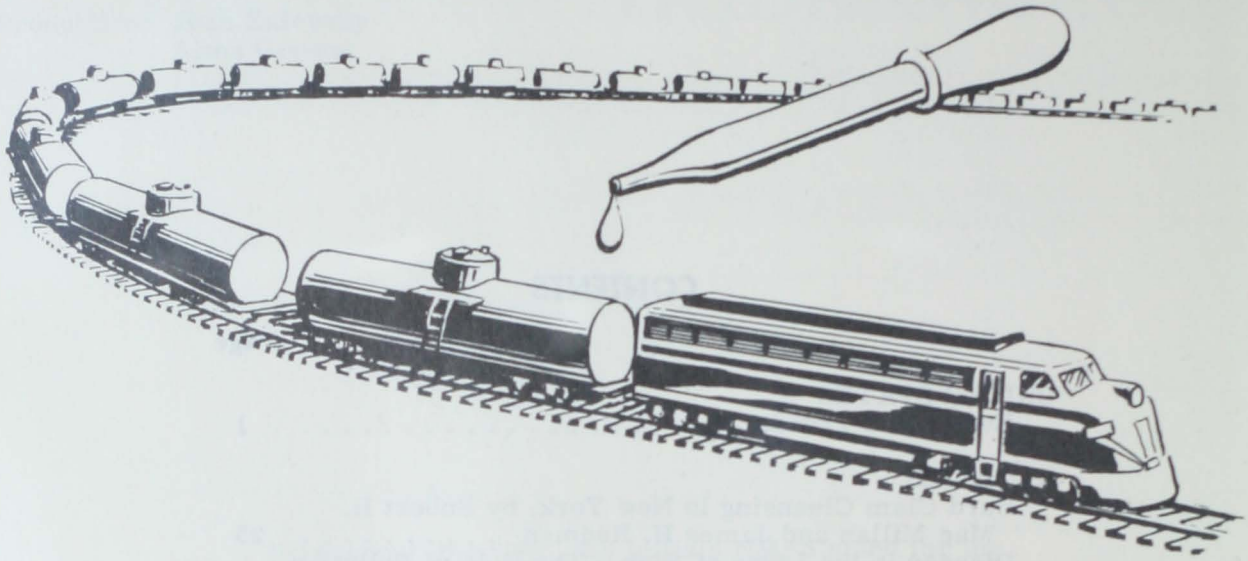


Laboratory tests reveal that some pesticides in fantastically small amounts kill crabs and shrimp. One part of DDT in a billion parts of water will kill blue crabs in 8 days. (One part per billion is about the relationship 1 ounce of chocolate syrup would bear to 1,000 tank cars of milk.)

Commercial brown and pink shrimp, exposed to a 0.3 to 0.4 part of heptachlor, endrin, or lindane in 1 billion parts of water were killed or immobilized in 48-hour laboratory tests. In the laboratory, paralyzed fish or shellfish may live for days, even weeks. But in the sea, where only the fittest survive, death may result almost immediately.

PESTICIDES PERIL OCEAN LIFE, SCIENTISTS WARN

Up to 25% of DDT compounds so far produced "may have been transferred to the sea," a Panel of the National Academy of Sciences has reported in "Chlorinated Hydrocarbons in the Marine Environment."

The scientists emphasize: "This report is not intended to represent an exhaustive survey of the literature. It has been prepared to alert the community of marine scientists to one of the more serious problems arising from the dispersal of man's materials to his surroundings. Emphasis has been placed upon DDT and its degradation products because they have been the most studied to date."

The amount of DDT compounds in the living things of the sea is estimated at below 0.1% of total production. But even this small percentage has had a "demonstrable impact upon the marine environment."

Bird populations that eat fish have failed to reproduce and have declined. And, as greater quantities of persistent chlorinated hydrocarbons accumulate in the marine ecosystem, more species will be threatened. These pollutants will reach "unacceptable levels" in the tissues of marine food fish.

Long-Lasting Harm

The experts state that it is very hard to set an exact figure on certain risks involved in using chlorinated hydrocarbons, but these risks require serious consideration. The rate at which such substances become harmless is unknown, but some of the more persistent materials remain deadly for years, even decades or centuries.

The future may hold even greater peril for marine life. If most of the remaining 75% of the persistent chlorinated hydrocarbons is now in reservoirs, but in time will reach the sea, then marine organisms will take in greater amounts despite improvements in future manufacturing practices. If these compounds last longer than decades, it will be virtually impossible to undo the damage.

In a grim cautionary note, the Panel states that the story of pesticide problems has revealed unexpected effects in the past decade. "Our prediction of the potential hazards of chlorinated hydrocarbons in the marine environment may be vastly underestimated."

PANEL RECOMMENDATIONS

The NAS Panel recommends:

- An extensive and immediate U.S. effort should be made to drastically reduce escape of persistent toxicants into the environment. The goal would be to virtually end this escape as soon as possible.

- Design programs to: determine entry rates of each pollutant into oceans; make base-line determinations of how these pollutants are distributed in the different parts of that environment. Later, a program should be devised to monitor long-term trends to see what progress has been made--"and to document possible disaster."

- Because the evidence shows some of these substances degrade the environment, the laws covering registration of chemical substances and release of production figures by government "should be examined and perhaps revised."

U.S. & WORLD PRODUCTION OF CHLORINATED HYDROCARBONS

Th U.S. uses about 30% of its production of DDT and 70-80% of its production of the aldrin-toxaphene group: aldrin, chlordane, dieldrin, endrin, heptachlor, and toxaphene.

World production data are hard to obtain because the available information is inadequate. But FAO data in 1969 suggest "that the total world production of DDT and the aldrin-toxaphene group is probably no more than one and one half times that of the U.S."

It is "even more pressing" to learn the production figures for the polychlorinated biphenyls, which have been used since the early 1930s.

PANEL ON MONITORING PERSISTENT PESTICIDES IN THE MARINE ENVIRONMENT

of the

COMMITTEE ON OCEANOGRAPHY

NATIONAL ACADEMY OF SCIENCES

Edward D. Goldberg, Chairman
Philip Butler
Paul Meier
David Menzel
Gerald Paulik
Robert Risebrough
Lucille F. Stickel

ROUTES OF DDT RESIDUES + PCBs TO MARINE ENVIRONMENT

After DDT is applied on land, its residues make their way to the ocean via rivers, sewage outfalls, and the atmosphere. DDT residues are DDT, DDE, and DDD. DDD and DDE are metabolites of DDT; DDD itself is a pesticide.

DDT residues reach the atmosphere in several ways: aerial drift during application by rapid vaporization from water surfaces, and by vaporization from plants and soils. When they are in the atmosphere, DDT residues may travel thousands of miles. They enter the ocean in precipitation or in dry fallout. The NAS Panel states: "There are few data for estimating these rates of transfer."

DISTRIBUTION OF CHLORINATED HYDROCARBONS IN MARINE ENVIRONMENT

There are few data to document concentration of chlorinated hydrocarbons (including PCBs) in open-ocean environment. But some observations reveal that DDT and its residues are probably distributed throughout marine biosphere.

- Gray whales concentrate up to four tenths (0.4) of a part of DDT residues in a million parts of their blubber. These whales feed largely on bottom-dwelling organisms in the Chukchi and Bering Seas. Sperm whales feed on larger open-sea organisms.

- Sea birds--petrels and shearwaters--feed on planktonic organisms far from land. Their concentrations of DDT residues run as high as 10 ppm.

- Such migratory fish as tuna harbor as much as 2 ppm in their gonads. Other marine mammals carry as much as 800 ppm in their fat. It is not known whether these concentrations resulted from localized contact in coastal waters--or were accumulated during their life in the open ocean.

- In the coastal environment, DDT and its residues range from undetectable levels to 5.4 ppm in oysters. Concentrations within these limits are highly variable, even within same estuary.

ECOLOGICAL IMPACT

The NAS Panel states: "The acute and chronic toxicity of chlorinated hydrocarbons has been identified by observing the effects of chlorinated hydrocarbons under controlled laboratory conditions. The exposure of test populations of marine fauna to several dilutions of these pollutants in flowing seawater has shown that they affect growth, reproduction, and mortality at concentrations currently existing in the coastal environments."

PLANKTON

Adding chlorinated hydrocarbons to laboratory cultures of molluscan larvae--and the phytoplankton they eat--causes (with increasing concentrations) "decreased growth rates, developmental failures, and increased mortality."

In one southeastern U.S. estuary, toxaphene levels were high enough to have killed most of phytoplankton suitable as food for molluscan larvae.

In the open ocean, phytoplankton are the base of the food chain. They may be primary concentrators of chlorinated hydrocarbons from the water.

CRUSTACEANS

In bioassay tests, laboratory populations of commercial species of shrimp and crabs, and zooplankton, are killed by exposure to chlorinated hydrocarbons, such as DDT and PCB, in parts per billion (ppb).

Exposing shrimp continuously to DDT concentrations of 0.2 ppb killed all of them in 18 days. A concentration of 0.12 ppb killed all in 28 days.

Such concentrations have been found in Texas rivers flowing into commercially important shrimp nursery areas. In such contaminated areas, there are significant mortalities of juvenile crustaceans.

In California, declining production of Dungeness crabs "may be associated" with DDT residues in the developing larvae.

Polychlorinated biphenyls (Aroclor 1254) at 5 ppb killed 72% of test populations of pink shrimp (Penaeus duorarum) in 20 days. These shrimp had accumulated 33 ppm of PCB in their tissues.

MOLLUSKS

The chlorinated pesticides and PCBs hinder oyster growth. One ppr of PCB Aroclor 1254 produces 20% decrease in shell growth.

Many pesticides interfere with oyster growth at levels as low as 0.1 ppb.

Mollusks concentrate these chemicals. They indicate pollution levels in marine waters. Monitoring coastal samples have shown that amount of chlorinated hydrocarbon residues in mollusks are correlated directly with application rates of these agricultural chemicals in adjacent river basins.

FISH

Nearly the world over, marine fish are contaminated with chlorinated hydrocarbon residues. There are expected concentrations in such lipid tissues as the ovary.

On the south Texas coast, in speckled sea trout, DDT residues in ripe eggs are about 8 ppm. This level may be compared with residue of 5 ppm in freshwater trout that causes 100% failure in development of sac fry or young fish.

"The evidence is presumptive for similar reproductive failure in the sea trout." In Texas's Laguna Madre, sea-trout inventories declined progressively from 30 fish per acre in 1964 to 0.2 fish per acre in 1969. Few juvenile fish have been observed in recent years. But only 100 miles away, in less contaminated estuaries, the distribution of sea-trout year-classes is normal.

In California, the sale of some mackerel has been banned because DDT residues were too high, even in the processed fish.

In the Mississippi River, in 1963-64, a large fish kill was traced to chemicals entering river system from insecticide-manufacturing plant. Very high endrin amounts were found in nearby sewers and in riverside dump.

Laboratory experiments showed that concentration of several chlorinated hydrocarbons, including DDE, damage reproductive success of birds, fish, and marine invertebrates.

BIRDS

"Chlorinated hydrocarbon residues have seriously affected both adult birds and their reproduction."

Deaths of bald eagles, common loon, and peregrine falcons have been correlated with deadly amounts of chlorinated hydrocarbons in body tissues.

In the Netherlands, many coastal birds died and the population of sandwich tern declined. This was traced to dieldrin

contamination of Dutch Wadden Sea and coastal North Sea resulting from factory effluent.

In the Baltic Sea, sea eagle reproduction has failed and deaths occurred because of very high levels of DDT compounds and PCB in the tissues.

Studies of museum series of eggs showed that, since mid-1940s, eggshell thinning has occurred in many species of fish-eating birds and birds of prey. Where there was shell thinning, the population usually declined. Eggshell thinning and the population decline that followed were linked to chlorinated hydrocarbon residues in eggs and in body tissues of birds.

In U.S. Atlantic Coast sites, black duck egg samples showed highest residues of chlorinated hydrocarbons in states where duck reproduction is poorest.

In southern California's marine ecosystem, concentrations of DDT compounds in fish may be greater than 10 ppm. In 1969, there was a catastrophic failure of reproduction among brown pelicans on Anacapa Island as a result of egg-shell collapse.

BIOCHEMICAL EFFECTS

The Panel states that "several physiological effects of chlorinated hydrocarbons could account for shell thinning and for the abnormal behavior observed in contaminated populations."

When they affect nerves, the chlorinated hydrocarbons, including DDE, "are believed to block the ion-transport process by inhibiting one or more ATPases in the nerve membrane that causes the required energy to be made available."

RECOMMENDATION: A NATIONAL EFFORT TO CURTAIL LONG-TERM EFFECTS OF CHLORINATED HYDROCARBONS ON COMMUNITY STRUCTURE

The Panel makes clear that these changes in the earth's living systems are part of an even more portentous pattern of changes in the "structure of the natural communities of estuaries, coastal regions, and the oceans." The familiar pattern is connected with stepped-up eutrophication and pollution of water bodies.

In the water, simplified communities of eutrophic lakes and estuaries develop. Harvestable fish populations often are depressed. Bird populations are dominated by scavengers, such as the herring gull.

The problem in the water is greater than that on land. This is because reduction of consumer populations is accompanied by a shift in plant species to hardy algae. The algae are not eaten by grazers. Worse, their production accumulates. There is less oxygen. And, the potential of the area to support man further diminishes.

Many factors cause these changes. But, the Panel states, the building up of persistent chlorinated hydrocarbons in estuaries and in coastal waters have made these agents major factors in speeding this pattern of change.

The Panel recommends: "A massive national effort to effect a drastic reduction of the escape of persistent toxicants into the environment, with the ultimate aim of achieving virtual cessation in the shortest possible time. Only in this way can we hope to curtail the deleterious effects of chlorinated hydrocarbons upon community structure."

RECOMMENDATION: A CHLORINATED HYDROCARBON BASE-LINE PROGRAM FOR THE MARINE ENVIRONMENT

There has been little analysis of chlorinated hydrocarbons in materials from the marine environment--and from parts of atmosphere and continental hydrosphere that provide these pollutants to the waters.

An effective monitoring program cannot begin "until the present dissemination of these materials at the earth's surface is detailed." A beginning can be made with a reasonable monitoring program by using a base-line study. This would determine concentrations of chlorinated hydrocarbons in geological and biological components of the marine environment, and in their transporting agencies. "Such an investigation can conceivably be carried out in a year."

The Panel believes that using a single laboratory to manage the program would minimize standardization problems of sample preparation and handling. It thinks of a thousand analyses during the first year's base-line program. "Temporal, geographic, and

spatial sampling procedures will be formulated for each of the groups of substances."

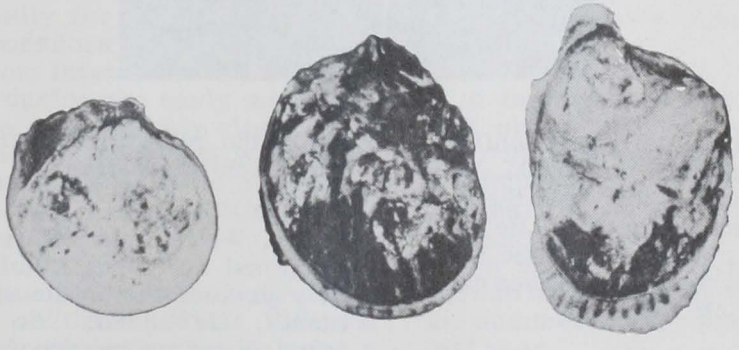
RECOMMENDATION: REMOVAL OF OBSTACLES TO PUBLIC ACCESS TO CHEMICAL PRODUCTION DATA

The NAS Panel lists among the causes contributing to lack of available data on chlorinated hydrocarbons a legal structure: when there are no more than 2 producers, they can withhold production figures as privileged information.

The scientists believe that "it is not in the public interest for government to maintain as privileged data that are necessary for research into the state of our environment and for an assessment of its condition."

And the Panel concludes: "We recommend that the laws relating to the registration of chemical substances and to the release of production figures by the Department of Commerce and the Bureau of the Census be reexamined and revised in the light of existing evidence of environmental deterioration. The protection afforded manufacturers by government is an artificial obstacle to effective environmental management, particularly with reference to the polychlorinated hydrocarbons. In view of other impediments--technological, methodological, and financial--such protection is clearly inappropriate."

Where the concentration of DDT is as low as 10 parts in a trillion parts of water, the oyster collects and stores the pesticides. Oysters have stored DDT during a 40-day exposure period to levels 70,000 times greater than a 0.1 p.p.b. concentration in surrounding water. Put back in clean water, oysters can, in time, eliminate the pesticide.



1 2 3

Typical effects of pesticides on growth of experimental oyster shell after 96 hours.

1. Control oyster with about one-fourth inch of new growth.
2. Oyster where exposure to a pesticide decreased growth by about 50 percent.
3. Oyster in which pesticide was so toxic it prevented any new shell formation.

The illustrations in this article come from "FISH, WILDLIFE and . . . PESTICIDES," written by Edward Edelsberg for Fish and Wildlife Service.

PUBLIC SHOULD CONTINUE TO EAT FISH & SHELLFISH, NOAA ADMINISTRATOR SAYS

Fish should remain a very worthwhile part of the American diet, Dr. Robert M. White, NOAA Administrator, recently told the Shellfish Institute of North America. He said it would be "needless and tragic" if the finding of mercury in a small number of fishes caused consumers to avoid all fish.

Dr. White emphasized: "There is no reason whatever not to eat--and enjoy--fish and shellfish."

Pledges Full Study

He pledged that NOAA's National Marine Fisheries Service (NMFS) will try to find out quickly and thoroughly the extent of mercury or other heavy metals in fish. NMFS will "keep the public informed, not only of those products with high levels but those which fall below the guidelines offered by the Food and Drug Administration."

Dr. White said NOAA works closely with the Food and Drug Administration (FDA) to help protect the public against fish contaminants. He added: "So far, what we have found gives us reason for optimism. Since the mercury problem first came to light about a year ago, swordfish is the only species that the FDA felt should be the subject of a warning to the public.

"I have faith in the common sense of the American people. I am confident that they will be guided by specific cases and will not deprive themselves of the nourishment, the economy, and the pure enjoyment of eating the vast majority of fish, which there is no reason to distrust."

SHELLFISH SITUATION

Richard W. Surdi & Donald R. Whitaker
NMFS Current Economic Analysis Division

Supplies of all shellfish, except calico scallops, decreased during the first 3 to 4 months of 1971. The lower level of imports this year, especially for shrimp and northern lobsters, has been a major reason for the present lack of supplies. Although imports of scallops from several countries and imports of lobster tails from Australia and South Africa increased, most shellfish-producing nations are experiencing declining catches; so U.S. imports have declined.

In addition to lower imports, domestic landings have been down during the first months of 1971. This drop has been due to several factors, including bad weather and lower abundance.

Another supply complication has been the rapid decline in holdings of frozen shellfish. Cold-storage holdings generally decline during the first part of the year for most species. During the first 4 months of 1971, however, the rate was much more rapid than in previous years. To satisfy the market, and to compensate partially for declining imports and landings, processors and retailers have drawn heavily from inventories. Consumption of shellfish during the early months of 1971 was about the same or only slightly below 1970. This stability is especially impressive in light of the sharp gains in prices for most species and the lower quantities available to be consumed.

The increase in prices has affected domestic and imported shellfish. While U.S. and world demand has continued to rise, relatively stable or declining supplies have boosted import prices.

OUTLOOK

The shellfish outlook during May-July was for continuation of the first 4 months' trends. Supplies were expected to remain below 1970. Rising prices at record levels and expected lower supplies probably would keep consumption at 1970 level. Demand, however, probably would remain strong.

Shrimp

Sales of fresh and frozen shrimp during January-April 1971 were a little over 100 million pounds, heads-off weight--a gain of about 2% from 1970. Sales were impressive in view of the early months of 1971.

The importance of shrimp inventories was never more evident than in the first 4 months. U.S. shrimp landings were down about 3 million pounds from January-April 1970. Shrimp imports declined 14 million pounds in the same months. Despite declines in landings and imports, sales actually gained a little over last year. The gain was possible because of inventory withdrawals. Between January 1 and May 1, 1971, inventories of frozen shrimp dropped 28 million pounds--15 million more than last year. Thus, inventories made up practically all the deficit in landings and imports. Exports of shrimp were also down in the first four months. This made more shrimp available for the domestic market. The combination of these supply factors enabled sales to gain a little in January-April.

If imports continue to decline, it will be difficult for sales to remain at year-ago levels. Inventories cannot continue to make up the import deficit. Preliminary indications pointed to another decline in imports in May--the sixth consecutive month imports have fallen below corresponding months in 1970. Shrimp landings in the Southern States during the summer are expected to be no higher than last year.

Unless imports show a quick turnaround, shrimp sales this summer likely will be off from last year.

Scallops

Supplies of sea scallops were 7.9 million pounds during the first 4 months of 1971. This was a slight decrease from a year ago. January-April landings of 1.4 million pounds were about 18% below same period in 1970. A slight

increase in imports partially offset the decline in domestic landings. Increases in imports from the United Kingdom and several other countries compensated for a large decline in shipments from Canada.

Consumption of sea scallops at 6.2 million pounds during January-April was 5% below 1970. The decline can be attributed to lower supplies and higher prices.

Supplies of sea scallops during the summer are expected to continue lower than in 1970. Domestic landings likely will continue low. Although the high prices of scallops would seem to indicate the probability of higher imports, this is unlikely because of the declining trend in imports from Canada. Increases in imports from other countries may just offset the Canadian decline.

Northern Lobsters

Supplies of northern lobsters at 5.8 million pounds, live weight, were 7% below first-quarter 1970. Maine landings fell 13% to 611,000 pounds, and compelled wholesale dealers to rely primarily on "pound" lobsters. Imports from Canada declined 6%.

The quantity demanded during first-quarter 1971 was light due to record high prices. Exvessel prices generally rise for the first 3 months of the year and then fall in April. Prices paid to fishermen not only rose an unusual amount, 32 cents during January-March, but continued to rise into April.

Lobster landings, which are seasonally low in the first quarter, generally increase in April and rise steadily until the peak in September or October. Prices normally drop during May, then rise during June and July. The normal seasonal pattern is expected to be followed this year but at a higher level than a year ago.

Spiny Lobster Tails

Supplies of spiny lobster tails were 17 million pounds during first 4 months of 1971--down about 2.5 million pounds from last year. Most of this decline resulted from lower inventories. Imports were higher in the first quarter but dropped in April. Inventories have been averaging about 40% lower than a year ago.

Demand has been strong. Sales were above the previous year during the first quarter despite sharply higher prices. At 10.2 million pounds, sales were up about 9% during January-March. Consumption, however, fell nearly 20% in April; the April decline resulted mainly from lower supplies. Prices of lobster tails have risen sharply in 1971--$.60 to $1.00 higher than in 1970.

Supplies of spiny lobster tails are expected to continue lower than a year ago during the summer; prices may edge up a little more from May levels and average well above a year ago.

West Coast Crabs

Production of West Coast crabs was off sharply in first-quarter 1971. Total landings were an estimated 32 million pounds compared with 49 million pounds in January-March 1970. Landings of dungeness and snow crabs were about half those a year ago, while king crab landing were marginally higher.

With generally shorter supplies likely in 1971 for West Coast crabs, some gradual strengthening in prices is likely this summer, especially for king and dungeness crabs. With prices of most shellfish at record high levels, and supplies generally lower, the possibility exists for some substitution of crab products.

A SABLEFISH FISHERY MAY BE POSSIBLE OFF CALIFORNIA

Two collapsible sablefish pots, developed by NMFS Seattle, were bought and assembled by NMFS Fishery-Oceanography Center, La Jolla, Calif. The pots measure 96" x 33" x 33". The large catches of sablefish (Anaplopoma fimbria) reported by Seattle base indicate that the pots fish more efficiently than standard longline gear.

Abundant Off S. California

The fish apparently are abundant off southern California in 100-500 fathoms. The main product in the U.S. is sold smoked, but local restaurateurs and fish dealers have shown interest in marketing the fresh product.

In the past, sablefish landings in southern California have been almost zero. R. Green of La Jolla is trying to interest local fishermen in making trial market catches.

JUVENILE JACK MACKEREL ADAPT TO FOOD DEPRIVATION

As part of its study of the ability of juvenile fish to survive food deprivation, NMFS La Jolla completed measurements of the respiration of starved jack mackerel. The researchers found that the basal level of respiration did not differ significantly from control, well-fed fish; it indicated that food energy is used up at about the same rate during starvation.

The Testing

The starved fish lost weight and 2-3g of body fat. But, after 45 days, these fish still were able to swim at sustained speeds only slightly slower than well-fed fish. This took place in an exercise machine where swimming speed was controlled. However, there was a behavioral adaptation to starvation: the juvenile jack mackerel, when permitted, reduced their overall swimming activity. Feeding began as soon as food was given to the starved fish. An increase in overall swimming became evident immediately.

NOAA AWARDS GRANT FOR PACIFIC ADVISORY PROGRAM

NOAA has awarded a $36,500 Sea Grant to support a Pacific Sea Grant Advisory Program (PASGAP). The program seeks to help many users of marine resources whose work carries them beyond the boundaries of a single state.

The NOAA grant went to Oregon State University, Corvallis. It will be administrator for 6 other participants: universities of Alaska, British Columbia, California, Hawaii, Washington, and National Marine Fisheries Service.

Fishermen of the northeastern Pacific usually seek certain species over wide areas. Often it is difficult to pass along to them useful extension advisory services. The salmon troll fleet ranges from California in the spring to Alaska in the summer and fall. Albacore tuna fishermen travel from Baja California to Vancouver Island.

The new NOAA-supported program will tie the productive marine advisory programs already in operation from Alaska to California. These programs are spurred by Sea Grant and state, provincial, and local programs.

Already, PASGAP has produced, with the participating groups, the first Commercial Fishermen's Directory of Emergency Services, and an inventory of publications and films on marine resources.

The NOAA grant will help produce more publications, conferences, and workshops geared to provide timely information to marine-resource users.

CALIFORNIA'S ANCHOVY-FOR-REDUCTION SEASON CLOSED MAY 15

California's open fishing season for anchovy to be reduced into meal, oil, and solubles, which began Aug. 1, 1970, was closed at midnight May 15, 1971. Nearly 80,000 short tons were landed, only about 73% of 110,000-ton quota, reported California's Department of Fish and Game.

In the last 4 open fishing seasons, landings were 83,473 (1969-70), 28,050 (1968-69), 6,506 (1967-68), and 37,615 (1966-67) tons.

NMFS PREDICTS GOOD ALBACORE FISHING OFF SOUTHERN CALIFORNIA

Commercial and sport fishermen should have a good albacore season in California coastal waters south of San Francisco, predicts Dr. R. Michael Laurs, NMFS laboratory in La Jolla, California.

Based on the historical trend of commercial albacore catch distribution and environmental conditions, commercial fishermen will catch an estimated 25 to 35 million pounds south of San Francisco, and 15 to 22 million pounds north of it. Sport boats will do well in southern California waters.

Favorable Conditions

Dr. Laurs and his colleagues say that there will be cooler-than-average sea-surface temperatures on the U.S. west coast particularly in the northwest; and stronger-than-normal north-northwest winds. These conditions favor local biological enrichment of the ocean and adequate food for the migrating tuna.

Dr. Laurs explained that the commercial albacore fishery was centered south of San Francisco during 1960-64. It shifted to Pacific Northwest in 1965 when ocean temperature in this area indicated a warmer-than-normal trend. The northward swing peaked in 1968: 85% of west coast catch was north of San Francisco, mainly in Oregon and Washington waters. In 1970, only about 65% of west coast commercial catch was north of San Francisco. It appears albacore fishing will continue return towards waters south of San Francisco.

Cruise Updates Information

To keep forecast information up to date, NMFS fishery biologists, meteorologists, and oceanographers, under Ron Lynn, were scheduled to leave San Diego, Calif., about June 28, aboard NMFS research vessel 'David Starr Jordan' for 19-day cruise to study migration route of albacore into U.S. coastal waters from central Pacific. The scientists were to troll jiglines and observe life history of albacore by studying age, length, weight, sex, stomach contents, and other statistics.

Also, observations would measure distribution of oceanographic features associated with albacore migration. Included would be plankton net hauls to obtain estimates of food available for albacore.

The commercial fishing vessel 'Typhoon' was slated to leave Newport, Oregon (about June 15) to make a preseason scouting survey 400 to 500 miles offshore from about Cape Mendocino southward to Erben Bank. Periodically, the Typhoon would radio sea-surface and subsurface temperature data and fishing information to Dr. Laurs at La Jolla via radio station WWD.

AVERAGE SEA SURFACE TEMPERATURE

The 11-year average (1960-70) of the optimum temperature zone for albacore for July 1-15 is shaded in Figure 1. The bulk of albacore are taken in this temperature range. Prevailing weather during July 1-15, 1971, "will no doubt cause deviations from this average pattern," which will influence albacore distribution. NMFS La Jolla will monitor evolving temperature patterns to project distribution as season develops.

RECENT TRENDS IN OCEANIC & ATMOSPHERIC CONDITIONS

The latest available observational data indicate that sea-surface temperatures along U.S. west coast from Vancouver Island to tip of Baja California--and out to longitude 135° W--are 2° (F) below average temperatures computed for past 10 years. These below-average conditions continue a pattern that has persisted since January 1971. The 60° isotherm normally begins northward advance between 125° W and 135° W in May; this year, it appeared to start earlier and reverse cool trend. But the momentum of early warming was short-lived: the 60° isotherm was still well south of its normal location in second half of May (Figure 2). These short-term events at beginning of the warming season help little to project probable distribution of sea temperature in mid-summer. NMFS La Jolla cautions that continued monitoring and careful interpretation may lead to forewarning of changes in trends over longer periods.

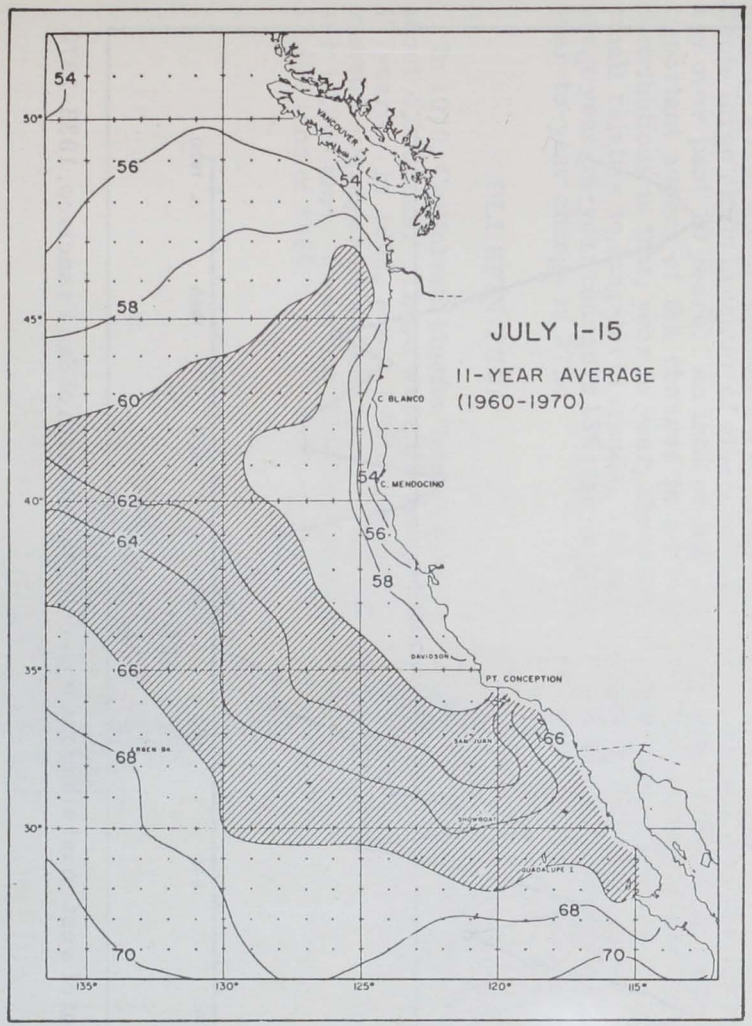


Fig. 1 - Average sea surface temperature fields for the July 1-15 interval. Shaded zone delineates region where most of the albacore would be available under these conditions.

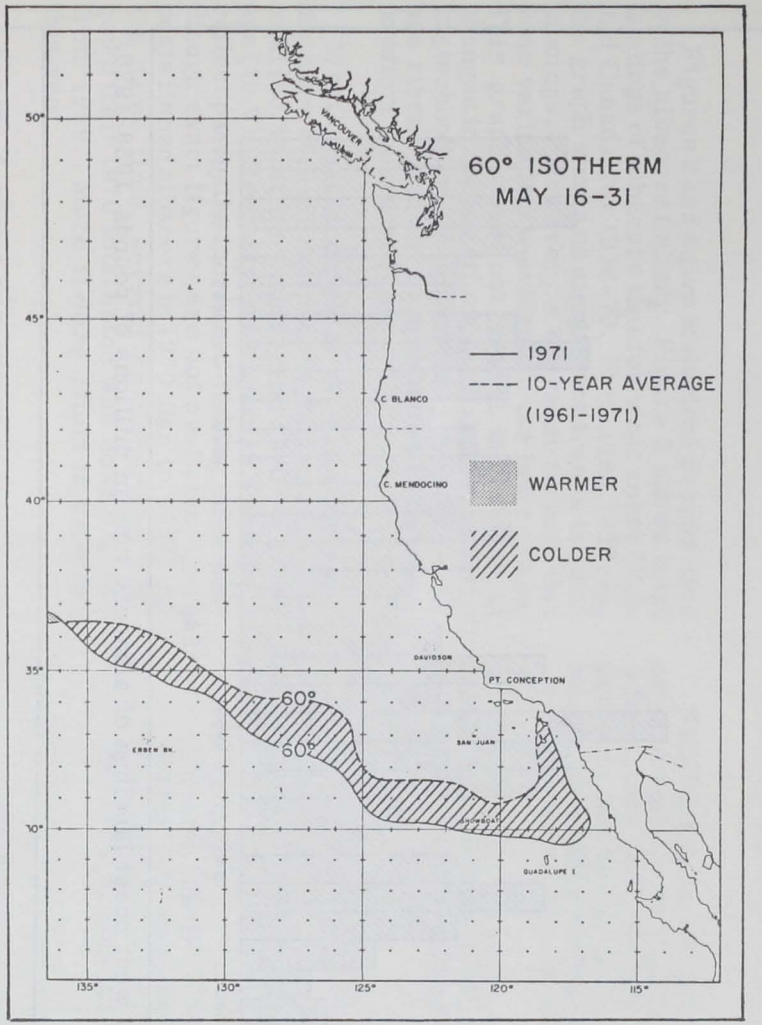


Fig. 2 - Relation of position of May 16-31, 1971, 60° F limiting isotherm to long-term average position for the same interval.

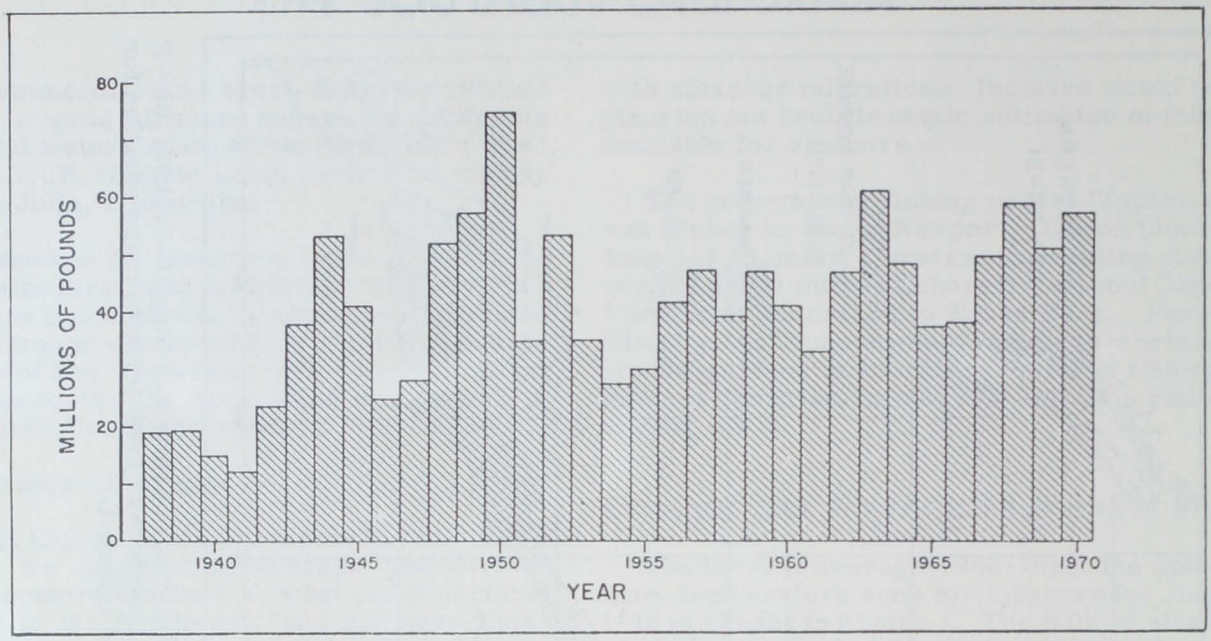


Fig. 3 - Total west coast landings of albacore tuna in millions of pounds, 1938-1970.

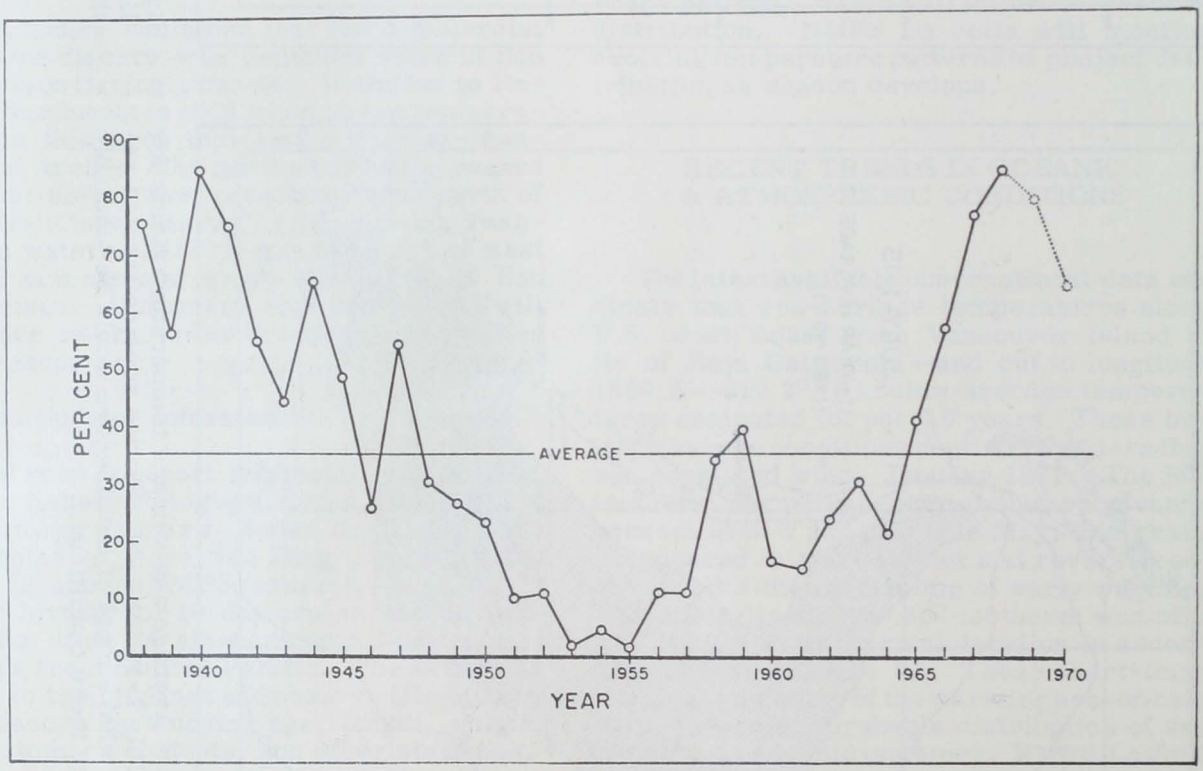


Fig. 4 - Percent of west coast albacore tuna catch taken north of San Francisco, 1938-1970.

HISTORICAL TRENDS IN CATCHES

Figures 3 and 4 give historical perspective to the albacore fishery. Figure 3 shows total landings of albacore tuna for west coast (U.S. and Canada) for 1938-70. Excluding 1938-41, the graph shows no significant trends in total landings. However, a decrease in year-to-year variability is evident in the later years. This graph does not reveal the effects of changes in fishing effort, availability, or fishing technology. In the last few years the catch has risen--but not in proportion to increase in effort and technology.

West coast landings for 1970 albacore season were 57.5 million pounds, higher than 1969 total (50.5 million pounds) and 1960-69 average (45.7). Probably, the higher 1970 landings reflect partly the increased fishing effort; although exact figures are not available, more boats fished albacore in 1970 than in 1969. At the same time, several jig-fishermen indicated their 1970 total catch was down 5 to 20% from 1969. More fishing effort is expected this year.

Figure 4 shows percentage of total catch north of San Francisco for 1938-70. The percentage north-south distribution of catch reflects large shifts in center of albacore fishery over past 30 years. An interesting and important aspect of the changes in percent distributions is that, year to year, these are small relative to long-term trends. The average year-to-year change is 13%; the largest year-to-year change is 27%.

BLUEFIN TUNA

In 1970, California bluefin landings were about 4,800 tons. These were the lowest in 17 years. In 1969, about 7,600 tons were landed. Average annual landings for 1957-68 are 10,900 tons; these include the record 17,400 tons of 1966.

ADVISORY OPERATIONS FOR 1971 SEASON

NMFS La Jolla will issue albacore advisory information throughout the season. The information will include sea-surface temperature charts, narrative albacore fish bulletins, and daily broadcasts of albacore fishing information over marine radio bands.

The Fishery-Oceanography Center at La Jolla will accept collect calls from fishermen at sea to report oceanographic, weather, and fishing information.

The telephone number is (714) 453-2820.

For more information about NMFS Albacore Advisory Information, contact:

Director
National Marine Fisheries Service
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037

COMMERCIAL FISHERMAN'S DIRECTORY AVAILABLE

A useful pocket-sized handbook for fishermen working off Pacific Northwest, the "Commercial Fisherman's Directory of Emergency Service," is available. It lists fish buyers and canners, medical facilities, motor and general boat repair companies, marine supply units, marine service stations, etc., for ports from Eureka, California, and north. It is a publication of the Pacific Sea Grant Advisory Program. It can be obtained free from: H.M. Dail, University of California Cooperative Extension, 1422 South 10th Street, Richmond, Calif. 94804.

THE FISHERMAN AND THE METRIC SYSTEM

The U.S. is the only major nation without plans to convert to the metric system. But it is being studied. In August 1968, Congress ordered the Bureau of Standards to study the system and make recommendations by August 1971.

Actually, the metric system has been legal in the U.S. for 105 years. Scientists, pharmacists, and others have long used the system. Many U.S. farm exports are sold by the metric ton (2,205 pounds) instead of the 2,000 pounds in the common weight. Some persons are advocating adoption of the metric system.

The Fisherman's Attitude?

Ernest D. McRae Jr., NMFS Woods Hole (Mass.) Exploratory Fishing and Gear Research Base, estimates it would take 10 to 40 years for fishermen to change from English pound system to French metric system.

Dr. J. Perry Lane, supervisory research food technologist, NMFS Gloucester, says average age of fishermen in Massachusetts area is 55 years. Change would come slowly.

The fisherman's charts list water depths in fathoms (6 feet); he hears that seas are running so many feet in wave height; visibility at sea is recorded in miles; wind speed comes in miles or knots per hour; his net's mesh size is measured in inches and his catch in pounds (especially in New England) or in tons (tuna).

Translating English into French may challenge Gloucester's school kids, who learn about the metric system, but observers are reluctant to predict that the average fisherman would embrace it warmly.

TAX REGULATION BENEFITS COMMERCIAL FISHERMEN

On June 9, the Internal Revenue Service and NOAA announced that those who lease commercial fishing vessels--and deposit money in a fund to buy, build, or rebuild such vessels--may file amended income-tax returns for 1970 if the money they deposit in the fund came from 1970 earnings.

Under a 1970 amendment to the Merchant Marine Act, eligible fishermen can agree with Department of Commerce to make such deposits. The law allows such taxpayers to reduce taxable income derived from operation of vessels covered under agreements by amounts of deposits.

How It Works

Even if a qualified taxpayer has not made such deposits, and his 1970 tax return has been filed, he may still enter into an agreement. Then he may file an amended return for a refund based on deposits into the fund.

To qualify, the taxpayer must act before Jan. 1, 1972, or within 60 days after final regulations are published, if this date is earlier. Deposits must be made within 60 days after agreement is executed.

To take advantage of new regulation, write to Director, National Marine Fisheries Service, Interior Bldg., Washington, D.C. 20235, for information.

BOSTON TO HOST FISH EXPO '71

Fish Expo '71, the 5th Annual American Fish Exposition, will be held at the Haynes Civic Auditorium, Boston, Mass., Wednesday through Saturday, Oct. 20-23, 1971.

The first expo of its kind in the U.S. was held in Boston during October 1967. Fish Expo '70 was held in Tampa, Fla., in October. Fishery industrial exhibits were displayed by organizations from 31 states and 9 foreign nations.

Information may be obtained from Fish Expo Headquarters, 3 School St., Boston, Mass. 02108.

NMFS HELPS GLOUCESTER FISHERMAN SWITCH FROM TRAWLING TO CLAM DIGGING

For about 40 years, Sam Favaloro, a ground fisherman in Gloucester, Mass., dragged for cod, whiting, haddock, and flounder. His father and grandfathers had fished before him. In recent years, it had become harder for Sam to make a living.

His attitude was reported by the New England Marine Resources Program:

"Faced with unreasonable competitive factors stemming from overfishing, foreign imports, fluctuating prices, foreign fishing boats poaching nearby fishing grounds, Sam came to realize that he would be unable to obtain an adequate living from the sea for his family of seven. His discouragement reached a high point last summer and fall when, after chasing for whiting, he returned to a seaport already overstocked with imports from South Africa and Argentina."

At that point, Sam was encouraged by scientists of the NMFS Gloucester laboratory. They urged him to investigate the ocean quahog (Artica islandica) as a developing resource for year-round fishing. The very abundant quahog is a potential substitute for the popular but disappearing surf and hard-shell clams. (See CFR, April 1971, p. 17.)

Back to Learning

Sam spent November and December 1970 learning about and digging for the "ocean" or "mahogany". Convinced that a potential market existed, he was the first to register his boat with NMFS for experimental research. On Jan. 4, 1971, he applied for a $5,100 grant to Economic Development Administration (EDA) in Washington, D.C., to prove that the close-at-hand quahog could keep fishermen in Gloucester. In late March, EDA approved grant. Contract signing by Sam, EDA, and NMFS would follow.

The Operation

There will be two 2-week expeditions. Sam and 2 helpers will dredge off Massachusetts under the NMFS flag. The NMFS Woods Hole Exploratory Fishing & Gear Research Base will outfit Sam's shrimp boat (a 50-footer with western rig). Ernest D. McRae Jr., assistant base director, reported that Sam will have latest experimental gear, including hydraulic dredge, air compressor to blow the water hose, and a 30-inch dredge pump and diesel. Sam will supply the boat, some rigging and a heavy mast, well-stayed with a fixed boom.

All data will become NMFS property.

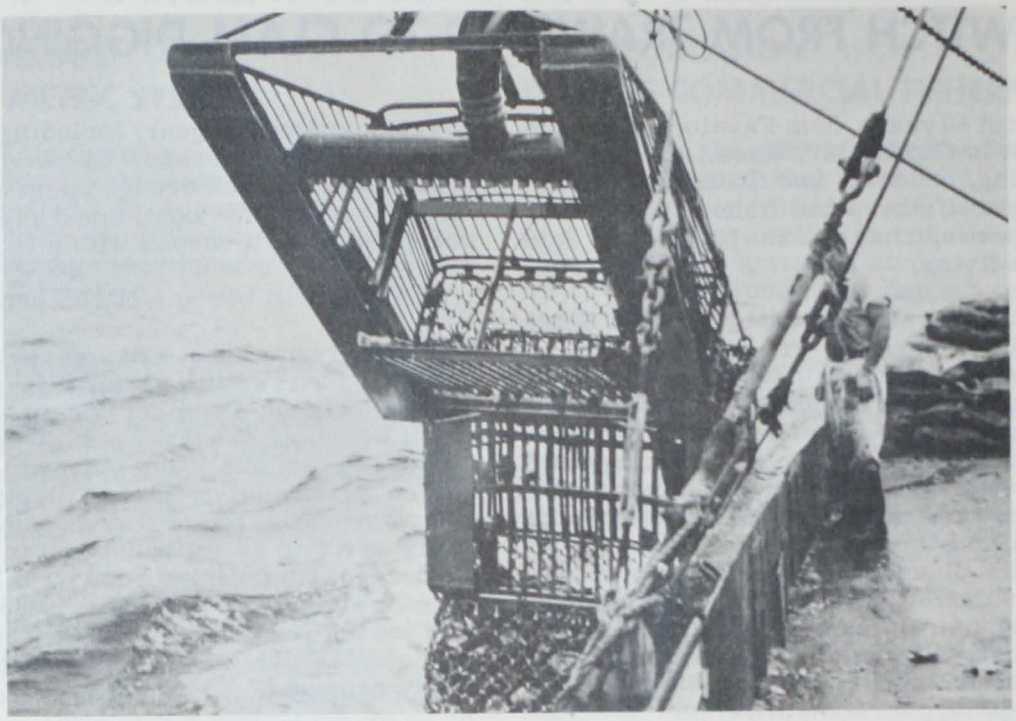
On one trip, Sam will use only a "dry" dredge. Fishermen call this a "rocking chair". It is the one most commonly seen on small boats off New England. This mechanical dredge is small, box-shaped, and steel-slatted with steel teeth for digging into the mud as dredge is towed across ocean bottom. There are 8 to 24 teeth, depending on size of the dredge towed behind boat. It is brought in over the stern by booms and winches. McRae said one big drawback of the dry dredge is that clams often are broken and the meats are easily damaged.

Second Expedition

The second expedition's hydraulic dredge uses jets of water to loosen bottom sediments ahead of digging blade. The water jets create turbulence on the ocean bottom. This exposes clams in path of the blade that scoops clams into attached steel net. The jet hits the ocean bottom about 3 to 4 feet ahead of the blade. Water is supplied to the jets through a 6-inch hose attached to a powerful salt-water pump on deck.

The 40-inch-wide digging blade at mouth of dredge can be adjusted to various digging depths. An inclined rack passes shellfish into the dredge. Two steel frames or cages form bulk of the dredge and support the jet manifold, cutting blade, and mesh bag usually made of 3-inch metal rings or links. The cage slides along bottom on broad flat runners dragging the 8- to 12-foot bag.

McRae said a 40- or 48-inch dredge needs 1,600 to 1,800 gallons of water per minute--at about 60-pounds-per-square-inch differential pressure between inside of manifold and outside water pressure, regardless of depth. Normally, the dredge is towed against tide along bottom for 5 to 15 minutes, depending on density of clam bed. Towing speed varies from 4 to 6 knots per hour.



A hydraulic jet dredge alongside commercial vessel before being taken aboard for dumping. Catch has nearly filled chain bag.

The 1,000-pound dredge is lowered by the main winch and a $\frac{5}{8}$-inch wire cable attached to a ring on forward cage towing bar. After cage is filled, the dredge is raised to surface. A line is attached to a chain bridle on rear cage. This line is used to raise rear end of dredge above deck so it can be dumped.

Can Be Operated Easily

McRae said this type of hydraulic dredge is commonly used by fishermen to harvest clams and quahogs. He added: "The hydraulic dredge can be operated quite easily from small draggers or other small fishing vessels, although this method of dredging requires more accessory gear and is more expensive than a dry dredge."

McRae reported that his unit's latest modification in the hydraulic dredge method was getting rid of the diesel pump-and-hose arrangement. This was replaced with an electrically driven submersible pump mounted on a special steel plate. The plate is located across forward end of dredge under towing bar and braces. The 8-inch pump discharge is connected directly to manifold with a reducing elbow and a short length of 6-inch hose; this acts as precaution against shock and vibration. A neoprene-jacketed cable supplies power to pump. It is handled on a powered reel that can be mounted anywhere aboard ship. Although total cost of submersible pumping system is higher, the efficiencies are greater, McRae noted.

Another Modification

Another future modification eliminates mesh bag and enlarges after-cage. Now, clams are dumped onto a sorting table equipped with running water. Fishermen stand and sort, an onerous and leg-punishing job, which is going out, says McRae.

He would like to see a constant return system. Using this, the catch is brought onto deck without hauling in the dredge. Also, he would like to see a complete preprocessing system on board ship. He noted that Soviets and others now operate such "factory" ships. These are equipped with preprocessing apparatus and refrigeration. "So this concept is certainly not new."

Ocean quahogs seem safe from Soviet exploitation because Soviets are bound by law not to dredge ocean bottoms.

McRae was optimistic about this: "Beds of clams that occur outside the contiguous fishing zone (3-mile limit) would probably be reserved for the American fisherman because the clams live within the bottom instead of over the bottom as do fish."

U.S. TO HOLD UP DISCHARGES INTO L. MICHIGAN UNDER 1910 STATUTE

Early in June, the Environmental Protection Agency (EPA) revealed that it would heed a relatively unknown 1910 Federal law and not grant permission to 7 heavy-industry firms to discharge waste into the southern end of Lake Michigan.

Chicago conservationist groups hailed EPA's decision. One of these groups, Businessmen for the Public Interest, had discovered the old law and informed EPA.

Refuse Act of 1899

EPA had planned to grant new permits for discharges into L. Michigan under Refuse Act of 1899. This act requires permission from U.S. Army Corps of Engineers, with EPA approval, before anything more can be dumped into navigable waters or their tributaries.

Earlier in 1971, Pres. Nixon had ordered a review of all existing permits. He directed EPA to renew these only if industry wastes had been purified enough to meet existing state and U.S. water-quality standards.

But the conservationist group argued that today's standards were much too low to prevent industrial discharges from seriously damaging lake. It maintained that permits that meet only present standards were only "licenses to pollute."

1910 Statute

The 1910 statute has been enacted specifically to protect southern end of L. Michigan. It banned discharge of any refuse from points along shore of Cook and Lake Counties--unless discharge is contained behind breakwater. No U.S. officer may authorize dumping contrary to this law.

1910 Statute Could Set Precedent

EPA's Administrator, William D. Ruckelshaus, said that 1910 Act could set precedent affecting future 1899 Act permits throughout U.S.

The EPA decision facilitates legal actions by conservationist groups to have the courts direct Cook and Lake County industries to change their disposal systems.

Challenge EPA's 1899 Permits

Businessmen for the Public Interest has filed suit in U.S. court challenging EPA policy on 1899 permits. The group wants the court to order EPA to require applicants for permits to instal the "most modern technology available" to clean their discharges instead of just meeting present water-quality standards.

Illinois Action

The Illinois Pollution Control Board was working to adopt more stringent standards for all State waterways. It planned to single out L. Michigan for special protection through new standards.

7 Large Companies

Use of the 1910 statute affects 7 of largest industrial firms along lake's southern shore: Inland Steel, U.S. Steel, American Maize Produce, American Oil, Union Carbide, Commonwealth Edison, and Northern Indiana Public Service.

Appeal to Atomic Energy Commission

The Businessmen for the Public Interest called on Dr. Glenn T. Seaborg, Atomic Energy Commission chairman, to ban new construction permits for nuclear power plants. It asked too that he close 11 of those already operating in U.S. until new emergency cooling systems have been designed.

The conservationist group reminded Dr. Seaborg that AEC's own studies showed present emergency cooling systems might not prevent catastrophic atomic discharge if break occurred in a reactor's normal cooling system.

U.S. & CANADA AGREE TO END GREAT LAKES POLLUTION BY 1975

Meeting in Washington on June 10, the U.S. and Canada agreed on a common program to end Great Lakes water pollution by 1975.

The $2-billion program's object is to produce over the next 4 years waters "clean enough for any fish to live in."

Unprecedented Scope

Russell E. Train, chairman of Environmental Protection Agency, described agreement as "historic first." He stated that its provisions were "unprecedented in scope" and could be model for international agreements everywhere.

Canada's Sharp

Mitchell Sharp, Canada's External Affairs Minister and a former fishery minister, noted that agreement was the "most far-reaching ever signed by 2 countries in environmental field."

Sharp had pointed out earlier that Great Lakes pollution had reached level where "two of the richest societies on earth are knowingly and wantonly poisoning this unique resource, and by extension, each other."

18-point Communiqué

At end of meeting, an 18-point communiqué announced U.S. & Canada would set up and carry out "common water quality standards" for Great Lakes and St. Lawrence River.

They agreed to conclude before end of 1971 an executive agreement on water-quality control to embrace these programs:

- Build treatment facilities for municipal and industrial wastes and animal husbandry operations.
- Reduce phosphorus discharges.
- Eliminate mercury and other toxic heavy metals from discharges.
- Control thermal, radioactive waste, and pesticide pollution.

The Cost

Implementing these controls is expected to cost U.S. about $2 billion over next 4 years--half paid by U.S., the rest by State and local governments.

Sharp said he did not know exact cost to Canada, but that it would run to "hundreds of millions of dollars." Canadian share is far less because industrial development on north shore of lakes is less advanced.

Combat Oil Spills

U.S. & Canada will coordinate steps to combat oil spills in Great Lakes. A joint response center will be activated when major spills occur.

The 2 countries will adopt compatible rules for ship designs and construction to prevent spills.

International Joint Commission

U.S. & Canada will enlarge authority of International Joint Commission. This body was set up under 1909 treaty. It has been studying for 6 years pollution problems in Lake Erie, Lake Ontario, and parts of the St. Lawrence that forms international boundary.

1970 U.S.-CANADA GREAT LAKES COMMERCIAL FISHERY FELL 10%

In 1970, the Great Lakes catch by commercial fishermen of the U.S. and Canada was 110.5 million pounds worth $11.7 million--a drop of 10.5% in weight and about 3% in value.

U.S. landings rose from 67 million pounds in 1969 to 70.4 million in 1970, but the increase was due principally to a larger alewife harvest in Lake Michigan. Last year, production in lakes Erie, Huron and Superior dropped to record lows.

The Canadian decline from an all-time high of 56.5 million pounds in 1969 to about 40.1 million in 1970 was caused primarily by a sharp drop in catch of yellow perch and smelt in Lake Erie. These two species were a little under 80% of total Canadian Great Lakes catch in 1969 and 73% in 1970. Another factor was the ban on commercial fishing in Lake St. Clair (permitted only in Canadian waters) in early April 1970 following discovery of substantial mercury contamination.

The 1970 data come from National Marine Fisheries Service office in Ann Arbor, Mich., and from preliminary statistics of Ontario Department of Lands and Forests.

The catch in waters of the Great Lakes states in 1970 was (in 000s of pounds):

Illinois	405.2	New York	533.6
Indiana	334.6	Ohio	8,420.0
Michigan	21,168.8*	Pennsylvania	505.5
Minnesota	1,306.5	Wisconsin	37,714.8*

*Alewives: Michigan 5,981.4; Wisconsin 27,478.7.

LAKE MICHIGAN

The lake's share of U.S. Great Lakes fishery production was 75% of 1970 total. Due to major role of low-value alewife--used for fish meal, oil, and pet food--the lake's share of catch value for all U.S. waters was 60%.

The 33.5 million pounds of alewives in 1970 was second only to 1967 record of 41.9 million pounds; in 1970, alewife was 48% of U.S. Great Lakes catch.

Lake Michigan also provides a large share of U.S. production of chubs and lake whitefish, the most valuable commercial species in U.S. section of Great Lakes. In 1970, the 9.6 million pounds of chubs and 1.7 million pounds of lake whitefish were 21% of total lake catch; their landed value of $2.7 million was 71% of receipts for all species. The whitefish catch was highest for lake since early 1950s.

Lake trout, the high-value species nearly eliminated by sea lamprey, provided a commercial catch of over 87,000 pounds in 1970, the greatest since restocking of this species began in Lake Michigan in 1965.

The coho salmon, first planted in Lake Michigan in 1966, has won an important place in lake's commercial and sport fishery. In 1970, the coho available to commercial outlets reached a record 2.2 million pounds. To a large degree, the fish marketed are bought from surplus stocks taken by Michigan's fishery agency during heavy fall spawning runs. This procedure permits use of huge number

of coho that cannot be taken by any sporting method--and would otherwise die in the streams after spawning.

	1969	1970	1969	1970
	(000 lbs.)		(000 $)	
U.S. total	66,968	70,389	5,968	6,338
Lake Ontario	294	333	44	79
Lake Erie	11,050	9,546	1,428	1,265
Lake Huron	2,897	2,411	493	404
Lake Michigan	47,489	53,091	3,028	3,819
Lake Superior	5,239	5,009	975	771
Canadian total	56,496	40,131	6,128	5,391
Lake Ontario	2,270	2,905	330	429
Lake Erie	48,026	31,722	4,244	3,769
Lake St. Clair	919	87	332	41
Lake Huron	2,329	2,120	819	734
Lake Superior	2,951	3,297	403	418
U.S.-Canada total	123,464	110,520	12,096	11,729

LAKE ERIE

Although Canadian landings dropped one third from 1969 to 1970, the 31.7 million pounds in 1970 were 77% of lake total. In 1969, the Canadian share was 81%. U.S. 1970 production for the 4 states bordering Erie was a new low of 9.5 million pounds, less than half the catch in 1961 and 1962.

In Canadian catch, yellow perch and smelt are dominant species--together 93% of 1970 Erie total. For yellow perch, a strong 1965 year-class was prime factor in 1969 record catch. But hatches after that have been weak to fair. So fade-out of 1965 class was reflected in 1970 landings. The high Canadian smelt catch of 1969 was dominated by a large 1967 hatch, which has not been repeated.

LAKE HURON

Commercial 1970 landings by U.S. and Canadian fishermen--about 4.5 million pounds--hit an all-time low. The downward trend results from the decline of several species. However, the Canadian catch of lake whitefish gained a fraction and reached nearly a million pounds, highest since 1960.

	Pounds				Dollar Value			
	1969 (000s)	% of Total	1970 (000s)	% of Total	1969 (000s)	% of Total	1970 (000s)	% of Total
U.S. total	66,968	100	70,389	100	$5,968	100	$6,338	100
10-species	63,513	95	66,927	95	5,156	86	5,621	89
Alewives	29,248	44	33,461	48	332	6	381	6
Chubs	10,156	15	10,934	16	1,550	26	1,842	29
Carp	6,507	10	6,582	9	266	4	397	6
Yellow perch	4,905	7	4,271	6	677	13	761	12
Smelt	3,614	5	3,555	5	116	2	96	2
Whitefish	2,323	3	2,352	3	1,412	24	1,331	21
Coho salmon	1,144	2	2,243	3	39	1	315	5
Lake herring	2,321	3	1,364	2	296	5	170	3
White bass	1,221	2	1,103	2	365	6	275	4
Sheepshead	2,074	3	1,060	1	103	2	53	1
Canadian total	56,496	100	40,131	100	$6,128	100	$5,390	100
5-species total	50,205	89	35,463	88	4,776	78	4,795	89
Yellow perch	30,468	54	21,241	53	3,313	54	3,419	63
Smelt	15,226	27	9,571	24	561	9	437	8
Lake herring	2,453	4	2,857	7	195	3	232	4
Whitefish	1,142	2	1,233	3	621	10	639	12
Carp	916	2	561	1	86	1	69	1

LAKE SUPERIOR

The 1970 catch was 8.3 million pounds, only slightly above 1969's 8.2 million, lowest figure since 1900. The 1970 catch was a record low for U.S. waters. The major factor in Superior's decline has been the sharp drop in U.S. landings of lake herring. The annual catch has decreased steadily from about 11.5 million pounds in 1961 to about 1.3 million in 1970. Smelt production in U.S. waters was 1.6 million pounds in 1970. For first time, it became leading species in Superior catch.

LAKE ONTARIO

Commercial landings in 1970 were 3.2 million pounds, the greatest since 1941 (3.7 million). The major part of lake's catch is taken in Canadian waters. A prime factor in 1970's gain here was the increase in yellow perch landings; the 1970 figure of nearly a million pounds were more than double 1969's. This gain was stimulated partly by a rise in sale price, which spurred fishing effort.

LAKE ST. CLAIR

Commercial fishing is limited to Canadian waters. In recent years, the annual catch has ranged from about 800,000 to 1 million pounds. However, in 1970, the discovery of mercury in St. Clair waters closed fishery early in the year; production was only 87,000 pounds.

OCEANOGRAPHY

NAVAL OCEANOGRAPHIC OFFICE CUTS GUESSWORK IN SEDIMENT STUDIES

The U.S. Naval Oceanographic Office (NOO) has eliminated much guesswork in investigating sediment deposits in harbor and coastal areas by using a special survey instrument. This was reported by Captain F. L. Slattery, NOO Commander.

The device is a high-resolution, high-frequency seismic profiler. It has been used successfully aboard small survey craft to measure the thickness and extent of subsurface layers.

How It Works

The instrument, said Newell Stiles, who directed the trials, generates continuous wave fronts on frequencies of 5 and 12 kilohertz. It records the time required for the sound pulse to travel through the water and the sediment cover. It plots these travel times automatically to produce cross-sectional outlines. These are coordinated with precise positioning data to make contoured maps.

Stiles noted: "As the wave fronts encounter materials of contrasting acoustic impedance (in the sediment cover), portions of the transmitted sound are returned, in the form of echoes, to the (water's) surface where they are sensed by the profiler's transducer. The materials of contrasting acoustic impedance are normally manifestations of geologic stratification or boundaries."

Contoured Maps Made Quickly

He said contoured maps showing thickness of muds and clays between the boundaries can be constructed easily in the field. The maps can be forwarded immediately to ocean scientists studying sediment cover.

The maps can eliminate the need to initiate tight survey patterns, the present method for adequately charting sediment deposits.

WATER-CIRCULATION STUDIES AID POLLUTION CONTROL

NOAA is conducting a detailed 2-year study of the dynamics of water circulation in Boston Harbor and Massachusetts Bay. It is part of a larger NOAA program of similar studies in coastal and estuarine waters.

The survey will provide necessary data for pollution-control authorities to maintain and preserve the marine environment. The latest information on current speed and direction in the Boston Harbor area also will contribute to navigation safety.

NOAA's National Ocean Survey's 'Ferrel' is being used.

Ferrel's Gear

The Ferrel's primary means of observing currents is the TICUS (Tidal Current Survey). The system, which is being used extensively in the program, employs current meters suspended from buoys at preselected stations throughout the Boston Harbor area. Observations of the current's speed and direction at various depths at each station are recorded for study by the National Ocean Survey at Rockville, Md.

Also, scientists are using a photographic recording current meter to record on 16 mm film the current's speed and direction. Other instruments include sensors for observing water temperature, salinity, and depth.

The survey results will appear in two National Ocean Survey publications.

NOAA has scheduled circulation studies of the entire coastal area from southern Maine to Rhode Island during the next 3 to 5 years.

NOAA SUPPORTS SALT-MARSH RESEARCH IN GEORGIA

NOAA has awarded a $216,700 Sea Grant to the University of Georgia to study the use and conservation of salt-marsh estuaries in Georgia. Part of the program will be conducted by the Skidaway Institute of Oceanography at Savannah.

There is a real need for salt-marsh ecological and utilization studies. For about a hundred years, the Georgia coastal region, except around Savannah and Brunswick, has had a low population and very little development. As the timber-and-plantation economy diminished, then died, many sea islands returned to a wild state.

A Period of Change

The status of the coastal region has been changing rapidly in recent years. Certain sea islands have been bought by or donated to the U.S. or Georgia. Planning for other islands and close-in areas includes resort development, strip-mining sites, and mariculture. A nuclear power plant is being built. Coastline and estuarine development is gathering momentum--yet there is little information on the effects changes might have on organisms and other resources within the marshes.

What Scientists Will Study

Scientists will investigate the natural and biological factors affecting growth and reproduction of marsh organisms, and the economic potential of salt marshes. Diseases that affect man's use of estuarine species will be studied. The scientists will monitor 4 finfish and 4 shellfish species and examine them for pathogenic microorganisms and parasites.

Using existing findings by NMFS and fishermen, the researchers will try to increase fishery production. They will focus on abundant fish species off Georgia that are not being fully used.

SATELLITES MEASURE SEA-SURFACE TEMPERATURE IN U.S.-MEXICO SURVEY

The results of a U.S.-Mexican oceanographic survey, LITTLE WINDOW II, are expected to tell scientists how accurately two meteorological satellites--NOAA I and ITOS I--can measure changes in the ocean's surface temperature and monitor the weather. This was reported by Rear Admiral W.W. Behrens Jr., Oceanographer of the Navy.

LITTLE WINDOW II was an oceanographic survey of a 100 by 100 mile square in the Gulf of California. It tested the ability of infrared sensors aboard the NOAA and ITOS satellites to measure the ocean's surface temperature from space.

U.S.-Mexico Survey

LITTLE WINDOW II was larger than a survey in the same area in March 1970. During early May 1971, U.S. and Mexican scientists used 3 specially equipped research aircraft and 5 survey vessels to run oceanographic transects of the window region. The temperature information will be compared with infrared readings collected simultaneously by the satellites during their twice-daily passage over the area.

Participating in this cooperative venture were Mexico's Navy and Instituto Nacional de Pesca; the Inter-American Tropical Tuna Commission; and FAO.

The U.S. Naval Oceanographic Office (NOO) coordinated LITTLE WINDOW II. Cooperating were NOAA's National Marine Fisheries Service, National Environmental Satellite Service, National Weather Service, and National Oceanographic Data Center; NASA and its Ames Research Center; and Scripps Institution of Oceanography.

Gulf of California Unique

NOO says the Gulf of California is uniquely suited for this type of experiment. It has an extremely dry atmosphere with a minimum of clouds, land masses distinctive enough to position spacecraft results within desired oceanographic tolerances, and a fairly uniform sea-surface temperature.

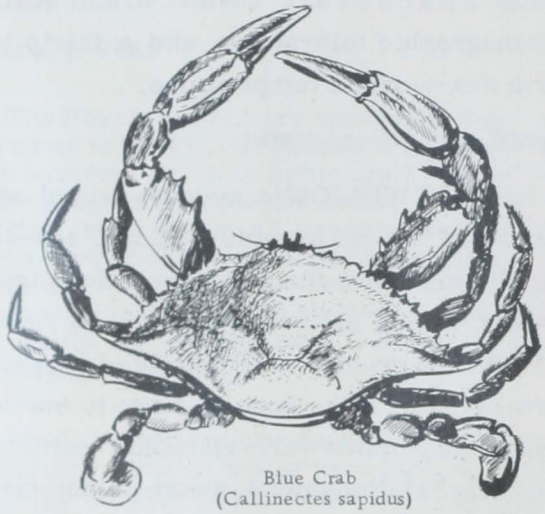
Significant If Successful

LITTLE WINDOW's success would show that satellites can provide continual sea-surface temperature for any ocean. Such information would be very helpful: to fishery scientist to predict distribution of temperature-oriented fish, such as tuna; to meteorologist, who studies warm and cold ocean fronts and their relationships to short-period meteorological changes and seeks reliable long-range weather forecasts; to oceanographer searching for a quick way to look at temperature conditions over broad sea surfaces. The meteorological and water-mass condition implications are especially interesting to the Navy.

CHESAPEAKE BAY HARD CRABS WILL BE SCARCE THIS SUMMER

Hard crabs will be scarce in the Chesapeake Bay until August, say scientists of the Virginia Institute of Marine Science (VIMS), Gloucester Point, Va. They conduct regular surveys of blue-crab stocks. They predict the crab-pot and trotline catch this summer will be 8 to 10 million pounds, near the lowest since 1960.

The average catch from June through August over the past 11 years was 16 million pounds. The average was exceeded in 7 of the 11 years; in 4 years, the catch was below average. The largest landings, in 1967, totaled almost 22 million pounds; the smallest was 8.5 million pounds in 1969.



Blue Crab
(Callinectes sapidus)

Present Crabs Hatched in 1969

The crop of commercial-sized crabs now available was hatched in 1969. Routine surveys of some Virginia rivers revealed few small crabs in fall 1969. The crop failure was believed caused by heavy rains during August 1969. Low supplies of the 1969 hatch were reported by VIMS in spring 1970 and again in the fall. The summer scarcity was expected.

The scientists add an optimistic note: there should be many soft crabs and peelers this summer, possibly more than at any time during the last 10 years. These crabs, hatched in 1970, will produce the bulk of the commercial hard-crab catch from September 1971 through August 1972.

VIMS STUDIES INCREASING PRODUCTION OF SOFT BLUE CRABS

A NOAA Sea Grant is enabling scientists of the Virginia Institute of Marine Science (VIMS), Gloucester Point, Va., to study methods of increasing soft blue-crab production in the Chesapeake Bay.

Soft crabs for food and peeler crabs for fishing bait have high public demand--but are only a small part of total blue-crab landings in Chesapeake Bay.

The 10-Year Record

During the past 10 years, an annual average of 3.5 million pounds of soft and peeler crabs were produced worth $1.2 million. Although these landings were less than 5% of the bay catch of crabs, they earned 20% of the dollars.

Records show fluctuations in hard and soft crab production, says Paul A. Haefner Jr., marine scientist in VIMS Crustaceology Department. The dollar value of hard crabs remains fairly constant; that of soft crabs varies according to number produced. Although dollar value of hard crab fishery exceeds that of soft crab, the latter is worth more per pound.

Haefner noted that if more soft and peeler crabs were taken, there would be fewer crabs to become mature hard crabs--but income from soft crabs would increase without changing markedly the value of hard crabs.

Adequate supplies of peeler crabs are available for harvesting. What has kept production of soft crabs at low levels has been absence of guidelines for efficient construction and maintenance of holding facilities.

Sea Grant Project's Aims

Haefner said the primary aim of the VIMS Sea Grant project is development of plans for physical plants for shedding crabs in tanks with open-flow or recirculated sea water. The scientists also will establish guidelines for acceptable levels of water quality, and for the condition and quantity of crabs that can be handled. Another project aspect is the study of crab mortality and, perhaps, ways to prevent this loss to industry.