# COASTAL OCEAN POLLUTION ASSESSMENT NEWS

## MAN AND THE MARINE ENVIRONMENT

Volume 1 Number 1 Fall 1980


The purpose of **Coastal Ocean Pollution Assessment** (COPAS) **News** is to provide timely dissemination of information on pollution in coastal waters of the United States — its sources and effects, what is being done to eliminate or mitigate it, and what research and monitoring activities are being conducted to develop more effective strategies to manage it. We publish brief articles describing recent events and activities, new approaches to resolving chronic pollution problems, and early warnings of potential problems. Also, announcements of cruises, meetings, and investigations will be posted.

The newsletter is not a substitute for publication in professional journals or presses. COPAS is not copyrighted, and any reference to material printed in the newsletter must be approved by the author.




**Published by:**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794


## In This Issue



## The Origin of COPAS

In the spring of 1980 the Marine Sciences Research Center (MSRC) was contacted by Dr. John B. Pearce of the National Marine Fisheries Service to determine whether MSRC would be interested in publishing jointly with the Northeast Fisheries Center (NEFC) a quarterly newsletter as a companion to Coastal Oceanography and Climatology News (COCN). The new newsletter would replace the Ocean Pulse newsletter and would be devoted to problems that result from society's uses of the coastal ocean of the northeast United States. An agreement was reached between MSRC and NEFC to produce such a newsletter with the first issue to appear in the fall of 1980.

Independently, the National Oceanographic Data Center (NODC) had decided to support, in conjunction with the Office of Marine Pollution Assessment (OMPA) and the National Marine Pollution Program Office (NMPPO), publication of a newsletter with very similar objectives, but from a national perspective. Discussions among representatives of the several NOAA organizations and the MSRC led to a proposal to publish jointly a single newsletter, rather than two. This is the first issue.

The Newsletter is called **Coastal Ocean Pollution Assessment News** and goes by the acronym COPAS. It will be produced quarterly. The newsletter concentrates on (1) people's impacts on the coastal ocean, its quality, living resources, and on public health; (2) programs to assess these impacts through research and monitoring; and (3) efforts to manage and rehabilitate coastal waters. The newsletter is national in scope. It covers all coastal waters of the United States and its territories and includes coverage of the Great Lakes. Articles on pollution in foreign waters or in open ocean waters may be published if the problems could impact U.S. coastal waters, or if the articles provide insight into dealing with similar problems in U.S. coastal waters.

Suitable subject matter for articles in COPAS includes reports of research and monitoring of pollution events and chronic pollution problems; of their effects on aesthetics, environmental quality, living marine resources, public health, and use patterns of affected waters; and on programs to protect and rehabilitate coastal waters. COPAS also publishes articles on potential pollution problems and on efforts to deal with them before they develop. A section of COPAS is reserved for editorials on subjects appropriate to COPAS and for responses to editorials. COPAS publishes a calendar of workshops, courses, symposia, meetings, and other events that deal with subject matter appropriate to COPAS.

We invite contributions and comments.

The Editors.

# Episodes

## Fish Larvae Used in Shipboard Bioassay For Pesticide Contamination

Spot larvae (*Leiostomus xanthurus*) were used in shipboard bioassay to determine if a pesticide reported to be leaking from a damaged freighter (MARIA COSTA) was present at acute toxicity levels. The ship encountered rough seas and developed several cracks in its hull, began to take on water in a hold containing 65 tons of the pesticide, and attempted to make port at Norfolk, VA. The water, as it mixed with some of the pesticide in the hold, formed a solution that threatened to pollute the entrance of Chesapeake Bay if it escaped from the ship.

The freighter carried MOCAP (O-ethyl S, S dipropyl phosphoro dithioate, generic name: ethoprop), an organic phosphate nematicide used on tobacco and other crops. Previous studies (Borthwick, 1979) have shown that the 96-h LC 50 for spot is 33 $\mu$ g MOCAP $1^{-1}$. Water samples were collected and fixed at the control and experimental stations for later chemical analysis by the Environmental Protection Agency (EPA) Environmental Research Laboratory, Gulf Breeze, FL, for the presence of MOCAP.

Bioassays were conducted aboard ship. Beginning at 1500 h on 7 March 1979, bioassays were conducted on 12-day-old and approximately 2-month-old spot using "control" water taken 5 km west of the freighter and "contaminated" water taken from two stations near the freighter at two depths, 1 m and 5 m below the surface. A large temperature differential between the larval transport seawater (20 °C) and the site water (3 to 5 °C) precluded the immediate exposure of the test larvae to the water, but tests were conducted when the fish were cooled, and the test water warmed to 12 to 15 °C (3 to 4 h later). The bioassay was conducted in a number of polyethylene beakers, each holding approximately 200 ml of water into which either five older larvae or ten younger larvae were introduced. Two to four replicates were used for each station for each size group. The test fish were examined at 1, 4, 12, or 16 and 24 h for mortalities.

Spot larvae have many characteristics that make them potentially useful as bioassay organisms in nearshore marine and estuarine areas. They are important in both the recreational and commercial fisheries, they are found over a wide geographical range (Massachusetts, U.S.A. to Yucatan, Mexico) and the natural spawning season is relatively long (from Chesapeake Bay to the northern Gulf of Mexico, spot spawn during fall and early winter). Although the spawning locations and times are unknown off Chesapeake Bay, the first larvae are caught in ichthyoplankton tow in February and March and are 10 to 15 mm in total length (J.V. Merriner, personal communication).

Recently, procedures have been developed to spawn spot in the laboratory so that eggs and larvae are available for considerable periods of time. The larval fish used in this test were spawned on 21 February 1979 at the National Marine Fisheries Service Southeast Fisheries Center's Beaufort Laboratory (Hettler, Powell and Clements, 1978). Older fish were captured in a modified neuston net (Hettler, 1979) during the month of February.

Both ages of fish (about 150 older larvae and 300 first-feeding larvae) were transported to the ship during the 6 h drive in one insulated box in clear plastic bags, half filled with sea water. Pure oxygen from a small pressure tank was periodically bubbled into the water. Temperature during transport was maintained at about 20 °C. No food was added to the water until the fish were aboard the ship and the box opened. Brine shrimp (*Artemia salina*) were fed to the postlarvae and rotifers (*Brachionus plicatilus*) were fed to the larvae. No significant mortality occurred within either group during transport. Both ages fed readily aboard ship.

The test (24 h survival) indicated that acute levels of the pesticide were not present in the water. In most cases, 100% of the larvae survived for 24 h and there was no indication of any difference between control and experimental fish. MOCAP was not detected in any of the water samples sent to the EPA Gulf Breeze Laboratory.

A main advantage of the field bioassay is that results are obtained relatively quickly at the pollution site. In the MARIA COSTA incident, preliminary results were available 24 h following arrival of the test organisms at the site. Chemical analysis for the presence of MOCAP were not available until several days later. A disadvantage of any field bioassay is that they are nonspecific for a pollutant. That is, mortality might be due to some other uncontrolled factor, or factors.

Spot was an appropriate test species because fish of the age used in this experiment are found in the Chesapeake Bay area at the time of year that the MARIA COSTA incident occurred. We do not, however, recommend the development of spot as a "universal" marine bioassay test organism. We would rather see the development of a number of species so that a typical species would be available for a geographical area and a particular season of the year.

In the future, we recommend that in addition to the shipboard bioassay (which gives relatively quick results), consideration be given to using modifications of the environmental chambers described by Laurence et al. (1979), so that in situ experiments could be conducted. These experiments might be conducted for a week or longer and would allow sublethal effects on larvae, such as changes in growth rate, to be examined.

References

Borthwick, P. 1979. Acephate, aldicarb, carbophenothion, DEF, EPN, ethoprop, methyl paratheion, and phorate: Their acute and chronic toxicity, viralconcentration potential, and persistence as related to marine environments. Unpublished report, Experimental Environments Branch, Environmental Research Laboratory, Office of Research and Development, U.S. EPA, Gulf Breeze, FL.

Hettler, W.F. 1979. Modified neuston net for collecting live larval and juvenile fish. The Prog. Fish-Cult. 41:32-33.

Hettler, W.F., A.B. Powell and L.C. Clements. 1978. Laboratory-induced spawning of spot, *Leiostomus xanthurus* (Lacepede). Pages 351-356 *in* Annual Report of the Southeast Fisheries Center, Beaufort Laboratory, Beaufort, NC to the U.S. Department of Energy.

Laurence, G.C., T.Z. Halavik, B.R. Burns and A.S. Smigielski. 1979. An environmental chamber for monitoring in situ growth and survival of larval fishes. Trans. Am. Fish. Soc. 108:197-203.

D.E. Hoss
W.F. Hettler
National Marine Fisheries Service
Southeast Fisheries Center
Beaufort Laboratory
Beaufort, NC 28516
919-728-4595

# Continuity

## Pollution Effects on Fish Parasites

The effects of various pollutants on the flora and fauna of different habitats have been intensively surveyed, but in few cases have effects on the parasite community been considered. This is unfortunate, since there are generally more numbers and species of parasitic animals than there are free-living, and the communities of hosts and parasites exert profound influence upon each other. Since 1978, a survey of winter flounder parasites from different habitats in the northwest Atlantic has been conducted in association with the National Marine Fisheries Service's project Ocean Pulse (now a component of the Northeast Monitoring Program). The objectives of this survey are to assess the effects of natural and anthropogenic environmental variables on the occurrence, community structure, and pathogenicity of flounder parasites, and to determine the utility of these effects for ecological monitoring.

Winter flounder, an important sport and commercial resource, are appropriate for inter-habitat comparisons of parasitism because of their wide distribution, opportunistic feeding habits, and limited migrations — characteristics which lead to a parasite fauna representative of local environmental conditions. The health of the resource is a concern, but characteristic parasite communities also provide information about the habitat which shaped them. Flounder parasites' potential as monitoring tools stems from their tendency to reflect the density and diversity of the local free-living community. This reflection occurs primarily because of the specificity of complex parasite life cycles. Most species require one or more specific intermediate hosts to complete these cycles, and therefore the numbers and types of free-living animals in an area influence the opportunities for different parasites to successfully reproduce them. More to the point, any pollution-mediated changes in the free-living fauna are reflected in the parasite community of appropriate hosts (such as winter flounder), where they can be monitored more easily due to the smaller number of species involved.

Since 1978, 646 winter flounder have been collected and examined from stations in the northwest Atlantic ranging from New Jersey to the Gulf of Maine. Certain consistent trends have been established during this time. In terms of natural geographic variation, there tend to be more species and individuals of parasites from inshore stations than offshore, in such areas as Georges Bank. Diagenetic trematodes, particularly the Opecoelidae, dominate the inshore communities, whereas offshore the acanthocephalan *Echinorhynchus gadi* and nematodes of the genera *Thynnascaris* and *Ascarophis* are most common. The complete explanation for this trend is not known, but is probably related to the flounder's diet, which includes a greater proportion of molluscs and polychaetes inshore, but more crustacea offshore. With regard to human health considerations, very few parasites have been found in the flesh of any flounder, where they might be infective to persons eating raw or improperly smoked fish.

There are natural variations in parasitism between different inshore sampling sites, but the most dramatic results concern differentially polluted areas. The numbers and diversity of flounder parasites from grossly degraded areas such as Raritan Bay have been found to be markedly reduced, so that many fish are essentially free from infections (Table 1). For the sake of comparison, the results for Block Island Sound are typical of marginally impacted coastal areas. Data for free-living biota at these areas (at the time flounder were sampled) are not yet available, but Raritan Bay is known to have a reduced benthic fauna as a result of various contaminants. Direct pollution effects on flounder or parasite physiology cannot yet be completely discounted, but the reduction in parasitism is believed to be mediated indirectly by this reduction in potential intermediate hosts.

TABLE 1

Comparison of Winter Flounder Parasites at Two Sites in July 1979

| | Block Island Sound (n = 90) | | Raritan Bay (n = 46) | |
|---|---|---|---|---|
| Parasite | Mean | % Infected | Mean | %Infected |
| *Echinorhynchus gadi* | 7.7 | 90.5 | 0 | 0 |
| *Ascarophis* sp. | 0.9 | 40.0 | 0 | 0 |
| *Thynnascaris* spp. | 0.3 | 19.0 | 0.1 | 15.2 |
| *Podocotyle atomon* | 0.2 | 7.4 | 0 | 0 |
| *Cryptocotyle lingua* | --- | 47.4 | 0 | 0 |
| *Lepocreadium* sp. | 0.1 | 1.0 | 0.8 | 38.9 |
| Opecoelio (unk.) | 0.2 | 7.4 | 0 | 0 |
| *Glugea stephani* | --- | 4.2 | --- | 4.3 |

TABLE 2

Diversity of Parasites of Winter Flounder at Two Sites in July 1979

| Index | Block Island Sound (n = 90) | Raritan Bay (n = 46) |
|---|---|---|
| Richness (No. of of Species) | 7 | 3 |
| Mean Richness per Host | 2.2 | 0.5 |
| Evenness (J') | 0.3 | 0.6 |
| $-\Sigma p_i \ln p_i$ (Shannon Index) | 0.7 | 0.7 |
| $-\Sigma n_i \cdot \ln p_i$ | 562.7 | 24.0 |

Beyond the reduced abundance of flounder parasites in Raritan Bay, their diversity also is generally lower (Table 2), and this effect is believed to reflect the free-living fauna. It is significant that the different indices of diversity don't equally reflect the differences between the communities. This is a function of the small size of the parasite populations, and the tendency of compound indices (such as Shannon's) to confound their richness and evenness components. As a result no single index is considered to be adequate for realistic habitat comparisons.

Pollution-related reductions in parasite abundance and diversi-

ty have thus been demonstrated. No effects on parasite pathogenicity have been revealed by frequency distribution analyses, but such investigations are hampered by the fact that few parasites of adult flounder have been implicated in pathology under any circumstances. More detailed histopathological studies under laboratory conditions are indicated for the future.

Despite the relationships of pollution to flounder parasitism, the utility of these effects for short-term monitoring appears to be limited by the occurrence of temperature-dependent parasite seasonality. Results for this summer show that the two dominant species of trematodes from Jamaica Bay, NY, can change radically within ten weeks. Between 6 June and 20 August, *Lepocreadium setiferoides* declined from a mean infection of 68.5 per fish, with 100% infected, to a mean of 5.9, with 14.3% infected. *Zoogonus lasius* changed from a mean of 1.4, 57.7% infected, to 3.6 per fish, 9.5% infected. Such variability overshadows that caused by all but the most extreme pollution. Geographic comparisons are possible from near-simultaneous samples, but temporal changes can be compared only on a long-term (annual or longer) basis, since the parasite seasonal cycles follow a consistent annual pattern. The utility of parasite data for monitoring might also be explored in a climate where seasonal changes are less marked. The economic importance of pollution-related effects on parasitism could be of further regard in cases where the parasite is a significant pathogen, or effects the marketability of a catch.

Peter R. Burn
New York Aquarium
Boardwalk West 8th Street
Brooklyn, NY 11224
212-266-8500

power plants, equipped with fly-ash precipitators and flue gas desulfurization scrubbers required to meet air pollution standards, produce large amounts of solid wastes. For example, a 500 megawatt power plant will burn as much as 1.0 million metric tons of coal per year, creating 600,000 metric tons of fly ash and scrubber filter cake. Disposal of these by-products represents a significant problem and a potential deterrent to the use of our most plentiful fossil fuel resource. Traditional disposal sites, such as land-fills, abandoned quarries and mine shafts, are limited and may also require stabilization of the scrubber sludge to mitigate environmental effects. A stabilization process, developed by IU Conversion Systems, Inc. of Horsham, PA, combines the fly ash and scrubber cake with a few percent of lime to form a structurally stable solid. However, the coal waste blocks lack compressive strength necessary for normal construction use; 46 kg $cm^{-2}$ (650 psi) compared to over 200 kg $cm^{-2}$ (2,900 psi) for concrete blocks of similar size.

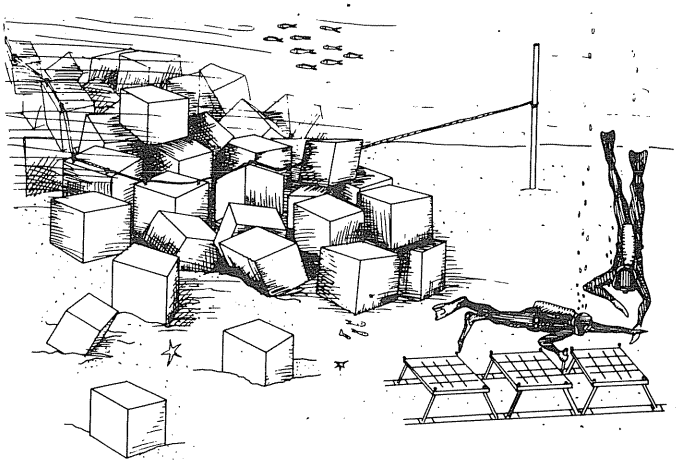


Figure 1. Artist's conception of coal waste artificial reef.

# Loomings

## Coal Waste Artificial Reef Project

On 12 September 1980, 500 metric tons of stabilized wastes from coal-fired power plants were dropped from a bottom-opening barge onto the Atlantic Ocean continental shelf to form an artificial fishing reef situated 4 km off Long Island's south shore. The coal wastes, a stabilized mixture of fly ash and scrubber filter cake, were compacted into solid blocks, the size of standard concrete construction blocks. The blocks serve as a hard substrate for colonization and overgrowth by marine epifauna and as a habitat for fish and crustaceans. The artificial reef will serve as a full-scale test of the environmental acceptability of waste products of coal-fired electric power generating plants for the proposed beneficial use.

The national energy policy anticipates return to coal as a major energy source to reduce reliance on oil. However, coal-fired

Background studies in preparation for the test reef were begun over three years ago at the Marine Sciences Research Center (MSRC) of the State University of New York. A research team, led by Professors Iver W. Duedall, a chemical oceanographer, and Peter M.J. Woodhead, a fisheries biologist, initiated comprehensive studies of the chemical composition, physical characteristics and biological acceptability of the stabilized coal waste blocks. Extensive lab and field testing have been conducted to answer major questions concerning use of compacted coal waste blocks as reef building material. Particular emphasis was placed on the following objectives: (a) to identify and quantify materials in the blocks that represent potential environmental pollutants, (b) to determine mechanics and rates at which such material might enter the environments, (c) to test durability of blocks to estimate probable lifetime of reef, and (d) to determine whether the blocks serve effectively as bases for biological settlement and colonization.

Laboratory analyses were supplemented by the construction of a "mini" test reef on the sandy bottom at the mouth of Conscience Bay on the north shore of Long Island. The reef consisted of several .03$m^3$ blocks of coal waste and separate reefs of concrete blocks and natural stone as controls. Colonization of all sur-

faces was rapid and only minor differences were noted between the coal waste and the control reefs in the rate of colonization by different species. After 460 days, extensive bryozoan, hydroid, and algae colonies covered all exposed surfaces and the initial differences in colonization were no longer evident. Several species of fish, rock crabs and a few lobsters also inhabited the reef sites.

In the laboratories, bioassays were conducted in accordance with Environmental Protection Agency procedures. Seawater elutriates from several different stabilized coal waste mixtures were assayed with unicellular algae, shrimps, and fish eggs and larvae. The results suggested that the elutriates had no measurable toxic effects on the phytoplankton cultures or the test animals used.

Long-term tank studies were performed in the laboratory to determine the leaching rates for the major and minor components present in the coal waste blocks. It was found that block dissolution is slow, the release of calcium and sulfite, both major components, occurs only in the outer few millimeters of the block over several years. Heavy metals such as copper and zinc, which are present in trace concentrations, are bound tightly to the fly ash in the blocks and are not solubilized.

A variety of physical tests were also performed on the stabilized coal waste blocks to determine ultimate block strength as a basis for predicting the lifetime in the ocean. An important index is the compressive strength and how it changes over time. Standard engineering compression tests were supplemented by an ultrasonic, non-destructive test correlating sound velocity with compressive strength, a method developed in the laboratories of the Stony Brook College of Engineering and Applied Sciences' Material Sciences Department. The ultrasonic test permits repeated testing and improved long-term estimates to be made concerning structural integrity. In one test series, coal waste and concrete control blocks from the Conscience Bay mini-reef were compared over a 500-day period for immersion. The concrete blocks had an initial compressive strength of 210 kg $cm^{-2}$ (3,000 psi) which after 300 days immersion decreased to 105 kg $cm^{-2}$ (1,500 psi) followed by an increase to 155 kg $cm^{-2}$ (2,200 psi) at the end of the test. The initial compressive strength of the coal waste blocks was 46 kg $cm^{-2}$ (650 psi). After a slight loss of strength over the first 100 days of immersion, the blocks regained compressive strength to the level of 44 kg $cm^{-2}$ (620 psi) after 500 days. While coal waste blocks lack the basic strength of concrete, it does appear that their lifetime as a substrate may be decades.

In preparation for the full scale coal waste test reef, focus of the MSRC investigations over the last year has been completion of a comprehensive baseline description of the marine environment at the reef site on the continental shelf. Following placement of the reef, a three-year monitoring program is scheduled to determine what, if any, changes occur in the artificial reef environment due to the presence of stabilized fly ash and scrubber sludge. The site of the coal waste reef is close to an existing fishing reef built ten years ago fron sunken barges and construction rubble. This proximity will enable the comparison of the two reefs and identification of any differences in colonization.

The successful application of the coal waste project will depend upon the availability of a technology to process and handle economically the large volume of wastes generated at a coal-fired power plant. With this in mind, MSRC scientists conducted large-scale experiments in Alpena, MI at the research facilities of the Besser Company to select proper mix designs and develop engineering methods for the automatic fabrication of the reef blocks using conventional concrete block mechanisms. The concrete block machines and associated factory handling equipment seemed well suited for the tasks. The work performed at Alpena in collaboration with the Besser Company was instrumental in the later successful production of the coal waste reef blocks carried out by the IU Conversion Systems, Inc., at a commercial concrete block factory.

F.G. Roberts
Marine Sciences Research Center
State University of New York
at Stony Brook
Long Island, NY 11794
516-246-6546

## Submarine Burial of Dredged Material

Work has begun on a project to study the feasibility of burying dredged materials in submarine pits. Scientists at the Marine Sciences Research Center (MSRC) of the State University of New York started a field program this summer in the Lower Bay of New York Harbor where there are several large borrow pits remaining as the result of sand mining. The combination of sand mining and dredged material disposal in mined pits has the potential of solving two problems at once — the need to obtain sand and gravel for construction aggregate and fill and the need to dispose of contaminated dredged materials. Both of these problems are particularly acute in the greater New York-New Jersey metropolitan area because terrestrial sources of sand and gravel within an economical distance are becoming limited, and acceptable disposal sites for contaminated dredged materials more difficult to identify and secure. Both problems could, perhaps, be alleviated by combining mining of sand in the Lower Bay of New York Harbor with disposal of materials dredged from the Upper Bay of New York Harbor and adjacent areas in the excavated pits.

The disposal strategy calls for the pit to be filled partially with dredged mud and for a sand cap to then be placed on the mud deposit. The dredged materials would be contained in the pit and isolated from the marine environment by the sand layer. The technique would have the additional advantage that the sea floor would be restored to its condition before mining.

The idea that mined pits could be used as disposal sites is not new (Johanson et al. 1976). The MSRC project is the first, however, to undertake field experiments and laboratory work to study the details of this disposal strategy for a specific location. The project is designed to address a wide range of questions concerning many different aspects of the disposal and capping operations.

In July, an experimental disposal operation was conducted in the Lower Bay. Discharges over a borrow pit were monitored acoustically and by taking pumped water samples to document the short-term processes involved in placing fine-grained dredged material on the pit floor. It had been previously shown that over a flat sea floor almost all of the dredged sediment discharged from a scow or hopper dredge was deposited in a small area from a dense slurry near the bottom. Preliminary results from the July

experiments in the bay suggest that the same is true in the pits and that the pit walls are effective barriers to the spread of the dredged sediment slurry.

The biological effects are also being considered. Samples have been taken on the sandy floor around the existing pits and from the mud floors of the pits to estimate the impact of such a disposal operation and to document recolonization of the sea floor. Other aspects of the work include a study of the mechanical behavior of a hypothetical deposit, a sand layer atop an unconsolidated mud deposit, and the possible effects of exposure of the benthos to dissolved contaminants.

This project is supported by the U.S. Army Corps of Engineers through the N.Y. Sea Grant Institute.

Henry J. Bokuniewicz
Marine Sciences Research Center
State University of New York
at Stony Brook
Long Island, NY 11794
516-246-8306

Reference

Johanson, E., S.P. Bowen and G. Henry. 1976. State-of-the-art survey and evaluation of open-water dredged material placement methodology. Tech. Rept. D-76-3, U.S. Army Corps of Engineers, Dredged Material Research Program, Waterways Experiment Station, Vicksburg, Mississippi.

# Research & Monitoring Updates

## Conferences on Regional Marine Pollution Problems

Society's increased, and often conflicting, uses of the ocean and coastal resources over the past several years led to Federal Government involvement to provide for the orderly development, utilization and conservation of these resources. Responsibilities for ocean programs were widely dispersed within the Federal Government resulting in an uncoordinated and fragmented Federal effort relating to ocean pollution studies. In 1978 Congress enacted the National Ocean Pollution Planning Act which designated the National Oceanic and Atmospheric Administration (NOAA) as the lead agency charged with responsibility to plan and coordinate the Federal ocean pollution program effort.

The Act charged NOAA with responsibility for developing a comprehensive five-year plan for Federal ocean pollution research, development, and monitoring (OPRDM) activities. To assist NOAA in carrying out the responsibilities under the Act, the President's Science Advisor chartered the Interagency Committee on Ocean Pollution Research, Development and Monitoring (COPRDM) as a standing committee of the Federal Coordinating Council for Science, Engineering and Technology. The COPRDM is made up of senior representatives for the eleven Federal departments and agencies involved in OPRDM activities and is chaired by NOAA's deputy administrator, James P. Walsh. The National Marine Pollution Program Office (NMPPO) was created to assist the Chairman and COPRDM in preparing the biennially revised five-year plans and ensuring that the recommendations contained in the plans are implemented.

The Act mandates that the Plan contain a statement of national problems related to ocean pollution, an identification of the information necessary to deal with those problems, an assessment of the priority in which OPRDM activities should be undertaken to meet those information needs, and an analysis of the extent to which existing and planned Federal programs will assist in meeting identified priorities. The Act also requires that the plan contain recommendations for changes in Federal OPRDM programs where necessary to address better assigned priorities. The plan is used by Federal agencies, the Office of Management and Budget and the Congress in making funding decisions on Federally supported marine pollution research, development and monitoring.

The first Federal plan, published in December 1979, analyzed ocean pollution problems from a regional perspective, and identified key pollutants and causes of marine pollution. Statements of regional marine pollution problems were developed by Federal experts at the national level with limited public participation and review. To strengthen the validity of regional concerns which are to be expressed in the second plan, a series of five conferences were held in June 1980, focusing on region-specific marine pollution problems and priorities. The conferences have provided an opportunity for regional coordinating bodies, state/local government officials, private industry, academic and public interest groups involved in ocean pollution issues to make policy statements regarding important regional marine pollution problems and information needs and to comment on specific Federal programs.

In planning the conferences, NMPPO divided the country into five regions: North and Mid-Atlantic; South Atlantic and Gulf; Pacific Coast; Great Lakes; and Alaska. The conferences developed a series of statements defining significant marine pollution problems, identified information needs, and set priorities in which the information needs should be met. Needed technical and scientific information, data for effective policy, regulation and resources management decisions relative to marine pollution were identified. All populated areas within the regions share common marine pollution problems such as dredging and municipal waste disposal, and discharges from non-point sources. Potential OCS oil and gas exploration could impact coastal regions. Marine pollution problems specific to certain regions include disposal of nuclear wastes, toxic wastes, and fisheries waste products.

These regional statements on marine pollution problems and the information needed to deal with them form the base for developing the next Federal plan.

Copies of the regional conference reports will be available in December and can be obtained by writing: National Marine Pollution Program Office, Room 927, 6010 Executive Boulevard, Rockville, MD 20852.

Dail W. Brown
National Marine Pollution
Program Office
6010 Executive Blvd.
Rockville, MD 20852
301-443-8817

# Toxic Substances Flux Program In Lake Michigan

Most polluting and enriching substances in the aqueous environment have a strong affinity for fine suspended particles, thus their transport and fate are dictated by the fine particle dispersal system. Total suspended matter (TSM) plays a vital role in the solution chemistry of the Great Lakes. TSM sorbs pollutants from the water, providing a mechanism for cleaning the lakes through sedimentation. In some cases, the sediments serve as a temporary reservoir for the sorbed contaminants, releasing them to overlying water and exposing the ecosystem to "trapped" contaminants. There is a need at this time not only to know concentrations of TSM and associated contaminants and nutrients, but to determine the net flux of these substances into the lakes and sediments.

Some of our past studies with sediment traps have shown open Lake Michigan metalimnetic TSM flux to be about 0.7 g $m^{-2}d^{-1}$ during the stratified, non-storm periods. The former agrees well with Lead-210 and Cesium-137 sediment accumulation rates from the same region leading us to believe that during the period of stratification, our traps at 35 m are measuring gross downward flux of suspended material and their associated contaminants. For storm and non-stratified periods, our measurements show a TSM flux of about 4.6 g $m^{-2}d^{-1}$.

To estimate these values on a lakewide basis, investigators at the National Oceanographic and Atmospheric Administration's (NOAA) Great Lakes Environmental Research Laboratory (GLERL) have initiated a sediment trap collection program with profiles of traps located at the stations shown in Fig. 1.

The program involved deployment of 111 sediment traps at 12 locations in Lake Michigan during mid-June, to be retrieved in late October 1980. Approximately every month station 8 (1978 station 4) was serviced. At these times the sediment trap collecting vessels were changed, water was collected at trap depths (15, 35, 60, 80 and 95 m) for determination of TSM, stable Pb and radioactive Pb and Be, used to determine apparent mass sinking rates and particle residence times. Station 7, its sister station, served as a control to determine if integrated monthly collections compare to the total stratified seasonal collection.

The basic station design included 2 traps at 15 m, 3 traps at 35 m (upper hypolimnion), 2 traps 20 m above the bottom, and 1 trap 5 m above the bottom. Depending on the depth, sets of 2 or 3 traps were placed in the mid-hypolimnion. Stations depths range from 50 to 250 m. Preservatives in the collecting containers are chloroform (for nutrients, silica, major and minor elements and inorganic carbon) and mercuric chloride (for toxic organics).

The program, initiated to measure fluxes of particulate matter and polynuclear aromatic hydrocarbons, was expanded in scope early in the planning stages because of the interest of outside investigators from several agencies. University of Michigan Great Lakes Research Division (GLRD) investigators include: Dr. John Robbins and Kjell Johansen (stable Pb and radioactive Pb and Be), Dr. Clifford Rice (polychlorinated biphenyls), Dr. Claire Schelske (biogenic silica), Dr. Marlene Evans (fecal pellets), and from the University of Michigan's Atmospheric and Oceanic Department, Dr. Phil Meyers (hydrocarbons). Investigators from Argonne National Laboratory include: Dr. John Parker (diatoms) and Dr. Thomas Tisue (x-ray fluorescence for elemental analysis).

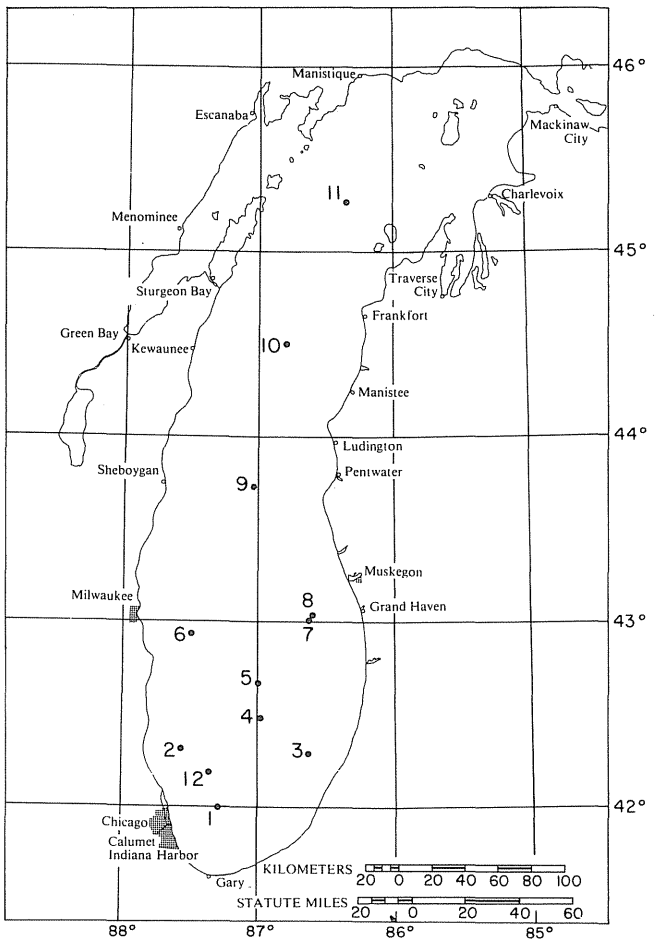



Figure 1. Locations of sediment trap arrays deployed for collection throughout the stratified season.

In conjunction with our sediment trap program the Environmental Protection Agency (EPA) Grosse Ile Laboratory (MI), through several university contractors, will be measuring both tributary and atmospheric loads of PCBs along with some other contaminants.

These programs will yield loading and mass flux estimates which are far superior to the limited information now available.

Brian J. Eadie
Richard L. Chambers
National Oceanic and Atmospheric Administration
Great Lakes Environmental Research Laboratory
Ann Arbor, MI 48104
313-668-2269

## Mirex—Lake Ontario Sediment Relationships

Mirex is a persistent, chlorinated hydrocarbon used extensively as a pesticide to control fire and infestations throughout the southeastern United States. It has also been used as a fire retardant under the trade name Dechlorane in the manufacture of fire resistent materials, and as a plasticizer possibly used in the paint, plastics and textile industries. Mirex is hydrophobic, fat soluble and highly persistent in the natural environment.

The Lake Ontario mirex problem gained public attention after publication of a 1974 *Science* article entitled "Mirex: An Unrecognized Contaminant of Fishes in Lake Ontario" by Klaus Kaiser. Because this persistent contaminant accumulates in fatty tissues, it directly threatens the future development and projected expansion of the Lake Ontario sportfishing industry.

Studies conducted by U.S. and Canadian researchers during the past five years have identified two major mirex anomolies where concentrations in Lake Ontario bottom sediments range from about 3 to in excess of 25 parts per billion. The mirex-contaminated sediments located offshore of the Niagara River resulted from waste discharges by the Hooker Chemicals and Plastics Corporation; waste discharges into the Oswego River by the Armstrong Cork Company contaminated a thirteen kilometer section of the river as well as Lake Ontario bottom sediments within and in proximity to the Oswego River Harbor.

During January 1979, a New York Sea Grant Institute study was initiated by the State University Research Center, State University of New York at Oswego, to determine whether natural and man-made redistributions of mirex-contaminated sediments are continuing to spread mirex to other parts of the Lake Ontario environment or whether natural sedimentation could be isolating mirex-contaminated sediments by burial. This latter objective would hopefully provide insight into determining whether mirex-contamination of Lake Ontario biota would diminish through time because of burial and therefore isolation by less contaminated sediments.

With the use of the U.S. Fish and Wildlife Service research vessel, the R/V KAHO, a series of ponar grab and piston core samples were collected from the Oswego River Harbor and the area immediately offshore of the Oswego River. In addition, a series of Oswego River bottom sediment samples were collected from the harbor to about 0.5 km upstream of the Armstrong Cork plant.

Preliminary results suggest mirex will continue to be a problem in Lake Ontario for many years. Piston core samples collected from the Oswego River indicate that mirex extends to a depth of about 15 cm at concentrations in excess of 1.8 ppm. Piston core samples analyzed from within the Oswego Anomoly — an area off the Oswego River where bottom sediments are enriched greatly in mirex — indicate contamination to sediment depths in excess of 7.0 cm. Mirex concentrations varied from less than 3 ppb to greater than 70 ppb in the upper 7.0 cm sediment horizon within this area. There is some suggestion that mirex concentrations are diminishing through time. This is particularly evident at a deep water ($\approx$230 m) sampling site from within the Oswego Anomoly where concentrations vary from about 70 ppb at a depth of 3-4 cm to about 30 ppb in lake surface sediments.

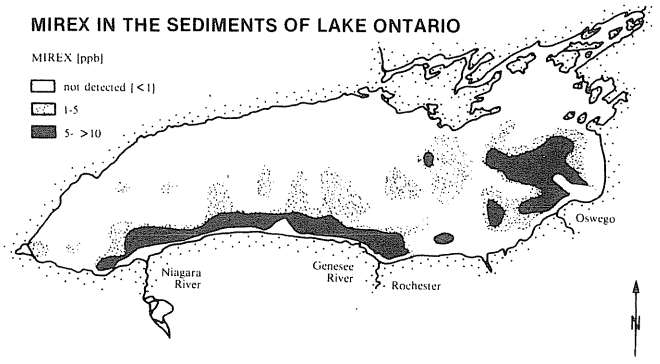
Since mirex was discharged into the Oswego River during the early to mid-sixties and has been detected to a sediment depth of about 7.0 cm, it suggests a sedimentation rate of about 0.4 cm $yr^{-1}$ for the deeper water parts of the Oswego Anomoly. This apparent sedimentation rate is far in excess of rates determined by other researchers suggesting that mirex may be migrating vertically in the deeper areas of Lake Ontario. Cs-137 and Pb-210 dating are currently being conducted to confirm sedimentation rates within the Oswego Anomoly.

Based on data collected from the Oswego River and Oswego Anomoly, it appears that mirex-contaminated sediments will continue to provide a source of contamination for many years. Although transfer mechanisms from sediments to lake biota are not well understood, it is clear that lake organisms, including important sportfish species, are continuing to accumulate mirex. Although contaminated sediments are invariably being isolated by burial, natural and man-induced perturbations will continue to provide a source of mirex to lake organisms and, thereby, continue to threaten the lake fishery.

Reference

Kaiser, K. 1974. Mirex: an unrecognized contaminant of fishes in Lake Ontario. Science 185:523-525.

Ronald J. Scrudato
State University Research Center
SUNY at Oswego
300 Washington Blvd.
Oswego, NY 13126
315-341-3088




## NOAA/EPA Pollution Monitoring Workshops

Users of monitoring information are evaluating the costs and benefits of marine and Great Lakes pollution monitoring at regional workshops which began in September 1980. Workshops are being co-chaired by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) in Stony Brook (NY), Seattle (WA), San Francisco (CA), Atlanta (GA), and Galveston (TX), and by NOAA and the Great Lakes Basin Commission in Ann Arbor (MI). The workshop objectives are to develop guidelines, strategies, and approaches for interrelating operational ocean pollution monitoring programs and for interrelating the findings of Federal, state, regional, and local efforts. Consideration is to be given to technological and economic factors which relate to policy and

decision making. Participants are to describe and assess utilization of data being received from on-going monitoring programs. They are also to evaluate and set priorities for monitoring needs and approaches to solving pollution monitoring problems. (Pollution problems and their related needs, priorities, and approaches were identified at five regional workshops convened by NOAA's National Marine Pollution Program Office in June 1980.) Products of the workshops are to include definitions and assessments of existing or proposed monitoring programs, a generic framework for planning site- or program-specific pollution monitoring activities, and a manual of practice to assist in conducting and operating them. Case studies include NOAA's Northeast Pollution Monitoring Program, EPA's New York Bight Monitoring Program, local and regional monitoring programs in the Southern California Bight, and international monitoring programs in the Great Lakes.

Charles Gunnerson
Environmental Research
Laboratories
NOAA
Boulder, CO 80303
303-497-6387

## Assessment of an Estuary—Raritan Bay, New Jersey

Raritan Bay is one of the most heavily polluted major estuaries on the east coast of the United States and receives a wide range of contaminants from various industrial outfalls, discharges of untreated and surficially treated domestic sewage, and runoff from various industrial manufacturing and agriculture sites. The first major investigations of benthic populations in Raritan Bay were reported upon by Dean and Haskin (1964). Subsequently, Dean (1975) provided additional data on benthic communities and populations in Raritan Bay. These studies were conducted in the mid to late 1950s. In 1974, McGrath published a paper concerned with the changes in benthic populations which had occurred subsequent to the earlier studies of Dean and Haskin. At the same time, investigations were conducted on trace metals in the sediments of Raritan Bay (Greig and McGrath, 1977). More recently, Koons and Thomas (1979) and Stainken (1979) investigated levels of petroleum hydrocarbons in sediments of Raritan Bay; Searl, Huffman and Thomas (1977) and Stainken and Frank (1979) reported on levels of petroleum hydrocarbons in Raritan Bay waters. Waldhauer, Matte and Tucker (1978) reported on lead and copper in waters of Raritan Bay. All of these studies indicate that the levels of contaminants are exceptional in the waters and sediments of Raritan Bay and that there has been a significant impact on the benthic fauna.

For these reasons we have begun to reassess the status of Raritan Bay. We established 82 stations at approximately one-mile spacing throughout Raritan Bay and have occupied these stations during the past year on a seasonal basis. Many of our stations are identical to or are located in close proximity to earlier stations that were studied by previous investigations. We are presently conducting analyses of sediment grain size, trace metal content of the sediment, and benthic fauna from all 82 stations; we are looking at petroleum hydrocarbons in sediments from 22 stations and all of the aforementioned analyses are nearing completion. Preliminary results indicate considerable variations between the four seasonal sampling periods and between the various stations within any one season.

The results of our sequential sampling will be useful in 1) evaluating trends (especially if data were taken from many of the same stations sampled over the past 20 years) and 2) establishing long and short range stresses that may be caused by various anthropogenic sources of pollution.

Our analyses indicate that very high levels of heavy metal contaminants continue to be found at the Raritan Bay stations and that in some areas the benthic fauna is as impoverished as was earlier reported by McGrath (1974).

Our research efforts, involving investigators from six institutions, have been sponsored by the New Jersey Sea Grant Program and the Toxic Substance Program of the New Jersey Department of Environmental Protection. Continuing research under funds from the New Jersey Sea Grant Program and the National Oceanic and Atmospheric Administration—Marine Ecosystems Analysis Program will involve determination of modes of transport of heavy metals into the Bay and estimates of the volumes of suspended sediments in transport.

References

Dean, D. 1975. Raritan Bay macrobenthos survey, 1957-1960. NMFS Data Report No. 99, U.S. Dept. of Commerce. 51 p.

Dean, D. and H.H. Haskin. 1964. Benthic repopulation of the Raritan estuary following pollution abatement. Limnol. Oceanogr. 9:551-563.

Greig, R.A. and R.A. McGrath. 1977. Trace metals in sediment of Raritan Bay. Mar. Poll. Bull. 8:188-192.

Koons, C.B. and J.P. Thomas. 1979. $C_{15+}$ hydrocarbons in the sediments of the New York Bight. Pages 625-628 *in* Proceedings, 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup). American Petroleum Institute, Washington, DC.

McGrath, R.A. 1974. Benthic macrofaunal census of Raritan Bay — preliminary results, benthos of Raritan Bay. Paper No. 24; Proceedings 3rd Symposium Hudson River Ecology, March 22-23, 1973, Bear Mt., NY. Hudson River Environmental Society.

Searl, T.D., H.L. Huffman, Jr. and J.P. Thomas. 1977. Extractable organic and nonvolatile hydrocarbons in New York Harbor waters. Pages 583-588 *in* Proceedings, 5th Conference on the Prevention, Behavior, Control and Cleanup of Oil Pollution, March 8-10, 1977, New Orleans, LA.

Stainken, D. 1979. Occurrence of extractable hydrocarbons in sediments from Raritan Bay, New Jersey. Bull. N.J. Acad. Sci. 24:6-11.

Stainken, D. and U. Frank. 1979. Analysis of Raritan Bay bottom waters for polynuclear aromatic hydrocarbons. Bull. Environ. Contam. Toxicol. 22(4/5):480-487.

Waldhauer, R.A., A. Matte and R.E. Tucker. 1978. Lead and copper in the waters of Raritan and Lower New York Bays. Mar. Poll. Bull. 9:38-42.

H. Gray Multer
Department of Earth Sciences
Fairleigh Dickinson University
Madison, NJ 07940
201-377-4700

## Marine Pollution Research and Monitoring In the Pacific Northwest—Puget Sound

Populations in the Pacific Northwest are continuing to grow and are placing greater demands on coastal waters and marine resources. Growth is particularly evident in the Puget Sound-Strait of Juan de Fuca area, especially in Tacoma and outlying areas of Seattle, Everett, Bremerton, Bellingham, and Port Angeles. As a result, Federal, state, local and private agencies are increasing pollution research and monitoring activities.

One major program is the NOAA Marine EcoSystem Analysis (MESA) Puget Sound Project which has been sponsoring a variety of multidisciplinary research programs in the Strait of Juan de Fuca and Puget Sound since 1975. The goal of the Project is to develop an understanding of the environmental impact of human actions on regional marine ecosystems, and to predict ecological consequences of these actions.

During the past five years, the U.S. Environmental Protection Agency (EPA) funded the Project for an environmental study of energy-related (petroleum) activities in Northern Puget Sound and in the Strait of Juan de Fuca. Studies have already been completed on: general, nearshore oil deep water circulation; the role of solids from local rivers in removing oil from the water column; meteorological conditions, characterization of refinery waste waters, and microbial decay of petroleum; and on seasonal and larger term inventories of microzooplankton, epibenthic zooplankton, intertidal and subtidal benthos, macroinvertebrates and fish, food web structure of nearshore communities and assessment of sea and shore birds and marine mammals.

Waters of the Strait of Juan de Fuca and Northern Puget Sound were found to exhibit typical estuarine-type flow but with occasional reversals and a number of tidal-induced nearshore eddys. The nearshore food web is primarily detritus-based and there are a number of unique and productive sea and shore bird nesting sites in the area.

The data were collected, via contract, by scientific teams from local and out-of-state universities, Federal and state agencies, and private companies. Much of the work is still being synthesized, but over 40 individual project reports are now available. It is anticipated that much of the data will be used to evaluate the proposed Northern Tier Pipeline Route through Puget Sound.

The MESA Project is also conducting studies on the quality of waters and marine life in Puget Sound especially in urban areas. Already completed or in progress are surveys and numerical model analyses of circulation, causes of oyster mortality, biological evaluation of water quality, mutagenicity of sediments, pollutant levels in suspended matter, and the health of nearshore fish and macroinvertebrates. Work in Puget Sound will expand with emphasis on the fate and effects of potentially toxic industrial synthetic compounds.

For more information, contact the MESA Puget Sound Office, 7600 Sand Point Way N.E., Seattle, WA 98115; 206-442-5590.

A new major project in the Puget Sound area is the Toxicant Pretreatment Program being undertaken by the Municipality of Metropolitan Seattle (METRO). Under sponsorship of the EPA, the University of Washington's Department of Ecology and METRO are conducting a three-year regional program to document sources of toxic substances from industry, urban runoff, combined sewer overflows, and other nonpoint sources as well as from municipal waste waters. The fate of toxic substances in receiving waters, sediments, and biota will also be measured. Sampling began in August 1980. METRO is establishing a sophisticated toxicant/water quality laboratory, and will use it in the new program. For more information contact Dr. Joseph Simmler, METRO, 821 Second Avenue, Seattle, WA 98105; 206-447-6326.

Many other Federal, state, and local agencies are conducting pollution-related research and monitoring activities in the Puget Sound area. Included is the Duwamish Waterway Navigation Improvement Study of the U.S. Army Corps of Engineers. The study is designed to assess effects and constraints of removing more than three million cubic meters of sediment from this highly industrialized waterway. A new six-year multidisciplinary, federally funded study of the Columbia River Estuary has also been initiated by the Pacific Northwest River Basins Commission, Vancouver, Washington. Federal, state, local, and university scientists are also busy studying other pollution-related matters in the area, including events as diverse as red tides, pulp mill effects, and effects of increased suspended solid loads in the Columbia River as a result of eruptions of Mount St. Helens. Articles on these and related subjects will be forthcoming in COPAS. Meanwhile, for more information on specific activities, obtain a copy of the 1979 Compendium of Current Marine Studies in the Pacific Northwest. The Compendium contains information on 676 ongoing projects and can be purchased for $30 from the Oceanographic Institute of Washington, 312 First Avenue North, Seattle, WA 98109.

Alan J. Mearns
NOAA/MESA Puget Sound Project
7600 Sand Point Way
Seattle, WA 98115
(206) 442-5590

## NODC Marine Pollution Data Format

The National Oceanographic Data Center (NODC) has developed a new digital data format to support studies of toxic substances and pollutants in marine and estuarine waters. This format was devised in consultation with and for use by investigators working under the auspices of major environmental assessment and monitoring programs for which NODC has data management responsibility. The format is identified as File Type 144 — Marine Toxic Substances and Pollutants. It allows for reporting both ambient concentrations near marine discharge sites and results of monitoring surveys for broad ocean areas.

The format consists of data fields for recording effluent information, as well as survey locations and dates of measurements for samples collected in the water column, the sediment, or biota. In this format, organisms and chemical substances are identified by means of two major code files — the NODC Taxonomic Code (a hierarchical system of codes of up to 12 digits) and the Chemical Abstracts Service (CAS) codes of the American Chemical Society (a series of registry numbers of up to 8 characters which are preceded in the format by an NODC-assigned alpha character). Other code groups are available for reporting analytical methods, gear types, and other relevant parameters.

Copies of File Type 144 and supporting documentation are available on request to the NODC.

James Audet
National Oceanographic Data Center
Washington, DC 20235
202-634-7441

## NOAA's Northeast Monitoring Program

Thirty million people live in the northeastern United States and all probably depend on or use the adjacent coastal waters and resources to some degree, directly or indirectly. For wise management and because many uses of the waters and its resources conflict or have an adverse effect on other uses, there is a need to assess and monitor the "health" of the marine environment and its living resources. For at least two decades, several governmental agencies have been doing this to some degree, usually in conjunction with a research project. Often, however, these programs have not provided sufficient information on long-term trends and impacts or were too restricted in scope. To help satisfy these gaps the Northeast Fisheries Center (NEFC) initiated a program called *Ocean Pulse* in 1977. This program has recently been integrated with two other more site-specific NOAA efforts: New York Bight Monitoring (initially under the Marine Ecosystem Analysis Program and now within the National Ocean Survey) and the Ocean Dumping Program (earlier under the National Ocean Survey and now under the Office of Marine Pollution Assessment) to form a unified pilot program, the Northeast Monitoring Program (NEMP).

NEFC has had prior programs that have studied site-specific problems, e.g. dredged material and waste dumping, power plant effluents and anoxia development in the New York Bight since the mid-1960s. However, it was not until the Ocean Pulse Program, which monitors up to 80 sites along the coast and farther offshore between the Bay of Fundy and Cape Hatteras several times a year, that a long-term, broad scope monitoring program was in place. This monitoring effort included many biological effects measurements, designed to provide sensitive new indications of sublethal environmental stress, by detecting changes in physiology, biochemistry, genetics, behavior, pathology and population or community dynamics. The MESA program studied the impact of waste disposal in the New York Bight, especially in the Apex. A goal of this program, which began in 1972, was to design a monitoring strategy for the New York Bight, an effort accomplished during FY 1979. The Ocean Dumping Program has been studying several dumpsites in the northeast and developing insight into potential impacts as well as techniques and methodologies which are appropriate for monitoring.

The goals of NEMP, besides fulfilling responsibilities assigned to NOAA by various legislation are: (1) to conduct an assessment and monitoring of the health of the northeast coastal ecosystems and biological resources, (2) to provide environmental data to support the wise management of the ocean resources and (3) to develop an environmental monitoring program that may have applicability outside of the northeast. To satisfy these goals, several objectives are being fulfilled: (1) determining levels and trends of specific contaminants in the marine and coastal environment, (2) determining the effects of specific impacts, e.g. oil drilling and waste disposal, on northeast ecosystems, (3) monitoring changes in the environment and ecosystems that may result in a loss of biological productivity or resources, (4) compiling an archive of marine pollution and ecosystem data to assess impacts on biological resources from unpredictable events such as contaminant spills, and (5) developing standard monitoring methodologies.

A major portion of the objectives will be addressed by extensive field surveys. An example of a type of survey required is that conducted for biological effects monitoring. During these seasonal surveys between the Canadian border and Cape Hatteras up to 80 stations are monitored that represent major ecosystems, specific impact areas and their controls, and critical habitats for resource species. Sediment, water, and specific biota samples are collected. The sediment and water samples are collected for chemical and bacteriological analysis. Water samples are also collected for chlorophyll concentrations, primary productivity estimates, phytoplankton community structure, and for algal bioassays as well as standard oceanographic variables. Biota, consisting of standard index or indicator organisms (fish and invertebrates) are collected and specimens prepared for future chemical contaminant analysis, for evidence of pathology, and for physiological, biochemical, bacteriological and metagenetic studies.

A significant portion of the NEMP assessment and monitoring effects are done under contract, but the program also fosters cooperative efforts using resources and ongoing efforts in several state and Federal agencies and other research institutions, to augment the efforts done directly under NEMP. In all cases, the unifying concept is to utilize fully and to integrate data which will allow the establishment of trends and predictive capability in regard to temporal and spatial changes in marine environmental quality and their effects on the fisheries and other living marine resources.

Although NEMP has been operational (as a unified program) for less than a year, it has been able to produce significant results because of the ongoing efforts of the individual programs that have been melded to create NEMP. One example of the type of results which are, or shortly will be, available include products of Ocean Pulse's Environmental Chemistry Investigation. Intensive near-monthly surveys of chlorophyll concentrations over the entire northeastern continental shelf have shown that remarkable inter-annual and inter-regional variations occur. For example, in 1979, there was a ten-fold decrease in chlorophyll concentrations over a large area of Georges Bank, compared to previous survey results in the same area and time of the year. This investigation will shortly also be able to produce the first accurate estimates of primary productivity for the entire Northeast Continental Shelf.

Similar results are or will be forthcoming from most of the more than thirty studies that are an integral part of NEMP. The following are examples of reports that are presently available from the Program Manager's Office (Dr. John B. Pearce, NOAA, NMFS, NEFC, Sandy Hook Laboratory, Highlands, NJ 07732) where additional information on NEMP is also available:

1. "Hydrographic Data, *Ocean Pulse* Environmental Monitoring Surveys April 1978 through April 1980," by F.W. Steimle, Jr., J.E. O'Reilly, D.J. Radosh and R. Waldhauer.
2. "Cruise Report, RP-23-KE-80, surveying bacteria and pathogenic amoebae in Narragansett Bay, R.I." by T.K. Sawyer.
3. "Chemical and Physical Analysis of Sediment Samples," by GEOMET Technologies, Inc.
4. "Community Structure of the Macrobenthos of Pigeon Hill in the Gulf of Maine," by J. Witman, A. Hulbert, L. Harris, K. Pecci, K. McCarthy and R. Cooper.

Frank W. Steimle, Jr.
NOAA, NMFS
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, NJ 07732

## Petroleum Hydrocarbons, PCBs, and Other Indications of Pollution in the Middle Atlantic Bight

In February 1980, the Northeast Fisheries Center conducted a cruise which collected fish, and invertebrate and sediment samples for analyses of PCBs and petroleum hydrocarbons at stations located between the Canadian border and the Mississippi Delta. As part of the Northeast Monitoring Program (NEMP), samples were furnished to Energy Resources Company, Inc., for analyses in order that a screening could be done in regard to the relative amounts of hydrocarbons and PCBs in fish tissues. The first report on the preliminary findings has been received by the NEMP program. Detectable amounts of PCBS were found in several species of fish at stations located over the continental shelf to the shelf slope-break. While the values did not exceed established action limits for PCBs they did indicate a wide distribution of this material in several species of fish over a wide geographic range. Petroleum hydrocarbons were also detected in several species of fish, again, over an extensive part of the continental shelf. Fish from the Middle Atlantic Bight seem to have higher values for both categories of contaminants but there were trends suggesting greater loading in fish from the New York Bight. A thorough evaluation of these findings will be presented in the forthcoming annual status of the environment report being prepared by the Northeast Monitoring Program.

In another study sediments were measured for the presence of PCBs, polynuclear aromatic hydrocarbons and coprostanol. The highest values for PCBs and coprostanol were found in sediments from the New York Bight apex. Polynuclear aromatic hydrocarbons were found to be widely distributed in the study area and, again, the highest values were generally found in the New York Bight. A thorough evaluation of the findings to date will be given in the NEMP annual report.

John B. Pearce
NOAA, NMFS
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, NJ 07732
201-872-0206

## Research Proposals Funded by NOAA's Office of Marine Pollution Assessment's Financial Support Program

Under Public Law 95-273, the National Ocean Pollution Planning Act, the National Oceanic and Atmospheric Administration (NOAA) has the mandate of preparing the Federal plan for ocean pollution research, development and monitoring. This same Act authorizes the Administrator of NOAA to provide financial assistance in the form of grants or contracts for projects or activities which are needed to meet priorities set forth in the plan. This responsibility has been delegated to the Assistant Administrator for Research and Development who, in turn, has delegated it to the Office of Marine Pollution Assessment (OMPA).

The Financial Assistance Program was announced by OMPA in the scientific and technical, and other media before mid calendar year 1980. Included in the announcement was information on requesting a comprehensive guidance package for preparing proposals. The package provided statements of the areas of program interest, proposal review procedures, evaluation criteria, and proposal preparation requirements.

The criteria were applied in the peer-review process that OMPA established for evaluating some 219 proposals submitted for consideration for funding in fiscal year (FY) 1980. A 25-member panel (representing NOAA, other Federal agencies, and academia) reviewed and ranked the proposals, based on scientific merit, scientific/technical competence of applicant, relevance of proposed effort to program priorities, and cost.

The review panel recommended to the Director of OMPA that 14 proposals be approved for funding. The Director approved 13 proposals for a total amount of $896,000. General topic areas under which proposals were considered are:

| Topic Area | Total Amount |
|---|---|
| Effects of coastal land use practices on marine ecosystems, particularly upstream pollutant sources, estuarine loadings, coastal pollution fluxes, and multiple facilities impacts. | $171.8K |
| Effects of pollution on human health and on living marine resources, particularly micro-organisms and synthetic organics. | 128.7K |
| Problems related to municipal sewage outfalls, including pollutant pathways and alterations, and the development of monitoring strategies. | 205.0K |
| Problems related to oil and gas development, including oil spill response and clean-up (particularly shoreline vulnerability classification, and oil weathering studies), damage assessment, and fate and effects studies. | 235.1K |
| Development and application of risk analysis and economic valuation for the assessment of marine pollution problems | 155.8K |
| | $896.4K |

The individual proposals which were approved for funding in FY 1980 are listed on the following page:

## Research Proposals Funded in FY80 by the Office of Marine Pollution Assessment's Financial Support Program (Section 6, Public Law 95-273)

| Principal Investigator | Institution | Title | Length (Years) | FY 80 ($, K) |
|---|---|---|---|---|
| List, E.J.<br>Morgan, J.J. | California Institute of Technology | Field Confirmation of Particle Coagulation Mechanisms in Seawater | 1 | 73.8 |
| Gerba, C.P. | Baylor | Development of Management Strategies for the Assessment and Control of Viral Pollution of Coastal Waters | 3 | 71.5 |
| Richards, R.P. | Heidelberg College | Assimilation and Flux of Sediments and Pollutants in the Sandusky River Estuary, Sandusky Bay, and the Adjacent Nearshore Zone of Lake Erie | 3 | 77.3 |
| Brown, G.M.<br>Galucci, V.F. | University of Washington | Bioeconomic Consequences for a Fishery Dependent upon a Benthic Community Perturbed by Petroleum | 1 | 68.3 |
| Hendricks, T.J. | SCCWRP | A Numerical Model of Sediment Quality Near an Ocean Outfall | 2 | 54.6 |
| Yang, E. | Environmental Law Institute | The Use of Environmental and Resource Valuation Techniques on Legal and Legislative Regulatory Proceedings: A Case Study of Hazardous Substances Damages to Coastal and Estuarine Resources | 1 | 87.5 |
| Koh, R.C.Y. | California Institute of Technology | Modeling of Transport and Fate of Pollutants from Ocean Wastewater Discharges | 3 | 76.6 |
| Garside, C. | Bigelow Laboratory for Ocean Sciences | The Development and Application of Screening Methods for the Determination of Nitrosamines at the Parts per Billion Level in the Marine Environment | 1 | 57.2 |
| Burton, J.K.<br>Show, I.T. | IDS Associates | Development of a Stochastic Risk Assessment Model of the Fates and Effects of Petroleum in Marine Ecosystems | 1 | 77.1 |
| Pankow, J.F.<br>Isabelle, L.M. | Oregon Graduate Center for Study and Research | The Dissolution Rates of Hydrocarbons from Crude and Refined Oils into Seawater | 3 | 69.6 |
| Hoffman, E.J.<br>Quinn, J.G. | University of Rhode Island | Hydrocarbons and Other Pollutants in Urban Runoff and Combined Sewer Overflows Characterization and Impact on Narragansett Bay Water Quality | 3 | 94.5 |
| Gundlach, E.R.<br>Boehm, P.D. | Research Planning Institute, Inc. | Determine Fates of Several Oil Spills in Coastal and Offshore Waters and to Calculate a Mass Balance Denoting Major Pathways for Dispersion of the Spilled Oil | 1 | 16.0 |
| Brooks, J.M.<br>Wiesenburg, D.A. | Texas A&M | Volatile Organic Studies in the Gulf of Mexico Estuarine and Coastal Ecosystems | 1 | 72.4 |
| | | | Totals | $896.4K |

The Financial Support Program will be publishing, in the not-too-distant future, a FY1981 guidance package. It will contain a revised list of priority activities, target funding levels, etc. Information for requesting the package, when published, will be provided in a later issue of COPAS, and in other scientific/technical media. The Manager of the Financial Support Program is Dr. Robert E. Burns, Special Projects Office, NOAA/RD/MPF28, Bldg. 264, 7600 Sand Point Way N.E., Seattle, WA 98115, telephone number 206-442-5590.

H.M. Stanford

# Announcements

## Cooperative Research Program Initiated

In December 1979 a joint research program in the Gulf of Mexico was initiated by the Atlantic Oceanographic and Meteorological Laboratory's (AOML) Ocean Chemistry Laboratory and the National Marine Fisheries Service (NMFS) Southeast Fisheries Center's (SEFC) Beaufort Laboratory. This joint effort, funded by the National Oceanic and Atmospheric Administration's (NOAA) Office of Marine Pollution Assessment (OMPA), utilizes chemical and biological expertise from both laboratories to obtain scientific information to establish criteria by which long-term effects of contaminants (particularly trace metals) on oceanic ecosystems can be detected or predicted. Specifically, this joint program attempts to (1) identify and describe the potential pathways of contaminant and energy transfer through the food web which supports the survival and growth of economically important species of larval fish in the northern Gulf of Mexico, and (2) determine the effects of differences in concentrations and chemical form of selected trace metals to marine plankton communities with emphasis on those which support larval fish.

Expertise at the SEFC Beaufort Laboratory on larval fish ecology, trace metal bioavailability/toxicity and bacterial productivity is being combined with expertise at AOML in phytoplankton-zooplankton ecology and nutrient, trace metal and organic chemistry. In addition, research on carbon and nitrogen isotopic characterization of larval fish food webs and on the response of phytoplankton isolates to trace metals is being conducted through subcontracts with Marine Biological Consultants and Woods Hole Oceanographic Institution, respectively.

Since the program started, four joint AOML/Beaufort cruises have been conducted. Two of these cruises were aboard the FRS OREGON II and dealt primarily with the characterization of larval fish food webs in northern Gulf of Mexico. The other two cruises were on the R/V ENDEAVOR and R/V RESEARCHER. Emphasis on these cruises was to occupy several stations with distinctively different trace metal chemistries (Cu, Cd and Zn), and to determine the response of natural populations of bacteria and phytoplankton to changes in trace metal activities resulting from trace metal and chelator additions in shipboard experiments. Stations were located: in coastal waters in the northern Gulf off the Mississippi Delta, and off Cape San Blas, FL; oligotrophic waters in the central Gulf; and in coastal waters off the Yucatan peninsula and in Campeche Bay in the southern Gulf.

Don Atwood
Atlantic Oceanographic and Meteorological Laboratory
Miami, FL 33149
305-361-5767

Ford Cross
Southeast Fisheries Center
Beaufort Laboratory
Beaufort, NC 28516
919-728-4595

## Funding Opportunity For Marine Pollution Research

The National Oceanic and Atmospheric Administration (NOAA) through its Office of Marine Pollution Assessment, announces programs of financial assistance for research related to (i) long-term effects of pollution and man-induced changes of marine ecosystems (for the purpose of this program the Great Lakes are considered "marine") under Section 202 of Public Law 92-532 (Marine Protection Research and Sanctuaries Act of 1972), and (ii) for research and development and monitoring projects needed to meet priorities set forth by Section 6 of Public Law 95-273 (National Ocean Pollution Research and Development Monitoring Planning Act of 1978).

Some of the general areas of research for which proposals are being requested include the following: fates and effects of synthetic organics, petroleum products, metallo-organics; role of resuspended particulates in marine ecosystems; coastal land use practices; municipal sewage disposal; development of risk analysis methods; ecosystem processes and living marine resources. Although most of the efforts supported will have an applied orientation, research of a more basic nature may also be addressed, especially in regard to ecosystem function and stability.

Individuals, corporations, educational institutions and others, including local, state and Federal agencies are eligible to submit proposals.

Additional information on proposal preparation, and evaluation and FY81 priorities and funding levels are obtainable from:

R.C. Farentinos
Long Range Effects Research Program
Office of Marine Pollution Assessment (RD/MP2)
325 South Broadway
Boulder, CO 80303
303-497-6486

## MESA/Puget Sound Data Catalog Available

The *Data Catalog for the Marine Ecosystems Analysis Puget Sound Project: Distribution and Summarization of Digital Data* (May 1980) is now available from the National Oceanographic Data Center (NODC). The MESA Puget Sound Project, sponsored by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA), was initiated to assess the impact of urban/industrial development on the marine ecosystems of the Puget Sound area. NOAA's Environmental Data and Information Service (EDIS) maintains a MESA data base by processing and archiving physical, chemical, and biological data from this project in a series of standard formats.

This catalog depicts all the data received by EDIS through

April 1980 with the exception of those being held for correction or resubmission by principal investigators. It contains graphic displays of station locations and summaries of information about the individual data sets.

Data listed in the catalog are available from NODC as copies of selected sets, as computer-generated data displays, statistical summaries, or other analytical products. Time and cost estimates for preparing data copies and data products can be provided on request. A Data Request Form is included in the catalog.

The MESA/Puget Sound catalog and further information about data availability should be requested from the EDIS MESA Data Coordinator at the address below.

James B. Ridlon
NOAA/EDIS
National Oceanographic Data Center
Washington, D.C. 20235
202-634-7441

## Report Published on 1976 Fish Kill In the New York Bight

A massive fish kill similar to the 1976 New Jersey disaster that destroyed an estimated $550 million worth of fish and shellfish could occur in the future, a federal report concludes.

The 345-page report, Oxygen Depletion and Associated Benthic Mortalities in the New York Bight, 1976, is edited by R. Lawrence Swanson of NOAA's Office of Marine Pollution Assessment, and Carl J. Sindermann of NOAA's Northeast Fisheries Center in Sandy Hook, N.J.

The report notes that while nothing can be done to prevent sea and weather conditions which caused the 1976 kill, better long-range forecasting could minimize the effects of any similar occurrence in the future on commercial fishing.

The 1976 kill occurred from July through October in an 8,600 square kilometer area of the New Jersey continental shelf. Chief losses were among shellfish, especially surf clams, ocean quahogs, scallops and lobsters.

The disaster was attributed by the report to a severe depletion of oxygen and the concurrent formation of hydrogen sulfide in the water. Among the contributing factors were high temperatures, abnormal river runoff, a decline in spring and summer storm activity, and four to six weeks of unusually persistent south and southwest winds.

These conditions caused a warming of the ocean's surface waters and a massive blooming of a small marine organism which consumed much of the diminished oxygen supply.

The report also indicated that sewage and manmade pollutants contributed to the problem, but were not determining factors.

It is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at a cost of $8.50. Reference to the GPO Stock No. 003017004643 should be made when ordering.

H.M. Stanford
NOAA/OMPA
Northeast Office
SUNY at Stony Brook
Long Island, NY 11794
516-751-7002

# Calendar

**January**

**13-15**

Workshop on Marine Pollution Information Management, Frederick, MD. Sponsored by National Oceanographic Data Center pursuant to requirements of Section B (Information Dissemination) of the National Ocean Pollution Planning Act of 1978 (PL 95-273). Contact: K. Hughes, EDIS, NODC, NOAA, Washington, DC 20235 (202-634-7510).

**27-29**

Overview of Regional Ocean Pollution Monitoring Requirements, Atlanta, GA. Contact: Nancy J. Hooper, Metrics, Inc., 290 Interstate North, Suite 116, Atlanta GA 30339.

**March**

**2-5**

7th Biennial Oil Spill Conference, Atlanta, GA. Contact: 1981 Oil Spill Conference, Suite 700, 1629 K Street, N.W., Washington, DC 20006.

**9-13**

1981 Pittsburgh Conference and Exposition on Analytical Chemistry and Applied Spectroscopy, Atlantic City, NJ. Contact: John Graham, President, 1981 Conference, 437 Donald Road, Pittsburgh, PA 15235.

**19-20**

Sixth Marine Recreational Fishery Symposium Sciaenids: Territorial Sea Demersal Resources, Houston, TX. Contact: Ken Hinman, P.O. Box 23298, Savannah, GA 31403.

**28-29 or April 4-5 (date to be decided after January 10, 1981).**

East Coast Benthic Ecology Annual Spring Meeting, Yale University, New Haven, CT. Contact: Nancy N. Knowlton, Department of Biology, Yale University, P.O. Box 6666, New Haven, CT 06511 (203-436-0731).

**April**

**8-10**

Environmetrics 81, Alexandria VA. Contact: Donald L. Thomsen, Jr., Chairman, Program Committee, 97 Parish Road South, New Canaan, CT 06840.

**Information for Contributors**

There is no prescribed format for preparation of manuscripts because of the wide range of material accepted. Authors should be guided by articles in COPAS.

1. Articles should be typed double-spaced and should not exceed 1,000 words.
2. The title should be informative and brief.
3. On first use full name and acronym must be used. Subsequent reference may be by acronym alone.
4. Measurements should be given in the metric system.
5. Figures and tables should be camera-ready and suitable for reduction to a 15.2 x 10.2 cm size, not including legend. Care should be taken with lettering and symbols so that they are readable when reduced. The combined number of figures and tables should not exceed three.
6. Proofs will not be sent to the author unless requested, but if significant editorial changes are made for brevity and clarity, authors will be contacted by telephone.
7. Reprints are not provided.
8. Deadlines for contributions are January 25, April 10, July 10, and October 10. Send all correspondence and material to:

   Coastal Ocean Pollution Assessment News
   Marine Sciences Research Center
   State University of New York
   Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News** is published quarterly. Subscription is free. Individuals wishing to subscribe should write to:
Coastal Ocean Pollution Assessment News
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794



**Address correction requested**

# COASTAL OCEAN POLLUTION ASSESSMENT NEWS

## MAN AND THE MARINE ENVIRONMENT

Volume 1 Number 2 Winter 1981


The purpose of **Coastal Ocean Pollution Assessment** (COPAS) **News** is to provide timely dissemination of information on pollution in coastal waters of the United States — its sources and effects, what is being done to eliminate or mitigate it, and what research and monitoring activities are being conducted to develop more effective strategies to manage it. We publish brief articles describing recent events and activities, new approaches to resolving chronic pollution problems, and early warnings of potential problems. Announcements of cruises, meetings, and investigations will be included.

Publication in COPAS is not to be construed as publication in the referred scientific literature. COPAS is not copyrighted, and any reference to material printed in COPAS should be approved by the author.




**Published by:**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794


# In This Issue



# Episodes

## Observations of the Columbia River Plume after the Eruption of Mount St. Helens

As part of the National Oceanic and Atmospheric Administration (NOAA)'s monitoring effort concerning the environmental impact of the recent Mount St. Helens volcanic activity, the Pacific Marine Environmental Laboratory in Seattle conducted three cruises off the Washington-Oregon coast to measure suspended particulate matter (SPM) concentrations and distribution in the water of the Columbia River plume. The first cruise (29 May-2 June 1980) occurred just ten days after the initial eruption; subsequent cruises were made during 8-11 July and 24-28 August.

Surface expression of the plume was mapped by continuous shipboard readings of light transmission, with use of a beam transmissometer, and salinity. Discrete water samples were taken periodically during each cruise in order to calibrate the beam transmissometer in units of mg $\ell^{-1}$.

Figures 1, 2, and 3 show the development of the plume in terms of surface SPM concentrations through the summer of 1980. Immediately after the eruption, the plume was found to be spreading to the southwest under the influence of weak northwest winds. Near the river mouth, concentrations exceeded 80 mg $\ell^{-1}$. Concentrations fell off less rapidly along the plume axis than to either the southeast or northwest, remaining $> 2$ mg $\ell^{-1}$ at least 60 km down the plume axis. Concentrations at comparable locations during 8-11 July had decreased to $< 15$ mg $\ell^{-1}$ and $< 1$ mg $\ell^{-1}$. During the final cruise in August, maximum concentrations outside the river mouth were only about 3 mg $\ell^{-1}$, about a 25-fold decrease over the three-month sampling interval.

Depth profiles in the plume just outside the mouth of the Columbia River, in 50 m of water, revealed a surface maximum of 12 m thick and two maxima just above the bottom. The surface maximum was approximately 250 mg $\ell^{-1}$, equivalent to the suspended load of the Mississippi River at flood stage. Scientists from NOAA's National Marine Fisheries Service noticed that fish that normally dwell on the bottom (flounder, sole) were caught in midwater trawls during the period of high suspended load.

The areal extent of the plume during the summer of 1980 was considerably less than normal, due to river runoff which was about 40% below the historical average. Work in the river and estuary during the summers of 1965 and 1966 by Conomos and Gross (1972) suggests that the ratio between river discharge ($m^3$ $sec^{-1}$) and SPM concentration (mg $\ell^{-1}$) is typically in the range 400-900. The combination of low discharge and high turbidity at

the end of May resulted in a reduction of this ratio to an anamalous level of~50.

References

Baker, E. T. 1971. Distribution, composition, and transport of suspended particulate matter in the vicinity of Willapa Submarine Canyon, Washington. Geol. Soc. Am. Bull. 87:625-632. Conomos, T. J. and M. G. Gross. 1972. River-ocean suspended particulate matter relations in summer. Pages 176-202 *in* The Columbia River Estuary and Adjacent Ocean Water, A. T. Pruder and D. L. Alverson (eds.). Univ. Washington Press.

Edward Baker
Herbert Curl, Jr.
Pacific Marine Environmental Laboratory
Seattle, WA 98115
202-442-5436

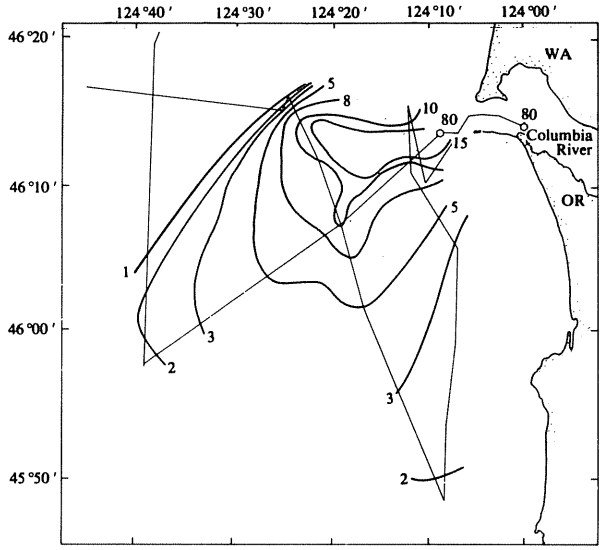



Figure 1. Concentration (mg $\ell^{-1}$) of suspended particulate matter in surface waters, 29 May - 2 June 1980.

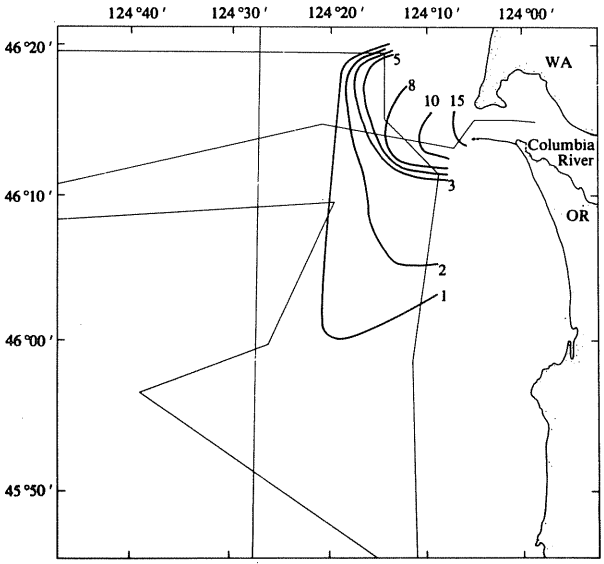



Figure 2. Concentration (mg $\ell^{-1}$) of suspended particulate matter in surface waters, 8-11 July 1980.

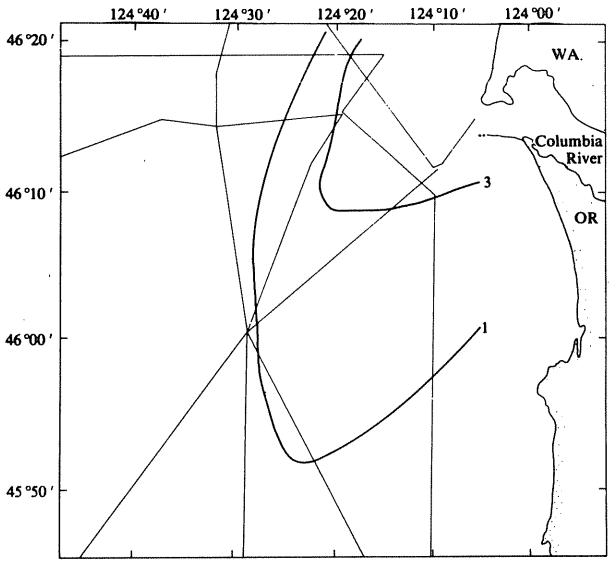



Figure 3. Concentration (mg $\ell^{-1}$) of suspended particulate matter in surface waters, 24-28 August 1980.

# Continuity

## Scientists Monitor Effects of Harbor Spoil

If the U.S. Army Corps of Engineers deepens the Hampton Roads (VA) shipping channel to accommodate an expected boom in Virginia's coal industry, more than 51 $m^3$ of polluted harbor sediments will be dredged. Environmental problems involved in the disposal of these materials are the subjects of a two-year study being conducted by a group of Old Dominion University (ODU) scientists. Tests have been performed to determine effects of the materials to be dredged on the animals and plants of area waterways and on the waters of potential disposal areas. Early results indicate that contamination "is probably not as widespread as one might think," said Dr. Raymond W. Alden III, an ODU assistant professor of biological sciences.

"Out of seven sites we studied in and around the harbor of the Elizabeth River, we found only two places with extremely toxic effects," he said. "And those samples are not toxic to the extent that, once the material is diluted in the open ocean, it would cause lethal effects to the area's ecology."

The polluted spoil around the highly industrialized southern branch of the Elizabeth River is, at this point in the study, the only material found to be highly lethal, Alden said. And that material will probably be dumped not on the ocean floor, but on the Craney Island landfill in Portsmouth.

Most of the other spoil, which is 80% seawater, is considered fairly harmless, he added, although tests are still being conducted on pesticide concentration.

Alden and colleagues Dr. Joseph H. Rule and Dr. Daniel M. Dauer are now engaged in laboratory experiments with use of a simulated disposal operation. Subjects for the experiments are living organisms collected offshore and kept at the bottom of

1,500-liter tanks, where they are exposed to the dredged spoil.

The scientists are also planting sediments in the bottom of the ocean to see if marine organisms recolonize and adapt to the spoil. Those plots are monitored once a month.

"To date we've not found anything extremely alarming. Considering the potential contaminants out there, there are really only a few areas that wouldn't meet Federal environmental guidelines. But as scientists they are still of concern to us," the ODU professor said.

Joan Coates
Old Dominion University
Norfolk, VA 23508
804-440-3115

## Toxicant Research in Puget Sound

Puget Sound, an inland marine system in Washington, is commonly perceived by local residents and scientists as a relatively pristine body of water. However, new evidence which indicates, perhaps, that Puget Sound is undergoing some transition to a stressed system has been revealed in recently completed research.

Following an initial survey in which trace metals, aromatic hydrocarbons, and synthetic organics were found in sediments at selected sites in the Sound, a large-scale investigation of the distribution and concentrations of these contaminants was conducted. Measurements of biological abnormalities in fish and invertebrates and community parameters in benthos and fish samples were also performed. The objective of the research was to determine the magnitude of the toxic chemical problems, if any, in the Sound. The work was supported by the Marine EcoSystems Analysis (MESA) Project, a part of the National Oceanic and Atmospheric Administration (NOAA)'s Office of Marine Pollution Assessment (OMPA). The results were reported in two NOAA Technical Memoranda (Malins et al., 1980; Riley et al., 1980).

Table 1 shows selected results of the chemical analyses. Aromatic hydrocarbons and chlorinated organic compounds were often most highly concentrated in the sediments and flatfish livers collected in the industrial areas of Commencement Bay near Tacoma and Elliot Bay near Seattle. The concentration of many of the chlorinated organics equalled those found in the New York Bight. The PCB levels of 3.8-4.6 ppm in muscle of fish from one urban waterway nearly equal the Food and Drug Adminstration (FDA) limit of 5.0 ppm for consumable fish tissue and exceed the FDA proposed action level of 2.0 ppm. Up to 9.1 ppm chlorinated butadienes were found in livers of flatfish taken from Commencement Bay. Trace metal concentrations in sediments varied considerably throughout the Sound. However, Sitcum Waterway near Tacoma had the highest levels of most metals (e.g., copper and arsenic concentrations of 1,600 ppm and 470 ppm in sediments, respectively). Up to 66,000 ppm arsenic have been measured in bank seepage samples taken nearby in Blair Waterway and analyzed by the Environmental Protection Agency.

Hundreds of as-yet unidentified alkyl-substituted aromatic hydrocarbons were found in sediment samples analyzed by GC-MS. More than 100 chlorinated compounds were present in some samples. Over 200 isomers of PCBs were detected.

TABLE 1

Ranges in concentrations ($\mu$g/g [ppm] dry weight) of selected organic compounds detected in Puget Sound samples. Numbers of samples given in parentheses; - indicates no samples performed.

| | sediment | fish livers | fish muscle*** | crab hepato-pancreas | suspended particulate matter** |
|---|---|---|---|---|---|
| polychlorinated biphenyls | 0.0005-1.2 (42) | 0.2-35.0 (37) | 3.8-4.6 (3) | 0.4-33.0 (6) | 0 |
| chlorinated butadienes | 0.002-9.0 (42) | 0.001-9.1 (39) | 0.01-0.3* (3) | 0-0.07 (6) | 0.001-0.15 (12) |
| hexachloro-benzene | 0.00001-0.25 (42) | 0.004-3.7 (39) | 0.05-0.2 (3) | 0.002-0.2 (3) | - |
| phenanthrene | 0.01-7.3 (42) | <0.005--.16 (39) | - | <0.005-0.50 (6) | 0.08-0.62 (18) |
| benz(a) anthracene | 0.003-6.8 (42) | 0.003-0.22 (39) | - | <0.01 0.09 (6) | <0.01 0.08 (18) |
| benzo(a) pyrene | 0.006-4.0 (42) | <0.007-0.37 (39) | - | <0.005-0.02 (6) | <0.01-0.12 (18) |

*hexachlorobutadiene only
**reported as averages of duplicate samples
***limited number of samples from one urban waterway where sediments contained high levels of synthetic organics

A total of 2,951 fish and 618 invertebrates were examined for gross and microscopic abnormalities. Abnormalities in the livers of fish and hepatopancreas of crustaceans appeared to be most common. Table 2 shows a summary of percent incidence data for selected histopathologic conditions for two species of fish. The data from the 33 sampling stations have been lumped into three categories: waterways and waterfronts (usually having highest toxic substance levels), outer bays (intermediate levels), and reference areas (most pristine, though not toxicant free). Though sample numbers were higher in the industrialized waterways and waterfronts, percent incidences of abnormalities were higher there in most cases. Adenomatous foci and cholangioproliferative foci resemble tumorous conditions induced in laboratory animals and were found exclusively in the most contaminated areas of the Sound. These two conditions were found in 2-3% of the fish collected throughout the year at most individual sites in the waterways and waterfronts. However, up to 9% were found diseased during individual seasonal surveys. Over 25% of the English sole collected off the Seattle waterfront in the summer had

megolocytic hepatosis. Some individual English sole had as many as four types of abnormalities. Necrosis of shrimp hepatopancreas was found in 56% and 21% of the individuals collected off the Seattle waterfront and in the waterways of Commencement Bay, respectively.

TABLE 2

Percent incidence of selected histopathologic conditions in livers of two flatfish species captured in Puget Sound. MH = megalocytic hepatosis; FH = focal hypertrophy; AF = adenomatous foci; CF = cholangioproliferative foce; FHH = focal hepatocellular hyperplasia. Pooled results from four quarterly surveys, 1979-1980.

| | English Sole | | | Rock Sole | | |
|---|---|---|---|---|---|---|
| | industrialized waterways/ waterfronts | outer portions of bays | reference areas | industrialized waterways/ waterfronts | outer portions of bays | reference areas |
| MH | 9% | <1% | <1% | 7% | 4% | 0 |
| FH | 5 | 5 | 0 | 2 | 0 | 0 |
| AF | 1 | 0 | 0 | 0 | 0 | 0 |
| CF | 1 | 0 | 0 | 1 | 0 | 0 |
| FHH | 3 | 0 | 1 | 3 | <1 | 5 |
| sample number | 559 | 311 | 133 | 348 | 265 | 105 |

The data base collected thus far indicate that toxic chemicals exist in all parts of the Sound and in relatively high concentrations in areas near Seattle and Tacoma. Whether or not they constitute an ecological problem is yet to be determined. The cause(s) of pathologic abnormalities are unknown, though they *may* be caused by toxicants. Clearly the toxicants measured have not created abiotic conditions, as fish abundance and diversity were highest in the areas with the highest chemical levels.

Future research planned for the succeeding years will attempt to answer the "So-what?" question concerning the concentration of toxicants. Bioassays and other field and laboratory tests to measure biological responses, if any, to ambient toxicant suites and model mixtures will be undertaken under the sponsorship of the MESA Project, along with studies to define further the processes that influence their fate.

References

Malins, D.C., B.B. McCain, D.W. Brown, A.K. Sparks, and H.O. Hodgins. 1979. Chemical contaminants and biological abnormalities in central and southern Puget Sound. U.S. NOAA Tech. Memo-OMPA-2. Nov., 1980. 295 pp.

Riley, R.G., E.A. Crecelius, D.C. Mann, K.H. Abel, B.L. Thomas, and R.M. Bean. 1980. Quantitation of pollutants in suspended matter and water from Puget Sound. U.S. NOAA Tech. Memo-ERL MESA-49. April, 1980. 99 pp.

Edward R. Long
MESA Puget Sound Project
Office of Marine Pollution Assessment
U.S. National Oceanic and Atmospheric Administration
7600 Sand Point Way N.E., Tower Building
Seattle, WA 98115

## Workshop on Marine Pollution Information Management

Invited experts in scientific data and information management, and in marine pollution data collection and use, gathered 13-15 January 1981 in Frederick, MD to participate in a Workshop on Marine Pollution Information Management. The workshop was sponsored by the Environmental Data and Information Service (EDIS) of the National Oceanic and Atmospheric Administration (NOAA) and organized by the National Oceanographic Data Center (NODC), the EDIS center that has been delegated responsibility for implementing Section 8 (Information Dissemination) of the National Ocean Pollution Planning Act of 1978. NODC convened the workshop to enable representatives of academia, private industry, public interest groups, and other government bodies and agencies to review and comment on proposals for fulfilling the mandate of the Act.

Section 8 of the Act presents its charge in one sentence of bold generality: "The Administrator (of NOAA) shall ensure that the results, findings, and information regarding ocean pollution research and development and monitoring programs conducted or sponsored by the Federal Government be disseminated in a timely manner, and in useful forms, to relevant departments, agencies, and instrumentalities of the Federal Government, and to other persons having an interest in ocean pollution research and development and monitoring." Central to the workshop discussions were the questions: what is timely and what is useful in regard to marine pollution data and information products?

The workshop was held in the Modified Assembly Style. Each participant was assigned to one of three panels: Digital Data, Data Synthesis, and Information Management. The three panels met separately, but each discussed all three of these broad subject areas. This format enabled the discussion groups to be kept to workable size and allowed the problems to be viewed from different professional perspectives.

A point of common reference for the three panels was a proposal for an Ocean Pollution Data and Information Network (OPDIN) that was presented in the first five-year Federal Plan for Ocean Pollution Research, Development, and Monitoring. This concept originated with the Subcommittee on Data Collection, Storage, and Distribution of the Interagency Committee that assisted NOAA in developing the Plan. Following the mandate of the Act, OPDIN relied as much as possible on existing Federal data and information facilities. It proposed to coordinate the marine pollution-related functions of these existing facilities through an entity dubbed the Central Coordination and Referral Office. As its name implies, the Central Coordination and Referral Office would have two primary functions. First, through access to appropriate data inventories, it would serve as an "information broker" for users of marine pollution data and information. Second, it would facilitate interaction among data collectors, processors, archivists, and users by taking a lead role in development of standard data management tools and procedures, such as data exchange formats and quality control procedures.

Many workshop recommendations focused on ways of modifying and elaborating the OPDIN concept so that it would work in reality; a reality constrained by the decentralized organizational framework of Federal ocean pollution activities, the broad range in complexity of marine pollution data and information needs, and limited resources.

The common opinion of all panels was that data synthesis needs deserve special priority because classical scientific data analyses do not always meet the needs of decision makers. It was agreed, however, that the Office should not duplicate or compete with existing data synthesis services in government agencies or the private sector. But the Office could provide valuable assistance to users in obtaining these services. A further suggestion was that the Office sponsor in-depth analyses of critical pollution problems.

Because of the size and complexity of the Federal pollution program, it was felt that communication among all program participants was vital to success. Therefore, the workshop recognized that Coastal Ocean Pollution Assessment News "serves a major information need and deserves support and cooperation."

NODC expects to complete its review of workshop recommendations and begin implementation of the proposed network during 1981.

Richard J. Abram
NOAA/EDIS
National Oceanographic Data Center
Washington, D.C. 20235
202-634-7500

*"As I see it, if we just lie low this will be over in another millennium or so."*

# Loomings

## Some Effects of PCBs in an Estuarine Environment

In a contaminated aquatic ecosystem, polychlorinated biphenyls (PCBs) will be found distributed among the following estuarine components: bottom sediments, the water column, suspended nonliving particulates, and living organisms including phytoplankton, zooplankton, and fish. At equilibrium, most of the PCBs will be found in bottom sediments, but various phenomena including storms, dredging, and high water flow redistribute the PCBs throughout these components.

For the past several years a research team, headed by Dr. Charles F. Wurster, at the Marine Sciences Research Center (MSRC) of the State University of New York at Stony Brook has studied the effects and transfer of PCBs among particulates and living organisms, particularly phytoplankton and zooplankton. PCBs labeled with $^{14}C$ were used to measure and trace movement of the PCB mixture within the experimental laboratory and field systems. Focus of the studies has been on the Hudson River estuary. Field experiments examining the behavior and biological effects of PCBs were conducted at Flax Pond, a research and instructional preserve encompassing a 59-hectare tidal marsh on the north shore of Long Island, 5 km from the Stony Brook campus. To simulate natural conditions, PCB-treated and control samples in dialysis membrane bags were suspended in rafts anchored in Flax Pond where, due to high flushing rates, the water approximates that of Long Island Sound.

In the Hudson River estuary, about 75% of the clays consist of illite and chlorite, present in a ratio of approximately 3:2. Illite was found to sorb more PCB from water than did an equal weight of chlorite, the concentration factors from water to particles being $1.4 \times 10^4$ and $1.0 \times 10^4$, respectively (Nau-Ritter and Wurster, in prep. I). Greater sorption occurs because an equal weight of illite provides more surface area than chlorite. Sorption of PCB by suspensions of clay and detrital particles increased as the particulate organic content of the suspension was increased.

The rates of desorption of PCB from illite and chlorite to the natural waters of Flax Pond were similar. The presence of clay particles within the dialysis membrane bags used in the experiment, however, impeded the loss of PCB from the system. After 24 h nearly 50% of the added PCB was retained within bags containing either inorganic or organic particles, whereas less than 25% remained within bags containing particle-free water (Biggs et al., 1980; Nau-Ritter and Wurster, in prep. I).

The transfer of PCB from clay particles to algal cells was measured. PCB-contaminated illite particles were mixed with living *Thalassiosira* sp. cells in a glass container. Within 4 h most of the PCB had desorbed from the illite and been taken up by the cells, the water, and the walls of the container. A sucrose density gradient technique was devised to separate cells from illite particles (Nau-Ritter, in prep.). The amounts of PCB associated with the cells, and with the illite clay, could then be determined. Throughout the experiment (50 h), cell numbers, chlorophyll *a* content, and photosynthesis were substantially depressed when compared with control cultures containing clean illite.

Experiments were conducted to determine the effects of PCB exposure on natural phytoplankton community carbon fixation, growth rate, species composition, and size distribution. The PCBs within the sediments of the upper Hudson River consist of 75% Aroclor 1254 and 12% Aroclor 1016. The toxicity of these two mixtures were tested against a natural estuarine phytoplankton community dominated by diatoms.

Aroclor 1254, the more highly chlorinated of the two PCBs, proved more toxic than Aroclor 1016 to these algae (Nau-Ritter and Wurster, in prep. II). When PCB $\ell^{-1}$ Aroclor 1254 was added directly to the water, yielding a concentration of 10 $\mu$g PCB $\ell^{-1}$, cell concentrations, photosynthetic carbon fixation, and chlorophyll *a* content were significantly lower than in assemblages similarly treated with Aroclor 1016. No significant differences in these parameters were evident, however, when these two Aroclors were added as PCB-sorbed particles.

Natural Hudson River suspended solids (HRSS) collected near Tarrytown in October 1979 were suspended at 100 mg $\ell^{-1}$, with natural estuarine phytoplankton, and incubated under ambient conditions. No significant difference in photosynthetic carbon fixation and chlorophyll *a* content was noted between HRSS-treated assemblages and control assemblages with or without clean illite particles. PCB sorbed onto HRSS or illite particles subsequently desorbed and showed similar toxicities to algae.

PCB sorbed to particulates may be more toxic to phyto-

plankton than to similar quantities of PCBs in the water (Nau-Ritter et al., in prep.). Daily additions of 10 $\mu g\ \ell^{-1}$ of PCB sorbed to illite reduced the photosynthetic carbon fixation rate and chlorophyll *a* content of a natural phytoplankton assemblage more than did 10 $\mu g\ \ell^{-1}$ of PCB added directly to the water. Both cultures also exhibited a shift in species composition from large diatoms to smaller-sized cells. The implications of this size shift in natural phytoplankton communities have been discussed by O'Connors et al. (1978).

Experiments begun in 1978 indicated that contaminated phytoplankton food significantly influenced PCB uptake and survival among small estuarine copepods (genus *Acartia*). Adult female *Acartia clausi* and *Temora longicornis* were fed contaminated phytoplankton suspensions to determine maximum PCB body burdens for these copepods at a particular phytoplankton PCB concentration. *Acartia clausi* and *Temora longicornis* reached maximum PCB concentrations after 30 and 48 h, respectively. *Temora*, a larger copepod than *Acartia*, contained five times more PCB than *Acartia* at equilibrium. These PCB concentrations in copepods fed contaminated plankton were much greater than when copepods were exposed to contaminated water alone.

In a similar experiment, PCB uptake by adult female *Temora longicornis*, fed contaminated phytoplankton suspensions of different size composition but equivalent particle volumes, was followed over time. It appears that *Temora* fed smaller-sized contaminated phytoplankton obtained PCB at a faster rate and had a greater PCB concentration after 30 h than did *Temora* fed larger-sized phytoplankton. By eating more small particles than large particles, *Temora* apparently was ingesting a greater surface area from which it assimilated more PCB than it could have obtained from ingesting large particles. Further work is needed to substantiate these preliminary findings.

The importance of PCB in the diet of small estuarine copepods was further illustrated by examining equilibrium PCB concentrations in adult female *A. tonsa* exposed to (1) different PCB concentration in water, (2) resuspended contaminated phytoplankton, or (3) phytoplankton suspensions injected with the same amount of PCB as had been injected into the water-alone experiments (Wyman and O'Connors, 1980). Equilibrium PCB concentrations in copepods were found to be linear functions of the equilibrium PCB concentration of the water in all treatments. Copepods fed contaminated phytoplankton, however, contained significantly higher PCB concentrations than those exposed to contaminated water alone.

Further research on the dynamics of PCB movements among particulates, water, phytoplankton, and zooplankton are necessary. The findings indicate that PCB contamination favors smaller phytoplankters, shifting the community toward a smaller average cell size (O'Connors et al., 1978; Biggs et al., 1978). This process may in turn favor smaller zooplankton while inhibiting larger zooplankters.

References

Biggs, D.C., R.G. Rowland and C.F. Wurster. 1979. Effects of trichloroethylene, hexachlorobenzene, and polychlorinated biphenyls on the growth and cell size of marine phytoplankton. Bull. Environ. Contam. Toxicol. 21:196-201.

Biggs, D.C., C.D. Powers, R.G. Rowland, H.B. O'Connors and C.F. Wurster. 1980. Uptake of polychlorinated biphenyls by natural phytoplankton assemblages: field and laboratory determination of $^{14}C$-PCB particle-water index of sorption. Environ. Pollut. (Series A) 22:101-110.

Nau-Ritter, G.M. and C.F. Wurster. In preparation I. Field and laboratory determination of polychlorinated biphenyl (PCB) sorption onto clays with effects on natural phytoplankton of particle-sorbed PCB. Submitted to Environ. Sci. Technol.

Nau-Ritter, G.M., C.F. Wurster and R.G. Rowland. In preparation. Polychlorinated biphenyls (PCB) desorbed from clay particles inhibit photosynthesis of natural phytoplankton communities. Submitted to Environ. Pollut.

Nau-Ritter, G.M. and C.F. Wurster. In preparation II. Comparison of the toxicity to natural phytoplankton of PCB (Aroclors 1254 and 1016) desorbed from clay particles.

O'Connors, H.B., C.F. Wurster, C.D. Powers, D.C. Biggs and R.G. Rowland. 1978. Polychlorinated biphenyls may alter marine tropic pathways by reducing phytoplankton size and production. Science 201:737-39.

Wyman, K.D. and H.B. O'Connors. 1980. Implications of short-term PCB uptake by small estuarine copepods (genus *Acartia*) from PCB-contaminated water, inorganic sediments and phytoplankton. Est. Coast. Mar. Sci. 2:121-131.

F.G. Roberts
Marine Sciences Research Center
State University of New York
at Stony Brook
Long Island, NY 11794
516-246-6546

## Environmental Assessments of Brine Discharges in the Gulf of Mexico

Several coastal salt domes in Louisiana and Texas have been designated for storage of large quantities of crude oil for strategic reserves or as a shorter term repository. Storage caverns are leached by injection of fresh water. The resulting brine with a total dissolved solids content of 200 to 260 g $\ell^{-1}$ must then be discarded either by reinjection into subsurface strata or discharge into coastal waters. Concern about the environmental effects of brine discharges have prompted extensive environmental characterization before, and impact assessments during, discharge of brine on the inner continental shelf.

Studies are underway at three disposal sites: U.S. Department of Energy (DOE) Strategic Petroleum Reserve Project's diffuser sites off Freeport, TX (Bryan Mound Reserve) and off Cameron in southwestern Louisiana (West Hackberry Reserve) and the Louisiana Offshore Oil Port (LOOP) diffuser site southwest of Grand Isle in southeastern Louisiana. Discharge of brine commenced in March 1980 at the Bryan Mound site, located 20.0 km offshore in 22 m of water, and proceeds at 660,000 barrels/day ($1 \times 10^8\ \ell\ d^{-1}$). The West Hackberry site is in 9.3 m of water 11.5 km offshore and has a design discharge rate of 1.08 million barrels/day ($1.7 \times 10^8\ \ell\ d^{-1}$). Discharge is scheduled to commence in May 1981. The LOOP discharge site, draining the Clovelly salt dome since May 1980 at a rate of 400,000 barrels/day ($6 \times 10^7\ \ell\ d^{-1}$), is located about 7 km offshore in 9.3 m of water.

Texas A&M University has conducted monthly sampling at the Bryan Mound site since fall 1977. Studies have included hydro-

graphic (CTD) survey, current meter measurements, chemical analysis of water and sediments, and assessments of macrobenthos, nekton, zooplankton, and phytoplankton. The dense brine tends to disperse along the seabed (increases observed to 9 m above the bottom but mainly confined to bottom 2 m), so a new approach was developed to map the distribution of the high-salinity bottom water using a conductivity-temperature meter mounted 25 cm above the seabed on a towed sled. A similar approach is also being employed at the two other brine discharge sites.

Maximum bottom salinities so far observed around the Bryan Mound discharge have been 6 ppt or less above the ambient salinity of 32-34 ppt. The areal extent of bottom water with detectably increased salinity has been 17.6 $km^2$ or less (3 ppt above ambient 3.3 $km^2$ or less).

The West Hackberry discharge site and several other potential sites off southwestern Louisiana were characterized between 1977 and 1979 during studies conducted by the National Marine Fisheries Service (NMFS)'s Galveston Laboratory, Science Applications, Inc., and Dames and Moore for DOE. Monthly sampling, similar to that conducted at the Bryan Mound Site, commenced in February 1981 in order to characterize conditions just prior to and during the scheduled discharge. McNeese State University is responsible for biological and some chemical studies and Texas A&M University is conducting physical and other chemical investigations. Studies are also being carried out in the Calcasieu Lake estuary to assess the effects of possible salinity intrusion due to the diversion of freshwater from its upper reaches for the purpose of leaching the salt dome.

In addition to these studies, the DOE is funding the operation of a telemetered spar with ocean floor sensors by the National Oceanic and Atmospheric Administration (NOAA)'s National Data Buoy Office, an extensive research program on shrimp spawning sites in the region of NMFS, Galveston, and a study of the effects of the West Hackberry brine discharge on menhaden, particularly larvae, by the Louisiana Department of Wildlife and Fisheries.

The pre- and post-discharge assessments at the LOOP discharge site are being conducted by the Louisiana Department of Wildlife and Fisheries under funding by LOOP, a consortium of private interests. Turbulent mixing and advection also have been effective in dispersing brine from the LOOP discharge; consequently, the area of detectably elevated salinity has been limited in this region of naturally more variable salinity than at the Bryan Mound site. Topics under study are generally similar to those in the DOE studies except that physical oceanographic investigations are much less extensive. Efforts are underway to coordinate studies in the three areas, particularly with regard to employing comparable methodology.

The results of these environmental assessments will assist in prediction of effects of other brine discharges, either from proposed expansion of strategic reserves or from utilization of geopressured gas reserves. Results should also contribute significantly to understanding environmental processes in the economically important but poorly studied inner shelf environment of the northwestern Gulf of Mexico.

Donald F. Boesch
Louisiana Universities Marine Consortium
Star Route Box 541
Chauvin, LA 70344
504-594-7552

# Research & Monitoring Updates

## Chemistry of the Delaware Bay Estuary

A group of chemical oceanographers and geochemists at the College of Marine Studies of the University of Delaware are studying the chemical dynamics of the Delaware Bay Estuary. Their study area extends from the lower Delaware River near Philadelphia, through the Delaware Bay and out about 15 km seaward of the mouth of the Bay with emphasis on the horizontal salt gradient region in the estuary.

From research done in the last two years, four examples are given of mixing for chemicals distinctly different in their behaviors. Silicate is an important controlling nutrient for the growth of some phytoplankton. The relationship of silicate to salinity is linear indicating little reactivity of silicate. Phosphate, also an important plant nutrient, exhibited a convex nonlinearity with salinity indicating an estuarine source of phosphate. A third important nutrient, nitrogen, frequently the most strongly limiting nutrient in most coastal and estuarine waters, was also examined. Nitrogen chemistry is complex because nitrogen can exist naturally in several different inorganic and organic forms. The most abundant form of nitrogen during most of the year in the Delaware Bay estuary is nitrate. The relationship of nitrate to salinity shows a concave nonlinearity indicating a large estuarine sink for nitrate. Iron also shows a strongly nonlinear relationship, but in this case there is a very abrupt decrease in the iron concentration in the 0 to 5 o/oo salinity reach of the estuary. In estuarine mixing situations the iron will aggregate and precipitate out of the water along humic acids. In this case then, the estuarine sink is due to geochemical rather than biological behavior.

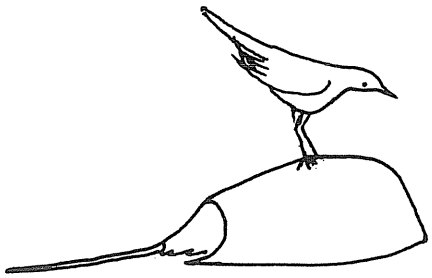
In the Delaware study, analyses are made of inorganic and organic forms of nitrogen and phosphorous, of organic carbon, of five trace metals, of oxygen and various other dissolved gases, and of the acidity and alkalinity of the water. This is being done to understand the biochemical and geochemical interactions involved in non-biological and biological processes. Determinations are also being made of the concentrations of total suspended particulate matter, its chemistry, and its affect on light. Attempts are being made to determine the standing crop and biological productivity of phytoplankton.

High levels of suspended material in the upper reaches of the estuary severely restrict light penetration in waters fresher than about 15 o/oo. This observation led to the hypothesis that biological productivity would be reduced greatly in the upper reaches of the estuary. This was confirmed by the study. The greatest biological productivity is near and seaward of the mouth of the estuary; productivity is reduced greatly in waters below 15 o/oo salinity.

This general picture is considered preliminary by the Delaware researchers. Sampling to date has been done along the axis of the estuary; in continuing work there will be better coverage of the estuary. Also, much more information is needed on seasonal variations (in preliminary work sampling was restricted to summer and early winter) on an expanded suite of chemicals, on air-water and sediment-water interactions, and on the variability of suspended material. More through estimates of the biological productivity and studies of nutrient uptake also will be made in the future.

The preliminary work has been done by Drs. Jonathan H. Sharp, Thomas M. Church, and Charles H. Culberson. These three scientists will be joined by Dr. Robert B. Biggs for the continuing study which is to be supported by the Sea Grant Office of the National Oceanic and Atmospheric Administration. This continuing study is viewed as essential for an understanding of the chemistry of the Delaware Bay estuary—a prerequisite to understanding pollutant transport. More thorough studies of physical and biological oceanographic processes, and studies of specific pollutants, will be added in the future.

Donald Maurer
Marine Lab
University of Delaware
Lewes, DE 19958
302-645-4308



*"Believe me, feathers aren't the answer either!"*

## 1980 Chesapeake Bay Plume Study — A Review of the SUPERFLUX Symposium

A study was initiated in 1980 to delineate the role of remote sensing in Federal programs concerned with the monitoring and assessment of the effects of pollution on marine resources. Sponsored jointly by the Northeast Fisheries Center (NEFC) of the National Oceanic and Atmospheric Administration (NOAA) and the Langley Research Center of the National Aeronautics and Space Administration (NASA-LaRC), the study — called SUPERFLUX — concentrated on the use of airborne remote sensors to study the impact of estuarine outflows on shelf ecosystems. The Chesapeake Bay plume was selected as the site for a series of prototype experiments, and a number of state agencies and universities participated in the study. Three interactive aircraft-boat experiments focused on techniques to characterize the spatial extent, variability, and biological and chemical properties of the plume during periods of high, moderate, and low runoff. These took place 11-20 March 1980 (SUPERFLUX I), 17-27 June 1980 (SUPERFLUX II), and 13-22 October 1980 (SUPERFLUX III). The results of these three experiments were presented at a symposium, held 21-23 January 1981 at Williamsburg, Virginia.

A synopsis of the SUPERFLUX research was presented in the final session of the symposium, which consisted of four papers that attempted to summarize and assess the accomplishments of SUPERFLUX and to look towards the future. The first paper considered SUPERFLUX relative to marine science and oceanography with particular emphasis on time-space scales. There was a region in time and space that was not covered adequately by either surface ships or satellites. SUPERFLUX had demonstrated that remote sensors flown on aircraft could respond to the temporal-spatial gap between ships and satellites. The aircraft platform with sensors covered the Chesapeake plume region at sub-tidal frequencies, with spatial resolutions on the order of 5 km between tracks and about 10 m along tracks. SUPERFLUX also demonstrated the capability for simultaneous measurements of temperature, salinity, effective light attenuation depth, fluorescence of chlorophyll *a* and phycoerythrin, and estimates of phytoplankton diversity, from a single aircraft platform.

The second paper assessed SUPERFLUX activities relative to the remote-sensing science. The activities were extremely valuable to the development of individual sensors. Sensors were tested over a wide range of marine environments for reliability and consistency. Individual algorithms were improved to provide quantitative measures — in the case of Airborne Oceanographic Lidas (AOL), as good as any obtained by shipboard methods. SUPERFLUX provided the first opportunity for an intercomparison of different instruments. Certain of the sensors [AOL, Multichannel Ocean Color Scanner (MOCS), Ocean Color Scanner (OCS), L-band microwave, and PRT-5 infrared radiometers] had real-time or near real-time output of the data that were reduced enough to impact decisions during the course of the experiment. These real-time or near real-time sensors are almost operational and as such are prime candidates for technology transfer. Other sensors — Testbed Airborne Multispectral Scanner (TBAMS) and Airborne Lidas Oceanographic Probing Experiment (ALOPE) — are still in a developmental state, but have the potential to make highly positive contributions for determining chlorophyll, turbidity, and phytoplankton diversity.

The third paper reviewed some of the oceanographic accomplishments of SUPERFLUX as they might affect the living marine resources. There is a relatively well-defined area east and south of the bay mouth that is influenced by both biostimulants and contaminants from the bay. The "outwelling" waters from the bay are enriched relative to adjacent waters in regard to plankton biomass, metabolic activity, biostimulants, and contaminants. The area of influence that these waters cover expands and contracts based on freshwater discharge, wind, and the physical oceanography of the open shelf. Finally, we see evidence for suggesting that particulate material, probably including contaminants, "rains out" of the water column to the benthos down the length of the plume.

The final speaker of the symposium, Dr. Robert L. Edwards, Director of the NEFC of the NOAA National Marine Fisheries Service (NMFS), discussed some of the implications of remote sensing to future monitoring and assessment programs. He made particular note of the unusually dry year during which SUPERFLUX had taken place, and suggested that the data collected be used as a "benchmark".

As a special guest speaker, former Congressman Robert Leggett, now of Leggett, Lanier, and Associates of Washington, DC, addressed an evening session of the symposium. He provided some sound advice concerning program survival in today's economic climate.

James P. Thomas
NOAA/NMFS
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, NJ 07732
201-872-0200

## Water Masses and Dumping at the 106-Mile Site

The 106-mile dumpsite is an area of approximately 40 x 40 km located beyond the continental shelf in water about 2,000 m deep (Fig. 1). In recent years the site has been used principally for the disposal of industrial chemical wastes—discharge from barges and small tankers. The quantity involved has amounted to about 800 million liters per year, generally distributed evenly throughout the year. Most of the discharged wastes have been dissolved or suspended materials, which tend to remain in the mixed layer above the thermocline. Some of the particulates settle to form a layer on the thermocline and some undoubtedly have sufficient density to break through the thermocline, but most of the discharged material remains in the mixed layer for an indefinite period, at least for days and probably for weeks.

The dumpsite's location places it in a dynamic environment subject to major aperiodic changes in circulation and water masses. The average southwestward drift is often interrupted by excursions of the Shelf-Slope front and passage of Gulf Stream eddy water.

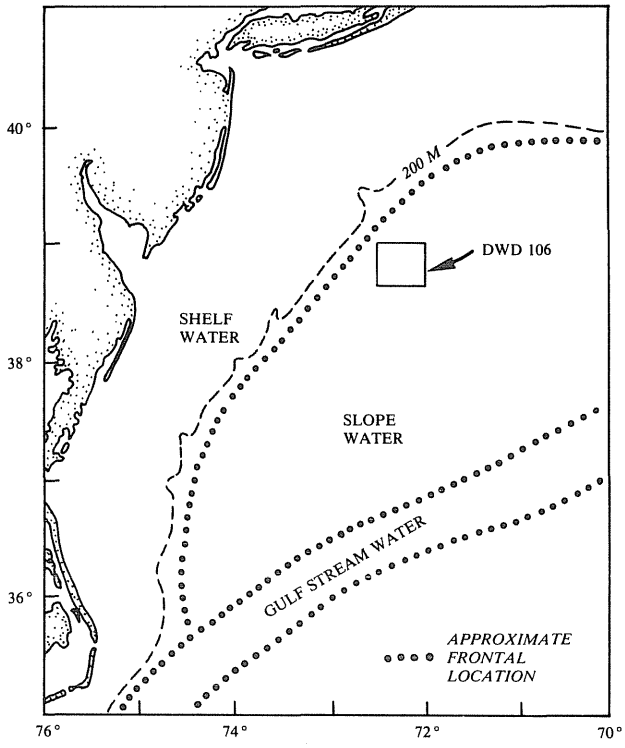



Figure 1. Approximate average location of water masses and fronts in the vicinity of the 106-mile dumpsite.

By monitoring weekly charts of eddy positions and frontal configurations produced by the National Earth Satellite Service (NESS), Bisagni and Behie (1980) found that between October 1979 and September 1980 the site was occupied by Shelf water at least 32% of the time. Gulf Stream eddy water was present 42% and Slope water 51% of the time. During 16 weeks, two masses were present and during one week all three masses were in the site. Clouds obscured the site during five weeks of the one-year period, making observation impossible. Longer periods of Shelf water presence in the dumpsite were associated with major seaward excursions of the Shelf-Slope front, up to 140 km seaward from the edge of the shelf. These excursions in turn were associated with

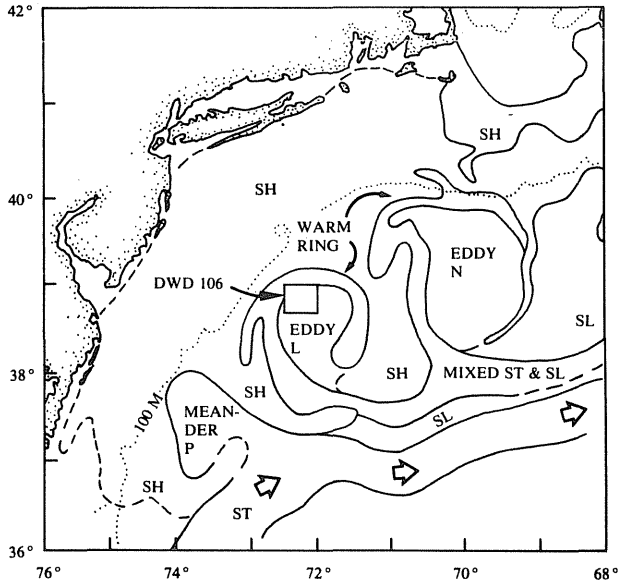



Figure 2. Location of eddies, meanders, and fronts in the Middle Atlantic Bight for the week of 20 July 1979. Redrawn from U.S. Naval Oceanographic Office Experimental Ocean Frontal Analysis Chart for that week.

the "trailing edge" effects of departing Gulf Stream warm core eddies.

The three surface water masses found in the site are considerably different in biological character as well as physical properties. The Shelf water contains the greatest abundance of foodfish of the three. This is manifestly apparent from various analyses of fisheries activities in the Middle Atlantic Bight. Perhaps one of the clearest indications is found in the study of the distribution of foreign fishing fleets in this area during 1969-77 as reported by McHugh and Ginter (1978). In only three cases did they find foreign fleets more than 20 km seaward from the shelf edge, and all of those incidents were off North Carolina. Otherwise, the fleets were found scattered over the shelf or concentrated in a 30-40 km band just inside the shelf break. The foreign fleets during this period amounted to an average of 200 vessels, ranging from 21 in July 1976 to 336 in September 1969. These fleets generally represented an intense, efficient effort to locate and harvest fish, so their distribution is reasonably representative of the distribution of the fish schools.

Because the risk of contaminating foodfish is greater when chemical wastes are discharged into Shelf water rather than Slope water or Gulf Stream eddy water, some alternative dumping strategies should be considered for the 106-mile dumpsite. One strategy would be to redirect the dumpers from the targeted quadrant of the site whenever it is occupied by Shelf water. Surveillance of satellite infrared imagery or graphical portrayals derived from the imagery could provide the basis for the guidance required. There are several groups within NOAA which could provide such guidance, the Atlantic Environmental Group of the Northeast Fisheries Center being just one. The implementation of this strategy would require a modification of the definition of the dumpsite and the operational specifications in the language of the various permits granted by the Environmental Protection Agency (EPA). In addition, the U.S. Coast Guard role in monitoring the actual location of dumping would become more complex.

Another strategy which would be simpler operationally but

more costly to the industry would be to move the dumpsite seaward far enough so that we would be certain that Shelf water would be absent at least 95% of the time. An analysis of the weekly charts of frontal and eddy positions prepared from satellite infrared imagery by NESS in 1978, a worst-case year, shows that the dumpsite would have to be moved about 120 km farther seaward.

Either of these alternate strategies would involve longer steaming time for the dumping contractors, resulting in greater costs to the chemical industries involved. These greater costs, ultimately passed on to the consumer, would have to be weighed against the value of the reduced risk of contaminating the foodfish harvested from the Shelf water.

References

Bisagni, J.J. and G.R. Behie. 1980. Water mass changes and circulation patterns in the vicinity of the 106-mile industrial waste dumpsite. Unpublished annual report to the Northeast Monitoring Program manager, Sandy Hook Laboratory, NMFS/NOAA, Sandy Hook, NJ.

McHugh, J.L. and Jay J.C. Ginter. 1978. Fisheries. MESA New York Bight Atlas Monograph 15. New York Sea Grant Institute, Albany, NY.

Merton C. Ingham
Atlantic Environmental Group
National Marine Fisheries Service
Narragansett, RI 02882
401-789-9326

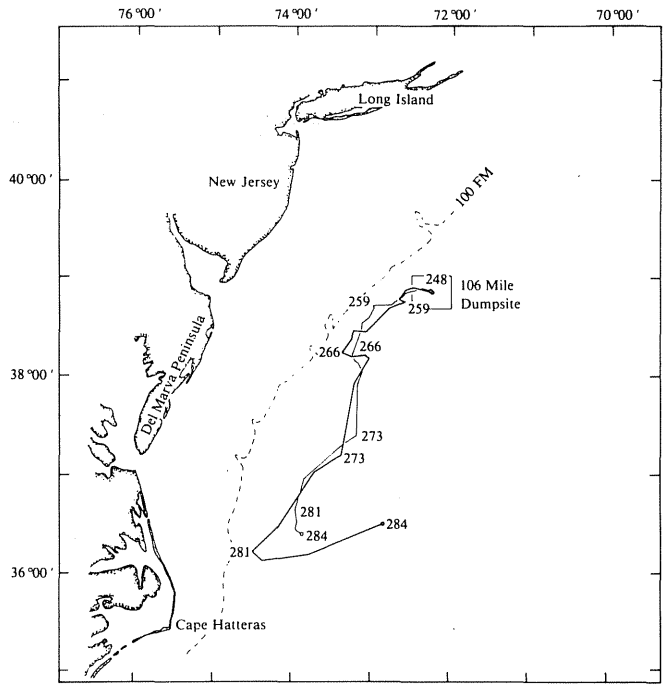



Figure 1. Deployment positions and 36-day trajectories of satellite-tracked drogue buoys 3020 (wide line) and 3021 (narrow line). Numbers indicate Julian days.

## Movements of Two Drogue Buoys Deployed at Deepwater Dumpsite - 106 Tracked by Satellite

A long-term circulation study, using drogue buoys, was carried out late summer and early fall, 1980 at the deepwater, or 106-mile, dumpsite. The movement of the buoys showed possible advection of water from the site and waste products contained therein. Two satellite-interrogated, oceanographic drifting buoys (3020 and 3021) were equipped with Service ARGOS-certified platform transmitter terminals (PTT) for providing positional and sea-surface temperature information via satellite to the ARGOS ground station in Toulouse, France. Positional fixes had an error radius of 1 km. The buoys were also equipped with window-shade-type drogues, centered at 10 m and a drogue sensor switch, the status of which could also be transmitted via satellite to the ground station.

Figure 1 shows the deployment positions for both buoys (near the center of the 106-mile dumpsite), and 36-day segments of each trajectory for which the drogues remained intact. These 36-day trajectories represent only a portion of each total trajectory which ended on 31 December 1980, when Service ARGOS ceased tracking efforts. The initial 36-day period was the most crucial to understanding where and how fast ocean-dumped waste may travel. Numbers written alongside the trajectories indicate the Julian day number for positional fixes, beginning with deployment, on 4 September 1980 (day 248), and ending 10 October 1980 (day 284). The positional fixes were obtained in almost-real-time, on a daily basis (except weekends) via telephone link with the French ground station. Multiple positional fixes and other data were collected by Service ARGOS every day, and sent fortnightly in printout form to the National Oceanic and Atmospheric Administration (NOAA)'s Office of Marine Pollution Assessment, Narragansett, Rhode Island.

Buoys 3020 and 3021 moved generally to the southwest, after an initial movement to the west-northwest, never moving inshore of the 100-km shelf break. The average speeds for buoys 3020 and 3021 along these trajectories, between days 248 and 281, were 16 cm $sec^{-1}$ (0.3 knots) and 12 cm $sec^{-1}$ (0.2 knots), respectively.

Analysis of sea-surface temperature measurements, and buoy velocity data has yielded information about water mass(es) encountered by each buoy. For example, beginning with day 266, both buoys showed a net offshore motion — before resuming a net southwesterly drift farther offshore by day 273. It is possible that this motion was due to both buoys encountering offshore flow around anticyclonic Gulf Stream ring 80-A centered near 37°40′N, 73°45′W at this time. Further analysis of the sea-surface temperature and positional data (two fixes per day), when combined with derived separation distances between buoys, will aid in addressing lateral shear and waste plume dispersal in the vicinity of the 106-mile dumpsite. As an example, buoy 3021 began to lag behind 3020 after the possible interaction with ring 80-A. Also, beginning with day 281 for 3020, and day 284 for 3021, possible interactions with the Gulf Stream caused further separation between the buoys. Processing of the more detailed data has begun, using spline-fitting programs developed at the Woods Hole Oceanographic Institution.

James J. Bisagni
NOAA/OMPA
RR 7, South Ferry Road
Narragansett, RI 02882
401-789-9326

# Announcements

## Remote Sensing Technology in NEFC Programs

Consistent with the strategic goals and objectives recently adopted by the National Marine Fisheries Service (NMFS) to guide its work, the Northeast Fisheries Center (NEFC) will be using increasingly remote sensing technology in programs concerned with marine pollution as well. The general objectives guiding these programs are to (1) advance the development of improved systems and techniques for monitoring and assessing regional marine resources and marine environmental quality; and (2) increase our understanding of regional marine ecosystems processes; and (3) provide an extensive, synoptic, integrated, and timely data base for application to problems of ocean resource and environmental management.

At present, remote sensing activities at NEFC are included in the following general areas of research:

*Project Superflux.* This is a joint program of the National Aeronautics and Space Administration (NASA)—Langley and NMFS-NEFC. One of its principal aims is the development of a prototype instrument to be used on aircraft to monitor coastal waters. The data output of this instrument will have real-time significance so that it may also be used at the time of catastrophic events. The sensor system will have the capability to recognize phenomena affecting distribution of pollutants and not necessarily pollution itself.

We chose the plume exiting Chesapeake Bay as our test for the evaluation of sensors and a rallying point for investigators. The principal investigators are Dr. James Thomas, NEFC, NMFS, and Dr. Janet Campbell, NASA Langley. NMFS is taking the primary responsibility for ground truth on the continental shelf. In the last experiment in June 1980, six regional institutions participated in gathering ground truth: Chesapeake Research Consortium (CRC), Chesapeake Bay Institute (CBI), Maryland State Department of National Resources (DNR), Virginia Institute of Marine Sciences (VIMS), Old Dominion University (ODU), and University of Delaware. Among the Federal agencies that participated were NOAA/NMFS, NOAA/National Ocean Survey (NOS)/Atlantic Marine Center (AMC), NASA Langley, and NASA/Wallops.

Preliminary findings from our June and October Superflux activities include the observations that at least 90% of the hydrocarbons in Chesapeake Bay plume waters are associated with suspended material. The investigators found that the hydrocarbon concentrations associated with total suspended matter were of the same order of magnitude as those in sediments from highly contaminated areas. They also found that the hydrocarbons in the Bay mouth were greater than offshore or further seaward in the plume, and that these hydrocarbons were of anthropogenic origin and significantly weathered. Other investigators found significant heavy metal concentrations which were positively correlated with the total suspended matter. Concentrations of Mn, Fe, Cu, Pb, and Zn were generally higher in the Chesapeake plume than in surrounding waters.

The investigations also suggest that there are distinct differences in the phytoplankton assemblages within the plume relative to waters outside the plume and that there is an increased presence of the Cyanophyta within the estuarine plume. Elevated concentrations of nutrients in the southern sector of the Bay mouth did not extend far offshore or to the south in the plume; this suggests a possible utilization by organisms within the plume system.

*Trends in Coastal Habitat.* The Mensuration and Assessment of Coastal Habitat Program (MACH) is based on part of our response to the NMFS goal — "to achieve by 1985 a zero net loss of habitat and productivity for critical living marine, estuarine, and anadromous species." The objective of MACH is to establish a basis for an annual survey of changes in the productivity, biomass, and area of principal coastal-zone habitat types. Although we plan to proceed with an operational test phase in 1981, the program is at this time just beginning to be formulated.

An attempt will be made to achieve full coverage of the coastal region for the eastern United States from the Mexico-Texas border at Brownsville to the Canadian border at Eastport, Maine.

MACH is a cooperative effort of the Northeast and Southeast Fisheries Centers and the two east-coast Regional Offices. The coordinators for the program are H. Kumpf (SEFC), H. Mustafa (NEFC), D. Ekberg (Southeast Region), and R. Lippson (Northeast Region).

*Mesoscale Phenomena.* The third area of research involving remote sensing is the study of mesoscale phenomena. For many years, satellites have been equipped with infrared (IR) sensors. With the recent introduction of very high resolution IR sensors and direct digital output, our ability to recognize and study ocean phenomena has increased markedly. The Coastal Zone Color Scanner (CZCS) has further enhanced this capability. For various reasons, scientific-vessel support has significantly decreased lately. Monitoring ocean-surface phenomena has become important to NEFC, not only from a purely research aspect but logistically as far as fuel savings is concerned as well by giving us an opportunity to better plan and change cruise stations in real time. If these data are available routinely, transects can be planned to monitor variations in the ocean surface and therefore determine the distribution of organisms and pollutants, making the cruises more efficient.

The following are potential involvements of various programs within the Center with frontal analysis activities. (1) Distribution maps of mackerel chromosome damage indicate significant frontal relationship. (2) Studies of the fate of pelagic larvae of sea scallops and surf clams require understanding of fronts, their movements, and their consequential influence on distribution. (3) Rates of removal and addition of water to the continental shelf due to the passage of warm-core rings is a necessary ingredient for continental shelf water-mass movement models. (4) Dispersion or aggregation of fish eggs and larvae ("patch" studies) requires direct knowledge of frontal activity. (5) Distribution and concentration of toxic materials on the continental shelf as they relate to long-term frontal positions (e.g., plumes). (6) Distribution of fixed bottom gear and, one day, understanding of factors affecting the placement of such ocean passive gear as floating traps. (7) As much as 70-90% of the primary production in our region may be directly associated with the primary and secondary frontal zones. Their persistence and seasonality is becoming a matter of great concern. (8) We need to identify prediction products of ultimate interest to fishermen and work out appropriate coordination mechanisms within other agencies.

*Interactive Resource, Archive and Analytic System.* Remote sensing technology has been influential in the development of

interactive data systems which make possible real-time as well as retrospective study analyses involving a multiplicity of data bases. As a result of Ocean Pulse and other cruises, NEFC has developed an extremely rich data base. Adding to this existing base the data obtained from remote sensing systems creates a major analytic problem, as well as a data base for extremely interesting and significant studies by imaginative scientists. At this time, there is a need to develop an appropriate analytic, interactive system.

*Northeast Area Remote Sensing System.* Various members of NEFC actively participated in the activities for the development of the Northeast Area Remote Sensing System (NEARSS), a consortium of government and state agencies and various other institutions in New England interested to gain timely access to available sources of remotely sensed data and information in a most efficient and cost effective manner. As soon as appropriate links between the institutions and sources are established, we think by the end of the year, it will be much easier to carry out work in NEFC activities using remotely sensed data.

Helen Mustafa
NOAA, NMFS
Northeast Fisheries Center
Woods Hole, MA 02543

## NOAA's Office Of Marine Pollution Assessment's Long-Range Effects Research Program Funds Research Proposals

The Long-Range Effects Research Program (L-RERP) is authorized by Public Law 92-532, the Marine Protection, Research, and Sanctuaries Act of 1972 (the Great Lakes are considered "marine" and are included under the Act). Section 202 of the Act directs the Secretary of Commerce—and by delegation the National Oceanic and Atmospheric Administration (NOAA)—to "...initiate a *comprehensive* and *continuing* program of *research* with respect to the possible *long-range effects* of *pollution, overfishing,* and *man-induced changes of ocean ecosystems.*" [Emphasis added]. The basic concerns of the Congress addressed by this Act are that the oceans are being stressed by man's activities, that the cumulative impact of these stresses is thought to be serious, and that there has been no systematic Federal research effort to detect and evaluate resulting problems. The proponents of Section 202 spoke of an "early warning system" to allow us to anticipate and, ideally, head off serious ocean problems before they reach the crisis stage. The legislative history associated with the Act indicates that the Program is intended to probe the more subtle pollution-related changes taking place in marine waters, those that may be detectable at an early stage if one only looks for them. It further indicates that the Program is expected to identify the gaps in current long-range effects research, and then to examine these in enough detail to determine whether larger application of effort and other funds may be required to fill the gaps.

The Long-Range Effects Research Program, responsible for carrying out the Section 202 provisions, resides within NOAA's Office of Marine Pollution Assessment (OMPA). The OMPA does not itself conduct extensive research or carry out development or monitoring projects, but does financially support, coordinate, and manage such research. Recipients of OMPA support or assistance have full responsibility, in accordance with the terms of their grants or other agreements, for the conduct of their projects or activities and for the results produced.

The language of the Act defines a broad area for L-RERP research activities, but one which has been significantly constrained by subsequent legislation. Public Law 94-265, the Fishery Conservation and Management Act of 1976, directly addresses the problems of fishery conservation and management and establishes Regional Councils with management responsibilities for, among other objectives, preventing overfishing by either foreign or domestic fishing interests. This objective is to be achieved through conservation and management measures "based upon the best scientific information available." Problems resulting from overfishing are covered under Section 304(e) of Public Law 94-265, and therefore are not supported under the present Program.

The other piece of subsequent legislation having major interaction with Section 202 is Public Law 95-273, the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978. The major thrust of Public Law 95-273 is to initiate a continuing planning endeavor in the general field of ocean pollution research. The Five-Year Federal Plan (and its biennial revisions) mandated by this Law is designed to improve coordination of Federal ocean pollution research activities and to eliminate whatever duplication may currently exist among those activities.

The first Five-Year Federal Plan was submitted to Congress and the President on 10 December 1979. (A copy of the Plan can be requested from the Superintendent of Documents.) The Plan provides an assessment and ordering, according to priority, of national needs and problems in relation to marine pollution research. The Section 202 Program (Public Law 92-532) is specifically included among the activities to be integrated into the Federal Plan. This means that Section 202 research is clearly subject to the coordination and nonduplication provisions of the 1978 Act, and the scope of Section 202 research is constrained accordingly.

The actual application of these major constraints affects the scope of Section 202 in the following ways. The research area of overfishing, originally mandated for Section 202, has now been essentially preempted by the Fishery Conservation and Management Act of 1976. Some Section 202 research on the effects of pollution on fish would appear to be similarly affected. Section 202 research, therefore, addresses primarily the "...possible long-range effects of pollution...of ocean ecosystems" and, additionally, any identified effects of man-induced changes which may fall outside the major categories of pollution and overfishing. The effects studied continue to include only those designated as long-range, and consideration is given even here to the elimination of duplication. These considerations have guided the selection of issues included in the Section 202 research scope for fiscal year (FY) 1980.

During 1978, NOAA conducted a series of five regional workshops to determine Section 202 research needs and priorities for the Atlantic, Pacific, Gulf of Mexico, Great Lakes, and Alaskan coastal regions. These planning activities identified five general research areas of approximately equal priority: (1) fates and effects of synthetic organic substances; (2) fates and effects of processed petroleum products; (3) pathways, fates, and effects of particles; (4) fates and effects of trace metals and metallo-organics; and (5) basic understanding of specific aquatic ecosystems. NOAA's Long-Range Effects Research Program

**TABLE 1**
**Research Proposals Funded in FY80**
**by the**
**Office of Marine Pollution Assessment's**
**Long-Range Effects Research Program**
**(Section 202, Public Law 92-532)**

| Research Category | Principal Investigator | Institution | Title | Length (Years) | FY80 ($, K) |
|---|---|---|---|---|---|
| Fate and Effects of Synthetic Organic Substances | Young, D.R.<br>Kleppel, G.S. | SCCWRRP | Organic: Aqueous Partition Coefficients as a Predictor of Trace Organic Accumulation in Marine Food Webs | 3 | 76.0 |
| | Martin, K.H. | State University of NY | Upstream Migration of the Lake Ontario Contaminant, Mirex | 2 | 51.3 |
| | Kocan, R.M.<br>Landdolt, M.L. | University of Washington | *In vitro* Testing Environmental Substances Using Marine Fish Cells | 3 | 44.8 |
| | Capone, D.G. | State University of NY | The Effect of Persistent Pollutants on Microbial Biomass and Activity in Salt Marsh and Estuarine Sediments | 1 | 48.1 |
| | | | | Subtotals- | 220.2 |
| Fate and Effects of Processed Petroleum Products | DeWalle, F.B. | University of Washington | Dynamics of Polynuclear Aromatic Hydrocarbons (PAH) in an Estuarine Environment Near an Urban Center | 3 | 75.0 |
| | Gundlach, E.R. | Research Planning Institute, Inc. | Resurvey the *Metula* Oil Spill Site to Determine Residence Time of Oil within a Subtemperate Environment | 1 | 15.0 |
| | Cowles, T.J. | Woods Hole Oceanographic Institution | Effects of Sublethal Concentrations of Crude Oil on the Feeding Behavior and Reproductive Success of Marine Zooplankton (Crustacea: Copepoda) in Laboratory Continuous Flow Systems | 2 | 61.6 |
| | Vanderhorst, J.R. | Battelle, Pacific Northwest Laboratories | Effects from Residual and No. 2 Fuel Oils on Intertidal Infauna Recovery Rate | 1 | 85.9 |
| | | | | Subtotals- | 237.5 |
| Fates and Effects of Trace Metals and Metallorganics | Roberson, B.S.<br>Tsai, Chu-fa | University of Maryland | Effect of Heavy Metals on the Susceptibility to and Immune Response of Striped Bass to Bacterial Pathogens (202) | 1 | 73.4 |
| | Costlow, J.D. | Duke University | Physiological and Biochemical Mechanisms of Trace Metal Detoxification in Marine Organisms | 3 | 147.4 |
| | | | | Subtotals- | 220.8 |
| Basic Understanding of Specific Aquatic Ecosystems | McCall, P.L.<br>Mafisoff, G. | Case Western | Faunal and Biogeochemical Succession Following Disturbance of Lake Erie Bottom Sediments | 3 | 99.7 |
| | Dodge, R.E.<br>Brass, G.W. | Nova University | Historic Pollution Levels and Ecological Responses in Sub-Tropical and Tropical Seas: The Record Contained in Banded Skeletone | 2 | 88.9 |
| | Chew, K.K. | University of Washington | Fish-Benthos Coupling in Sewage Enriched Marine Environments | 2 | 107.3 |
| | Pilson, M.E.Q. | University of Rhode Island | Fecundity, Growth,and Behavior of Estuarine Zooplankton Exposed to Low-Level Chronic Organic Pollutants | 2 | 71.3 |
| | Smayda, T.J. | University of Rhode Island | Elucidation of Long-Term Changes Occurring in a Coastal Marine Ecosystem: Narragansett Bay | 3 | 58.0 |
| | Carpenter, E. | State Un' ersity of NY | Recovery Processes in an Eutrophic Estuary | 2 | 53.5 |
| | | | | Subtotals- | 478.7 |
| | | | | Totals- | $1,157.2K |

(Section 202 Program) is centering around these five areas over the next few years.

The emphasis of the Long-Range Effects Research Program is on *longer-range* problems. On the basis of the above, and within limitations of available funding, the table that accompanies this article shows the research proposals for the indicated problem areas which are currently being funded under the L-RERP.

The Long-Range Effects Research Program was announced by the OMPA in the scientific, technical, and other media before mid-calendar-year 1980. Included in the announcement was information on requesting a comprehensive guidance package for preparing proposals. The package provided statements of the areas of program interest, proposal review procedures, evaluation criteria, and proposal preparation requirements.

The criteria were applied in the peer-review process that the OMPA established for evaluation of proposals submitted for consideration for funding in FY1980. A 25-member panel (representing the NOAA, other Federal agencies, and academia) reviewed and ranked the proposals, based on scientific merit, scientific/technical competence of applicant, relevance of proposed effort to program priorities, and cost. The review panel recommended to the Director of the OMPA proposals for funding. The Director approved 16 proposals for a total amount of $1,157,200.

The Long-Range Effects Research Program published a FY1981 guidance package on 9 January 1981. It contains a revised list of priority activities, target funding levels, etc. The package can be requested from Dr. Robert E. Burns, Manager, L-RERP, NOAA/RD/MPF28, Building 264, 7600 Sand Point Way N.E., Seattle, WA 98115, telephone number 206-442-5590.

O.W. Terry
Marine Sciences Research Center
State University of New York
at Stony Brook
Long Island, NY 11794
516-246-3366

H.M. Stanford
NOAA/OMPA
Northeast Office
State University of New York
at Stony Brook
Long Island, NY 11794
516-751-7002

## New Coastal Research Center at Woods Hole Oceanographic Institution

The Woods Hole Oceanographic Institution (WHOI) has received a $1.75 million grant from the Andrew W. Mellon Foundation, $750,000 of which is being used to establish a Coastal Research Center at the Institution.

Dr. John Ryther has been appointed Director of the Center. A committee of WHOI scientists is the major planning and decision making body. Initial efforts have been in the areas of developing seed programs for three specific coastal studies, and proposing construction of a new laboratory complex for experimental work.

The three start-up projects have been identified as (1) development of specialized instrumentation for oceanographic studies in coastal regions, (2) a study of the assimilative capacity of the coastal zone for waste disposal, primarily the dispersal of particulates in the marine environment, and (3) a comprehensive scientific study of Georges Bank.

To promote coastal research at the Institution and to provide a focus for the work of the Center, a new building will be erected on the Quisset Campus of WHOI.

The Coastal Research Center invites participation of investigators at other institutions. For further information, contact Susan Smith, Clark 2, WHOI, Woods Hole, MA 02543 (617-548-1400 x 2722).

Susan Smith

## Ocean Dumping Symposium to be Held

The Third International Ocean Disposal Symposium will be held 12-16 October 1981 at the Woods Hole Oceanographic Institution. Sponsored by NOAA, the symposium will provide a forum for the exchange of ideas on ocean disposal research, and will generate recommendations and guidelines for future studies of ocean disposal practices. Drilling wastes, incineration at sea, and coal waste disposal are among the topics to be emphasized.

Abstracts (500-1,500 words) of contributed papers must be submitted by 1 July 1981 to Dr. Iver W. Duedall, Marine Sciences Research Center, State University of New York, Stony Brook, Long Island, NY 11794 (516-246-3367). For further information, contact Dr. Duedall.

## NOAA's "ACE" in the Hole

The Office of Marine Pollution Assessment (OMPA) is coordinating the National Oceanic and Atmospheric Administration (NOAA)'s plans for a research program titled "Assimilative Capacity of Ecosystems (ACE)", which is being developed for a fiscal year (FY) 1983 budget initiative. The basic premise of this program is that disposal in the oceans of finite amounts of certain waste materials is acceptable under certain conditions. The goal of the program will be to establish procedures for determining the types and quantities of wastes appropriate for ocean disposal situations. This goal will be achieved by accomplishing the following objectives: (1) Developing methodologies for balancing ocean waste disposal ecologic impacts and related costs with economic benefits and values. The Program will modify and couple existing techniques of analysis and assessment in ways which have not been done successfully in the past. (2) Developing conceptual frameworks that permit forecasting of results of alternative waste disposal practices. The Program will utilize a holistic approach for specific ecosystem types. (3) Developing a capability within NOAA to improve the decision process regarding contaminant release into the Great Lakes and coastal waters. The techniques and expertise developed by ACE will be directed to a broad range of existing and projected problems.

The draft ACE Program Development Plan (PDP) was prepared by OMPA, with guidance and assistance from a working group composed of representatives from NOAA laboratories, Office of Sea Grant, and the National Ocean Survey. The draft was submitted for review to all OMPA field offices, the working group, and the Office of Habitat Protection in the National Marine Fisheries Service. A revised version of the ACE PDP will be completed for the NOAA budget presentation in March.

OMPA will begin advance preparation for the ACE program by conducting literature review and synthesis activities during FY 81-82 in three areas: case histories of ocean waste disposal, ecosystem impact assessment, and environmental prediction. These synthesis activities will aid in the detailed planning for the

new work to begin in FY 1983.

This program, which stresses wise use of the oceans rather than strict protection only, will set the tone for NOAA's environmental programs in this decade.

John A. Calder
NOAA/OMPA
Rockwall Building, Room 320
Rockville, MD 20852
301-443-8906

## NOAA/SUNY Cooperative Research Agreement Signed

On 19 December 1980, representatives of the National Oceanic and Atmospheric Administration (NOAA) and the Research Foundation of the State University of New York (SUNY) signed a cooperative agreement to study coastal ocean pollution. Through this agreement, several research projects will be conducted each year by personnel of the Marine Sciences Research Center (MSRC), SUNY's coastal oceanographic research institution.

The research, which will be coordinated by NOAA's Office of Marine Pollution Assessment (OMPA), will be national in scope. Included in the new cooperation program will be MSRC's development of emergency teams prepared to initiate immediate investigations of coastal pollution crises as they develop. This rapid response could be applied to such problems as oil spills or major fish kills.

The cooperative agreement was arranged through Dr. Earl Droessler, Director of NOAA's Office of University Affairs. Though NOAA has always maintained strong ties with MSRC, Dr. Droessler feels that such formal agreements enable NOAA to "broaden its scientific ties with the academic community."

Dr. Ferris Webster, NOAA's Assistant Administrator for Research and Development, and OMPA Director R. Lawrence Swanson signed the agreement on NOAA's behalf. Dr. John H. Marburger, President of SUNY at Stony Brook, MSRC Director J. R. Schubel, and Mr. Peter Tenbeau of the Research Foundation signed the agreement for the University.

Susan J. Risoli
Marine Sciences Research Center
State University of New York
at Stony Brook
Long Island, NY 11794
516-246-6546

## NODC to Study Synthesis Needs in the Management of Marine Pollution Data

Beginning in 1981, the National Oceanographic Data Center (NODC) will attempt to assess the needs of those organizations and individuals involved with data related to biological and chemical pollutants in the marine environment. This effort will focus on the requirements for synthesis and monitoring. The primary tool to be used for determining the needs of the user community will be a questionnaire which will be prepared and sent during the second quarter of the calendar year 1981.

A mailing of about one thousand questionnaires is planned. Among the targets of these questionnaires will be academic institutions, municipalities, and possibly other elements of the private sector involved in the study, monitoring, and prevention of marine pollution. Questions will attempt to identify the level of user need of expanded NODC services, and will also determine the best methods for increasing data flow into the archives.

"Synthesis" is defined as "assemblages of all that is known about these (effects) and other factors for specific areas — both as a way of preparing information for decision makers and as a way of identifying the (many) problems needing further research." These assemblages may take many forms — e.g., printouts, digitized magnetic tape, CRT displays, and hard copy publications or guides. Some of those organizations using archived data already possess equipment required to produce one or all of these products, and to conduct sophisticated analyses. Many groups, however, lack such capabilities and do not have the necessary funds or expertise to utilize such facilities effectively. This latter group may need the NODC services which could be listed in an NODC catalog. The former group may be able to make use of a variety of services from NODC, thereby freeing their systems for other applications. A problem, related to providing the services available from NODC, lies in identification of an appropriate format and an efficient data input. The questionnaire will, in part, help define these format requirements, and will improve data submission procedures.

Those groups and individuals on the "COPAS" mailing list will be included in the study. The Sea Grant catalog of marine science curricula will also be used as an addressee source. Anyone who would like further information concerning this program or who would like to express an opinion or provide input is asked to write to:

LCDR C.R. Berman, Jr.
NOAA/NLBRA
P.O. Box 5101
Virginia Beach, VA 23455
804-464-2072

# Calendar

**June**

**8-10**

IEEE International Geoscience and Remote Sensing Symposium, Washington, D.C. Contact: Sam Shanmugam, Remote Sensing Laboratory, University of Kansas, Lawrence, KS 66044 (913-864-4836).

**11-17**

Bergbau '81—International Mining Exhibition and Congress, Dusseldorf, West Germany. Contact: German American Chamber of Commerce, 666 Fifth Avenue, New York, NY 10019 (212-974-8830).

**September**

**7-9**

Symposium on Mechanics of Oil Slicks. Contact: Dr. A. Hauguel E.D.F., Nationale d'Hydraulique 6, Quai Watier B.P. 24, 78400 Chatou, France.

**15-18**

Offshore Europe '81, Aberdeen, Scotland. Contact: Judith Patten, 24 Eaton Drive, Kingston-upon-Thames, Surrey, KT2 7QT, U.K.

**16-18**

Oceans '81, Sheraton Boston, Boston, MA. Contact: Oceans '81, P.O. Box 132, Portsmouth, RI 02871.

**Information for Contributors**

There is no prescribed format for preparation of manuscripts because of the wide range of material accepted. Authors should be guided by articles in COPAS.

1. Articles should be typed double-spaced and should not exceed 1,000 words.
2. The title should be informative and brief.
3. On first use full name and acronym must be used. Subsequent reference may be by acronym alone.
4. Measurements should be given in the metric system.
5. Figures and tables should be camera-ready and suitable for reduction to a 15.2 x 10.2 cm size, not including legend. Care should be taken with lettering and symbols so that they are readable when reduced. The combined number of figures and tables should not exceed three.
6. Proofs will not be sent to the author unless requested, but if significant editorial changes are made for brevity and clarity, authors will be contacted by telephone.
7. Reprints are not provided.
8. Deadlines for contributions are January 25, April 10, July 10, and October 10. Send all correspondence and material to:

   Coastal Ocean Pollution Assessment News
   Marine Sciences Research Center
   State University of New York
   Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News** is published quarterly. The newsletter is funded by NOAA: Office of Marine Pollution Assessment, National Marine Fisheries Service, National Oceanographic Data Center, and the National Marine Pollution Program Office. Partial support is provided by the Marine Sciences Research Center of the State University of New York. Subscription is free. Individuals wishing to subscribe should write to:
Coastal Ocean Pollution Assessment News
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794



**Address correction requested**

# COASTAL OCEAN POLLUTION ASSESSMENT NEWS

MAN AND THE MARINE ENVIRONMENT

Volume 1 Number 3 Spring 1981


The purpose of **Coastal Ocean Pollution Assessment** (COPAS) **News** is to provide timely dissemination of information on pollution in coastal waters of the United States — its sources and effects, what is being done to eliminate or mitigate it, and what research and monitoring activities are being conducted to develop more effective strategies to manage it. We publish brief articles describing recent events and activities, new approaches to resolving chronic pollution problems, and early warnings of potential problems. Announcements of cruises, meetings, and investigations will be included.

Publication in COPAS is not to be construed as publication in the referred scientific literature. COPAS is not copyrighted, and any reference to material printed in COPAS should be approved by the author.




**Published by:**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794


## In This Issue



## Continuity

### Baseline Levels of Organic Pollutants in Fish

Selected finfish and benthic epifaunal samples collected from the Gulf of Main south to Cape Hatteras (Fig. 1) were analyzed for levels of petroleum hydrocarbons (PHC), chlorinated hydrocarbons (polychlorinated biphenyls [PCB], DDT compounds), and polynuclear aromatic hydrocarbons (PAH). These samples were collected as part of the Gulf and Atlantic Survey (GAS I) sampling effort, undertaken 4-20 February 1980 by National Marine Fisheries Service (NMFS) personnel to determine ambient levels of pollutants in species of existing and potential commercial value and to relate observed levels to possible pollutant sources.

The samples, which consisted of muscle tissue from 1-10 individuals, were digested and solvent extracted, then analyzed by glass capillary gas chromatography/flame ionization detector ($GC^2$/FID). An initial column cleanup was sufficient to allow gross PHC contamination to be detected. Those samples containing hydrocarbon compositions resembling petroleum were fractionated and analyzed in detail by $GC^2$. A number of those samples selected for fractionation were also analyzed by glass capillary gas chromatography/mass spectrometry ($GC^2$/MS) to determine and identify the PAH compounds. Chlorinated hydrocarbons were analyzed by electron capture gas chromatography (GC/ECD).

Literature data on the concentrations of PHC compounds in fish are not plentiful; however, it can be said that the levels reported here (Table 1) fall well within the previously reported range for the offshore region and are lower than the PHC concentrations reported in fish samples along the coast (Boehm and Barak, 1978, 1979; Panicirov and Brown, 1977; Whittle et al., 1977, Mackie et al., 1974, Parket et al., 1972).

PAHs were detected over a wide range of concentrations and the chromatograms indicate a combined source of these compounds, from both petroleum and pyrogenic (combustion) sources. PCB and DDE compounds are more widespread than PHC compounds and, although present in very low levels, behave independently of PHC distributions. A summary of the chlorinated hydrocarbon levels is found in Table 1. Both the percent occurrence and absolute levels of PHC, PAH, and PCB compounds are highest in the silver hake, which contained unambiguous indications of elevated pollutant levels that apparently

were related to inputs from the New York estuarine/coastal, and perhaps other, systems.

The baseline data amassed here will be very useful for future monitoring efforts. Also, the multi-tiered analytical procedure proved to be a rapid and cost-effective method of obtaining the desired combination of screening and more sophisticated (e.g., $GC^2/MS$) analyses.

The detailed results and conclusions are presented in a final report available from Dr. John B. Pearce, NOAA/NMFS/NEFC, Sandy Hook Laboratory, Highlands, N.J. 07732. A follow-up study, which covers the geographical study region south of Cape Hatteras through the Florida Straits and to the Mississippi Delta, is underway. In combination with the complete study, this follow-up study will form the first comprehensive data base on selected organic pollutant levels in fish along the U.S. East and Eastern Gulf Coasts.

TABLE 1
Incidence of the Presence of PHC Compounds

| | | Petroleum Hydrocarbons | | Polychlorinated Biphenyls | |
|---|---|---|---|---|---|
| Species | No. of samples | Percent Occurrence | Concentration ($\mu g\ g^{-1}$ dry wt.)* | Percent Occurrence | Concentration ($\mu g\ g^{-1}$ dry wt.)* |
| Silver hake | 14 | 86 | 6-90 | 100 | 0.025-0.457 |
| Red hake | 14 | 29 | 1-5 | 93 | 0.002-0.042 |
| Yellowtail flounder | 16 | 45 | 2-7 | 94 | 0.002-0.052 |
| Winter flounder | 13 | 15 | 6-9 | 85 | 0.002-0.031 |
| Windowpane flounder | 8 | 38 | 1-5 | 100 | 0.004-0.086 |
| Four spot flounder | 4 | 50 | 2-6 | 100 | 0.004-0.008 |
| Summer flounder | 1 | 25 | 1 | 100 | 0.004 |
| American dab | 4 | 25 | 1-2 | 100 | 0.001-0.024 |
| Haddock | 7 | 0 | - | 100 | 0.001-0.026 |
| Cod | 5 | 0 | - | 80 | 0.002-0.018 |
| Skate | 2 | 0 | - | 100 | 0.002-0.012 |
| Scallop | 1 | 0 | - | 100 | 0.001 |
| Rock crab | 1 | 100 | 327 | 100 | 0.043 |
| Lobster | 2 | 0 | - | 100 | 0.1-0.15 |

* Concentrations on a wet weight basis may be obtained by dividing by 5.

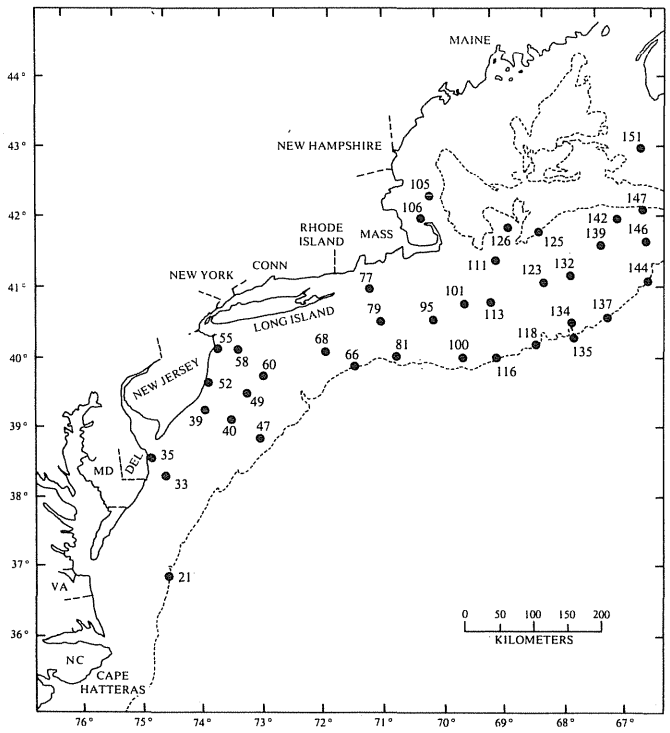



Figure 1. Map of Sampling Locations for Petroleum Hydrocarbon and PCB Analysis.

References

Boehm, P.D. and J. Barak. 1978. Chemical analysis of fish samples for gasoline from the Ocean 250 gasoline spill. Final report, NOAA Contract No. 03-78-D01-30. NOAA/NMFS, Narragansett, RI.

Boehm, P.D. and J. Barak. 1979. Petroleum hydrocarbon analysis of fish collected in the vicinity of the Argo Merchant oil spill - April to October 1977. Final Report, NOAA Contract No. NA-79-FAC-00015. NOAA/NMFS, Sandy Hook, NJ.

Mackie, P.R., K.J. Whittle, and R. Hardy. 1974. Hydrocarbons in the marine environment. I. n-alkanes in the Firth of Clyde. Est. and Coastal Mar. Sci. 2:359-374.

Pancirov, R.J. and R.A. Brown. 1977. Polynuclear aromatic hydrocarbons in marine tissues. Env. Sci. and Tech. 11:989-992.

Parker, P.L., J.K. Winter, and J. Morgan. 1972. A baseline study of petroleum in the Gulf of Mexico. Pp. 555-581 *in* Baseline studies of pollutants in the marine environment background papers workshop. Brookhaven National Laboratories, NY.

Whittle, K.J., P.R. Mackie, R. Handy, A.D. McIntyre, and R.A.A. Blackman. 1977. The alkanes of marine organisms from the United Kingdom and surrounding waters. Rapp. P.-v. Reun. Cons. int. Explor. Mer 171:72-78.

Paul Boehm
Diana Pilson
Environmental Sciences Division
Energy Resources Co. Inc. (ERCO)
185 Alewife Brook Parkway
Cambridge, MA 02138
617-661-3111

## Methylmercury Tolerance in Killifish

We have been studying the effects of $HgCl_2$ and methylmercury on the embryonic development of the killifish, *Fundulus heteroclitus* (Weis and Weis, 1977a, 1977b), and have found three major types of defects produced by exposure to 0.05 ppm. One type of malformation involves progressive convergence of the optic cups, producing cyclopia or intermediate conditions. We have developed a craniofacial index (CFI) to quantify the degree of abnormality in any individual embryo. In this index, 0 = normal, 5 = cyclopic, and 6 = anencephalic (no head). Heart abnormalities involve failure of the heart chambers to differentiate properly. In severe cases, the heart remains a thin feebly beating tube, incapable of circulating the blood. In very severe cases, no discernable heart tissue is present at all. Our cardiovascular index (CVI) quantifies the degree of heart abnormality produced (0 = normal, 5 = no heart tissue). The third type of malformation involves skeletal defects, which include vertebral bends and stunting.

We have observed in a population from Montauk, New York, a relatively pristine area of the east end of Long Island, that some females produced eggs which were far more resistant to the effects of methylmercury (meHg) than other females. Eggs and sperm were stripped into fingerbowls of sea water (30 o/oo). Large batches, when available, were divided into separate groups and fertilized by different males. A total of 85 females and 35 males were used, which produced 128 different batches of eggs. One to two hours after stripping, eggs which initiated cleavage were placed into "dosed" fingerbowls (.05 ppm methylmercury, or controls). Daily changes for the first four days provided constancy in dosing through the critical stages of development. After one week, embryos were examined and each embryo scored for CFI, CVI, and presence of skeletal malformations.

In all groups, control eggs were either 100% or close to 100% normal. Figure 1 shows the distribution of treated batches of eggs with respect to the average degree of craniofacial defects. It can be seen that some batches of eggs were very susceptible, other intermediate. We have done the same experiments on a population of killifish from Pile's Creek (a tributary of the Arthur Kill in industrialized northern New Jersey), an area heavily impacted with metal and oil pollution. In this population, very few females produced susceptible eggs, and most batches were tolerant with respect to the three types of malformations. Figure 2 shows the distribution of craniofacial defects in 106 batches of eggs. Thus, the stressed population seems to have become resistant to the methylmercury. Adaptation to metal pollutants in chronically stressed populations has been demonstrated for a number of other organisms (reviewed in Bryan, 1976).

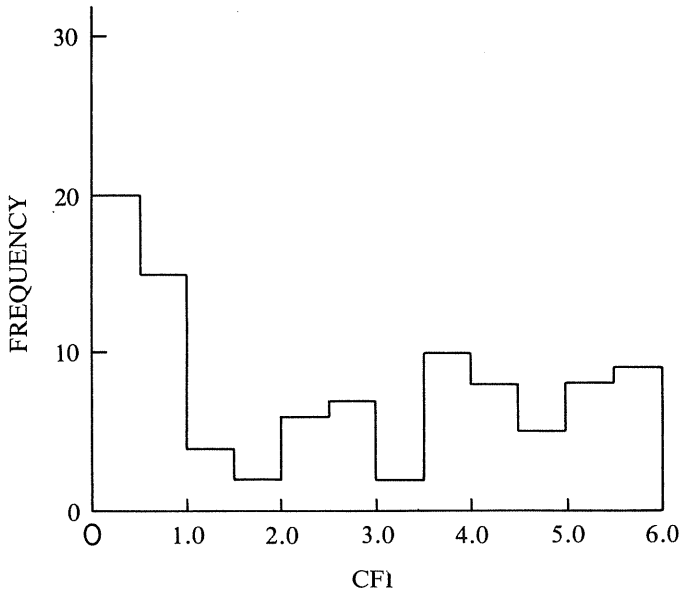



Figure 1. Distribution of CFI among treated batches of eggs from Montauk.

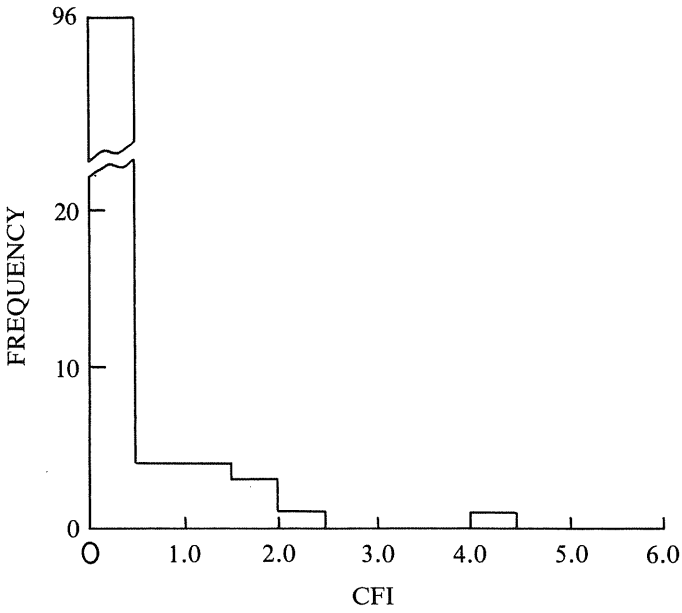



Figure 2. Distribution of CFI among treated batches of eggs from Pile's Creek.

The great variation in the Montauk population allows it to be "preadapted" to a potential influx of mercury pollution. Whether a population will adapt to or become eliminated in response to introduced stress depends on the rapidity and severity of the stress in relation to the capacity of the population to adapt. The diversity in *Fundulus,* coupled with its polygynous mating system, allows for rapid evolutionary response to environmental changes.

Future research (supported by the New Jersey Sea Grant Program) will be directed toward whether these meHg-tolerant embryos are also tolerant to other pollutants and whether other life stages of these fish are also resistant to pollutants.

Variation in susceptibility to toxicants, both within a population and between populations, has serious implications for routine bioassay procedures. As Levinton (1980) has pointed out, the outcome of the bioassay will depend on the degree to which the population has become resistant to the toxicant.

References

Bryan, G.W. 1976. Some aspects of heavy metal tolerance in aquatic organisms. Pages 7-34 *in* Effects of Pollutants on Aquatic Organisms, A. Lockwood (ed.). Cambridge Univ. Press, Cambridge.

Levinton, J.S. 1980. Genetic divergence in estuaries. Pages 509-520 *in* Estuarine Perspectives, V. Kennedy (ed.). Acad. Press, NY.

Weis, J.S. and P. Weis. 1977a. Effects of heavy metals on development of the killifish, *Fundulus heteroclitus.* J. Fish Biol. II: 49-54.

Weis, J.S., P. Weis, and M. Heber. 1980. Variation in response to methylmercury by killifish *(Fundulus heteroclitus)* embryos. Presented at Fifth Symposium on Acquatic Toxicology ASTM, Philadelphia, PA.

Weis, P. and J.S. Weis. 1977b. Methylmercury teratogenesis in the killifish, *Fundulus heteroclitus.* Teratology 16:317-326.

Judith S. Weis
Dept. of Zoology
Rutgers University
Newark, NJ 07102
201-648-5019

Peddrick Weis
Dept. of Anatomy
College of Medicine & Dentistry of N.J.
Newark, NJ 07103
201-456-4409

## Dredging Impact Mitigation Through Seagrass Transplantation

An inevitable source of pollution in the coastal ocean is the dredging of navigational channels. Except for chemically polluted areas, the major impacts from this operation are from turbidity during dredging and subsequent transport of the dredged material by currents into nearby biologically productive habitats. Both may be considered point source problems originating at the dredge and disposal sites. But dredging in the coastal area is essential to recreation, commercial fishing, energy exploration, ocean-going commerce, and national defense. Techniques which attempt to reduce these impacts are being developed through a joint Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS)—U.S. Army Corps of Engineers Coastal Engineering Research Center project on seagrass transplanting. The goals of the project are to: (1) develop cost-effective techniques for transplantation of eelgrass, *Zostera marina,* and shoalgrass, *Halodule wrightii* on dredged sites; (2) provide guidelines for reducing maintenance dredging and costs by stabilizing subtidal dredged material (thus reducing turbidity and dispersion of material—the major post-dredging impacts); and (3) simultaneously develop biologically productive habitats.

In referring to biologically productive habitats, we touch on the basis for determining whether an area is "polluted" or not. The reduction in productive habitat, especially of the faunal components, constitutes a measurable impact of the dredging activity. Covering habitats either at the primary disposal site or from drift off the immediate impact zone means that production of those areas is removed from the coastal area. Many of these sites remain biologically unproductive because of the high fluid energy at the disposal site. Successful transplanting onto these areas, however, results in the stabilization of the area, which leads to a concomitant development of an extensive faunal component. Together, these effects provide a major mitigation of the dredging impact. Stabilizing the site could drastically reduce the frequency of dredging in that area, which not only would reduce the time-averaged impact on the local biota, but could thereby decrease maintenance dredging cost. We are now testing to see if the cost of planting could, in practice, actually reduce the frequency and cost of maintenance dredging in some areas.

The concept of planting as well as stabilizing dredged areas is not new. Churchill et al., (1978) reported good growth of *Zostera marina* when transplanting onto an older dredged material disposal site. Although much of the planted area later died, it seems that a bathymetric shift in the site itself rather than a biological failure was the cause. Phillips (1978) at Port St. Joe, Florida, had little success in establishing *Halodule wrightii* on fresh dredged material for a number of reasons, most of which involve natural post-planting perturbations of the site.

Our study recognizes the fact that while seagrasses may be easily transplanted, their extended survival depends heavily upon finding a satisfactory planting site and making engineering efforts to maintain the structural integrity of the site. Our work has addressed the former problem with *Zostera marina* in particular (Fonseca et al., 1979, Kenworthy et al., 1980), and we are now developing a site feasibility evaluation process based on that work. The engineering and hydraulic planning of the site is drawing on other related work (Scoffin, 1970; Fonseca, 1981) but lacks the application that the site evaluation procedure has had.

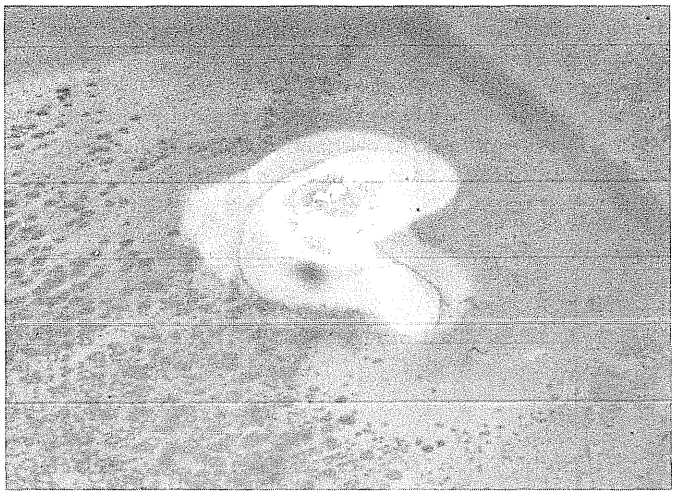


Figure 1. This dredge material island at Barden's Inlet (Cape Lookout), NC, has been encircled with sandbags and planted with *Spartina alterniflora* on the emergent portions of the island to aid in stabilization. Seagrasses, *Zostera marina* and *Halodule wrightii,* are colonizing the lower portion to the sandbagged area. Post-dredging planting of seagrasses in such embayments as afforded by the sandbags and along the channel edge (right side of photograph) are projected to be the most effective zones for subtidal stabilization by the grasses.

We now know the rates at which seagrasses in this area reduce currents. There also exists a relation between current flow and meadow growth, which is perpendicular to the direction of maximum current flow and forms a raised bedform. There are also

characteristic population growth rates and morphologies under a depth/current interaction. We have begun to utilize this information in establishing planting guidelines to mitigate the biologically and financially deleterious side effects of some dredging activities (Fonseca et al., 1979) by achieving maximum cover most rapidly under a given hydraulic regime. There are some areas, however, where no amount of transplanting will stabilize the sediments. We theorize that dredged material placement in co-operation with a vegetation colonization plan across all tidal areas can result in a tremedous mitigation of this source of pollution in the coastal zone (Fig. 1).

References

Churchill, C.A., A.E. Cok, and M.I. Riner. 1978. Stabilization of subtidal sediments by the transplantation of the seagrass, *Zostera marina L.* New York Sea Grant. NYSSGP-RS-78-15.

Fonseca, M.S. 1981. The interaction of a seagrass, *Zostera marina L.*, with current flow. M.S. Thesis. University of Virginia. 35 pp.

Fonseca, M.S., W.J. Kenworthy, J. Homziak, and G.W. Thayer. 1979. Transplanting of eelgrass and shoalgrass as a potential means of economically mitigating a recent loss of habitat. *In* Proc. 6th Annual Conference on Wetlands Restoration and Creation, May 19, 1979. D.P. Cole (ed.), Hillsborough Comm. Coll., Tampa, FL.

Kenworthy, W.J., M.S. Fonseca, J. Homziak, and G.W. Thayer. 1980. Development of a transplanted seagrass, *Zostera marina L.*, meadow in Back Sound, Carteret County, NC. *In* Proc. 7th Annual Conference on Wetlands Restoration and Creation, May 16, 1980. D.P. Cole (ed.), Hillsborough Comm. Coll., Tampa, FL.

Phillips, R.C. 1978. Habitat development field investigations, Port St. Joe seagrass demonstration site, Port St. Joe, Florida. Dredge Material Research Program. Tech. Rep. D-78-33.

Scoffin, T.P. 1970. The trapping and binding of subtidal carbonate sediments by marine vegetation in Bimini Lagoon, Bahamas. J. Sediment. Petrol. 40:249-273.

Mark S. Fonseca
NOAA/NMFS
Southeast Fisheries Center
Beaufort Laboratory
Beaufort, NC 28516

# Loomings

## Oil Spill Fishery Interaction Modeling: Applications to Georges Bank

Researchers from the Graduate School of Oceanography and the Department of Ocean Engineering, University of Rhode Island, have joined forces with modelers from Applied Science Associates, Inc., an ocean engineering consulting firm in Wakefield, RI, to apply an integrated modeling system to assess the impact of oil spills on commercial fisheries. The study is funded by the Department of Interior, Bureau of Land Management and is coordinated through its New York office.

The oil spill-fishery interaction model composed of an oil spill fates model, a shelf hydrodynamics/constituent transport model, and a fishery population model, originally developed by Reed and Spaulding, has been improved and applied to the Georges Bank/Gulf of Maine region to assess probable impacts of oil spills on several key fisheries. The model addresses first-order direct effects of oil on the commercial fishery through hydrocarbon-induced egg and larvae mortality.

Surface and subsurface oil concentrations are mapped in space and time and tested for intersection with similar mappings of fish eggs and larvae. The reduced cohort of young of the year is included as input to a Leslie matrix-based population model. Hydrocarbon-induced mortality is estimated by assuming a threshold toxicity. Final output is measured in terms of differential catch, comparing the natural and hydrocarbon-impacted fishery.

Simulations of four seasonal tanker (52.99 million liters) and blowout (189.25 million liters) spills at two separate locations in the Outer Continental shelf (OCS) lease areas have been completed for Atlantic herring, haddock, Atlantic cod, and yellowtail flounder. Results to date suggest a complex interaction between spill location and timing, the spatial and temporal spawning distribution, and the hydrodynamics of the area. The largest impacts occur for spring and winter spills.

For additional information on the program contact the authors of this article.

References

Reed, M. and M.L. Spaulding. 1979. An oil spill-fishery interaction model and comparison of treated vs. untreated spill impacts. Pages 63-73 *in* Proc. 1979 Oil Spill Conference. American Petroleum Institute, Washington, D.C.

Reed, M., M.L. Spaulding, and P. Cornillon. 1979. A fishery oil spill interaction model: estimated consequences of an oil well blowout. Proc. of the NATO Symposium on Operations Research in Fisheries. Trondheim, Norway.

Reed, M., M. Spaulding, and P. Cornillon. 1980. Oil spill-fishery interaction model-development and applications. Department of Ocean Engineering, University of Rhode Island, Kingston, RI.

Malcolm L. Spaulding
Department of Ocean Engineering, Lippitt Hall
University of Rhode Island, Kingston, RI 02881
401-792-2537

Saul B. Saila
Graduate School of Oceanography,
University of Rhode Island
Narragansett Bay Campus, Narragansett, RI 02882
401-792-6239

# Research & Monitoring Updates

## An Interim Report on the Pigeon Hill Dive Site

Pigeon Hill at Jeffreys Ledge, Gulf of Maine, was selected in 1977 as a Northeast Monitoring Program monitoring site to involve diving operations. During that year, baseline population densities, individual sizes, and biomass were determined from 0.25 $m^2$ disruptive epibenthic samples and quantitative 0.25 $m^2$photographs. With use of this information and observations from many qualitative dives, a plan was developed for long-term monitoring of the communities by utilizing key indicator species selected for their trophic, numerical, or community importance. Underwater photography was utilized as a cost-effective quantitative sampling technique, and key species were monitored during 1979 and 1980. Specimens of key species were also collected in 1980 for contaminant levels analysis.

Diving allows the use of high resolution quantitative photography to monitor the site. Our established permanent transects can be readily and precisely rephotographed to follow variation in community composition and growth. The epibenthic communities of the rough granitic substratum cannot be effectively sampled with conventional surface-oriented sampling equipment designed for soft substrate. SCUBA techniques allow careful examination of the Ledge type bottom, which is typical of a large proportion of the northern New England coast likely to be affected by man's activities.

We have chosen as community indicators four species: the red algae, *Ptilota serrata* (a primary producer), the sea star, *Leptasterias* sp. (a primary carnivore), the tunicate, *Ascidia callosa,* and the brachiopod, *Terebratulina septentrionalis* (suspension feeders). The use of key indicators of complex communities provides for an efficient and precise *in situ* analysis of community health and potential changes; the approach also allows observation of critical biological interactions, which lends insight into the interpretation of future community changes.

The densities of three groups of animals—asteroids, solitary ascidians, and brachiopods—have been analyzed from the 0.25 $m^2$photographs taken in 1978, 1979, and 1980 (Table 1) along permanent horizontal and vertical transects at the 33 m depth site.

TABLE 1
0.25 $m^2$ photographic summaries (1978, 1979, 1980)

| | | Abundance (#/0.25 $m^2$) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Asteroids | | Solitary Ascidians | | Brachiopods | | |
| Year | Transect | $\bar{X}$ | S | $\bar{X}$ | S | $\bar{X}$ | S | N |
| 1978* | Horizontal | 0.60 | .91 | .0 | .0 | 3.0 | 3.05 | 55 |
| | Vertical | 3.66 | 2.48 | 5.0 | 6.89 | 44.20 | 19.18 | 53 |
| 1979 | Horizontal | 2.13 | 1.83 | .52 | .92 | 4.68 | 5.95 | 61 |
| | Vertical | 14.72 | 8.52 | 14.14 | 8.03 | 56.08 | 20.17 | 50 |
| 1980 | Horizontal | 4.58 | 3.20 | .24 | .47 | 3.68 | 3.55 | 60 |
| | Vertical | 37.58 | 17.87 | 2.98 | 2.18 | 28.68 | 16.36 | 51 |

*A different photography system was utilized for the initial 1978 transects and the results are not directly comparable to the 1979 and 1980 results.

Vertical surfaces always had a greater average number of individuals, and generally the abundance was an order of magnitude greater. Ascidians and brachiopods were more common on, and are an integral portion of the ecology of, the vertical surfaces, where they probably find a more suitable feeding environment in the absence of the dense algal mat typical of the horizontal areas, while asteroids are ubiquitous. The higher asteroid counts from the 0.25 $m^2$ quantitative photographs of the vertical surfaces reflect the higher detectability possible in the absence of an algal canopy.

Stability in the densities of indicator animals during the three years varied. From the horizontal counts we found the asteroids increased from 0.6 per 0.25 $m^2$ to 2.1, then to 4.6 in 1980 (a similar trend of about the same magnitude was noted on the vertical surface). Ascidians and brachiopods were uncommon and their densities remained low over the three years on the horizontal surfaces.

On vertical surfaces asteroids were found to have an approximate tenfold increase in density over the three years monitored. In 1978 density was 3.7/0.25 $m^2$; by 1979, density had increased to 14.7, then to 37.6 in 1980. Fluctuations in asteroid abundance could be due to their mobility or seasonality or longer-term changes. Ascidians and brachiopod densities showed no definite trends.

Analysis of the vertical 0.25 $m^2$ photographs revealed low algal coverage (<2%); only a few areas had *Ptilota serrata.* Horizontal surfaces are dominated by a dense algal mat covering approximately 70% of the surface area. Algal cover was 47% in 1978, increased to 87% in 1979, and was 76% in 1980. The general increase from the 1978 baseline may represent: (1) a natural fluctuation in coverage and growth; (2) a restoration to a naturally high coverage following a depletion at the 1978 baseline; or (3) an abnormally high growth of algae in 1979 that is gradually returning to the 1978 level. Analysis of photos to be taken in 1981 should offer additional insights.

We also monitored two permanently marked square meters of horizontal surface for algal coverage during 1979 and 1980. Both showed a decrease in algal coverage from 1979 to 1980 as did the horizontal transect results.

Disruptive samples taken in 1978 were sorted to the species level. Weights (grams blotted wet weight/0.25 $m^2$) of sorted specimens are recorded for each disruptive sample. Deep station samples contained greater biomass than shallow station samples (238.0 grams/0.25 $m^2$ vs. 33.23 grams/0.25 $m^2$). At the deeper station horizontal and vertical samples had similar biomass (300 grams/0.25$m^2$ vs. 380 grams/0.25 $m^2$) while at the shallow station the horizontal samples had over twice the biomass as vertical (298/0.25 $m^2$ vs. 133/0.25 $m^2$). The proportionately larger biomass of material on the horizontal surfaces of the shallow station was due to algal material, primarily *Ptilota serrata* and the complex matrix of tubeworms in some quadrants, both of which provide secondary substrate, trap sediment, and provide refuge for many invertebrates. The brachiopod *Terebratulina septentrionalis* was a major portion of the biomass on vertical surfaces. Photonegative settlement of brachiopod larvae may provide a partial explanation for the observed distribution.

Benchmark body burdens of heavy metals tested for in the Pigeon Hill indicator species were: barium, cadmium, copper, chromium, mercury, lead, and zinc. The following concentrations in ppm were found: Ba 29.1-48.1, Cd 0.04-1.04, Cu 0.76-1.84, Cr

0.7-2.3, Hg 0.009-0.034, Pb 0.18-1.31, and Zn 11.1-34.2.

When the concentrations of trace metals are plotted for each species (Fig. 1) some trends become evident: (1) tunicates were lower in all heavy metal levels (except zinc) than either algae or asteroids; (2) a comparison between algae and asteroids shows algae higher in chromium, lead, and zinc, while asteroids are higher in barium, cadmium, copper, and mercury; (3) the trend in the various metal levels found in tunicates was also evident in algae, but the concentrations were higher in algae; and (4) zinc concentration was highest in tunicates compared to algae and asteroids; tunicates had the lowest concentration of all other metals.

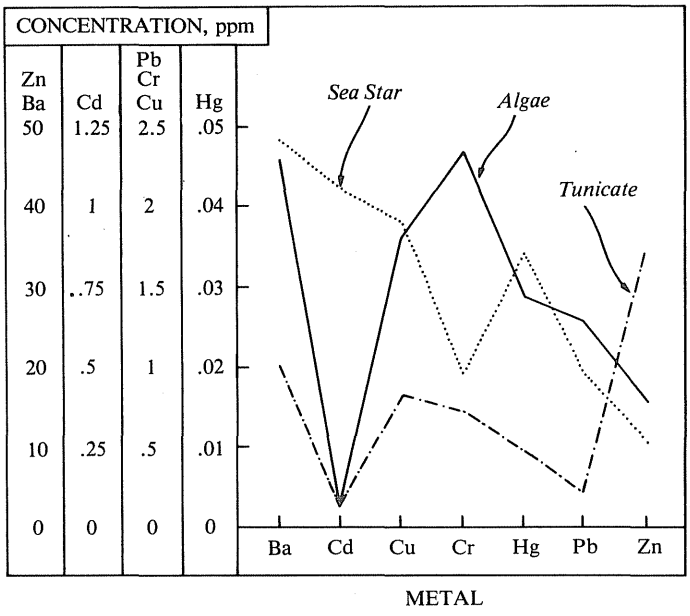



Figure 1. Concentration of heavy metals found in sea stars, algae, and tunicates from Pigeon Hill.

With our preliminary benchmark information (Whitman, et al., 1980; Pecci and Hulbert, 1981) we can monitor this relatively unpolluted site, using quantitative photographic techniques. Plans call for a major summer cruise each year for intensive site-specific studies, and seasonal monitoring of the key indicator species.

References

Pecci, K. and A. Hulbert. 1981. NEMP Annual Report: Jeffreys Ledge, Gulf of Maine.

Whitman, J., A. Hulbert, L. Harris, K. Pecci, K. McCarthy and R. Cooper. 1980. Community structure of the macrobenthos of Pigeon Hill in the Gulf of Maine. UNH-NMFS Technical Report. 83 pp.

Ken Pecci
Alan Hulbert
Northeast Fisheries Center
National Marine Fisheries Service
Woods Hole, MA 02543
617-548-5123, Ext. 234

## Identifying Marine Areas of Biological Concern

Effective planning for development of the marine environment requires the identification of areas with the greatest potential for conflict with environmental values. Such areas have been called *areas of biological concern* or *sensitive habitats.* A number of Federal regulations require their identification, yet offer no means for doing so beyond a list of possible factors that could indicate sensitivity.

A systematic method for defining sensitive habitats would not only facilitate regulatory compliance but would make it possible, for developer and regulator alike, to avoid wasting time, effort, and money on areas where unacceptable adverse impacts would likely occur. Such a method should be understandable, rational, defensible, and simple to use. It would also be desirable to reduce the subjectivity of decisions, identify the bases for all conclusions, and avoid the confounding of these bases. We have reviewed pertinent ecological theory, studies of environmental degradation and recovery, and Federal regulations to determine the ways in which habitats or communities could be deemed sensitive. We have developed for the U.S. Environmental Protection Agency a conceptual framework in which decisions are based on a comparison of the ecological attributes of a representative series of habitat types (Lippincott and Wolfson, 1980). Human values may also be included as decision factors, but are not treated here because of ample discussion elsewhere (Lindstedt-Siva, 1976; Hamilton et al., 1979; Ray et al., 1979).

Our approach to the problem of identifying sensitive habitat rests first on a general definition of the term sensitive: (1) ecologically important, and (2) susceptible to disturbance. This general definition can be reduced to a series of specific definitions, or criteria, that amount to "ways to be sensitive." We propose several organizational rules for evaluating a habitat in terms of such criteria: (1) assessment criteria should be operationally independent (assessed without cross reference) even when conceptually related; (2) since any criterion may be especially significant in a given instance, it should be possible to base an inference of sensitivity on a single criterion; (3) the basis for an inference should be relative, that is by comparison of habitat types; and (4) ecological sensitivity should be qualified in regard to geographic importance.

The proposed assessment method consists of several stages of information processing (Fig. 1). In stage one, both the habitat type that corresponds to the candidate habitat (under assessment) and the project type are identified. The latter will bear on the interpretation of some criteria. Stage two is comprised of assessment criteria derived from specific definitions of the term sensitive. The assessment is made in two parts, with the second part subordinated to the first. The ecological importance of a habitat is determined based on its relative productivity and/or significance to the support of life-history functions (reproduction, migration, feeding, and dispersal).

Given an inference of ecological importance, the likely community response is assessed through four criteria. Two of these criteria measure community attributes that could promote susceptibility to disturbance: (1) excessive reliance on nutrients stored in the biomass (e.g., coral reefs) and (2) dependence on a biological (key or foundation species) or physical (e.g., tidal flushing) controlling factor. The second two community-response criteria are: (3) resistance (capacity to withstand a disturbing influence) and (4) resilience (capacity to recover from disturbance), which are expressions of community response. These four criteria are assessed

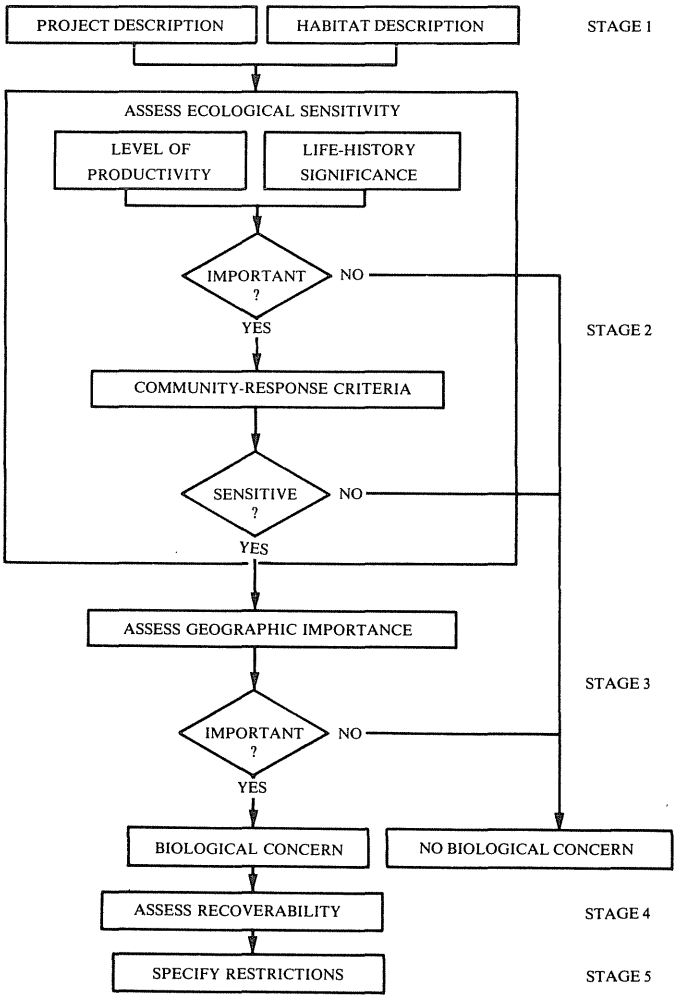



Figure 1. Schematic flow diagram of proposed sequence of information processing for the identification of areas of biological concern.

independently to avoid confounding the interpretation.

In the third stage, habitats found to be ecologically sensitive are assessed with respect to their geographic importance, that is, in terms of relative areal extent and degree of prior encroachment. This has the effect of deemphasizing widespread habitat types unlikely to be materially affected by development. For habitats considered to be of biological concern, the degree of concern is measured in stage four by estimating the time required for recovery from disturbance. The final stage of the assessment, stage five, involves the specification of appropriate stipulations, restrictions, and mitigative requirements necessary to limit or preclude development in the sensitive area. The information gained from the assessment will be useful in tailoring the specifications to the particular habitat.

The evaluation of an assessment criterion is made in the context of all habitat types to establish a relative basis for inference. This is done by comparing the relevant attributes or characteristics of the candidate habitat with those of other habitat types so that an overall distribution can be established. To the extent that data are available, this will place the specific sensitivity of a habitat in the perspective of other habitats. There remains, however, a disparity between the need for a dichotomous decision (sensitive or not sensitive) and the continuous properties of underlying ecological phenomena. Clear thresholds are not common among ecological systems. The dilemma can be resolved by establishing a standard, for each criterion, that falls somewhere in the arguable middle region between the two extremes of the distribution (Fig. 2). The

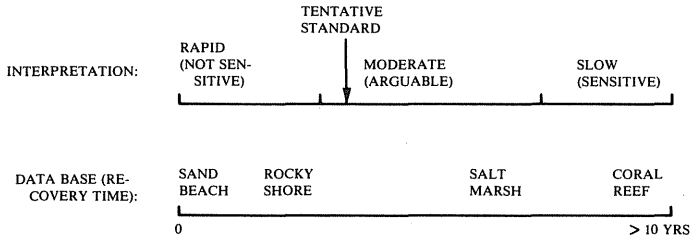



Figure 2. Interpretation of an assessment criterion. The lower graph shows a hypothetical distribution of recovery times for four habitat types. The upper graph gives an interpretation of sensitivity in terms of recovery time. It is divided into three regions, with the standard arbitrarily in the *arguable* region. In this interpretation, salt marshes are *considered* sensitive and coral reefs are *clearly* sensitive.

standard should be allowed to vary as new information becomes available or at the discretion of the assessor. In the latter case, disagreement may persist, though the lines of argument would be clearly drawn.

Under the proposed conceptual framework, an effort is proceeding to develop a data base that will serve as a factual reference source for decision making. This reference frame will include not only a comparative context, but will ascribe sensitivity to specific ecological aspects or criteria. Thus, the legislatively mandated threshold of sensitivity can be placed with respect to empirical distributions and will be unequivocally defined. The placement of thresholds may be either standardized or ad hoc, depending on the needs of the regulatory assessor.

References

Hamilton, C.O., S.J. Starr, and L.L. Trasky. 1979. Recommendations for minimizing the impacts of hydrocarbon development on the fish, wildlife and aquatic plant resources of Lower Cook Inlet. Marine/Coastal Habitat Mgmt., Alaska Dept. Fish and Game. Anchorage, AK. 261 pp.

Lindstedt-Siva, J. 1976. Oil spill response planning for biologically sensitive areas in the Santa Barbara Channel. ARCO. Los Angeles, CA. 47 pp.

Lippincott, W.H. and A. Wolfson. 1980. A method for identifying marine areas of biological concern. Report to U.S. EPA, Ocean Programs Branch, Washington, D.C. 70 pp.

Ray, G.C., R.V. Salm, and J.A. Dobbin. 1979. Systems analysis mapping: an approach toward identifying critical habitats of marine mammals. Mar. Mamm. Comm. Rept. No. MMC-76/18.

William H. Lippincott
Arthur Wolfson
W.H. Lippincott and Associates
13549 Calais
Del Mar, CA 92014
714-755-5752

## Research on the Columbia River Estuary

The Columbia River is the largest river on the Pacific Coast; its estuary is the ninth largest in the United States, yet very little is known about it at the present time. Major land and water use conflicts exist and management decisions are being made on limited information. For these reasons, the Pacific Northwest River Basins Commission (PNRBC) is conducting a five-year research program—the Columbia River Estuary Data Development Program (CREDDP). This program, authorized by PL 92-482 in October 1978, is in its third year. This article summarizes the approaches which were taken in this program, the end products thus far, and some of the initial findings of the data-gathering effort.

CREDDP is comprised of a management team and 26 contractors that study circulation and biological processes in the estuary. The purpose of CREDDP is to provide managers, local citizens, and decision makers on the estuary with sufficient usable information to allow intelligent use and development of the estuary. Key taxa and habitats are being determined and mapped and their susceptibility to human disturbance will be presented in annual data interpretation reports and in an annual report.

While the study will not provide sufficient information to predict impacts of specific developments at particular locations, it will provide generic information, such as sensitive habitats to avoid in planned developments, types of gear to be used in site-specific studies, the species present in each habitat, the spatial and temporal variability in numbers and biomass, and some indication of the secondary effects of various types of disturbances.

Two particularly noteworthy findings have emerged. First, in the highly productive salt wedge that ranges between the mouth of the estuary and 40-50 km upstream, is an area of heavy detritus flocculation induced by high mortality of both marine and freshwater plankton. Juvenile and adult fish and zooplankton feed heavily on the detritus-based food web of the area. Since the salt wedge migrates with varying hydrographic conditions, its productivity could be enhanced or mitigated by various developments far upstream from the entrance. A second finding concerns the effects of silt and ash from the 1980 eruption of nearby Mount St. Helens. Siltation of the estuary altered the vertical distribution of infauna and greatly reduced their abundance for a period of at least one to two months. More importantly, although the epifauna survived siltation, they were apparently unavailable to the food web; fish stomachs were invariably empty, due perhaps to the inability of the fish to locate food in the highly turbid water. In spite of these effects, however, the volcanic material was not toxic. Analyses are in progress to determine to what extent the benthos has recovered from this impact.

Progress has also been made in identifying taxonomic priorities for all researchers; community, functional, and trophic structures; key habitats; temporal and spatial variations in the biota; and physical controlling mechanisms and interactions between them and the biota.

Several reports are available from the Basins Commission. These include: (1) Literature reviews and annual reports for the following work units: Emergent Plants, Benthic Primary Production, Water Column Primary Production, Zooplankton and Larvae Fish, Benthic Infauna, Epibenthic Organisms, Salmonid and Nonsalmonid Fishes, Avifauna, Marine Mammals, Wildlife, Current Studies, Sedimentation Studies, Shoaling, and Biophysical Interaction; (2) *A Review of Numerical Models of the Columbia River Estuary;* (3) *Characterization of Water Quality of the Columbia River Estuary;* (4) *Columbia's Gateway, a History of the Estuary to 1980;* (5) *Log Storage Effects in the Columbia River Estuary;* (6) *A Literature Review of Reptiles and Amphibians of the Columbia River Estuary;* (7) *A Literature Review of Seed Production in the Columbia River Estuary;* (8) *A Literature Review of Nitrogen Fixation in the Columbia River Estuary;* (9) *A Literature Review of Terrestrial Insects in the Columbia River Estuary;* and (10) *Columbia River Estuary Data Development Program Annual Executive Report.*

CREDDP has one full field year remaining; at the end of that period a final report will be formulated which will detail the interactions of the estuary ecosystem to the extent possible.

Copies of the reports and other items listed may be obtained from Robert Moulton, PNRBC, 1 Columbia, Vancouver, Washington. Questions concerning the program can be directed to the author.

Gary G. Lawley
Environsphere Company
10800 NE 8th Street
Suite 715
Bellevue, WA 98004
206-453-6060

## Key Largo Coral Reef Marine Sanctuary Literature Survey and Water Quality Monitoring Program

The Key Largo Coral Reef Marine Sanctuary literature survey and water quality monitoring program report is complete and available upon request.

The Sanctuary, designated in 1975 and managed by the Sanctuary Programs Office, Office of Coastal Zone Management in cooperation with the Florida Department of Natural Resources, contains over 260 $km^2$ of this nation's most luxuriant coral reefs.

As Phase I of our Sanctuary water quality monitoring program, this report is a precursor to the development of a permanent Sanctuary water quality monitoring program. The report presents a review of the pertinent literature for the Key Largo Coral Reef Marine Sanctuary and adjacent areas. Unpublished data are also presented.

The aim of the study was to examine existing literature to locate historical data suitable for use as a baseline against which new water quality data can be evaluated.

The literature review is divided into four sections. The first section reviews water quality information for the Sanctuary; the second reviews water quality for adjacent areas. The next two sections present geological and biological studies conducted within the Sanctuary and in the adjacent areas. Water quality within the Sanctuary and factors that are important in maintaining a healthy reef environment are discussed, and recommendations are proposed for establishing a water quality monitoring program in the Sanctuary to detect subtle, long-term changes in the water that flows through the Sanctuary. These recommendations emphasize long-term trends rather than transient disturbances such as hurricanes, occasional phytoplankton blooms, or severe cold spells, because the latter are unpredictable and ephemeral.

In summary, very little water quality data were found for the

Florida reef tract. Biologists and geologists have been very active on the reefs, but chemists have not. Chemical oceanographers have been interested primarily in the deep waters of the Florida Current, while other chemists have concentrated their efforts in the nearshore waters of Biscayne Bay and Card Sound, where thermal pollution, dredge and fill operations, and drainage canals have focused public attention on water quality.

The clear waters of the reef tract, in contrast, are at present relatively pristine and are in no immediate danger of gross contamination from human activity. However, as the level of human activity along the adjacent shoreline and in the adjacent inshore waters increases, it is possible that detrimental physical and chemical changes in water quality will impact on these reef areas. These are the most extensive coral reefs within the territorial waters of the continental United States, and they deserve protection against such possible impacts. Such protection will require an early warning of adverse trends in critical water quality parameters. There is a lack of relevant water quality background information for the Sanctuary and adjacent areas, and this lack adds significance to the development of a comprehensive water quality monitoring program.

Phase II of the Sanctuary water quality monitoring program, a study of the current system in and around the Sanctuary, is now underway. This will allow Sanctuary managers to determine properly the location and number of permanent sampling stations to be used for long-term water quality monitoring. Phase III of the program will be the implementation of a water quality monitoring program on a regular monthly basis. Also, a nutrient transport model will be developed that will be capable of simulating the distribution and fate of nutrients introduced into the Sanctuary. These activities will commence in fiscal year 81.

Other future monitoring and assessment efforts will be conducted in the Looe Key, Grays Reef, Channel Islands, and Point Reyes/Farallon Islands Sanctuaries.

Lt. Stephen C. Jameson
Sanctuary Programs Office
Office of Coastal Zone Management
2001 Wisconsin Avenue, NW
Washington, D.C. 20235
202-634-4236

## Casco Bay Study

The Maine Department of Marine Resources (DMR) has completed an inventory of the marine resources of Casco Bay. This study, conducted by DMR personnel and funded by the Maine Department of Environmental Protection, was part of an extensive integrated research program involving several state agencies, the University of Maine, and the Bigelow Laboratory for Ocean Sciences. The value of the marine resources of the bay and the proximity to Portland Harbor, one of the East Coast's busiest oil terminals, prompted development of research needed to preserve and protect these resources from oil spills.

The objectives of this study were to inventory the resources of the bay; to establish an evaluation system to determine protection priorities in the event of a major oil spill; to provide a mechanism for assessing damages caused by an oil spill; and to provide the data needed to develop a computerized oil spill tracking model. The study encompassed the examination and survey of more than 200 km of shoreline and 5 $km^2$ of intertidal flats. Information was collected and compiled, and characterizations made, for 63 distinct fishery resources and 146 recreational areas. All of these data were catalogued for incorporation into a marine resources atlas for the bay. An extensive literature review provided data, which were summarized as reference tables as a guide to protection priorities, on the effects of oil on marine species and the environment.

The goal for the research is the development of predictive capabilities coupled with a rapid response time in the event of a catastophic oil spill. The computer tracking model will be used to determine the drift and distribution of oil from a spill and the atlas will be used by the oil spill response teams to determine priorities for protective measures such as the deployment of oil containment booms and cleanup efforts. Similar research and planning efforts are under consideration for other environmentally sensitive areas of the Maine coast.

Clement Walton
Bureau of Marine Sciences
Maine Department of Marine Resources
West Boothbay Harbor, ME 04575
207-633-5572

## NOAA's Office of Marine Pollution Assessment and New Jersey Sea Grant Jointly Fund Research in the Hudson-Raritan Estuary

Circulation and nitrification in the Hudson-Raritan Estuary are receiving increased attention in 1981-82, as a result of research sponsored jointly by the National Oceanic and Atmospheric Administration (NOAA)'s Office of Marine Pollution Assessment Northeast Office (OMPA NEO) and New Jersey's Sea Grant program. This research represents one aspect of more comprehensive estuarine studies being undertaken separately by each of these groups. OMPA NEO's participation is through its Hudson-Raritan Estuary Project, which was initiated in October 1979 and which will fund research through September 1985 to develop scientifically sound recommendations, balanced by up-to-date socio-economic insight, for rehabilitation of the estuary. New Jersey Sea Grant's involvement is through its Northern Estuaries initiative. The New Jersey Sea Grant Program is administered by the New Jersey Marine Sciences Consortium and supports research on the fate and behavior of pollutants.

Cooperative support is being provided for two research teams during 1981-82. Drs. George Mellor (Princeton University) and Richard Hires (Stevens Institute of Technology) are undertaking physical oceanographic and numerical simulation studies of the Hudson-Raritan Estuary. Working with Dr. Frank Cantelmo (St. Johns University), Drs. James Simpson and Hugh Ducklow have been studying nitrification in Raritan Bay.

The Mellor-Hires team is applying an established numerical model to describe velocity, temperature, and salinity fields. Field observational data obtained by Dr. Hires are combined with data from recent NOAA National Ocean Survey tidal current studies in New York Harbor to verify the capabilities of the model. A major goal is to establish a reliable description of transport within the estuary. Future applications of the model may shed light on the dispersion of pollutants and sediments within the estuary.

The study of nitrification in Raritan Bay is interdisciplinary, with an investigative team comprised of geochemists, microbiologists, and ecologists. The investigators are focusing their attention on the possible contribution of nitrification to summer oxygen depletion in Raritan Bay. Studies involve: (1) evaluating the utility of nitrous oxide ($N_2O$) as an indirect indicator of oxygen consumption during bacterial nitrification (the nitrogenous biological oxygen demand); (2) determining *in situ*

nitrification rates in the Bay water column and sediments; and (3) assessing the role of benthic meiofaunal communities in stimulating nitrifier populations.

All data gathered from these research efforts are to be archived in the National Oceanographic Data Center (NODC).

Robin D. Zimmer
New Jersey Marine Science Consortium
Building 22
Fort Hancock, NY 07732
201-872-1300

# Announcements

## The Duke University Marine Biomedical Center

The National Institute of Environmental Health Services (NIEHS), provides support to the Duke University Marine Biomedical Center with the objective of promoting research in the marine sciences relevant to problems of environmental health. The research goals of the Duke Univeristy Marine Biomedical Center are to gain an understanding of the mechanisms involved in the adaptation of man and other organisms to an environment that is both hostile and continually changing. Emphasis is on the biochemical and biological impact of metallic pollutants.

Studies at the Center concern: (1) the effects of chemical pollutants on respiratory proteins and electron transport proteins; (2) the effects of metal and nonmetal pollutants on larval development of various invertebrates; (3) pollutant toxicology using blood as a model organ; (4) behavioral aspects of pollution of estuarine and marine systems; (5) the role of metal and nonmetal pollutants in processes associated with animal, plant, and artificial membrane systems; and (6) effects of heavy metals on ion transport phenomena and cellular membrane potentials. Feasibility studies are conducted to explore the advantages of various experimental approaches and to encourage innovative research.

An outline of the objectives of the Duke University Marine Biomedical Center is shown below:

DUKE UNIVERSITY MARINE BIOMEDICAL CENTER

Basic Research

MECHANISMS AND EFFECTS OF ENVIRONMENTAL TOXINS

Marine Systems as Models in Studies of Human Health

Mechanisms and Toxins in the Marine Environment

SPONSORS:
National Institutes of Health
(Core Support)
National Oceanic and Atmospheric Administration
National Science Foundation
Environmental Protection Agency
Department of Energy
Office of Naval Research

Applied Research

RESEARCH AND DEVELOPMENT OF MEANS TO TEST AND CONTROL MAN'S ENVIRONMENT

Environmental health research within the Marine Biomedical Center focuses on better understanding of the mechanisms and effects of toxins. In addition, some applied research concerning development of better means of testing and controlling our environment is becoming an increasingly important part of the Center's activities. We feel that this coupling of "basic and applied" aspects is essential in developing a realistic approach to living in harmony with our increasingly complex industrial civilization.

Drs. Joseph and Celia Bonaventura are the Directors of the Marine Biomedical Center. They are members of the Duke Medical Center's Biochemistry Department and have their research laboratories at Beaufort. Participants in the Center are drawn chiefly from departments of the Duke University Medical Center and departments of Duke's Trinity School of Arts and Sciences. The majority of participants who act as members of the Steering Committee are year-round residents of the Duke University Marine Laboratory. The close ties between the Marine Laboratory and the Medical School of Duke University facilitates transfer of information from the marine sciences into the realm of biomedical practice.

The Marine Biomedical Center of Duke University is one of five centers established by the NIEHS that focus on marine and freshwater biomedicine. The five NIEHS marine and freshwater biomedical centers and their directors are: (1) Dr. Earl P. Benditt, Dept. of Path., SM-30, School of Medicine, University of Washington, Seattle, WA 98195; (2) Dr. John J. Lech, Department of Pharmacology, Medical College of Wisconsin, 561 North 15 Street, Milwaukee, WI 53233; (3) Dr. Don Walsh, University of Southern California, Institute for Marine and Coastal Studies, University Park, Los Angeles, CA 90007; (4) Dr. Lavern J. Weber, Marine Sciences Center, Marine Sciences Drive, Newport, OR 97365.

In subsequent issues of COPAS, articles will appear that feature research activities of the Duke University Marine Biomedical Center. These articles will emphasize projects done in collaboration with National Marine Fisheries Service labs and other projects of probable interest to the COPAS readership.

The Marine Biomedical Center is interested in communicating with individuals who share common interests. A bimonthly newsletter, ENVIRONS, is distributed to over 1,000 people, throughout the world. If you are interested in receiving ENVIRONS, please write a letter of request and you will be put on the mailing list.

Joseph Bonaventura
Celia Bonaventura
Duke University Marine Biomedical Center
Beaufort, NC 28516
919-728-2111

## NODC Taxonomic Codes and Products in Alaska

The National Oceanographic Data Center (NODC) maintains the NODC taxonomic code file, which is used to support all environmental programs with biological data. This code file is used in all digital data formats that contain biological information.

The NODC taxonomic code covers a worldwide distribution of flora and fauna, with species concentrated in the marine environment. The file is hierarchical, and uses approximately 25,000 codes. There are five taxonomic levels — phylum, class, family, genus, and species *or* class, order, family, genus, and species; each is represented by a two digit number.

The NODC taxonomic code file evolved from two earlier ver-

sions of taxonomic files. An original taxonomic code file was developed in the 1960's at the Virginia Institute of Marine Science (VIMS) by Dr. Rick Swartz. This original code file was primarily of Chesapeake Bay species, and concentrated on the aquatic taxa. When the Outer Continental Shelf Environmental Assessment Program (OCSEAP) began data collection and digitization, a taxonomic code that would include the Alaskan and Pacific Northwest species was needed. Mr. George Mueller at the University of Alaska, Fairbanks was contracted by NODC to add those species with use of the VIMS taxonomic code as the base. In addition to adding the new codes, he further modified and defined the structure and implementation of the code file. Mr. Mueller's code file was submitted in 1975-76 as the "Alaskan code file."

The Anchorage Information Service Center has checked the taxonomic codes in the biological data from the OCSEAP and the Marine EcoSystems Analysis Puget Sound Project. The conversion from pre-Alaskan and Alaskan codes to the NODC taxonomic codes is an integral part of the services to these studies programs. Master files are maintained to confirm the identification and properly convert the code to the NODC taxonomic code. This correction and checking process allows the taxonomic coding to be exploited rigorously in data products.

Because the code file is "controlled," many application products have been developed for the digitized biological data. For example, selected segments of a data set may be isolated with use of the taxonomic code. Taxonomic codes may also be used as tools in data reduction before further analysis. They may also be used to assist in noting the presence or absence of individual species or species groups. The code file may also be used to assist in the correct scientific name spelling or relative classification.

After the biological identifications have been coded with the use of the NODC codes, the user can select segments of data in two ways. One way is through predator/prey information. This information may be summarized for a data file with the predator's name and code number listed, followed by the prey name and number, with either the number of occurrences or the percent occurrence in the total stomachs noted. Each predator that occurs in the file is listed, followed by its prey(s). It is also possible to select only those predators desired from a data file. Again, each selected predator's prey information follows. The second selection method is that of selecting all the data records of one species, genus, family, etc., to create a data file subset. This subset can then be used in further analysis or taxonomic comparisons.

The use of the taxonomic codes as data reduction tools involves the grouping of taxonomic codes into species categories or groups. Once the data have been placed into records of taxonomic groups, further analysis may occur on the reduced data. This process allows the user to identify important highlights.

Many other taxonomic applications and application products are available. For additional information on taxonomic products, please contact the author at the address below. For additional information on the NODC code file, please contact Mrs. Mary Hollinger, National Oceanographic Data Center, Page Building #1, 2001 Wisconsin NW, Washington, D.C. 20235.

Marilyn Allen
Anchorage Information Service Center
Arctic Environmental Information and Data Center
707 A Street
Anchorage, AK 99501
907-279-4523

## The National Marine Pollution Information System

The National Marine Pollution Information System (NMPIS) is an interactive data base that contains detailed information about marine pollution research, development, and monitoring projects conducted or funded by Federal agencies. To date, it contains descriptions of over 2,500 individual projects from 96 programs in 11 Federal agencies. The data base is updated annually and is now complete through fiscal year 1980. Each NMPIS record includes: (1) project title and description; (2) performing, funding, and managing organizations; (3) funding and personnel levels; (4) pollution cause and specific pollutants under study; (5) geographic areas of concern; and (6) project objectives.

NMPIS can be searched interactively to answer specific questions such as, "What are the funding levels of projects that are monitoring PCBs in the Great Lakes?" In addition, associated software is available to generate standard reports that summarize the entire data base or selected subsets of it. Available reports include funding summaries, funding and personnel analyses by organization or project, and analyses of interagency funds transfers. These reports have various options so they can be tailored to meet user requirements. The funding analysis, for example, can display funding for past, present, and next fiscal year and selected subcategories such as region, zone, and pollutant.

The National Oceanographic Data Center (NODC) manages the development and operation of NMPIS for the National Marine Pollution Program Office of the National Oceanic and Atmospheric Administration. Although created specifically to support biennial revision and updating of the five-year Federal Ocean Pollution Plan, principal investigators, project managers, and other interested users may obtain online access to NMPIS by arrangement with NODC. NMPIS operates on a commercial time-sharing network that one can gain access to from most major cities in the United States and Canada, and in the greater part of Europe. NMPIS reports requested interactively are mailed to users. A NMPIS Terminal Operator's Guide is available on request from NODC.

James Berger
NOAA/EDIS
National Oceanographic Data Center
Washington, D.C. 20235
202-634-7441

# Calendar

**September**

**29-1 October**

International Association on Water Pollution Research Conference on Disposal of Sludge to Sea, London, U.K. Contact: M.C. Dart, Thames Water Authority, New River Head Laboratories, 177 Roseberry Avenue, London EC1R 4TP, U.K.

**October**

**11-14**

Coastal Society's 7th Conference: Achievements of the 70's , Prospects for the 80's, Galveston, TX. Contact: Niels West, Dept. of Geography and Marine Affairs, University of Rhode Island, Kingston, RI 02881.

**12-16**

Third International Ocean Disposal Symposium, Woods Hole, MA. Contact: Iver W. Duedall, Marine Sciences Research Center, State University of New York, Stony Brook, NY 11794.

**18-23**

Fourth Conference on Water Chlorination: Environmental Impact and Health Effects, Pacific Grove, CA. Contact: Dr. Robert L. Jolley, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, TN 37830.

**19-23**

Ocean Pollution 1981, Bedford Institute of Oceanography, Halifax, Nova Scotia, Canada. Contact: J.H. Vandermuelen, Bedford Institute of Oceanography, Dartmouth, N.S., Canada B2Y 4A2 (902-426-2479).

**20-22**

Twelfth Underwater Mining Institute, Madison, WI. Contact: G. Hedden, Sea Grant Advisory Services, University of Wisconsin, Madison, WI 53706 (608-262-0644).

# Viewpoints

## Hazardous Waste Management

On 8 June 1981, New York State Department of Environmental Conservation (NYSDEC) Commissioner Robert Flacke announced that an 11.3 $km^2$ tract of land at Sterling, Cayuga County, New York, had been selected as a potentially suitable site for a high technology, hazardous waste treatment facility. At the Albany press conference, Commissioner Flacke stressed the need for a facility designed to neutralize, detoxify, or destroy about 90,000 metric tons of the more than 360,000 metric tons of waste for which there is currently no in-state treatment capability.

Currently, New York generates about 1.3 million metric tons of hazardous waste per year. Of this amount it is estimated that as much as 360,000 metric tons received improper treatment during 1978. It is anticipated that stricter Federal and state regulations will significantly increase the amount of waste that requires proper disposal. NYSDEC estimates that as much as 630,000 metric tons per year will require treatment once state and Federal regulations are finally adopted. When you consider that about a third of the hazardous waste generated within the state is currently being improperly disposed of, it is clear that something must be done, and soon, to develop a comprehensive waste management plan. This 360,000 metric tons of improperly managed waste is currently contaminating our surface and groundwaters—resources we can ill afford to squander.

The proposed high technology waste treatment facility will be scaled to treat as much as 0.4 x $10^6 m^3$ of waste each year, which translates into 50-70 truckloads of wastes per day. This treatment facility will be designed to treat a wide range of hazardous materials, including aqueous organic and inorganic materials, cyanides, sludges, combustible and noncombustible sludges, waste oils, and halogenated and nonhalogenated solvents. It will, therefore, be a multipurpose facility that will employ a wide range of treatment including aqueous treatment, fixation, biological treatment, incineration, and landfilling.

The proposed Sterling site is located in northern Cayuga County and is currently owned by the Rochester Gas and Electric Corporation (RG&E). This 11.3 $km^2$ site was purchased by RG&E for construction of a nuclear electrical generating plant site, which would have been the fourth within a 24 km radius. Although NYSDEC and the Environmental Facilities Corporation, a public interest state agency, have developed the overall plan and are actively involved in the siting process, the proposed high technology facility will be privately operated.

As expected, DEC was confronted with open and often hostile opposition by Sterling-area residents. It is unlikely that the response would have been different in any other area of the state tentatively selected for siting a large-scale waste treatment facility. No community would welcome the opportunity to be the annual repository for 0.4 million $m^3$ of hazardous waste. Siting opposition was expected, and was undoubtedly at least one of the major reasons DEC opted for a single large-scale operation, rather than attempt to implement a program requiring that smaller hazardous waste treatment facilities be located near major generating areas. Multiple facilities would obviously prove far more difficult, considering the public's reluctance to accept responsibility for management of hazardous chemical waste.

DEC's selection of the Sterling site has many site-specific limitations. "Neutralized waste," to use DEC's vernacular, will be discharged to Lake Ontario. There are two municipal water intakes located 10 km west of the proposed waste discharge, and the nearshore lake circulation is toward the east. Lake Ontario waters serve the City of Oswego and a large proportion of the Syracuse population, and provide a source of water for large breweries that rely on lake waters for beer production.

Sterling lies within the snowbelt area of north central New York; lake effect storms have deposited as much as 0.6 to 1.0 m of snow within 24 h and it is not uncommon for this area of the state to receive as much as 5 m of snow. Imagine the problems related to 50-70 truckloads of hazardous waste converging on the area each day!

In addition to these serious limitations, the Sterling area is located on the shores of Lake Ontario, the largest source of freshwater in the state. Lake Ontario has already been severely affected by industrial wastes that have recently impacted a growing sportfishery. A ban on salmonid possession was imposed by the previous DEC Commissioner in 1977 due to chemical contamination of these fishes. Lake sportfish are known to contain elevated levels of PCBs, mirex, and mercury. Most recently, dioxin, one of the most toxic substances known, has been identified in lake fish and herring gull eggs. The salmonid sportfishery is an estimated 100 million dollar industry in an area of the state where

unemployment is far above the state and national average. Ironically, DEC is actively promoting an expanded sportfishery that includes the construction and operation of a large salmonid hatchery within 50 km of the proposed waste treatment facility, while proposing to discharge quantities of "neutralized waste" into a lake already heavily burdened by organic and inorganic contaminants.

Although Commissioner Flacke should be commended for attempting to develop a needed hazardous waste management program, far more consideration should be given to alternative strategies. No area of the state should be expected to assume the economic, social, environmental, and psychological burdens of a large-scale hazardous waste treatment facility. Hazardous waste should be the responsibility of the area that derives the direct benefits from the many waste-producing industries, municipalities, and institutions. Alternatives to the proposed large-scale facility will require a commitment by the state to ensure that DEC staff and resources are strengthened to cope with the additional responsibilities of hazardous waste management.

We all have a vested interest in any hazardous waste management program and even though many state residents may have been relieved that another area has been tentatively selected for siting, we should keep in mind that we all share in the responsibilities for protecting the state's natural resources. We suspect it won't be long before the enormous fresh water resources of upstate New York are enviously eyed to relieve the water deficits of downstate New York and other parts of the country.

R. J. Scrudato & Suzanne Weber
State University Research Center
SUNY at Oswego
Oswego, NY 13126
315-341-3088

## Court Decision Makes Future of Sewage Sludge Ocean Dumping Uncertain

A recent decision by a Federal district court in New York has placed a cloud over the future of sewage sludge ocean dumping in the New York Bight. Congress, in a 1977 amendment to the Ocean Dumping Act, had specified that there could be no further ocean dumping, beyond the end of 1981, of sewage sludge that might "unreasonably" degrade or endanger human health or the marine environment. The House Committee Report on this amendment indicates that Congress intended the phase-out deadline to apply to sewage sludge "which cannot meet Environmental Protection Agency (EPA)'s own Ocean Dumping Criteria" and felt it necessary "to codify EPA's stated goal of ending the ocean dumping of sewage sludge which is harmful to the marine environment or to human health, welfare, and amenities."

The problem was that the original 1972 Ocean Dumping Act defined "unreasonable" degradation and endangerment in terms of a balance of factors, including environmental impact, dumping need, and availability of alternatives to ocean dumping, while the EPA Criteria, "codified" by the 1977 amendment, made sludge subject to the phase-out requirement based on environmental impact considerations alone. The court, in *The City of New York vs. U.S. Environmental Protection Agency,* 80 Civ. 1677 (ADS) (S.D.N.Y. 14 April 1981), held that the original 1972 statutory factors for determining "unreasonable degradation" remained unaffected by the 1977 amendment and that, therefore, EPA must provide New York City with an opportunity to present its claims "as to the environmental consequences of its ocean dumping vs. land-based disposal" and must decide these claims based upon "all of the statutory factors relevant to a reasoned determination."

Meanwhile, there are indications that the city of Philadelphia, which halted its ocean dumping operations in the fall of 1980, may be reconsidering that phase-out decision in light of the New York City court decision and the more favorable economics of ocean dumping. If the court decision remains intact, a variety of ocean dumping chemical companies may also reconsider their willingness to end ocean dumping.

As EPA and the Department of Justice reassess Federal ocean dumping policies and explore litigation options, attention will focus on whether or not the judge in the New York City case made the following legal and factual errors:

(1). Ignored the fact that the emphasis of EPA's Ocean Dumping Criteria on environmental impact considerations is not only justified but compelled by the requirements of Article IV and Annex I of the London Ocean Dumping Convention, as incorporated into Section 102(a) of the U.S. Ocean Dumping Act. (The Convention flatly prohibits the ocean dumping of wastes, including sewage sludge, which contain mercury and cadmium compounds, organohalogens, and oil and grease as other than "trace contaminants"—defined in the Ocean Dumping Criteria on the basis of bioassay test results).

(2). Ignored the evidence assembled by EPA that technologically practicable alternatives to sewage sludge ocean dumping are available both in general and for New York City. (The general practicability of land-based alternatives was established at an extensive adjudicatory hearing at EPA Headquarters in May 1975 on the determination to phase-out ocean dumping of sewage sludge by the city of Philadelphia. The specifics of New York City's situation were addressed in a three-part report by the Interstate Sanitation Commission entitled "Technical Investigation of Alternatives for New York-New Jersey Metropolitan Area Sewage Sludge Disposal Management Program." EPA also has amassed extensive experience with land-based sludge management alternatives through its construction grants and research and development programs.)

(3). Ignored EPA's consideration of the comparative environmental impacts of land vs. ocean disposal of sewage sludge. (The Philadelphia adjudicatory hearing fully explored such contrasts between land and the ocean as the land's status as a containment medium and, as such, its ability to serve as a safer and more readily controllable repository for sludge than the ocean, which is the prototypical dispersal medium.)

(4). Misread the legislative history of the 1972 Ocean Dumping Act and of the 1977 amendment. (These reflected a strong congressional acknowledgement and approval of the Administration's oft-stated intention to terminate the ocean dumping of both raw and digested sewage sludge.)

(5). Incorrectly assigned the burden of proof to EPA rather than to New York City. (The statute does not make approval of ocean dumping a right; it is a privilege to be conferred where an

applicant demonstrates that unreasonable degradation will not result.)

The judge in the New York City case will issue a final order shortly, and the government then has to decide whether to appeal. At the same time, the fate of ocean dumping of sewage sludge by a group of New Jersey municipalities is being considered by another Federal judge in New Jersey.

EPA has been attempting to resolve all of these cases on the basis of allowing continued dumping at "Deepwater Dumpsite 106"—some 104 km off the coast. (Dumping now occurs at a site 14 km offshore). It is expected that EPA will initiate a rule-making proceeding in the near future on whether to shift sludge dumping to the 106-site or to extend the approval for dumping at the 14-km site. The basic issue of disposal at sea vs. that on land is likely to be relegated to a somewhat subordinate role, although it will doubtless be debated in detail as EPA grapples with renewed ocean dumping permit applications from New York City and other litigating municipalities. Although ten key members of the House Merchant Marine and Fisheries Committee have taken a position contrary to that of the judge in the New York City case in a pair of mid-July letters to the EPA administrator, it now seems a foregone conclusion that ocean dumping of sewage sludge will remain with us well beyond the end of this year.

The Administration is in the midst of a comprehensive review of its ocean dumping policies. A new hierarchy of officials has taken hold of the ocean dumping reins at EPA and seems determined to eliminate any "special protections" for the ocean and to more fully integrate EPA's ocean disposal programs into its other waste management activities. It also seems determined to put its own stamp on the ocean dumping program. For example, the Agency recently decided to scrap the consulting contract with Interstate Electronics Corporation for the study and formal designation of several dozen active ocean dumpsites throughout the U.S. Instead, it apparently intends to handle the site-study effort in-house. (The existence of an adequate in-house capability seems highly questionable).

While it is difficult to fault the desire to approach sewage sludge (or other waste) management on a multi-medium basis or to avoid the arbitrary classification of any one medium as totally off-limits to waste disposal, there is a danger in moving too far in the other direction. Not only may land have inherent waste disposal advantages over the ocean when a containment rather than dispersal medium is desired (e.g., for persistent toxic wastes), but the "common resource" aspects of the ocean may dictate special government protection beyond that necessary to safeguard land in the private property sphere. Specifically, the same logic which made it necessary for Congress to preclude building Federally-funded highways through public parks (unless there were no "prudent and feasible" alternatives) might well justify erecting at least marginally greater barriers to waste disposal in the ocean than on land.

Whatever the end result, it is clear that much will be happening on the ocean dumping front in the weeks and months ahead. It is hoped that the marine science community will actively involve itself in this process.

Kenneth S. Kamlet
National Wildlife Federation
1412 Sixteenth Street, NW
Washington, D.C. 20036
202-797-2945

## Book Review

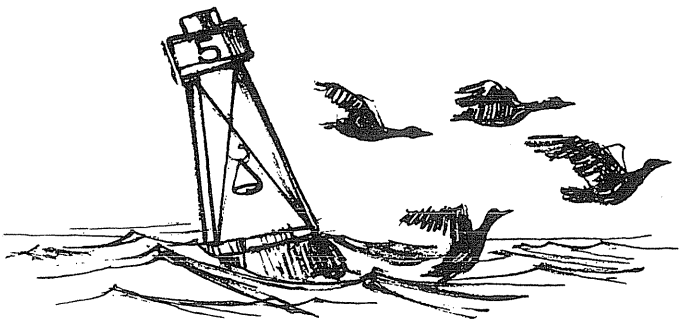
*Ocean Dumping of Industrial Wastes.* Edited by Bostwick H. Ketchum, Dana R. Kester, and P. Kilho Park. Plenum Press Marine Science Volume 12, 1981, 525 p.

Ocean dumping research in the United States in the early to mid-1970's suffered from a mentality produced from the focus on environmental impact statements or environmental assessments. This focus was to determine site specific effects subsequent to dumping with massive monitoring efforts. These approaches have not been effective for predicting the fate and behavior of wastes or the long-range effects of marine waste disposal. In the late 1970's, emphasis was placed on science and specific process studies.

This book (25 papers plus "Editors Future Prospects"), with its emphasis on physical, chemical, and biological processes, is the first product of such thinking. It also presents a historical overview, both national and international, and contributes to information exchange on a global pollution problem. A shortfall of the book is that with an emphasis on waste disposal in the deep ocean, it does not cover sedimentary processes. However, the forthcoming volumes from the second International Ocean Dumping Symposium (April 1980) will have a special volume on dredged material. Another shortcoming is that it assumes that, within the United States, ocean dumping may appear to be a "dead" issue (i.e., in view of the regulations and legislation to terminate "harmful ocean dumping" by 31 December 1981). However, we do not know what will be the long-range effects of the previous dumped industrial wastes or the effects of the dumping of "non-harmful wastes," therefore, what is now termed "non-harmful" may be "harmful" in the long term. In reality the 1981 deadline may prove impractical or unrealistic. Also, waste management technology is still in its infancy and its total expense in the future may reduce the interest to protect the marine environment.

In summary, the significance of this volume is that it is not a collection of papers, but an integration of related studies which focuses on the concepts and processes involved in marine waste disposal. This contribution is attributable to the diligence and hard work of the reviewers and editors.

Michael A. Champ
The American University
Washington, D.C. 20016
202-686-2177



*"O.K., remember — from here on in we don't drink the water!"*

**Information for Contributors**

There is no prescribed format for preparation of manuscripts because of the wide range of material accepted. Authors should be guided by articles in COPAS.

1. Articles should be typed double-spaced and should not exceed 1,000 words.
2. The title should be informative and brief.
3. On first use full name and acronym must be used. Subsequent reference may be by acronym alone.
4. Measurements should be given in the metric system
5. Figures and tables should be camera-ready and suitable for reduction to a 15.2 x 10.2 cm size, not including legend. Care should be taken with lettering and symbols so that they are readable when reduced. The combined number of figures and tables should not exceed three.
6. Proofs will not be sent to the author unless requested, but if significant editorial changes are made for brevity and clarity, authors will be contacted by telephone.
7. Reprints are not provided.
8. Deadlines for contributions are Janurary 25, April 10, July 10, and October 10. Send all correspondence and material to:

Coastal Ocean Pollution Assessment News
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News** is published quarterly. Subscription is free. Individuals wishing to subscribe should write to:
Coastal Ocean Pollution Assessment News
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794



**Address correction requested**

# COASTAL OCEAN POLLUTION ASSESSMENT NEWS

MAN AND THE MARINE ENVIRONMENT

Volume 1 Number 4 1981/1982


The purpose of **Coastal Ocean Pollution Assessment** (COPAS) **News** is to provide timely dissemination of information on pollution in coastal waters of the United States — its sources and effects, what is being done to eliminate or mitigate it, and what research and monitoring activities are being conducted to develop more effective strategies to manage it. We publish brief articles describing recent events and activities, new approaches to resolving chronic pollution problems, and early warnings of potential problems. Announcements of cruises, meetings, and investigations will be included.

Publication in COPAS is not to be construed as publication in the referred scientific literature. COPAS is not copyrighted, and any reference to material printed in COPAS should be approved by the author.




**Published by:**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794


## In This Issue



## Continuity

### Trace Metal Contamination of Samples Biases Rate Estimates of Heterotrophic Processes in Seawater

Trace metal contamination, particularly copper, appears to be more toxic to natural communities of marine bacterioplankton than previously believed. Radiotracer studies of dissolved free amino acid (DFAA) utilization by bacteria in seawater samples collected with trace metal clean technique (developed by seagoing trace metal chemists) demonstrates toxic response within the ambient range for copper in open ocean seawater (Sunda and Ferguson, in press). Demonstration of the extreme sensitivity of marine bacteria to copper, however, first required elimination of trace metal contamination, which invariably occurs in water samples collected with use of less rigorous standards for cleanliness (Boyl, 1975; Bruland et al., 1979; and Bruland, 1980). Additions of as little as 0.12 ppb copper to "clean" samples from oligotrophic stations in the central Gulf of Mexico inhibited DFAA utilization by bacteria. Higher concentrations, up to 5 ppb added copper with 6 h exposure, are required to cause 50% inhibition of measured DFAA utilization rates in samples from more productive neritic waters of the northern and northeastern Gulf of Mexico (Sunda and Ferguson, in press).

Kinetic analysis of DFAA utilization in uncontaminated samples (Ferguson, Sunda, and Palumbo, in prep.) indicate that DFAA is being cycled 4 times daily in neritic and about 1.3 times daily in oceanic surface waters. Values from comparison samples collected by us with traditionally employed technique and previous literature estimates for DFAA turnover are biased low due to sample contamination (Table 1). Our studies indicate that natural communities of bacterioplankton rapidly utilize DFAA at low ambient concentrations (Lee and Bada, 1977) and that they are particularly vulnerable to contamination. The high sensitivity of marine bacteria to copper in these short-term experiments (1-6 h) indicates a need to assess longer-term impacts of chronic trace metal contamination on planktonic food webs.

This research is being conducted in the Gulf of Mexico as part of a cooperative program between the Beaufort Laboratory of the Southeast Fisheries Center and the National Oceanic and Atmospheric Administration's Atlantic Oceanographic and Meteorological Laboratories in Miami. Its primary goal is to determine the effects of trace metal pollutants on larval fish food webs in the Gulf of Mexico. The project is funded by the Office of

Marine Pollution Assessment's Long-Range Effects Research Program.

TABLE 1

Amino acid turnover time (range and geometric mean in days) for samples collected in near surface marine waters in this study or reported previously in the literature (Williams and Yentsch, 1976; Williams et al., 1976) and in numerous authors cited in Hoppe, 1978. From Ferguson et al., in preparation.

| | This Study* | | Literature** |
|---|---|---|---|
| | Clean | Comparison | |
| | d | | |
| Neritic | 0.08 - 1.0 (0.23) N=52 | 0.07 - 10.4 (2.2) N=26 | 0.10 - 360 (5.6) |
| Oceanic | 0.34 - 2.0 (0.75) N=35 | 1.2 - 32 (4.9) N=2 | 16.0 - 400 (119) |

*Data for tritiated glutamic and mixed amino acids with "clean technique" and for more traditional "comparison technique" to collect sample water. Clean technique limits contact of sample water to acid-cleaned Teflon and ultra filtered air. Samples are collected with a Teflon-lined Go Flo sampler (General Oceanics) which is suspended on a Kevlar hydrowire (Dupont) and triggered with a Teflon messenger (Piotrowicz et al., in press). Water is subsampled in a laminar flow hood and dispensed with a Teflon-lined pipet (Brinkman, Dispensette). Comparison technique includes PVC Niskin sampler with internal rubber closure spring and exposure of sample water to ship's air in an oceanographic laboratory. All incubations were conducted in acid-cleaned Teflon.

**Data for $^{14}C$ and tritium-labeled single amino acids and for $^{14}C$-labeled mixed amino acids are geometric means of ranges reported by the authors.

References


Boyle, E. and J.M. Edmond. 1975. Copper in surface waters south of New Zealand. Nature 253:107-109.

Bruland, K.W., R.P. Franks, G.A. Knauer, and J.H. Martin. 1979. Sampling and analytical methods for the determination of copper, cadmium, zinc and nickel at the nanogram per liter level in sea water. Analyt. Chim. Acta 105:233-245.

Bruland, K. 1980. Oceanographic distributions of cadmium, zinc, nickel and copper in the North Pacific. Earth Planetary Sci. Lett. 47:176-198

Hoppe, H.G. 1978. Relations between active bacteria and heterotrophic potential in the sea. Neth. J. Sea Res. 12:78-98.

Lee, C. and J.L. Bada. 1977. Dissolved amino acids in the equatorial Pacific, the Sargasso Sea and Biscayne Bay. Limnol. Oceanogr. 22:502-510.

Piotrowicz, S.R., G.R. Harvey, M. Springer-Young, R.A. Courant and D.A. Boran. In press. Studies of cadmium, copper and zinc complexation by marine fulvic and humic materials using anodic stripping voltammetry. *In* Proc. NATO Advanced Research Institute Conference, Trace metals in seawater, Erice, Sicily.

Sunda, W.G. and R.L. Ferguson. In press. Sensitivity of natural bacterial communities to additions of copper and cupric ion activity: a bioassay of copper complexation in seawater. *In* Proc. NATO Advanced Research Institute Conference, Trace metals in seawater, Erice, Sicily.

Williams, P.J. LeB., T. Berman, and O. Holm-Hansen. 1976. Amino acid uptake and respiration by marine heterotrophs. Mar. Biol. 35:41-47.

Williams, P.J. LeB. and C.S. Yentsch. 1976. An examination of photosynthetic production, excretion of photosynthetic products, and heterotrophic utilization of dissolved organic compounds with reference to results from a coastal subtropical sea. Mar. Biol. 35:31-40.



R.L. Ferguson
W.G. Sunda
NOAA/NMFS
Southeast Fisheries Center
Beaufort Laboratory
Beaufort, NC 28516


## Influence of Organic Enrichment on Demersal Fishes

Organic input from terrestrial runoff, decaying marine biota, and sewage discharge can produce changes in coastal sedimentary environments that markedly alter the structure of benthic communities. While the influence of increased sediment organic content on benthic invertebrate communities has been described in detail (Pearson and Rosenberg, 1978), effects on demersal (i.e., bottom-dwelling) fishes rarely have been documented. The objectives of our study[1] are to evaluate the influence of sediment properties, particularly organic content, on demersal fish assemblages and to determine the extent to which observed relationships are an indirect result of the effects of sediment characteristics on benthic invertebrate communities, the primary food source of the fishes.

Fish populations, benthic invertebrate communities, and surficial sediments were sampled in three embayments of Central Puget Sound (Elliot Bay, Commencement Bay, and Sinclair Inlet) during late spring and early summer of 1981. Each embayment is influenced by sewage discharge from a major urban center (Seattle, Tacoma, and Bremerton). Seven experimental stations were established in depositional environments, while five control sites were located in nondepositional areas where water movements inhibit settlement of most suspended particles. Two of the three faunal zones identified for Puget Sound by Wingert and Miller (1979) were sampled by locating stations at depths of 12 and 35 m (seven and five stations, respectively). Fish assemblages were sampled by otter trawl during four diel periods (i.e., dawn, day, dusk, and night). Benthic invertebrate communities and surficial sediments were sampled at 5 stations along each trawl transect using a van Veen bottom grab.

Particle size distributions of sediment samples were determined with use of methods described in Folk (1968). Five physical sediment properties (i.e., median diameter, sorting, and percent sand, silt, and clay) were calculated. In addition, weight loss on ignition (LOI: 600 °C) was measured and used as an index of sediment organic content.

[1]Sponsored by the Office of Marine Pollution Assessment of the National Oceanographic and Atmospheric Administration.

Abundances of each fish species at depositional and corresponding control sites were compared using the Randomization Test for Matched Pairs (Siegel, 1956). Data were pooled across the four diel periods to represent total site use during a 24 h interval. Of the 11 most abundant species in the study area, nine showed a strong preference ($P < 0.10$) for either depositional or nondepositional environments (Table 1). Habitat preference of these nine species was further investigated by examining associations between fish abundance, stratified by depth, and each of the six sediment variables using Spearman's Rank Correlation Coefficient (Siegel, 1956). Ten of the total 17 species-depth pairs correlated strongest with LOI, suggesting that organic content is the sediment property with which the fish distributions are most closely associated. As correlation does not imply causation (Sokal and Rohlf, 1969), these results do not necessarily indicate a direct effect of enrichment on fishes. They do, however, suggest that LOI is the best index of the factor(s) to which the fishes respond directly.

TABLE 1

Comparisons of species abundance between depositional and non-depositional habitats using the Randomization Test for Matched Pairs (two-tailed).

| Species | Rank | P Value | Preferred Habitat |
|---|---|---|---|
| English sole *(Parophrys vetulis)* | 1 | 0.031 | depositional |
| Rock sole *(Lepidopsetta bilineata)* | 2 | 0.031 | nondepositional |
| Blackbelly eelpout *(Lycodopsis pacifica)* | 3 | 0.063 | depositional |
| Dover sole *(Microstomus pacificus)* | 4 | 0.063 | depositional |
| Ratfish *(Hydrolagus colliei)* | 5 | >0.1 | ---------- |
| Staghorn sculpin *(Leptocottus armatus)* | 6 | 0.031 | nondepositional |
| Pacific tomcod *(Microgadus proximus)* | 7 | >0.1 | ---------- |
| Flathead sole *(Hippoglossoides elassodon)* | 8 | 0.031 | depositional |
| Shiner perch *(Cymatogaster aggregata)* | 9 | 0.016 | nondepositional |
| Plainfin midshipman *(Porichthys notatus)* | 10 | 0.078 | depositional |
| Copper rickfish *(Sebastes caurinus)* | 11 | 0.031 | nondepositional |

The relationship between relative abundance, stratified by depth, and sediment organic content for the five species that correlated significantly ($P < 0.05$) with LOI is presented in Figure 1. The observed patterns suggest that the effect of enrichment on the major elements of these demersal fish assemblages is a continuous, transitional process rather than a series of discrete steps with well-defined critical points. Similar patterns were found by Pearson and Rosenberg (1978) for benthic invertebrates subjected to a temporal organic enrichment gradient.

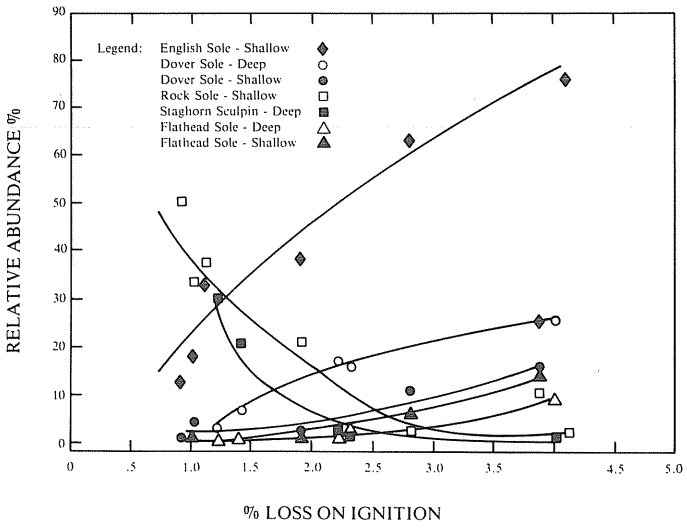



Figure 1. Relative abundances of 5 species along an enrichment gradient. (Curves were fit by eye.)

Preliminary support for the hypothesis that enrichment effects are mediated through feeding processes is given when the observed preference of English sole *(Parophrys vetulis)* for depositional habitats is considered in relation to the feeding success of this species. Success, as estimated by frequency of empty stomachs, was consistently greater in depositional than in nondepositional habitats (Fig. 2). These results suggest that the feeding ability of English sole is enhanced in its preferred habitat.

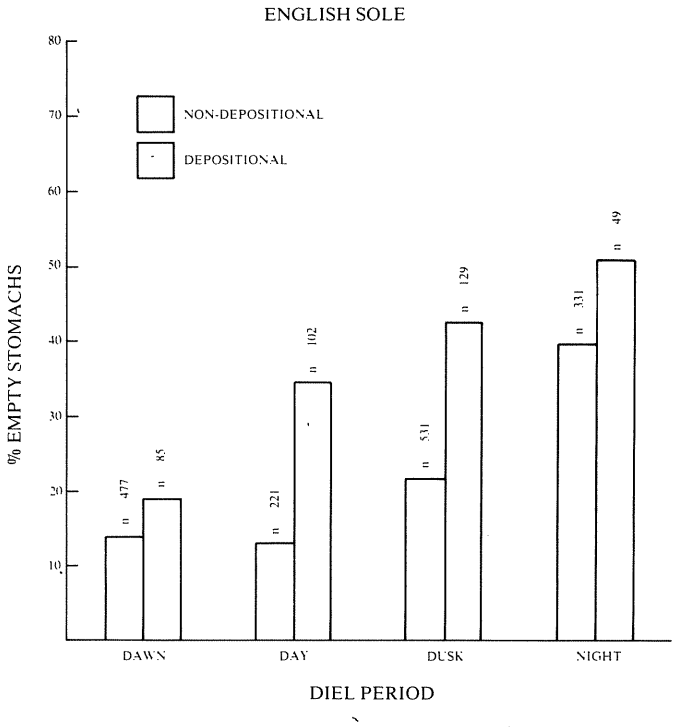



Figure 2. Comparison of percent empty stomachs of English sole captured in depositional and nondepositional habitats during 4 diel periods.

In summary, our results indicate that organic enrichment is a major structuring force of demersal fish assemblages in Central Puget Sound. In addition, feeding success of English sole suggests that the effects of enrichment are mediated through feeding processes. Comparative analyses of fish stomach and benthic invertebrate communities are in progress currently to more fully evaluate these initial conclusions.

A more detailed presentation of this study is available in the form of an annual report to the National Oceanic and Atmospheric Administration's Office of Marine Pollution Assessment, and can be obtained by request from the authors. The final report for this two-year study will be available in November, 1982.

References

Folk, R.L. 1968. Petrology of sedimentary rocks. University of Texas, Austin, TX. 170 pp.

Pearson, T.H. and R. Rosenberg. 1978. Macrobenthic succession in relation to organic enrichment and pollution in the marine environment. Oceanogr. Mar. Biol. 16:229-311.

Siegel, S. 1956. *Nonparametric statistics for the behavioral sciences.* McGraw-Hill, NY. 312 pp.

Weingert, R.C. and B.S. Miller. 1969. Distributional analysis of nearshore and demersal fish species groups and nearshore fish habitat associations in Puget Sound. FRI-UW-7901, Fisheries Research Institute, University of Washington, Seattle, WA. 110 pp.

D. Scott Becker
Nancy L. Gerrish
Kenneth K. Chew
School of Fisheries
University of Washington
Seattle, WA 98195

## Concentrations of Organic Toxicants in Salmon, Cod, and Sole from Puget Sound

One aspect of a recent cooperative study between the National Oceanic and Atmospheric Administration (NOAA)'s Pacific Office of Marine Pollution Assessment (OMPA) and the Environmental Conservation (EC) Division of the Northwest and Alaska Fisheries Center (NWAFC) was to determine the concentrations of certain organic toxicants (Table 1) in blackmouth salmon *(Oncorhynchus tshawytscha),* Pacific cod *(Gadus macrocephalus),* and English sole *(Parophrys vetulus)* in Puget Sound. These toxicants included aromatic hydrocarbons (AHs), polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB), polychlorinated butadienes (CBDs), and chlorinated pesticides. The fish species were selected because of their recreational and commercial importance and their respective habitats and feeding strategies. The test animals were collected from Elliott and Commencement Bays, areas where sediment samples were known to contain high concentrations of the target chemicals, and from relatively noncontaminated reference areas (Point Jefferson, Case Inlet, or Port Madison, Fig. 1).

Aromatic hydrocarbons usually were not detected in the liver or skeletal muscle of salmon, cod, or sole [detection limits were 2 ppb (ng/g) wet weight]. These findings are consistent with recent

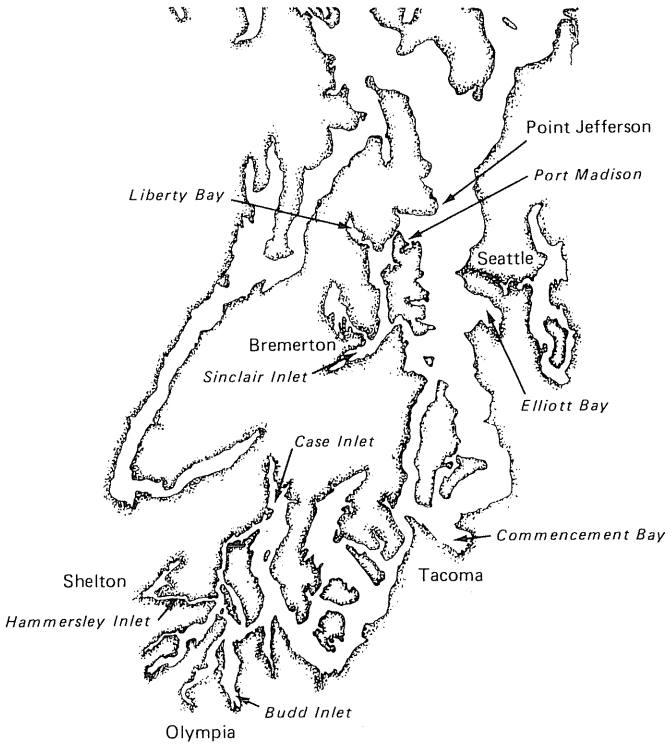



Figure 1. Map of Puget Sound. Salmon, cod, and sole were obtained for chemical analysis from Commencement Bay, Elliott Bay, and a reference area near Point Jefferson.

observations that aromatic hydrocarbons are converted readily to oxygenated products in fish (Malins et al., 1980, 1981 and references contained therein), which are not detected by current analytical techniques.

In contrast, PCBs, which characteristically are poorly metabolized by fish and other animal species, were present in liver and muscle of all of the fish collected. It should be recognized that many factors (e.g., habitat, residence time, diet, age, sex, and the content and distribution of lipids) affect the accumulation of PCBs by different species of fish. Many of these factors cannot be quantified in a modest study such as this. Table 2 shows the extent to which the three fish species, which reside in three distinct habitats, accumulated PCBs in their livers and skeletal muscle. English sole, which spend most of their lives in direct contact with bottom sediment, contained the highest concentrations of PCBs. Cod, which generally dwell in the lower reaches of the water column and may feed on sediment-associated fauna, had high concentrations of PCBs in the liver, in some cases comparable with concentrations found in sole livers. The PCB concentrations in cod skeletal muscle were the lowest of the three species considered. The difference in concentrations of PCBs between cod liver and cod muscle is in part due to the high oil content in the liver. Salmon, typically a midwater fish which has little direct contact with bottom sediment, had low concentrations of PCBs in both the liver and skeletal muscle.

The findings were, therefore, that the PCBs in the skeletal muscle of salmon and cod and in the liver of salmon generally occurred at such low concentrations that they were barely detectable by the best existing analytical techniques. In contrast, the concentrations of PCBs in the skeletal muscle of sole and in both sole and cod liver were much higher.

TABLE 1

List of the target organic compounds analyzed in salmon, cod, and sole collected from three areas in Puget Sound.

| Aromatic Compounds (AHs) | Chlorinated Hydrocarbons | |
|---|---|---|
| O-Xylene | Hexachlorobenzene | |
| Isopropylbenzene | Lindane ($\gamma$-BHC | |
| n-Propylbenzene | Heptachlor) | |
| Indan | Aldrin | |
| 1,2,3,4-Tetramethylbenzene | o, p'-DDE | |
| Napthalene | $\alpha$-Chlordane | |
| Benzothiophene | trans onachlor | |
| 2-Methylnaphthalene | p,p'-DDE | |
| 1-Methylnaphthalene | o,p'-DDD | |
| Biphenyl | m,p'-DDD | |
| 2,6-Dimethylnaphthalene | p,p'-DDD | |
| Acenaphthene | o,p'-DDT | |
| 2,3,5-Trimethylnaphthalene | p,p'-DDT | |
| Fluorene | Dichlorobiphenyls | PCBs[1] |
| Dibenzothiophene | Trichlorobiphenyls | |
| Phenanthrene | Tetrachlorobiphenyls | |
| Anthracene | Pentachlorobiphenyls | |
| 1-Methylphenanthrene | Hexachlorobiphenyls | |
| 3,6-Dimethylphenanthrene | Heptachlorobiphenyls | |
| Fluoranthene | Octachlorobiphenyls | |
| Pyrene | Nonachlorobiphenyls | |
| Benz [a] anthracene | Dichlorobenzene | |
| Chrysene | Trichlorobutadiene | CBDs |
| Benzo [e]pyrene | Tetrachlorobutadiene | |
| Benzo [a]pyrene | Pentachlorobutadiene | |
| Perylene | Hexachlorobutadiene | |
| Dibenzanthracene | | |

[1]PCBs are the sum of the concentrations of the 8 groups of isomers.

TABLE 2

Mean concentrations (and ranges) of PCBs ng/g (ppb) wet weight in liver and skeletal muscle of adult salmon, cod and sole[a] captured from Elliott Bay, Commencement Bay, and reference areas.

| Sampling Area | Sole (5)[b] | | Salmon (5)[b] | | Cod (3)[b] | |
|---|---|---|---|---|---|---|
| | Liver | Muscle | Liver | Muscle | Liver | Muscle |
| Elliott Bay | 9200 | 1000 | 130[c] | 150[c] | 3800[c] | 36[c] |
| | (2100-16000) | (270-2100) | (99-160) | (140-150) | (3300-4200) | (14-38) |
| Commencement | 7400 | 590 | 87 | 44 | 2500 | 42 |
| Bay | (1500-24000) | (160-860) | (63-190) | (39-57) | (2200-2700) | (31-49) |
| Reference | 470[c] | e | 92 | 83 | 1500 | 10 |
| Area[d] | (340-590) | | (41-150) | (28-130) | (700-2000) | (6.8-14) |

[a]The lengths of the fishes used were: English sole - 350 mm ± 55mm, n = 27; salmon - 500 mm ± 140 mm, n = 15; and cod - 440 mm ± 37 mm, n = 9.

[b]Number of individual samples analyzed from each sampling area.

[c]Composite samples, each consisting of two or more fish.

[d]Reference area for salmon and cod was Point Jefferson; for sole, Port Madison and Case Inlet.

[e]Sample not analyzed.

Other chlorinated compounds such as HCB and CBDs were found in low concentrations in the liver and muscle of salmon and cod from all three areas. Relatively high concentrations of these two chemicals were found, however, in sole from Commencement Bay. In addition, sole from Commencement Bay contained highly complex mixtures of other chlorinated compounds, most of which cannot be identified due to the difficulty in separation and the lack of reference standards (compounds). These findings point out the need to develop techniques to identify these compounds.

Overall, little chemical contamination was found in the limited number of analyses performed on edible tissue (skeletal muscle) of salmon and cod from Puget Sound. English sole from polluted areas, on the other hand, contained levels of PCBs (as well as complex mixtures of other chlorinated compounds) in the edible tissue, similar to those found in related species such as winter and windowpane flounders from the New York Bight (MacLeod et al., 1981). It is not known whether or not these chemicals are affecting the health of the fish or the consumer. Well conceived and coordinated studies are needed to resolve these issues.

References

MacLeod, W.D., Jr., L.S. Ramos, A.J. Friedman, D.G. Burrows, P.G. Prohaska, D.L. Fisher, and D.W. Brown. 1981. Analysis of Residual Chlorinated Hydrocarbons, Aromatic Hydrocarbons and Related Compounds in Selected Sources, Sinks and Biota of the New York Bight. NOAA Tech. Memo. OMPA-6. 128 pp.

Malins, D.C., S-L. Chan, B.B. McCain, D.W. Brown, A.K. Sparks, and H.O. Hodgins. 1981. Puget Sound Pollution and its Effects on Marine Biota, submitted as a Progress Report to Marine Ecosystems Analysis Puget Sound Project, Office of Marine Pollution Assessment, 7600 Sand Point Way N.E., Seattle, WA 98115.

Malins, D.C., B.B. McCain, D.W. Brown, A.K. Sparks, and H.O. Hodgins. 1980. Chemical Contaminants and Biological Abnormalities in Central and Southern Puget Sound. NOAA Tech. Memo. OMPA-2. 295 pp.

Donald C. Malins
Environmental Conservation Division
Northwest and Alaska Fisheries Center
NOAA/NMFS
2725 Montlake Boulevard East
Seattle, WA 98112

# Loomings

## Presence of the Toxic Dinoflagellate *Gonyaulax tamarensis* in Southern New England Waters

The planktonic dinoflagellate *Gonyaulax tamarensis* is the causative agent of paralytic shellfish poisoning (PSP). Until recently its most southerly records were in several embayments on the south shore of Cape Cod. However, in a survey of sediments in Connecticut, Rhode Island, and New York, cysts were discovered in nine sites (Anderson et al., in press). In Connecticut, cysts were observed in three bays east of New London. On Long Island, cysts were noted in two north shore harbors and at four locations on the south shore. Anderson and co-workers examined sediments from 75 sites in the three states. One location had cyst densities comparable to those in areas closed to shellfishing as a result of PSP. Long Island cysts were cultured by

Anderson and were shown to be toxic by Y. Shimizu of the University of Rhode Island.

*Gonyaulax tamarensis* typically overwinters in sediments as a thick-walled hypnocyst. Excystment occurs upon warming in the spring. If favorable conditions are present, the planktonic stage may bloom; however, if the environment is unfavorable the organism forms a pellicle cyst to survive until conditions again are favorable. The pellicle cyst has thinner walls than the hypnocyst and is not capable of long-term survival. Typically, *G. tamarensis* survives in the hypnocyst stage in winter and summer and is in the planktonic stage in spring and fall.

Paralytic shellfish poisoning is produced by several toxins, all of which have a similar molecular structure. The toxins resemble purine and are thought to be involved in synthesis of nucleic acids. Toxicity is caused by blockage, by the toxin, of membrane sodium channels, thus preventing depolarization. Shellfish consume the dinoflagellate as food and while they are not harmful, they can be toxic to a person who eats them. Symptoms of PSP are numbness around the mouth, tingling in the extremities, nausea, lack of balance, and difficulty breathing. There have been about 300 fatalities worldwide.

The New York State Sea Grant Institute, together with the New York State Department of Environmental Conservation and the Suffolk County Department of Health Services, will fund a study on the distribution and density of *Gonyaulax tamarensis* in Long Island waters. The study will be carried out by students from the Marine Sciences Research Center at The State University of New York at Stony Brook with guidance from E. J. Carpenter at Stony Brook and Donald M. Anderson of the Woods Hole Oceanographic Institution.

Edward J. Carpenter
Marine Sciences Research Center
State University of New York
at Stony Brook
Long Island, NY 11794
516-246-8307

References

Anderson, D.M. D.M. Kulis, J.A. Orphanos, and A. R. Ceurvels, in press. Distribution of the toxic dinoflagellate *Gonyaulax tamarensis* in the southern New England region. Estuarine and Coastal Mar. Sci.

# Research & Monitoring Updates

## Long Island Sound Dredged Material Containment Study

Long Island Sound has long posed special problems to marine navigation because of its large, sediment-contributing watershed, and its importance as an avenue of water-borne commerce as well as a recreational boating area. In the last decade, difficulty has been encountered in completing dredging projects required to maintain rivers and harbors and keep them safe for commercial and recreational boat traffic. The major cause of this difficulty has been a growing resistance to the traditional open-water disposal method of dredge material.

In response, the Corps of Engineers, New England Division, has implemented a program to seek alternative ways of handling dredged material. A priority alternative being considered is the possibility of developing dredged material confinement areas designed to accommodate portions of the Sound's dredged material load for a number of years. Three types of confinement basins are receiving attention: (1) medium or small structures located along and attached to shorelines; (2) detached containment facilities located in shallow water (10.7 m or less) which, when filled, could become artificial islands; and (3) wetland habitat creation consisting of semi-enclosed areas. A key issue is the chemical and physical nature of the dredged materials, which may be used for productive habitat creation or enhancement, or which are heavily contaminated and will require complete confinement.

The authority to conduct this study is outlined in a resolution of the Committee on Public Works and Transportation (U.S. House of Representatives), sponsored jointly by three Connecticut congressmen and adopted 10 May 1977.

Preliminary site identification and screening has been completed for over 300 shoreline and shallow water locations. A series of public workshops at selected locations around Long Island Sound was held between 18 and 21 May 1981 to inform special interest groups and the general public of the study.

Prototype environmental impact studies are planned for at least three sites to determine the overall environmental and economic feasibility of the construction of such facilities. An important component of the study will be a comparative analysis to open-water disposal operations.

Gilbert L. Chase
Impact Analysis Branch
New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

## National Assessment of Requirements for Monitoring Marine Pollution

The Office of Marine Pollution Assessment (OMPA) of the National Oceanic and Atmospheric Administration (NOAA) held six regional workshops on marine pollution monitoring requirements in cooperation with the National Ocean Survey and the Office of Ocean Technology and Engineering Services of NOAA. The workshops were part of the development of the second Federal Plan for Ocean Pollution Research, Development, and Monitoring, mandated by the National Ocean Pollution Planning Act of 1978 (Public Law 95-273).

The workshops were held between September 1980 and February 1981 in geographical regions coincident with the designated regions of the Environmental Protection Agency (EPA), and were cosponsored by EPA Regional Offices in each coastal region; one workshop involving the Great Lakes was cosponsored by the International Joint Commission. The locations were: Northeast—Stony Brook, New York; Southwest—Pasadena, California; Western Gulf—New Orleans, Louisiana; Northwest—Seattle, Washington; Southeast—Atlanta, Georgia; and Great Lakes—Ann Arbor, Michigan.

Invitees to the workshops were selected to achieve a balance among Federal, state, and local governments, environmental organizations, and industry, and between technical experts and managers.The intent of the workshops was to address broad objectives concerning the development of guidelines, strategies, and approaches for operational ocean pollution monitoring programs with the aim of improving overall effectiveness and minimizing costs. Descriptions and assessments of existing monitoring programs and a definition of additional monitoring needs were also stated.

In addition to individual workshop reports, a national assessment report was issued, entitled "Assessment of Great Lakes and Ocean Pollution Monitoring in the United States." The national report combines the findings that appeared most commonly in all workshops. Recommendations fall under the following categories: (1) coordination; (2) data, information, and quality assurance; (3) synthesis; (4) program evaluation; (5) compliance monitoring; (6) ecosystem investigations; (7) trend assessment monitoring; and (8) technology development.

The report recommends strongly local involvement in the design and execution of regional pollution monitoring programs, in the review and update of monitoring program designs, and in the rationalization of monitoring guidelines imposed on local agencies and industry. Further, it recommends that functions such as regional coordination, effective information dissemination, and synthesis and interpretation of monitoring results should be undertaken by NOAA.

Individual workshop reports and the national assessment report are available from:

George Peter
NOAA/OMPA
11400 Rockville Pike
Rockville, MD 20852

## Ocean Pollution Data and Information Network Being Developed

The Central Coordination and Referral Office (CCRO) of the developing Ocean Pollution Data and Information Network (OPDIN) has recently been established at the National Oceanographic Data Center (NODC), Environmental Data and Information Service (EDIS), National Oceanic and Atmospheric Administration. The function of this office is to develop or strengthen Federal capabilities for timely acquisition, processing, and dissemination of useful marine pollution data and information, and to coordinate and improve Federal interagency, as well as state, local and private sector communications concerning marine pollution data activities. Mr. John J. Audet was assigned to manage this office, effective 4 May 1981.

The office was established in response to the 1978 recommendations of the Interagency Committee on Ocean Pollution Research, Development, and Monitoring, and more specifically, the April 1979 report by the Interagency Committee's Subcommittee on Ocean Pollution Data Collection, Storage, and Distribution. This Subcommittee was formed to address Section 8 (Information Dissemination) of the National Ocean Pollution Planning Act of 1978 (PL 95-273). Its recommendations were in turn refined and modified by an EDIS-sponsored workshop on Marine Pollution Information Management, held in Frederick, Maryland in January 1981 (see COPAS, Winter 1981). The results of the workshop included an endorsement of the OPDIN as a mechanism to facilitate acquisition and dissemination of marine pollution data and information. Other recommendations included establishment of a series of Regional Coordination and Referral Offices (RCROs), reasonable cost recovery for network operations, and maintenance by the CCRO of a list of vendors providing data synthesis services.

The OPDIN is intended to supplement and coordinate rather than replace existing agency data and information sources. The network will operate with existing facilities as much as possible. The final version of the OPDIN is scheduled for operational implementation in 1984. Ongoing activities in system design, improvements in the capabilities of the five EDIS/NODC liaison offices (so that they can serve as the initial RCROs), and improved communication and data dissemination within Federal agencies involved with marine pollution data are some of the efforts being coordinated by the CCRO as part of the current OPDIN operations.

As its name indicates, this office will have two main tasks: (1) it will assume a major role in fostering standard procedures for the management of marine pollution data and information; and (2) it will serve as a single, central point of contact for users who are having difficulty in locating a product or service that they need. Marine pollution data collectors and users who have special problems or concerns and who are unsure of where to turn for assistance are encouraged to contact the CCRO.

John J. Audet
NOAA/EDIS
National Oceanographic Data Center
Washington, D.C. 20235
202-634-7510

# Announcements

## Research Proposals Funded by NOAA's Office of Marine Pollution Assessment's Ocean Dumping Program, Long-Range Effects Research Program, and Financial Support Program in Fiscal Year 1981

The Office of Marine Pollution Assessment (OMPA) provides the focus for the National Oceanic and Atmospheric Administration (NOAA)'s programs and activities in marine pollution research, development, monitoring, and assessment. This responsibility includes conducting an assessment of the short-term and long-term impacts of pollution that result from man's utilization of the marine environment. The overall goal of these programs and activities is to identify, develop, and implement rational management strategies to permit optimum balance between use and quality of the marine environment.

In order to fulfill its broad functional responsibilities, OMPA encourages and supports a program of research projects or activities that are conducted by non-OMPA organizations or in-

dividuals. This program is designed to complement existing efforts and has the programmatic objective of improving management capability.

Work is authorized and implemented under several legislative mandates. One of these is the Marine Protection, Research, and Sanctuaries Act, Public Law 92-532. NOAA's Long-Range Effects Research Program (L-RERP) is responsible for carrying out the provisions of Section 202 of this Act. A more detailed description of L-RERP activities is provided in the Winter 1981 issue of COPAS (Volume 1, Number 2). Another legislative mandate is the National Ocean Pollution Research and Development and Monitoring Planning Act, Public Law 95-273. A description of this Act, and of the Five-Year Federal Plan designed under its auspices, is also included in the Winter 1981 issue of COPAS.

An announcement of OMPA's research support programs was made in December 1980, in scientific, technical, and other media. Included in the announcement was information on requesting a comprehensive guidance package for preparing proposals. The package provided statements of the areas of program interest, proposal review procedures, evaluation criteria, and proposal preparation requirements. By the end of March 1981 closing date, 258 proposals had been received as a result of this announcement.

The proposal review procedure consisted of several steps. In contrast with some Federal programs, the objective of this review procedure was to identify proposals which addressed the programmatic objectives that utilized the best quality of science available. To this end, all of the proposals were reviewed to determine responsiveness to the fiscal year (FY) 81 OMPA priorities outlined in the guidance package. A minimum of three reviewers (and a maximum of eight) read all proposals and graded them in terms of degree of programmatic relevance. The procedure was specifically designed to preclude overlooking highly relevant or relevant proposals. At the completion of this review, conducted by OMPA personnel, an identifiable group of proposals had emerged (98), evaluated as most relevant to program objectives.

A mail review procedure was then employed to consider the scientific and technical content of this group of proposals. In this second stage of review the 98 proposals were evaluated by at least three reviewers. All mail reviewers received a copy of guidelines outlining and defining factors to be considered during their evaluation and requesting both specific comments and an overall rating (Excellent, Very Good, Fair, Poor) of the scientific quality of the proposal. Programmatic relevance was *not* considered during this stage of the review. In all, there were 300 reviews returned; 132 from university reviewers, 78 from reviewers at Federal agencies, 81 from reviewers in the private sector, and 9 from reviewers at state agencies. The distribution of individual grades of scientific quality was:

(1) Excellent - 36;
(2) Very Good - 84;
(3) Good - 66;
(4) Fair - 69;
and
(5) Poor - 45.

The third stage of the review combined the relevance and scientific quality scores. The 98 proposals considered at this stage were distributed as indicated in Fig. 1, based on the combined grades received.

All of these proposals then underwent a final review, in which programmatic priorities and funding limitations were considered. This final ranking resulted in recommendations for support of 23 proposals representing 1.8 million dollars of new grants. Of these proposals, 20 were submitted from academia, two by private research organizations, and one by a Federal laboratory. A listing of the individual proposals funded is included with this article.

| RELEVANCE | Highest | Good | Marginal | |
|---|---|---|---|---|
| Highest | 10 | 9 | 5 | 24 |
| Good | 20 | 28 | 4 | 52 |
| Marginal | 10 | 9 | 3 | 22 |
| | 40 | 46 | 12 | 98 |

Robert E. Burns
NOAA/OMPA
7600 Sand Point Way N.E.
Bin C15700
Seattle, WA 98115

**TABLE 1**
**Research Proposals Funded in FY81**
**by the**
**Office of Marine Pollution Assessment's**
**Ocean Dumping Program, Long-Range Effects Research Program, and Financial Support Program**

**Ocean Dumping Program**
**(Section 201 P.L.92-532)**

| Principal Investigator | Institution | Title | Award |
|---|---|---|---|
| Gibbs, Ronald J. | University of Delaware | Particle Dynamics of Sewage Sludge Dumping in the Ocean | $77,987 |
| Roesijadi, G. | Batelle, Pacific Northwest Laboratories | Significance of Metal-Binding Proteins and Lysosome-Like Vesicles in Mussels in a Metal-Contaminated Environment: An Experiment Field Study | 94,354 |
| Leschine, Thomas M. | Woods Hole Oceanographic Institution | The Development of Strategies for Managing the Social, Economic, and Environmental Impacts of Ocean Dumping in a Region | 67,906 |
| Boehm, Paul D. | Energy Resources Co., Inc. (ERCO) | Organic Pollutant Transforms and Bioaccumulation of Pollutants in the Benthos From Waste Disposal-Associated Sediments. | 85,584 |
| Hunt, James R. | University of California | Pollutant Particle Coagulation in Seawater | 87,895 |
| Thompson, Ida | Rutgers University | Monitoring the Effects of Sludge and Acid Waste Dumping Using the Annual Shell Increments of the Ocean Quahog *Artica islandica.* | 53,241 |
| | | TOTAL | $466,967 |
| | | Average | $ 77,828 |

**Long-Range Effects Research Program**
**(Section 202 P.L. 92-532)**

| Principal Investigator | Institution | Title | Award |
|---|---|---|---|
| Sanders, James G. | Academy of Natural Sciences of Philadelphia | Adaptive Behavior of Euryhaline Phytoplankton to Stress: Response to Chronic, Low-Level Additions of Trace Metals | $89,128 |
| Santschi, Peter | Columbia University | Removal and Fate of Pollutant Trace Metals in Coastal Waters | 51,162 |
| Wakeham, Stuart G. | Woods Hole Oceanographic Institution | Fates and Persistence of Pollutant Volatile Organic Compounds in Estuarine and Coastal Seawater: Microcosm Studies Using Radiolabelled Model Compounds | 75,258 |
| Stoecker, Diane K. | Woods Hole Oceanographic Institution | Effects of Trace Metals on the Microzooplankton Link in Gulf of Mexico Food Webs | 66,502 |
| Snedaker, Samuel C. | University of Miami | Uptake, Transformation and Effects of Water-Borne Pollutants on Intertidal Woody Halophytes | 58,984 |
| Klump, J. Val | University of Wisconsin | The Fate and Transfer of Organic Pollutants in Benthic System | 66,710 |
| Grassle, Judith P. | Marine Biological Laboratory | PCB's in Marine Sediments; Effects, Uptake, and Metabolism in Opportunistic Polychaetes | 88,265 |
| Calabrese, Anthony | NOAA/NMFS/ NEFC, Milford Laboratories | Influence of Water Quality and Body Burdens on Compromising the Movements of Fish: Environmental Correlates of Striped Bass and Smelt Locomotor Capacity. | 53,500 |
| | | TOTAL | $549,509 |
| | | Average | $ 68,689 |

**Financial Support Program**
**(Section 6, P.L. 95-273)**

| Principal Investigator | Institution | Title | Award |
|---|---|---|---|
| Pfaender, Frederic K. | University of North Carolina | Particulate-Dissolved Partitioning and Fate of Toxic Organics in Estuarine Environments | $109,079 |
| Flint, R. Warren | University of Texas | Marine Ecosystem Monitoring: Integrated Impact Assessment | 90,080 |
| Scrudato, R.J. | State University of New York & Oswego St. College | The Bioavailability of the Lake Ontario Contaminant, Mirex | 115,588 |
| Cheng, Lanna | University of California, San Diego | Transfer of Cadmium from Sea-Skaters to Seabirds | 32,871 |
| Soule, Dorothy F. | University of Southern California | Assessment of the Ocean Disposal Alternatives for Management of Fish Processing Wastes | 118,601 |
| Pamatmat, Mario M. | San Francisco State University | Measuring the Toxic Effects of Long-Buried Chemical Wastes in Marine and Estuarine Sediments | 78,588 |
| Brown, Gardner M. | University of Washington | A Bioeconomic Valuation of Alternative Strategies to Manage a Fishery Recovering from a Catastrophe | 80,334 |
| Anderson, Donald M. | Woods Hole Oceanographic Institution | Effects of Coastal Development and Land Use on the Spreading of Toxic Red Tides | 68,290 |
| Lane, Patricia | Harvard College | A Qualitative Approach to Cause and Effect in Evaluating Marine Pollution | 67,634 |
| | | TOTAL | $761,065 |
| | | Average | $ 84,563 |

## New Edition of Guide to Marine Science Acronyms

ICES, GEOSECS, POLYMODE, OCSEAP, CTD, WHOI, BNDO. The literature of the marine sciences is awash with acronyms of organizations, programs, projects, expeditions, instruments, and institutions. Even when we remember their exact wording, the significance of many of these shorthand terms may escape us. To help researchers, students, technical writers, information specialists, and others cope with this inevitable side-effect of big science, the National Oceanographic Data Center (yes, NODC) announces publication of the third edition of *Annotated Acronyms and Abbreviations of Marine Science Related Activities.*

This handy reference work, first published in 1969, has been completely revised and expanded. At 349 pages, it is three times as long as the second edition. Originally covering only acronyms and abbreviations of international organizations and activities, it now includes acronyms and abbreviations of both U.S. and foreign organizations and activities. The U.S. section covers the Federal government, state agencies and organizations, and regional and private organizations; the foreign section is a survey by country.

The organization and format of this publication make it more than a list of acronym titles. Acronyms and abbreviations are described in context by entries that are grouped to show pertinent relationships. Two alphabetical indexes—one listing acronyms and abbreviations and the other listing full titles—provide keys to the text entries.

*Annotated Acronyms* is available from NODC for a three-dollar handling charge.

Richard J. Abram
NOAA/EDIS
National Oceanographic Data Center
Washington, D.C. 20235
202-634-7500

## OCSEAP Data Products Catalog

The National Oceanographic Data Center (NODC) announces availability of Part 4 of the *Catalog of OCSEAP Data.* This publication contains examples of graphic data products and data summaries developed in support of the Alaska Outer Continental Shelf Environmental Assessment Program (OCSEAP).

OCSEAP was initiated by the Bureau of Land Management (BLM) to assess environmental effects of offshore oil and gas development. Study programs for designated Alaskan lease areas, as well as nonsite specific studies, are being conducted for BLM by the OCSEAP Offices of the National Oceanic and Atmospheric Administration (NOAA). NODC and the National Geophysical and Solar-Terrestrial Data Center (NGSDC), two of the centers within NOAA's Environmental Data and Information Service (EDIS), have primary responsibility for processing and storing most of the OCSEAP data in comprehensive, interdisciplinary data bases.

Other facilities besides the EDIS data centers also provide data processing and analytical support services to OCSEAP investigators, and their data products are included in the catalog. Among these are the Arctic Environmental Information and Data Center, NOAA's Pacific Marine Environmental Laboratory, the Data Projects Group at the University of Rhode Island, and the National Institutes of Health. In general, OCSEAP products generated by these facilities are not routinely available to all OCSEAP investigators or to the public, but they often can be made available through special arrangements with OCSEAP management or with the individual facilities.

In cooperation with the OCSEAP offices and investigators, NODC and NGSDC have developed digital data formats, known as "file types", for recording and archiving OCSEAP data. Most data products in the catalog are derived from and refer to data in a specific file type. The presentations are grouped by discipline, including physical oceanography, ocean dynamics, marine chemistry, marine biology, marine geology/geophysics, microbiology, and data validation and data management.

Part 4 of the *Catalog of OCSEAP Data,* other parts of the catalog published previously, and further information about OCSEAP data and data products are available on request from the NODC.

James Audet
NOAA/EDIS
National Oceanographic Data Center
Washington, D.C. 20235
202-634-7441

# Calendar

**April**

**19-21**

Underwater Technology Conference, Bergen, Norway. Contact: Ingrid McMullin, UTC Secretary, P.O. Box 4252, N-5013 Bergen/Nygardstangen, Norway.

**19-22**

Hazardous Material Spills Conference, Milwaukee Exposition and Convention Center, Milwaukee, WI. Contact: 1982 Hazardous Material Spills Conference, Suite 700, 1629 K Street N.W., Washington D.C. 20006 (202-296-8246).

**May**

**22**

State of the Sound Conference: Dredging and Dredged Disposal Alternatives, Marine Sciences Research Center, SUNY Stony Brook, Long Island, NY 11794. Contact: Whitney Tilt, Long Island Sound Task Force (203-327-9786) or Henry Bokuniewicz, Marine Sciences Research Center (516-246-8306).

**August**

**2-13**

Joint Oceanographic Assembly, Dalhousie University, Halifax, Nova Scotia, Canada. Contact: Leo O'Quinn, JOA, 240 Sparks Street, 7th Floor West, Ottawa, Ontario, Canada K1A OE6.

**September**

**20-22**

Oceans '82: Government, Industry, and Academia — Partners in Ocean Progress, Shoreham Hotel, Washington, D.C. Contact: 1730 M Street N.W., Suite 412, Washington, D.C. 20036 (202-659-3251).

**October**

**4-9**

Fifty-fourth Annual Water Pollution Control Federation Conference, Detroit, MI. Contact: Conference Department, Water Pollution Control Federation, 2626 Pennsylvania Avenue N.W., Washington, D.C. 20037.

# Viewpoints

## Environmentalists Have Get-Acquainted Meeting with NOAA Administrator John Byrne

Nine senior representatives of eight national environmental and conservation organizations met 8 September 1981 with the National Oceanic and Atmospheric Administration (NOAA)'s new Administrator Dr. John V. Byrne. The organizations represented were: Center for Environmental Education, Conservation Federation, Defenders of the Earth, Environmental Policy Center, Friends of the Earth, National Audubon Society, National Wildlife Federation, and Natural Resources Defense Council. This article represents the views of one of the representatives as to the outcome of the meeting. Byrne impressed the participants as being personable and sympathetic on most issues, working on mastering the intricacies of the bureaucracy he was appointed to head. The representatives expressed concern that Dr. Byrne preserve the autonomy and jurisdiction that NOAA has enjoyed. The meeting was billed primarily as an opportunity for the environmental community to acquaint the new Administrator with its own concerns and priorities. What follows is a capsule summary of the highlights of the meeting.

(1) COASTAL ZONE MANAGEMENT (CZM)

*Issue:* There is a need to preserve this unique program that addresses important national interest, and gives a lot of value at little cost. Work with the states must continue, to ensure that Federal CZM dollars are well spent. States like New York and Florida, with new CZM programs, need sufficient funds to get their programs off the ground.The integrity of the CZM office must be maintained and its able staff retained. It is hoped that the

office won't be broken up as part of any reorganization, and that the new office heads will be well-qualified.

*Byrne:* Dr. Byrne regards the CZM program as very important. He believes that the "carrot" approach used in the first phase of the program has worked "reasonably well." ("We have some sort of management program approved for nearly the entire coastline.") He believes that responsibility in the second phase of the program will rest, to a great extent, with the states. "But by the same token, you need someone who is cognizant of issues that transcend state boundaries." Dr. Byrne agrees that the CZM program is "going to stay" and "it's going to be important."

*Issue:* There is a need to avoid an abrupt ending of CZM funding (as opposed to gradual phase-down).

*Byrne:* We all understand the budget process and we know that we don't always end up with everything we want.

*Issue:* We have to be concerned over the total reversal of past Administration positions on the "Federal consistency" provision. How can NOAA's new position on "Federal consistency" be reconciled with this Administration's support for states rights?

*Byrne:* We're all partners in the same system. The system often involves conflicts among branches of government, between the states and the Federal government, etc. It behooves each of us to do our job as best we can. Hopefully, the system will ensure the best final outcome. NOAA is part of a larger entity. "We don't totally control our destiny or fate." It's a tough issue that is currently in litigation. It's not a dead issue. We're still in the process of change.

*Issue:* What role will NOAA take in commenting on proposed OCS lease sales?

*Byrne:* We'll approach these issues straightforwardly—at least at the outset. I regard NOAA as a service and science agency that is dedicated to learning the truth. When we come out with a position, that position will be based on our best assessment of the evidence. Things may not always come out the way we would like them to, however. ("We may not always agree with you, but I hope we'll always listen to you.")

*Issue:* There is a need for NOAA to support Barrier Island legislation, such as that proposed by Senator Chafee and Representative Evans, which includes a cut-off of Federal subsidies for barrier island development.

*Byrne:* He did not feel that he was familiar enough with the issue to respond.

(2). MARINE SANCTUARIES

*Issue:* Dismay exists over the suspension of Point Reyes and Farralon Island Marine Sanctuary designations off California. They are the marine equivalent of national parks and there is a strong consensus that they should be protected. It is believed that regulations should be put back into effect as soon as the regulatory analysis is completed. Management regulations should then be developed promptly to control their use.

*Byrne:* We feel the same way. Otherwise we wouldn't have a sanctuaries program. We have a good staff and we'll do the best we can.

(3). ACID RAIN

*Issue:* NOAA has taken the position that "no clear link has yet been established between man-made emissions and acid precipitation" and that there is still lacking "key information to make rational decisions." However, a new National Academy of Sciences report (issued 4 September 1981) concludes that "evidence for [the] role [of power plant emissions in the production of acid rain is] overwhelming" and that "continued emissions of sulfur and nitrogen oxides at current or accelerated rates..., will be extremely risky from a long-term economic standpoint as well as from the standpoint of biosphere protection." Given your commitment to NOAA's role as a science agency dedicated to the search for truth, is NOAA willing to reassess the evidence on acid rain and, if it concludes that enough is known about the causes and cures of acid rain to warrant immediate remedial action, would NOAA be willing to recommend a reassessment of the Administration's current position of "more research, no action" on acid rain?

*Byrne:* There are a lot of problems of global significance that, if we don't get a handle on them rather quickly may lead to species extinction and other dramatic impacts. Acid rain is only one of these, along with saving the ozone and providing enough water. I think we should address it. We'll do what we can to assess it. NOAA's role is principally as a fact-finding agency and not a regulatory one. Our job is to assess.

(4). MARINE POLLUTION

*Issue:* There has been lack of opportunity for public input into the draft Federal Plan for Ocean Pollution Research, Development, and Monitoring (for Fiscal Years 1981-85).

*Byrne:* The important thing is that the Plan generate a dialogue. I don't know whether it matters whether that dialogue is produced before or after the Plan is finalized. I don't know which is better. In any case, plans are no good if you don't follow them.

*Issue:* The draft Plan fails to specify, as required by P.L. 95-273, whether the priorities set forth will be adequately met during the Plan period and, if not, to recommend changes in the overall Federal effort that would ensure that those priorities are adequately met during the Plan period. Also, contrary to the intent of the statute, NOAA seems to be playing more of an editorial than of a substantive lead role in the development of the Federal Plan. It relies heavily on an interagency committee. The Plan represents more an interweaving of separate agency plans and preferences submitted by committee members, than a consolidated statement of national goals and priorities.

*Byrne:* The dynamics of committee work are such that you tend to end up with a consensus. A Plan developed by other means would probably never see the light of day.

(5) NOAA REORGANIZATION AND STATUS

*Issue:* What is the status of a NOAA reorganization plan?

*Byrne:* There will be some reorganization. I don't know what yet. It's clear there are some inequities in how we manage things. I would welcome your views on reorganization. I'm getting them from all sorts of people.

*Issue:* There is a concern for NOAA's autonomy within the Department of Commerce.

*Byrne:* NOAA is too important for it to disappear. NOAA has always been in the Department of Commerce. However, a feeling of autonomy has been created historically. Whether we do our activities within Commerce or independently is still an open question and is undergoing a transition. I understand where the concerns are coming from. I don't think they're premature. I don't think they should be disregarded. I'm optimistic that things will work out okay.

It was suggested that another meeting might be timely in one and a half to two months.

Kenneth S. Kamlet
National Wildlife Federation
1412 Sixteenth Street, NW
Washington, D.C. 20036
202-797-2945

**Information for Contributors**

There is no prescribed format for preparation of manuscripts because of the wide range of material accepted. Authors should be guided by articles in COPAS.

1. Articles should be typed double-spaced and should not exceed 1,000 words.
2. The title should be informative and brief.
3. On first use full name and acronym must be used. Subsequent reference may be by acronym alone.
4. Measurements should be given in the metric system
5. Figures and tables should be camera-ready and suitable for reduction to a 15.2 x 10.2 cm size, not including legend. Care should be taken with lettering and symbols so that they are readable when reduced. The combined number of figures and tables should not exceed three.
6. Proofs will not be sent to the author unless requested, but if significant editorial changes are made for brevity and clarity, authors will be contacted by telephone.
7. Reprints are not provided.
8. Deadlines for contributions are January 25, April 10, July 10, and October 10. Send all correspondence and material to:

   Coastal Ocean Pollution Assessment News
   Marine Sciences Research Center
   State University of New York
   Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News** is published quarterly. Subscription is free. Individuals wishing to subscribe should write to:
Coastal Ocean Pollution Assessment News
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794

**Coastal Ocean Pollution Assessment News**
Marine Sciences Research Center
State University of New York
Stony Brook, Long Island, NY 11794

NON-PROFIT ORG.
U.S. POSTAGE
**PAID**
STONY BROOK, N.Y.
PERMIT No. 65

**Address correction requested**