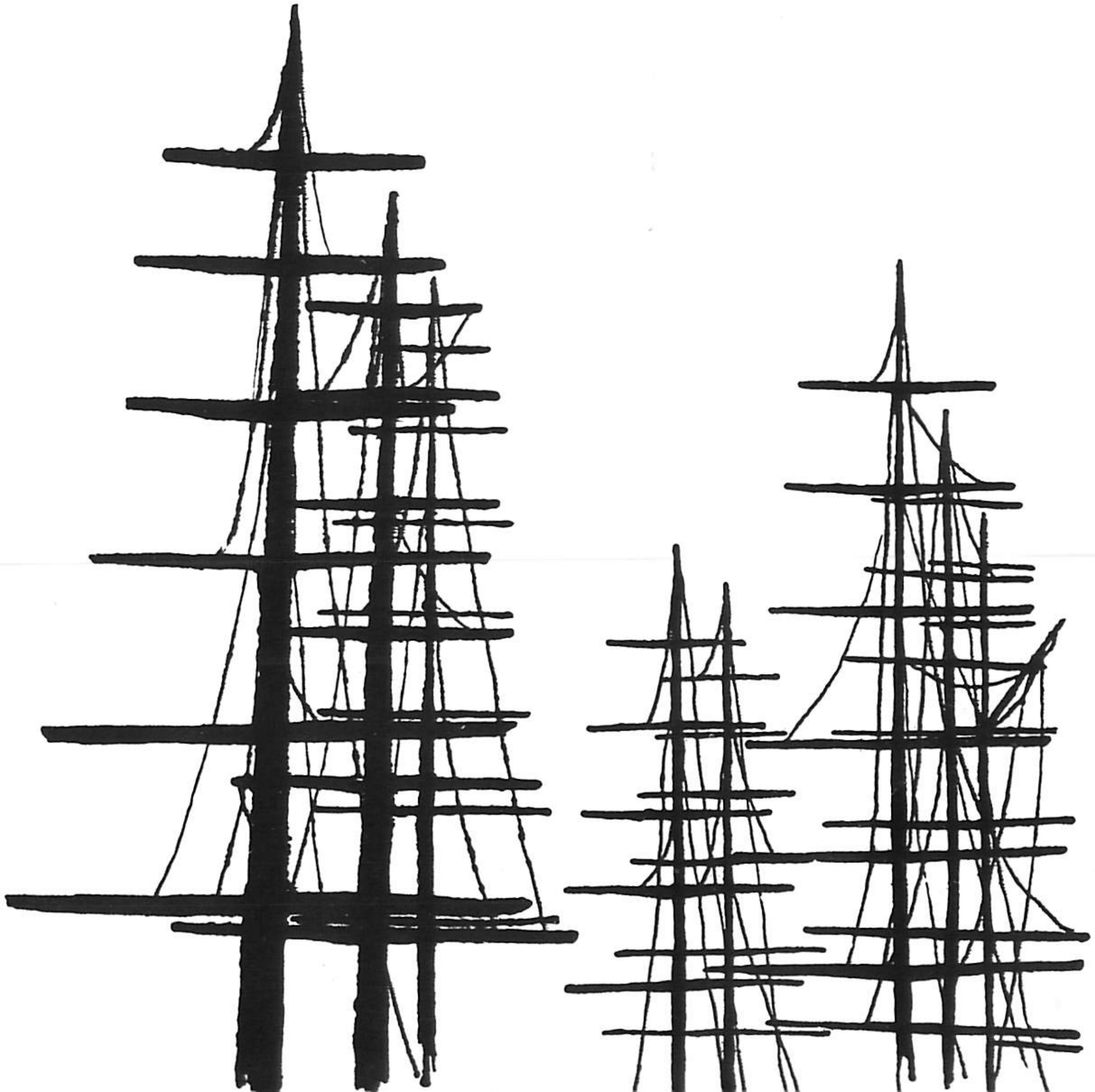
New Jersey Sea Grant Annual Report 1980-1981



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INTRODUCTION TO THE NEW JERSEY SEA GRANT PROGRAM

Report of the Fifth Year 1980-1981

This account represents the fifth year of the New Jersey Sea Grant Program. Despite its relative newness, the program has developed and experienced an orderly growth permitting achievement of the objectives established by the Congress of the United States when it created the National Sea Grant College Program in 1966. This effort embraces assistance to the state, region and nation in the protection and development of coastal and marine resources through a strong educational base, responsive research, and prompt dissemination of knowledge. It has been accomplished by integrating programs of excellence in marine research, advisory services, and education. The Sea Grant Program is administered by the National Sea Grant Office in the National Oceanic and Atmospheric Administration, United States Department of Commerce.

The New Jersey Sea Grant Program is managed by the New Jersey Marine Sciences Consortium, an organization of 23 institutions of higher education, a number of business and industrial corporations, and qualified individuals. The Consortium was created to pool intellectual and institutional resources for the purpose of providing the state with a comprehensive program in marine research, education and advisory service. The Consortium conducts college and pre-college education activities and provides facilities and support for basic and applied research. It is an important vehicle of communication among institutions and state and federal agencies utilizing conferences, seminars, lectures, and publications. Its advisory services represent a significant liaison among scientists, industrialists, and the public.

During the 1980-81 Sea Grant year, our program consisted of seventeen projects carried out at the following Consortium institutions: Fairleigh Dickinson University, the Lamont-Doherty Geological Observatory of Columbia University, Lehigh University, Montclair State College, the New Jersey College of Medicine and Dentistry, Princeton University, Rutgers University, Stevens Institute of Technology, Stockton State College, The Wetlands Institute, Lehigh University, and the state chapter of The Girl Scouts of America.

During this year, New Jersey's Marine Research Program coalesced into three major categories: the Northern New Jersey Estuarine System, Fisheries and Shore Processes.

Dr. Robert B. Abel
Director

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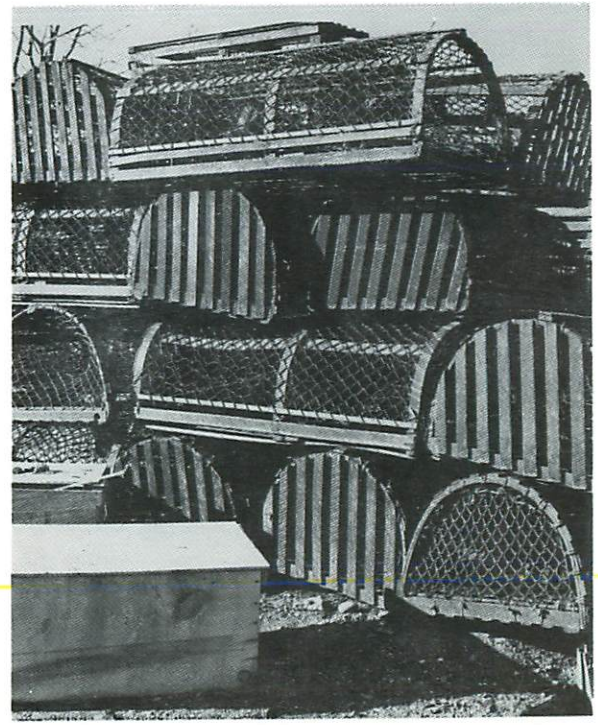
I NORTHERN NEW JERSEY ESTUARINE SYSTEM

The waters of Newark and Raritan Bays exemplify the conflict in use of the coastal zone as much as any estuarine system in this country. New Jersey shares this, the most heavily trafficked body of water in the western hemisphere, with its neighbor to the north. In addition to its maritime commerce, the complexity of the area is characterized by the intensity of fishing and aquatic recreation. It is unlikely that more serious pollution problems exist anywhere in the United States.

The coordinated team research begun two years ago nears completion during Sea Grant's fifth year in New Jersey. Each project described in the following pages attacks the bays' problems in a slightly different milieu. An important theme relates to the dynamic and ongoing nature of the investigations. As Drs. S.J. Koepp and J.M. McCormick (Montclair) complete their studies of the soft clams in the bays, H. C. Multer's (Fairleigh Dickinson) work on sediment dynamics of the area was in midcourse, and J. Simpson's (Lamont-Doherty) was just getting underway.



FATES OF POLLUTANTS AND SEDIMENT DYNAMICS

H.G. Multer

Continuing studies concerning various pollutants and sediment dynamics in the Raritan estuary were carried out under a grant to Principal Investigator Dr. H. G. Multer, Fairleigh Dickinson University, by three investigating teams. (1) Research conducted by Dr. D. Crerar, A. Maest, and P. Bauman, from Princeton University, focused on the mode of transport of 10 metals carried into the estuary by the Raritan River. One of their observations noted the heavy metal transport mode down the Raritan River varied, with Cd, Cr, Co, Cu, Mn, and Ni being carried predominantly in solution; Al, Fe, and Pb mainly as crystalline material; and Zn mostly as absorbed material. These studies are of particular significance as they help identify the availability of trace metals to the biota and, thus, potential buildup in the food chain. Team member Paul Bauman received the National Sea Grant Outstanding Undergraduate Research Award for 1981 for his contribution. (2) In a preliminary investigation of a variety of sources for suspended sediment found in the Raritan estuary, Multer observed, during high runoff periods, a three-fold increase in total suspended sediment loading at the bottom of the Raritan River where it enters the estuary; indications of a variety of bottom and surface suspended transport loadings along the eastern margin of the estuary and significant quantities of suspended sediment originating from resuspension during local storms and local tidal scour. Wastewater outfalls, propwash and dredging operations were other localized sources of suspended sediments identified. (3) Drs. R. Bopp and J. Simpson of Lamont-Doherty analyzed a series of core samples to gain a clearer understanding of the depositional rates of sediments in the estuary using Ce 137 techniques. They found little or no recent sedimentation in the northeastern part of the Bay; one core from the west central part of the Bay indicated an average sediment accumulation rate of about 0.6 cm/yr over the past three decades; two other sites, one near the entrance to the Lower Bay off Sandy Hook, and the other near the USN pier, showed evidence of recent sedimentation to depths of 20 and 10 cm, respectively.

The results of these three investigative studies involving important aspects of metal transport, suspended sediments (which can carry, deposit, and remobilize metals) and the rates and sites of sediment deposition are enabling us to better understand the dynamics of this large, complex and stressed estuary.

NUMERICAL AND OBSERVATIONAL STUDIES OF THE HUDSON-RARITAN ESTUARY

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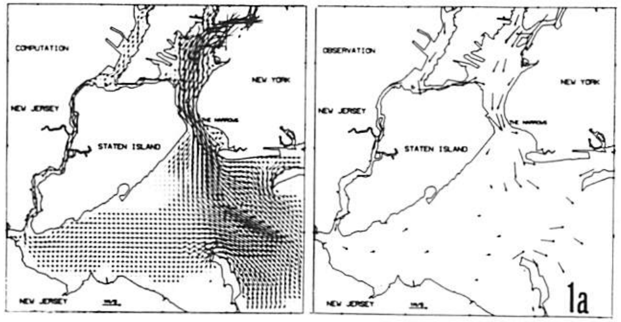
G.L. Mellor, R.I. Hires

A study of tidal flow characteristics in the Hudson-Raritan Estuary, with a two-dimensional, depth-averaged finite difference model, is now complete. This model is the "external mode" portion of a fully three-dimensional numerical model designed by Blumberg and Mellor (1978), modified to include rivers as one dimensional channels with variable width and depth. Extensive comparisons of calculated tidal currents, ranges and phases, with observations throughout the estuary, demonstrate the model has significant predictive skill. Typical results are shown in Figures 1, 2 and 3. Comparisons with observations also indicate the calculated residual (mean) currents contribute significantly to the overall steady circulation in the estuary. These and other results are contained in a report by Oey, Mellor and Hires (1982).

Currently, the fully three-dimensional model of the estuary is being implemented. As initial tests, we have applied the model to the Hudson River from the Battery to Troy. The purpose of this early study is two-fold; to see what types of boundary conditions are required, and to assess the model's predictive skill by comparing the model output with detailed salinity and current observations obtained by Hires during April 1981.



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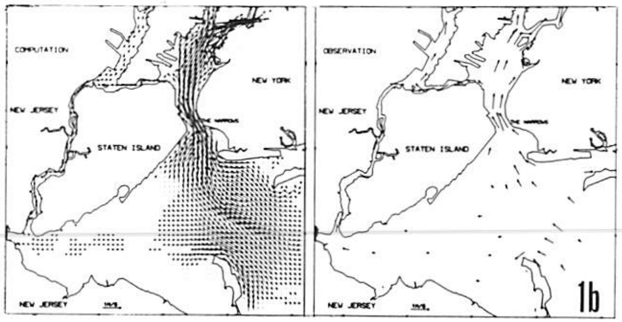

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- Figures 1a. Tidal current vector plots at three hours after time of slack, flood begins (SFB) at the Narrows.
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- Figures 2. Comparison of computed and observed times of high and low water relative to Sandy Hook.
- Figures 3. Comparison of computed and observed tidal ranges.

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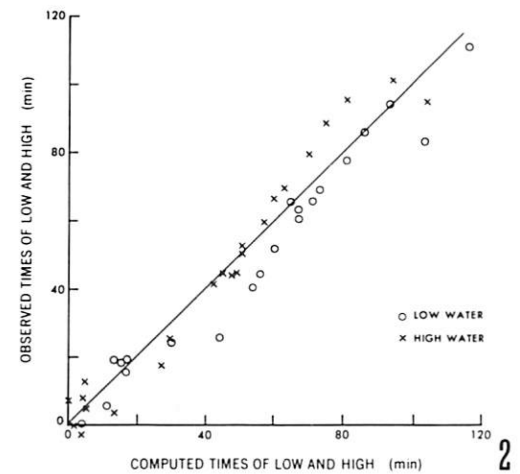
1. Blumberg, A.F. and Mellor, G.L. (1978) "Mathematical Modeling of Estuarine Physics," in Lecture Notes on Coastal and Estuarine Studies, Vol. 1, J. Sundermann and K.P. Holz, ed.
2. Oey L.Y., Mellor, G.L. and Hires, R.I. (1982) "Tidal Modeling of the Hudson-Raritan Estuary," Princeton University, Department of Mechanical and Aerospace Engineering, Report 15551/MAE.



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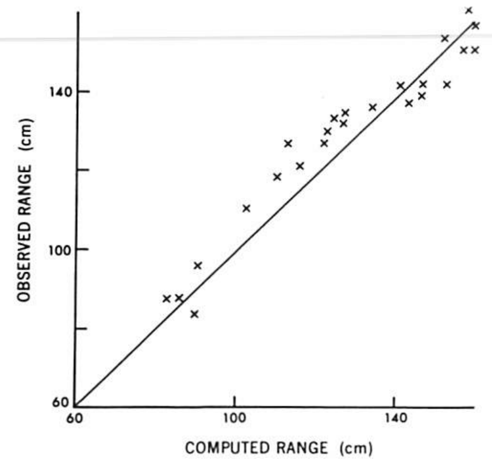

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FIELD DETECTION OF CHRONIC STRESS IN NEWARK BAY TARGET BIOTA, INCLUDING CORRELATION WITH ON-GOING TRACE METAL BIO-ASSAY STUDIES WITHIN THE SAME SYSTEM

S.J. Koepp, J.M. McCormick

Drs. Stephen J. Koepp and J. Michael McCormick of Montclair State College completed a two-year ecopathologic study of soft clams (*Mya arenaria*) from Newark Bay and Upper New York Bay. Due to severe cutbacks in funding, second year activities were restricted to consideration of a single sizable clam population residing on Constabile Hook, near the mouth of the Kill Van Kull. The study area is subject to periodic oil spills, in addition to sewage discharges from the Passaic Valley Sewage Authority Cavern Cove outfall.

Bimonthly collections of 50 soft clams each were made between May and November of 1980 at this site. For purposes of comparison, a single collection of 50 clams was concurrently obtained in November from a relatively unpolluted site in Chesapeake Bay, Maryland. Upon capture, individual clams were measured and grossly evaluated for color and lesions, after which representative portions of gill and gonadal tissues were prepared for microscopic examination. Both light and electron microscopy were used in tissue evaluation.

The New York Bay population exhibited symptoms of chronic stress at gross histologic and cytologic levels. The majority of individual clams exhibited yellowish visceral discoloration, blackened siphons and flaccid siphonal response to tactile stimulus. Conversely, the Chesapeake-collected clams showed white plump visceral masses, and normal muscular responses. The mean weight/mean length ratio was significantly lower for the New York Bay-collected clams, regardless of month of capture.

Microscopic examination of gill tissue revealed extensive injury in 60% of those clams examined, often including symptoms of chronic irreversible damage. Only 2% of Chesapeake clams showed similar lesions. As high as 20% of New York Harbor clams exhibited necrotic gill cells as compared with 8% of the Chesapeake animals. No gill epithelial neoplasia was observed among either population. However, over 40% of the New York Harbor soft clams exhibited Feulgen-positive nuclei within epithelial cells associated with the food groove apparatus of the gill. Electron microscopic examination of these cells revealed nuclei containing replicating papilloma-type DNA virus. This represents the southernmost report of this virus to date for *Mya arenaria*, and the first described case within the Hudson River-Raritan Bay estuarine system. The fact that the virus is found only within ciliated epithelia of the food groove suggests a water-borne mode of infection. Feulgen-positive nuclei were observed among only 4% of the Chesapeake-collected clams.

In the course of gill observations, amebiocytic blood cells were frequently observed in New York Harbor soft clams to contain electrondense granules similar to those described in green-sick oysters. Using electron probe X-ray microanalysis, the latter identified zinc and copper within similar membrane-bound granules. Both zinc and copper, as well as other heavy metals are known to be contaminants in the study area. No such granules were apparent within amebiocytes of Chesapeake-collected clams.

The gross and microscopic appearance of the New York Harbor soft clam population suggests emaciation and a significantly shortened life span. The possible role of exogenous contaminants as causative agents for these effects is still under investigation. However, it is noteworthy that the extracted epithelia, hyperplastic mucus cells and other cytopathologic observations of gill tissues of *M. arenaria* closely resemble manifestations experimentally induced in various marine target species following exposure to toxic metals.

Soft clams represent a significant shellfish industry for coastal New Jersey communities. It is hoped that the findings presented above will stimulate renewed interest and concern for this marine resource. The possible role of this clam in sequestering DNA-type viruses is of particular concern and deserves further investigation.

HEAVY METAL DISTRIBUTION IN WATERBIRDS OF RARITAN BAY: BIOMAGNIFICATION, IMMIGRATION/EMIGRATION AND SEASONAL VARIATION

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J. Burger, M. Gochfeld, C. Leck

Drs. Burger, Gochfeld, and Leck collected 64 birds of 8 species from the waters or shores of Raritan Bay and from Ocean County salt marshes. Birds from Ocean County represented a control population. The birds collected represented various levels of the estuarine food chain including plant eaters (e.g., Black Ducks, ***Anas rubripes***), invertebrate eaters (Greater Scaup, ***Aythya marila***; and Herring Gull, ***Larus argentatus***), and fish eaters (Common Tern, ***Sterna hirundo***; and Herring Gull).

Most analyses were performed for mercury, lead and cadmium, the metals designated as the most significant toxic metals in the New York Bight. The preliminary work focused on the liver, since it is known to provide the best overall indication of body burden. They also made determinations of zinc, nickel, cobalt, manganese, copper, and chromium. The highest levels obtained were as anticipated, for copper and zinc.

A notable result is the discovery that cadmium shows significant biological amplification in the birds, with concentration factors similar to those for lead and approaching those for mercury. This occurred despite the fact that organocadmium compounds are rarely encountered in nature. This poses a previously undetected hazard warranting further exploration. The fish-eating birds at the top of the estuarine food chain provide a valuable analogy to humans and are, therefore, an excellent model for understanding cadmium dynamics in humans.

All birds obtained were dissected and tissues preserved for analysis. All specimens were collected either under state and federal permits or through cooperation of state and federal officials. All specimens were accurately identified to species, assigned to age class based on plumage characteristics, weighed, and sexed by dissection.

Analyses were performed by the Environmental Chemistry Laboratory of the New Jersey State Department of Health, under the supervision of S. Shaheid, PhD. Specimens were submitted in number-coded containers, with about ten percent submitted as blind duplicates for quality control.

Six of ten quality control samples for mercury gave results within five percent, the remaining four within twelve percent. Quality control results for lead and cadmium were slightly better than for mercury. No generalizations can yet be drawn about the other metals, but virtually all duplicate analyses yielded results within fifteen percent agreement.

The investigators obtained analytical results for 176 metals on 30 tissue samples. An additional 43 specimens, with 430 analyses pending, were sent to the laboratory for processing.

PRELIMINARY RESULTS ON NINE METALS

Very high levels (exceeding 10,000 ppb) were found for copper and zinc reflecting the important physiologic role of these metals, hence their natural occurrence at high levels in all organisms in the food chain. Molluscs are known to concentrate zinc at very high levels; thus, one would expect mollusc eaters (e.g., scaup and herring gull) to show higher concentrations than the other species. The preliminary results suggest this is true to some extent, since these two species had the highest levels of zinc. However, the avian body may have efficient homeostatic mechanisms to prevent the buildup of zinc.

It is also known that zinc-metallothionein, a protein in the kidney, responds to cadmium. It will be necessary to examine the interaction of these two metals in the future.

The greatest variability within species occurred for nickel, chromium, cobalt, and mercury.

Levels of cadmium and lead were more uniform both within and between species. However, both were present in surprisingly high levels.

BIOLOGICAL AMPLIFICATION OF MERCURY, LEAD, AND CADMIUM

Biological amplification refers to the tendency of metals to concentrate at greater levels in organisms that are higher on food chains. It is characteristic of lipid soluble organic chemicals which dissolve in fat and can be stored in the body. Metals that form organic species, most notably methyl mercury, are particularly subject to biological amplification.

The most important outcome of the study is the finding that cadmium shows biological concentration similar to lead, and only slightly less than for mercury. This will require a reevaluation regarding cadmium dynamics in estuarine ecosystems, and of the significance of cadmium levels in fish for humans who consume them.

There are some possibilities requiring immediate attention:

a. obscure organic sources of cadmium do occur, probably as strong complexes between the metal and organic compounds, which allow it to be concentrated as a non-polar, lipophilic substance;

b. concentration occurs because of metal binding to proteins such as metallothioneins.

It is essential to clarify the role of these two possibilities. If, for example, environmental cadmium is present as organic complexes subject to biological amplification, this has important implications for human consumption of fish or waterfowl. If, on the other hand, the observed CF's relate to protein-binding, it

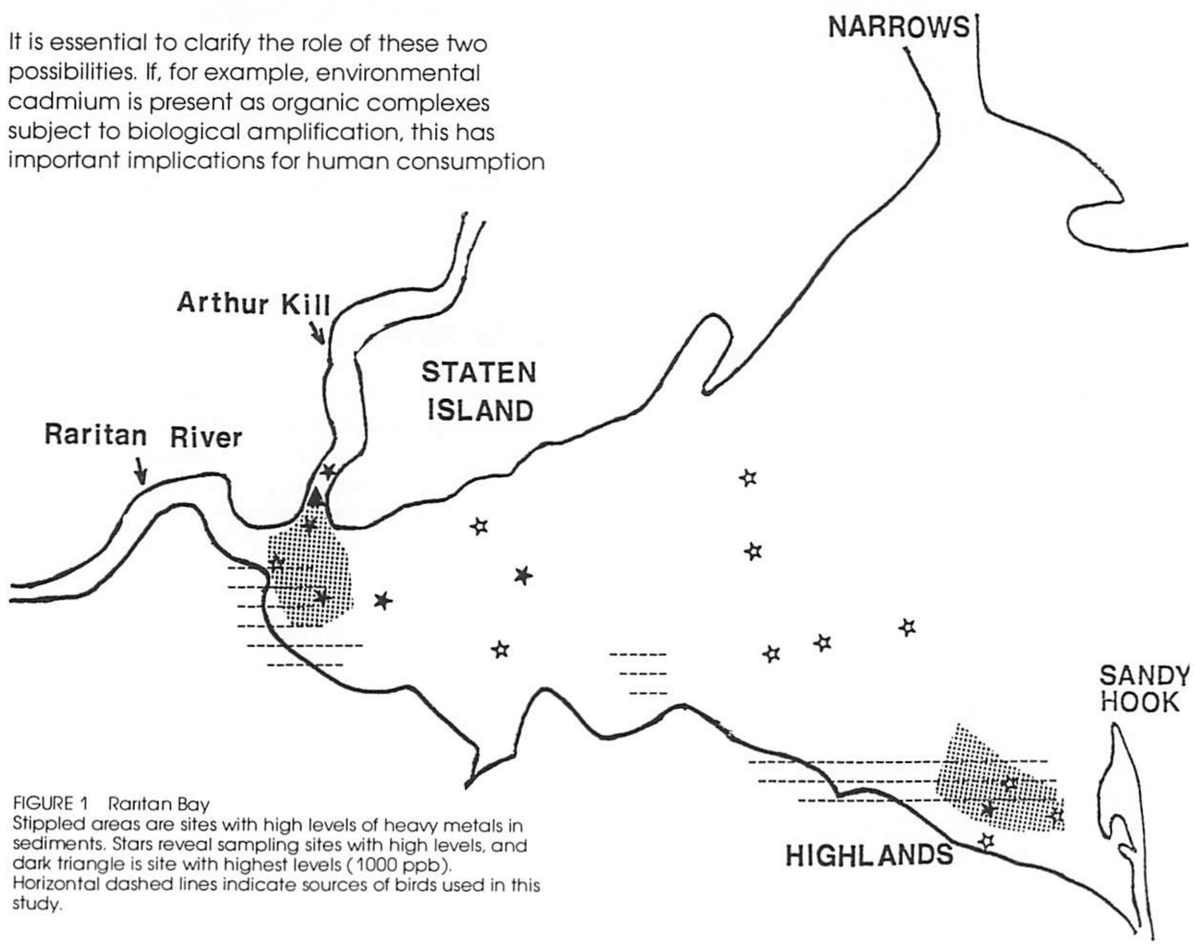

FIGURE 1 Raritan Bay
Stippled areas are sites with high levels of heavy metals in sediments. Stars reveal sampling sites with high levels, and dark triangle is site with highest levels (1000 ppb). Horizontal dashed lines indicate sources of birds used in this study.

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TABLE 1

Summary of preliminary results on metal levels in livers of Raritan Bay waterbirds. All values are means of log-transformed data. Sample sizes are 3-5 birds.

SPECIES	MERCURY	LEAD	CADMIUM	COBALT	CHROMIUM	COPPER	MANGANESE	NICKEL	ZINC
Black Duck	221	96	109	109	85	9,822	2767	55	25,585
Greater Scaup	316	276	412	185	290	16,135	4770	224	43,005
Herring Gull	383	560	773	229	337	10,720	2052	35	82,610
Common Tern	583	872	574	45	224	55,245	3988	40	40,280
Additional data based on single specimens									
Double-crested Cormorant	120	184	153	180	5	15,415	4644	134	40,755
Red-breasted Merganser	1210	---	---	---	---	---	---	---	---
Hooded Merganser	1650	---	---	---	---	---	---	---	---

becomes important to determine whether different species have characteristic proteins adapted for binding metals, or whether this is a general phenomenon among vertebrates. Moreover, the competitive interaction of zinc vs. cadmium for naturally-occurring metallothioniens must be investigated.

REFERENCE

1. O'Connor, J.S. & Stanford, H.M. (eds). 1979. Chemical pollutants of the New York Bight; priorities for research, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 217 pp.

TRANSFORMATIONS OF MERCURY

R. Bartha

Mercury is indispensable in the chemical industry as a catalyst and as the cathode in chloralkali plants. It is used in batteries, switches and thermostats by the electronics industry. In various chemical forms, it is also used as a biocide or as an ingredient of paints. Unfortunately, the above uses introduce substantial amounts of this toxic heavy metal into aquatic environments, occasionally with disastrous effects, as in the mass poisonings at Minamata and Niigata Bays in Japan.

The danger of mercury pollutants in the environment is greatly amplified by the ability of some anaerobic microorganisms to convert inorganic mercury to monomethyl - and dimethylmercury. In these forms, mercury is much more poisonous and has a tendency for bioaccumulation in aquatic food chains. The rate and extent of these transformations determines the ecological and human health impact of mercury as much or more than the total level of the pollutant.

The microbial methylation and demethylation of mercury in the environment are regulated by environmental conditions in a manner as yet largely obscure. Investigations directed by Dr. R. Bartha at Rutgers University recently revealed an inverse relationship between the methylation process and the salinity of the aquatic environment. More simply, he found that, at a given mercury pollution level, more methylmercury will be generated in fresh water than in sea water (see Figure 1). The causes for the above effect are complex. Hydrogen sulfide, arising from the microbial reduction of sulfate, a major component of seasalts, ties up inorganic mercury and renders it unavailable for methylation. Also, salinity appears to favor microbial populations that demethylate rather than methylate mercury. Other effects of the ionic environment on the methylation and demethylation process are still under investigation.

The above studies, in addition to their scientific interest, have significant practical consequences. If we know that the same amount of mercury pollutant is less toxic in sea water when in fresh water, this will lead to more specific and appropriate pollution tolerances for each of these environments. Also, the siting of inevitable mercury pollution sources, e.g., chloralkali plants, at locations where the discharges will enter salt water rather than fresh water environments, will reduce the future ecological and human health impacts of this hazardous heavy metal.

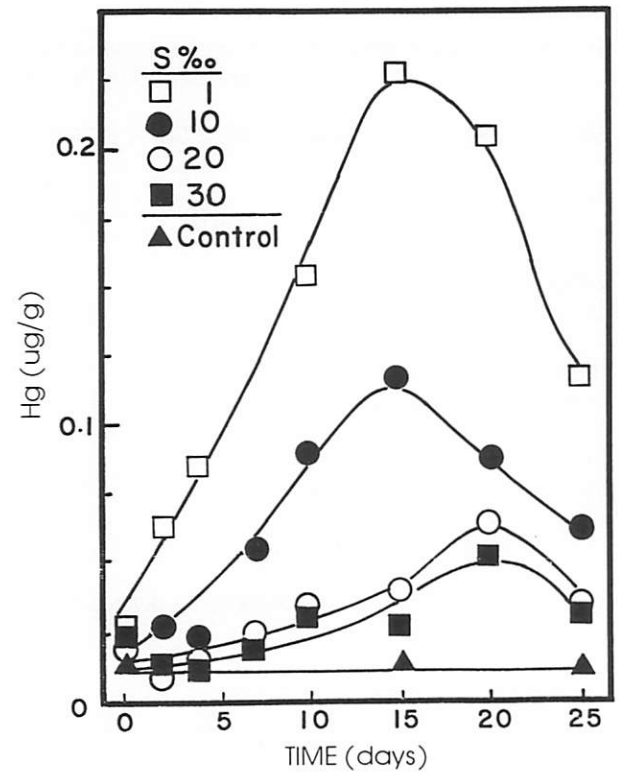

Figure 1. Relationship of salinity to the microbial methylation of inorganic mercury in anaerobic salt marsh sediments. Salinity (S) is expressed in parts per thousand (0/100). The control is poisoned to suppress microbial activity. The ordinate shows micrograms of methylmercury formed per gram sediment from 10 parts per million of inorganic mercury.

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EFFECTS OF METHYLMERCURY ON KILLIFISH

P. Weis, J. Weis

Drs. Weis and Weis, of C.M.D.N.J. and Rutgers - Newark, have been studying effects of methylmercury (meHg) on embryos of the killifish, ***Fundulus heteroclitus***. In studying a population from a relatively clean area (eastern Long Island), they noted that some females produced eggs very susceptible to teratological effects, while other females produced eggs more tolerant. Tolerance of the embryos was found to be correlated with certain characteristics of the female and of the eggs. In studying fish from Pile's Creek, a tributary of the Arthur Kill in Linden, N.J., an area heavily impacted by metal and oil pollution, the vast majority of females produced eggs tolerant to methylmercury (Fig. 1 and 2). This is interpreted as evidence for the development of resistance on the part of a stressed population. Uptake data indicated tolerant eggs took up less mercury than resistant eggs.

Later studies comparing meHg tolerance with tolerance to other metals showed that in the L.I. population meHg tolerance was correlated with $HgC1_2$ tolerance. In Pile's Creek, however, while there was considerable tolerance to meHg, the $HgC1_2$ proved more toxic in terms of causing embryonic mortality. This is evidence that tolerance is specific for a particular toxicant, and not universal. Furthermore, in the L.I. population, meHg tolerance was inversely correlated with lead tolerance, and in the Pile's Creek population, there was no correlation of MeHg and Pb tolerance, although overall Pb tolerance was greater than in L.I.

Toxicity tests on larvae hatched from control groups from L.I. revealed a clear correlation of larval meHg tolerance with embryo meHg tolerance. This indicates that the degree of tolerance is inherent in the embryos, and not just a function of chorionic permeability to the particular toxicant.

Metallothioneins, protective metal-binding proteins, were found in some gels of unfertilized eggs from both populations, but in very low quantities. It is unlikely that this small amount could account for a significant amount of Hg binding and be responsible for increased tolerance.

Figure explication: CFI (cranio-facial index) is a measure of the degree of abnormality in development of the head and eyes, in which 0 = normal, 1 = slight convergence of the eyes, 2 = greater convergence, to touching 3 = synophthalmic 4 = fusion of eye cups, but two lenses formed, 5 = cyclopic, and 6 = anencephalic (no head).

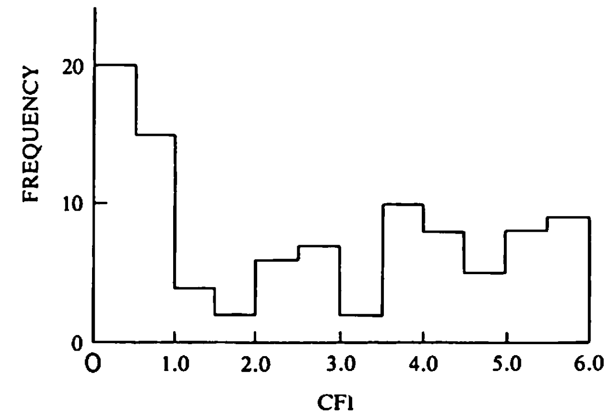


Figure 1. Distribution of CFI among treated (0:05 ppm meHg) batches of eggs from Long Island.

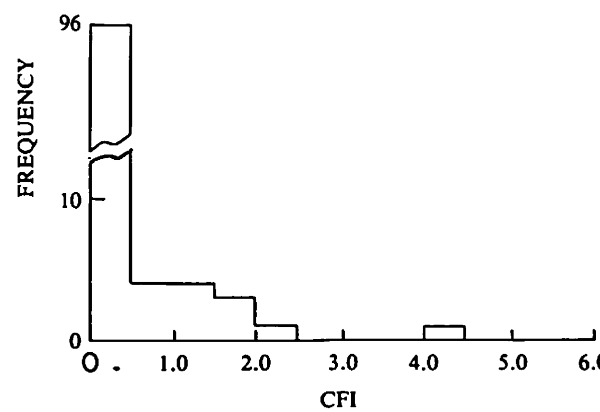
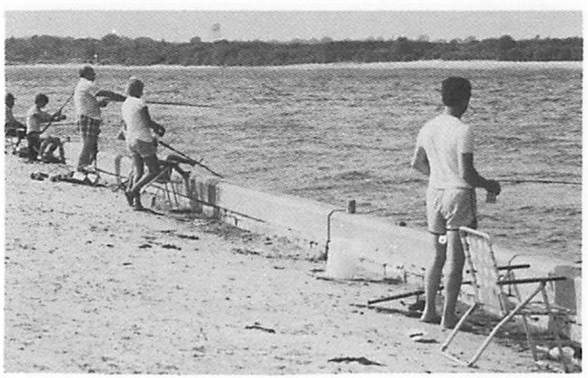


Figure 2. Distribution of CFI among treated batches of eggs from Pile's Creek

II FISHERIES



Fishing is extremely important in New Jersey. Our state perenially ranks among the top twelve in value of commercial landings and in the first six in sport fishing expenditures. In both economic and cultural terms, therefore, fisheries enjoys priority in the state. Ironically, fisheries technology is only just beginning to emerge as a recognized component of academia. This icthyological rennaissance is due mainly to the Sea Grant program.

Owing to the serious decimation of fish stocks in this area, assigned mainly to pollution, overlap between these two categories in our program is inevitable. Thus, characteristically, two of the projects included as "Fisheries" deal with species under stress.

Finally, our report strives for balance, with an equally important study of the fishing community itself.

LIFE HISTORY AND POPULATION DYNAMICS OF TILEFISH IN THE MID-ATLANTIC BIGHT

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C. Grimes, K. Able

The tilefish, *Lopholatilus chamaeleonticeps*, is an important fishery resource in several Mid-Atlantic and southern New England states. During the last three years the dockside value for the entire tilefish fishery has exceeded $8 million per year. Fishermen have received as much as $1.45 per lb. and this accounts in part for the fact that tilefish have been the most important finfish in New York and New Jersey in recent years. In 1981 over 4 million lbs. were landed at New Jersey ports, primarily Barnegat Light, grossing nearly $4 million. In addition, these figures do not reflect the additional revenue generated by the fishery for those involved in dockside support, shipping and marketing as well as the small, but persistent, recreational fishery. Recently there is evidence of interest in tilefishing spreading from New Jersey ports to Virginia, South Carolina, Florida and Texas. Despite the present economic value and the potential for expanding the tilefish catch in other areas of the east coast and in the Gulf of Mexico, there is relatively little known about the life history and population dynamics of tilefish.

To this end, Drs. Churchill Grimes and Ken Able of Rutgers University, and their graduate students, are trying to understand the life history and population dynamics of tilefish to provide the basis for the rational management of this resource. Tilefish live at the edge of the continental shelf in depths of approximately 550-800 ft. making it somewhat difficult to study them. Samples obtained from the commercial longline fishery indicate that tilefish can grow to be about 30 years old. However, growth rates are very different for male and female tilefish, accounting for the fact that most all the large fish (50-60 lbs.) are males. The investigators now know that tilefish reproduce from spring through fall, each female probably spawning several times, with a peak in the summer. Preliminary tagging studies with specially designed gear, allowing the fish to be tagged on the bottom, suggest that tilefish move very little. One of these tagged tilefish was recovered over 19 months later in the same area in which it was initially tagged. Other observations of tilefish from submersibles by these scientists have found them living in burrows that may be inhabitated by individual tilefish for as long as one year. These studies help to explain another finding, namely, that tilefish off the Mid-Atlantic states are a single population and separate from those off the south Atlantic states and in the Gulf of Mexico. Analysis of catch data from cooperating fisherman indicate that catch rates have declined somewhat since 1974, but further studies are needed to determine the magnitude and significance of the decline. The same data have shown that a pronounced seasonal change in catch rates occurs, with the poorest catches typically made during the summer and fall. Attempts to define the sustainable yield of tilefish are being examined by modeling effects of different levels and strategies of fishing.

Our preliminary findings have been used by fishermen in the Mid-Atlantic Bight and elsewhere, and are being incorporated into the tilefish management plans for the regional fishery management councils. They have also been taken into consideration by government agencies interested in the effects of offshore oil development.

INHIBITION OF NUTRIENT ABSORPTION IN FLOUNDER AND OTHER FISH, CAUSED BY METAL POLLUTANTS

A. Farmanfarmaian

A. Farmanfarmaian, Rutgers University, is attempting to establish the range of mercury concentrations that would significantly inhibit absorption of essential amino acids in commercially and recreationally important fish, such as the summer and winter flounder. The killifish is being similarly investigated, in view of its popularity as food for larger species. The laboratory studies are being related to actual conditions in coastal waters and Dr. Farmanfarmaian is further exploring the possibilities of finding ways to render the heavy metals inert, in terms of intestinal absorption.

Inhibition of leucine absorption has been measured in the range of 0.25-10 ppm Hg^{++} in a variety of fishes including summer flounder, winter flounder, common killifish, striped killifish, toadfish, and sea robin. The level of inhibition ranged from 10 to 80%. Two species of sea urchins were also tested in this respect because they are an important food of man, fish, and lobsters and extensively used as experimental animals. Both had inhibition in the range of 10-40%. By contrast CH_3Hg^+ did not cause inhibition except at the high concentration levels of 10 and 20 ppm.

The range of Hg^{++} which caused serious inhibition is well within those reported by Multer and also Koepp and McCormick for sediment and organismal samples from Sandy Hook, Raritan, New York, and Newark Bays. The same range can be found in major harbor areas in the U.S. and other areas of the world. Gut contents of eels and fish from contaminated waters have also been shown to contain heavy metals in the range tested.

Summer flounder from Sandy Hook Bay (polluted) and from Brigantine Inlet, N.J. and Buzzards Bay, Mass. (unpolluted) and killifish from Piles Creek, N.J. (polluted) and Beachhaven, N.J. (unpolluted) were compared with respect to the effect of Hg^{++} on leucine absorption. It was shown that animals from polluted areas were more readily inhibited presumably because of the existing load of the toxicants. This may lead to poorer growth and development of flounder in the Sandy Hook Bay, a favorite nursery for summer and winter flounder. We would like to compare the two populations with respect to growth and development. These experiments must be repeated and extended to other nutrients in order to increase the confidence in the field data and establish the generality of the observed phenomena.

EFFECTS OF NAPHTHALENE ON THE SHRIMP NEOMYSIS AMERICANA

B.R. Hargreaves & S.S. Herman

Ecologists & fisheries scientists have known for some time the importance of mysids in the diet of many fish species in New Jersey coastal waters, in particular flounder and weakfish. Their small size (less than 15 mm long) belies a much larger ecological role, since they occur in dense aggregations during spring and summer months.

Since the mid-70's it has been known that some mysids are more sensitive to oil pollution than most other marine animals, yet the dominant mysid in our region had not been studied with a focus on pollution until the project of Drs. Bruce R. Hargreaves and Sidney S. Herman (Lehigh University) began. Their study is addressing ecologically relevant questions of hydrocarbon toxicity using model compounds, such as naphthalene (a common moth repellent and toxic component of crude and refined oils), to learn about the affects of more complex toxic mixtures which enter the marine environment from many sources (for example, crankcase oil, in sewage and road surface runoff).

The project became possible with the development by Dr. Hargreaves (in 1978) of laboratory culture techniques for the dominant mysid, *Neomysis americana*. With an understanding in hand of what mysids require to remain in good health in the laboratory, a study of the short-term effects of naphthalene began. To explore the possibility that sensitivity to naphthalene might change with changing seasons, mysids were collected monthly and were tested at normal water temperatures (between 7 and 25°C thus far). Only a few previous studies have investigated temperature effects on hydrocarbon toxicity in crustaceans, and none has combined such a study with an investigation of effects of season.

The study uncovered a seasonal shift in sensitivity to naphthalene: mysids were more sensitive during summer months (probably the period of highest oil pollution because of summer boat and auto traffic). The median lethal concentration after a 4-day exposure was 0.8 parts per million (ppm) naphthalene at 25°C and approximately 1.5 ppm at lower temperatures. Several dual-temperature experiments then showed that the increase in sensitivity was largely caused by exposure to temperatures above 20°C, regardless of the season. The study is continuing to document the effect of temperature and establish whether other seasonal effects also exist.

The lowest level of naphthalene, which kills *Neomysis* during several days exposure, is probably above typical levels found in most of southern N.J. coastal waters. What, then, do the mysid experiments tell us about the potential for poisoning the natural populations? As the focus changes to a study of chronic effects, (when exposure to naphthalene will extend to weeks and months), the data indicate a range of temperatures must be tested to obtain a realistic estimate of environmental impact. The data must be extended by testing other related compounds, since mysids are exposed to complex mixtures in nature, and many are more toxic than naphthalene. Information is needed on the concentrations of this and similar compounds in nature, but the task is difficult because water concentration does not necessarily indicate availability to the animals.

A better estimate of the potential impact of hydrocarbon pollution can be made when Hargreaves and Herman have completed tests of related aromatic hydrocarbons and determined the effect of mixtures on toxicity. The accumulation of this class of compounds in mysid tissues is also of concern, especially when there is the possibility that the chemicals (some of which are carcinogenic in mammals) will be passed through the food chain to fish and perhaps man. As with the well-publicized pesticides made from chlorinated hydrocarbons (for example, DDT and DDE), aromatic hydrocarbons are concentrated ir fatty tissue in animals at concentrations far above the concentration in the water.

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EFFECTS OF CHANGES IN THE LEGAL REGIME ON NEW JERSEY FISHING COMMUNITIES

B.J. McCay

Since the inception of Sea Grant, social science has been considered an integral part of research efforts towards its mission. The social science perspective focuses on the human components of the complex ecological systems that link the resources and processes of the sea to the needs, values, and activities of society. Using this perspective, Dr. Bonnie J. McCay of Cook College, Rutgers University, is engaged in a study of the social and econonic effects of changing laws of the sea on commercial fishing communities of northern New Jersey, with particular reference to the Fishery Conservation and Management Act of 1976 (FCMA).

An earlier phase of the project contributed by focusing on the "fishery management system" of one of the fishermen's cooperatives in the study region. Analysis of the system suggested the need to look not only at the effects of systems imposed from the outside, but also to recognize that fishermen can and often do play a substantial role in the creation of management systems which directly affect them. In 1980-81 the project involved the completion of socio-economic profiles for three fishing ports in the region—Point Pleasant Beach, Shark River Inlet (Belmar/Neptune) and Belford—and a more direct focus on the impacts of the 1976 Act on these fishing ports. The project also investigated historical aspects of New Jersey's fisheries because of discovery, while doing field research, that fishermen frequently point to the history of fisherman/government interactions when trying to explain present difficulties in working together for improved fisheries management and development.

The study thus far suggests that:
— The FCMA has improved the investment market in New Jersey's commercial fisheries.
— The fishermen worry about regulation of specific fisheries, and intend to have alternatives in the event of burdensome regulation.
— Some fishermen have reduced involvement in cod, haddock, and yellowtail flounder because of quotas.
— Concern has been transferred from foreign competition to domestic management.
— Some fishermen have engaged in cooperative ventures with foreign firms.
— Many fishermen have been severly affected by the Surf Clam and Ocean Quahog Plan.

Dr. McCay is currently assessing the extent to which different groups of fishermen depend on fishing for a living and exploring the popular supposition that fishermen with the least education and experience in alternative occupations are most committed to fishing. The most commonly voiced advantage of fishing is "being your own boss."

A final branch of the study explores kinship and family relations, fishermen's organizations, and cultural shifts.

III SHORE PROCESSES

As mentioned previously, New Jersey's waters are the most heavily trafficed of any state in the country — including waterborne commerce and commercial/recreational fishing and boating. Thus, the condition of the state's inlets, passages, barrier beaches, and other coastal features is crucially important, both economically and culturally.

This component of New Jersey's Sea Grant program is concerned with determining changes in the shoreline and how they may best be reconciled.

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LITTORAL SEDIMENT DISPERSAL OF MATERIALS DREDGED FROM BARNEGAT INLET USED AS BEACH NOURISHMENT ON THE NORTHERN END OF LONG BEACH ISLAND, NEW JERSEY

G. Ashley, S. Halsey

The trio of strong northeast storms during the winter of 1977-78 caused severe beach erosion along much of the New Jersey coast. Citizens of Long Beach Island, some whose memories of the 1962 storm were all-too-fresh, pressed their government officials for action to repair their beaches. Congressmen William Hughes, a coastal resident himself, found money in an emergency account in Washington and had it obligated to the Army Corps of Engineers for a northern Long Beach Island beach fill project using Barnegat Inlet channel sand. (Figure 1, arrow points at critical zone).

A research project was designed by Gail Ashley, Rutgers University. Susan Halsey NJDEP; and Stewart Farrell, Stockton College to answer the following questions: would the grain size of beachfill be compatable with the beach sediment already there? We knew that too fine a fill would soon disappear. How long would the fill last before nourishment was needed again? We knew the residence time for sand in certain areas of the coast was quite short, mainly due to fine grain sizes. When it did begin to erode, where would the sand go, how fast would it move, and what impacts would the transported sand have on the recipient beach? We knew from research in other coastal states that longshore currents changed direction in a certain location along a barrier island. The question for Long Beach Island was where was

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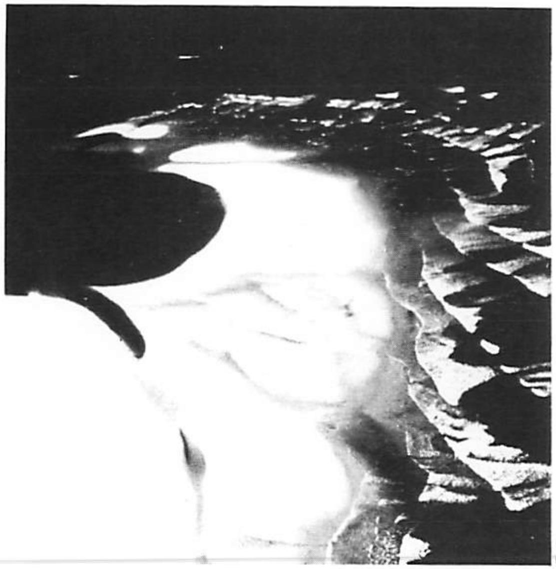

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this nodal zone and what would be the result of this movement?

The Corps plan called for approximately 1.5 million cubic yards to be dredged from Barnegat Inlet Channel and dispersed on the beach. Because of severe weather the dredge did not begin nourishing the beach until mid-March 1979 (Figure 2) allowing 5 months to study the area prior to nourishment. The dredging continued until late July and the design volume was determined to be equivalent to 100 cubic yards per linear foot along 15,000 feet of northern Long Beach Island, extending from the south jetty of Barnegat Inlet to Loveladies in Long Beach Township. The finished emplaced volume amounted to just less than 1 million cubic yards of sand.

Approximately every two weeks, the research team repeated the profiles, took ground photos, longshore current measurements and sediment samples. Grain size analysis of the dredge spoil indicated that although the dredge spoil (ranging from 4mm to 0.44mm) was more poorly sorted then the initial beach, both had mean grain sizes of 0.44mm and thus were compatible.

The eroded sediment from the forebeach-berm areas of the nourished beaches migrated north joining with a landward migrating ebb delta bar, forming a large arcuate shoal just south of the Barnegat Inlet south jetty (Figure 3). This bar migrated steadily landward and, during the summer of 1980, the average movement landward of the advancing slipface was approximately 3 meters per week. The bar finally welded to the beach in December, 1980. Since that time the shoal has grown northward, oblivious to the presence of the inlet jetty, hooking into the interjetty area and enclosing a pond between it and the beach.

The remarkable growth northward of this shoal despite the occurrence of approximately 12 major storms and 12 minor ones since emplacement, and the results of the littoral current observations, confirmed our prediction of an effective northerly longshore drift from the middle of Harvey Cedars north to the inlet. This particular result of the study has already been used by the Army Corps in their Phase I General Design Memorandum for their proposed alternative for the realignment of the Barnegat Inlet south jetty. Based on the results of this Sea Grant project, the sand dredged from the new inlet will be used as beach fill for the eroding beaches in the nodal zone, but will be more carefully emplaced so as not to be eroded and carried to the north.

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SHORELINE CHANGE AND LAND USE AT TIDAL INLETS IN NEW JERSEY

K.F. Nordstrom

One of the problems of management of coastal environments in developed areas is that of optimizing land use in locations characterized by rapid and unpredictable changes, susceptible to considerable environmental hazard. The problem of shoreline management is particularly acute near tidal inlets because the beaches in these locations are subject to rapid change. Additionally, inlet shorelines have historically been prime locations for development.

Dr.Karl F. Nordstrom, of the Rutgers University Center for Coastal and Environmental Studies, has been conducting a study designed to develop models of beach change and land use to provide the basis for adequate planning in highly dynamic inlet environments in New Jersey. To be effective, the selection and implementation of land uses must reflect the dynamics of the physical system. Work conducted during the first year of the project has, therefore, been directed toward this end.

Dr. Nordstrom has constructed maps showing both long-term and short-term changes at each of the twelve New Jersey inlets using charts dating back to the early ninteenth century, supplemented by aerial photographs and ground surveys conducted in the field. The dimensions of the beaches and dunes at each inlet have been quantified, and rates of shoreline change have been calculated. Dr. Nordstrom has concluded that changes in shoreline position at inlets have been occurring at a lower rate in the past 50 years compared with earlier periods of record because of the implementation of programs of beach erosion control and inlet stabilization. However, inlet shorelines are subject to more rapid changes in position than the ocean shorelines adjacent to them, and the short-term shifts in shoreline position at inlets are often nearly as great as long term shifts measured over periods as long as a century. This high degree of beach mobility makes the inlet shorelines particularly vulnerable to erosion hazard and, therefore, not very suitable for new development.

There are inherent differences in the form and dimensions of the beach and dune environments at different locations near natural inlets resulting from the manner in which inlet tidal currents interact with wave-created longshore currents. The differences in shoreline form and susceptibility to barrier island breaching and inlet migration on these categories of shoreline imply different land uses are appropriate to each location. Major areas of concern are the shorelines updrift of unjettied inlets subject to barrier island breaching during storms. This vulnerability implies that such areas should be devoted to non-structural uses such as public parks. Shorelines downdrift of inlets can suffer accelerated erosion under storm conditions, but storms can occasionally cause net accretion here. Significant erosion can also occur under non-storm conditions at these beaches. Changes on these highly mobile beaches are not easy to predict, which makes it difficult to identify appropriate land uses for these areas.

There is a considerable amount of land without existing buildings on many of the updrift inlet shorelines. In most other locations already developed for residential use, few exceed maximum possible building densities. As development of such areas continues, the degree of erosion hazard increases as does the need to reformulate policies for management of these areas. Dr. Nordstrom is now developing criteria for assigning appropriate land uses for inlet shorelines and examining the land use controls available to local, state, and federal governments in light of the physical constraints of the natural system at each inlet. The result will suggest management strategies and policy changes which may be applied for each inlet and for inlet shorelines in general.

DETERMINATION OF THE IMMEDIATE SOURCE AREAS AND PROBABLE SEDIMENT TRANSPORT PATHWAYS OF NEW JERSEY BEACH SEDIMENTS

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B. Carson

This study by Dr. Bobb Carson, Lehigh University, sought to determine the immediate source areas and sediment transport directions of New Jersey beach sands by examining the heavy mineralogy and texture of beach and nearshore (18 m) deposits. Multivariate factor and cluster analyses were employed to delineate diagnostic mineral species and define mineralogic zonations in beach and nearshore deposits.

The New Jersey beaches can be divided, on the basis of mineralogy, into three distinct zones (Figure 1). Zone 1 deposits consist of hornblende-rich fine (0.125 - 0.250 mm) sands, extending from Brigantine Inlet to Cape May. Zone 2 sediments are illmenite-rutile-pseudorutile-tourmaline-rich medium (0.250 - 0.50 mm) sands which occur on beaches between Barnegat Inlet and Brigantine Inlet (northern Zone 2) and on the Delaware Bay shore (southern Zone 2). Zone 3 deposits are dominated by glauconite and consist of medium (0.250 - 0.50 mm) sands which extend from Sandy Hook to Barnegat Inlet.

The sources of these beach sands are diverse. Beach deposits from Sandy Hook to Barnegat Inlet (Zone 3) are derived principally from the Tertiary coastal formations which comprise the headlands between Asbury Park and Monmouth. The beach sands from Barnegat Inlet to Brigantine Inlet (northern Zone 2) are currently derived from inner-continental shelf deposits (Figure 1). Southern Zone 2 (Delaware Bay shore) beach sands are derived from the Cape May Formation, which crops out on the shore. The immediate source of beach sand from Brigantine Inlet to Cape May (Zone 1) is nearshore (within 7 km) continental shelf sediment (Fig. 1). Modern sediments of the Great Egg Harbor, Mullica, and Wading Rivers are not being transported in discernible amounts to the New Jersey beaches.

The distribution of northern Zone 2 and Zone 3 source deposits in relation to the occurrence of like sediments on the beaches (Fig. 1) indicates sediment transport from the inner shelf to the beach is directed to the southwest, rather than directly onshore.

Under normal conditions, littoral drift south of the Manasquan region is dominantly southward, while north of Manasquan it is generally northward. The abrupt changes in mineralogy at Barnegat and Brigantine Inlets suggest significant sand transport may not occur across these inlets. Southerly transport across Manasquan and Little Egg Inlets has been effected, however, either during major storms or by dredge disposal on the south side of the inlets.

Both sediment texture and mineralogy suggest longshore transport of New Jersey beach sands is limited. While it obviously occurs along individual islands, transport across the inlets may not be volumetrically significant.

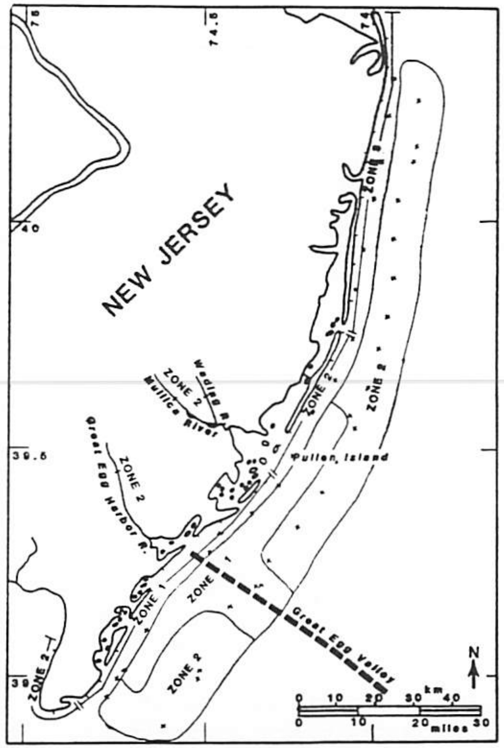

Figure 1. Mineralogical zones for beach, shelf, and river samples.

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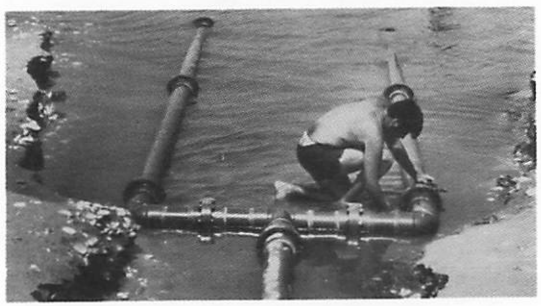
MAINTAINING NAVIGABLE CHANNELS BY FLUIDIZATION TECHNIQUES

J. Parks & R. Weisman

Along the Atlantic coast of New Jersey, thousands of recreational and fishing boats use the inlets between barrier islands as marine highways to get to and from marinas and harbors on the lagoon side and fishing areas on the ocean side. These inlets are strongly affected by twice-daily tides. Rising tides produce strong landward-directed currents in the inlets and, a few hours later, falling tides produce strong seaward currents. These water currents, fluctuating in both direction and velocity, react on the sandy bottom sediments to form shifting shoals hazardous to boat navigation in and near the inlets. Conventional dredging of navigable channels offers only a temporary solution since a channel may become partially filled with sand in only a few weeks or months, and must be dredged again and again.

Another approach to maintaining navigable channels is to assist natural processes — to make it easy for sand to move through the inlet channel and to make it difficult for sand to come to rest and build up shoal deposits in the channel. A method called fluidization has worked well in the laboratory. A year ago, Drs. James M. Parks and Richard N. Weisman of Lehigh University completed several years of laboratory-scale experimentation aimed at understanding the fluidization process.

The concept is to place several perforated pipes along the length of a channel immediately after normal dredging. At frequent time intervals (weekly, monthly), when a few inches of sand has accumulated locally within the channel, water is pumped into the buried pipe. As the water emerges from the pipe perforations, the sand becomes fluidized to form a slurry mixture that will flow naturally down a seaward bottom slope, or will be carried out of the inlet by strong tidal bottom currents. The channel will be stabilized in both position and navigable depth.



During the past year, a larger version of the fluidization system was field-tested at a location in Corson's Inlet, New Jersey. Scaling-up such a system and testing it under natural (not controlled laboratory) conditions will usually reveal unanticipated problems. Two such problems were encountered: (1) floating seaweed tended to clog both the pump intake openings and the perforation in the buried pipe, thereby reducing the efficiency of the system; and (2) many large dead clam shells in the sand deflected the water jets, reducing the width of the fluidized zone. These shells did not readily move down the channel slope and remained behind to form a concentrated pavement.

Neither problem appears to be serious. Although equipment limitations did not allow many changes during the field tests, placing the pump several feet below the water surface should prevent the seaweed problem. Once the clam shells are exposed, the swift tidal bottom currents should be able to move them along the channel length. Again due to equipment limitaitons, this field experiment had to be set up on the margins of the inlet, where the tidal currents were not as strong as they would be in the middle of the inlet.

Despite these minor problems, the single 40 foot long fluidization pipe worked well, and the dual 20 foot long parallel pipes interacted to form a fluidized channel over 6 feet wide, as expected. Sufficient data are now available to design a full-scale system for a specific inlet. Although the initial cost may be double that of a single dredging, the expected life of a fluidization system should be 15 to 20 years, providing long term savings. In additon, the fuidization method would keep the channel at navigable depths at all times, whereas with dredging, shoaling and shifting the navigation channel gets progressively worse with elapsed time since dredging.

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ADVISORY SERVICES

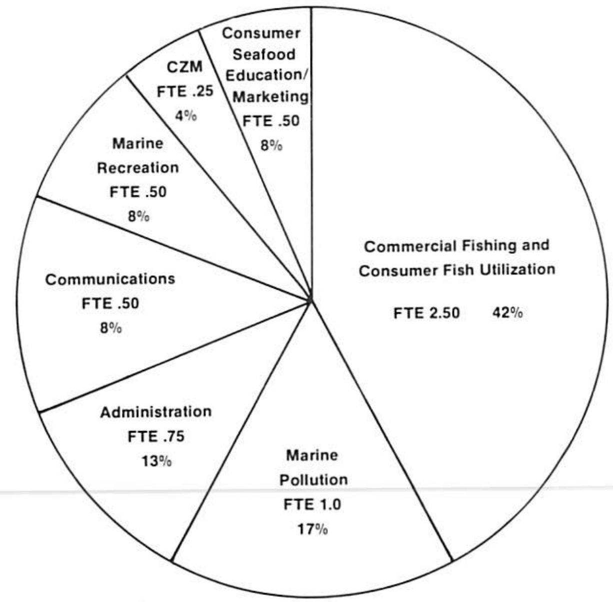
J. Murray

New Jersey is a state richly endowed with coastal and marine resources. Despite the state's small physical size, its 1792 miles of coastline ranks fourteenth among the states. Eighteen percent of the state is classified as coastal by the N.J. Coastal Area Facility Review Act. This percentage ranks fifth among the states. Perhaps the most striking feature of New Jersey's coast is its diversity. The coast harbors the petrochemical industry, the state's largest, houses many of its citizens in 240 coastal municipalities, and provides recreational opportunities for the inhabitants of the nation's most densely populated state.

Since the inception of the Sea Grant program in New Jersey in 1975, the Marine Advisory Service has been the educational component of the Sea Grant program. It's primary aim is to address the interests of this diverse community. The overall objective of the MAS is to develop and implement educational and informational programs which will promote the wise use and development of New Jersey's coastal resources. Specifically, the MAS 1) identifies informational needs of user groups; 2) transfers information by variety of mechanisms to coastal user groups; 3) stimulates user groups to apply this information; and 4) assists the research community to develop research programs that address these needs.

Mechanisms employed to carry out these goals include:
— initiation of a problem-solving educational program in the areas of commercial fisheries aquaculture, seafood consumer education/marketing, coastal law, marine trades, urban waterfront redevelopment, and marine pollution.
— establishment of a close working realtionship with federal, state, and local agencies. educational institutions and private interest groups.
— organization of an inter and intrastate communications system using print, radio, and television media.
— solicition of input from user groups through agent advisory committees and attendance of a variety of private interest group board meetings.
— assistance with the development of the Sea Grant research program as members of the reseach review committee.

DISTRIBUTION OF EFFORT MARINE ADVISORY SERVICE



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ADVISORY SERVICES — SELECTED ACCOMPLISHMENTS

Commercial Fisheries -
The major objective of our Ocean County marine agent's advisory committee was the improvement of weather information services. A concern was voiced by the 80 fishermen attending an October 1980 conference on weather and the fishing industry, sponsored by the MAS and the National Weather Service (NWS). As a result of the meeting, the NWS asked the agent to form a regional task force of fishermen to suggest ways to improve forecasting. The task force meeting was held at the NWS headquarters in Washington and about a dozen fishermen participated. Two problems expressed were the time lag of obtaining NWS and satellite isotherm data and relatively poor offshore weather forecasting.

Both of these problems were addressed this past year. The satellite data are transmitted to the marine agent's office by telefax machine from the World Weather Building in Washington, D.C., and sent out immediately. Also, as part of the package, the agent developed LORAN-C overlays and temperature conversion charts, which are now received by fishermen in one day, rather than the customary seven days after they had been recorded. Results were striking. A letter from the President of the National Swordfishermen's Association indicated the program saved the swordfish industry approximately $2,250,000 in fuel costs in the first year.

Seafood Education -
The MAS specialist presented information on radio and television in four eastern cities (Pittsburgh, Buffalo, Philadelphia, and Wilmington) as part of the National Marine Fisheries Service, National Fisheries Institute, and Food Marketing Institute's "Catch America" campaign. An average of 50 people per show sent for materials. At Buffalo, sales tripled at the Belle's Supermarket Chain during the 30 days following the campaign from a Lenten high of 2,100 lbs. per week to 6,315 lbs. Comparable figures for the Giant Eagle Chain in Pittsburgh showed an increase from 4,300 lbs. to 5,700 lbs. per week over the average of preceding years. Additionally, several contacts were made which assisted New Jersey fishermen to find new markets. For example, Kotok-Heims, the major seafood distributor in Buffalo, evidenced an interest in handling tilefish. The MAS specialist arranged for a tilefish fisherman and his wife to go to Buffalo to educate company's distributors about tilefish, with the result that the product is now being marketed in the Buffalo area.

Marine Recreation -
The MAS worked with the Marine Trades Association of New Jersey to sponsor the 3rd Annual Marine Trades Conference. Fifty-five marina owners and boat dealers attended. One of the sessions addressed the condominium concept for marinas. As of this writing, one Marina owner is planning to "condominiumize" his marina. In view of interest in this subject, an article was prepared for the Jersey ShoreLine, and Marina, a national magazine.

Much of the communications work is ongoing. Close to seven million viewers, mostly on the network stations in Philadelphia, saw the 31 MAS-conducted television shows on a variety of topics related to the Sea Grant Program. When publications were offered to the public, an average of 125 viewers per show requested materials. Our Cape May Agent conducts a regular television series (nine per year) in the Cape May area. The Rutgers Marine Line continued with a weekly show syndicated on 23 radio stations throughout the New Jersey area (including New York City) with an estimated listenership of three million/week, or approximately 150 million per year. In the print medium, quarterly issues of the Jersey ShoreLine were produced and distributed to 2,000 subscribers per issue.

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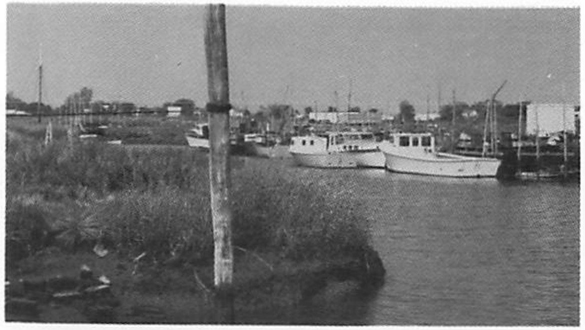
Regional Programming -
MAS specialists from other states twice presented programs in New Jersey this year. New Jersey agents and specialists have participated in seven programs within the region during the year. The New Jersey MAS organization, in conjunction with other Mid-Atlantic MAS programs, sponsored a major Artificial Reef Conference attended by over 120 people from the Mid-Atlantic states.

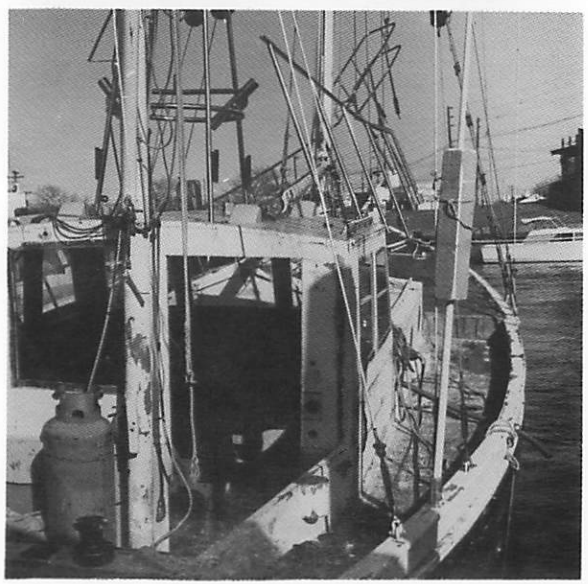
Interaction With Agencies -
The MAS pollution specialist position is funded jointly by the NOAA's Northeast Office of Marine Pollution Assessment and the MAS. This individual develops programs based on OMPA,NE and Sea Grant Northern New Jersey Estuarine Project information, and acts as coordinator between the two projects. Eight proposals were submitted to OMPA,NE by New Jersey investigators after an informational meeting organized by the pollution agent. Additionally, initiation of a waterfront redevelopment program in New Jersey meshed nicely with OMPA's plans to improve monitoring in the Hudson/Raritan Estuarine Program. For example, the pollution specialist met with city planning officials in six Northern New Jersey waterfront communities to describe the Sea Grant and OMPA Estuarine Programs, and to discuss needed programs in waterfront development.

The State Secretary of Agriculture requested MAS to organize commodity councils for fisheries agencies and fishermen. Meetings held by the Cape May agent resulted in a council being formed for the surf clam industry. The MAS law specialist assisted the Department of Agriculture and the councils with the legal framework.

A key policy issue to marine fisheries management is residency versus non-residency requirements for licensing. The Marine Fisheries Administrator fo the New Jersey Department of Environmental Protection asked the MAS law specialist for assistance in tracing the legal history of the residency issue. The administration believed much of the present day policies were based on a cumulative series of past unsound legal decisions. Presently the MAS law specialist is tracing the legal history of this issue in order to determine important legal requirements. When completed, it is expected the interpretation will provide a new legal basis for fisheries management in New Jersey.

Distribution of Effort -
The pie chart shows the distribution of effort in the program during the 1980-81 year. With only six FTE's to do marine programming state-wide, movement across program lines is frequent. For example, our communications specialist split her time between communications and consumer seafood education/marketing. The director spent 50% of his time on administration and 50% on recreation programming, while the law specialist spent 25% of his on CZM programming, 25% in recreation, and 50% in commercial fisheries and is folded into those programs. Although imprecise, the chart does depict relative effort.





MARINE EDUCATION

The education component of New Jersey's program is quite limited, in keeping with the size of the overall program. It is dedicated entirely to precollege education. A novel aspect of New Jersey's Sea Grant Education program relates to our partnership with the Girl Scouts organization and the pioneering effort taking place. Hopefully, project techniques developed here will be exported throughout the national Girl Scouts network.

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THE SEA EXPERIENCE FOR GIRL SCOUTS

B. Church

The Burlington County (New Jersey) Girl Scout Council is pioneering in development of a marine and coastal experience program for the Girl Scouts of America. The component projects are varied, but all relate to the central theme of acquainting the young women with the ocean and shore, the effects of society's activities upon them, and why it is important to recognize and understand the sensitivity of the land/sea interface.

Senior Troop #103 of Burlington County, through intensive practice, developed selected skills relating to the ocean and marine affairs. In May of 1980 the troop conducted a teachers workshop, under the auspices of the New Jersey Education Association and the New Jersey Marine Education Association, at Island Beach State Park. The Scouts conveyed to the assembled teachers the skills that they had developed, including scrimshaw, Japanese fish printing, and other marine arts.

Stemming from this first workshop a pilot program was then developed for other Scout troops and presented to 36 selected teachers in two three-day summer sessions at Sandy Hook. For the remainder of the Sea Grant year, the leaders worked with their troops, testing the pilot materials. In November of 1980 the pilot program occupied a booth at the New Jersey Teachers' Association Annual conference at Atlantic City. Predictably, it received gratifying attention from the conference participants. The remainder of the year was devoted to testing the pilot program and conduct of evaluation and training sessions.

Heading into 1981, the highlight was the Sea Grant Leaders' Workshop, planned and conducted by the Morris Area Council. On April 11 the workshop was held at Old Cabin, with table exhibits of pilot troop projects. Topics included:

1. World of People: Communication, flag signals; town meeting, water issues.
2. World of Arts: Crafts, "found objects"; music and dancing; poetry and folklore.
3. World of Today and Tomorrow: "Science Sleuth" and "Water Wonders"; the Morris Canal.
4. World of Well-Being: Recreational use of the coast (slides); resources at Sandy Hook; nutrition.
5. World of Outdoors: Stream exploration; water testing; identification of flora and fauna.
6. Ecology of Jockey Hollow: Animal tracks, conservation.

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

MARINE EDUCATION AND TRAINING

A. Galli, V. Guida

During the Sea Grant V year the Wetlands Institute of Lehigh University conducted four highly successful public seminar programs, focusing on shore processes and problems/issues critical to the New Jersey coast. Topics included dune and shore protection, waterway and inlet maintenance, disaster preparedness and wetlands protection. Each seminar, held at the Wetlands Institute, provided a balanced diversified discussion by involving state, federal, university and private business representatives who discussed environmental, social and economic aspects of the issues.

The seminars were well attended and media coverage disseminated information throughout South Jersey. A fact sheet on each topic was developed and over 8,000 were distributed to the general public, teachers, Institute members and others. A slide tape program focusing on the coastal issues has been presented to civic groups as well as 3 statewide teacher workshops. Evaluations of the program by seminar and teacher workshop participants have been excellent and requests for the program continue to be received.

Continuation of this project will focus on providing elementary school-age children, teachers and youth leaders with information and learning activity packages that will introduce them to concepts of shore processes and problems. Two statewide teacher training workshops are scheduled.

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

PUBLICATIONS

NORTHERN NEW JERSEY ESTUARINE SYSTEM

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NEW JERSEY
MARINE SCIENCES
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Schroeder, T.S., and Carson, B., 1982, Immediate source areas and probable sediment transport pathways of New Jersey beach sands, Geol. Soc. America, Abstracts with Programs, 14(1,2), p.80.

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NEW JERSEY
MARINE SCIENCES
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PROGRAM SUMMARY

MARINE RESOURCE DEVELOPMENT

R/F-2
Life History and Population Dynamics of Tilefish, Lopholatilus chamaeleonticeps.
Dr. C. B. Grimes, Dr. K. W. Able, Rutgers University

R/S-2
Littoral Sediment Dispersal of Materials Dredged from Barnegat Inlet Used as Beach Nourishment on the Northern End of Long Beach Island, New Jersey.
Dr. G. M. Ashley, Rutgers University
Dr. S. D. Halsey, NJDEP
Dr. S. C. Farrell, Stockton State College

R/S-4
Determination of the Immediate Source Areas and Probable Sediment Transport Pathways of New Jersey Beach Sediments.
Dr. B. Carson, Lehigh University

MARINE LAW AND SOCIO-ECONOMICS

R/F-3
Human Ecology of New Jersey Fisheries.
Dr. B. J. McCay, Rutgers University

MARINE TECHNOLOGY RESEARCH & DEVELOPMENT

R/S-1
Stabilization of Tidal Inlet Channels for Improved Boat Trafficability by Fluidization of Bottom Sediments.
Dr. J. M. Parks, Dr. R. N. Weisman, Lehigh University

MARINE ENVIRONMENTAL RESEARCH

R/S-3
Shoreline Change and Land Use at Tidal Inlets.
Dr. K. F. Nordstrom, Rutgers University

R/E-1
Field Detection of Chronic Stress in Newark Bay Target Biota, Including Correlation with Ongoing Heavy Metal and Experimental Bioassay Studies Within the Same System.
Dr. S. J. Koepp, Dr. J. M. McCormick, Montclair State College

R/E-4
Modes of Heavy Metal Transport, Release and Mobilization in Raritan Bay, New Jersey.
Dr. H. G. Multer, Fairleigh Dickinson University

R/E-3
Physical Oceanographic and Modeling Studies in Raritan Bay.
Dr. G. L. Mellor, Princeton University
Dr. R. I. Hires, Stevens Institute of Technology

R/E-5
Relationship of Salinity and Redox Potential to Microbial Transformations of Mercury Pollutants in Estuarine Sediments of Northern New Jersey.
Dr. R. Bartha, Rutgers University

R/E-8
Heavy Metal Distribution in Waterbirds of Raritan Bay: Biomagnification, Immigration/Emigration and Seasonal Variation.
Dr. J. Burger, Dr. M. Gochfeld, Dr. C. Leck Rutgers University

R/F-1
Sublethal Effects of Heavy Metals on Intestinal Absorption of Nutrients (Amino Acids, Sugars, and Cations) in Fish Found in Newark Bay/Raritan Bay Areas.
Dr. A. Farmanfarmaian, Rutgers University

R/F-4
Tolerance to Methylmercury Teratogenesis in Newark Bay Killifish.
Dr. J. S. Weis, Rutgers University
Dr. P. Weis, NJ Medical & Dental University

R/F-6
Oil Pollution Impact on New Jersey Coastal Waters: Acute and Chronic Effects of Napthalene on the Shrimp Neomysis americana.
Dr. B. R. Hargreaves, Dr. S. S. Herman, Lehigh University

MARINE EDUCATION AND TRAINING

E/P-1
Shore Processes and Problems: Educating the Public on Critical Coastal Issues.
Dr. A. E. Galli, Dr. V. G. Guida, Lehigh University

E/P-2
Marine Aquatic Awareness Project
Ms. B. S. Church, Burlington County Girl Scout Council

E/T-2
Special Student Research Topics on New Jersey Marine Affairs.
Dr. D. L. Morell, Princeton University

ADVISORY SERVICES

A/S-1
New Jersey Marine Advisory Service
Mr. J. D. Murray

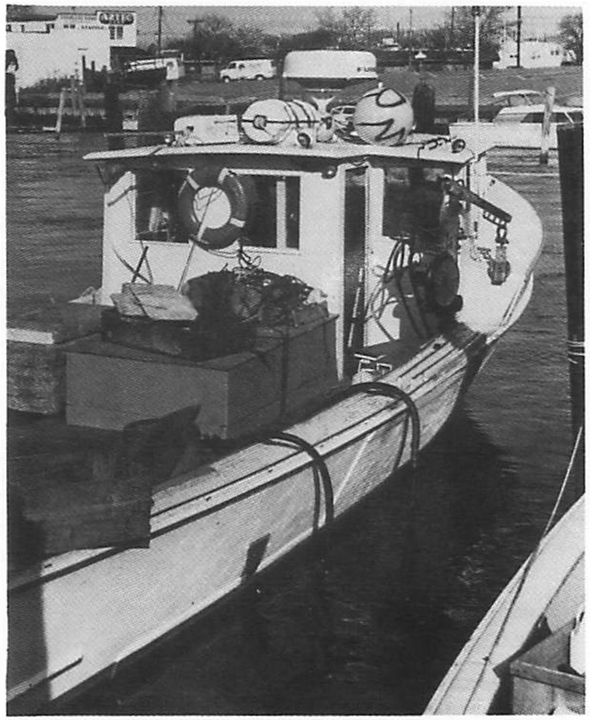
PROGRAM MANAGEMENT AND DEVELOPMENT

M/M-1
Program Administration.
Dr. R. B. Abel, Mr. R. S. Stevens, New Jersey Marine Sciences Consortium

M/M-2
Program Development.
Dr. R. B. Abel, Mr. R. S. Stevens, New Jersey Marine Sciences Consortium

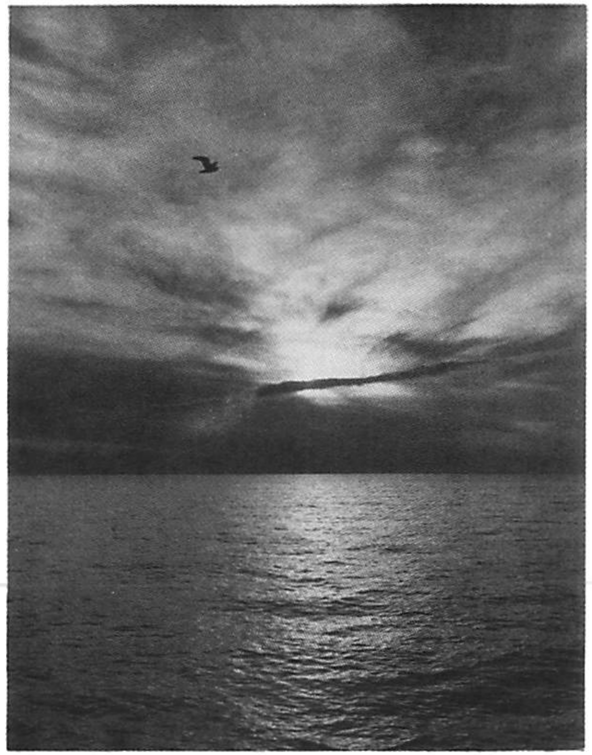
ACTIVITY BUDGET

ACTIVITY BUDGET SHEET (Summary Totals by Activity)



	NOAA Grant Funds	University Matching Funds
MARINE RESOURCES DEVELOPMENT		
Living Resources	$ 30,000	$ 16,500
Mineral Resources	27,000	20,400
MARINE LAW AND SOCIO-ECONOMICS		
Socio-Political Studies	13,500	7,600
MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT		
Coastal Engineering	19,500	9,100
MARINE ENVIRONMENTAL RESEARCH		
Research in Support of Coastal Management Decisions	10,000	9,800
Ecosystems Research	24,000	28,100
Pollution Studies	64,000	62,200
Environmental Models	31,000	22,100
MARINE EDUCATION AND TRAINING		
College-Level	3,000	3,000
Public Education	20,000	14,400
ADVISORY SERVICES		
Extension Programs	123,000	88,900
PROGRAM MANAGEMENT AND DEVELOPMENT		
Program Administration	119,000	59,000
Program Development	20,000	
TOTAL	$504,000	$341,100

ADMINISTRATION



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Mr. Robin D. Zimmer
Director, New Jersey Sea Grant Extension Service

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Building 22
Fort Hancock, New Jersey 07732
201-872-1300