New Jersey Sea Grant Annual Report 1984-1985

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INTRODUCTION TO THE NEW JERSEY SEA GRANT PROGRAM

Report of Sea Grant Nine: 1984-1985

The National Sea Grant College Program is operated by the National Oceanic and Atmospheric Administration of the United States Department of Commerce. Through the education, research, and advisory activities of the state Sea Grant programs, the National Sea Grant College Program has come to be recognized as a successful partnership of government, university and industry, working toward sound economic development and wise utilization of the nation's marine resources.

New Jersey's Sea Grant Institutional Program is managed by the New Jersey Marine Sciences Consortium. The Consortium currently represents an alliance of 28 institutions of higher education, as well as business, industrial and private organizations actively interested in the future of New Jersey's marine environment.

The ninth year of New Jersey Sea Grant marked a mix of continuing projects of established value with new activities designed in direct response to needs and opportunities expressed by our constituency. Included in this constituency are federal and state agencies, industries that have brought us problems, to solve-often related to us through the New Jersey Sea Grant Extension Service-and a strong advisory committee, comprised of people whose experience and positions put them in the best position to help guide the program and to suggest directions toward the most productive ends.

In addition to serving the State, New Jersey Sea Grant has recognized its regional mission, since we share vital bodies of water with other states, the Delaware River and Bay; and the Hudson River, Hudson-Raritan Estuary and the New York Bight. Relationships with our fellow Sea Grant programs of adjacent states are excellent, as are our working relationships with the cognizant federal agencies-NOAA components, the Environmental Protection Agency and the Corp of Engineers. We are in the process of developing stronger relationships with port authorities. Strong, productive bonds exist with New Jersey's state agencies, particularly the Department of Environmental Protection, with which we share common goals in improving utilization and protection of the state's marine shores and waters.

New Jersey remains near the top of the national list of marine problem areas from polluted waters to endangered shores. But the state also remains near the bottom of the list in available resources to help solve the problems. Within the confines of our own resources, New Jersey Sea Grant has matured rapidly to become proficient, productive and able to operate with high professional skill and effectiveness. While room for improvement remains, I present this account of year nine for New Jersey Sea Grant, as one of our best to date.

Dr. Robert B. Abel
Director

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FISHERIES PROGRAM

The importance of the state fisheries has been stressed since the New Jersey Sea Grant Program's inception. With over 400 companies in the fisheries business and a payroll in excess of 100 million dollars, Sea Grant emphasis remains high on helping to improve this important sector.

Fisheries is an area of strong cooperation, with direct communication among federal, state, and regional managers, researchers, the fishing industry, and Sea Grant Extension Agents who serve as valuable communications links. The entire spectrum of interests is represented in our fisheries program.

The scope of activities ranges from direct problem solution to providing essential scientific information and working tools for fisheries managers and researchers. The common thread which ties the diverse activities together is the program goal: ***Achievement of the full economic, social, and environmental potential of New Jersey commercial and recreational fisheries.***

New Jersey Sea Grant fisheries research continues to emphasize development of new resources, continuing improvement in means of rapid assessment of mollusk populations at a very early stage of development and this year, supported new research which will concentrate on the difficult problem of viral contamination. We also aggressively pursued research that will determine how the state's serious marine pollution problems affect the health and reproduction of fish stocks, and continued the productive studies of socio-economic factors that affect and are affected by fisheries management decisions.

IDENTIFICATION OF BIVALVE LARVAE: A MULTI-INSTITUTIONAL APPROACH

R. Lutz

New Jersey Sea Grant IX was the 4th year of a proposed 5-year project directed by Dr. Richard A. Lutz of Rutgers University. The primary objective of the effort is publication of a comprehensive manual/scientific monograph for the identification of bivalve larvae and early postlarvae (through *routine optical* microscopic examination of the larval hinge apparatus) in estuarine and marine waters of the North Atlantic. This objective is being accomplished through a multi-institutional, co-operative effort, involving 16 institutions (academic, federal, and private industrial) in both North America and Europe.

As emphasized in our Sea Grant VIII annual report, the many difficulties associated with accurately identifying bivalve larvae within the plankton have long hampered applied and basic research efforts in estuarine and open coastal marine environments. For example, as a result of existing practical barriers, detailed studies concerning spatfall predictions for aquacultural and fisheries management purposes have been extremely limited. Year-to-year fluctuations in larval abundance and juvenile recruitment are often not possible to define due to an inability of researchers to discriminate individual larval and early postlarval specimens. Similarly, it has been virtually impossible in routine plankton identification studies to unambiguously assess the impact of various environmental perturbations (natural "disasters", chemical pollutants, thermal discharges, oil spills, dredge-spoil dumping, etc.) on the larvae of individual species of bivalves. While a few keys for larval bivalve identification do exist, their usefulness is limited and, at the present time, it is not possible to unambiguously identify the larvae of many bivalve species, particularly at the early (straight-hinge) developmental stages. This ongoing project offers an approach aimed at eliminating many of the existing obstacles to future research. The involvement in this project of a number of researchers at various institutions, who are presently culturing the larvae of numerous species of bivalves for other purposes, has proved to be an extremely cost-efficient means of achieving the goal of the proposed effort (i.e., publication of a practical identification manual).

Over the past year we have expanded our studies through a collaborative effort with Dr. Marcel Le Pennec of the Laboratoire de Zoologie, Universite de Bretagne Occidentale, Brest, France. Dr. Le Pennec presently has at his disposal preserved samples of the larvae and early postlarvae of over 20 species of bivalves and has agreed to provide us with sub-samples of these for photographic documentation of the various ontogenetic stages for inclusion in the final manual. We are presently in the process of assessing how adequate these specimens (which have been preserved for considerable lengths of time) will be for inclusion in the manual.

Over the past 3 years of our project we have obtained larval and, in many cases, postlarval specimens of the following 55 species of bivalves (the list includes those of Dr. Le Pennec, some of which may not be adequately enough preserved for inclusion in the final manual): *Mytilus edulis* (blue mussel); *Modiolus modiolus* (northern horse mussel); *Geukensia demissa* (Atlantic ribbed mussel); *Mytilus californianus: Ischadium* (= Brachiodontes) *recurvum* (hooked mussel); *Brachiodontes exustus; Perna perna, Mytilus galloprovincialis, Crassostrea virginica* (American oyster); *Crassostrea gigas* (Japanese oyster); *Ostrea edulis* (European oyster); *Argopecten irradians* (bay scallop); *Placopecten magellanicus* (deep-sea scallop); *Pecten maximus; Chlamys opercularis; Chlamys varia; Chlamys distorta; Mya arenaria* (soft shell clam); *Mya truncata; Hiatella arctica; Hiatella rugosa; Spisula solidissima* (surf clam); *Spisula subtruncata; Mulinia lateralis* (dwarf surf clam); *Macoma mitchelli; Macoma balthica; Tagelus plebeius* (stout razor clam); *Donax variabilis; Ensis directus* (razor clam); *Arctica islandica* (ocean quahog); *Noetia ponderosa* (ponderous arc); *Arca noae* (common arc); *Astarte castenea* (chestnut clam); *Periploma leanum; Lyonsia hyalina; Anomia ephippium; Anomia patelliformis; Anomia simplex* (common jingle shell); *Cyclocardia borealis; Cerastoderma edule; Cerastoderma glaccum; Corbicula manilensis; Pholas dactylus; Diplothyra smithii; Nucula proxima; Nucula annulata; Venerupis aura; Ruditapes decussata; Ruditapes philippinarum; Venus verrucosa; Venus faciata; Petricola pholadiformis* (false angle wing); *Gemma gemma* (gem clam); *Pitar morrhuanus;* and *Mercenaria mercenaria* (hard clam). Photographic sequences of the available larval and/or postlarval specimens of each of these species are being prepared for inclusion in the final monograph, together with other useful aids for the identification of individual organisms isolated from both benthic and plankton samples.

An invited paper entitled IDENTIFICATION OF LARVAL BIVALVES IN THE PLANKTON: IMPLICATIONS FOR PREDICTING SPATFALL was presented at a special international meeting hosted by the Irish Marine Farmers' Association in Tralee, Ireland entitled MANAGEMENT OF A SHELLFISH RESOURCE. More than a dozen papers and abstracts have been published in refereed journals summarizing our results obtained to date.

THE INCIDENCE AND DEVELOPMENT OF *GLUGEA STEPHANI* IN FIELD COLLECTED AND LABORATORY INFECTED *PSEUDOPLEURONECTES AMERICANUS* (WINTER FLOUNDER) FROM THE N.Y. - N.J. AREA

A. Cali and P. Takvorian

New Jersey Sea Grant IX was the second year of a two year project directed by Drs. Ann Cali and Peter M. Takvorian of Rutgers University, Newark, New Jersey to study *Glugea stephani*, a disease of American winter flounder.

American winter flounder represent a major portion of the fishery in the northeastern Atlantic coastal area and account for over 32 million pounds of the flatfish landed commercially in 1982. In addition, they comprise a major portion of the sport fishery as indicated by a 1979 U.S. recreational survey, which reported that over 22 million winter flounder were caught by sport fishermen in that year.

One of the diseases that flatfishes are susceptible to is microsporidosis. Microsporida are spore-forming intracellular obligate protozoan parasites, known to infect every major group of animals.

Species of the microsporidan genus *Glugea* parasitize fish and produce large "cysts" or xenomas that range in size from microscopic to greater than five mm in diameter. *Glugea* infections are highly pathogenic and cause numerous disorders that may lead to death or reduction of survival capabilities. Additionally, *Glugea* organisms have been responsible for massive fish kills in other host genera.

Glugea stephani parasitizes several genera of economically important flatfish throughout the world. In the United States, at least five flatfish species have been identified as hosts for *G. stephani.*

In 1981 we documented the presence of the disease in the New York-New Jersey area. To determine the incidence of *G. stephani* in local flounder, we have monitored the disease prevalence continuously since 1978 (Table I) and we were able to demonstrate that *G. stephani* is present in local flounder stocks on a year-round basis.

Studies of *G. stephani* pathology indicate that it invades connective tissue cells of the digestive tract. Infected cells may be found in any of the connective tissue areas from the mesentary to the laminar propria of the villar projections, producing massive host cell hypertrophy, xenomas, often exceeding five mm in diameter. With the histological observations obtained during this portion of the project, we became increasingly aware that the pathology led to death of the fish. In an effort to prove this point we needed to experimentally infect and maintain winter flounder.

Last year we were able to experimentally infect pre-recruit winter flounder and demonstrate *Glugea*-induced mortality. Since this had never been done before, we repeated the experiment (Among fishes in the experimentally exposed group 49.1% were infected, and 63.3% of them died from *G. stephani*). This year our additional goals were to define the nature of the pathology and demonstrate how the parasite kills its host.

Our mortality data from experimental exposures documents a point that is difficult, if not impossible, to demonstrate in the field. We and others have observed field collected fishes that clearly appeared to be moribund. However, proving that a diseased animal will soon die is an illusive point to demonstrate (flatfishes that are moribund or dead are likely to be consumed by scavengers rather than captured). Stunkard, in his 1969 review of the sporozoa stated in regard to field collected young-of-the-year winter flounder massively infected with *G. stephani:*

> "All information shows that these fishes do not survive into their second year"...

Our histological observations on morbund and live fishes demonstrate that they may die from a

TABLE I
Annual and Monthly Incidence of *Glugea stephani* in Winter Flounder from the New York-New Jersey Area 1978-1983.

Year of Collection	1978	1979	1980	1981	1982	1983
Average % Infection (annual)	4.8	8.9	10.7	10.7	7.0	5.3
Peak % Infection (single month)	8.6	13.6	25.0	28.6	16.7	20.0

Figure 1. Histological section of a sub-mucosal infection obtained from a fish that died from a low intensity infection. Note the presence of the xenoma (X) which caused a massive enlargement and distention of the villus (V). The serosa (S) and muscularis (M) both appear normal.

low intensity of *Glugea* infection if the xenomas are located in the mucosa where their size causes rupture of the epithelial lining (Fig. 1). A fish may die from a high intensity of *Glugea* if the massive infection results in occlusion of the intestinal lumen, disruption of the intestinal integrity (Fig. 2), or emaciation (starvation) (Fig. 3). Additionally, a fish with a relatively high intensity of infection may survive if the xenomas are located on the serosal side of the intestinal tract and do not deplete the nutritional needs of the host to the point of starvation and death. Thus, the importance of xenoma location as well as intensity is evident in the pathology of *Glugea stephani* disease.

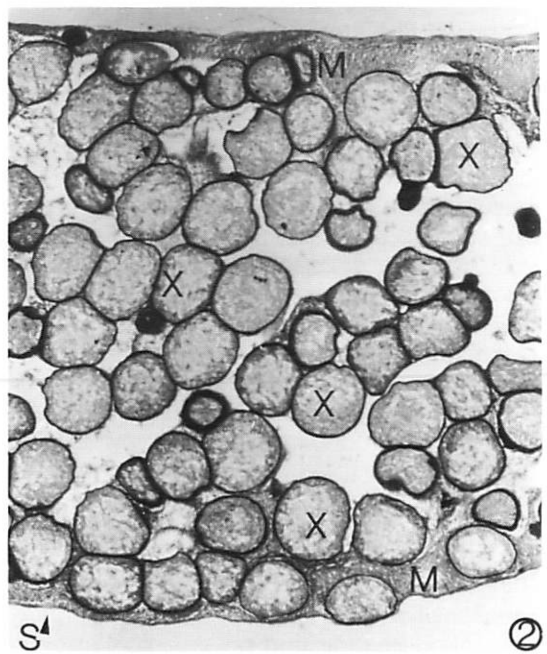

Figure 2. Histological section of a massively infected flounder intestine. The lumen is occluded by the xenomas (X) and the villar projections are totally destroyed. Small amounts of muscle (M) and serosa (s) are all that remain of the intestinal tube.

Our experimental infections have demonstrated what could not be seen in the field. It is our belief that a combination of pathology, in-laboratory infections and field observations will provide us with a better perspective of the disease impact than any one of these factors could alone.

Our ultimate goal is to create an awareness of this disease, and its impact on the fishery. There is a pressing need, for management purposes, to expand our knowledge of diseases of such commercially important resources as the flatfish.

This research represents the cooperative involvements of Rutgers University, New Jersey Sea Grant, the National Marine Fishery Service, N.E. Laboratories, and the NEMP program.

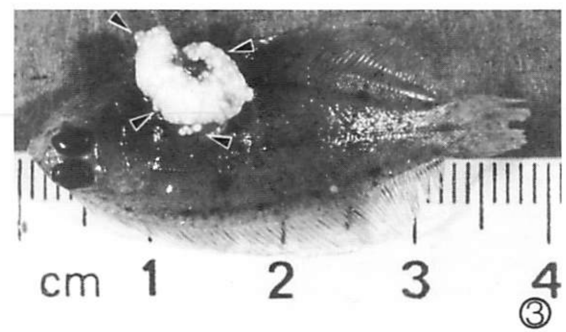

Figure 3. Massively infected pre-recruit winter flounder that died as a result of Glugea stephani. Note the xenomas (arrows) which cover the entire intestine.

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VIRAL CONTENT AND FILTRATION RATES IN THE HARD CLAM *MERCENARIA MERCENARIA* AT A COMMERCIAL DEPURATION FACILITY

F. Cantelmo and T. Carter

COMMERCIAL FISHERY

The commercial fishery for hard clams (*Mercenaria* sp.) is the largest clam industry in the United States. In data compiled by the National Fishery Statistical Program (U.S. Department of Commerce, 1985), landings of hard clams account for 42.7% ($49.8 million) in total exvessel (dockside) value ($116.5 million) for all commercially harvested clams during 1984. The Atlantic Coast landings of *Mercenaria mercenaria* account for approximately 95% of all hard clams harvested.

New Jersey currently ranks third among hard clam producing states in terms of pounds landed (Barbara O'Bannon, NMFS, Bureau of Statistics, personal communication). Landings of hard clams in New Jersey reached peaks in the early 1950's (5 million pounds) and mid 1960's (2.9 million pounds), and the current harvest of 1.6 million pounds in 1984 is 44.8% lower than the landings in 1967 (Fig. 1). However, the 1984 landings are up 23.1% over the 1983 harvest of 1.3 million pounds and 68.2% higher than the 1982 harvest of 951,000 pounds. These increases may well be due to the greater number of clams harvested from marginally polluted areas and either relayed or depurated.

VIRAL DEPURATION, ENVIRONMENTAL PARAMETERS AND PHYSIOLOGICAL STUDIES

Although our local metropolitan waters support one of the largest hard clam populations in the U.S., approximately 29% of N.J. shellfish waters are currently condemned for the harvest of shellfish (New Jersey Department of Environmental Protection, Bureau of Shellfish Control). Cognizant of this closure and the dramatic decline in hard clam landings since the mid 1960's, the N.J. Department of Environmental Protection and the N.J. State Health Department are investigating the feasibility of depuration operations in which hard clams harvested from marginally polluted areas are placed in tanks of running sterilized seawater for 48 hours. Currently, Jersey Shore Shellfish, Inc., Highlands, N.J. is the only hard clam depuration facility in the New Jersey/New York area. The plant is owned and operated by Mr. Jayson Harvey, who has agreed to cooperate with the P.I.'s to facilitate the ongoing study.

The depuration plant is required to monitor coliform levels in hard clam meats after depuration, but will not be addressing the potential problem of viral pathogens, or the effect of various water quality and physical parameters on the depuration ability of *Mercenaria mercenaria*. Coliform standards are currently being used as indicators of fecal pollution and are the basis for the N.J. Shellfish Growing Water Classification Code (special restriction, seasonal, condemned and approved). However, it is questionable whether the coliform standards are applicable to enterovirus contamination of either ambient water or hard clams.

In conjunction with our viral studies, a clearer identification and characterization of environmental parameters and physiological characteristics influencing viral accumulation and depuration by *Mercenaria mercenaria* were initiated during the first year of this study. Since viruses and bacteria are filtered from the water by *Mercenaria mercenaria* during suspension feeding activities, it is vital to ascertain the relationship of filtration rate to viral accumulation and depuration at various environmental and acclimation conditions throughout the year. The filtration rate studies, in conjunction with data on spawning condition and the possible sequestering of particles in areas other than the gut lumen will lead to a clearer understanding of the mechanisms of depuration. Manipulation of these parameters may thus enable hard clam depuration facilities to increase the elimination efficiency of accumulated microbial pollutants in clams taken from moderately polluted shellfish waters (a median of 70-700 total coliforms/100ml). Our objectives for the complete project are:

1) To determine whether a new pilot depuration facility in Highlands, New Jersey is able to reduce or eliminate enterovirus contamination of the hard clam *Mercenaria mercenaria* harvested from restricted waters.
2) To examine the effect of various physical and chemical parameters on the filtration rate of *Mercenaria mercenaria*, with the further objective of defining those physiological characteristics that may be correlated with uptake and accumulation or mobilization and unloading of enterovirus contaminants.
3) To apply results of laboratory model studies to the New Jersey facility with the intent of maximizing viral depuration efficiency.

RESULTS AND ACCOMPLISHMENTS

During the first year of our study, we have monitored enterovirus and *Clostridium perfringens* content of hard clams before and after depuration. Analysis of 14 sets of clam samples taken from May, 1984 to September, 1985 detected no enteroviruses in either undepurated or depurated samples in all but 2 months. On the two occasions when enteroviruses were detected in samples from the Highlands plant (Table 1), both occurred during the winter months, when *Cl. perfringens* levels were low and when the ability to depurate the resident *Cl. perfringens* was generally poor (Table 2). In one case (12/7/84), although the depuration efficiency of *Cl. perfringens* was approximately 70%, one of the eight undepurated pools and three of eight depurated pools yielded virus. On the second occasion (2/22/85) when no depuration of *Cl. perfringens* was observed, enterovirus plaques were recovered in one of five undepurated pools and none in nine depurated pools.

Because the viral data are not extensive, the following interim conclusions must be regarded as tentative:

1) Levels of recoverable enteroviruses are generally low or absent in the clams depurated at the Highlands facility.
2) Winter months appear to be the most likely time for occurrence of enteroviruses in the hard clam population under study. This may be related to the generally low filtration activity during this season.
3) When enterviruses are present, the levels vary widely among individual clams.
4) Commercial depuration during the winter did not always eliminate enterovirus contamination.

The *Clostridium perfringens* assay proved to be rapid and reliable. Average results for 21 samples (15 clams each) taken on 14 separate occasions before and after depuration can be summarized as follows:

1) The initial bacterial content (undepurated clams) was dependent on area of harvest, and was highly variable from area to area, but was fairly consistent within a given area on a particular harvest date.
2) Overall water quality based upon the coliform index (Condemned *vs* Conditionally Restricted for shellfish harvest) was not a good predictor of *Cl. perfringens* in the hard clam.
3) The presence of *Cl. perfringens* in several pools of depurated clams was consistent with the possibility that individual clams occasionally may not depurate efficiently.
4) The average depuration efficiency was seasonally variable. In general, results of the first 14 months of sampling suggest an overall trend toward low levels of *Clostridium perfringens* in undepurated clams, as well as less efficient depuration, between October and March than during the summer months. However, instances of efficient depuration of low levels as well as inefficient depuration of high levels were occasionally observed (Table 2).

Our results to date also support the conclusion that *Clostridium perfringens* is not a good quantitative predictor of enterovirus contamination in the hard clam. In the two months during which enterovirus contamination was detected, the bacterial content was nearly the lowest during the year. Furthermore, in one case in which *Cl. perfringens* levels decreased significantly after depuration, enteroviruses were found in depurated samples.

During the first few months of Sea Grant IX, we set up a laboratory scale flow-through depuration system with initial parameters derived from the commercial facility. There were significant correlations and no significant differences in average siphon extension of clams in the flow-through and commercial tanks. Figure 2 illustrates just a few of the many comparative experiments conducted on the flow-through and commercial system. The successful establishment of a flow-through laboratory system enabled us to perform our initial experiments on the effect of acclimation conditions and we now have a reliable system in which to address more specific objectives regarding depuration efficiency of enterovirus contaminants by ***Mercenaria mercenaria***.

Individually numbered clams from various harvest locations in Sandy Hook Bay were monitored for siphon extension in the commercial tanks at one hour intervals for 48 hours. Results from August 1984 to August 1985 (Table 3) indicate that the percent siphon extension activity over a 48 hour cycle is highly variable for individual hard clams. The average siphon extension for populations of hard clams was highest from March through June (48.0%-35.4%) and lowest (10.6%) at the end of the summer in August. The low overall activity during August 1984 and 1985 coupled with the failure of some clams to extend their siphons during the 48 hour depuration cycle suggests that commercial depuration during the later part of the summer may have to be extended beyond the current state requirement of 48 hours. During any given month, the siphon extension activity was not related to sex (Table 4). In addition, a similar activity range and average was observed among ripe, slightly spent or spent clams within a given sex.

There appears to be evidence of distinct rhythms during some months (Figs. 3 and 4), with generally higher levels of activity during the first 24 hours of depuration. In this case "percent activity" refers to the percentage of clams that had siphons extended at each one hour observation. These cycles are important to consider when attempting to establish the overall efficiency of depuration within the present 48 hour commercial process. It was additionally observed that acclimation conditions prior to depuration are extremely important. Similar population of clams held under refrigeration for up to 24 hours had significantly higher siphon extension activities but the same overall pattern as those placed directly in the depuration system after harvest (Fig. 5).

In an attempt to determine whether the parameters of siphon extension or filtration rate could be used to predict either the bioaccumulation of microorganisms or the efficiency of their depuration, we exposed groups of clams to fecal suspensions seeded with poliovirus in a static system. After 3 hours, some individuals were analyzed for microbial content; the remainder were depurated either in a static system or in a laboratory scale flow-through system at the Highlands plant for varying amounts of time before analysis of microbial content. During both loading and depuration, individual clams were observed every 15-30 minutes to determine the amount of time siphons were extended. Figure 6 shows the individual filtration rates for 8 clams compared to the bioaccumulation of *Clostridium perfingens* and fecal coliforms. There was no quantitative correlation between filtration rate and accumulation of either bacterial species other than in the null case, in which a filtration rate of zero correlated with no bioaccumulation. Furthermore, bioaccumulation of the two bacterial indicator organisms was not equally efficient, even though the ratio of the two organisms in the fecal suspension was relatively constant.

Figure 7 illustrates an example of another experiment in which clams loaded for 3.5 hours were depurated for approximately 12 hours. When only those clams that extended their siphons during the loading period were considered, both *Cl. perfringens* and fecal coliforms were reduced by greater than 90% from the average "loaded" value. A substantial average decrease in poliovirus content was also observed, although the magnitude of reduction (68%) was not as great as for either of the bacterial species. If only those clams with observed siphon extensions greater then 3mm were included when calculating depuration efficiency of poliovirus, however, the average virus depuration efficiency was 83%, approaching that for the bacteria. Thus, whereas it is not possible to predict the extent of either viral or bacterial accumulation - or their efficiency of depuration - from observing the filtration rates or siphon extension activities of *individual* clams, a reasonable correlation was observed when population averages were considered. Further work will therefore employ populations of clams to monitor filtration rates and their relationship to microbial content during both bioaccumulation and depuration.

Observations of siphon activity, filtration rate, bacteriological and virological analysis of clams from the depuration facility will continue into the second year of our grant. The data collected thus far indicate a wide range of activity for individual clams. In addition, some clams may not filter during the 48 hours of depuration. In order to address these concerns, we have proposed additional experimental designs for the laboratory controlled depuration experiments during Sea Grant X and XI which will allow us to make specific recommendations regarding any seasonal differences in depuration efficiency and ways to increase depuration efficiency within a given season by altering acclimation and/or depuration conditions.

FIGURE LEGEND

1	***Annual Commercial Landings of Hard Clams in New Jersey (1950-1984).***
2	***Hard Clam Siphon Extension Activity at Commercial Depuration Plant and Flow-Through Laboratory System (11/9/84-11/11/84).***
3	***Hard Clam Siphon Extension Activity at Commercial Depuration Plant (4/12/85-4/14/85 and 5/13/85-5/15/85).***
4	***Hard Clam Siphon Extension Activity at Commercial Depuration Plant (6/24/85-6/26/85 and 7/22/85-7/24/85).***
5	***Hard Clam Siphon Extension Activity of Refrigerated and Directly Depurated Clams at Commercial Depuration Plant (4/12/85-4/14/85).***
6	***Relationship Between Hard Clam Filtration Rates and Bioaccumulation of Indicator Bacteria (4/12/85).***
7	***Clostridium perfringens, Fecal Coliforms and Polio Virus Levels in Loaded (3.5 hrs.) and Depurated (11.6 hrs.) Hard Clams on 3/22/85 (N=22).***

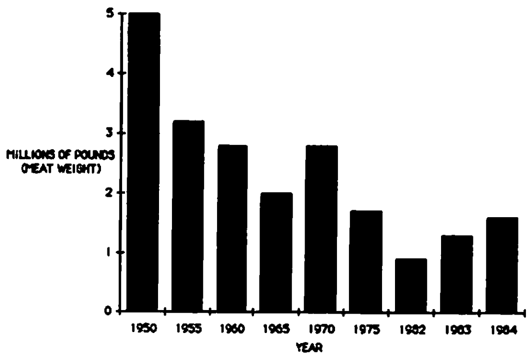

Figure 1

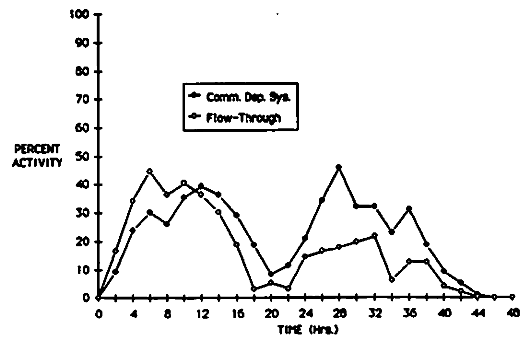

Figure 2

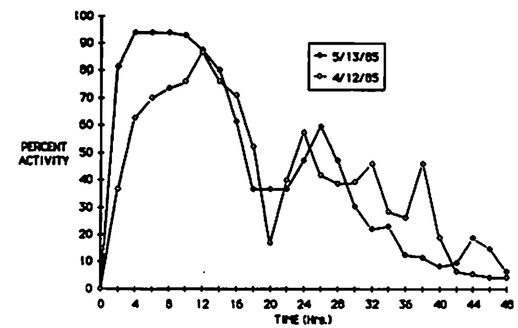

Figure 3

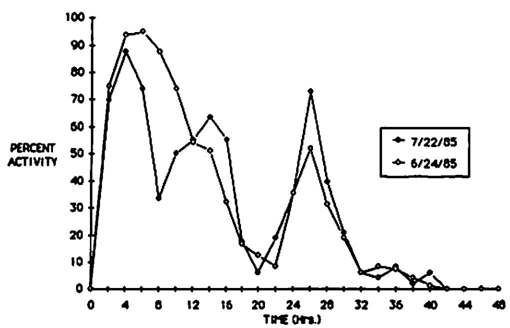

Figure 4

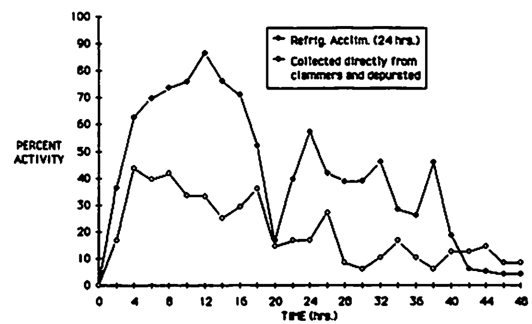

Figure 5

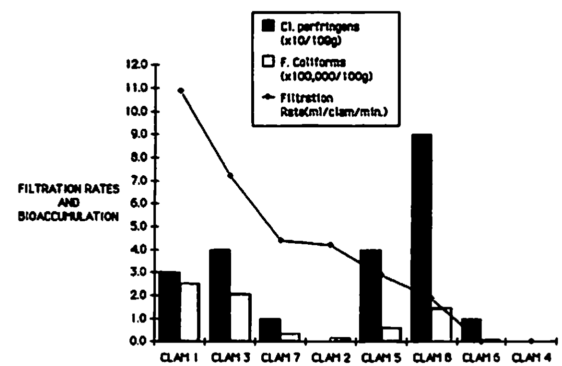

Figure 6

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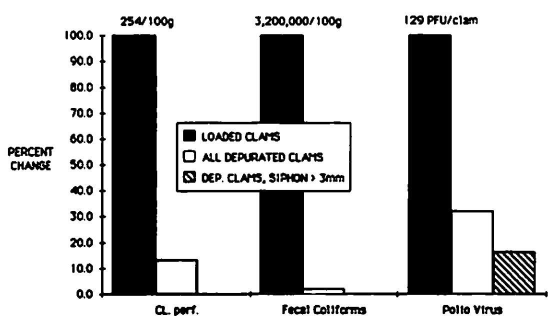

Figure 7

TABLE	*LEGEND*
1	*Enterovirus and Clostridium perfringens Recovery from hard Clams at the Commercial Depuration Plant.*
2	*Clostridium perfringens Content of Hard Clams Before and After Commercial Depuration (May 1984-Aug. 1985).*
3	*Siphon Extension Activity of Hard Clams at Jersey Shore Shellfish, Inc. (48 hr. Commercial Depuration Cycle, Aug. 1984-Aug. 1985).*
4	*Siphon Extension Activities vs. Sex of Hard Clams at Jersey Shore Shellfish, Inc. (Aug. 1984-Aug. 1985).*

	Clostridium perfringens/100g		Enterovirus plaques/100g	
Date	Before (N)	After (N)	Before (N)	After (N)
12/7/84	40.6 (8)	12.5 (8)	24 (1)	6 (1)
			0 (5)	39 (1)
				41 (1)
				0 (5)
2/22/85	10.0 (5)	116.0 (9)	22 (1)	0 (9)
			0 (4)	

(N) refers to the number of clam pools, each containing 3 individuals.

Table 1

Clostridium perfringens/100g				
Date	Group	Before	After	Efficiency
5/30/84	a	3989	21	99.4
	b	571	73	87.2
	c	538	52	90.3
6/6/84	a	230	<10	(100.)
	b	<10	<10	-
7/11/84	a	75	132	0
	b	15	31	0
	c	15	<10	(100.)
10/5/84	a	<10	<10	-
	b	10	31	0
	c	15	31	0
11/9/84		75	132	0
12/7/84		40.6	12.5	69.2
2/22/85		10	116	0
3/22/85		80	20	75.0
4/12/85		64	32	50.0
5/12/85		524	54	89.7
6/11/85		>2400	780	>68
6/24/85		3067	56	98.0
7/22/85		1576	700	55.0
8/26/85		65.4	10.5	84.0

Table 2

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Date	N	Temp.[1]	Temp.[2]	Percent Siphon Extension Activity: Variability of Individuals	Percent Siphon Extension Activity: Population Average	Acclim.*
8/22/84	24	20.0	23.0	0-24	13.5	1
10/5/84	24	14.0	14.5	2-52	26.3	2
11/9/84	24	15.0	12.3	1-53	17.3	1
12/7/84	24	9.5	3.0	—	0.0	3
2/22/85	48	15.0	5.7	4-63	22.1	2
3/22/85	48	12.0	6.5	11-77	48.0	4
4/12/85	48	12.0	9.6	10-63	42.6	2
5/13/85	48	16.8	19.2	17-65	44.8	1
6/24/85	48	19.2	20.2	21-54	35.4	4
7/22/85	48	17.8	24.9	15-54	29.7	2
8/28/85	48	19.8	24.5	0-52	10.6	4

Acclimation: (1) Depurated as soon as clams were brought into plant.
(2) Refrigerated for 24 hrs. prior to depuration.
(3) Experimental run at low depuration temperature.
(4) Refrigerated for 48 hrs. prior to depuration.

[1]Depuration Temperature (°C) [2]Sandy Hook Bay Temperature (°C)

Table 3

Date	N	Sex	Percent Siphon Extension Activity: Variability of Individuals	Percent Siphon Extension Activity: Population Average
8/84	31	M	4-54	25.7
	41	F	0-62	23.9
10/84	25	M	2-24	29.1
	23	F	5-52	28.0
11/84	24	M	5-48	21.3
	24	F	1-53	18.3
2/85	19	F	4-40	18.4
	27	M	8-63	22.2
3/85	29	M	11-75	44.7
	13	F	17-77	51.2
4/85	27	M	10-63	42.4
	13	F	17-60	37.8
5/85	21	M	35-65	46.2
	21	F	17-60	44.2
6/85	25	M	21-54	37.1
	19	F	21-41	32.8
7/85	14	M	21-42	27.8
	10	F	15-54	28.6
8/85	18	M	0-18	8.1
	29	F	0-52	11.8

Table 4

JOB SATISFACTION AND FISHING: A COMPARATIVE STUDY

B. McCay and J. Gatewood

Fishing is an unusual form of work. Fishermen labor long and erratic hours in an economically uncertain enterprise. The work setting is typically far from home and family. Rather than a daily schedule of work, leisure, and sleep, the typical fisherman's work day is simply work and sleep. Computed on an hourly basis, fishermen's earnings are generally low compared to other forms of work and also unpredictable. Despite the uncertainty, long hours, and low pay, thousands of Americans persist in the occupation of commercial fishing. What, then, is so attractive about commercial fishing? What do fishermen like and dislike about the work they do?

Drs. McCay and Gatewood are investigating these questions by surveying commercial fishermen in New Jersey's marine waters. The questionnaire went through five revisions, the final form being twelve-pages long. It is administered to fishermen dockside, and it is in two parts. The first part consists of 33 specific items, for which fishermen indicate their level of satisfaction on a five-point scale ("very dissatisfied" to "very satisfied"), three global measures of job satisfaction, and two questions dealing with alternative work opportunities. The second part asks a wide range of biographical questions, providing descriptive information about the people engaged in commercial fishing and specifics regarding their boats, gear, and other objective aspects of their current situations. Data from Part I of the questionnaire allow comparisons to be made among different fishery groups, both in terms of levels of job satisfaction (analysis of variance) and patterning among the specific components of satisfaction (factor analysis). The biographical information from Part II provides the independent variables for other sorts of correlational analyses of the job satisfaction data.

The survey is expected to take three years and will include interviews with about 350 fishermen working in seven fisheries. Sampling is done by the "dockside intercept" method in several ports along the Jersey Shore. No more than three interviews are done with the fishermen on a single boat: the captain and two hands (captain and three hands in fisheries where crews are large).

During the first year of the project, about 130 sea clammers, longliners, and baymen completed questionnaires. These groups represent the extremes of variation among New Jersey's major commercial fisheries. Sea clamming (including both surf clamming and quahogging) is a heavily mechanized fishery, involving daytrips in pursuit of relatively immobile prey species. Longlining for tilefish or swordfish and tuna is more of an open ocean enterprise requiring trips of several days to several weeks, and the prey are highly mobile. Baymen operate on a much smaller, personal scale and have much more control over the timing of their activities. In subsequent years, draggermen, oystermen, scallopers, and gillnetters will be included in the sample, as well as a comparison group of fisheries scientists and managers.

Although no results are available from the survey at this early stage, there are a couple of observations to note. Firstly, only about eight of approximately 140 fishermen asked to do interviews have refused. This exceptionally high response rate (ca. 95%) indicates the fishermen themselves are interested in the project and its subject matter. Secondly, almost all of the first year's sample indicated they would like to receive a copy of the survey's findings when these are ready. Apparently, fishing is regarded as an unusual form of work not only by social scientists, but also by the fishermen themselves.

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MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT

Less a program than a category, because the marine technology and development needs and opportunities of the state and region lend themselves to projects, but not to a single theme, the New Jersey Sea Grant Program supported two unique projects in the area of Marine Technology Research and Development during year nine.

The waters giveth and the waters taketh away—and mostly taketh away—sand. As a consequence, beach maintenance for shore protection and public use has, in many locations, depended on nourishment with sand brought from other places. Sand is taken from offshore areas, back bays, inland borrow pits, nearby inlets, and more distant sources. As local supplies are used up, the cost of bringing sand to the depleted beach increases, and structures to retain sand become economically feasible.

Research designed to evaluate the effectiveness and performance in sand saving of a "perched beach" on Delaware Bay will ultimately lead to definitive quidelines and designs for beach erosion control which can be applied on a broad basis.

Turning to the sea as a source of biomedicinals, the second project in this category focused on the pursuit of cobalamins (vitamin B-12) and its analogs in the marine environment. Current methods involve complex and difficult bioassay techniques, resulting in the decline of research in this area. This project focuses on a simplified technique for determining cobalamins in marine waters, and could result in immeasurable benefit to both the medical and marine science communities.

EVALUATION OF THE PERFORMANCE OF A PERCHED BEACH - SLAUGHTER BEACH. DELAWARE

R. Weggel

Beach nourishment (placing sand on a beach to provide a wide recreational beach or to protect development behind the beach) has historically been an economical way to solve many beach erosion problems. In recent years, however, the cost of sand for beach nourishment has increased significantly. One way of possibly reducing these costs is to include sand retaining coastal structures in a project to reduce the rate at which sand is lost from the project. Conventional coastal structures such as groins (termed jetties in New Jersey) have traditionally been used to prevent longshore movement of sand out of a project area. A little-tested, sand retaining structure thought to be effective against offshore sand loss, is a low-crested, shore-parallel sill which, in theory, reduces the offshore sand transport rate. See Figure 1. Termed a "perched beach" since it elevates (or perches) the beach within the project area above the surrounding beaches, it provides a wider beach within a well-defined project area.

Few perched beach projects have been built and none have been built in an exposed, open ocean environment. Those that have been built are all in semi-protected bays or sheltered inland waters. In 1978, under the auspices of the Shoreline Erosion Control Demonstration Act, the Corps of Engineers built a perched beach in Delaware Bay at Slaughter Beach, Delaware. This project provides a unique opportunity to study the performance of a perched beach since there is a wealth of historical wave and beach profile data available for both before and after the time the sill was built. The present study is aimed at quantifying the

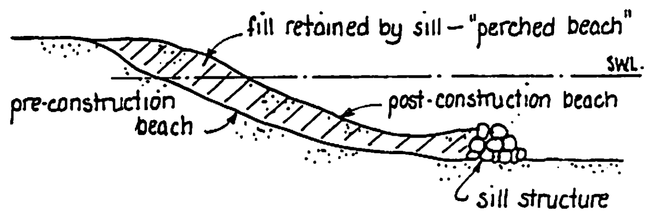

Figure 1. Conceptual perched beach installation showing offshore sill and raised beach behind sill.

physical environment and coastal processes at Slaughter Beach and the changes in those processes brought about by construction of the sill. Although immediately directed at the Slaughter Beach project, the study is more general since it seeks to transfer what is learned at this site to other sites.

The offshore sill at Slaughter Beach is 1000 feet long and about 200 feet from shore. It is built in water about 3.5 feet deep (MLW datum). See Figure 2. Three different types of construction were used; the northernmost section is built of sand-filled bags, the middle section of timber sheet piling, and the southermost section of sand-filled concrete boxes. Each section is about 330 feet long. The sill's crest elevation is at about the MLW line so the crest is often visible at low tide. Shore return sections connect the sill with the beach at the northern and

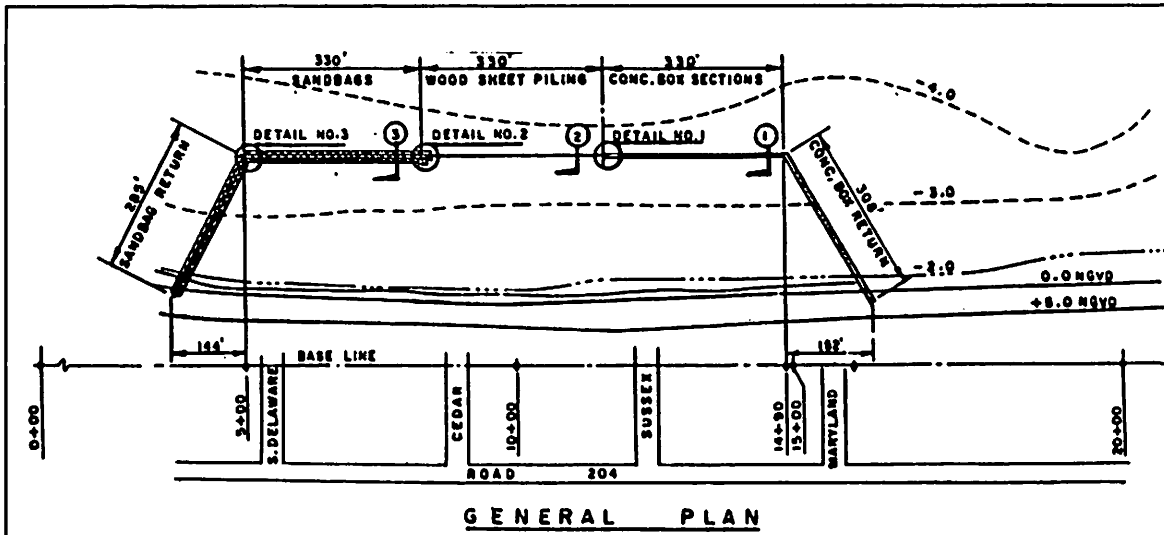

Figure 2. Slaughter Beach, Delaware — Perched Beach Project

southern ends of the project so that the structure forms an enclosure. The enclosure was subsequently filled with coarse beach fill dredged from offshore in Delaware Bay.

During the first year of the present study efforts were directed toward obtaining data, putting in into computer compatible form, and performing preliminary analyses to define the physical environment at Slaughter Beach. Longshore sand transport rates were computed from visually obtained breaking wave height and period data, breaking wave angles, and longshore current measurements. Two different (though not totally independent) estimates of longshore sand transport rates are shown in Figure 3 and 4. Generally the two methods give comparable results. A third method using wind data obtained at Dover AFB and the shallow water wave hindcasting equations is presently being explored. The computer algorithm developed for the shallow water hindcasting equations was first written as an interactive BASIC microcomputer program. This program has been documented and will be published as a Drexel University, Hydraulics and Water Resources Laboratory Report entitled "An Interactive BASIC Computer Program for Predicting Shallow Water Wave Conditions."

Work during the second year of funding is being directed toward describing and quantifying beach profile changes in response to the wave and longshore transport environment - both within and outside of the perched beach area. Example beach profiles taken through the sill preceding and following construction are shown in Figure 5. Net onshore-offshore transport between successive surveys is being determined by a finite difference,

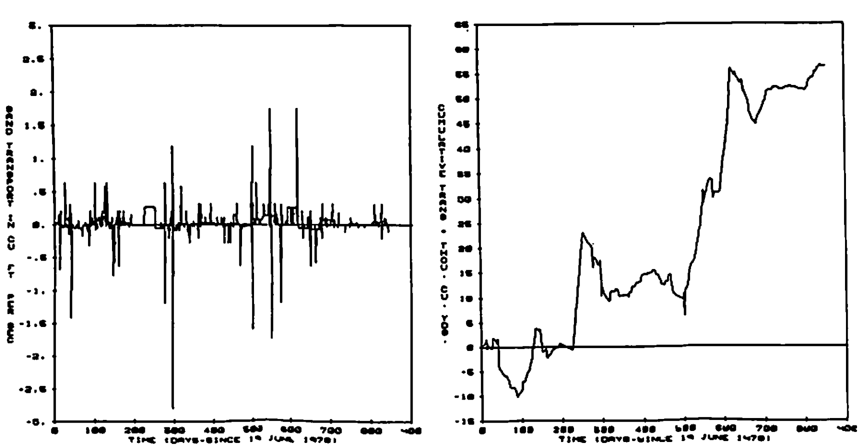

Figure 3. Longshore sand transport rates and cumulative longshore transport based on measurements of breaking wave angle.

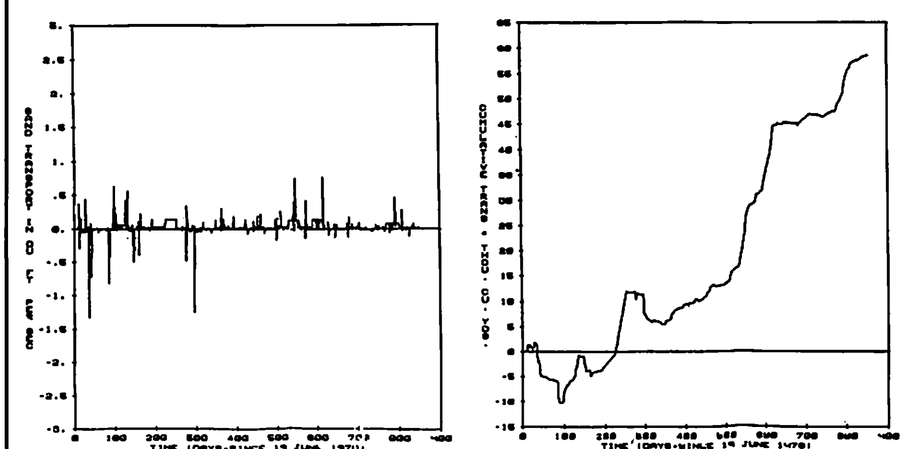

Figure 4. Longshore sand transport rates and cumulative longshore transport based on measurements of longshore current velocity.

mass balance sheme at discrete points across the profile. These net onshore-offshore transport rates will be related to local values of water depth, beach slope, and with the wave conditions prevailing during the intervening period. The transport rates will be compared with available onshore-offshore transport models and the sill's effect on this onshore-offshore transport determined. We suspect that the sill might reduce onshore sand movement more than it reduces offshore movement. This is contrary to what is desired and would cause an increase in offshore sand loss. If this is found to be the case, a perched beach could do more harm than good. The conclusion must await completion of the analysis!

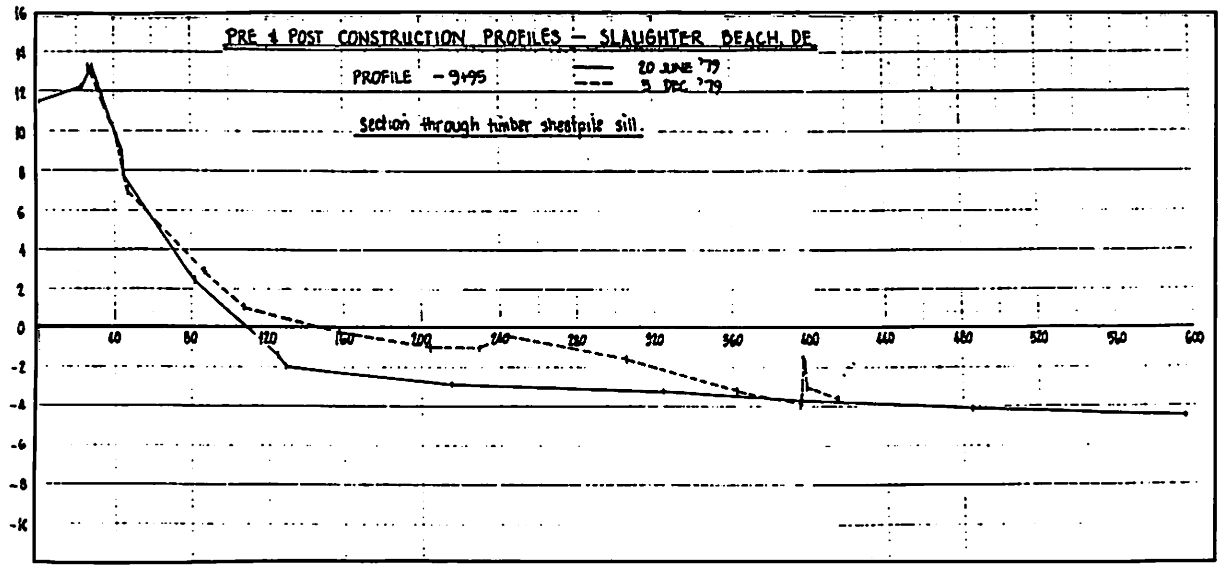

Figure 5. Typical beach profiles through perched beach project — before and after sill construction.

RADIOISOTOPE DILUTION TECHNIQUES FOR THE DETERMINATION OF COBALAMINS IN MARINE WATERS

G. Sharma, H. Shigeura, and B. Mueller

Vitamin B_{12} and its more than a dozen analogs are collectively called cobalamins. These biologically highly potent micronutrients are present in ocean waters in extremely small amounts. Because of their limited supply and metabolic importance, many investigators have suggested that cobalamins, especially B_{12}, may be playing an important role in controlling geographical and seasonal aspects of the phytoplankton succession. However, much work is needed to decide whether this is the case.

The progress in marine B_{12} work has been hindered by the lack of analytical techniques by which the seasonal variations in the concentration of the micronutrient in ocean waters could be measured rapidly and accurately. The microbiological techniques which have thus far been used for the analysis of B_{12} in the marine environment are technically tedious and time consuming. In addition, bioassays give false low values when inhibitors are present in ocean waters. Once the presence of inhibitors is suspected in samples a much more elaborate protocol suggested by Carlucci needs to be followed. Because of these drawbacks of microbiological assays no more than 4 to 5 dozen samples can be analyzed by a single investigator in one month. Research programs aimed at the evaluation of ecological role of cobalamins usually generate a large number of samples for the assessment of B_{12} and its analogs. In order to complete the studies in a reasonable period of time, it will be essential to develop techniques by which concentration of B_{12} and its analogs in ocean waters could be measured rapidly and precisely regardless of the presence of inhibitors in the samples.

The radioisotope dilution techniques (RID techniques or simply radioassays) developed for the determination of B_{12} in human blood plasma are endowed with all the characteristics needed for the determination of the micronutrient in ocean waters. These techniques require the use of four reagents: vitamin B_{12}; ^{57}Co-labelled B_{12}; a protein that binds vitamin B_{12} specifically and coated charcoal. The procedure involves addition of the same amount of labelled B_{12} to aliquots of samples and standard solutions of unlabelled B_{12}. Then a substoichiometric amount of B_{12}-binding protein is added. Since the protein binds the labelled and unlabelled B_{12} with equal affinity, the level of radioactivity bound is inversely related to the amount of B_{12} present in samples and standard solutions. Coated charcoal is added to absorb all the free B_{12}. After centrifugation, the supernatants, which contain only bound B_{12}, are counted and from the data B_{12} levels in unknown samples can be calculated. With these techniques more than 50 samples can be analyzed in duplicate by a single investigator in one day!

The detection limits of radioassays depend upon the association constant of the protein for B_{12}. Among the cobalamin-binding proteins so far discovered mammalian intrinsic factor (IF) is the only protein that binds B_{12} specifically. The binding constant of IF for B_{12} is 10^{10} M^{-1}. When this protein is used as a binding agent in radioassays the detection limit of the technique is around 20 pg B_{12}/ml.

The concentration of B_{12} in ocean waters as determined by bioassays lies in the 1-15 pg/ml range. The determination of such low levels of B_{12} by radioassays will require proteins which should bind B_{12} specifically with affinity constant in excess of 10^{11} M^{-1}. The problem is that proteins which bind B_{12} specifically with such high avidity have not been discovered yet.

In the 1984 Sea Grant proposal, we suggested that proteins with higher affinity and specificity for B_{12} should be present in marine organisms. The rationale behind this idea was that many marine organisms are able to satisfy their biological need for B_{12} and/or its analogs by absorbing them directly from the water column. These organisms must be accomplishing the remarkable feat of sequestering B_{12} from a medium of extremely low concentration with the help of proteins that bind B_{12} and its analogs differentially with affinity constant greater than that of intrinsic factor. These proteins may be isolated and used for the development of RID techniques needed for the determination of B_{12} in ocean waters.

We have obtained confirmation of this hypothesis by discovering that B_{12}-binding proteins are present in the body fluids and/or tissues of horseshoe crabs (***Limulus polyphemus***), clams and sponges (Table 1). The most gratifying discovery of the project has been that Limulus blood plasma which is a waste product of Limulus Amebocyte Lysate industry (LAL industry) is rich in two proteins which bind vitamin B_{12} with specificity reminiscent of mammalian intrinsic factor. These proteins have been separated into fractions A and B by a combination of ammonium sulfate precipitation and gel filtration techniques (Fig. 1).

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Fractions A and B exhibit binding constants of 5×10^{11} and 1×10^{11} M^{-1} respectively for vitamin B_{12}. These fractions are by no means homogenous. Fraction A is a mixture of B_{12}-binding proteins, extraneous proteins that don't bind cobalamins at all and a small amount of proteins which bind B_{12} and its analogs indiscriminately. Fraction B on the other hand contains only two types of proteins; a B_{12}-binding protein and proteins that don't bind cobalamins.

By using Fraction B proteins as the B_{12} binding agent we have developed a radioassay technique for the direct determination of the micronutrient in ocean waters. Current detection limit of the method is around 5 pg B_{12}/ml and the standard deviation at this level is $\pm$ 0.5 pg.

Compared to Fraction B, Fraction A exhibits 5 times higher binding constant for B_{12}. By using Fraction A as the binder we hope to lower the detection limit of the assay to less than 2 pg B_{12}/ml. However, use of this fraction in RID techniques will have to await its further purification to remove those proteins which bind not only B_{12}, but its analogs as well. Further work on the development of radioisotope dilution technique is in progress.

In conclusion, our investigations have shown that Limulus blood plasma is rich in proteins which bind B_{12} specifically with affinity constants at least an order of magnitude greater than that of intrinsic factor. We anticipate that Limulus blood plasma may serve as a commercially prefered source of B_{12}-binding proteins needed by all diagnostic companies to serve as binding agent in their vitamin B_{12} radioassay kits. The use of Limulus B_{12}-binding proteins in these kits is expected to increase the low-end sensitivity of the standard curve. The low-end sensitivity of radioassays is important for diagnosing vitamin B_{12} deficiency and evaluating patients with anemia.

TABLE 1

B_{12}-BINDING ACTIVITIES OF MARINE ORGANISMS

Marine Organisms	Biological Specimen	B_{12}-Binding Activity
Horseshoe Crabs	Blood Plasma	+++
	LAL	+++
	Amebocyte Ghosts	+++
Blue Crabs	Blood Plasma	-
	Blood Cells	-
Clams	Whole Animal Tissue	+++
	Clam bellies	+++
Sponges (Three Species)	Whole Animal	+

Abbreviations: +++ = very active; ++ = active; ++ = moderately active; - = no B_{12}-binding activity; LAL = Limulus Amebocyte Lysate

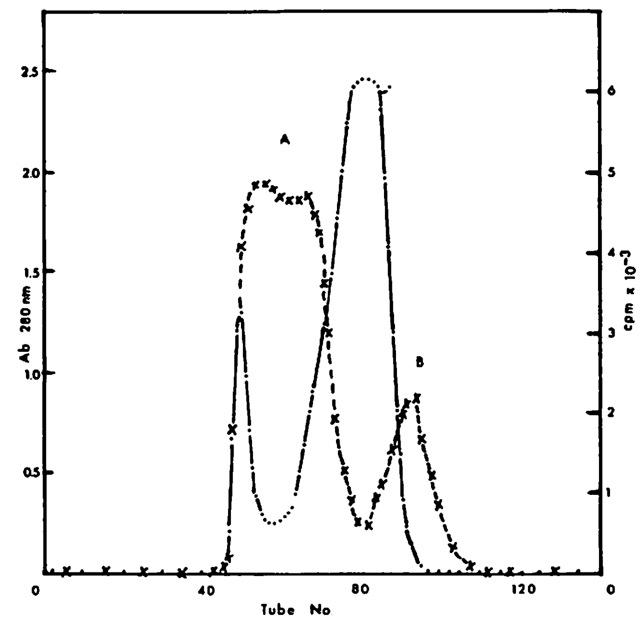

Fig. 1. Sephadex G-150 chromatography of the precipitate obtained after the addition of ammonium sulfate to Limulus blood plasma. The column (3 x 90 cm) was eluted with 0.1 M NH_4HCo_3 solution and 125 fractions, each measuring 3.6 mL, were collected. Solid line (0--0) represents absorbance at 289 nm and the broken line X--X) represents $^{57}CCoB_{12}$ binding activities of the fractions.

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COASTAL SYSTEMS PROGRAMS

In program year eight, New Jersey Sea Grant introduced a fully integrated coastal systems program of four mutually supporting projects directed to a state and national problem: the filling and narrowing of waters between barrier islands and headlands. This filling in of back barrier areas has serious implications. First, as waters become more shallow and shoal-filled, both the navigability and general utility of the areas are diminished. Second, the environments evolve from subtidal to intertidal, and finally to salt marshes with narrow channels.

The process is well underway along the New Jersey shore, but is not limited to this state; it occurs to a greater or lesser degree wherever barrier islands exist.

Research during year nine continued to define the processes, so that the futures of the ecosystems can be predicted, possible management steps defined, and development and preservation planning more soundly based. Because of the importance of the barrier island system and its back barrier areas, the program has the full cooperation of the New Jersey Department of Environmental Protection and already has benefited from consultation with the Corps of Engineers on selection of a model to provide a core program element.

As data collected from all projects reaches adequate size, work on the sediment transport/accumulation model will continue until, at completion, the model will be implemented and the "ground truth data" from the field scientists will provide accurate criteria for model evaluation.

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SEDIMENT CHARACTERISTICS AND RECENT ACCUMULATION RATES: DETERMINATION OF VARIABLES REQUIRED FOR A NUMERICAL SIMUALTION OF MODERN SEDIMENTATION IN THE SALT MARSH COMPLEX OF SOUTHERN NEW JERSEY

B. Carson

The second year of this study was devoted to determination of the characteristics of suspended sediments and examination of short-term accumulation rates in Great Sound and Great Channel, portions of a tidal lagoon complex located west of Avalon and Stone Harbor, New Jersey (Fig. 1).

Suspensate in the region consists of single (silt and fine sand) grains, organic-mineral agglomerates, and fecal pellets (Carney, 1982). Single grains (16 - 200 um) are transported primarily on maximum ebb and flood currents, and comprise the dominanat constituent of channel and near-channel bottom deposits. Organic-mineral agglomerates incorporate very fine inorganic particles (< 8 um) in aggregated bundles ranging in size from 8 to 36 um, and in density from 1.07 to 1.20 Mg/m^3. Their settling velocities are equivalent to single quartz grains with diameters ranging from 5

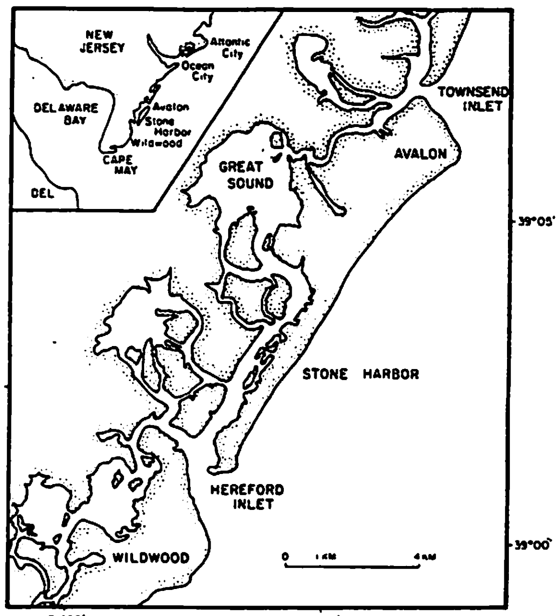


Figure 1. Location of Great Sound along the southern coast of New Jersey (from Thorbjarnarson et al.).

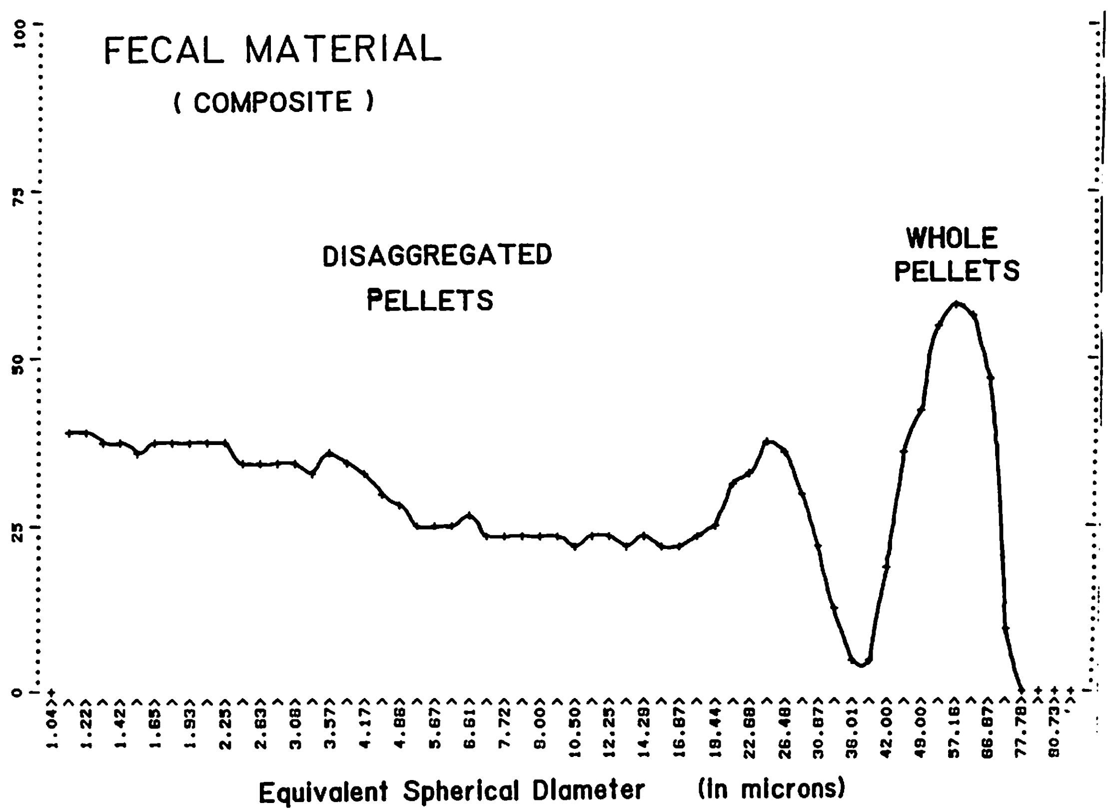


Figure 2. Sizes of whole fecal pellets and the grains which comprise them from one settling velocity fraction (31 to 44 um equivalent spherical diameter, density = 2.65 Mg/m^3) of suspensate collected in Great Channel. Note the prominant silt peak at 26 um and the broad spectrum of particle sizes below 16 um. Abundances reflect relative weight percent.

to 13 um. Bottom sediments of comparable (disaggregated) sizes are found only on the extreme eastern and western margins of Great Sound. Fecal pellets are found primarily in the 25 to 63 um (equivalent quartz diameter) settling fractions, although their measured diameters range from 34 to 120 um. Consequently, densities range from 1.6 to 1.9 Mg/m^3. All pellets consist of varying proportions of two components: a broad spectrum of fine and medium silt to clay (< 10um), and a mode of very fine to coarse silt (between 6 and 60 um). An example of fecal material in one settling velocity fraction (31 to 44 um, equivalent diameter) is shown in figure 2. Equivalent bottom sediments appear to accumulate east and west of the Intracoastal Waterway, in the open portions of the Sound unifluenced directly by dredge spoil disposal.

In Great Channel, fecal pellets on flood tide contain fine to medium silt and clay (minimum 45-50% by volume, <10 um); the silt mode is less pronounced (maximum 50-55% by volume). During ebb tide, however, pellets contain less very fine silt and clay (minimum 15-20% by volume, <8 um) and a well-defined silt mode (maximum 80-85% by volume). This temporal pattern of pellet variation may reflect either differing populations of pellet producers in Great Sound and in the seaward reaches of Great Channel (near Hereford Inlet) or disaggregation and reformation of pellets over a 12 hour tidal cycle. Regardless of the mechanism, the observed pattern of biologically aggregated constituents implies a preferential seaward transport of >10 um particles and landward transport of finer grains in pellets.

Sediment traps deployed in Great Sound (Figure 3) record short-term (2weeks-2months) deposition ranging from <0.002 to 0.45 g/cm^2/day (or about 57 to 940 cm/yr). These rates, which are similar to those recorded by Levy (1978) in adjacent Jenkins Sound, are four to five orders of magnitude higher than the Pb-210 determinations (Thorbjarnarson et al, submitted) at comparable locations (cores 4 (0.27 cm/yr) and 11 (0.54 cm/yr), traps 6 (700 cm/yr) and 14 (245 cm/yr), Figure 3). These data indicate that short-term deposition and resuspension are the norm in all parts of Great Sound. The sediment trap data indicate that short-term deposition rates are much higher near former dredge disposal sites (traps 2 (2474 cm/yr) and 12 (9400 cy/yr), Figure 3). No longer-term radiochemical accumulation rates are available from these coarser sediments.

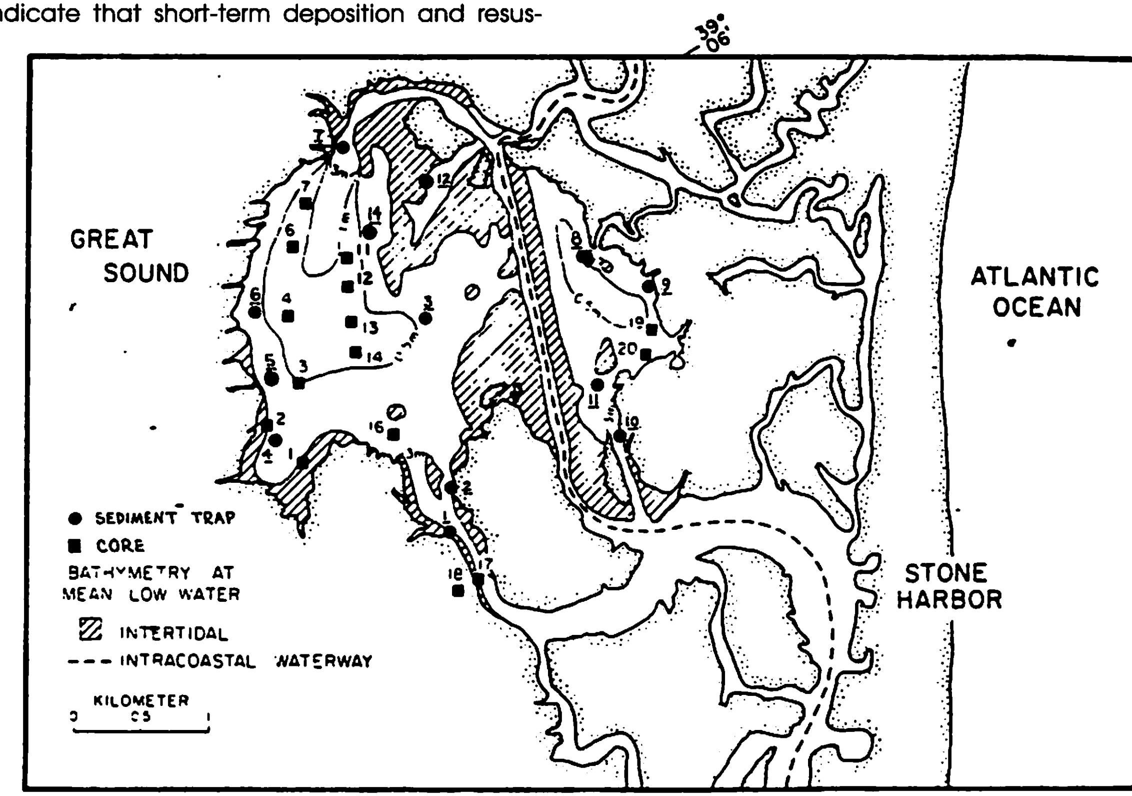


Figure 3. Bathymetry, core locations, sediment trap locations, and position of the Intracoastal Waterway in Great Sound (after Thorbjarnarson et al.). The islands and intertidal portions of the sound represent regions affected by dredge spoil disposal.

HYDRODYNAMIC MODEL OF AN INLET-SOUND SYSTEM IN SOUTHERN NEW JERSEY

G. Lennon and R. Weisman

The second year of this study was devoted to applying the two-dimensional finite-difference hydrodynamic model, HYDTID, to the Great Sound region of New Jersey. The model had previously been used for Masonboro Inlet, North Carolina by the U.S. Corps of Engineers and for Hereford Inlet, New Jersey by these writers. Figure (1) shows the study area with grid lines indicating the discretized finite difference cells of the system. The model grid extends from Great Channel to Ingram Thorofare, including all of Great Sound.

In addition to the starting hydrodynamics (water levels and velocities), the model required a transient tidal water level forcing function where the channels cross the model grid. Then, for the discretized geometry, bathymetry, and for assumed values of the roughness parameter, the water depth in each cell and flows between each cell are computed.

In order to calibrate the roughness parameter a field effort was undertaken in the second year (1984) to obtain water levels and flowrates at four locations as indicated in Figure (1). Flow measurements were obtained using a Gurley-Price saltwater current meter. An additional water level recording station was installed at Stone Harbor Boulevard Bridge. A survey team ran a vertical survey that tied water level measurements to a common vertical datum (National Geodetic Vertical Datum or NGVD). A simplified governing differential equation was utilized to obtain the variation in the Manning's roughness parameter (see Fig. 2). The 1983 and 1984 field work yeilded

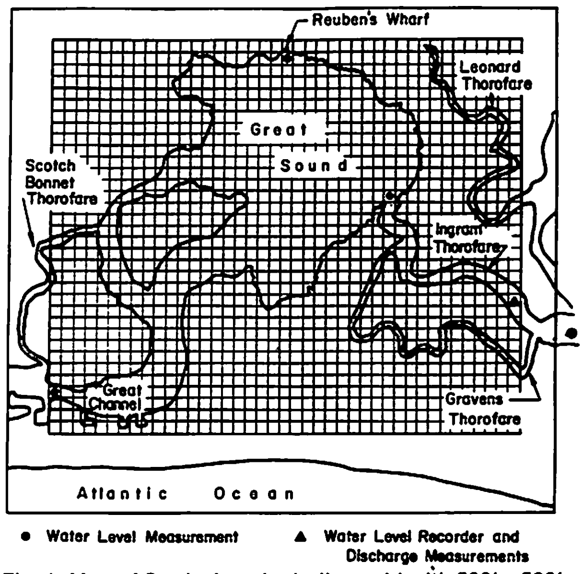


Fig. 1. Map of Study Area including grid with 500' x 500' cells.

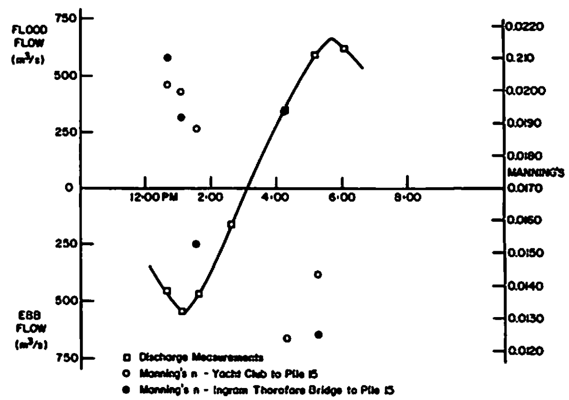


Fig. 2. Variation in Manning's n for a Tidal Cycle, Spring Tide, May 31, 1984.

simultaneous stage and flow hydrographs at the above mentioned locations for both neap and spring tides. Some of these data were acquired while other investigators were simultaneously obtaining velocity, bathymetry, and sediment data (Carson, Ashley, Hall and Nadeau).

Figure (3) shows simultaneous water level data observed for a spring tide at the three water level stations. Figure (4) shows the comparison of calculated and observed water levels at Rueben's Wharf. Figures (5) and (6) show flow rate hydrographs at the two discharge measurement locations in Great Channel and Ingram Thorofare. The calculated tidal prisms for Great Channel and Ingram Thorofare (at the grid boundaries) are shown in Tables 1 and 2 respectively.

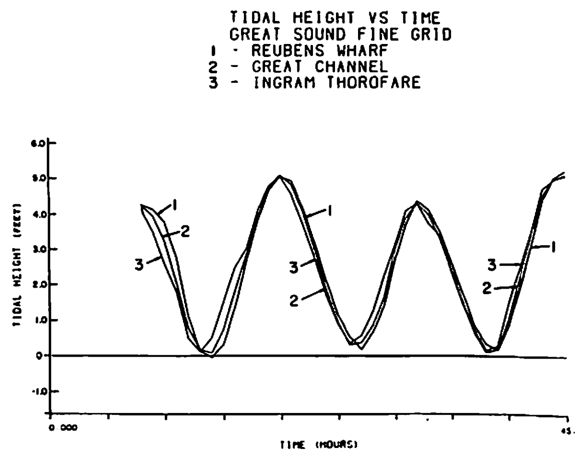


Fig. 3. Spring Tide Water Level Measurements, May 24-25, 1983

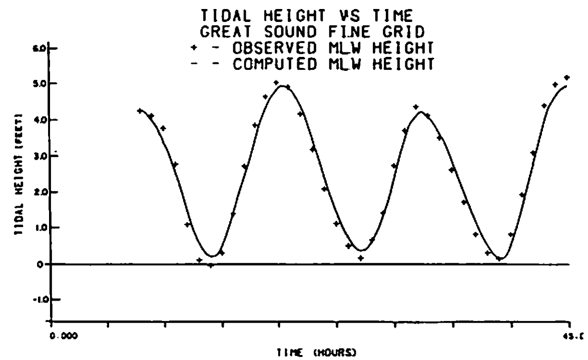


Fig. 4. Tidal Height Versus Time - Spring Calibration

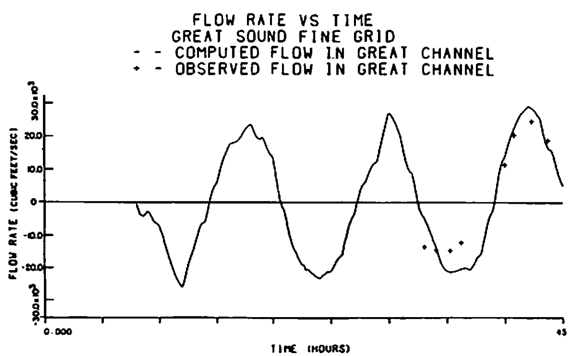


Fig. 5. Flow Rate Verus Time in Great Channel - Spring Calibration

At the end of the second year, the hydrodynamic model was calibrated for the 1983 neap tide data using the 1984 Manning's roughness values. Figure (7) depicts a current pattern throughout the system at an instant in the tidal cycle during filling of the sound.

From these results it can be seen that the model accurately simulates neap tide conditions in Great

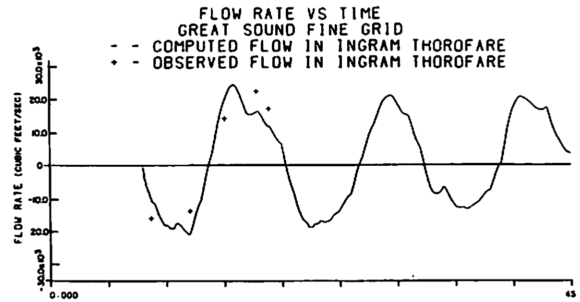


Fig. 6. Flow RAte Versus Time in Ingram Thorofare - Spring Calibration

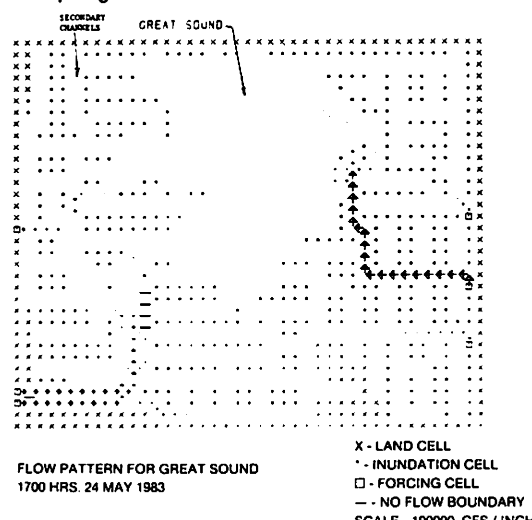


Fig. 7. Flow Map of Great Sound

Sound. Further calibration and verification will be performed as part of the third year of effort.

In addition, work has begun on the sediment transport model of the Great Sound system. A full report on that work will be included in the Annual Report of the third year of this study (1985-1986).

Ebb/Flood	Start Time	Tidal Prism	
		(m^3)	(ft^3)
E	0800	$9.90x10^6$	$34.97x10^7$
F	1400	$1.31x10^7$	$46.15x10^7$
E	2030	$1.35x10^7$	$47.60x10^7$
F	2730	$9.62x10^6$	$33.96x10^7$
E	3230	$1.40x10^7$	$49.35x10^7$
F	3900	$1.61x10^7$	$56.90x10^7$

Table 1: Tidal Prisms for Great Channel — Spring Calibration

Ebb/Flood	Start Time	Tidal Prism	
		(m^3)	(ft^3)
E	0800	$1.32x10^7$	$46.57x10^7$
F	1400	$1.53x10^7$	$54.04x10^7$
E	2100	$1.38x10^7$	$48.83x10^7$
F	2700	$1.15x10^7$	$40.78x10^7$
E	3200	$9.90x10^6$	$34.97x10^7$
F	3900	$1.38x10^7$	$48.77x10^7$

Table 2: Tidal Prisms for Townsend Inlet — Spring Calibration

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

THE ROLE OF SECONDARY TIDAL CHANNELS IN SEDIMENTATION WITHIN THE BACK-BARRIER ENVIRONMENT, INTRACOASTAL WATERWAY, NEW JERSEY

G. Ashley and M. Zeff

The southern coast of New Jersey is characterized by developed barrier islands backed by salt-marshes. A 3-year research project designed by Dr. Gail M. Ashley (Rutgers University) and assisted by Marjorie L. Zeff (a PhD candidate at Rutgers) was initiated in 1983 to assess the different roles played by the various tidal channel types that dissect the marshes of Stone Harbor, NJ and to characterize the patterns of sediment dispersal in the back-barrier marsh system.

Back-barrier marshes are traversed by branching networks of tidal channels of various dimensions. The 2 largest channels in this study area, primary channels, lead from Townsend Inlet in the north and Hereford Inlet in the south to Great Sound, a shallow lagoon. Secondary and tertiary channels are smaller distributaries that branch off the primary channels and penetrate the marsh interior (Fig. 1).

The role of the primary channels in sediment dispersal in the marsh was investigated in Sea Grant VIII (1983-84). The objective of year 2, Sea Grant IX (1984-85), was to: 1) quantify water movement and sediment flux in secondary and tertiary tidal channels and 2) integrate these data with that of primary channels to fully characterize sediment dispersal in this system under normal (non-storm) conditions.

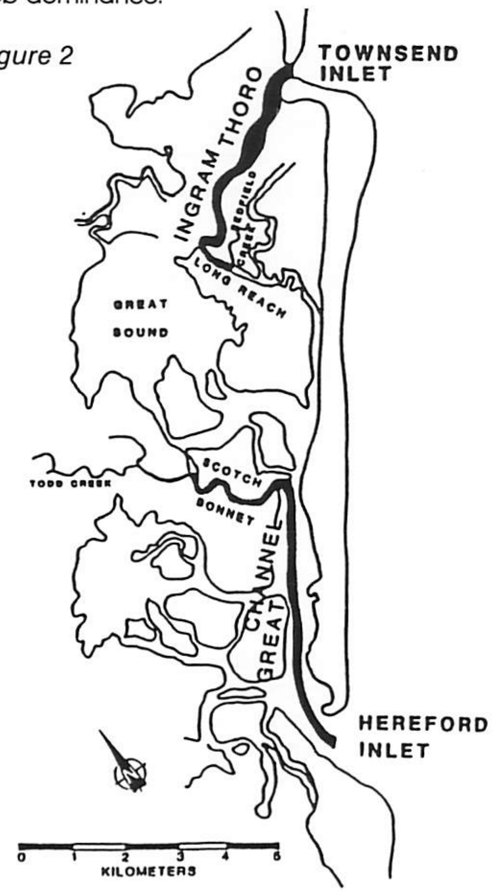
Field data were collected during the summer of 1984 and winter of 1985. Velocity profiles and suspended sediment samples were taken in two representative tidal channel networks each consisting of primary, secondary, and tertiary channels in series. System I (Ingram Thorofare, Long Reach, and Redfield Creek) and system II (Great Channel, Scotch Bonnet, and Todd Creek) are shown on Figure 2. Measurements were taken during both flood and ebb portions of the tidal cycle over a variety of tidal range conditons. Highest discharges are reached during spring tidal ranges.

Figure 1. Aerial view looking northward towards Hereford Inlet.

The simultaneous measurement of velocity and suspended sediment load permitted the temporal and spatial correlation of changes in hydraulic conditions and sediment transport load in each system. In addition, the integration of these data with similar data collected in primary channels during year 1 has allowed us to develop a descriptive model of fair-weather water and sediment flux through the marsh.

The time-velocity relations of each channel type are unique (Fig. 3). Peak velocities reached in the secondary and tertiary channels are less than those attained by primary channels under similar tidal ranges. Secondary channels peak earliest in the flood cycle, followed by primary and lastly by tertiary channels. With rapid drainage off the marsh, tertiary channels peak earliest during the ebb pahse, followed by primary and lastly by secondary segments. While primary channels are strongly flood-dominant, flow in secondary and tertiary channels exhibit weak flood-dominance to slight ebb-dominance.

Figure 2



The total suspended sediment load transported through the channel system is noticeably greater in secondary and tertiary channels (peak values reached 59 mg/L at 0.4d-0.5d) than in primary channels where peak values under similar conditions reached 16 mg/L at 0.4d. Total suspended sediment concentrations throughout the system generally increase during the ebb cycle to maximum values late in the ebb and into the flood cycle. During the flood the suspended load decreases.

The time-velocity asymmetry relations and the suspended sediment concentrations suggest that finer sediments draining the marsh during the ebb are transported back to the marsh interior when flow direction reverses and are deposited there as flow velocities wane. Primary channels are the major conduits of sand dispersal, primarily from the inlets to Great Sound, while secondary and tertiary channels are the pathways of fine sediment disperal to the marsh interior.

The temporal and spatial relationships of water velocities and sediment load have been characterized for the Stone Harbor back-barrier marsh system under fair-weather conditions. In order to more fully describe and understand the dynamics of sediment movement through this system, hydraulic and sediment data will be collected under storm conditions during the third and final year of this study.

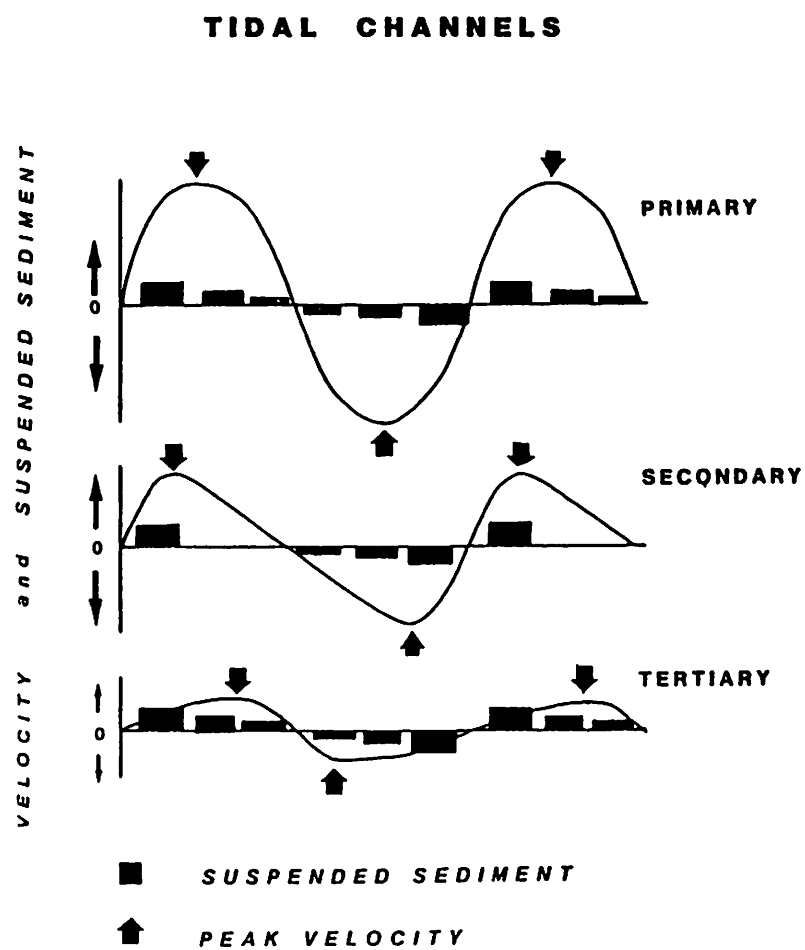


Figure 3

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

TRACING OF POLLUTANTS USING TRACE METALS ASSOCIATED WITH SEDIMENTS IN THE LAGOONS OF SOUTHERN NEW JERSEY

J. Nadeau and M. Hall

Great Sound is located in southern New Jersey behind the barrier island between Hereford Inlet and Townsend Inlet (Figure 1). Great Sound was selected for intensive study since the fresh water inlet is minimal or non-existant and some prior information and historical studies had been completed previously.

The purpose of the second year of investigation was to determine the levels of contamination of nine trace metals (As, Cd, Cu, Cr, Fe, Mn, Ni, Pb, and Zn) within the transport system as suspended sediment. This information is used to evaluate the fine-grained sediment movements within the tidal system. In addition, identification of organic components within the transport system is being completed on selected samples. This information allows selection of organics to be used in evaluating movement of sediments as well as provide a baseline for organic contaminant concentrations.

Previous work had been completed by the authors and several students in the nearshore environments of southern New Jersey. Trace metals had been used to establish the existance of a plume which, under certain conditions, moved sediments from Delaware Bay northward into the shallow marine environment in southern New Jersey.

Areal distributions of bottom grab samples collected during the first year reveal that higher concentrations of all metals considered in this work were associated with the southern access route to Great Sound via Gull Island Thoroughfare. Concentrations were comparable to those in the

ANALYTICAL SUMMARY

SITE	Cu	Zn	Cr	Pb	Fe
1. Great Channel (North of Stone Harbor Bridge)					
Suspended Ebb	800	246	20	47	5685
Suspended Flood	130	156	25	51	4533
Bottom	20	198	16	38	1024
2. Gull Island Channel					
Suspended Ebb	314	276	37	49	6412
Suspended Flood	69	107	32	47	4474
Bottom	61	155	28	35	1471
3. Cresse Thoroughfare					
Suspended Ebb	—	—	—	—	—
Suspended Flood	119	203	52	39	5073
Bottom	131	197	34	98	1135
4. Great Sound					
Suspended Ebb	—	—	—	—	—
Suspended Flood	132	182	51	22	4414
Bottom	81	127	36	14	1478
5. Ingram Thoroughfare (At Entrance to Great Sound)					
Suspended Ebb	216	172	25	38	4205
Suspended Flood	70	85	26	32	4292
Bottom	25	79	19	16	1052
6. Ingram Thoroughfare (South of Avalon Bridge)					
Suspended Ebb	211	360	48	90	7856
Suspended Flood	150	234	36	56	5944
Bottom	55	182	21	48	1137

TABLE 1 — Analytical summary of data derived to date. All samples were collected from the channel along the ICW. Results presented are in ppm/g.

shallow marine environment and suggest that some of the materials have been brought into the Great Sound system by tidal activity. This is further supported by the distribution of higher metal levels in the southern access area even though the major flow volume of water now enters from the north.

Ten sample sites were sellected within the main flow distribution channels of the area. Suspended samples were collected at both flood and ebb tide approximately 1.3 meters below the surface. Each sample was digested and analyzed by atomic absorption for As, Cd, Cr, Cu, Ni, Pb, and Zn (Table 1). Values for As, Cd, and Ni were present in trace amounts and are not included in the sumary table.

Although suspended sampling is incomplete, two trends are apparent. First the ebb tidal samples have higher metal content than flood tidal samples. Second, trace metal concentration in suspended samples is higher than in bottom samples for the same location.

Since work is still in progress, two possible explanations for higher concentrations during ebb tide are being considered.

1.) The high biota productivity in Great Sound results in the removal and concentration of metals from sediments by chelation processes. During ebb tide these organisms rich in metals would flow out of the Great Sound area. During flood tide entering organics would be mixed with sediments and other organics from the ocean thereby diluting the metal content.

2.) The higher velocities associated with flood tide may cause erosion of the muddy channel sides thereby diluting the trace metal content in suspended sediments. The higher concentrations in suspended samples versus bottom sediments is a function of particle size. In general, the size of particles within the suspended samples are finer than those in the analyzed portion (63 micron fraction) of bottom sediments. Finer particles tend to have greater trace metal concentrations due to the high surface area per unit weight.

Certainly additional evaluation of the organic content and its associated metal concentrations is needed before more definitive conclusions will be able to be resolved.

LOCATION MAP

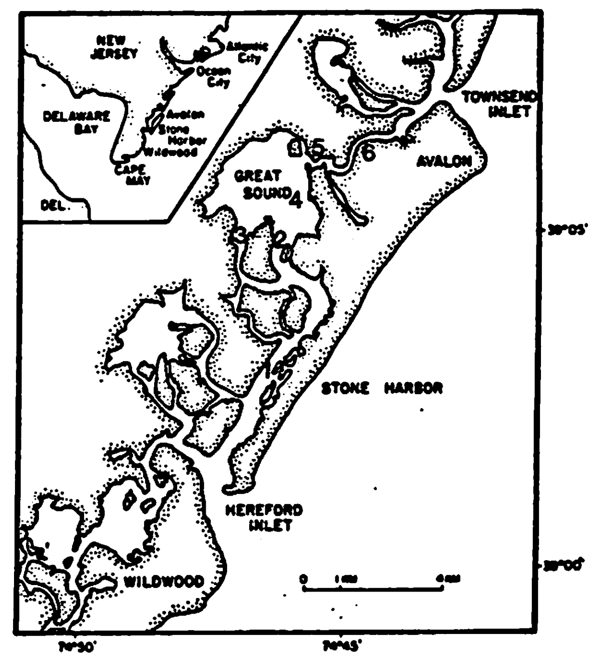


Figure 1. Location Map. Suspended sample sites are Number (1-6). (1) Great Channel north of Stone Harbor Bridge, (2) Gull Island Channel, (3) Cresse Thoroughfare, (4) Great Sound (ICW), (5) Ingram Thoroughfare, (6) Ingram Thoroughfare south of Avalon bridge.

MARINE EDUCATION PROGRAM

NEW JERSEY MARINE SCIENCES CONSORTIUM

The sea encompasses more than 70% of the earth. The ancestors of the many millions of inhabitants of lakes and forests emerged from the sea eons ago. The waters and the shore are barriers that are often violently attacked but seldom bridged. The ocean and beach zones are one of conflict and an arena for the development of unique lifestyles by species from both the land and the sea.

The 1,792 mile shoreline of New Jersey is, without question, one of the state's major natural resources. It is obvious that there is a pressing need to ensure the future of the beaches, estuaries, the inland waters and the living ocean that are so much a part of the Garden State. To meet this need will require wise use of these marine resources, as well as their intelligent development.

An early, positive exposure to our coastal resources is essential as a first step in educating the people of New Jersey about the value, beauty, and critical importance of these parts of their environment. Marine topics can also be used to motivate learning in all subject areas, since the sea and its creatures have a fascination for most students which is often sadly lacking in their other studies. For these reasons, we need programs for everyone, not just future marine scientists.

The marine educational needs of New Jersey are many. New Jersey Sea Grant's goal is to provide comprehensive marine education programs tailored to the needs of New Jersey. Our programs are designed to educate citizens through pre-college, college and public programs aimed at those not involved with marine related fields.

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

SPECIAL STUDENT RESEARCH TOPICS ON NEW JERSEY MARINE AFFAIRS

J. Highland

Princeton University's Center for Energy and Environmental Studies continues to support several university departments independent senior thesis and other independent student research projects related to marine affairs in New Jersey. By so doing, highly qualified Princeton students are encouraged to examine issues of marine science in New Jersey; and the quality of their research is enhanced. As a result, our knowledge about New Jersey's marine environment, the pool of individuals knowledgeable on this subject, and the number of students interested in marine careers also increases.

Student research may cover a wide range of coastal topics relevant to New Jersey, and students from any of the university's departments may apply. In each case, students requesting research support under this program submit a brief proposal and supporting budget to Dr. Joseph Highland, the Principal Investigator.

Results of this activity are in the form of student research reports, primarily senior theses, but also include some doctoral dissertations, junior independent papers, and graduate or undergraduate student coursework papers. Where appropriate, these papers are reproduced as formal Working Papers or Reports of the Center for Energy and Environmental Studies, thereby available for wide distribution to interested users in government, industry, academia, environmental groups, and the public at large. Through this mechanism, new information about marine affairs in New Jersey should reach a broader audience.

This effort has been funded by New Jersey Sea Grant as a marine education project for the past five years. The following are the independent student research projects completed in the 1984-85 academic year with some financial assistance from N.J. Sea Grant:

1. Jeanne Panek, '84, B.A. Biology Princeton University, "A Study of Lichens as Indicators of Air Pollution in the New Jersey Pine Barrens"
2. Michelle R. Kriegman, '85, B.S.E. Program in Geological Engineering, Civil Engineering, Princeton University, "The Sulfur Redox System in a Salt Marsh, Tuckerton Meadows, NJ"
3. Irene Kijak, '85, Doctoral candidate, Department of Geological and Geophysical Sciences, Princeton University, "Trace Metals and Nutrients in the Interstitial Waters of Salt Marsh Sediments, Tuckerton Meadows, NJ"

RESEARCH PAPERS IN MARINE LAW

A. Wypyszinski

In order to stimulate legal research in marine affairs, hopefully with a focus on state or regional problems, the New Jersey Sea Grant Extension Service Director and Coastal Law Specialist, Alex Wypyszinski, implemented a law student writing competition through the Sea Grant Program. The short-term objective is to identify to both students and faculty the New Jersey Sea Grant Program, the New Jersey Marine Sciences Consortium, and the important need for this type of research. Long-term objectives which could be accomplished by this program are provision of the impetus for development of a law school course offering in ocean and coastal law, as well as development of a better educated legal community; more aware of the legal issues and problems related to the many facets of marine affairs.

Legal writing is an integral part of a law student's education. Usually, a major written work or at least some evidence of facility in legal writing is a requirement for graduation. While the choice of topics is normally not extensive there is some flexibility. Established graduate law programs at the University of Washington and the University of Miami law schools require a major writing effort on a marine affairs topic. Furthermore, similar legal writing competitions presently exist in other areas of the law; e.g., the Letourneau Award given for the outstanding paper on a legal-medicine topic.

Papers submitted in conformity with the promulgated rules for this project are reproduced and distributed to members of the Student Awards Committee. This committee is presently composed of four attorneys, each a graduate of the Marine Affairs program of the University of Washington School of Law and each employed in some aspect of the marine affairs specialty. The committee chooses winners by consensus.

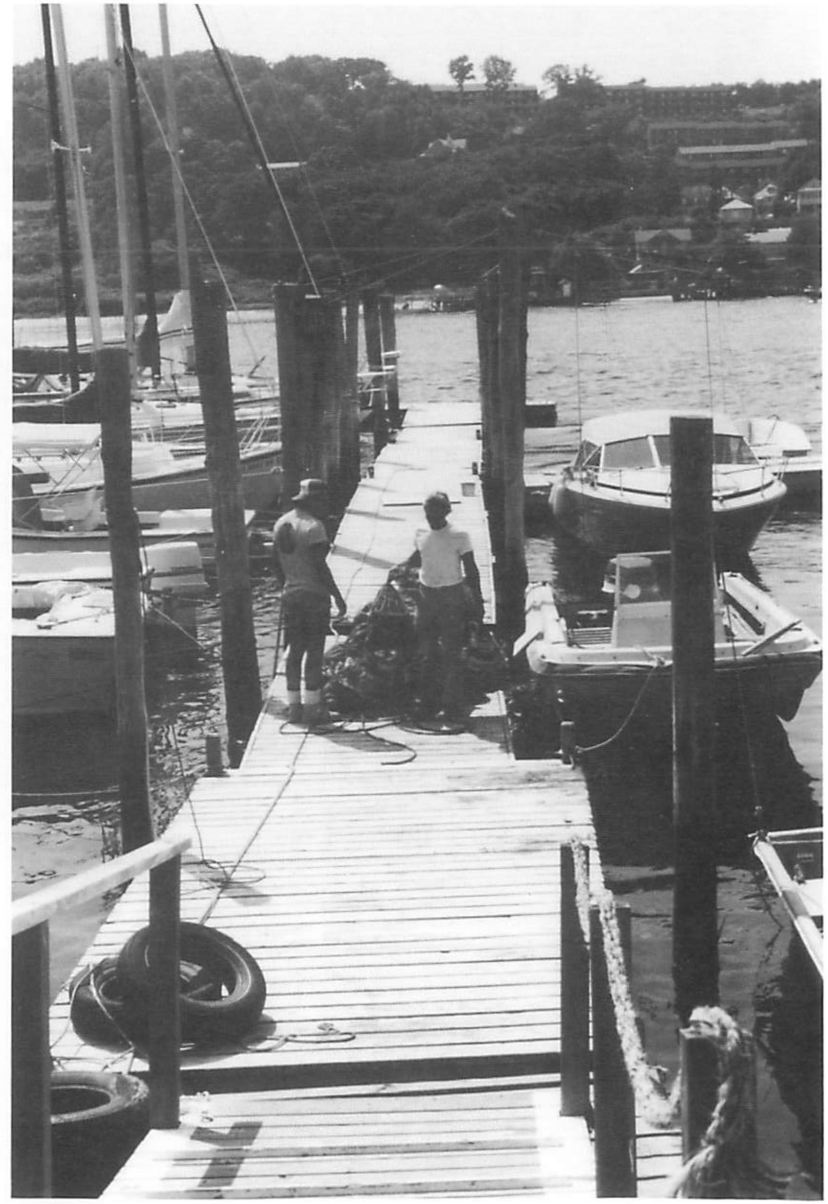
In 1985, New Jersey Sea Grant Law Awards were received by:

1st Prize - "The Perenial Question: Who Owns the Seabed Beneath the High Seas", Tim Hyden, McGeorge School of Law, University of the Pacific, Sacramento California.

2nd Prize - "The Limit of the Department of Interiors' Authority Over the Continental Shelf", Donna Dam, University of Washington Law School."

3rd Prize - "A Constitutional Solution to the Deleterious Effects of a Common Property Resource", Marquis C. Blom, University of Maryland, School of Law.


CARTA BLANCA



ADVISORY SERVICES

More than one-sixth of New Jersey's land area is classified as "coastal." It is vitally important, therefore, to see to it that this fragile environment be protected, maintained, and conserved. The tremendous pressures placed on the marine related resources — the beaches, marshes, and estuaries — require careful and considered decisions concerning their multiple uses.

In 1976, a full decade following the inception of the federally-funded Sea Grant Program of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, New Jersey joined the national effort. Under the Sea Grant Program managed by the New Jersey Marine Sciences Consortium, the New Jersey Sea Grant Extension Service (SGES) operates as part of the Cooperative Extension Service at Cook College, Rutgers, The State University of New Jersey.

With a methodology similar to the highly successful, experienced and visible land-grant agricultural program, SGES is a natural component of the Cooperative Extension Service. The tripartite philosophy of both land-grant and sea-grant is based on the integration and articulation of teaching, research, and extension. This is the unique feature of the educational programs and projects of the Extension Services, and responsible for their proven effectiveness in the application of research to practical situations in a relatively short time frame.

The goal of SGES is quite simple and direct: To inform the citizens of New Jersey and other user groups of the value of coastal resources and the need to promote the intelligent management of these resources.

Acting on the principle that only can an informed public act in a responsible manner, SGES facilitates the flow of information to assist in the maintenance of the quality of the marine environment as it accepts and responds to intensive use.

NEW JERSEY SEA GRANT EXTENSION SERVICE

A. Wypyszinski

This report period covers the 6th year of the New Jersey Sea Grant Extension Service's association with the N.J. Marine Sciences Consortium and the N.J. Cooperative Extension Service at Cook College, Rutgers, the State University.

New Jersey's SGES can best be described as the outreach arm of the N.J. Sea Grant Program. Its goal is to provide an effective two-way communication between the users and researchers in the marine science and coastal fields. Through the SGES, the results of scientific research are communicated to those who will apply them. Likewise, the problems and needs of these user groups are communicated to Sea Grant researchers. NJSGES is the means by which useful information is transferred from laboratories and scientific journals into the hands of those who can use it. To accomplish this, the SGES reaches users through group meetings, seminars, one-on-one consultation, exhibits, conferences, lectures and print and electronic media. NJSGES offices located throughout the State have come to be commonly and frequently used sources of information pertaining to marine and coastal affairs. The services and expertise of NJSGES personnel are used by legislators, public officials, representatives of the fishing industry and other marine related businesses and the general public.

Sea Grant IX saw the addition of a full-time communicator to the stall and continued planning of a marketing specialist as the next step in staff expansion. The small, but dedicated group now numbers five, and their continued enthusiam, commitment and experience is instrumental to the success of the NJSEGS in its efforts to effectively transfer knowledge and information concerning the State's extensive marine resources.

For the Director of the SGES/coastal law specialist, priorities for Sea Grant IX included concentrating on coastal law activities and maintaining continuity of the SGES program, while developing and implementing new projects in cooperation with the N.J. Marine Sciences Consortium, the Rutgers Cooperative Extension Service and other SGES staff.

The results of efforts to stimulate interest in developing a marine legal project at Seton Hall Law School came to fruition in the form of a new course in Ocean and Coastal Law, providing students with an overview of legislation and regulations related to marine resources and to the coastal zone.

Additionally, the Sea Grant Law award continued to thrive, achieving its goal of stimulating legal research in marine affairs, with a focus on local and regional problems. By implementing this law student writing competition, we continue to identify to both students and faculty, the New Jersey Sea Grant Program, the New Jersey marine Sciences Consortium and the important need for this type of research. Hopefully, the long-term goal of better educating the legal community with regard to the issues and problems related to the many facets of marine affairs, will be realized through the continued implementation of this competition.

The diversity of directorship was emphasized through on-going interaction with outside agencies, serving as a member of the Port Authority Seafood Quality Committee, the NJDEP Bureau of Coastal Planning and Development Environmental Advisory Group, the "voice" of the NJSGES, by narrating our daily radio feature, and successfully working with the staff to solicit non-traditional funds to help support program activities. Additionally, this year's efforts resulted in obtaining funds from the N.J. Department of Agriculture for joint publications and from the Rutgers Fisheries and Aquaculture Center for the funding of our imminent seafood marketing specialist.

Our marine agents, stationed at Toms River and Cape May continued their close working relationships with the commercial fishing industry, and implemented both new and continuing projects. Gef Flimlin, while on sabbatical for eight months in 1985, continued to report regularly and participate in planning a shellfish habitat rehabilitation project in cooperation with a number of state agencies and with Tim Visel of the Connecticut Sea Grant Program.

The Fisherman's Forum was again organized by Gef Flimlin and Stew Tweed in cooperation with the New Jersey Farm Bureau. This highly successful annual event was held this year in Cape May, NJ, and was attended by over 500 commercial and sport fishermen and by hundreds of vo-tech students as well. Legislators, researchers and agents from a number of east coast states were given an opportunity to listen to and to share concerns directly with members of the fishing industry.

The Sea Surface Temperature Chart Program developed and promoted by Gef Flimlin had grown fivefold since its introduction in 1980. The charts had proven to be cost effective; and, based on surveys and questionnaires had an economic return at least 10 to 1 on subscription investment - saving time and money for commercial fishermen. In fulfilling the mission of Sea Grant, this highly successful program was turned over to private industry in 1985. Initial reports indicate a continued high regard for the program among commercial fishermen.

Cape May County's commercial fishing industry has been encouraged to harvest more under-utilized (high volume but low value) species that will require capital improvements and considerable risk. To reduce this risk, Cape May County Marine Extension Agent Stew Tweed organized two work-shops for leaders of the fishing industry and local government as well as Economic Development Commissioners for the purpose of identifying programs that could provide low interest loans for fishing industry needs. He identified the Small Cities Block Grant Program as a potential source of funds and prepared a proposal for a Revolving Loan Fund for Fishermen. After the grant was obtained, Stew announced the availability of the loans and application procedures in his newsletter to 300 fishermen families. He also organized another workshop to explain the program and to teach application procedures. Fact sheets on loan applications were prepared and brochures describing the program were distributed at three fishermen meetings.

Area companies and individuals who benefited from the first low interest loans included two fish docks planning to add new handling and processing equipment, a soft crab shedding company increasing shedding capacity, a pot fisherman who obtained partial financing for a new vessel, and a bay clammer upgrading equipment. Now in its second year, it is estimated that the program has created more than 35 new jobs in the industry, has leveraged over $250,000 of private financing, and has saved the industry substantial interest payments.

Stew Tweed has also been the NJ contact in the broader Sea Grant effort at development of a soft crab industry. As a result of his promotion of Sea Grant research results, the industry shows a good deal more potential here than it has in past years. Assisted by a low interest loan obtained through the Small Cities Block Grant Program, a Cape May business obtained funding to expand from 4 to 28 shedding tanks in 1985. Stew also assisted the Cape May County 4-H Marine Science club in building a small scale blue crab shedding facility. The exhibit won first prize in the booth exhibits and in addition shed about 24 soft crabs.

For the third year in a row Stew Tweed was a member of the planning committee for the Cape May Seafood FEstival. As in past years, over 5000 people attended the festival. Proceeds are used to provide emergency funds for families of fishermen lost at sea, to establish a monument to the county's fishermen and to help support the Fishermen's Form. For his work in setting up and conducting the festival, this year Stew was the winner of the New Jersey Pride Award, a program administered by the Agricultural Agents Association.

Formerly the marine Pollution Specialist with the NJMSC, John Tiedemann joined the SGES in late 1984 as a marine extension agent with program responsibility to the marine recreation industry. Needless to say, his expertise in the subject matter allowed the SGES to deliver information related to New Jersey's persistent pollution problems to state and local officials and to the public. In recognition of the fact that he is one of the State's most knowledgeable individuals on NJ's coastal water quality, John was asked to serve as a member of the Governor's Science Advisory Committee.

When chemical waste discharge problems raised questions of public health and threatened the tourist industry in Lavallette, NJ, John worked directly with the mayor and prepared a report used in public hearings on the problem.

As a result of his work in providing information related to the marina industry and its economic and other importance to the State and nation, Clarks Landing Marina in Point Pleasant, NJ - previously unsuccessful in obtaining a zoning variance for a new dock - was informed that the township would consider a new "Marina Zone", which would allow marina expansion as a preferred waterfront/water dependent use.

A survey of party and charter boats willing to book trips for specialty groups like children, the physically impaired, or senior citizens has been prepared, and the information will be used to compile a bulletin/directory of those boats. As a result, New Jersey's coastal resources will be enjoyed by groups previously without access to them.

Over 800 requests for copies of the SGES publications by John Tiedemann, "Aqualines: A fisherman's Calendar for Coastal New Jersey" and "Sand Piper: A birding Calendar for Coastal New Jersey" were received by the SGES office.

Much of the demand for SGES information and publications is generated by the work of the communicator. Chet Teller, associated with SGES for the last two years, left in June 1985. His style and expertise contributed much to the growth of the program and he will be missed. Kim Kosko, now the communications coordinator, is responsible for the Shoreline newsletter, the Shoreline radio show, the Sea Grant annual report, fact sheets, bulletins, releases, workshop and conference announcements and publicity. In the short period Kim has worked with the SGES program she has established a system which regularly sends reports of NJ Sea Grant research and activities to a network of 21 daily and 52 weekly newspapers, 25 network and cable television stations, and over 40 radio stations. Twenty of those radio stations now carry the Jersey Shoreline radio show five days a week. Kim designed the format, produced and has directed the radio show since its inception in April of this year. She has coordinated 12 SGES staff appearances on the KYW-TV Farm Home and Garden Show, and was responsible for a WPVI-TV program featuring John Tiedemann which was aired in Philadelphia to a potential 2.5 million viewers.

Who's On Board

At present, the Sea Grant Extension Service consists of the following individuals whose expertise is available to provide educational and informational assistance to marine researchers, marine resource users, teachers, consumers and citizens throughout the state.

Alex Wypyzinski, Director/Coastal Law Specialist
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Gef Flimlin, Marine Extension Agent
Ocean County Agricultural Center, 201-349-1152
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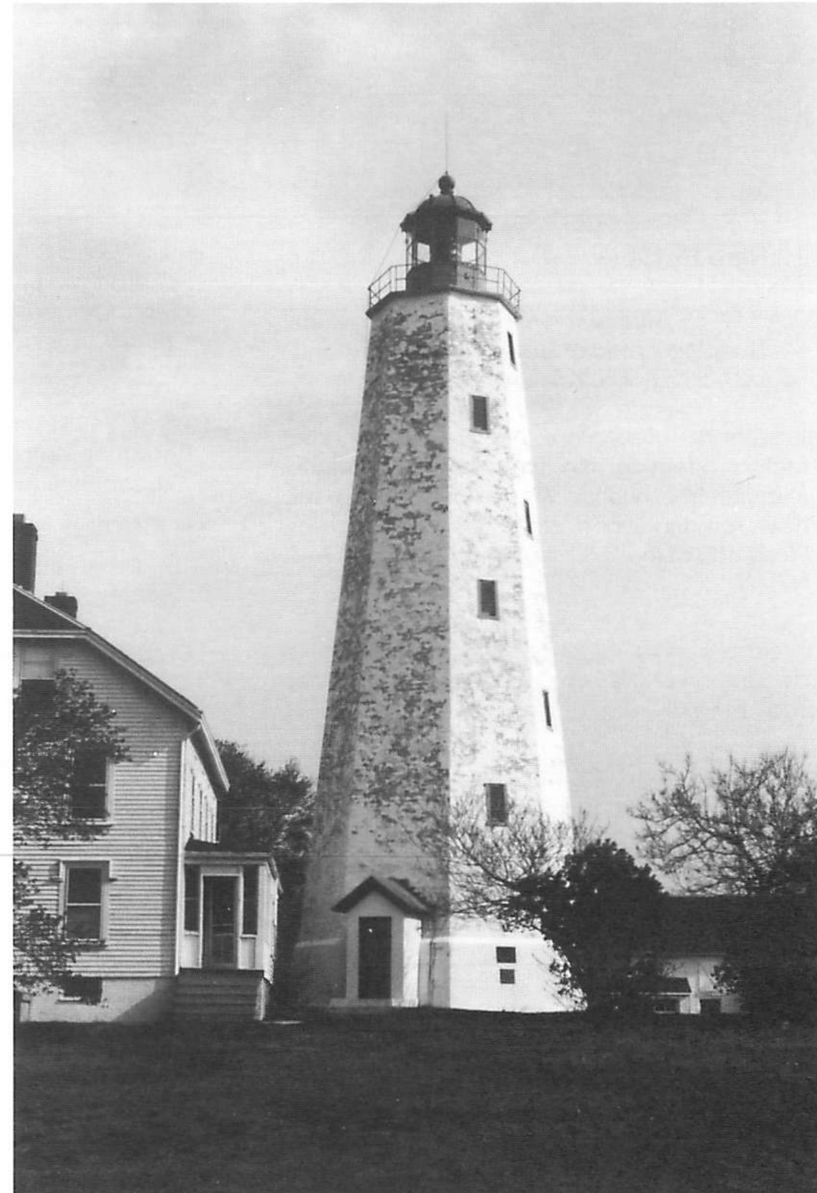

NEW JERSEY MARINE SCIENCES CONSORTIUM

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Sharma, G., H. Shiquera and L. Liu. (1985) Vitamin B-12 binding proteins of the horseshoe crab *Limulus polyphemus*. Biochemical and Biophysical Research Communications. 128:241-248.

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COASTAL SYSTEMS PROGRAM

Ashely, G. and M. Zeff. (1985). Tidal channel heirarchy in a low mesotidal salt marsh: flow and sediment characteristics. (Abstract). SEMP Annual Midyear Meeting Abstracts Vol. II, p. 7.

Lennon, G. (1985). Wave-induced forces on Buried pipelines. Journal of Waterways, Port, Coastal and Engineering Div. ASCE, Vol. III, No. 3 pp. 511-524

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Kijak, I. (1985). Trace metals and nutrients in the interstitial waters of salt marsh sediments, Tuckerton, NJ. Department of Geological and Geophysical Sciences, Princeton University. Doctoral Thesis.

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Flimlin, G. 1984. Is the Fishing Industry Floundering? Monmouth Ocean Development Council quarterly. pp. 8-9.

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PROGRAM SUMMARY

MARINE RESOURCES DEVELOPMENT

Marine Biomedicinals and Extracts

R/N-6
Radioisotope Dilution Techniques for the Determination of Cobalamins in Marine Waters
Dr. G. Sharma, William Paterson College

Living Resources

R/F-7
Identification of Bivalve Larvae: A Multi-Institutional Approach
Dr. R. Lutz, Rutgers University

R/F-11
Incidence and Development of *Glugea stephani* in Field Collected and Laboratory Infected Psuedoplueronectes americanus (winter flounder)
Dr. A. Cali and Dr. P. Takvorian, Rutgers University

Socio-Political Studies

R/F-17
Viral Content and Filtration Rates in *Mercenaria mercenaria* (hard clam) at a Commercial Depuration Facility
Dr. F. Cantelmo and Dr. T. Carter, St. John's University

Marine Law and Socio-Economics

R/F18
Job Satisfaction and Fishing: A Comparative Study
Dr. B. McCay, Rutgers University

MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT

Ocean Engineering

R/N-4
Evaluation of the Performance of a "Perched Beach"

Dr. R. Weggel, Drexel University

MARINE ENVIRONMENTAL RESEARCH

Research in Support of Coastal Management Decisions

R/S-5
Sediment Characteristics and Recent accumulation Rates: Determination of Variables Required for a Numerical Simulation of Modern Sedimentation in Salt Marsh Complex of Southern NJ
Dr. B. Carson, Lehigh University

R/S-6
Hydrodynamic Model of an Inlet-Sound System in Southern NJ

Dr. G. Lennon and Dr. R. Weisman

R/S-7
Flow Characteristics and Sediment Flux in the Great Sound Section of the Intercoastal Waterway (Stone Harbor, NJ)
Dr. G. Ashley, Rutgers University

R/S-8
Tracing Pollutants Using Trace Metals Associated with Sediments in the Lagoons of Southern NJ
Dr. M.J. Hall and Dr. J. Nadeau, Rider College

MARINE EDUCATION AND TRAINING

College Level

E/T-2
Special Student Research Topics on NJ Marine Affairs
Dr. J. Highland, Princeton University

E/T-3
Research Papers in Marine Law
Alex Wypyszinski, Esq.

ADVISORY SERVICES

Extension Programs

A/S-1
New Jersey Sea Grant Extension Service
A. Wypyszinski, Director

PROGRAM MANAGEMENT AND DEVELOPMENT

M/M-1
Program Administration

Dr. R. Abel, New Jersey Marine Sciences Consortium

ACTIVITY BUDGET

ACTIVITY BUDGET SHEET (Summary Totals by Activity)

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

	NOAA Grant Funds	University Matching Funds
MARINE RESOURCES DEVELOPMENT		
Living Resources	$106,000	$231,500
Marine Medicinals and Extracts	31,200	18,800
Marine Law and Socio-Economics	30,000	18,700
	167,200	269,000
MARINE DTECHNOLOGY RESEARCH AND DEVELOPMENT		
Ocean Engineering	6,000	3,800
	6,000	3,800
MARINE ENVIRONMENTAL RESEARCH		
Research in Support of Coastal Management Decisions	114,000	102,200
	114,000	102,200
MARINE EDUCATION AND TRAINING		
College Level	5,000	4,500
	5,000	4,500
ADVISORY SERVICES		
Extension Program	147,800	113,600
	147,800	113,600
PROGRAM MANAGEMENT AND DEVELOPMENT		
Program Administration	160,000	86,400
	160,000	86,400
TOTAL	600,000	579,500

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

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NOTES

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