

Marine Currents May Have Caused 1976 New Jersey Fish Kill

A massive 1976 fish kill off New Jersey may have been caused in part by an unusual combination of ocean currents, according to scientists with the National Oceanic and Atmospheric Administration (NOAA).

Gregory Han, Donald Hansen, and Jerry Galt of the Commerce Department agency's Environmental Research Laboratories have studied the ocean currents off New Jersey for the summer of 1976, when severe oxygen depletion turned the waters deadly. They reported, at a recent meeting of the American Geophysical Union, that an uncommon current pattern prevailed which could have transported phytoplankton from a wide region and concentrated them in one area, where they contributed to the consumption of oxygen in the bottom waters.

Han emphasized that the study demonstrated only one possible cause of the mortalities. "We've shown a mechanism for concentration of plankton and other organic material, but we can't tell how much oxygen these organisms were actually burning," he said.

It originally was thought that the anoxia might be caused solely by phytoplankton naturally occurring in the area, combined with normal summer stratification of the water. When the plankton drifting on the surface die, their remains sink to the bottom and decompose, a process that consumes oxygen. Stratification, in which waters form stable layers, tends to cut off the bottom waters from infusions of oxygen from the atmosphere.

There was more to it than that in this instance, according to Han. He and the other scientists used a computer model developed by Galt to simulate the cur-

rents off New Jersey during the summer of 1976. The model uses data on currents, water density, and temperature to provide a picture of water movements.

Much of the data used in the model came from an intense environmental study of the New York Bight—a section of the Atlantic Ocean between Long Island and New Jersey—by NOAA's Marine Ecosystems Analysis (MESA) program. This information came from current meters moored in the area, and other types of measurements made from ships during routine research voyages.

"During the summer," Han said, "the currents east of New Jersey normally flow to the southwest. But in 1976, winds from the south turned the

flow around near the shore, pushing it northward, back toward the mouth of the Hudson River. There was a convergence of currents, and this could have brought in, and concentrated, organisms and organic matter from all over the Bight." This event, in turn, was coupled with an upwelling of water near the shore, he said. "So you had an onshore flow along the bottom, and an offshore flow at the surface." The waters flowed north, rose, and flowed back to the southwest.

The converging currents were capable of concentrating large numbers of a type of phytoplankton called *Ceratium tripos* in a relatively small area, where they could have become trapped by their own natures, according to Han. Different species of phytoplankton prefer to live at different depths, and *Ceratium* is found at the level where the currents converged.

The phytoplankton added substantially to the consumption of the area's supply of oxygen, both through respiration, and decomposition, the NOAA scientists believe. Other types of organic matter brought in by the currents would also have decomposed, using still more oxygen.

NOAA Scientists Trace Gulf Stream Meanders

Satellites operated by the National Oceanic and Atmospheric Administration are helping that agency's scientists explore and map the intricate, meandering collection of ocean currents stemming from the Gulf Stream. This complex current system, the NOAA scientists have reported, can now be mapped in detail from the tip of Florida to Labrador's Grand Banks in two days, a task formerly requiring weeks of ship time to accomplish.

This is one of the results of a study reported at the recent meeting of the American Geophysical Union in Miami, Fla., by George A. Maul, P. Webb DeWitt, Alan Yanaway, and Stephen R. Baig of the Commerce Department agency. According to Maul, an oceanographer with NOAA's Atlantic Oceanographic and Meteorological

Laboratories in Miami, the constantly shifting meanders along the west wall of the Gulf Stream in particular are of importance not only to mariners, but to those concerned with the carry-off of pollutants in coastal waters and other phenomena.

Shipboard time-series studies using current meters and other equipment in the Gulf Stream system indicate that meanders have longer periods in some regions than in others. While an annual period seems to dominate the system in the eastern Gulf of Mexico, meander periods in the region between Cape Hatteras, N.C., and the Grand Banks southeast of Labrador are about 1.5 months. Other shipboard surveys have revealed that the fluctuations in the Gulf Stream current boundary may last 4-10 days in the Straits of Florida near

Miami, and 4-7 days at Onslow Bay, N.C.

"Little is known about meander periods briefer than a fortnight in the Gulf Look Current or in the Gulf Stream northeast of Cape Hatteras," the NOAA scientists reported, "or about longer (monthly or annual) periods in the Straits of Florida or off Onslow Bay."

Furthermore, it is not practical to simultaneously study the meanders along the entire 1,500-nautical-mile (2,750-kilometer) Gulf Stream system between Cuba and Labrador by conventional shipboard techniques, Maul and his colleagues said. As a result, the NOAA scientists concluded that satellite observations of the sea surface temperature pattern associated with the entire current system is presently the only practical method for synoptically tracking the meanders.

Before the launch of NOAA's first geostationary operational environmental satellite in 1974, many satellite investigations were limited to case studies using a few good cloud-free examples. The GOES satellite, however, has an operational 30-minute observation schedule which means the images can be put together in a continuous sequence so that, on the average, the entire current can be located every 2-3 days.

As a result, Maul and Baig, who is with NOAA's National Environmental Satellite Service, located the entire Gulf Stream from the Yucatan Strait between Mexico and Cuba and the Grand Banks near Labrador, Canada, using satellite image sequence techniques. A subsequent study of the Gulf Stream by another scientist used GOES data to investigate meanders off Onslow Bay, N.C., and found frequencies similar to shipboard observations made in 1961.

Foreign Fish Boats Off U.S. Coasts Increase in March

The number of foreign fishing vessels sighted in the United States 200-mile conservation zone increased from

Foreign fishing vessels sighted off U.S. coasts in March 1978 and 1977.

Area	Nation	No. of Vessels	
		March 1978	March 1977
New England and Mid-Atlantic	Canada	0	1
	Japan	5	14
	Mexico	2	0
	Soviet Union	19	24
	Spain	21	21
		47	60
Gulf of Mexico	Japan	15	0
Alaska	Japan	123	73
	S. Korea	6	1
	Soviet Union	56	46
	Taiwan	1	0
		186	120
Total		248	180

206 in February to 248 in March, according to preliminary figures released by the National Oceanic and Atmospheric Administration. The ships, sighted by the Commerce Department agency's National Marine Fisheries Service and Coast Guard personnel, were from six foreign nations.

The largest number, 143, was from Japan which had 123 vessels fishing for

groundfish and pollock off Alaska, 15 fishing for tuna in the Gulf of Mexico, and five fishing for squid off New England and the Mid-Atlantic coasts. The Soviet Union had 56 vessels fishing for groundfish in Alaskan waters, and 19 vessels fishing for squid and hake off New England and the Mid-Atlantic States.

The summary of foreign fishing vessels operating off U.S. coasts during March 1978 and March 1977 is given in the accompanying table.

Foreign vessels sighted off the coasts in 1976 were as follows: January—420, February—510, March—435, April—560, May—924, June—970, July—842, August—543, September—514, October—452, November—258, December—240. In 1977: January—319, February—314, March—180, April—235, May—374, June—767, July—786, August—492, September—437, October—378, November—256, and December—188. In 1978: January—158, February—206, March—248.

Fishing Vessel Accidents Eyed

The causes of fishing vessel sinkings and accidents will be studied by University of Washington scientists under a \$1,794,000 National Oceanic and Atmospheric Administration (NOAA) Sea Grant announced by Secretary of Commerce Juanita M. Kreps. The study, being done in cooperation with NOAA's National Marine Fisheries Service, could result in saving lives and millions of dollars worth of fishing craft, the scientists believe.

The project is one of 51 to be pursued by Sea Grant scientists at Washington under the grant, which will be augmented by non-Federal matching funds of \$1,025,000, according to Ned A. Ostenso, Director of NOAA's National Sea Grant Program. The researchers plan to compile an extensive record of accidents involving commercial fishing vessels so that a permanent Fishing

Vessel Safety Analysis Center, similar to the military's Aviation Safety Centers, can be established.

Cooperating in the collection of data will be the U.S. Coast Guard, underwriters, vessel owner associations, legal representatives, and individual fishermen. Benefits of such a data base, say the researchers, will be availability of information from a single source, more accurate statistics, more effective safety programs, and wide dissemination of the underlying causes of accidents with anticipated reductions in losses of lives and vessels.

In addition to the study of fishing vessel casualties, other new projects being initiated this year include an investigation into the distribution, abundance, growth, and residence time of juvenile salmon in the Skagit salt marsh; a program, along with industry, on genetic improvement on salmon being raised in pens; a study into the economic impact of marine recreational boating in Washington, being underta-

ken in cooperation with the Northwest Marine Trade Association; and, a program to develop teaching materials for two sequential courses outlining how to use environmental information in making decisions in coastal management.

Two other new educational projects will be initiated at the University's Institute of Marine Studies. One will be to develop a syllabus of readings for a course in ocean law enforcement, and the other to develop a seminar course on the technical, legal, economic, and environmental aspects of managing marine resources.

Under this year's grant, marine advisory services will continue at about the same level of effort as last year, although much more emphasis will be placed on the establishment of a stronger field program in the Columbia River region.

Bowhead Whaling Rules Published

Final regulations controlling the subsistence hunt of bowhead whales by Alaskan Eskimos during 1978 have been published by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service. According to the Commerce Department agency, these regulations implement the limited aboriginal subsistence quota adopted by the International Whaling Commission (IWC). Effective 20

March 1978, Alaskan Eskimos were required to adhere to the bowhead whale quota of either 12 landed or 18 struck.

The regulations allocate the IWC quota among the affected villages (Kaktovik, Nuigsut, Barrow, Wainwright, Point Hope, Kivalina, Gambell, Savoonga, and Wales) and provide that, once a village has achieved its quota, it must cease whaling. If a village does not reach its quota, the remaining portion may be reassigned to another village. The regulations provide for licensing of whalers, prohibit whaling in a wasteful manner, and establish requirements for marking weapons.

Residents of nine villages annually hunt the whales during their spring and fall migrations through openings in the sea pack ice near their villages. Whale hunting has been an important part of the culture and subsistence lifestyle of Alaska Eskimos for centuries. The spring hunt, when most whales are taken, begins about 1 April, depending on ice conditions, and lasts 6-8 weeks.

In addition to the Federal regulations, the Alaska Eskimo Whaling Commission (AEWC) has prescribed regulations for its member whaling captains to assure that the equipment and whaling techniques used will complement the Federal regulations and will promote the use of the best means possible to reduce the number of whales that are struck and not landed.

NOAA will implement a \$700,000 multi-year research program to determine the status of the bowhead whale stock. The Eskimos have agreed to assist in the program by allowing the research personnel access to the whales that are landed and permit them to take specimens. Eskimo whalers will continue to count whales after the hunt has ended and report the results to the research party. NOAA will assist in establishing additional research camps on the ice in response to a suggestion by the AEWC.

NOAA has made arrangements with a commercial company to investigate possible modifications and improvements in the weapons used by the Eskimos to reduce the number of whales

that are struck and lost due to improperly functioning weapons. A representative of the company visited the villages in March to instruct the whalers on the proper procedures to load the munitions and to demonstrate the use of the weapons. If the weapons need additional modifications, NOAA will fund additional development work needed on the weapons.

NOAA will provide eight electronic "pingers" and two tracking devices to at least two of the Eskimo whaling captains so that the research team can test the effectiveness of the tracking devices to follow whales that have been struck in order to facilitate recovery.

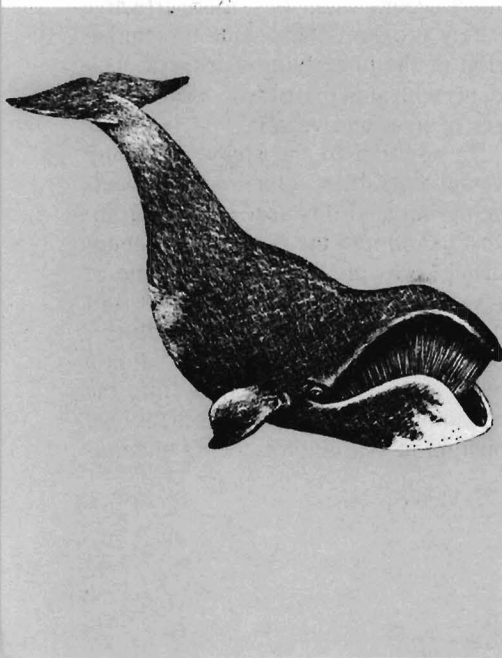
The U.S. has arranged for an international observer from Denmark to observe the hunt and will provide accommodations for the observer.

Eskimos will be employed by the National Marine Fisheries Service to assist NMFS enforcement agents that will be used as monitoring teams in six of the Eskimo villages during the spring hunt. The Eskimo will be a Federal employee while a member of the team and will assist the NMFS agents in informing whalers of the strikes and landings of other whalers, recording information, performing inspections, and carrying out any necessary investigations.

After a village has reached its quota, the NMFS agents will leave and the locally hired employee will continue to monitor activities of the village. Information gathered by the local reporting officer will be made available to the AEWC which may use the information for enforcement of the AEWC regulations.

Scientists Observe Caribbean Currents

The surface waters of the Caribbean may retain pollutants longer than existing current charts suggest, according to a National Oceanic and Atmospheric Administration (NOAA) scientist. Reporting at an April meeting of the American Geophysical Union in Miami Beach, NOAA oceanographer Robert Molinari described results from a recent study which used satellite-tracked



buoys to trace the circulation of the region.

Molinari said that Caribbean surface currents were much more complicated than had been generally believed, so that water—and any pollutants it may receive—would tend to remain in the Caribbean for months before returning to the Atlantic through the Florida Straits. “This longer residence time has implications for environmental impact studies, since any pollutants discharged in the region would remain longer than previously assumed,” he said.

The conventional view of currents in the area, explained Molinari, a researcher with the Commerce Department agency’s Atlantic Oceanographic and Meteorological Laboratories in Miami, is based on “pilot charts,” compiled from numerous ship observations spanning the last century. The charts show a simple pattern of water movement in the Caribbean—a flow from east to west, at about a knot or a knot and a half (slightly over a mile an hour), with little north-south variation. The new buoy results show quite a different picture.

For the study, Molinari and colleagues at Nova University and the University of Puerto Rico deployed a total of 19 mini-buoys at the eastern end of the Caribbean Sea. The buoys carry wind sensors and drogues—a type of underwater parachute that ties the buoy to the water and minimizes the effect of wind. In October 1975, scientists on the NOAA ship *Researcher* deployed eight of the buoys in the passages between islands of the Lesser Antilles. Three months later 11 more were set afloat, within several passages, and west of the undersea Aves Ridge. Their movements were tracked by satellite, averaged together, and plotted on charts. The results did show a general east-to-west flow, but hardly in a direct line.

The buoys made large excursions to the north and south, Molinari reported, carried by meanders (winding currents) and eddies (circular, whirlpool-like motions). In the Grenada Basin, between the Lesser Antilles and the Aves Ridge, eddies as large as 60 miles (100 km) across caught the buoys. Meanders carried them 150 miles (250 km) to the

north and south. The course of these meanders described a wave pattern across the sea, watery oscillations with a wavelength of 240 miles (400 km), the same as the distance between the major ridges in the basin. Molinari plans further study to see if the two observations are related.

In the corner of one basin of the sea, the researchers found the waters rotating in the opposite direction from that shown on pilot charts. They also found that the flow in the eastern Cayman Sea, south of Cuba, is dominated by a large eddy. The researchers were surprised at how their results differed from the pilot charts, but, according to Molinari, “the charts are based on the movements of

ships, a ship’s motion is affected by the wind as well as currents, and the winds do blow pretty consistently from east to west.”

The main implication of their findings, Molinari said, is that things stay in the Caribbean longer than thought, implying that pollutants might have a greater effect, because it would take longer for circulating waters to flush them out. Other implications are less obvious. The Caribbean, the NOAA scientist pointed out, is a part of the North Atlantic Gyre, the grand clockwise circulation that includes the Gulf Stream. What happens here affects what goes on in the entire North Atlantic, he said.

Study Boosts Foreign Sales for U.S. Fish

A \$400,000 contract to study the structure and trade barriers of foreign markets for species of fish which, although abundant off U.S. coasts, are little used domestically, has been awarded to Earl R. Combs, Inc.¹, Seattle, Wash., by the National Oceanic and Atmospheric Administration (NOAA).

The Commerce Department agency’s study also will determine the capability of the U.S. fishing industry to produce products for these markets, according to NOAA Administrator Richard A. Frank. “This study is part of NOAA’s continuing effort to improve the economic health of the domestic fishing industry by encouraging development of new export markets for U.S. fishermen,” Frank indicated. The project, lasting a year, will examine markets in 16 European and Far Eastern countries where many fish underutilized in the U.S. are considered delicacies. Squid, herring, eels, and various underused groundfish are in short supply overseas.

By examining market structure, price mechanisms, and trade barriers,

the study will identify potential market areas and provide the U.S. fishing industry with information on marketing techniques, pricing mechanisms, and product type and demand in specific market areas. The project also will identify potential demand for fish and shellfish, including underutilized species, in domestic markets. Both domestic and foreign impediments to development of these fisheries will be reviewed. Such items as tariffs, gear regulations, border taxes, and quotas all may serve to inhibit the development of markets or the supplies needed.

The contract is funded by six Department of Commerce units: the National Marine Fisheries Service, the Economic Development Administration, and four Regional Commissions (Coastal Plains, Pacific Northwest, Upper Great Lakes, and New England).

Frank emphasized that the U.S. fishing industry had helped design the study and would participate in its development. Noting the study was a significant step in identifying specific markets for fish products available in the United States 200-mile zone, he said it will provide guidance to the fishing industry on when and how to develop this potential.

The contractor will visit various industry groups to gather information.

¹Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

throughout the project. In the fall, a National Conference on Fishery Development will be held to review the findings of the study. However, during the progress of the work, findings of immediate use and interest will be relayed to industry so that opportunities may be taken advantage of as they appear.

NOAA Monitors Marine Mining Tests in Pacific

Operational test-mining of the deep ocean floor was underway for the first time in history in the central Pacific Ocean in April, with scientists from the National Oceanic and Atmospheric Administration (NOAA) on-site to evaluate their impact on the marine environment.

A converted ocean oil-well drilling ship, the *Sedco 445*, owned by one of a group of U.S., Canadian, West German, and Japanese companies that make up Ocean Mining, Inc.¹, was pumping manganese nodules from the sea bed at a depth of more than 3 miles, testing a system by which the nodules are collected, separated from other ocean floor material, and lifted up to the vessel.

During the early stages of the test period, the NOAA Ship *Oceanographer*, working nearby the *Sedco 445*, observed the effect of these activities. Two separate events were also monitored: the plume of materials along the ocean floor generated as the collector draws in and separates the nodules and other materials, and a surface plume caused by shipside disposal of excess materials brought to the surface along with the nodules.

The precise environmental effect of both events is uncertain, requiring their monitoring, according to Robert E. Burns, NOAA's chief scientist on the project. The Commerce Department agency official was doing his monitoring with previously-placed ocean bottom instruments, while a colleague,

mineralogist Leal Kimrey, was aboard the *Sedco 445*, sampling the surface discharge. These monitoring activities are essential to the planning of future Federal regulation of ocean-mining operations.

Later in April both ships sailed the 1,000 miles northwestward to Honolulu where the *Sedco 445* was to be refitted to return to the work area and test a different collection system. The *Oceanographer* was to monitor this activity, as well, which was expected to last until mid-May.

The mining tests and environmental studies, both of which started early in April, culminate extensive preliminary activities. Industry has been working for several years to develop techniques for collecting the nodules, while NOAA researchers have been engaged in baseline studies of the waters, life forms, and sea bed prior to the start of the mining tests. The nodules are roundish lumps of rock containing high concentrations of nickel, copper, manganese, and cobalt. When the current series of tests is completed, NOAA's deep ocean mining team will maintain a watch over the mining site, observing how it recovers, and how long the recovery will take.

Seafood Taste Test Method Is Developed

As part of a program to further domestic use of traditionally underutilized fishery resources, the Fisheries Development Division of the National Marine Fisheries Service (NMFS) Southwest Region has designed a taste test methodology to evaluate new seafood preparation. Interval scales of seven are used to rate food items in terms of appearance, texture, flavor, and overall eating quality. Single-word adjectives describe the ends of each scale, and the remaining five intervals are left unlabeled. For analysis purposes, integer values are assigned to each scale interval after the taste testers have rated the food.

The developed methodology was used to test the taste acceptability of Pacific hake and walleye pollock dishes

at two Los Angeles food conventions. A description of the test situation and results can be obtained from: Fisheries Development Division, National Marine Fisheries Service, NOAA, P.O. Box 3266, Terminal Island, CA 90731. Their telephone number is: (213) 548-2571.

Benton Named Associate Administrator of NOAA

George S. Benton, former President of the American Meteorological Society and former Vice President of Johns Hopkins University, has been nominated by President Carter as Associate Administrator of the National Oceanic and Atmospheric Administration (NOAA), it has been announced. The nomination requires confirmation by the Senate.

NOAA Administrator Richard A. Frank said Benton, one of the Nation's leading authorities in the atmospheric, oceanic, and hydrologic sciences, will significantly strengthen the Commerce Department agency's management team. President of the American Meteorological Society in 1969, Benton received his bachelor and doctorate degrees at the University of Chicago, and joined the faculty at Johns Hopkins in 1948. He was appointed Professor of Meteorology there in 1957, and Chairman of the Department of Mechanics in 1960.

For three years, from 1966 through 1969, he was Director of the Research Laboratories of the Environmental Science Services Administration, a predecessor of NOAA. In 1970 he returned to Johns Hopkins as Chairman of the Department of Earth and Planetary Sciences. He became Dean of the Division of Arts and Sciences in 1971, and Vice President of the Homewood Divisions in 1972. In addition to gaining an international reputation for his academic activities, Benton is professionally recognized for his research, which has been primarily concerned with the mechanics of rotating and stratified fluid systems, including the atmosphere and the oceans.

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