

ATLANTIC SALMON (R. K. Brigham)

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ATLANTIC SALMON NEEDS INTERNATIONAL PROTECTION, DR. GLASGOW SAYS

Conservation of the Atlantic salmon depends significantly on international cooperation and careful management, believes Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife and Parks. He served this year as chief of U.S. delegation to annual meeting of International Commission for the Northwest Atlantic Fisheries.

ICNAF has recommended that its 15 member nations keep high-seas catches of salmon in Northwest Atlantic at 1969 level.

Salmon are hatched and spend their early life in freshwater coastal streams. Then they go to sea, where they migrate long distances before returning to native streams to spawn. The cycle is repeated.

Need for Controls Surfaces

The need for international controls became apparent in the mid-1960s, when high-seas fishing for salmon developed off Greenland. That island has no significant salmon-producing rivers. Many of the salmon caught off Greenland must have hatched elsewhere.

Dr. Glasgow said: "Fishing for salmon on the high-seas is contrary to principles of good conservation. It is essential to allow a certain number of salmon to escape to each spawning stream in order to maintain the resource. This can be done only if fishing op-

erations are restricted to inshore waters and streams, where close supervision is possible."

ICNAF's Work

ICNAF coordinates high-seas conservation of fisheries in the Northwest Atlantic. Its members include the principal countries fishing there. It has sponsored studies that show some salmon caught off Greenland come from streams in Great Britain, Canada, and the U.S.

In 1969, ICNAF recommended a complete ban on salmon fishing in international waters; this proposal was not accepted by Denmark and West Germany. However, these countries agreed to catch limitation proposed for 1971. Denmark has the largest salmon fishing fleet off Greenland.

U.S. Position

"The freeze on 1971 catches is an interim measure and far from satisfactory," Dr. Glasgow has stated. "The United States approved this proposal only when it became clear that agreement could not be reached on more effective measures. Over the long term, stronger international controls will be necessary to serve the interests of good conservation. We shall do our utmost to this end."



HERRING AND MENHADEN APPROVED FOR FPC

The Food and Drug Administration (FDA) has approved the use of herring and menhaden in producing fish protein concentrate (FPC). FDA had examined data supplied by BCF before acting. Only hake and hakelike fishes had been approved before.

The value of recovered oil from herring and menhaden will reduce costs of producing FPC, a virtually odorless, tasteless light-tan powder made from whole fish. FPC contains over 75% animal protein and several nutritionally beneficial minerals.

Worldwide use of FPC could help provide a better-balanced diet for undernourished millions. It also offers profitable use of many unused fish off U.S. coasts.

Aberdeen FPC Plant

Assistant Secretary of the Interior Leslie Glasgow said August 25 that an experimental and demonstrational plant being built at Aberdeen, Washington, is scheduled for completion late this year. It is designed to process up to 50 tons of raw fish during a 24-hour day--and to produce up to 7.5 tons of high-quality FPC. The plant is intended to demonstrate the feasibility of manufacturing FPC by a BCF-developed extraction process using isopropyl alcohol. The plant also will provide a basis for design and construction of privately owned full-scale plants.

About 25¢ A Pound

Nutritionists estimate 750 million people suffer from a serious protein deficiency in their daily food--and their number is increasing daily. Commercial development of the BCF extraction process using hake is expected to provide a product costing about 25 cents a pound. This could compete easily with other available animal protein supplements on a protein-content basis. Tests have shown that less than half an ounce of FPC per day will produce a remarkable improvement in a protein-deficient diet.



LAND FIRST COMMERCIAL CATCH OF PELAGIC RED CRAB

The 'American Eagle' landed the first commercial load of pelagic red crabs in San Pedro, Calif., in July. The Starkist Food Co. bought the 1,700-pound catch.

BCF gear, a 16-foot otter trawl, and a 5' x 5' Blackburn neuston net were used to catch the crabs in international waters off southern Baja California. Rough seas permitted only 2 days of fishing during the 7-day trip. A BCF biologist was aboard.

Catching and Preparing Crabs

Both bottom and midwater trawls caught red crabs successfully. Samples were collected and prepared in several forms: whole, raw; ground, raw; and ground, cooked. The crabs were preserved in the spray-brine tank, or in a chest freezer.

The samples will be used by the BCF Technological Laboratory in Seattle, Wash., for analysis and experimental processing. According to lab director Dr. Maynard Steinberg, the most promising use of red crabs seems to be for pet food or animal feed.



110,000-TON QUOTA SET FOR CALIFORNIA ANCHOVY REDUCTION

An anchovy catch quota for reduction of 110,000 tons for the 1970-71 season--10,000 tons for Northern Permit Area and 100,000 tons for Southern--was approved on July 31 by the California Department of Fish and Game.

Fishermen are restricted from fishing for anchovy for reduction in designated zones ranging from 3 to 6 miles offshore.

The season opened August 1 for the northern area, and September 15 for the southern area. The fishery will be closed during February 1971. The season will end when the quotas have been attained, or on May 15, 1971.



U.S. FOOD SITUATION

"Food prices have increased much less rapidly in recent months than they did last fall and winter," reports the U.S. Department of Agriculture. In June 1970, food prices averaged 1.3% (seasonally adjusted annual rate) over March, and 3.3% over last December. This contrasted with gain of 5.7% for total Consumer Price Index. Much of the increase for food resulted from higher prices of food eaten outside the home. Retail-store prices of food rose a fraction.

Price Decline in Fall

"Food prices may show a small seasonal increase this summer," Agriculture Department states, "but they likely will decline more than seasonally this fall if the red meat supply, especially pork, increases as expected. Seasonally large supplies of fresh fruits, vegetables, and potatoes also will contribute to lower prices later this year." For 1970 as a whole, the total food price index may average about 5% above 1969. This will be due partly to large increases between fourth-quarter 1969 and first-quarter 1970.

Per-Capita Consumption Up

Per-capita consumption of food will increase this year. Contributing to rise will be expected increases in consumption of poultry, fish, fruit, potatoes, and sugar. Meat consumption also is expected to rise slightly. Less consumption of dairy products is in prospect.

Smaller % of Income For Food

Food expenditures increased 1% in second-quarter 1970, the smallest advance since late

1968. However, spending was still over 8% higher than in second-quarter 1969. For 1970, expenditures may total around \$113 billion; 1969's were \$105 billion. Disposable income probably will increase more than expenditures. This will lead to a decline from 16.7% in 1969 (revised) to 16.5% this year in proportion of income spent for food.

Food Prices

Between January and June 1970, retail food prices rose less than half as fast as prices for nonfood goods and services. There was a 1.5% increase for food compared with a 2.9% increase in prices of nonfood items. Prices of all consumer goods and services rose 2.6%. Since 1957-59, prices of all nonfood items have increased around 36%; total food prices have risen 32½%. Prices of food in stores rose 28%, and eating-place prices rose 55%.

The retail price index for all food averaged 7% higher during January-June 1970 than during same period 1969. Retail-store prices rose 6.7%, while prices of food eaten outside home went up nearly 8%.

SUPPLIES OF FISHERY PRODUCTS INCREASE

Supplies of edible fish during January-June 1970 rose an estimated 6% above first-half 1969. Supplies were lifted by a 14% rise in imports over a year ago, and an increase of about 4% in domestic catch.

Fish landings in the New England area for first 6 months of 1970 were a fraction below a year earlier. U.S. fishermen caught only about half the haddock of a year earlier. However, there were gains in flounder, ocean perch, pollock, and whiting.

Among the other major U.S. fisheries, shrimp "is well on its way" toward record production; catches are running 13% above last year. Pacific halibut landings probably will be a little below last year; tuna likely will be about the same.

Imports Much Above 1969

Imports of major edible fishery products are considerably above 1969. Imports of fillets are up 25%--led by sharp increases for cod, flounder, and haddock. The only sizable drop has been in ocean-perch fillets. Receipts of raw materials for fish sticks and portions have increased 15%. Imports of sardines are about 10% above 1969.

Imports of foreign lobsters have declined this year, but imports of shrimp are 17% above a year ago.

Inventories of frozen fish and shellfish are 11% higher than last year. Inventories of frozen fillets are up a third; stocks of cod and flounder fillets are substantially larger. Frozen haddock fillets are up slightly; stocks of ocean-perch fillets are down slightly.

Cold-storage holdings of shellfish are 11% above 1969 because of larger shrimp stocks. Most other shellfish are slightly below year-ago levels.

Strong Demand

Demand for fishery products was strong in first-half 1970. This continued 1968 and 1969 trends. Movement of most products is reported good. Fish prices are averaging 8 to 9% above a year ago.

Supplies Ample

Supplies of most fishery products will increase seasonally for the remainder of this summer. They are expected to be ample for trade needs. Price levels generally will continue higher than in 1969.

Large catches of Alaska salmon will ensure plentiful supplies of frozen and canned salmon for current marketing year. Supplies of most frozen fillets are higher than last year. Production of the popular fish sticks and fish portions is well above year-ago levels. Supplies of most shellfish will be adequate. Shrimp are expected to be plentiful for remainder of 1970.



CONSUMPTION OF SHELLFISH RISES 12% ABOVE 1969

From January-July, consumption of fresh and frozen shrimp, northern lobsters, spiny lobster tails, and sea scallops increased about 12% over a year earlier. These items made up 62% of all U. S. shellfish consumption in 1969.

Consumption of fresh and frozen shrimp has risen 15% in 1970; lobster tails have shown a moderate increase; sea scallops are a fraction ahead of last year; and northern lobster consumption is off a little.



SHRIMP-SEPARATOR TRAWLS TESTED IN GULF OF MEXICO

Tests of shrimp-separator trawls have been conducted in Gulf of Mexico by BCF's Pascagoula (Miss.) Exploratory Fishing and Gear Research Base. Two western-type, 70-ft., semiballoon shrimp trawls were modified into shrimp-separator trawls and tested on brown-shrimp grounds.

The horizontal panel trawl (modified Pascagoula design) was slightly more effective than vertical panel trawl (modified Seattle design) in channeling shrimp into the side or shrimp bags; but the former had a higher percentage of fish contamination.

The separating percentage for both trawls was below earlier trials with 40-ft. separator trawls. This is attributable partly to: (1) small fish encountered; (2) large horizontal opening of trawl, which permitted more shrimp to reach fish bag without contacting separator panel; (3) size of mesh in separator; and (4) basic design of western semiballoon trawl.

The Modified Designs

The modified designs, though less satisfactory at sorting shrimp, were much more efficient catchers of shrimp and fish than earlier models; they caught as much as standard trawls.

The accumulated data indicate strongly that radical design changes are required. Possibly, observations by SCUBA divers will be necessary before developing a commercially effective separator trawl for penaeid shrimp in the Gulf of Mexico.



EXCESS LAKE MICHIGAN SALMON WILL BE HARVESTED

An estimated 3 million pounds of salmon surplus to the needs of sport fishermen in fall 1970 will be taken from Lake Michigan streams for processing. The Michigan Department of Natural Resources has authorized the Blackport Packing Co. of Grand Rapids to do the job.

Terms of Contract

If the fish meet State and Federal food standards, they will be made available to qualified buyers in Michigan at a fair market price. Also, Blackport will process about 50,000 coho and chinook salmon for free distribution to Michigan's licensed salmon fishermen.

The 3 million pounds to be processed, and the free salmon, will be collected at 3 weirs operated by the Department of Natural Resources.



MAINE SARDINE COUNCIL SEEKS ANSWER TO HERRING SCARCITY

The Maine Sardine Council has made a grant for a study of the effect of environmental conditions on the habits, supply, and movement of herring along the Maine coast. The work will be done by The Research Institute Gulf of Maine (TRIGOM) and the Maine Medical Center.

Richard E. Reed, council executive secretary, said the most serious scarcity of fish in 10 years triggered the action.

Traditional runs of sardine-size fish have failed to appear. Maine's 21 sardine canneries have been operating at 20% or less of capacity since January. Reed said the condition existed over most of the Gulf of Maine because the Canadian industry was having the same problem.

Study Goals

Reed described the study goals: "We hope to find some clues that will permit our industry to anticipate the extent of fluctuations in herring supply that may be expected from year to year, determine the cause and then seek an effective plan for conservation and management of the fishery. New techniques and approaches developed by TRIGOM and the Medical Center will supplement extensive biological research that has been carried on by state and federal agencies for the past 25 years."



ESTIMATION OF FISH STOCKS BEING IMPROVED

Haddock stocks in the northwest Atlantic Ocean are under strong international regulations because of increased fishing and low recruitment. Regulation of the yellowtail flounder fishery because of increased fishing also has been proposed.

Characteristics of fishing fleets have been changing. Vessels previously used for standard measurements of fish are no longer fishing the same species.

Improved Estimates Needed

According to BCF's Biological Laboratory, Woods Hole, Mass., international regulations and changing fisheries have made acute the need to improve estimates of vital statistics. One statistic is relative abundance. Generally, it is expressed as landings per-unit-effort. Estimates of factors necessary to assess stocks depend upon estimates of abundance. The more precise this abundance estimate can be made, the higher the confidence that can be placed on the population factors.

Logbooks Issued

The standard method of obtaining fishing effort has been to interview the vessel's cap-

tain at dockside after a trip. However, this provides limited effort and discard information. To obtain more precise observations of effort and catch, on-board vessel logbooks are used. Segments of the haddock, yellowtail flounder, and ocean perch (redfish) fleets have been issued logbooks. Data from this sample will be the basis for evaluating the system. After necessary refinements are made, the logbooks will be put into general use.



SKIPJACK TUNA DISTRIBUTION IN PACIFIC MAY BE CHANGING

The results of a series of 5 oceanography-fishery cruises to the equatorial Pacific by BCF Honolulu suggest that skipjack tuna are increasing 500-1,000 miles southeast of Hawaii--while they are decreasing in Hawaiian area.

This could indicate a seasonal shift southward. BCF is investigating the subject thoroughly.



OREGON'S SHRIMP FISHERY REMAINS STRONG

Shrimp boats fishing off Oregon this year have landed 7.9 million pounds in Oregon's coastal ports through July, reports Jack Robinson, Fish Commission biologist in charge of monitoring the state's million-dollar-plus industry.

Landings should top 10 million pounds in 1970, says Robinson, the fourth highest on record. Although the high was 11 million pounds in 1968, the annual catch over the past 10 years has been a little over 4 million pounds. The fishery, which opened March 1, closes October 31.

Productive Areas

Coos Bay, with over 3 million pounds, is high port; landings at Newport are 1,067,000 pounds. Other productive areas for the cocktail-size shrimp include Astoria and Garibaldi.

Landings might have gone even higher, notes Robinson, except for poor market conditions in May, June, and July.

SIGNAL CRAYFISH FISHERY IS DEVELOPING IN PACIFIC NORTHWEST

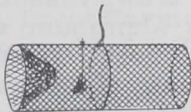
A fishery for signal crayfish, *Pacifastacus leniusculus*, is beginning to develop in the Pacific Northwest. This species apparently is similar to the European species. A shortage in Europe has fostered great demand in Scandinavia.

At the end of July, fishermen were getting about 40 cents a pound--but price has been as high as a dollar. Average size crayfish are 4 to 5 inches, 12 to 14 per pound.

Wide Distribution

Assessment of the resource has not begun, but indications are that species can be found in most lakes and streams in Northwest and in Northern California.

Cylindrical crayfish pots--2' by 10" diameter--have been built for testing.



SALT-WATER REARING OF SALMON IS TESTED

BCF Seattle Biological Laboratory staff are conducting experiments to determine the relation among water temperature, feed, and growth of salmon. They are using a system of screened pens and webbing enclosures supported by floating rafts attached to a pier.

First Trials Encouraging

Initial trials with coho salmon were very encouraging. In July 1969, 0.7-ounce fingerlings were placed in saltwater pens; by January 1970, they had grown to an average weight of 10 ounces. Conversion rate was 1.4 pounds of feed per pound of fish during late summer. This compares with conversion rate range of 1.2 to 1.5 pounds of feed per pound of fish under normal hatchery operations for cohos. During winter, the growth rate slowed, but the fish remained in the excellent condition.



'KELEZ' STUDIES HIGH-SEAS RED SALMON POPULATION

BCF's 'George B. Kelez' has been indexing the red salmon population on the high seas south of the Aleutian Peninsula. Gillnet catches on August 15 and 16 were exceptionally high (445 red salmon on the 16th). Fish that have been at sea through one winter are designated .1 fish. The proportion of these fish is much higher than expected following this year's large run to Bristol Bay.

.1s are 80% of Reds

Eighty percent of the reds caught on the cruise have been .1s. The .2 reds (at sea through two winters) are not as abundant as usual following a large run; .1 fish are more abundant than usual.

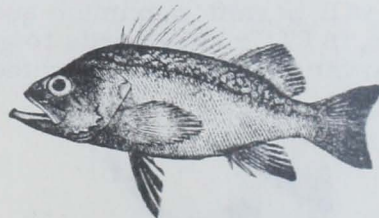
The .3 fish usually move farther west than younger age groups--beyond abstention line at 175° W. longitude. This may mean that in 1971 there will be fewer North American fish exposed to the Japanese compared to other years following peak runs.



ROCKFISH SHOW STRONG HOMING INSTINCT

Tagged yellowtail rockfish from a submerged wreck north of Juneau, Alaska, have shown remarkable ability to return home. So far, 10 of 34 fish released at Auke Bay, 6 miles away, have returned; another quickly found its way across a channel one mile wide and 300 feet deep to return to the wreck.

The fish released from Auke Bay also had good "memory": they had been captive for 3 months before release.



CAMBRIDGE (MD.) WELCOMES ICELAND'S 'GODAFOSS' ON MAIDEN VOYAGE

On August 14, residents of Cambridge, Md., welcomed the Icelandic vessel Godafoss on her maiden voyage. The visit was significant to Cambridge; the vessel carried 3,000 tons of fish, the largest single load of fish to reach the port. Also, it marked the beginning of a biweekly service of 3 Iceland Steamship Co. vessels between Reykjavik and Cambridge.

The Godafoss

The fully automated Godafoss is represented in Cambridge by Terminal Shipping Co. She features three 5-ton-capacity hydraulic deck cranes; two of the three can be operated together as a twin crane of 10-ton capacity.

The vessel has a cargo capacity of 150,000 cubic feet. Her holds are insulated to permit transportation of refrigerated and dry cargoes.



WILLIAM TERRY APPOINTED U.S. COMMISSIONER ON IATTC

On Aug. 13, the President appointed William M. Terry a U.S. Commissioner on the Inter-American Tropical Tuna Commission (IATTC). He succeeds J. Lawrence McHugh, who has resigned. Terry is Acting Deputy Director of BCF.

IATTC's Role

The Commission, created in 1950, conducts scientific investigation of tuna and bait fishes in the Eastern Pacific Ocean. It collects and interprets information necessary to maintain stocks of tuna and bait fishes at levels that will permit maximum sustained yields. Also, IATTC recommends to governments conservation measures indicated by its investigations.



MEETINGS

FISH EXPO '70 OPENS IN TAMPA, FLORIDA, OCT. 14

Fish Expo '70 will be held at the Curtis Hixon Convention Center on Hillsborough River in Tampa, Florida, Oct. 14-17.

Fish Expo originated in Boston, Mass., in 1967, and was held there again in 1968. Fish Expo '69 took place in Seattle, Washington, where gross sales from the exhibition floor reportedly were over \$1,000,000.

Show Hours & Features

The show hours for the trade will be 12 noon to 6 p.m. From 10 a.m. to 12 noon, seminars will be conducted on the detection, catching, handling, processing, and marketing of fish; fishing vessels; and vessel subsidies.

Several otter trawl vessels built of wood, steel, fiber glass, aluminum, and cement will be displayed at the dock. These will give fishermen an opportunity to compare fishing vessels built of different materials. Exhibitors from the U.S., Canada, Mexico, Norway, England, Germany, France, Portugal, Denmark, and Japan will show latest fishing gear and equipment available to the commercial fishing industry.

BCF's Market News Service

The BCF exhibit will include a temporary Fisheries Market News Service office complete with teletype machine. On business days, information will be available on current fish and shellfish landings, receipts, prices, and market trends.



ATLANTIC & GULF GROUPS TO MEET

The annual meetings of the Atlantic States Marine Fisheries Commission and the Gulf States Marine Fisheries Commission will be held jointly at International Inn, Tampa, October 14-16.



TROUT FARMERS TO MEET IN CALIFORNIA, OCT. 28-30

The Eighteenth Annual Convention of the U.S. Trout Farmers Association will be held October 28, 29, and 30 at the Sacramento Inn, Sacramento, California. It is not limited to trout culturists.

The convention will feature a tour of hatching and rearing facilities on Oct. 29. Trout farm equipment will be demonstrated.

Highlights

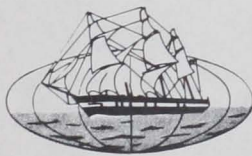
Reports will discuss the use of ultraviolet in treatment of waters for control of diseases; the virus diseases and their control methods (IHN, IPN, whirling disease, and others). Engineering of hatcheries and fish farms, including practical systems of reusing water, also will be discussed.

For more information contact: Clay M. Robinson, U.S. Trout Farmers Assn., 67 West 9000 South, Sandy, Utah 84070.



GAME FISH MEETING CANCELLED

The Game Fish Research Conference of the International Oceanographic Foundation, scheduled for Curacao, Nov. 13-14, 1970, has been cancelled.



BCF CONTINUES WHALE RESEARCH PROGRAM

Although whales lost their economic importance years ago, they have not lost their popular appeal. To quiet rumors that Federal whale research would be curtailed, Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife and Parks, said BCF has never announced a reduction in funds or end of the program.

Has Scientists Closer To Whales

Dr. Glasgow stated: "In order to make better use of available funds, we are planning to relocate certain research activities, and to consolidate the scientific staff working with whales and other cetaceans. [Cetaceans are hairless, fish-like water mammals which include porpoises and dolphins, among other species.] Research on the gray whale population, which includes a yearly count of the whales as they migrate northward along the California coast, will continue. The program relocation would simply move the scientists closer to the whales they are studying."



CALIF. BANS COMMERCIAL FISHING OF PACIFIC MACKEREL FOR 2 YEARS

Gov. Reagan signed into law in August a bill banning the commercial fishing of Pacific mackerel for 2 years.

The bill was introduced to protect the dwindling Pacific mackerel resource from possible extinction.





A SIGN OF THE TIMES. The "ribbon" around neck of this dog fish was not won in competition. It is a plastic beer-can holder found on fish when it was removed from trawl net. (R. K. Brigham)

SALMON PLANT IN WILLAMETTE RIVER MAY BE LARGEST

The Oregon Fish Commission recently released into the Willamette River more than 10.5 million young fall chinook. It was another step in a 10-year program, which began in 1968, to develop the Willamette's potential for natural salmon production. It may have been the largest stocking effort of fed salmon ever undertaken within one state for that purpose.

Roy Sams, Commission project leader for Willamette Basin studies, said the young 3- to 4-inch fish are now well on their way to sea. They are destined to return as 3- and 4-year-old adults in 1972 and 1973.

Most unusual, the fish had not been reared in salmon hatcheries for all their juvenile freshwater cycle. Rather, they had been transferred from hatcheries to gravel borrow pits and a summer swimming pond at Cascades Gateway Park in Salem. Many more fish were reared in this way than could have been accommodated in existing hatchery facilities.

5% of Chinook Potential Utilized

Biologists believe that less than 5% of the fall chinook potential is being utilized--and that annual Pacific coast harvest of naturally produced Willamette River fall chinook could be multiplied.

The Commission believes this potential can be developed now because water-pollution control has been improved and many fish-passage problems corrected in the Willamette system. Oregon City's Willamette Falls, natural barrier to upstream migration, are main reason system is underutilized by fall chi-

nook. This problem has been overcome as Fish Commission's \$4 million Willamette Falls fishway nears completion. The funds were provided by Bureau of Commercial Fisheries and Portland General Electric.

Sams and others believe the quickest, most economical way to develop the natural spawning potential for fall chinook is to use inexpensive natural rearing ponds.

Pond Rearing Program

Sams said that this year over 12 million fall chinook, surplus to regular hatchery program needs, were available for the pond rearing program. "In early April, we stocked the four ponds at Salem, Stayton, and Aumsville with 2 to 5 million young weighing up to 600 to the pound. Then, for 8-10 weeks we fed them a commercially manufactured pellet diet at a cost of only \$26,000." This is the largest part of the program's total cost.

During recent releases from the ponds, 85% of young chinook emigrated of their own choice, an excellent survival rate. The fish averaged about 100 to the pound.

The Commission hopes to increase the ponds' production level to 15 million a year for at least 8-10 years.

After the number of returning adults increases to the required level for adult spawning escapement, the pond rearing program could be discontinued. The run would perpetuate itself with little or no more expenditure. However, the ponds probably will be operated after developmental period because of their great value as production facilities.

LIGHTWEIGHT POTS ON LONGLINE EFFECTIVELY CATCH SABLEFISH

BCF's 'John N. Cobb' returned to Seattle on July 1 after a 12-day gear research cruise, in offshore waters off south-central Washington, during which technicians experimented with longline pot fishing for sablefish. They report: ". . . It is apparent that fishing lightweight pots on a longline is an effective method for taking sablefish."

Primary objective was to evaluate feasibility of fishing sablefish pots on longlines. Other objectives were to determine: optimum fishing distance between pots; suitable pot design for longline fishing; influence of soaking time on catch rates; and proper methods for handling pots and longlines aboard vessel.

GEAR AND METHODS

Pots and Longline Gear

Experimental pots of various designs and tunnel configurations were prepared to fish from longline gear. Most pots were constructed of 11-gauge, 2-by 4-inch, galvanized wire mesh and supported with $\frac{1}{2}$ -inch mild steel rings and rungs. Most wire mesh pots were cylindrical, 6 to 10 feet long, 3 feet in diameter, with 8-inch tunnel openings and spring-tensioned triggers. Some pots had tunnel at one end; others had tunnels at each end. Several pots had experimental fyke tunnels. A few had 2 tunnels at one end to form double compartment. Five pots were rectangular, 40 by 30 inches by 8 feet, with tunnel at each end.

In addition to experimental wire mesh pots, 4 commercially designed and manufactured pots were evaluated. Two were plastic pots separated into halves and attached to webbed frame 40 inches square by 14 inches deep. These pots resembled a cloverleaf and had 4 openings. The remaining two pots were collapsible fyke-type nets with double tunnels at one end (two compartments) and completely webbed cod end.

The pots were fished from a 600-fathom longline (groundline) of $\frac{1}{2}$ -inch, 6 by 19 galvanized wire cable. Stoppers formed by $\frac{1}{2}$ -inch cable clamps were attached every 10 fathoms on groundline. One hundred fathoms at each end were free of stoppers.

Two Navy-type anchors, each 200 pounds, and 10 feet of anchor chain were used at each end of the groundline.

Buoylines, in 50-fathom coils, were $\frac{7}{8}$ -inch, $\frac{3}{4}$ -inch, and $\frac{5}{8}$ -inch polypropylene and $\frac{1}{2}$ -inch nylon. Two surface buoys, a pole marker, and a gill net light were used to mark each end of buoyline.

Setting and Hauling

Before setting gear, bottom was reconnoitered with echo sounder to determine depth and topography. Groundline was set from and hauled onto cable-towing winch drum from amidship on starboardside. An open-faced pursing block attached to a short boom extended outward and led groundline into winch. Groundline was transferred to and from anchor chain to a drum pendant using a short idler cable, flat links, and G-hooks. Pots were attached to groundline, when setting, with either a snap-on hook or $\frac{3}{8}$ -inch shackle attached to gangion. The hauling operation was reverse of setting procedure, with exception that a hoist was used to lift pots aboard (see figures 1-6).

Area of Operation

Experimental fishing was conducted at two locations: 46°55' N.; 124°50' W. in 190-210 fathoms, and 46°49' N.; 124°54' W. in 175-200 fathoms. Three gear lifts were made at each.

RESULTS

Strong northwest winds offshore delayed operations, so only 6 sets were made. Catch results are summarized by pot type in table.

Pot Type	No. Pot Hauls	Range of Catches Per Pot Lift	
		Marketable Sablefish ^{1/}	No. Wt.
Cylindrical:			
2 tunnel, std.	20	0-42	0-231
1 tunnel, std.	20	1-25	5-137
1 tunnel, fyke	7	1-17	5-93
Double compartment	12	1-71	5-436
Rectangular	2	7-14	37-77
Cloverleaf, plastic,			
4 tunnel	4	2-4	10-20
Fyke net, 4' x 12'	2	0	0
Total	67		

^{1/}A marketable sablefish is longer than 17 inches from insertion of first dorsal fin to end of tail.



Fig. 1 - These pots on deck of John N. Cobb will be fished from a groundline.

Fig. 2 - A rectangular pot built on deck.

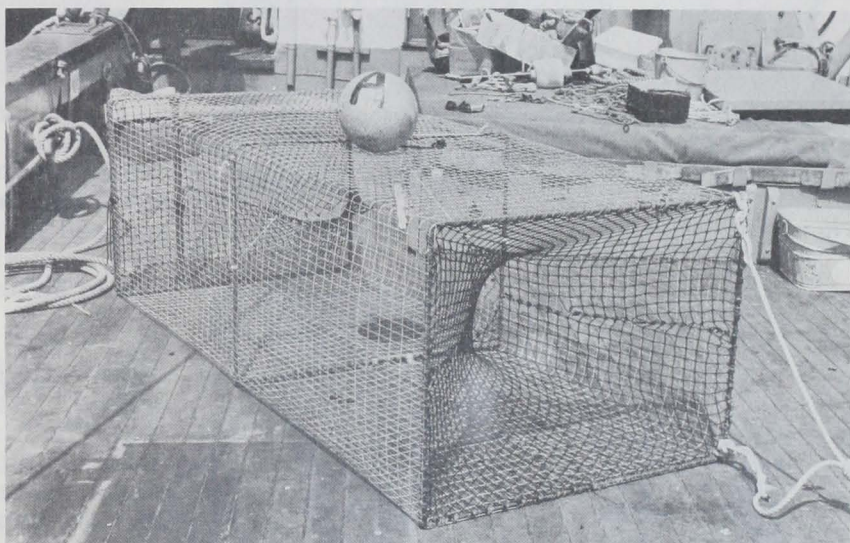


Fig. 3 - Buoy line connected to anchor and groundline is wound on net reel.

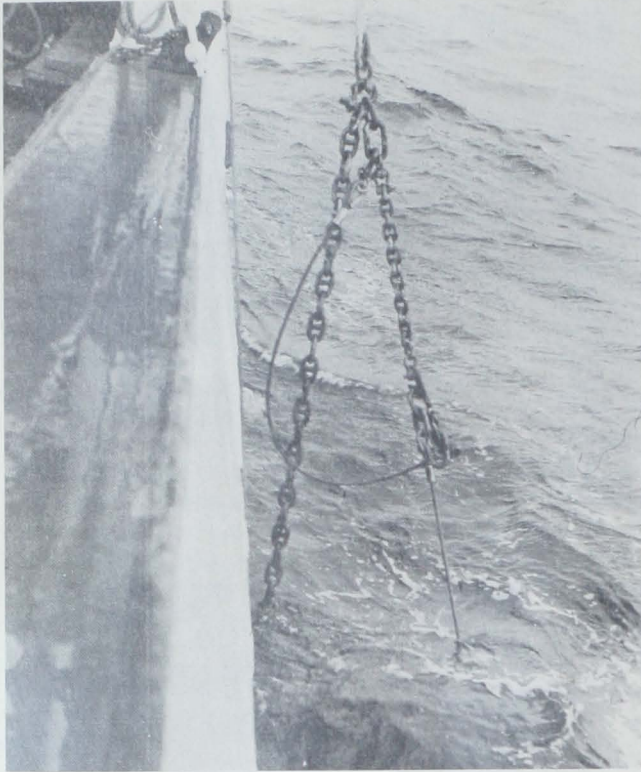


Fig. 4 - Groundline and anchor are held with buoy line until connected to pendant with idler cable.



Fig. 5 - Pot coming out of water.

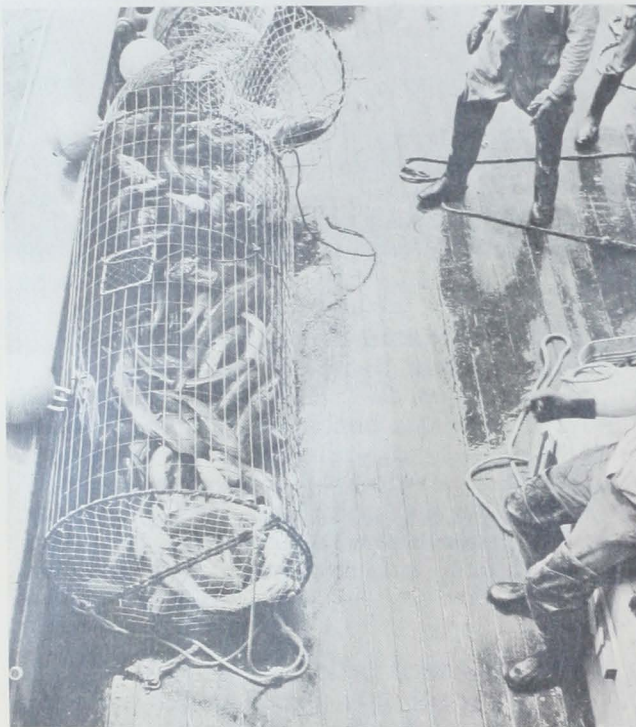


Fig. 6 - Largest fish catch made in double compartment pot--71 market-size sablefish; dressed weight of 436 pounds.

Soaking times ranged from 11 to 66 hours with best catches on longer soaks. Pots were spaced 10 to 30 fathoms apart on groundline -- but no noticeable differences in catch rates could be detected due to pot spacing.

On first set, failure of snap-on hooks resulted in loss of 13 of 24 pots set. Later, all pots were fastened to groundline with $\frac{3}{8}$ -inch shackles. No further losses occurred.

Fishing pots on longline was no problem. As expected, hauling time per pot was much better than experienced in past when fishing individually buoyed pots. The best record using longline gear was 18 pots hauled in 2 hours.

The BCF technicians concluded: "Although the lack of repetitive observations makes it difficult to make any conclusive statements regarding optimum soaking time, distance between pots or pot design, it is apparent that fishing lightweight pots on a longline is an effective method for taking sablefish."

"Averaging over the entire experiment, it appears that the double-compartment pots outfished the other pots. The two largest catches, 240 and 436 pounds of marketable sablefish per lift, were made with this type of pot. The plastic cloverleaf-type and fyke net-type pots fished poorly or not at all."

For more information contact: A. T. Pruter, Acting Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Blvd. East, Seattle, Washington 98102 (Phone: 583-7729).

LAKE ERIE: COMMON EFFORT CAN SAVE IT

The Nation's greatest freshwater resource, the Great Lakes, is seriously threatened. "Accelerated enrichment, unabated pollution, overexploitation, and introductions of exotic species, have all been guided--more often misguided--by man." Of all 5 Great Lakes, Lake Erie is most damaged and most threatened. This evaluation was part of a statement by BCF Ann Arbor, Mich., to the Lake Erie Enforcement Conference in Detroit, Mich., on June 3. It was delivered by Dr. Wilbur L. Hartman, Investigation Chief, Lower Great Lakes Program.

For over 100 years, Lake Erie has supported a commercial fishery. Even today, more than 50 million pounds of fishes are landed each year by U.S. and Canadian fishermen. This is comparable to levels of past half-century. In the last decade, the U.S. sport fishery has increased tremendously. These combined U.S. and Canadian fisheries in Lake Erie, nearly 70 million pounds, are worth nearly \$5,000,000 today. When thousands of pleasure boats are included, capital investment in gear for these fisheries reaches hundreds of millions of dollars.

Shift to Cheaper Fishes

Unfortunately, the BCF Ann Arbor statement noted, "there has been a drastic shift in the commercial and sport harvest from high-value fishes to medium- and low-value fishes." The fisheries for lake trout, northern pike, blue pike, and sauger are memories. Sturgeon, whitefish, and ciscoes are nearly gone. Today, emphasis is on catching such medium-value fishes as yellow perch and white bass.

Many Changes in Lake Erie

Lake Erie is about 241 miles long; its maximum width is 57 miles.

Industrial, municipal, and agricultural pollution and enrichment have produced many changes in the living aquatic resources and environment: "massive nuisance and toxic algal blooms of *Microcystis* and *Aphanizomenon*, destruction of the valuable mayfly benthos in the western and central basins, a 20-fold increase in plankton, which is the diet

staple for several nuisance and low-value fishes that have undergone population explosions in the last 15 years, increased levels of such pesticides as DDT and Dieldrin in fish flesh, dangerously high levels of mercury in many fishes, the destruction of spawning areas of some of our most valuable fishes, and disappearance of oxygen from the bottom waters of the central basin during the summer."

The statement warned: "Unless major action is taken immediately to remedy the deleterious activities of man, Lake Erie tomorrow will have very few walleyes, an unhealthy yellow perch population, increasingly larger populations of low-value fishes such as carp, goldfish, suckers, freshwater drum (sheepshead) and alewives. Without effective action, Lake Erie tomorrow will have increased fish kills, smothering algal blooms, greater bacterial contamination, and more extensive oxygen depletion. The quality of the water so desperately needed to supply a broad spectrum of users will continue to deteriorate."

Water Chemistry

About 40 billion gallons of untreated municipal sewage and many billion gallons more of partially treated sewage are dumped into Lake Erie each year. An estimated 137,000 pounds of phosphorous enter Lake Erie each day--72% from municipal waters. So nutrient levels have increased substantially.

Total dissolved solids have increased over 50 parts per million (ppm) during past 50 years. These increases alone have not directly killed fish, "yet they reflect the changes man has wrought, and have serious indirect effects... The latest data on Lake Erie water chemistry shows no significant deceleration of these rates of increase."

Organic Production

Generally warm water temperatures, increasing slightly over the years, are 2° F. warmer on average since 1920 due to climate changes. This and tremendous increases in nutrient levels have produced dramatic increases in organic production, particularly

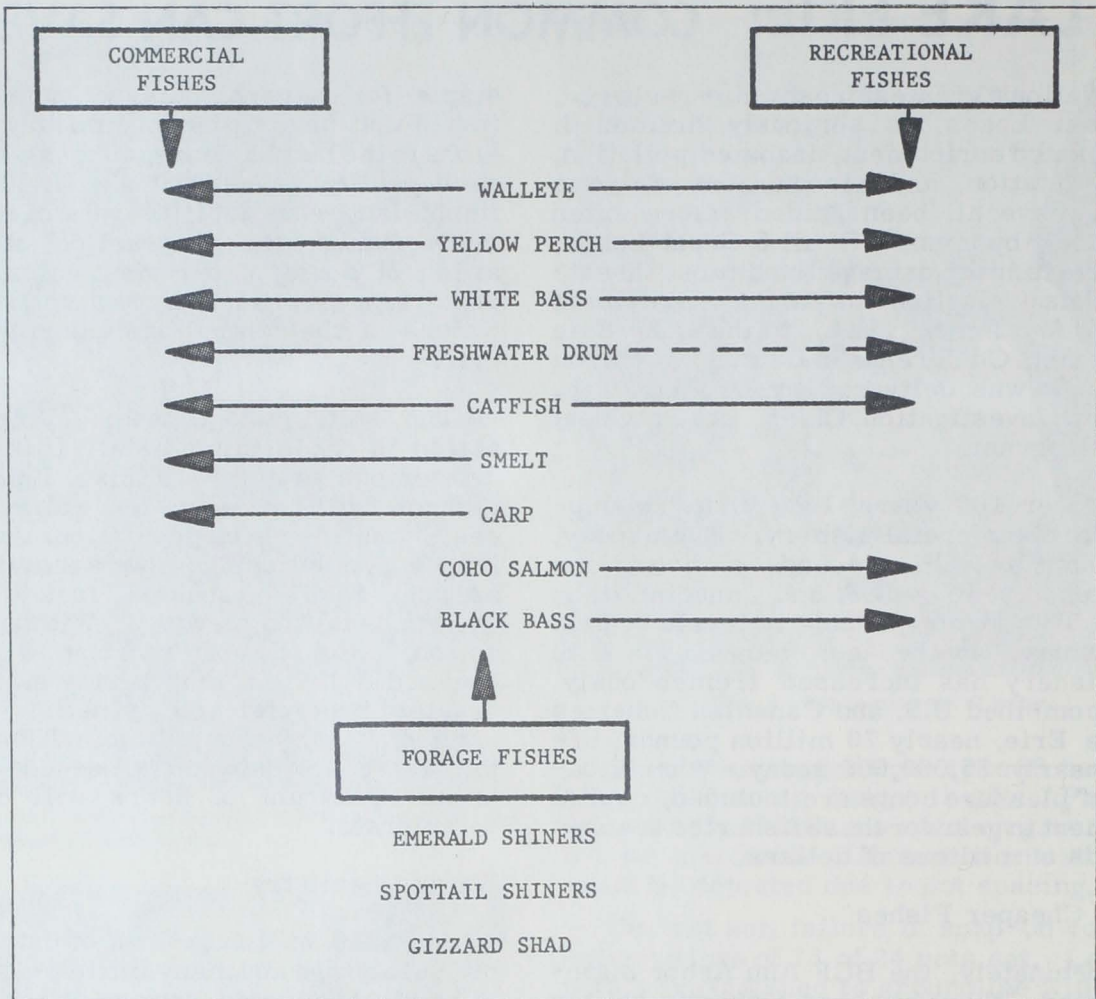


Fig. 1 - The fish resource of Lake Erie is a complex biological system involving predator fish--walleye; forage fish--emerald shiners; competitor fish--yellow perch and freshwater drum; parasitic fish--sea lamprey; and fish that seriously disturb the environment--carp.

at algal level. Over the past 50 years, plankton algae have increased 20-fold. The growths of filamentous algae, such as *Cladophora*, have boomed. These are a nuisance along Lake Erie's shores. Millions of tax dollars have been lost because property has been devalued.

The composition of the plankton algae has changed adversely. "The noxious blue-green algae, *Microcystis* and *Aphanizomenon*, have recently become dominant summer species. In 1969, the late summer blooms of these forms in the western basin were unusually and unbelievably dense and widespread."

Oxygen Levels

Organic production directly affects oxygen regime in Lake Erie. The fallout of dead algae sinking through water column to bottom

creates a tremendous biological-oxygen-demand (BOD) during decomposition. The greater the organic production, the greater the BOD.

Thermal Conditions

The waters of Lake Erie undergo considerable thermal change each season. During severe winters, 95% may be ice covered. Summer surface temperatures exceed 75° F. each year.

At present, Lake Erie is about 2° F. warmer than during early 1920s. Between 1925 and 1930, the greatest increase in mean annual air and water temperatures occurred.

The oxygen regime has been seriously degraded. During thermal stratification, the sediments and bottom waters become isolated

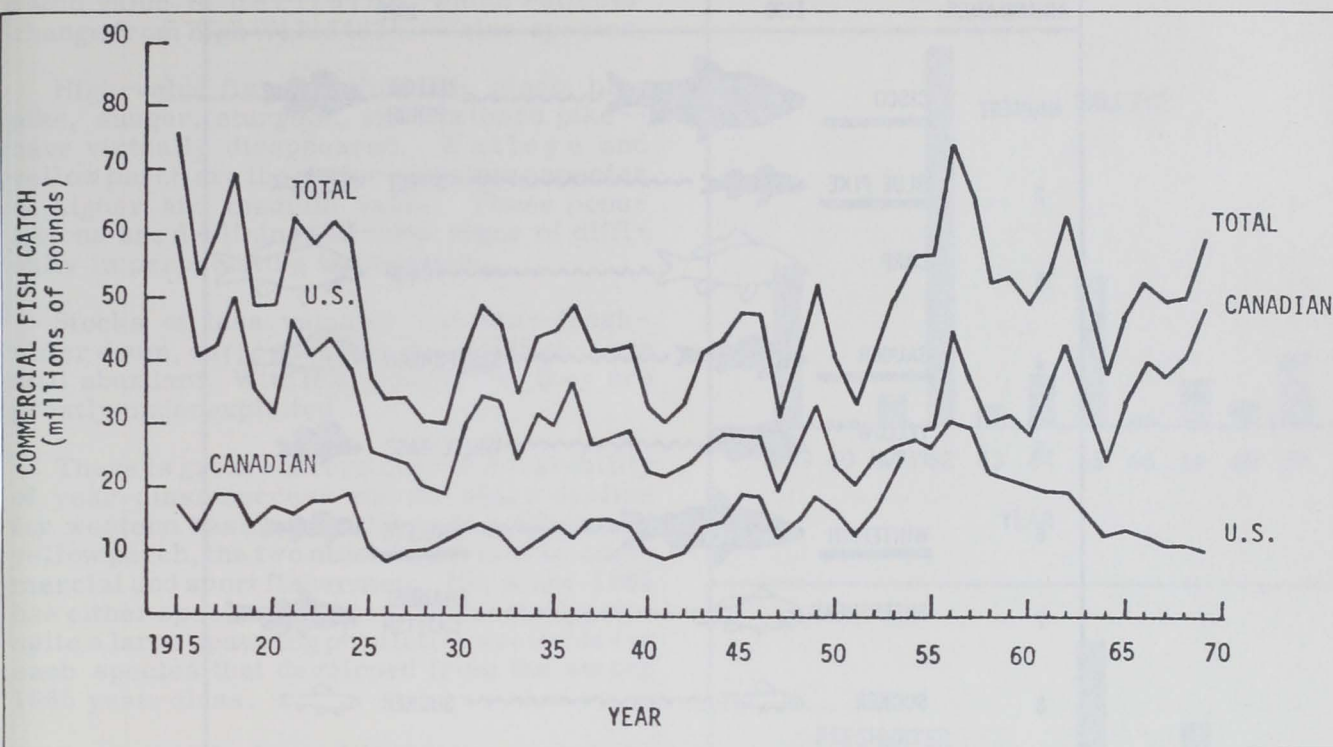


Fig. 2 - The commercial catch of Lake Erie fish has averaged 50 million pounds since 1915. Before 1954, U.S. fishermen landed most of the catch. Now Canadian fishermen reap the harvest and U.S. landings are at an all-time low.

from overlying surface waters. Oxygen lost in bottom waters cannot be replenished adequately until stratification breaks down and a mixing with oxygen-charged surface waters occurs.

Increased organic production and introduction of reduced, oxygen-demanding organic and inorganic materials have resulted in deterioration of oxygen levels in many areas of Lake Erie.

Bottom Organisms

Degradation of the oxygen regime has altered dramatically the populations of bottom organisms essential as food to certain valuable fish. Since 1953, this phenomenon has reduced mayfly larvae (*Hexagenia*) from 400 to 10 individuals per square meter and, in places, entirely eliminated them. It has "increased the numbers and distribution of sludge worms (*oligochaetes*) many-fold, reduced caddisfly larvae almost to the vanishing point, favored large increases in the populations of low oxygen tolerant forms of midges, reduced the non-tolerant forms, caused an increase in some species of finger-nail clams, and generally reduced the numbers of all pollution-sensitive bottom organisms."

The original community of organisms was an essential part of the food chain important to desirable fish. Changes in this community have adversely affected these fish and, in turn, the economics of the fishing industry. The narrow stratum in the bottom of Lake Erie, with its low dissolved oxygen content, "is so polluted that the future status of the entire lake as a useful producer of fishery products is uncertain."

Thermal Effluents

Nuclear power plants on Lake Erie are proliferating. BCF is concerned with potential bad effects of heated discharges on fishes and associated aquatic resources for these reasons:

1) A uniform increase of temperature will increase metabolic activities of organisms and result in increasingly greater levels of organic production. This would increase rates of BOD and degradation of oxygen regime.

2) The highly valuable walleye in western Lake Erie have separate spawning sites on shallow reefs. The spawning areas are shallow, 2 to 10 feet. The spawning and incubation physiologies of walleyes are such that large

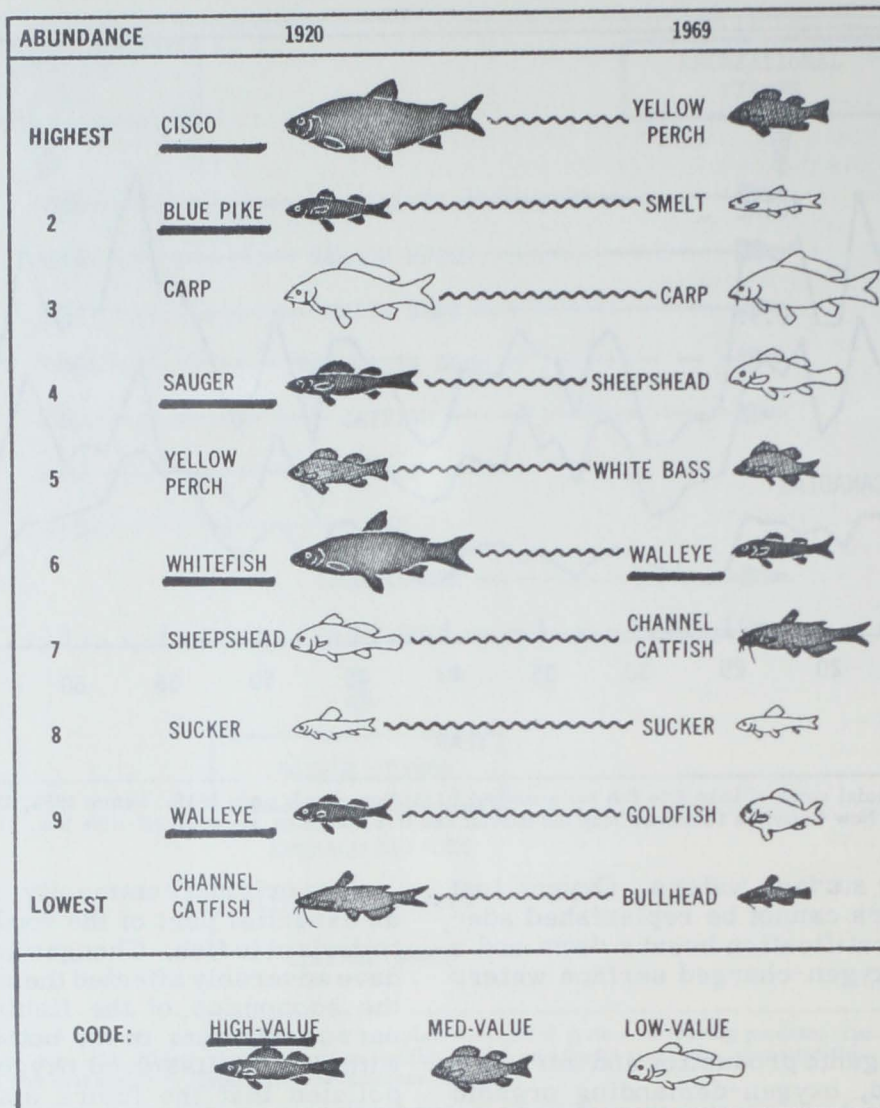


Fig. 3 - In 1920, the commercial catch from Lake Erie was dominated by five high-value fishes--cisco, blue pike, sugar, whitefish, and walleye. Now only the walleye is left, and it is in serious decline. The pressures of rapid environmental degradation and heavy exploitation have left us with a fishery resource composed only of medium and low-value fishes.

heated discharges would disrupt spawning severely and could destroy incubating eggs.

3) BCF data show that an increase in incubation temperatures from 10 to 15° C., for example, will decrease incubation period of walleyes from 20 to 10 days. Quite possibly, unnatural heating in areas where eggs are incubating would result in unnaturally earlier hatching when environment could be unsuitable to their survival. German scientists have demonstrated this for reduction of whitefish in Lake Constance, Switzerland.

There should be no significant additional thermal inputs into Lake Erie, especially into

western basin, under possible consequences have been assessed.

Fishery Resources

Of all Great Lakes, Lake Erie has been most fertile and productive in pounds of fish. Nineteen species have been significant in the landings at some time. Annual combined U.S. and Canadian production, which has fluctuated little in the past 50 years, has averaged about 50 million pounds.

Lake Erie fish production, on a poundage basis, continues to maintain itself. However,

catch value is declining, which reflects change from high-value to low-value species.

High-value fishes--whitefish, cisco, blue pike, sauger, sturgeon, and northern pike--have virtually disappeared. Walleye and yellow perch are the major remaining species of higher and medium value. These populations are declining and show signs of difficulty in perpetuating themselves.

Stocks of less valuable species--freshwater drum, carp, suckers, and goldfish--are still abundant. With few exceptions, they are greatly underexploited.

There is great concern over the instability of year-class success and the sharp decline for western basin populations of walleye and yellow perch, the two most important to commercial and sport fishermen. Not since 1965 has either species spawned successfully, despite a large spawning population available for each species that developed from the strong 1965 year-class.

Some people have felt for years that the decline and disappearance of so many valuable species from Lake Erie were due to over-exploitation. "Actually, the combination of overexploitation, environmental degradation, and the introduction (accidental or otherwise) of exotic fishes such as sea lamprey, carp, and goldfish have all contributed together in some measure over the years to cause changes in the abundance of our valuable species. Yet the decline of the walleye and yellow perch today must be attributed in larger part to extensive deterioration of the environment. In this sense, the populations are in double jeopardy."

Research during the 1969 walleye spawning season tends to support BCF contentions that the degraded environment is a primary factor influencing the abundance of certain species in Lake Erie.

Introduction of Coho Salmon

Ever since 1870, researchers have stocked Lake Erie with several species of salmon fry. Their efforts failed. But the experimental introductions of yearling coho salmon in recent years appear successful. The newly coordinated coho program among the States began officially in spring 1968: 121,000 salmon were released in the tributary waters of Ohio, Pennsylvania, and New York. Plantings were

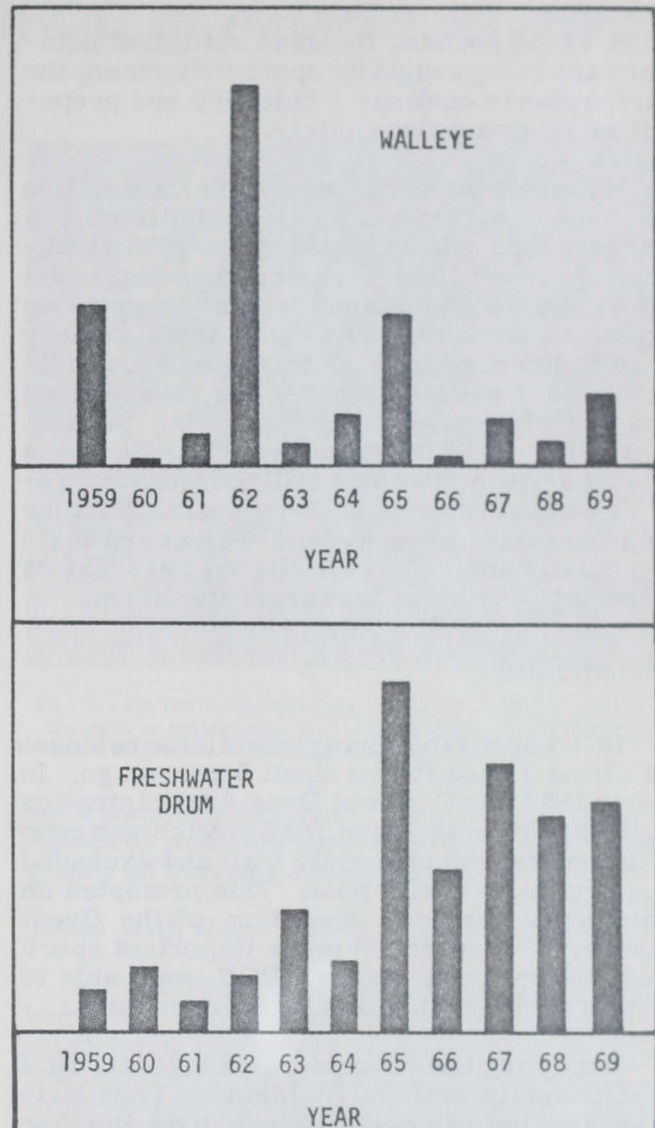


Fig. 4 - Here are shown the relative numbers of young-of-the-year walleye and freshwater drum (sheepshead) sampled with bottom trawls in Western Lake Erie at permanent index stations, 1959-69. The walleye, the last high value fish in Lake Erie, is in drastic decline with good hatches only every third or fourth year. Freshwater drum, on the other hand, are rapidly increasing in numbers and constitute a huge underutilized resource.

continued in 1969 with the spring release of 230,000 yearlings and, again this spring, with another 545,000 fish. The technological advances over the past 15 years in raising coho salmon to yearling size (4-7 inches) have assured a better chance of success for current plantings.

These coho salmon reach adult size in the fall of the year following year of release. More often than not, they return to original release stream to spawn. Based on returns from 1968 stockings, the adults may range

from 4 to 10 pounds. Because sufficient numbers are being caught by sport fishermen, the States plan to continue a hatchery and propagation program indefinitely.

However, important research information on these stockings is meager. Estimates of harvest of coho from the original 1968 stocking were about 10%. These catches represent sportsmen's landings and returns to weirs on spawning streams. The commercial fishery is prohibited from taking this species. Additional data suggest cohos move slowly about lake in clockwise direction during season. Actually, their midsummer distribution is restricted to colder and still-oxygenated waters on north side of eastern basin. Further degradation of oxygen regime in eastern basin eventually may place limits on Lake Erie's capacity to support this coldwater form.

Insecticides

BCF began monitoring insecticide residues in Great Lakes fishes about 5 years ago. In early 1969, the Food and Drug Administration announced that levels of DDT in Michigan coho salmon were dangerously high and exceeded the action level of 5 ppm. This prompted an immediate broader sampling of the Great Lakes. It focused on more important sport and commercial fishes. BCF was able to obtain considerable data in a few months.

Excepting Lake Superior, the levels of DDT and its derivatives and Dieldrin for Lake Erie fish are lower comparatively than in other Great Lakes. They fall well under action level of 5 ppm. Nevertheless, the problem is serious. In the past few years, growing concern about DDT buildup in the environment has led to bans on sale of these pesticides in several states.

The Mercury Crisis

The most recent environmental crisis in Lake Erie is mercury contamination of fish. On March 25, 1970, Canadian officials an-

nounced that levels of mercury in walleye, northern pike, and other species taken from Lake St. Clair were considerably above the 0.5 ppm action level set by Canada's Food and Drug Directorate. Later, they banned taking of fish for any purpose from Lake St. Clair and its tributaries. Immediately, U.S. public health and resource agencies became concerned about Lake Erie. Sampling programs were initiated. Since then, several hundred fish samples from Lake Erie-St. Clair areas have been examined by Federal and State agencies. As more data became available on fish taken from U.S. waters of Lake Erie, Ohio, Michigan, and New York began varying fishing bans.

Preliminary data from BCF sampling in Lake Erie show following ranges in mercury levels for certain fish from the western basin (the FDA tolerance level is 0.5 ppm): yellow perch (0.2 to 0.5 ppm), coho salmon (0.2 to 1.0 ppm), carp (0.1 to 0.8 ppm), white bass (0.3 to 1.5 ppm), channel catfish (0.3 to 0.6 ppm), freshwater drum (0.1 to 1.0 ppm), and walleye (1.0 to 3.0 ppm). An inspection of fish analyses by FDA shows most of their values within these ranges. Also, predator fish show higher values than forage fish. There are very little data from the eastern basin, but the mercury levels there are somewhat lower.

The consequences of mercury contamination have been tremendous. Sport and commercial fisheries have suffered considerable economic losses.

Conclusion

The environmental problems of Lake Erie are complex and discouraging. "And we certainly are in for further crises." Yet, BCF hopes that mounting national concern over fate of environment will generate greater urgency and support for all programs aimed at reducing degradation of Lake Erie's environment and its aquatic living resources. "Lake Erie is not dead. It can be saved if we all work together."



HARD-CLAM CULTURE METHOD DEVELOPED AT VIMS

A method of protecting hard-clam seed from natural enemies has been devised by scientists of the Virginia Institute of Marine Science (VIMS). "Aggregates"--shell, gravel, or other materials--are spread over sand or mud bottoms before planting seed. The aggregates protect seed clams from predators.

VIMS states: "Predators destroy nearly all unprotected clams smaller than one inch. The blue crab is the major predator in Virginia waters. Other crabs, boring snails, bottom-dwelling fish and waterfowl also take many clams. The hard clam (quahog) requires moderately high-salinity waters where these predators abound and often prevent natural reproduction from being successful."

Past Methods

In the past, experimental methods of protection included planting clams in screened trays or boxes; within fenced enclosures; under sheets of netting or hardware cloth; in saltwater ponds or tanks; and intertidally. However, reports VIMS, "these techniques are unreliable, expensive and cause silting and slow growth." So they have not been suitable for commercial use.

Spreading Aggregate

Scattering aggregate over bottoms or clam beds is a simple procedure. VIMS scientists believe that increased yields soon will pay initial cost of aggregate. There is no maintenance. The Maryland hydraulic escalator clam harvester automatically deposits buried shell on surface; so, if buried shell is available, harvesting clams will prepare beds for planting.

Besides boosting production from commercial beds, the new technique promises to encourage operations of clam hatcheries. Several now operate experimentally on Eastern Shore of Virginia, and elsewhere. VIMS states: "Hatcheries can offer an almost limitless supply of seed clams from selected, fast-growing parents. A major obstacle has been growing seed clams to usable size after they have been reared to setting. Holding millions of young clams in trays to avoid predators requires expensive handling, feeding,

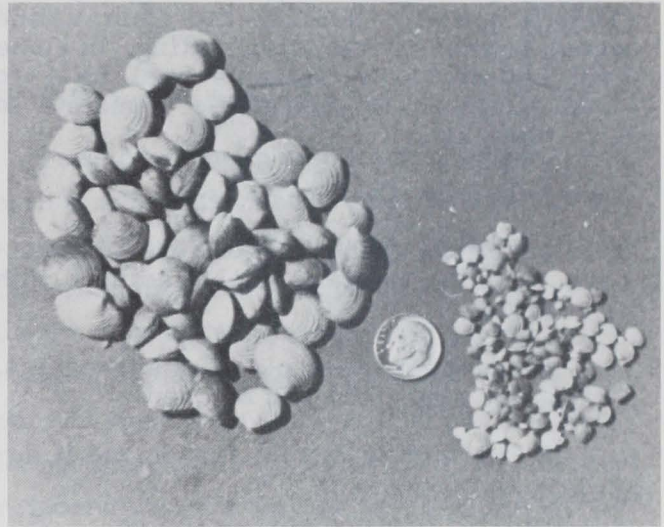


Fig. 1 - On left is fingernail size seed now planted by industry. On right is match-head size seed reared by hatcheries; these could be planted if protected with aggregate.

and cleaning operations. The use of aggregate makes it possible for these tiny clams to be grown on bottoms instead of in trays."

Tests With Hard Clams on Eastern Shore

In April 1967, experiments with aggregates began on seaside of Eastern Shore, where most hard clams are harvested in Virginia. During preliminary tests, scientists discovered 3 aggregates successfully protected small hard clams (*Mercenaria mercenaria*, also called Venus *mercenaria*). The three were: 1) crushed oyster shell, 2) crushed stone (as used in road building), and 3) stream bed gravel (sold as pea gravel).

An average of over 80% of the seed clams planted on these covers survived seasons when blue crab and other predators were most active. In two tests, more than 90% of the clams lived. In control plots, where clams were planted without aggregate protection, survival was about 16% but never over 30%.

Young clams of various sizes were grown in the VIMS Wachapreague Laboratory to serve as test animals. These ranged from $\frac{1}{25}$ to 1 inch--between extremely small seed not used by industry to fingernail size seed now planted.

Clams larger than match-head size survived best. Smaller clams, too mobile, would leave protection of aggregate and become exposed to predators. This moving, explains VIMS, is possible because the clam, unlike oyster, retains its foot after setting. In some tests, however, even clams as small as $\frac{1}{25}$ to $\frac{1}{5}$ inch survived in acceptable numbers in some plantings.

VIMS Recommendations

VIMS offers these suggestions to clambers wishing to start trial plantings with aggregates.

1. Select cheap and plentiful aggregates. Almost any aggregate can be used.
2. Before buying in bulk, test to see if aggregate particles are:
 - a. heavy enough to sink and remain on bottom.
 - b. small enough to pack well
3. Spread aggregate 1- to 3-inches thick over clam-planting area when using coarse

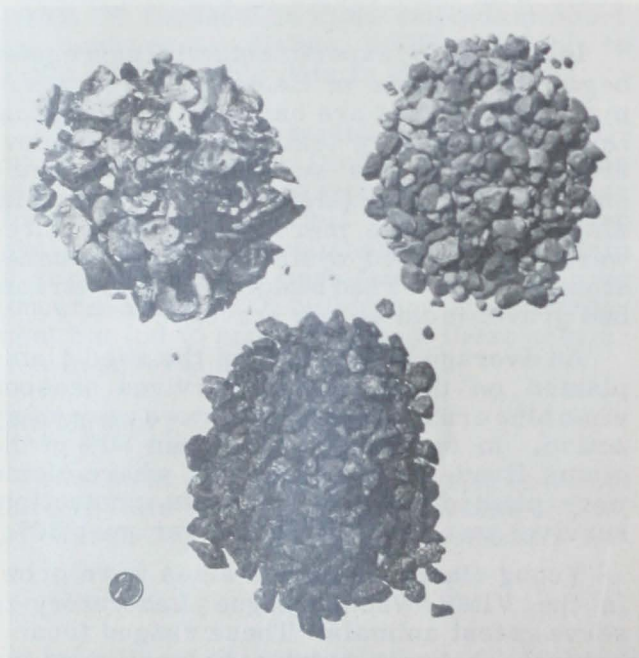


Fig. 2 - Three aggregates that successfully protected small clams from predators. Top left, crushed oyster shell. Top right, pea gravel. Bottom, crushed stone.



Fig. 3 - Young clams of various sizes were grown in VIMS Washapraque Laboratory to serve as test animals in experiments with aggregates. Many trays of clam larvae were spawned, cultured, and maintained by VIMS scientists and technicians.

materials (uncrushed shell), and one to two inches when using fine materials (pea gravel, crushed stone, or crushed shell). Level aggregate by dragging 4-ft. section of cyclone-type fencing over area.

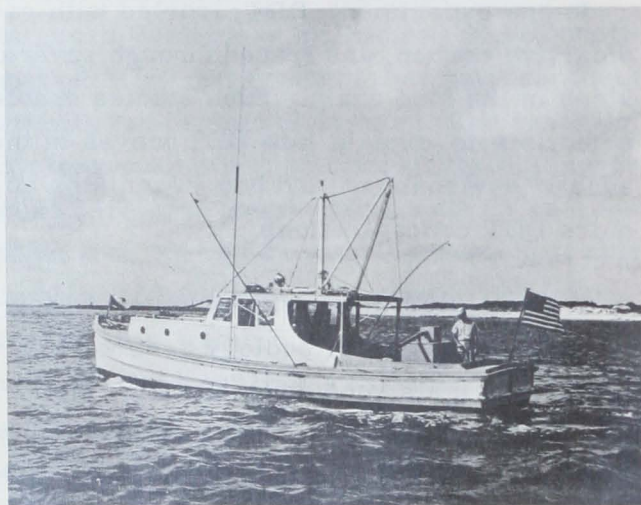
4. Scatter seed clams evenly over aggregate at rate of about 25 to 50 per sq. ft. The clams will burrow through aggregate and into bottom. It is important that you do not over-plant because crowded clams will move away from each other--and possibly out of protected area. If too crowded, they will not grow as fast because of competition for food and space.

5. Aggregate can be put on bottoms any time. Clams should be planted when active--when water temperature is 48° F. or higher. Clams will burrow under aggregate in short time at higher temperatures. Plant at slack tide to avoid excessive clumping or scattering of clams.

BCF'S CENTER FOR ESTUARINE AND MENHADEN RESEARCH

A 1968 reorganization combined BCF's Biological Laboratory at Gulf Breeze, Fla., and Radiobiological Laboratory at Beaufort, N.C. The title of the combined labs was the National Center for Estuarine Research. In 1969, another reorganization combined the National Center for Estuarine Research with the Beaufort Biological Laboratory creating the Center for Estuarine and Menhaden Research.

The Gulf Breeze Laboratory was concerned with pesticides and the Beaufort Laboratory with radioactivity. The consolidation of the 2 labs strengthened research and facilitated solving problems on estuarine pollution, since radioactive material and pesticides have similar effects on some plants and animals.



This boat catches and transports live animals to the laboratory.

Research of the Center is concerned with: (1) fate of radioactive materials and pesticides in estuarine environment, (2) effect of radiation and pesticides on marine organisms, (3) application of radioactive tracer

techniques to fishery biology, (4) effects of pesticides on the ability of marine organisms to survive, grow, and produce, and (5) cycling of pesticides through water sediments and food chains of the estuary.

These approaches are used to tackle the problems of radiation at the Beaufort Lab: (1) data are collected in the lab to predict the fate of radioactive materials, (2) tanks and ponds are used to test questionable findings obtained in the lab, and (3) cycling of radioisotopes is observed in certain natural bodies of water, restricted from the public. The Laboratory believes that data collected by these three approaches, when integrated and correlated, make for a better understanding of the role of plants and animals in cycling of radioactivity in estuaries and marine areas.

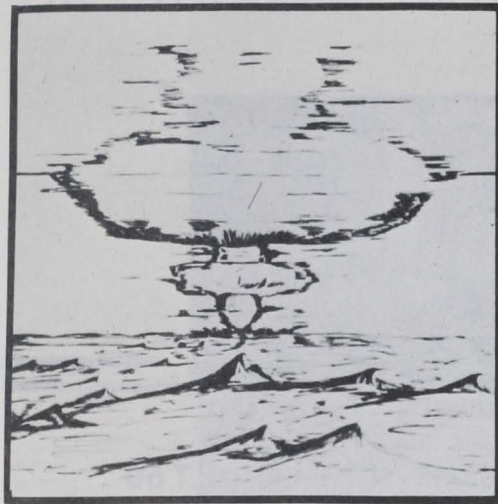
Past significant accomplishments with pesticides by the Gulf Breeze Laboratory include: (1) determination of acute toxic effects of 200 formulations of pesticides on oysters and shrimp, and other organisms under controlled conditions in the laboratory. This information was passed on to the Pesticide Registration Board to assist them in labelling procedures. (2) Analysis of over 5,000 samples as part of nationwide monitoring program to determine levels of pesticides in fish and shellfish; (3) investigation of the effect of MIREX, a chemical used to control fire ants in the southeast, on estuarine organisms; and (4) discovery of occurrence of PCB (polychlorinated biphenyl) in seafood organisms in local area, located and stopped source.

The Center for Estuarine and Menhaden Research will lose the Gulf Breeze facility, if the President's reorganization plans become effective. The Lab will become part of an independent agency called the Environmental Protection Agency. (BCF Circulars 298 and 309.)

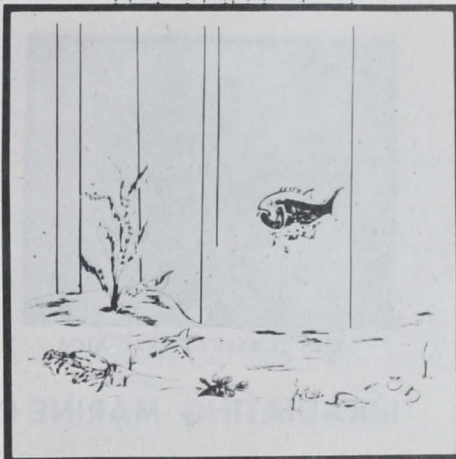
(See photo spread following pages.)

Monitoring Fallout Radioactivity in Estuarine Organisms

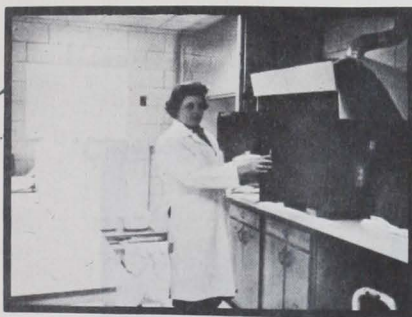
Stratosphere Circulation



Worldwide Fallout



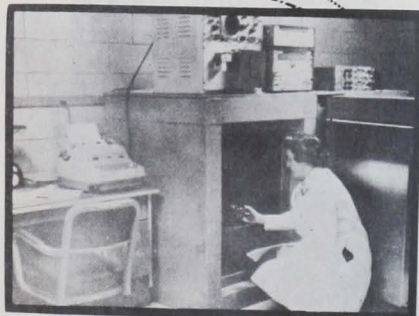
Biological Concentration



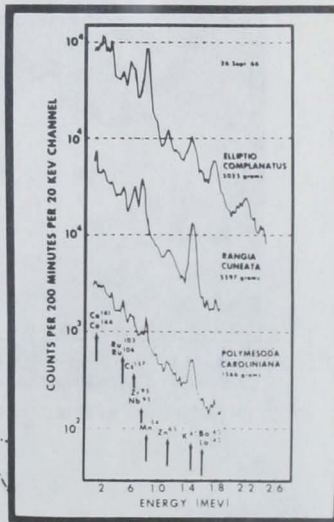
Sample Preparation



Collection of Organisms



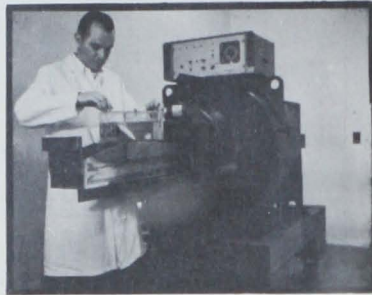
Measurement of Radioactivity



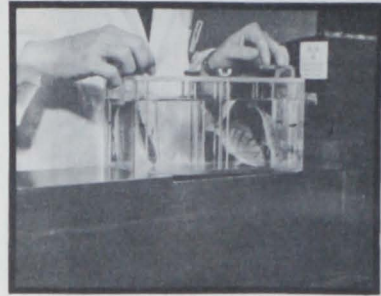
Gamma Spectral Analysis

Radioactive materials are added to the estuarine environment through fallout from the explosion of nuclear weapons. These materials often are accumulated and concentrated by seafood organisms. As part of a program to study the biological concentration of fallout radioactivity by estuarine organisms, investigators collect organisms in the natural environment and take them to the laboratory for analysis. The amount and type of radioactivity in the organisms are measured with specially designed electronic equipment. The radioactivity content of some fresh-water and estuarine clams is shown in gamma spectral analyses.

STUDYING EFFECTS OF RADIATION



USING COBALT 60 IRRADIATOR



INSERTING FISH INTO IRRADIATOR

IRRADIATING MARINE ORGANISMS WITH COBALT 60



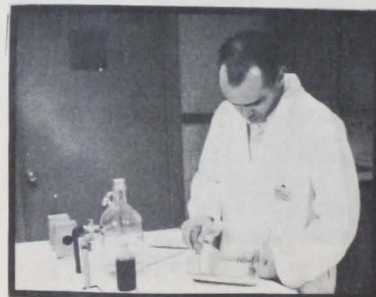
BIOCHEMICAL DETERMINATIONS



MEASURING RESPIRATION

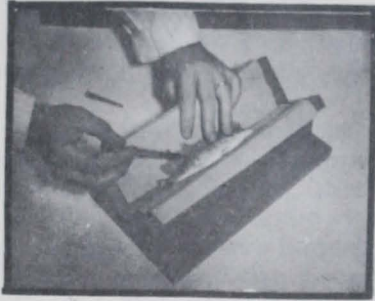


MEASURING TOTAL ELEMENT



DETERMINING PROTEINS

ON ESTUARINE ORGANISMS



REMOVING BLOOD

The effect of ionizing radiation on estuarine organisms is studied at the Radiobiological Laboratory. Organisms are exposed to gamma radiation from a cobalt 60 source which is contained in a specially built irradiator. After exposure to radiation, the organisms are subjected to various biochemical and cellular tests. Often, radiation-induced physiological changes occur first in the blood.

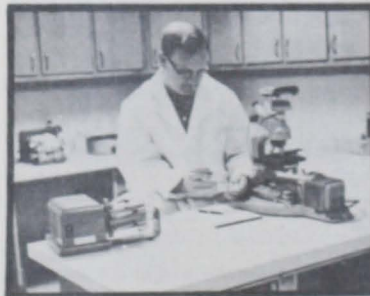
CELLULAR CHARACTERISTICS



MEASURING PACKED CELL VOLUMES



COUNTING CELLS



DETERMINING CELL TYPES