
		P. heterobranchia	4.0 (4.95)	Capitella capitata	14.8 (17.74)	Mediomastus spp.	10.6 (10.81)
		T. dorsobranchialis	3.8 (1.48)	F. trilobata	12.2 (14.65)	F. trilobata	3.2 (6.61)
		Minuspio spp.	1.4 (2.61)	A. philbinae	8.6 (4.39)	A. philbinae	2.6 (3.44)
		Mediomastus ambiseta	1.2 (1.79)	Mediomastus spp.	8.0 (5.29)	Glycinde solitaria	2.0 (2.12)

Den. = Mean number of individuals per core (81.03 sq. cm.)
S.R. = Mean number of species per core
Div. = Shannon-Weiner diversity (base e)
e = Eveness of distribution
Dom. = List of the 5 most abundant species

* Numbers in parentheses are 1 standard error

POLYCHAETES (CONT'D)

Station		6/87		Frequency of dominance	
JG	Den.	326.8 (109.73)		P. heterobranchia	1.00
	S.R.	11.4 (1.95)		K. simoni	1.00
	Div.	H'= 1.1928 e= 0.3859		F. trilobata	1.00
	Dom.	F. trilobata	231.0 (93.94)	A. philbinae	0.75
		T. dorsobranchialis	27.6 (13.28)	T. dorsobranchialis	0.50
		K. simoni	24.0 (21.38)	A. mucosa	0.25
		A. philbinae	11.2 (5.54)	L. culveri	0.25
		P. heterobranchia	11.2 (6.42)	N. acuminata	0.25
CG	Den.	61.0 (86.27)		T. dorsobranchialis	1.00
	S.R.	6.0 (8.49)		A. philbinae	1.00
	Div.	H'= 1.7568 e= 0.7070		F. trilobata	0.75
	Dom.	T. dorsobranchialis	20.0 (28.28)	Mediomastus spp.	0.75
		F. trilobata	19.5 (27.58)	P. heterobranchia	0.50
		Mediomastus spp.	6.5 (9.19)	G. solitaria	0.25
		A. philbinae	5.0 (7.07)	C. capitata	0.25
		P. heterobranchia	4.0 (5.66)	Minuspio sp.	0.25
				M. ambiseta	0.25

APPENDIX TABLE 5

CLAM BAY PHYSICAL DATA

Mean (One Standard Error)

	Temp. (Degrees C)	pH	Salinity (ppt)	D.O. (mg/1)	Total PO4 (mg/1)	Ortho PO4 (mg/1)	NO3 (mg/1)	NO2 (mg/1)
1975	22.8 (4.11)	7.80 (0.93)	30.2 (2.91)	7.24 (2.24)	.038 (.018)	.011 (.004)	.269 (.059)	.010 (0)
1976	24.7 (4.72)	7.76 (0.26)	27.5 (3.74)	7.43 (1.00)	.070 (.059)	.028 (.031)	.204 (.158)	.012 (.008)
1977	24.6 (6.23)	8.08 (0.22)	33.6 (2.75)	6.74 (1.43)	.187 (.220)	.021 (.014)	.101 (.066)	.017 (.009)
1978	24.3 (5.30)	7.88 (0.12)	33.2 (1.76)	5.84 (1.49)	.168 (.143)	.014 (.007)	.056 (.056)	.010 (0)
1979	24.0 (4.94)	7.94 (0.26)	33.8 (1.95)	7.33 (2.29)	.125 (.095)	.012 (.006)	.048 (.023)	.010 (0)
1980	25.7 (4.55)	8.11 (0.10)	29.7 (3.35)	7.79 (1.28)	.056 (.029)	.012 (.006)	.039 (.024)	.010 (0)
1981	25.6 (5.22)	7.84 (0.22)	30.1 (4.64)	6.19 (1.48)	.056 (.028)	.01 (0)	.029 (.025)	.010 (0)
1982	23.7 (4.09)	8.02 (0.12)	33.3 (3.39)	7.19 (1.24)	.058 (.038)	.012 (.004)	.044 (.043)	.010 (0)
1983	26.3 (3.88)	8.06 (0.12)	29.3 (3.35)	8.06 (1.04)	.051 (.020)	.01 (0)	.019 (.013)	.010 (0)
1984	24.6 (5.34)	8.00 (0.17)	30.1 (5.12)	7.23 (2.02)	.040 (.020)	.012 (.006)	.014 (.005)	.014 (.005)
1985	22.3 (6.51)	8.10 (0.13)	27.6 (8.77)	7.73 (2.72)	.033 (.010)	.011 (.004)	.023 (.005)	.020 (0)
1986	25.6 (5.50)	8.10 (0.27)	20.8 (4.28)	5.86 (1.20)	.06 (.066)	.016 (.008)	.099 (.170)	.020 (0)
1987	26.3 (6.83)	8.09 (.44)	20.5 (4.44)	7.20 (1.15)	.028 (.013)	.01 (0)	.08 (.047)	.02 (0)
13 year Mean	24.7 (4.97)	7.96 (0.25)	29.6 (5.24)	7.11 (1.64)	.081 (.099)	.016 (.015)	.088 (.112)	.012 (.006)

CLAM BAY PHYSICAL DATA (CONT'D)

Mean (One Standard Error)

	NH3 (mg/1)	TKN (mg/1)	TDS (mg/1)	BOD (mg/1)
1975	.03 (0)	.425 (.128)	40095 (2978.9)	2.29 (0.83)
1976	.032 (.007)	.550 (.262)	38834 (5389.9)	2.81 (1.27)
1977	.	.422 (.215)	38155 (2061.9)	2.51 (1.20)
1978	.	.517 (.371)	36989 (2402.1)	2.28 (1.01)
1979	.	.358 (.178)	37874 (4233.3)	2.10 (.87)
1980	.	.102 (.095)	39387 (7666.4)	2.84 (.86)
1981	.	.173 (.176)	36033 (5486.1)	3.22 (1.26)
1982	.	.252 (.122)	38578 (3584.1)	2.68 (1.50)
1983	.	.135 (.098)	34138 (3734.2)	4.36 (2.17)
1984	.	.287 (.229)	35773 (2480.0)	2.40 (1.28)
1985	.	.850 (.529)	28031 (13300.0)	2.10 (.93)
1986	.	1.660 (2.31)	30050 (13946.5)	1.51 (1.09)
1987	.052 (.018)	.460 (.136)	33002 (4942.4)	.4 (0)
13 Year Mean	.035 (.011)	.434 (.588)	36608.1 (6546.9)	2.65 (1.39)

* . = indicates missing data

APPENDIX TABLE 6

1987 CLAM BAY (CB) & JOHNSON BAY (JB) PHYSICAL DATA

Temp. (Degrees C)	pH	Salinity (ppt)	D.O. (mg/l)	Total PO4 (mg/l)	Ortho PO4 (mg/l)	NO3 (mg/l)	NO2 (mg/l)
29.7 (.86)	32.1 (2.57)	4.54 (.683)	7.53 (.156)	ND	ND	ND	ND
26.3 (6.83)	20.5 (4.44)	7.20 (1.15)	8.09 (.44)	.028 (.013)	.01 (0)	.08 (.047)	.02 (0)

* Numbers are annual means (1 Standard Error)

1987 CLAM BAY (CB) & JOHNSON BAY (JB) PHYSICAL DATA (CONT'D)

NH_3 (mg/1)	TKN (mg/1)	TDS (mg/1)	BOD (mg/1)	SITE
ND	ND	ND	ND	JB
.052 (.018)	.460 (.136)	33002 (4942.4)	.4 (0)	CB

* Numbers are annual means (1 Standard Error)

APPENDIX TABLE 7. Species list for benthic core data from Johnson and Clam Bay grass stations. The first list gives all taxa collected during the study. The other two lists present taxa collected in Johnson and Clam Bays.

BENTHIC CORE MASTER SPECIES LIST

CRUSTACEA: MYSIDACEA
- MYSIDOPSIS BAHIA
- TAPHROMYSIS BOWMANI

CRUSTACEA: AMPHIPODA
- AMPELISCA ABDITA
- AMPELISCA HOLMESI
- GRANDIDIERELLA BONNIEROIDES
- CYMADUSA COMPTA
- CERAPUS TUBULARIS
- RUDILEMBOIDES NAGLEI
- COROPHIUM TUBERCULATUM

CRUSTACEA: OSTRACODA
- HAPLOCYTHERIDA SPP
- MYODOCOPA SPP

CRUSTACEA: TANAIDACEA
- TANAIDAE SP D
- TANAIDAE SP E
- HARGERIA RAPAX
- HALMYRAPSEUDES BAHAMENSIS

CRUSTACEA: DECAPODA: BRACHYURA
- NEOPANOPE TEXANA
- "XANTHIDAE SP (JUV)"
- PAGURUS SP (JUV)
- PINNIXA SP (JUV)

CRUSTACEA: DECAPODA: CARIDEA
- AMBIDEXTER SYMMETRICUS
- ALPHEUS NORMANNI
- LEANDER TENUICORNIS
- PERICLIMENES SP
- PALAEMONETES PUGIO

CRUSTACEA: CUMACEA
- ALYMYRACUMA SP
- OXYUROSTYLIS SMITHI

CRUSTACEA: ISOPODA
- XANTHURA BREVITELSON
- SPHAEROMA FLORIDANA
- CYATHURA POLITA
- CASSIDINIDEA OVALIS

ISOPODA (UNID)

NEMATODA
NEMATODA (SPP)

NEMERTEAN
"NEMERTEAN SPP"

PHORONIDA
PHORONIS ARCHITECTA

SIPUNCULA
PHASCOLION SPP
SIPUNCULA SP A
SIPUNCULA SPP

ANNELIDA: OLIGOCHAETA
OLIGOCHAETA SPP

POLYCHAETA: SERPULIDAE
SPIRORBIS SP

POLYCHAETA: OPHELIIDAE
"OPHELIDAE SP"

POLYCHAETA: SPIONIDAE
PRIONOSPIO HETEROBRANCHIA
PRIONOSPIO FALLAX
PRIONOSPIO SPP
PRIONOSPIO CRISTATA
STREBLOSPIO BENEDICTI
PRIONOSPIO STEENSTRUPI
APOPRIONOSPIO PYGMAEA
MINUSPIO SPP
MINUSPIO CIRROBRANCHIATA ?
SPIOPHANES BOMBYX

POLYCHAETA: CAPITELLIDAE
HETEROMASTUS FILIFORMIS
CAPITELLA CAPITATA
CAPITELLA SP (JUV)
MEDIOMASTUS CALIFORNIENSIS
MEDIOMASTUS AMBISETA
MEDIOMASTUS SPP
NOTOMASTUS HEMIPODUS
NOTOMASTUS LATERICEUS
DASYBRANCHUS LUMBRICOIDES
AXIOTHELLA MUCOSA

POLYCHAETA: SABELLIDAE
"SABELLIDAE SPP"
FABRICA TRILOBATA

POLYCHAETA: SYLLIDAE
- "SYLLIDAE SPP"
- BRANIA WELLFLEETENSIS

POLYCHAETA: PECTINARIIDAE
- PECTINARIA GOULDII

POLYCHAETA: LUMBRINERIDAE
- LUMBERINERIS SP
- LUMBERINERIS SP E
- "LUMBRINERIDAE SPP"

POLYCHAETA: MALDANIDAE
- AXIOTHELLA MUCOSA
- ASYCHIS ELONGATUS

POLYCHAETA: ONUPHIDAE
- KINBERGONUPHIS SIMONI
- DIOPATRA CUPREA

POLYCHAETA: GLYCERIDAE
- GLYCERA AMERICANA
- GLYCERA SP (JUV)

POLYCHAETA: ORBINIIDAE
- LEITOSCOLOPLOS FRAGILIS
- LEITOSCOLOPLOS FOLIOSUS
- SCOLOPLOS RUBRA

POLYCHAETA: NEREIDAE
- LAEONEREIS CULVERI
- NEANTHES ACUMINATA
- "NEREIDAE SPP"
- NEANTHES MICROMMA

POLYCHAETA: AMPHINOMIDAE
- "AMPHINOMIDAE SP B"

POLYCHAETA: PARAONIDAE
- ARICIDEA TAYLORI
- ARICIDEA FRAGILIS
- ARICIDEA PHILBINAE
- ARICIDEA SPP

POLYCHAETA: CIRRATULIDAE
- CIRRIFORMIA SPP
- THARYX DORSOBRANCHIALIS
- THARYX SP
- CAULLERIELLA SPP

POLYCHAETA: GONIADIDAE
- GLYCINDE SOLITARIA

POLYCHAETA: PHYLLODOCIDAE
- ANAITES ARENAE

POLYCHAETA: HESIONIDAE
GYPTIS BREVIPALPA

POLYCHAETA: MAGELONIDAE
MAGELONA PETTIBONAE

POLYCHAETA: ARABELLIDAE
"ARABELLIDAE SPP"

POLYCHAETA: AMPHARETIDAE
MELINNA MACULATA

POLYCHAETA: EULEPEPHIDAE
GRUBEULEPIS SP

POLYCHAETA: POLYNOIDAE
MALMGRENIELLA SP B. (VITTOR)

POLYCHAETA: PILARGIDAE
SIGAMBRA CF BASSI

POLYCHAETA: CHAETOPTERIDAE
SPIOCHAETOPTERUS C. OCULATA
CHAETOPTERUS VARIOPEDATUS

POLYCHAETA: DORVILLIDAE
SCHISTOMERINGOS RUDOLPHI
PISTA SP

CEPHALOCHORDATA
BRANCHIOSTOMA CARIBBAEUM

JOHNSON BAY GRASS BEDS BENTHIC CORE SPECIES LIST

CRUSTACEA: MYSIDACEA
- MYSIDOPSIS BAHIA
- TAPHROMYSIS BOWMANI

CRUSTACEA: AMPHIPODA
- AMPELISCA ABDITA
- AMPELISCA HOLMESI
- GRANDIDIERELLA BONNIEROIDES
- CYMADUSA COMPTA
- CERAPUS TUBULARIS
- RUDILEMBOIDES NAGLEI
- COROPHIUM TUBERCULATUM

CRUSTACEA: OSTRACODA
- HAPLOCYTHERIDA SPP
- MYODOCOPA SPP

CRUSTACEA: TANAIDACEA
- "TANAIDAE SP D"
- "TANAIDAE SP E"
- HARGERIA RAPAX
- HALMYRAPSEUDES BAHAMENSIS

CRUSTACEA: DECAPODA: BRACHYURA
- "XANTHIDAE SP (JUV)"
- "XANTHIDAE SP"
- PAGURUS SP
- PINNIXA SP

CRUSTACEA: DECAPODA: CARIDEA
- AMBIDEXTER SYMMETRICUS
- PALAEMONETES PUGIO

CRUSTACEA: CUMACEA
- ALYMYRACUMA SP
- OXYUROSTYLIS SMITHI

CRUSTACEA: ISOPODA
- XANTHURA BREVITELSON
- SPHAEROMA FLORIDANA
- CYATHURA POLITA
- CASSIDINIDEA OVALIS
- ISOPODA (UNID)

NEMATODA
- NEMATODA SPP

NEMERTEAN
- NEMERTEAN SPP

PHORONIDA
- PHORONIS ARCHITECTA

SIPUNCULA

PHASCOLION SPP

ANNELIDA: OLIGOCHAETA

OLIGOCHAETA SPP

POLYCHAETA: SPIONIDAE

PRIONOSPIO HETEROBRANCHIA
PRIONOSPIO FALLAX
PRIONOSPIO SPP
PRIONOSPIO CRISTATA
STREBLOSPIO BENEDICTI
SPIOPHANES BOMBYX

POLYCHAETA: CAPITELLIDAE

HETEROMASTUS FILIFORMIS
CAPITELLA CAPITATA
MEDIOMASTUS CALIFORNIENSIS
MEDIOMASTUS AMBISETA
MEDIOMASTUS SPP

POLYCHAETA: SABELLIDAE

"SABELLIDAE SPP"
FABRICA TRILOBATA

POLYCHAETA: SYLLIDAE

"SYLLIDAE SPP"

POLYCHAETA: LUMBRINERIDAE

LUMBERINERIS SP
LUMBERINERIS SP E
"LUMBRINERIDAE SPP"

POLYCHAETA: MALDANIDAE

AXIOTHELLA MUCOSA
ASYCHIS ELONGATUS

POLYCHAETA: ONUPHIDAE

KINBERGONUPHIS SIMONI
DIOPATRA CUPREA

POLYCHAETA: GLYCERIDAE

GLYCERA AMERICANA

POLYCHAETA: ORBINIIDAE

LEITOSCOLOPLOS FRAGILIS
LEITOSCOLOPLOS FOLIOSUS
SCOLOPLOS RUBRA

POLYCHAETA: NEREIDAE

LAEONEREIS CULVERI
NEANTHES ACUMINATA
"NEREIDAE SPP"
NEANTHES MICROMMA

POLYCHAETA: AMPHINOMIDAE
"AMPHINOMIDAE SP B"

POLYCHAETA: PARAONIDAE
ARICIDEA TAYLORI
ARICIDEA FRAGILIS
ARICIDEA PHILBINAE
ARICIDEA SPP

POLYCHAETA: CIRRATULIDAE
CIRRIFORMIA SPP
THARYX DORSOBRANCHIALIS
CAULLERIELLA SPP

POLYCHAETA: GONIADIDAE
GLYCINDE SOLITARIA

POLYCHAETA: PHYLLODOCIDAE
ANAITES ARENAE

POLYCHAETA: HESIONIDAE
GYPTIS BREVIPALPA

POLYCHAETA: MAGELONIDAE
MAGELONA PETTIBONAE

POLYCHAETA: ARABELLIDAE
"ARABELLIDAE SPP"

POLYCHAETA: CHAETOPTERIDAE
SPIOCHAETOPTERUS C. OCULATA
CHAETOPTERUS VARIOPEDATUS

POLYCHAETA: DORVILLIDAE
SCHISTOMERINGOS RUDOLPHI
PISTA SP

CLAM BAY GRASS BED BENTHIC CORE SPECIES LIST

CRUSTACEA: MYSIDACEA
- TAPHROMYSIS BOWMANI

CRUSTACEA: AMPHIPODA
- AMPELISCA HOLMESI
- AMPELISCA ABDITA
- COROPHIUM TUBERCULATUM
- GRANDIDIERELLA BONNIEROIDES

CRUSTACEA: OSTRACODA
- HAPLOCYTHERIDA SPP

CRUSTACEA: TANAIDACEA
- HARGERIA RAPAX

CRUSTACEA: DECAPODA: BRACHYURA
- NEOPANOPE TEXANA

CRUSTACEA: DECAPODA: CARIDEA
- ALPHEUS NORMANNI
- LEANDER TENUICORNIS
- PERICLIMENES SP

CRUSTACEA: CUMACEA
- OXYUROSTYLIS SMITHI
- ALYMYRACUMA SP

CRUSTACEA: ISOPODA
- CYATHURA POLITA
- XANTHURA BREVITELSON

NEMATODA
- NEMATODA SPP

NEMERTEAN
- NEMERTEAN SPP

PHORONIDA
- PHORONIS ARCHITECTA

SIPUNCULA
- SIPUNCULA SP A
- SIPUNCULA SPP
- PHASCOLION SPP

ANNELIDA: OLIGOCHAETA
- OLIGOCHAETA SPP

POLYCHAETA: SERPULIDAE
- SPIRORBIS SP

POLYCHAETA: OPHELIIDAE
- "OPHELIDAE SP" (JUV)

POLYCHAETA: SPIONIDAE
- PRIONOSPIO STEENSTRUPI
- PRIONOSPIO HETEROBRANCHIA
- PRIONOSPIO CRISTATA
- PRIONOSPIO SPP
- PRIONOSPIO FALLAX
- STREBLOSPIO BENEDICTI
- APOPRIONOSPIO PYGMAEA
- MINUSPIO SPP
- MINUSPIO CIRROBRANCHIATA ?

POLYCHAETA: CAPITELLIDAE
- CAPITELLA CAPITATA
- CAPITELLA SP (JUV)
- MEDIOMASTUS SPP
- MEDIOMASTUS CALIFORNIENSIS
- MEDIOMASTUS AMBISETA
- NOTOMASTUS HEMIPODUS
- NOTOMASTUS LATERICEUS
- DASYBRANCHUS LUMBRICOIDES
- AXIOTHELLA MUCOSA

POLYCHAETA: SABELLIDAE
- FABRICA TRILOBATA
- "SABELLIDAE SPP"

POLYCHAETA: SYLLIDAE
- BRANIA WELLFLEETENSIS

POLYCHAETA: PECTINARIIDAE
- PECTINARIA GOULDII

POLYCHAETA: MALDANIDAE
- ASYCHIS ELONGATUS

POLYCHAETA: ONUPHIDAE
- KINBERGONUPHIS SIMONI

POLYCHAETA: GLYCERIDAE
- GLYCERA SP (JUV)
- GLYCERA AMERICANA

POLYCHAETA: ORBINIIDAE
- LEITOSCOLOPLOS FOLIOSUS

POLYCHAETA: NEREIDAE
NEANTHES ACUMINATA
LAEONEREIS CULVERI

POLYCHAETA: PARAONIDAE
ARICIDEA PHILBINAE
ARICIDEA SPP

POLYCHAETA: CIRRATULIDAE
THARYX DORSOBRANCHIALIS
THARYX SP (DAM)
CIRRIFORMIA SPP

POLYCHAETA: GONIADIDAE
GLYCINDE SOLITARIA

POLYCHAETA: PHYLLODOCIDAE
ANAITES ARENAE

POLYCHAETA: HESIONIDAE
GYPTIS BREVIPALPA

POLYCHAETA: MAGELONIDAE
MAGELONA PETTIBONAE

POLYCHAETA: AMPHARETIDAE
MELINNA MACULATA

POLYCHAETA: EULEPEPHIDAE
GRUBEULEPIS SPP

POLYCHAETA: POLYNOIDAE
MALMGRENIELLA SP B

POLYCHAETA: PLARGIDAE
SIGAMBRA CF BASSI

POLYCHAETA: CHAETOPTERIDAE
SPIOCHAETOPTERUS C. OCULATA

CEPHALOCHORDATA
BRANCHIOSTOMA CARIBBAEUM

APPENDIX TABLE 8. DROP NET EPIFAUNAL DATA FROM DECEMBER 1986. NUMBERS ARE MEAN NUMBERS OF INDIVIDUALS IN THREE REPLICATE 1 X 1 METER DROP NET SETS.

TAXA	STATIONS				TOTAL	OCCURRENCE FREQ.
	CLAM GRASS	CLAM SAND	GORDON PASS	JOHNSON GRASS		
LEANDER TENUICORNIS	6.67	0.00	42.00	0.00	486.00	0.50
ALPHEUS NORMANNI	5.67	0.33	10.00	0.00	160.00	0.75
CALLINECTES SAPIDUS (JUVENILE)	0.33	0.33	0.00	0.00	6.00	0.50
SESARMA SP (MEGALOPE)	0.33	0.00	0.00	0.00	3.00	0.25
NEOPANOPE TEXANA (FEMALE)	0.33	0.00	0.00	0.00	3.00	0.25
PAGURUS MCLAUGHLANI (JUVENILE)	1.00	0.00	0.00	0.00	10.00	0.25
PROCESSA SP	0.00	0.33	0.00	0.33	6.00	0.50
PANOPEUS OCCIDENTALIS (JUVENILE)	0.00	0.33	0.00	0.00	3.00	0.25
PAGURUS LONGICARPUS	0.00	0.33	0.00	0.00	3.00	0.25
PAGURUS MCLAUGHLANI	0.00	0.33	0.00	0.00	3.00	0.25
PENAEUS SP	0.00	0.00	0.67	0.00	6.00	0.25
PENAEUS DUORARUM	0.00	0.00	0.67	0.00	6.00	0.25
PENAEUS AZTECUS	0.00	0.00	1.00	0.00	10.00	0.25
PENAEUS SP (POST LARVAE)	0.00	0.00	1.33	0.00	13.00	0.25
PENAEUS SETIFERUS (JUVENILE)	0.00	0.00	0.00	0.33	3.00	0.25
PERICLIMES LONGICANDATUS	0.00	0.00	0.33	0.00	3.00	0.25
CALLINECTES SAPIDUS	0.00	0.00	2.67	0.00	26.00	0.25
PORTUNIDAE	0.00	0.00	2.67	0.00	26.00	0.25
PORTUNUS SAYI	0.00	0.00	0.33	0.00	3.00	0.25
SESARMA SP	0.00	0.00	0.67	0.00	6.00	0.25
NEOPANOPE TEXANA	0.00	0.00	0.67	0.00	6.00	0.25
PORTUNUS SAYI (JUVENILE)	0.00	0.00	0.00	2.33	23.00	0.25
TOTAL NUMBER OF INDIVIDUALS	14.33	2.00	63.00	3.00	0.00	0.00
TOTAL NUMBER OF TAXA	6.00	6.00	12.00	3.00	0.00	0.00

CUMULATIVE NUMBER OF TAXA COLLECTED= 22