

Bypass and Collection System for Protection of Juvenile Salmon and Trout at Little Goose Dam

JIM ROSS SMITH and WINSTON E. FARR

ABSTRACT—Juvenile fish screening, bypass, and collection facilities at Little Goose Dam on the lower Snake River are described. The complex includes traveling screens for diversion of downstream migrants from turbine intakes, a bypass system for routing fish around the turbines, and a fish collection area for grading, enumeration, and examination of the migrants passed to the tailrace area. The system was operated and evaluated in 1971-72 by the National Marine Fisheries Service under contract to the U.S. Army Corps of Engineers.

INTRODUCTION

In recent years, solutions to problems associated with downstream passage at dams of juvenile Pacific salmon, *Oncorhynchus* spp., and steelhead trout, *Salmo gairdneri*, have been centered on development of safe diversion, bypass, and collection systems. For a number of years researchers working at dams on the Columbia River in the Pacific Northwest had observed juvenile fish milling in turbine intake gatewell slots (Fig. 1) and considered various methods to remove these fish safely. Fish rising up into these water-filled wells apparently did so volitionally, possibly in response to increasing pressures that prevailed on them as they were drawn into the turbine intake. Snyder¹ found in experiments at Bonneville Dam that fingerlings could be discharged safely from the gatewell slots into an adjoining ice and trash sluiceway by means of an orifice drilled in the upstream wall of a gatewell. Specific placement of an orifice in a gatewell to attain the best escapement was determined by Liscom (1971) at Ice Harbor Dam

¹Snyder, G. R. 1964. Passage of downstream migrating salmonids through an orifice in a turbine intake gatewell at Bonneville Dam. Review of Progress 1964, Vol. 4, Paper 53. Fish Passage Research Program, Bureau of Commercial Fisheries, USFWS, Seattle, Wash. 4 p. (Processed.)

in 1965. In 1968, the U.S. Army Corps of Engineers cut two 6-inch orifices in each of three intake gatewells at McNary Dam to determine whether orifice bypasses should be installed at all dams where applicable. Bentley and Raymond (1969) found these orifice bypasses to be effective; accordingly, the Corps completed drilling of 39 additional orifices at McNary Dam and considered installation of similar bypass systems at other projects.

The orifice-bypass system installed at Ice Harbor Dam in 1970 was modified into a collection system described by Park and Farr (1972). It has been successfully used to collect or bypass juvenile seaward-migrating salmon and trout.

Fingerling bypass systems were incorporated in the design and construction of recently completed dams such as John Day (1968), Lower Monumental (1969), and Little Goose (1971), but they differ from those installed at earlier dams in that an enclosed fish-transport pipe is used to pass fish around the turbines instead of an ice and trash sluiceway.

During the time that studies were being conducted on orifice bypass systems, concurrent research was underway to determine whether greater numbers of fish could be diverted into the gatewell slots and thus be

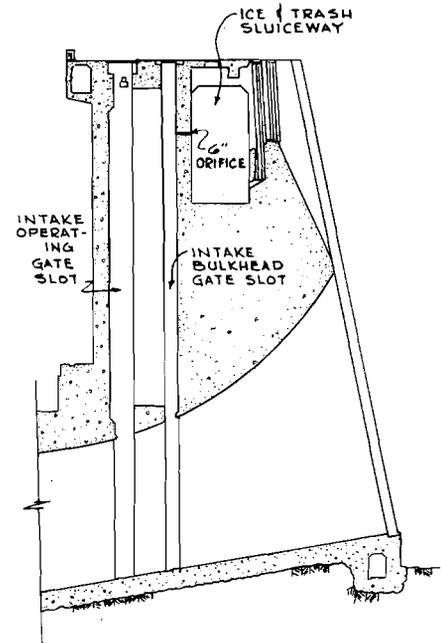


Figure 1.—Sectional view of turbine intake, gatewell, and ice and trash sluiceway.

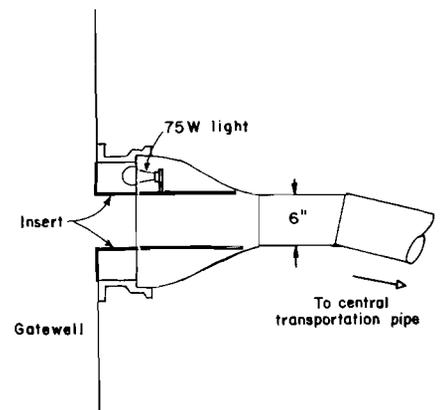


Figure 2.—Gatewell orifice showing insert modification of bell shape and placement of light.

prevented from entering the turbines. Laboratory studies by Marquette and Long (1971) indicated that a screen placed to intercept migrants traveling near the ceiling of a turbine intake was successful in diverting 87 percent of the fish entering the intake into the gatewell slot. A prototype traveling screen was subsequently installed in a turbine intake at Ice Harbor Dam to test this concept under actual field conditions.

In these preliminary tests made in 1968, the traveling screen diverted

Jim Ross Smith and Winston E. Farr are with the Northwest Fisheries Center, National Marine Fisheries Service, NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

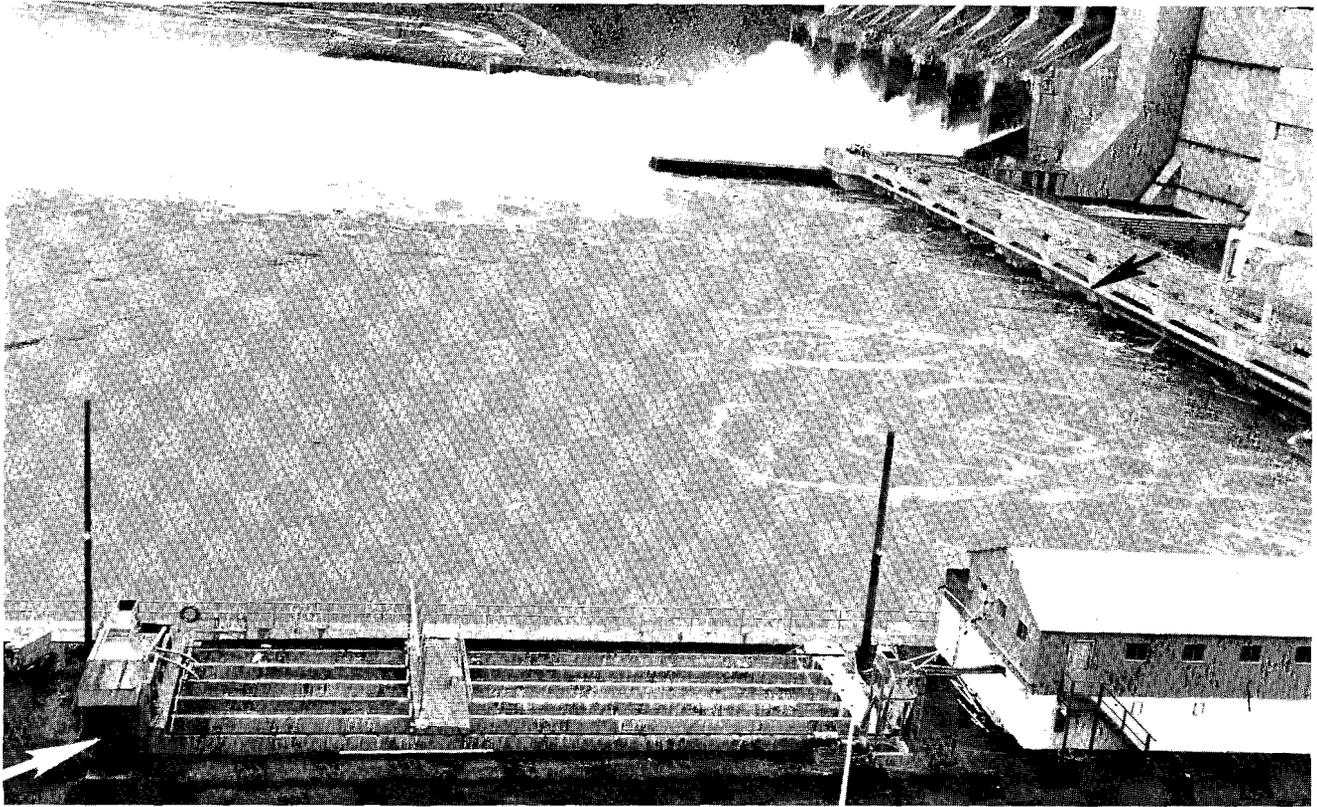


Figure 3.—Fish bypass transport pipe (dark arrow) and raceways for holding juvenile salmon and steelhead trout at Little Goose Dam. Transport pipe discharges through upwell at left end of fish holding area (light arrow).

about 75 percent of the juvenile chinook salmon, *O. tshawytscha*, and 25 percent of the juvenile steelhead trout from the turbine intake into a gatewell slot. Further mechanical improvements were made, and three experimental traveling screens were placed in operation at Little Goose Dam in 1971 to determine the feasibility of utilizing a complete diversion and bypass system for either collection and transport or diversion and bypass to the tailrace of a major portion of the fish entering operating turbine units.

This report describes the system installed and tested at Little Goose Dam in 1971-72. The study was part of a continuing cooperative effort between the National Marine Fisheries Service (NMFS) and the U.S. Army Corps of Engineers to improve fish passage on the Columbia and Snake Rivers.

GATEWELL ORIFICES AND TRANSPORTATION PIPE

Passage of fish from a gatewell slot at Little Goose Dam was provided through a submerged orifice. The

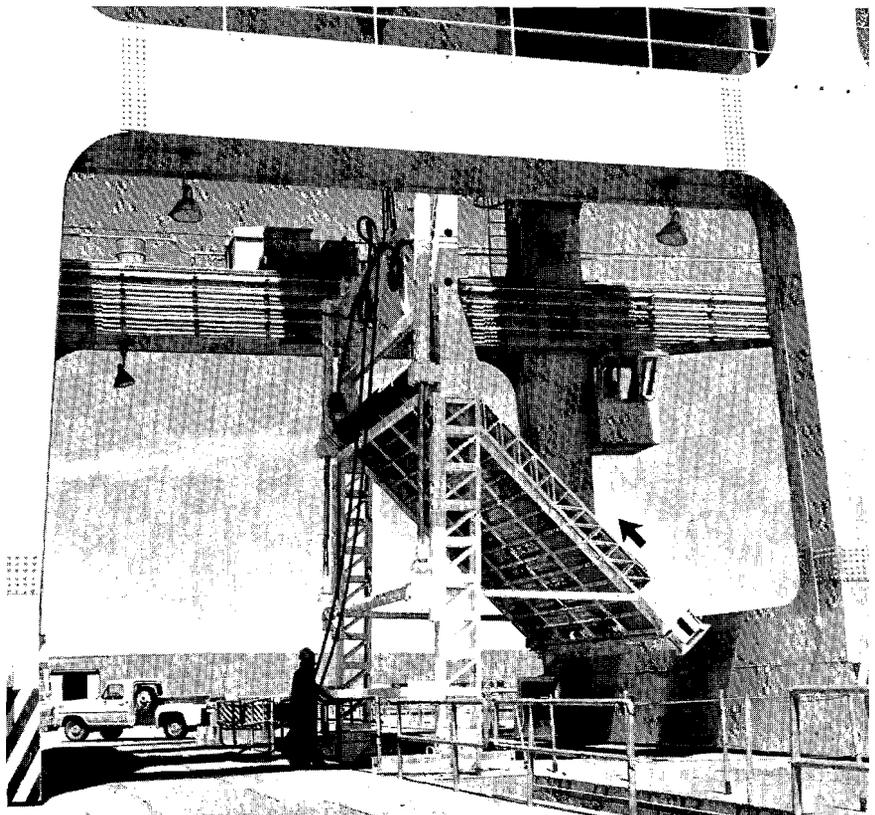


Figure 4.—Traveling screen assembly. Screen is shown extended and in the operating position. Arrow designates direction of travel.

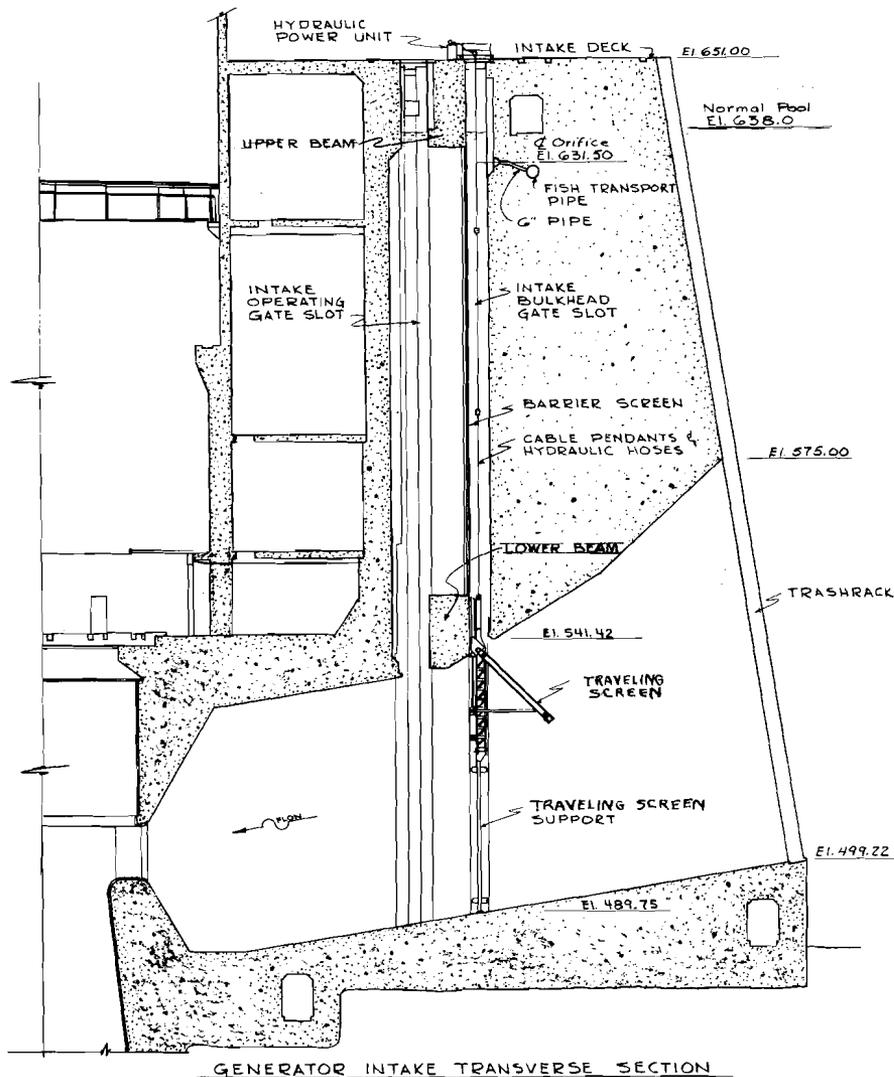


Figure 5.—Sectional view of turbine intake unit at Little Goose Dam showing traveling screen, barrier screen, support structure, gatewell orifice, and fish transportation pipe.

original orifice was bell-shaped, measuring 14 inches in diameter at the inlet and tapering to 6 inches at its connection with the short section of pipe leading to the main transportation pipe. The latter passageway was 1.0 ft in diameter at the southern end of the powerhouse, enlarging to 3.0 ft at the northern (downstream) end. Each orifice was located in the northeast corner of the gatewell, 20.5 ft below the intake deck and submerged from 1 to 7 ft, depending upon forebay elevation. Because the quantity of water discharged from the main transportation pipe was controlled, intake velocity at the orifices changed very little. Initial observations indicated that the unlighted, bell-mouthed opening was relatively ineffective in attracting available fish from the gate-

well. On the other hand, previous tests at McNary and Ice Harbor Dams had indicated that a naturally-lighted, straight 6-inch diameter opening was far more effective. Therefore, the orifices at Little Goose Dam were modified to provide 6-inch diameter lighted orifices (Fig. 2).

Water and fish passing through the individual orifices entered the central transportation pipe and were discharged into the tailrace in the area between skeleton turbine unit number 6 and the first spillway bay. Subsequently, the bypass was extended from the original point of discharge by adding approximately 900 ft of 24-inch pipe across the face of the tailrace deck and downstream to fish-holding raceways located on the south shore below the dam (Fig. 3). Fourteen

tapered baffles were placed in the interior of this extension to maintain water velocity at 9 fps near the downstream extremity. Each baffle restricted flows to a 15-inch diameter orifice; calculated velocity through these orifices was 23 fps. The system was designed to deliver 28 cfs of water at all times regardless of forebay level. This flow passed into a 5-ft diameter upwell pipe through a water elimination system and discharged the fish into a fish grader located at the fish-holding area.

FISH SCREENING FACILITIES

Typical Kaplan turbine units at dams on the Columbia and Snake Rivers have three separate intakes; hence, three individual screens are required to divert fish from each turbine unit. The first experimental traveling screen (Fig. 4) installed at Ice Harbor Dam was modified to fit slot dimensions at Little Goose Dam. Two additional traveling screens were constructed and installed at the latter site in the spring of 1971 to divert fish entering one of the three operating turbines.

Components of the traveling screen assembly included a rotating belt screen (20.75 × 22.0 × 1.5 ft), an outer framework for housing the belt screen and drive mechanism, and a support structure (23 × 30 × 3.66 ft) upon which the screen was positioned when operating in the turbine intake. The traveling screen unit was bolted to, and rested on, the support structure. Screen belting consisted of four woven panels of E42 × 36 × 16 wire. Power for rotating the screen at 0.5 fps was supplied by two hydraulic motors connected to gear boxes with a 7:1 reduction. One gear box and motor were attached to each end of the top shaft of the screen. Direction of screen travel was upward on the upstream face and downward on the returning side (Fig. 4).

Installation of the traveling screen assembly was as follows: The turbine was shut down and the bottom support structure was partially lowered into a gatewell and dogged off. The collapsed traveling screen unit was then lifted with the gantry crane, lowered onto the support structure and the

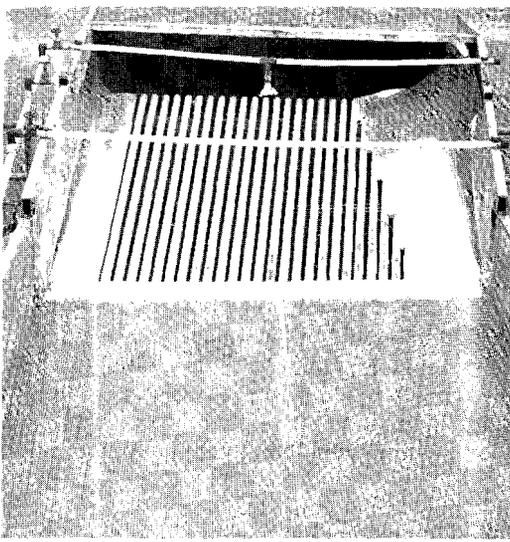
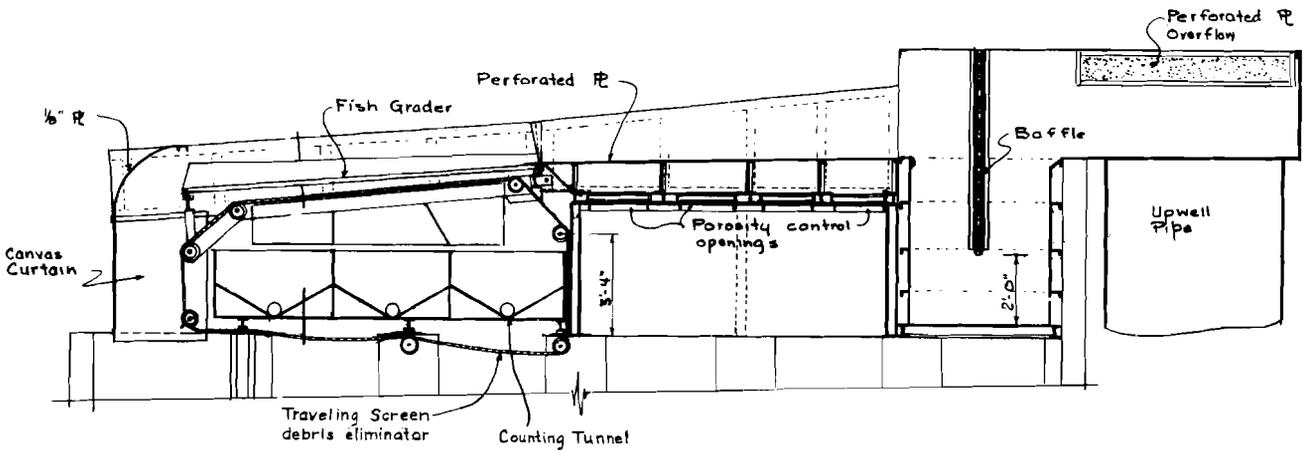


Figure 6.—Overhead view of fish grader. Shown are the perforated plate, grader bars, and sprinkler system.

two sections were bolted together. After removal of the dogs, the total assembly was then lowered into the intake by use of cable pendants. When the support structure reached the bottom of the turbine intake, the cable pendants were dogged off. The traveling screen was then tilted into operating position at approximately 45° by activation of the hydraulic pistons. After the traveling screen had been placed in position, the valve controlling the movement of the traveling screen conveyor belts was activated, and the system was ready to divert fish (Fig. 5).

Separate 25-hp hydraulic power units were used for each traveling screen. These units were located on the deck adjacent to the gatewell

Figure 7.—Sectional view of separator showing upwell pipe, perforated plate, fish grader, and debris eliminator.



opening. Installation and removal of the hoses were expedited with quick-disconnect couplings. Hoses between the top of the traveling screen frame and the intake deck were of the same length as the cable pendants so they could be installed and removed simultaneously. A more detailed description of the design and operational features of the turbine intake traveling screen is given by Farr (In press).

Fish diverted into the bulkhead gate slot were confined to that area by a vertical barrier screen which prevented movement into other areas of the gatewell (Fig. 5). Prior to the addition of this screen, fish entering the gatewell could pass downstream around the lower beam and back into the turbine intake. Three barrier screens were required for each turbine intake. These were installed in guides fastened to the gatewell walls. Each screen was 21 ft wide by 84 ft deep. Subsequently, portions of these screens (upper and lower ends) were covered with paneling to control flow turbulence at surface levels in the gatewells. Before installation of the panels, a pronounced upwelling was evident in the gatewells and was believed to have had an adverse effect on egress of fish to the bypass pipe. This surface turbulence was largely eliminated when the panels were installed.

UPWELL AND FISH GRADER

Fish emerging from the upwell at the terminus of the transportation pipe spilled over a perforated-plate screen and then on to the fish grader (Fig. 6). The flow of water to the fish

grader was regulated by porosity-control gates beneath the perforated-plate screen (Fig. 7). Water passing through the screen could be diverted to the holding raceways or returned directly to the river. The fish grader consisted of aluminum tubes 1.25-inches in diameter and 10 ft in length which were progressively spaced from narrow to wide openings to grade fish into three size categories. Spacing could be varied to accommodate the various sizes of fish. Graded fish fell into one of three water-filled hoppers located below the bars. Fish leaving these hoppers passed through a pipe containing an electronic counter and into one of the five holding raceways.

The grading system functioned satisfactorily, but small debris periodically passed into the raceways and occasionally plugged the fish transfer pump used to lift fish from the raceways to the marking facility. In the fall of 1972 a traveling debris carrier belt (Fig. 7) was placed between the grading bars and the hoppers. This belt consisted of 5/16-inch cross rods spaced 2 inches on centers with the ends of the rods passing through holes punched in the side bars of C2080 chains. These rods were covered with 0.5-inch schedule 80 PVC pipe, leaving a gap of 1.5 inches between the individual cross rods. A preliminary test showed that fish were separated from debris and that about 90 percent of the debris was removed from the system.

When desirable, fish emerging from the upwell could be bypassed directly to the river by merely covering the grader bars with a metal sheet. Fish

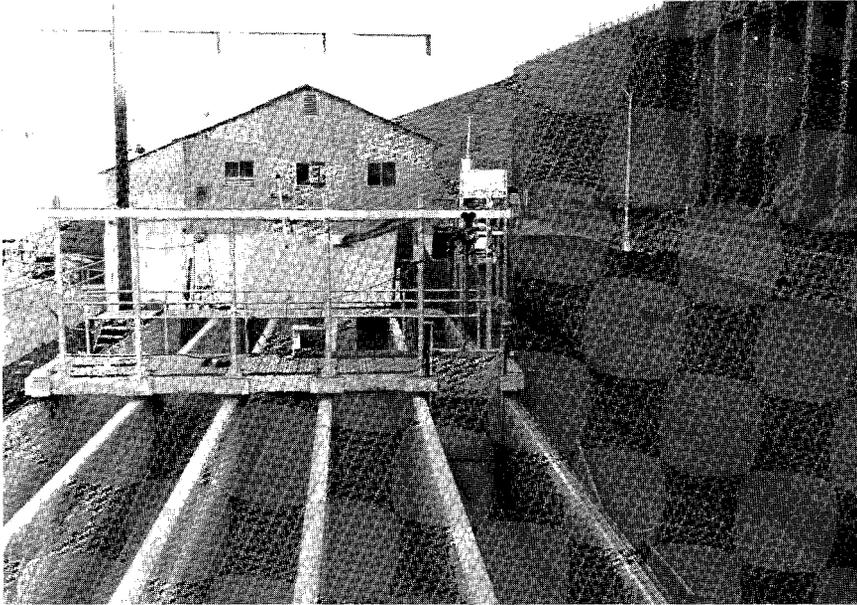


Figure 8.—Fish crowder with single screen in position in raceway on extreme right. Fish-marking facility is in background.

passed in this manner entered a pipe at the end of the grader and were discharged into the frontroll of the turbine discharge.

FISH HOLDING AREA

The fish-holding area consisted of five adjacent raceways 80 ft long \times 4 ft wide \times 7 ft deep. Each raceway was provided with an inlet and outlet screen which prevented escapement of fish. Water flow and depth in each raceway were controlled by adjustment of stoplogs at the head and end of the raceways; excess water spilled back into the Snake River. Cooling water could be provided when needed by three 30-ton chillers plumbed into the raceways.

When fish were removed from the holding area for transfer to the marking building or to fish-transport trucks, each raceway was handled independently. Water depth in a designated raceway was lowered to 2 ft by lifting

stoplogs at the downstream end. The outlet screen was then pulled and fish were crowded toward the intake of the fish pump.

The crowder (Fig. 8) ran on tracks mounted on the two outside walls of the fish-holding area and was powered by a variable-speed, reversible electric motor with reduction gear. A single crowder screen was connected to a traversing hoist to permit ready transfer to any raceway. To remove fish from a raceway, the crowder tramway was moved to the inlet screen and the crowder screen lowered into position. The outlet screen of the raceway was then removed, a slide-gate valve to the pump-intake pipe was opened, and the fish pump was activated. The crowder was then moved down toward the exit to concentrate all fish near the pump intake. From this point the fish were either pumped into the marking facility or directly to a transport truck.

The transfer pump was a 5-inch, helical port-impeller type, driven by

a 7.5 hp variable-speed motor. Diameter of the pump intake was 6 inches. During initial tests in 1971, before the installation of the debris eliminator, periodic inspection revealed that sticks (8-inch or longer) occasionally lodged at the junction of the intake pipe and the helical impeller; this condition caused some descaling and injury of fish. A clear plastic section of pipe was installed at this junction to permit ready detection of debris. Where noted, the debris could be immediately removed by unbolting the intake pipe. Total dynamic head (TDH) of the pump comprised 6 ft of suction lift and 12 ft of discharge head.

SUMMATION

In general, the fish diversion, bypass, and collection system at Little Goose Dam operated satisfactorily in 1971-72. More recent inspections in 1973 indicated that incidence of descaling and general physical condition of the fish were directly associated with turbine load and related approach velocities on the intake traveling screens. Further improvements and modifications to the system are planned and will be tested in forthcoming years.

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NOAA Awards Honor Employee Achievements

Five persons were presented 1974 NOAA Awards by National Oceanic and Atmospheric Administration Administrator Robert M. White at a luncheon at Bolling Air Force Base, Washington, D.C., 11 October 1974. The Commerce Department agency also recognized two employees for outstanding achievement in its Equal Employment Opportunity program.

The \$1,000 NOAA awards from the nation's civilian air-sea agency honored distinguished accomplishment for direction of U.S. participation in the world's largest weather experiment; automation of the National Weather Service's field operations; world leadership in magnetospheric physics; helping American surveyors toward modern practices; and major contributions to the development of a minority crab processing business.

Recipients were: Douglas H. Sargeant of NOAA's headquarters in Rockville, Md., Director of the U.S. Project Office of GATE—the Atlantic Tropical Experiment of the Global Atmospheric Research Project—for Program Administration and Management; Robert E. Johnson, Chief, Systems Integration Division, Systems Development Office, National Weather Service, Silver Spring, Md., for Engineering and Applications Development; Donald J. Williams, Director of the Boulder, Colo.-based NOAA Environmental Research Laboratories' Space Environment Laboratory, for Scientific Research and Achievement; Joseph Dracup, supervisory geodesist of the NOAA National Geodetic Survey in Rockville, Md., for Public Service; and Burton L. Tinker, food technologist at the Northeast Utilization Research Center of the NOAA National Marine Fisheries Service, Gloucester, Mass., for Public Service.

Sargeant has directed U.S. preparations for and participation in GATE, the field phase of which was recently completed off Senegal, Africa. The experiment involved approximately 4,000 persons from 70 nations, and a wide array of satellites, aircraft, ships and other platforms. Sargeant, more than any other individual, has

contributed to the highly successful execution of the observational phase of the GATE program. His resourceful management helped overcome threatened loss of vital satellite information and other equipment difficulties, during the project. His skill in complex international negotiations helped bring agreements acceptable to all nations concerned. "Largely as a result of his keen judgment and diligence," his award states, "this program will be recorded as a monument of scientific accomplishment."

Johnson, affiliated with the National Weather Service since 1966, has pioneered in the application of modern engineering technology to field operations. In 1971, he led in analyzing these operations in terms of their suitability for automation. From his efforts came the NWS' recently-unveiled Automation of Field Operations and Services (AFOS) Program, designed to speed and improve weather forecasts and warnings. He directed the development of an experimental model AFOS station, a system hailed as one of the most advanced applications of minicomputer technology in the Nation.

Williams, Director of NOAA's Space Environment Laboratory since 1970, has organized the best magnetospheric and one of the best interplanetary medium research groups in the United States. An expert in the dynamics of magnetospheric particle populations, he was instrumental in developing detectors for the measurement of ions and electrons at very low energies, and has used the instrumentation of 12 satellites to map the magnetosphere's charged-particle population in space and time. His work has eliminated areas of major ignorance about magnetic storms.

Dracup for many years has devoted much of his own time helping surveyors through the transition to modern methods that use NOAA's products and services. He has organized and participated in many workshops, usually on weekends, instructing surveyors in modern methods. Federal, state, and local surveyors have been assisted by these efforts.

Tinker, in 1970, began counseling a New Bedford, Mass., minority group interested in processing red crab, an underutilized shellfish. His technical assistance included aid in the preparation of proposals and plant design requirements. The group, which eventually became the New Bedford Atlantic Associates, received an Economic Development Administration grant in 1972 to undertake a pilot project. In 1973, Atlantic Associates materially expanded operations and on 30 August 1974 broke ground for a new plant in New Bedford. Tinker's assistance, much of it in off-duty hours, contributed significantly to the success of the venture.

Receiving \$500 NOAA Equal Employment Opportunity Awards will be NOAA Assistant Administrator for Administration Theodore P. Gleiter and Jacqueline A. Coit of NOAA's National Marine Fisheries Service.

Gleiter has been cited for continuing aggressive and imaginative leadership in all aspects of EEO. He has pointed out areas in employment where minorities and women tend to be locked into dead-end jobs, and has sponsored and encouraged a number of upward mobility programs to enable lower-level employees to enter new careers. Through various NOAA programs, he has assured that his own division has increased its number of minorities and women at higher grade levels. He has initiated programs in career counseling and race relation seminars to help managers and supervisors, as well as employees, come to a better appreciation and understanding of the problems of minorities and women.

Coit, an Administrative Assistant at NOAA's Southwest Fisheries Center in La Jolla, Calif., was recognized for "exceptional initiative and effort in encouraging the employment of handicapped individuals." She was instrumental in the recruitment of several severely handicapped individuals at the center. She has also contributed to EEO progress in the employment of minority and female candidates at the center, contacting and working with the Neighborhood Youth Corps, Work Incentive Program, Urban League, summer aid program, Upward Bound groups and

others. She has presented lectures on National Marine Fisheries Service job opportunities to minority and school groups, stressing the EEO plan, and maintains contacts with minority and women's organizations to establish continuing relationships and increased recruitment opportunities.

Regulations on Taking Marine Mammals Printed

Commercial fishermen who take marine mammals while fishing were required to be included under a general permit after 20 October 1974, according to the Commerce Department's National Oceanic and Atmospheric Administration.

The Marine Mammal Protection Act of 1972 was passed to protect, maintain, and if necessary rebuild the populations of marine mammals. The Act, among other things, restricts the taking and importing of marine mammals and marine mammal products.

Because there are times when fishermen might unavoidably take marine mammals during their normal fishing operations, it was necessary to make provisions in the Act which would allow fishermen to take marine mammals incidental to their commercial fishing operations.

A system was established by NMFS/NOAA whereby organizations representing fishermen could apply for a general permit to cover fishing operations using five general categories of fishing gear. Once these general permits had been issued, individual commercial fishermen could be included under the general permit by applying for a certificate of inclusion under one of the five categories.

Conditions of the general permits, and the certificates of inclusion under the permits, require, among other things, that commercial fishermen take special measures, and in some cases use special fishing gear, to avoid injuring or killing marine mammals in their fishing operations. If a marine mammal is killed or injured it must be reported to the National Marine Fisheries Service or a State enforcement agency.

NOAA's National Marine Fisheries Service published regulations controlling the incidental taking of marine

mammals in the Federal Register on 5 September 1974, to become effective on 30 September 1974. These regulations, as amended, govern the issuance of general permits and certificates of inclusion.

The initial general permits and related certificates of inclusion will be good until 31 December 1975. General permits and certificates issued thereafter will expire 31 December of the year they are issued.

The five general categories of fishing gear are towed or dragged gear; encircling gear, yellowfin tuna purse seining; encircling gear, seining other than yellowfin tuna; stationary gear; and other gear such as trolling, gill nets, and hook and line gear.

Applications for the certificates of inclusion will be accepted at the National Marine Fisheries Service's Regional Offices in Seattle, Washington; Terminal Island, California; Gloucester, Massachusetts; St. Petersburg, Florida; and Juneau, Alaska.

Applications for certificates of inclusion will include the name of the person(s) which is to appear on the certificate, the category of general permit under which the applicant wishes to be included, the species of fish sought and general area of operation, identity and date of expiration of State or local commercial fishing licenses, if any, under which fishing operations are conducted, and the name and signature of person making application.

Cost of the certificates is \$10 for everyone applying under all categories except yellowfin tuna purse seining encircling gear, which is \$200.

NOAA Dedicates New Great Lakes Facility

Officials from the National Oceanic and Atmospheric Administration dedicated the new Great Lakes Environmental Research Laboratory in Ann Arbor, Mich., 18 October 1974. Representative Marvin L. Esch, U.S. Congressman from Ann Arbor, was the principal speaker at the afternoon ceremony. John K. Tabor, Under Secretary of Commerce; Wilmot N. Hess, Director of NOAA's Environmental Research Laboratories; Charles G. Overberger, Vice-President for

Research of the University of Michigan; and Jack E. MaKeever, Executive Director of the Ann Arbor Chamber of Commerce, also participated. Eugene J. Aubert, Director of the new laboratory, discussed some of its objectives and projects.

Formally established on April 25, the Great Lakes laboratory is the newest of the Commerce Department agency's Environmental Research Laboratories, headquartered in Boulder, Colo. It brings together researchers from the limnology and computer divisions of the National Ocean Survey's Lake Survey Center in Detroit and NOAA scientists working on the International Field Year for the Great Lakes (IFYGL). The new laboratory's 30 scientists are investigating the total lake ecology—waters, sediments, life forms, climate, and surrounding terrain.

The main task of the Great Lakes laboratory for the first few years will be continued analysis of the data collected during IFYGL in 1972-73. The project is a joint U.S.-Canada study of Lake Ontario. Aubert estimates that IFYGL will occupy two-thirds to three-fourths of the laboratory's efforts until 1977.

Research at the laboratory will take two directions. Basic research will contribute to the background of general knowledge about the lakes. Other projects are aimed at providing improved environmental information to solve specific problems or meeting specific needs, such as improving navigation or preventing erosion or pollution.

The emphasis will be on interdisciplinary research, says Aubert. The laboratory will also provide environmental information and advisory services to planners and policy makers in government and private organizations.

Among the main long-range goals of the laboratory will be comprehensive models of lake circulation, lake ecology, lake levels, and flows. Studies will focus on waves and currents, design and siting of power plants, pollution of public beaches, lake climatology, winter ice, lake hydrology, the population dynamics of key organisms, and water quality in the various bays, rivers, and harbors.

The facilities at Ann Arbor will include laboratories for studies of water chemistry, sediment, biology, and ice. A lakeside facility at Monroe, Mich., will provide a starting point for field research. For research on the waters of the lakes, the limnologists will use the 65-foot research vessel, *Shenehon*, operated by NOAA's National Ocean Survey.

NMFS IMPORT INSPECTION SERVICE NOW IN USE

Boston Bonnie, Inc., Boston, Mass., one of the country's largest importers of fisheries products, is the first to use the Import Inspection Service offered by the Department of Commerce's National Oceanic and Atmospheric Administration.

The service includes technical assistance in developing purchasing, processing, and end-product specifications; determining compliance with the importers' requirements; and pre-testing and analyzing the imported seafoods for wholesomeness, quality, and condition. Assistance is also provided to the importer with product labeling, quality assurance, sanitation, and other problems.

The import inspection service is one of several inspection services administered by NOAA's National Marine Fisheries Service which will help to assure manufacturers that the fisheries products they offer to the consumer are safe, clean, and wholesome. The inspection is provided on a fee-for-service basis to anyone involved in distributing and processing fisheries products.

Boston Bonnie, Inc., employs over 100 people and imports millions of pounds of fisheries products a year for processing and worldwide distribution.

David M. Trilling, Vice President of Boston Bonnie, Inc., points out that inspection protects the foreign shipper as well as the U.S. receiver by providing certificates of the condition of the products at the time of the inspections. He feels that this is a step forward in assuring the processor that the imported fisheries products he uses are of high quality, thus providing a better product to the consumer.

Extensive Gulf of Alaska Ecological Study Is Assessing Probable Oil Lease Impact

What could possibly be one of the richest oil discoveries since Alaska's Prudhoe Bay—the oil-bearing formations beneath the continental shelf in the Gulf of Alaska—could also pose a formidable set of ecological questions.

The National Oceanic and Atmospheric Administration, working with other Federal and State agencies in a major investigation for the Bureau of Land Management, U.S. Department of the Interior, is attempting to assess this risk so that it can be weighed against the national imperatives for developing adequate domestic energy sources.

The \$2.5 million project focuses on an area in the northeast Gulf of Alaska between Prince William Sound and Yakutat Bay, a region thought to contain potential petroleum reserves—and to present some difficult environmental problems.

The study is managed by the Marine Ecosystems Analysis (MESA) program office of the Commerce Department agency's Environmental Research Laboratories in Boulder, Colo., and coordinated for the Bureau of Land Management by its Outer Continental Shelf office in Anchorage, Alaska.

"This kind of investigation," says Wilmot N. Hess, director of the NOAA laboratories, "is an absolutely essential prelude to outer continental shelf petroleum development."

"In the view of many environmental scientists in Federal agencies and private institutions alike, baseline environmental studies are needed to quantify our present rather subjective understanding of the risks of outer continental shelf development. Without quantification of these risks—that is, without knowing which action produces which environmental consequences—we cannot compare the probable risks with the probable benefits of development."

Although the project is managed by NOAA, it will draw on the special talents and experience of scientists in NOAA and in such institutions as the University of Alaska, Alaska Department of Fish and Game, and the Interior Department's Geological Sur-

vey and Fish and Wildlife Service. Herbert Bruce, of NOAA's National Marine Fisheries Service Auke Bay, Alaska, laboratory, directs the project in the field.

The Council on Environmental Quality, in its April 1974 report, indicated that oil development in the northeastern Gulf of Alaska presented potentially greater environmental risks than in any other continental shelf area studied. Among the special problems of the area cited by the Council were a superficial understanding of the region's rich, complex, and economically important marine ecosystem; the effect on possible oil spills, of tides, currents, and winds; the hazard presented to offshore facilities by the furious maritime storms which parade across the Gulf; and the relatively high level of seismicity (earthquake activity) and the earthquake-generated sea waves called tsunamis.

These crucial unknowns played a key role in shaping the present study, which in its first year will emphasize measurement and analysis of the key environmental factors which must be quantified before oil exploration, drilling, and production can begin.

In the first year's effort, the investigators hope to:

- 1) Characterize the circulation of the ocean (and estuarine) waters of the region, both over the continental shelf and offshore, identify the dominant dynamic mechanisms involved in flow patterns and mixing processes, describe characteristic waves and weather, and develop numerical models as aids in interpreting results and exploring simple dynamic processes. This will be a cooperative effort of the Pacific Marine Environmental Laboratory (one of the Environmental Research Laboratories) in Seattle, Wash., NOAA's National Ocean Survey, and the Institute of Marine Sciences at the University of Alaska.

- 2) Develop a comprehensive knowledge of the area's seabed geology and the sediment flow from contributory rivers, assess the earthquake hazard there, and delineate natural oil seeps—the sources of nature's small, chronic "oil spills." This part of the study

will be undertaken by the Interior Department's Geological Survey.

3) Provide baseline characteristics of the seabed and water-column chemistry, with emphasis on establishing natural levels of hydrocarbons and distributions of trace metals (for example, nickel, cadmium, zinc, copper, and mercury) in the marine environment and its life before petroleum development begins there. The chemical program will be conducted by NOAA's Northwest Fisheries Center, Seattle, Wash., and the University of Alaska's Institute of Marine Science, in consultation with the Commerce Department's National Bureau of Standards.

4) Complete a thorough census and description of the micro- and larger organisms which constitute the region's marine and estuarine population, particularly the fragile ecosystems of the intertidal regions, and assess the abundance of marine birds and mammals in the study area and how these populations vary seasonally. The biological program will be carried out by NOAA's Northwest Fisheries Center, the Institute of Marine Science of the University of Alaska, the Alaska Department of Fish and Game, and the Interior Department's Fish and Wildlife Service.

A follow-on program of studies designed to refine further scientific understanding of the study area's marine ecosystem and the possible impacts of oil exploration, production, and transportation, will be proposed early this year. A final report of the project's first-year results will be issued by mid-August.

NOAA Issues Coastal Management Criteria

A key set of criteria to guide the management of the nation's coastal areas has been issued by the National Oceanic and Atmospheric Administration (NOAA), a Department of Commerce component. They outline basic elements that a State coastal management program should contain to qualify for approval by the Secretary of Commerce and were published in draft form in the Federal Register on 21 August 1974.

The criteria were issued in response

to the Coastal Zone Management Act of 1972. The Act provides Federal funds to State governments wishing to develop coastal management programs. Participation in the program is voluntary, but all 34 eligible States and territories were expected to take part in 1974.

Under the Act, the 30 coastal States (including those along the Great Lakes) and four territories may submit for Federal approval management programs for protecting, developing, and restoring coastal lands and waters. When the Secretary approves the program, the State becomes eligible for additional funds to assist in its implementation. In addition, Federal activities carried on in the coastal zone, or which may affect the coastal zone—including grants, loans, licenses, and permits—must be conducted in a manner consistent with the program.

Among the new criteria is the provision that the management program describe how the State will exercise control over the use of coastal resources of Statewide interest in cooperation with local governments and regional bodies.

Another criterion provides that States designate areas of particular concern within the coastal boundary. Areas, for example, which are of historical and scenic importance as well as of significant ecological value. Additional consideration should be given to coastal areas vulnerable to natural disasters or of high recreational potential and urban concentration.

Recent proposals to accelerate oil and gas production in the offshore waters of the United States have intensified interest in wise coastal zone management. Oil refineries, beaches, harbors, second homes and condominiums, power plants, wildlife refuges, airports, highways and commercial development all compete with one another for a relatively limited, but extremely critical, strip of shoreline.

Robert W. Knecht, director of NOAA's Office of Coastal Zone Management, says the new criteria "represent a major step forward in building the kind of 'shared partnership' between the Federal, State and local governments that is visualized in the

Coastal Zone Management Act." He added, "Coastal States are encouraged to submit coastal zone management programs meeting the criteria established by the Secretary of Commerce. In exchange, the Federal Government is committing itself to conform Federal actions to the approved State program." Knecht emphasized that the basic coastal resource management decisions would continue to be made by State and local governments.

Marine Pollutant Data Available

Environmental data from a study to assess the potential effects of man-generated substances and activities on the marine environment is now available from the Commerce Department's National Oceanic and Atmospheric Administration.

According to NOAA's Environmental Data Service the data are from the Prediction of Ocean Pollutants Study conducted by the Ocean Affairs Board of the National Research Council which began in May 1973 with the identification of six substance types for study.

The substances were chosen because of their persistence, and abundance in the marine environment. They include nuclear wastes, synthetic organic chemicals, marine litter, metallic processing wastes from industrial operations, organic sludges, and medical and agricultural pharmaceuticals.

Information on each substance's basic chemical and physical properties, U.S. and foreign production, major uses, environmental leakages, routes through the environment, and potential effects on the environment were collected by ten NRC research associates during the summer of 1973. The collection of information, consisting of papers from scientific journals, tables, data, status reports from industry and government agencies, formal and informal reports, and referenced personal communications, has been indexed and is available through the Environmental Science Information Center, Marine and Earth Sciences Library (Fisheries Branch), 3300 Whitehaven Street, N.W., Washington, DC 20235.

Monitor Nominated As A "Marine Sanctuary"

The remains of one of the nation's most historic warships, the ironclad U.S.S. *Monitor*, and the ocean area where it has rested for more than 100 years have been nominated to become the country's first Marine Sanctuary.

Robert W. Knecht, Director of the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration, announced receipt of the nomination last fall from North Carolina Governor James E. Holshouser, Jr. The *Monitor* rests 220 feet beneath the surface of the ocean some 16 miles off Cape Hatteras, N.C.

In nominating the *Monitor* and its site as a Marine Research Sanctuary, Governor Holshouser cited both the historic and technological value of the Civil War gunboat. The *Monitor* is best known for its celebrated encounter with the Confederate ironclad ram, C.S.S. *Virginia*, popularly known as the *Merrimac*.

To ship builders, however, the *Monitor* represents a revolutionary concept in 19th century naval technology, symbolizing both the end of the wooden, sail-powered fighting ships and the beginning of the development of the modern capital ship.

Designation of the wreck site as a Marine Sanctuary will help to ensure that the *Monitor* is safeguarded and that archaeological research will be controlled, Governor Holshouser pointed out in his nominating letter.

Under the Marine Protection, Research and Sanctuaries Act of 1972, the Secretary of Commerce is authorized to designate marine sanctuaries to preserve or restore such areas for their conservation, recreational, ecological, or esthetic values. NOAA's Office of Coastal Zone Management is the government agency through which evaluations of marine sanctuaries nominations are conducted.

A discussion paper on the *Monitor* nomination was reviewed by the Department of Commerce, and a draft environmental impact statement—required for marine sanctuary sites—was developed for public release. A public hearing was also scheduled later in the year.

The *Monitor* foundered during a gale off Cape Hatteras on the last day of December, 1862, and sank with 16 of her crew onto treacherous Diamond Shoals. There the 172-foot warship rested, upside down and uncharted, for almost 111 years until the summer of 1973 when the wreckage was discovered by a marine research team using sonar and underwater photography techniques.

Early this year a more elaborately-equipped scientific expedition operating aboard the *Alcoa Seaprobe* confirmed the earlier find, obtaining hundreds of photographs of the wreckage and eliminating all doubt that it was, indeed, the *Monitor*.

Discovery and positive identification of the *Monitor* was a team effort on a large scale. Among those involved thus far have been scientists from Duke University's Marine Laboratory, the North Carolina Department of Cultural Resources, the National Science Foundation, the National Geographic Society, the U.S. Navy, Massachusetts Institute of Technology, the University of Delaware, and Aluminum Company of America.

Research Associate Will Study Squid Behavior

Brian J. Rothschild, Director of the NMFS Southwest Fisheries Center, La Jolla, Calif., has announced that Ann Hurley, animal behaviorist, is the latest recipient at the La Jolla Laboratory of a National Research Council Senior Research Associateship, awarded by the National Academy of Sciences and funded by the National Marine Fisheries Service, an agency in the U.S. Department of Commerce, National Oceanic and Atmospheric Administration. According to Rothschild, the annual award at the Center provides an opportunity for postgraduate scientists to work on basic research problems with professional staff at the laboratory.

During her 12 months at the La Jolla laboratory, Hurley plans to examine the importance of various types of visual stimuli on the schooling behavior of squid (*Loligo opalescens*) and will attempt to examine the development of schooling behavior using the facilities of the La Jolla Laboratory's saltwater aquarium where squid

can be maintained. According to Hurley the squid is important in the pelagic food web off the California coast. It is a predator on many species of small fish and crustaceans and is itself a food item in the diet of larger fish, and marine mammals; the squid also increasingly serves as an abundant and nutritious protein source for man. The squid forms large schools in open water and migrates to shallow water to spawn, often in the vicinity of the La Jolla Laboratory. There is a small commercial fishery for squid in California and most biologists agree that it is presently an underutilized fisheries resource.

The mechanisms which cause squid to form large schools and to maintain their orientation within a school have not been studied, Hurley said. She thinks that vision probably provides the primary sensory input for schooling behavior and also appears to be important in other social interactions. She also noted that the survival value of schooling in fish has been considered but its use to squid or other pelagic invertebrates is unknown. Schooling in squid may be important as a mechanism to escape predators, or its main function may be to form breeding groups which migrate inshore to spawn. Hurley hopes that her work on comparisons of schooling in fish and squid may give clues to physiological mechanisms involved in schooling and the ecological importances of schooling to both groups of animals.

The first woman to receive a National Research Council Fellowship at the La Jolla Laboratory, Hurley, 27, is a graduate of Stanford University and received her Ph.D. in biological oceanography from the University of California, San Diego in 1972. Recently, Hurley held a position as a postgraduate research neuroscientist at the University of California, San Diego, where she conducted experiments to determine the feasibility of experiments on squid both on board ship and in the laboratory at the Scripps Institution. While on a three-week cruise aboard the University of California research vessel, *Alpha Helix*, she examined the mating behavior of *Loligo*, and has also observed spawning squid during scuba dives.

Malins, Stansby Get New NWFC Positions

Donald C. Malins has been appointed Director, Environmental Conservation Division, Northwest Fisheries Center, National Marine Fisheries Service, NOAA, Seattle, Wash. He succeeds Maurice E. Stansby who, as advisor to Center Director Dayton L. Alverson, now is Scientific Consultant on Contaminants Research, concentrating on petroleum hydrocarbons and their effects on marine life. Malins will supervise research in the fields of biology, biochemistry, physiology, and pathobiology.

NOAA Sea Grant Assists University of California Marine-Related Research

Continuing work to develop a commercially feasible lobster aquaculture program, commercial exploitation of the California squid fishery and further development of a dynamic floating breakwater for dissipating wave energy are major parts of the University of California Sea Grant program for which Commerce Secretary Frederick B. Dent announced a \$1,631,000 grant last fall.

Headed by Jeffrey D. Frautschy of UC-San Diego, the program involves investigators from the University of California campuses at San Diego, Berkeley, Santa Cruz, Davis, and Santa Barbara; the Moss Landing Marine Laboratory; the California State University campuses in San Diego, San Jose, and Northridge; and the University of San Diego.

The grant was made by the National Sea Grant Program of the National Oceanic and Atmospheric Administration. Purpose of the program is to enhance the development of America's marine resources in the oceans, the Gulf of Mexico, and the Great Lakes. At least one-third of the funds for each Sea Grant project must come from non-Federal sources.

The major aquaculture work will continue to focus on the American lobster. Investigators at Davis and Bodega are concentrating on the development of closed systems using both natural and artificial seawater in order to obtain good control of all

factors affecting the animals. The use of temperature control to achieve rapid growth, and research on problems of mass larval rearing and disease identification, control, and immunization will be emphasized at San Diego. The economic study for a scaled-up commercial venture will also be continued.

The breeding and growth cycles of the crab, *Scylla serrata*, will also be studied as a potential candidate species for aquaculture. It is a tasty, disease-resistant crab that grows to one and a half pounds in ten months and breeds and grows in confined spaces.

Rounding the aquaculture program are projects dealing with seaweed production, the ecology of the kelp forest, and the biology and breeding of salt-tolerant land plants possessing a potential for commercial crop raising in saline environments.

Commercial exploitation of the California squid fishery is the objective of a project new last year. Improved harvesting gear, better knowledge of spawn areas, and determination of sustainable yields are included in this many-faceted investigation. Continuing efforts for developing quick chemical assays of "red tide" toxins, improving seafood preservation methods, and determining impacts of various schemes for restricting entry to fisheries are planned.

Under the marine products program, the University will continue its efforts in the chemistry of marine-derived compounds which are active

U.S., France Extend Oceanic Cooperation

The United States and France have agreed to continue this year cooperative ocean programs begun in 1970, according to Robert M. White, Administrator of the Commerce Department's National Oceanic and Atmospheric Administration.

Plans were revealed by White on his return from a meeting of the U.S.-French Cooperation in Oceanography last fall at the Brest Center of Oceanology, the major laboratory of France's National Center for the Exploitation of the Oceans (CNEXO).

White and Yves LaPrairie, Director-General of CNEXO, termed the

against marine bacteria and which demonstrate algae-inhibiting properties for application in antifouling agents. A new project will assess the interference that naturally halogenated compounds produce in present analytical techniques for determining pesticide levels. Since current pesticide analytical methods are incapable of distinguishing between natural and unnatural substances, many of the reported high levels of PCB's may in fact be due to high levels of naturally occurring compounds.

Two ocean energy related projects are included in the program. One, a continuing development of a dynamic floating breakwater for dissipating wave energy, may provide a less expensive way of protecting ships in harbors from wave damage. The second is a determination of the biological effects of waste heat effluent from the large electric power plant at Morro Bay.

Under the education program a practical on-the-job course will be continued in the technology of marine science at California State University, San Diego. The California advisory service program will employ a variety of methods to communicate research results to those who will apply them in properly utilizing the marine resources for managing the marine environment. Arrangements have been made for cooperation with other Sea Grant programs in the State under the joint designation of a California Marine Advisory Program.

sessions a major step forward in international scientific cooperation. In a joint statement, the oceanic leaders described as a highlight of the year the French-American Mid-Ocean Undersea Study (Project FAMOUS), whose field phase was recently completed.

In Project FAMOUS, after three years of planning and preparation, some 50 manned investigations to depths of 3,000 meters in the Mid-Atlantic Ridge southwest of the Azores were conducted by the U.S. submersible *Alvin* and France's *Cyana* and *Archimede*. The dives provided, for the first time, direct observations

by man advancing the concepts of continental drift and the scientific theories of plate tectonics. The scientific data acquired will be analyzed, and a bilingual report prepared.

New exchange activities have been initiated in marine pollution investigation. The nations will examine techniques for controlling oil discharges from ships. Another joint effort will study remote surveillance systems for response and enforcement against ships discharging oil, as prohibited by national and international

conventions. Working with CNEXO to develop technical symposia and demonstrations in airborne surveillance systems will be the U.S. Coast Guard.

A new area of cooperation initiated at Brest provides for research in coastal processes. Industrial development along the coasts has accelerated greatly in recent years, and the U.S.-French research will be designed to help assure environmentally acceptable patterns of development.

Other significant continuing efforts

concern the development of buoys and associated sensors for monitoring the ocean environment, aquaculture, instrumentation standardization and comparability, and such vital aspects of man-in-the-sea as diving safety and physiology.

White and LaPrairie also agreed to examine possibilities for cooperation in additional plate tectonics studies involving further use of submersibles, and methods of converting wind and temperature differences, currents and tides to useful energy.

Foreign Fishery Developments

Japanese Foreign-Based Skipjack Fishery Develops in South Pacific

Japanese fishery firms conducting skipjack tuna fishing in the South Pacific jointly with foreign partners had good catches last year.¹ Taiyo's vessels based in the British Solomons, and the Papua New Guinea-based fishing fleets, operated by Kyokuyo (which was having Daido Suisan manage the operations), Hokoku Suisan and Kaigai Gyogyo, were expected to attain their catch targets set for 1974. The good fishing experienced brightened the outlook for establishing a skipjack fishery in the southwest Pacific. The Papua New Guinea-based fishing operations were conducted experimentally in accordance with the plan to establish a fish cannery at Madang, for which the Papua New Guinea Canning Company was formed in 1972 jointly by the Japanese fishery firms, a U.S. tuna packer, and an investment firm in Papua New Guinea.

Solomon Taiyo is a jointly operated fishing venture based in the British Solomons. This company, formed one and one-half years ago, operated ten pole-and-line vessels (mostly of wooden construction). The fleet, based in Tulagi, fared well, as can be seen from its catch of 1,200 tons in June, 1,500 tons in July, and 1,200 tons in August. The catch goal for 1974, set at 10,000 tons, was expected to be easily surpassed. Most of the catch was frozen for export to the United States. Two ferro-concrete boats of

50 gross ton size were scheduled to be added to the fleet by March 1975. These boats, being built in Japan at a cost of 50 million yen (US\$166,700 at 300 yen = US\$1) each, will be the first Japanese-built fishing boats of ferro-concrete construction.

At Tulagi, the joint company operates an 800-ton capacity cold storage, built in August 1973, and a tuna cannery with production capacity of 1,300 cases/day, constructed in October that year. While the cannery was packing 500 cases a day in mid-1974, production was expected to increase as the local employees gained experience. "Katsuobushi" (dried skipjack loin) production, temporarily suspended earlier in 1974, was resumed in July and the daily output in September was 5 tons (converted to raw fish).

Gollin Kyokuyo was established in Kavieng jointly by Kyokuyo and Australian interests. This venture operated 11 Okinawan pole-and-line boats (39 gross ton in size) which, as in 1973, experienced good fishing. Their combined three-month catch to 31 July was over 5,000 tons. At that rate, it was expected that they would soon reach their catch goal of 10,000 tons set for 1974. Fifteen percent of the landings were processed into "katsuobushi," and 85 percent were frozen and exported to the United States.

New Guinea Marine Products is a joint skipjack fishing venture formed in Madang by the Japanese fishery firm Hokoku Suisan and an Austr-

lian firm. Fishing by this venture was reported to be good in 1974 compared with 1972 and 1973, when results were unfavorable. Fish landings by two motherships and nine catcher vessels had reached 5,200 tons in September and the catch goal for 1974 was 6,000 tons.

Carpentaria Kaigai is a joint venture company based in Rabaul. This company was operating 14 skipjack vessels (mostly 39-ton Okinawan pole-and-line vessels) in September 1974. Favored by good fishing conditions, the fleet, which began fishing in April, was catching 1,200-1,300 tons/month. The skipjack landings were frozen and exported to the United States. Until the cannery planned for construction in Madang is completed, all the skipjack catch will be frozen for export to the United States.

Source: *Suisan Keizai Shimibun*, 18 Sept. 1974.

VIBRIOSIS HITS NORWEGIAN FISH

Many thousands of young saithe were found dead or dying along the coast of western and central Norway in mid-October 1974 reports Norinform. The fish, most of which belong to the 1973 class, are victims of the bacterial disease vibriosis. It is reported to be too early to say what effect these deaths will have on the stocks of saithe, an important fishery in Norway. Although the 1973 class is large, it is feared that considerable losses may nevertheless be recorded. There have also been reports that other fish species have been hit by the disease, but the Institute of Marine Research in Bergen has so far been unable to confirm this. Species

¹See also, Kearney, R. E., "Skipjack Tuna Fishing in Papua New Guinea, 1970-73," page 5.

reputed to be affected include cod, plaice and eels, though only in small numbers if at all. If the disease spreads to the whole of northern Norway, the effect on stocks could be serious.

No cause is known for the sudden outbreak, though the Institute of Marine Research has suggested in a statement to the press that the size of the class itself, as well as special environmental factors such as pollution, may be responsible. Vibriosis, one of the earliest diseases of fish to be recorded, is endemic among saithe, and mass deaths such as the present have been recorded from time to time, the last being in 1967.

USSR Holds Meeting on Commercial Fish

In March 1974, a nationwide conference of Soviet scientists was held in Murmansk to discuss the biology of commercial fish and invertebrates at early stages of development. It was organized by the N. M. Knipovich Memorial Polar Scientific-Research Institute of Marine Fisheries and Oceanography (PINRO), the Northern Fisheries Administration Department of the Ichthyological Commission, and the Murmansk Department of the All-Union Hydrobiological Society.

Participating in the conference were 115 specialists from research institutes of the USSR Ministry of Fisheries, the USSR Academy of Sciences, and various universities. About 150 papers were presented on such topics as: composition year-classes of commercial fish stocks, factors determining survival at early stages of ontogenesis, and the effect of the age and the condition of spawners on the viability of gametes and young fish. Many reports dealt with various aspects of artificial reproduction of fish in inland waters, as well as problems in a new field—marine aquaculture.

There has been a noticeable increase in both the number and the complexity of investigations into the early life of commercial fish and invertebrates, in particular physiological-biochemical investigations into the early stages of ontogenesis of marine and freshwater fish. Knowing these stages is extremely important

for long-term forecasting of fish populations.

The conference revealed the practical problems that must be solved by further investigations into the early stages of fish development such as: perfecting existing methods and finding new methods for forecasting the status of fish stocks; developing methods for regulating fisheries on the basis of determining and quantitatively expressing the link between the stock and recruitment; working out the principles of marine aquaculture and perfecting freshwater aquaculture; and determining the necessary recruitment parameters for utilization in automatic control systems by the fishing industry.

Considering the enormous scientific and practical importance of investigations in this field, the conference passed a resolution stressing the need for specialized ichthyoplankton laboratories within the research institutes of the Ministry of Fisheries.

Participants in the conference also suggested creating a council attached to the Ichthyological Commission to coordinate investigations into the early stages of ontogenesis of commercial fish and invertebrates.

Source: *Rybnoe Khoziaistvo*, June 1974.

Experimental Cuban Boats Seek Shrimp and Lobster

A flotilla of experimental vessels built in Cuban shipyards for catching shrimp and lobster has set out on its first fishing expedition. The 20-meter vessels are constructed of steel-reinforced concrete and are intended for coastal fishing in the region of the Gulf of Guacanayabo and south of Camaguey province. The nine fishing vessels are equipped with modern navigation and fishing gear. Such Cuban-built vessels, as well as vessels bought from Peru, will soon begin to catch shrimp and lobster in other coastal waters of Cuba. Ships of this flotilla, which are capable of cruising on the high seas and of operating in conjunction with special refrigerated trawlers, characterize a qualitatively new stage in the development of the Cuban fishing fleet. In time they will fully supplant the inefficient fishing craft.

Source: *Ostsee Zeitung*, 18-19 May 1974, East Germany.

Japan and Russia Agree to International Observation for 1974-75 Whale Season

Japan and the Soviet Union, on 13 September 1974, signed an agreement in Tokyo to continue, as in the previous season, the international observer scheme for the 1974-75 Antarctic whaling operations. The agreement, to be effective until 31 August 1975, provides that the two governments will designate international observers (to be formally appointed by the International Whaling Commission), one for each factoryship of the other country. The observers will be maintained to ensure compliance with the terms of the International Whaling Convention.

Boarding costs will be paid by the country dispatching the observers. The Japanese and Soviet representatives, at the same meeting, also signed the agreement initiated earlier concerning allocations of the international whale catch quotas by regions established by the International Whaling Commission for the 1974-75 Antarctic whaling season.

Sources: *Minato Shimibun and Suisan Tsushin*.

Japan-USSR catch quota allocations for 1974-75 whaling season.

Whale species	Number of whales			
	Japan	USSR	Total	
Antarctic Ocean (1974-75)				
Fin	598	¹ (867)	402 (583)	1,000
Sei	2,392	(2,632)	1,608 (1,768)	4,000
Minke	3,500	(4,000)	3,500 (4,000)	7,000
Sperm				
Male	1,196	(1,200)	4,985 (5,000)	² 8,000
Female	683	(690)	2,871 (2,900)	² 5,000
North Pacific Ocean (1974-75)				
Fin	134	(246)	166 (304)	300
Sei	1,345	(2,017)	655 (983)	2,000
Sperm				
Male	2,565	(2,565)	3,435 (3,435)	6,000
Female	1,710	(1,710)	2,290 (2,290)	4,000

¹Figures within parentheses denote 1974 allocations.

²Includes allocations to Australia, South Africa, and Brazil.

Canada's Fishermen Get Ice Damage Compensation

Details of a compensation program to share in the cost of reimbursing Newfoundland fishermen for destroyed or damaged fishing gear and equipment caused by abnormal ice conditions in 1974 were announced jointly by the Federal Minister of State (Fisheries) Roméo LeBlanc and Newfoundland Fisheries Minister Harold Collins.

The Federal cabinet approved use of the peacetime disaster formula to compensate for the gear loss and damage, estimated at \$3 million. Under this formula, the estimated Federal share will amount to 53.9 percent, or \$1.62 million, and the Provincial contribution will be 46.1 percent, or \$1.38 million.

So severe were ice conditions off the coasts of Newfoundland and Labrador last year that normal fishing operations were delayed 2 months or more. When conditions improved and fishermen finally were able to set their nets and traps, constantly shifting ice wreaked havoc with the gear. All of the fishing gear used off the coast of Newfoundland was fixed (i.e. anchored) rather than towed, and was particularly vulnerable to damage or loss by shifting ice.

Estimated losses include 80,700 lob-

ster traps, 1,800 salmon gill nets, and 300 cod traps. Other gear lost or damaged included lumpfish nets, cod and herring gill nets, anchors, buoys and radar reflectors. The situation has been declared a disaster by the Government of Newfoundland.

Administration of the joint compensation program will be handled by the Province, which will also be responsible for enumerating and evaluating the claims. Under the Federal Government's peacetime disaster formula, Federal participation occurs when losses exceed \$1 per capita of provincial populations. As losses increase the Federal share applies on an increasing percentage basis, as follows:

Losses per Province Eligible for Sharing (per capita)	Federal Share
First \$1	0
Next \$2	50%
Next \$2	75%
Remainder	90%

Norway Seeks Partial Cod Trawling Ban

Norway will seek the establishment of four zones in the waters beyond the 12-mile fisheries limit off northern Norway from which trawling for cod will be banned for part of the year, reports Norinform. The four areas in question cover Jennegga and Malangsrunden off Vesterålen, Hjelmsøybanken off West Finnmark, Nysleppen off West Finnmark and Nordbanken and Østbanken off East Finnmark. The zone off Vesterålen, where the ban is to operate from 1 October to 30 April, extends from

4 to 19 nautical miles beyond the 12-mile limit. The two adjacent zones off West Finnmark extend from 27 to 33 nautical miles from the 12-mile limit, while that off East Finnmark extends from 27 to 42 nautical miles beyond the 12-mile limit—which means that it reaches out beyond a future 50-mile fisheries limit in places. The ban on trawling in the latter three zones is to last from 1 October to 31 March.

This was announced 24 October 1974 by the Minister responsible for

fisheries limits questions, Jens Evensen, at a press conference in Oslo. Evensen explained that the zones chosen are ones in which there have been a large number of collisions between trawlers and passive fishing gear (such as long lines or drifting nets) put out by coastal fishermen, or where coastal fishermen have been driven off traditional fishing banks by trawlers. The zones are intended primarily to protect the coastal fisherman and his gear from loss, rather than to conserve fish stocks. They are regarded as a first step towards an extension of the fisheries limits to 50 nautical miles and the eventual establishment of an economic zone stretching out 200 miles from the coast.

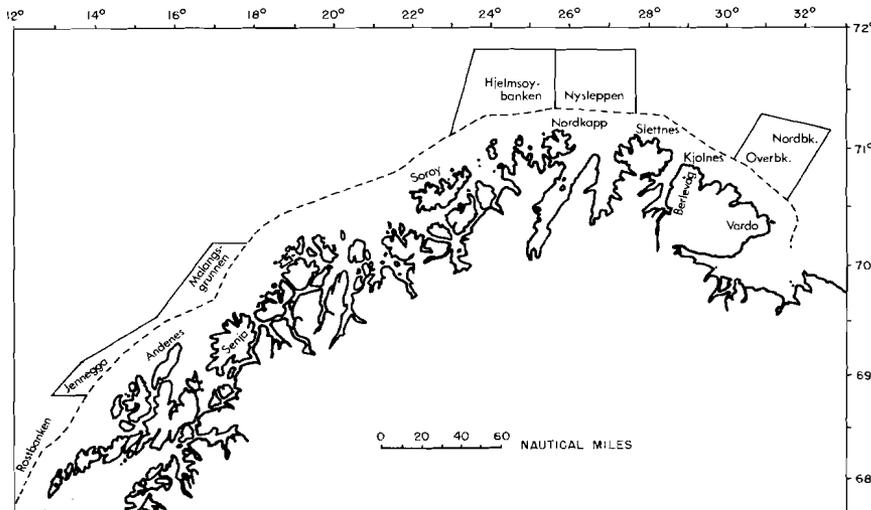
The proposed zones cover a total area of 5,300 nautical square miles, or about 20 percent of the area between the present 12-mile fisheries limit and a future 50-mile limit off northern Norway between Skomvær in Lofoten and the boundary with the Soviet Union.

The zones are to be created on a nondiscriminatory basis. In other words, both Norwegian and foreign trawlers are to be excluded. Only trawling for cod is involved. Trawling for other species, including, for instance, the capelin fishery off Finnmark, is not to be covered by the ban, the Ministry of Fisheries has made clear.

Evensen has recently been on a tour of Western European capitals and Moscow to explain the Norwegian proposals with regard to the fisheries limits and the no-trawling zones. On the map of northern Norway left the broken line shows the existing 12-mile fisheries limits, and the solid lines enclose the four proposed no-trawling zones.

NORWAY'S 1973 WINTER COD CATCH DECLINES

Norway's 1973 catch of spawning cod amounted to only 113,000 metric tons, a decline of 41 percent from the 1972 figure of 193,000 tons reports the NMFS International Fisheries Analysis Division. Between 1970 and 1974 the annual take of capelin had been between 1.3 and 1.5 million tons, but this year a reduced quota of 700,000 tons was established to pre-



vent a serious depletion of the resource. Scientists accurately predicted catch declines by analyzing each species by year classes since the early 1960's, but Norwegian fishermen tended to reject such dire predictions.

Overfishing of young cod and capelin is generally blamed for the current shortages, but some recovery in these fisheries is predicted by 1976 or 1977, unless heavy fishing of the Barents Sea by Soviet, British, and other trawlers continues unabated.

In the mid-1960's Norway's herring

fishery also slumped badly due to overfishing, so a switch was made to the capelin resource. Both species were used primarily for reduction to meal, but recently Norway has joined other nations in proclaiming that herring is too important for human consumption to be used for reduction purposes.

As the capelin resource has declined, research interest in the catch of blue whiting has increased greatly. It is estimated that this resource could provide an annual yield of 500,000 to 1,000,000 metric tons, most of which

would be used for reduction purposes or for minced products. Currently blue whiting accounts for about 20 percent of the catch listed under the generalized category of "Norway pout."

According to the NMFS International Fisheries Analysis Division, Norway currently appears to be predisposed toward acceptance of a 200-mile Fishing Zone, and unrestricted trawling off her coastline will do nothing to lessen her conviction that such an extension is absolutely necessary to preserve her fishery resources.

Publications

Polish, Yugoslavian, Russian, German, and Italian Fishery Translations Are Available

A limited number of the following Polish, Russian and Yugoslav publications translated and printed for the National Marine Fisheries Service (NMFS) under the Special Foreign Currency Science Information Program (financed with Public Law 480 funds) are available for free distribution from the Language Services Division, F43, Office of International Fisheries, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235. Please request by translation (TT) number.

Translation numbers, titles, and authors include: TT 66-57049, Technological and chemical characteristics of the North Atlantic redfish, Hryniewcka, K.; TT 66-57050, Statistics of Polish fisheries in 1961, Kazmierski, K., et al.; TT 66-57054, Economic foundations of Polish sea fisheries development, Lasczynski, S.; TT 66-57055, Polish fishery statistics in 1920-1960, Lasczynski, S.; TT 66-57056, Separation of fish flesh amines by the modified Steiner-Kamienski method, Minakowski, W., and O. Rzewuski.; TT 66-57058, Trawler operation in the North Sea, Noetzel, B.; TT 66-57059, Method of examination of yield of catches of a fishing fleet on distant fishing grounds, Orłowski, J.; TT 66-57060, Psychosociological problems of work in the fisherman's occupation, Polanska, A.; TT 66-57063, Preliminary examination of the operation of B-23 trawlers on fishing grounds of the northwest Atlantic shelf, Swiniarski, J.; TT 66-57064, Effect of ther-

mal denaturation on the mechanical resistance and texture of animal tissue (Baltic herring), Tilgner, D.J., and B. Markowski; TT 66-57065, Mechanical resistance of fresh Baltic herring, Tilgner, D.J., and B. Markowski; TT 66-57066, Chemical and weight composition of fish. II. Edible parts and offals of *Coregonus albula* L., Ziechik, M., and J. Zamojski; TT 66-57067, Chemical and weight composition of fish. I. Edible and inedible parts and gonads of flounder, Ziechik, M., and J. Nodzynski; TT 66-57068, Variable factors in the production of canned sprat in relation to labor productivity, Ziemia, Z.; TT 66-57069, Frozen fish as raw material for the processing industry (1959 data), Zukowski, K.; TT 71-50120, Automation of navigation and tactical control in fishing, Ol'khovskii, V. E., et al.; TT 71-50128, Soviet fisheries investigations in the Indian Ocean, Bogdanov, A.A. (editor); TT 71-50129, Theory and design of commercial fishing gear, Fridman, A. L.; TT 71-50130, Fauna of the Kurile-Kamchatka trench and its environment, Bogorov, V.G. (editor); TT 72-50035, Life activity of pelagic communities in the ocean tropics, Vinogradov, M.E. (editor); TT 71-50019, Chemistry and technology of Pacific fish, Kizevetter, I.V.; TT 70-55125/8, 9, Marine Technology and Management, Vol. 20, Nos. 8, 9; TT 70-55125/12, Marine Technology and Management, Vol. 20, No. 12; TT 70-55126/5, 6, Shipbuilding, Vol. 15, Nos. 5, 6; TT 77-55126/11, 12, Ship-

building, Vol. 15, Nos. 11, 12; TT 60-21144, State of Stocks and means of increasing the number of Amur pink salmon, Abramov, V.V.; TT 60-21150, Age of pink salmon and the pattern of their fluctuations in abundance, Vedenskiy, A.P.; TT 60-21865, Technology of fish processing, Styr, J.; TT 60-51041, Population dynamics and the state of the chum and pink salmon stocks in the Amur River basin, Birman, I.B.; TT 60-51129, Some suggestions on the standardization of Far Eastern trawls, Lestev, A. V., and G. Ye. Grishchenko; TT 61-11367, Thrusting implements for fishing (archeological study), Znamierowska-Pruffer, M.; TT 64-11101, Bibliography of literature on fisheries of the Far East. 1923-1956, Romanov, N.S.; TT 65-50097, Annotated bibliography on fisheries of the southern basins of the U.S.S.R., 1918-1953, Romanov, N.S.; TT 65-50365, Chlorophyll in the seston of certain Polish lakes as an indicator of productivity, Solski, A.; TT 65-50368, Hydrographic observations in the southern Baltic in 1953-1955, Filarski, J.; TT 65-50503, Selected translations from Roczniki Nauk Rolniczych (Polish publication); TT 66-51047, Parasites of the fishes of the Barents Sea, Polyanskii, Yu. I.; TT 66-57048, Sprat freezing with the use ascorbic acid and alginian gel, Gora, A., and P. Trzesinski.

ICCAT PAPERS TRANSLATED

"Albacore populations in the northeast Atlantic," by H. Aloncle and F. Delaporte, 78p.; "Some data on bluefin tuna (*Thunnus thynnus* L.) fishing

in the North Atlantic," by J.C. Dao and C. Bessineton, 16p.; "Representation of spatio-temporal groupings on the basis of statistics of parasite infestation in the Atlantic yellowfin (*Thunnus albacares*). First results obtained through a factorial analysis of correspondences," by F. Baudin Laurencin, 18p.; "Comparative fishing efficiency and evolution of the effort of the tuna boats of the French-Ivory Coast-Senegal fleet exercised on the various sizes of Atlantic yellowfin tuna," by A. Fonteneau and A. Caveriviere, 15p.; "Application of Schaefer model and derivatives to the Atlantic yellowfin (*Thunnus albacares*) populations," by A. Fonteneau and A. Caveriviere, 40p. The above papers presented at the Fourth Meeting of the Permanent Committee for Research and Statistics (SCRS), International Commission for the Conservation of Atlantic Tunas (ICCAT), November 19-24, 1973, Paris, have been translated in Tunisia for the National Marine Fisheries Service under the Special Foreign Currency Information Program (financed with PL-480 monies). Aloncle and Delaporte establish heterogeneity of the albacore stock in the northeast Atlantic, based particularly on 1971-72 tagging research. Dao and Bessineton studied Atlantic bluefin catch data and suggest that a larval concentration may exist off Morocco and Mauritania, as they found a concentration of young fish in this area, quite far from known spawning grounds. Laurencin uses factorial analysis of data on parasitic infestation of yellowfin to distinguish among stocks, noting two stocks, north and south respectively, in the Gulf of Guinea, and a third stock in the sea off Antilles. Fonteneau and Caveriviere analyze catch statistics for Atlantic yellowfin tuna since 1969, showing greatly increased fishing effort on the larger yellowfin, somewhat less on 2-4 year-class yellowfin, and relatively unchanged pressure on the small yellowfin. The second Fonteneau-Caveriviere paper applies the Schaefer-type model to Atlantic yellowfin stocks and estimates fishing effort, 1960-1972, in the eastern tropical Atlantic fishery, to give an average MSY of approximately 50,000 metric tons, signalling the

need for a catch quota in the near future. The translations are available on loan from the Language Services Division, F43, Office of International Fisheries, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

POLISH PROCEEDINGS

The following five articles from the Fiftieth Anniversary Volume of the Polish publication, Proceedings of the Sea Fisheries Institute, 1971, were recently translated in Poland for the National Marine Fisheries Service (NMFS), NOAA, under the Special Foreign Currency Science Information Program (financed with Public Law 480 funds). They are available on loan from the Language Services Division, F43, Office of International Fisheries, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

"Studies on selectivity of trawls as a factor in ensuring Polish fisheries interests in the north Atlantic," by W. Strzyzewski, 38p. Tests were conducted in the Baltic and North Seas and in the north Atlantic by Polish researchers interested in selectivity of trawl gear, especially in the cod and herring fisheries. Coefficients of selectivity were calculated for codends constructed of various nets and fibers and surrounded by covers and chafers to prevent tearing the codend on the slipway when hauling gear, and a knotless chafer was developed which protected the codend but still allowed high selectivity.

"Progress in the development of processing by Polish fishing vessels in 1945-1970," by E. Kordyl, 37p. Kordyl traces technological and strategic developments in the Polish fisheries, from their concentration on the Baltic and North Seas to their expansion into the North Atlantic, and some of the reasons for these developments.

"Economic consequences of the expansion of the fishing range," by Z. Polanski, 31p. Polanski discusses the various factors determining the value of catch per unit of fishing effort during expansion of the fishing range. He concludes that technology is the primary factor: expansion of the range accompanied by technological improvements will tend to cause unit

cost to drop, whereas without those improvements unit cost will tend to rise.

"Problems of fish refrigeration in economic works of the Sea Fisheries Institute," by K. Zukowski, 22p. This is a survey of the results of research conducted at the Sea Fisheries Institute on the refrigeration of catch. It compares developments in refrigeration technology in Poland with that in other countries. Zukowski's particular concern is for coordination of refrigeration technology with other aspects of the fisheries economy.

"Research on fish resources on the fishing grounds of Nova Scotia and New England," by B. Draganik, 60p. This presents results of Polish research into fish stocks in ICNAF subareas 4, 5, and 6 in 1964-1969. It includes Polish catch statistics for certain species and calculations of fishing effort and CPUE. Species investigated include herring, haddock, Argentine, mackerel, butterfish, blueback, alewife, silver hake, and squirrel hake.

"Type ranges of benthic invertebrates and the biogeography of South American temperate waters," by V.N. Semenov, Wealth of the World Ocean, (P.A. Moiseev, editor), No. 2, Proceedings of the All-Union Scientific Research Institute of Marine Fisheries and Oceanography, Vol. 77, 1972, p. 120-152. Semenov reviews data leading to classification of faunal ranges of the South American continental shelf and on the basis of this identifies 24 type ranges, in 4 distinct groups: warm waters, warm-temperate waters, temperate waters, and cold-temperate waters. Rather than diversity indices, indicator species are used to delineate the type ranges. Although this classification is restricted to horizontal distribution, Semenov is able to make some general statements about correlation with the vertical. After proposing the type ranges, he discusses their characteristics in some detail, noting particularly their relative importance. He stresses transitional areas, especially where two ranges overlap to a considerable extent. The translation was done in Israel for the National Marine Fisheries Service under the Special Foreign Currency Science Information Program (financed with PL-480 funds).

It is available on loan from the Language Services Division, F43, Office of International Fisheries, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

GERMAN, ITALIAN VOLUMES

The following two German and one Italian fishery publications produced by the Naples Zoological Station, Naples, Italy, were translated and printed in Israel in 1972 for the Smithsonian Institution under the Special Foreign Currency Science Information Program (financed with PL-480 funds): "Fauna and Flora of the Bay of Naples," Monograph No. 35, "Cephalopoda," by Adolf Naef, 1921/1923, Part I, Vol. 1, Fascicle 1, 292 pp., TT 68-50343/1, and Part I, Vol. 1, Fascicle 2, 625 pp., TT 68-50343/2; and "Fauna and Flora of the Bay of Naples," Monograph No. 38, "Eggs, Larvae and Juvenile Stages of Teleostei," by Salvatore Lo Bianco, Parts I and II, 1931-1933, 417 pp., TT 68-50346. The Smithsonian was unable to obtain the copyright release at the time the translations were issued. Thus they were printed in a very limited number of copies and no outside distribution was made. The National Technical Information Service (NTIS), Springfield, VA 22151, has recently received the authorization to enter the three volumes into its system. The cost per xeroxed copy is as follows: TT 68-50343/1 — \$6.75; TT 68-5034/2 — \$13.00; and TT 68-50346 — \$8.50. Foreign requesters will have to add \$2.50 per copy for postage. Checks should be made payable to NTIS and orders must include the translations' accession numbers.

RUSSIAN BOOKS

"Whales and dolphins," by A. V. Iablokov, et al, Nauka publishers, 1972, 472p. This book, translated by the U.S. Joint Publications Research Service, is a broad but thorough survey of the behavior and functional anatomy of cetaceans. It is designed to provide basic information on cetaceans for researchers in all areas of biology and applied sciences. While it covers all of the cetaceans, there is considerable emphasis on current studies of dolphins, as more meaning-

ful generalizations may be drawn from the larger number of dolphins examined. It includes a comprehensive current bibliography and over 200 figures. The translation in two volumes, is available on loan from the Language Services Division, F43, Office of International Fisheries, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235. It can be purchased from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22151. The first volume, JPRS 62150-1, is \$6.50; the second volume, JPRS 62150-2, is \$6.75 (total \$13.25). On microfiche, the price is \$1.45 per volume. If ordering from overseas, there is an additional mailing charge of \$2.50 per volume. Please cite accession numbers when ordering.

"The world ocean," by A.L. Kolodkin, Mezhdunarodnoe otnosheniia publishers, 1973, 232p. This book, trans-

Recent NMFS Scientific Publications

NOAA Technical Report NMFS SSRF-679. Wing, Bruce L. "Kinds and abundance of zooplankton collected by the USCG icebreaker Glacier in the eastern Chukchi Sea, September-October 1970." August 1974. 18 p.

ABSTRACT

Zooplankton samples were taken at 39 oceanographic stations in the eastern Chukchi Sea in September and October 1970. Sampling was done by vertical tows from near bottom to the surface with a 0.5-m diameter No. 0 (0.57 mm) mesh NorPac standard plankton net. Data are presented on the distribution and relative abundance of 63 categories of zooplankton at the onset of winter. Zooplankton abundance generally was lowest in waters with temperatures below 0°C; it did not appear to be associated with the distribution of salinity; and it tended to be inversely related to dissolved oxygen concentration. Comparison of zooplankton abundance in 1970 with published observations on the Chukchi Sea in 1947 shows probable seasonal variation of meroplankton abundance and yearly variation of holoplankton abundance.

NOAA Technical Report NMFS SSRF-680. Sanger, Gerald A. "Pelagic amphipod crustaceans from the south-

eastern Bering Sea, June 1971." July 1974. 8 p.

ABSTRACT

Fourteen species of pelagic amphipods were present in zooplankton samples collected from the southeastern Bering Sea in June 1971. *Parathemisto pacifica* strongly dominated relative abundance (68-96 percent) and was present in numbers up to an estimated 2,755/1,000 m³ of water. *Primno macropa* was the only other species present in all hauls and ranged from 4 to 27 percent in relative abundance. *Cyphocaris challengerii* was present in numbers up to 48/1,000 m³ during night hauls, but only one animal was taken in all daylight hauls. *Hyperia medusarum* was present in 14 (82 percent) of the hauls but accounted for less than 1 percent of the total numbers.

A presumed diurnal vertical migration was evidenced for *Primno macropa*, *Cyphocaris challengerii*, and possibly for *Scina rattrayi*, *Hyperoche medusarum*, and *Hyperia medusarum*.

The occurrence of *Scina stebbingi*, *S. rattrayi*, *Vibilia caeca* (?), *Paraphronima crassipes*, *Phronima sedentaria*, and *Primno macropa* extended their known ranges in the Bering Sea eastward, and the occurrence of *Cyphocaris anonyx* represents a new record for the Bering Sea.

Oyster Reefs, Swordfish, and Gravel Incubators

. . . . Some 18 acres of **new public oyster reefs constructed in Florida's Dixie County** by the Division of Marine Resources last summer are expected to be harvestable by spring 1975. Approximately 1,600 tons of a mined limestone aggregate were used as cultch material, according to *Florida Conservation News*. Continued statewide oyster reef construction and rehabilitation is planned. . . .

. . . . **Dr. Roger D. Anderson has been named** head of the Department of Advisory Services of the Virginia Institute of Marine Science, the institution reports. Anderson has been assistant director of the Center of Marine Resources at Texas A&M University, College Station, Tex. He will administer VIMS' field extension and advisory activities. . . .

. . . . **Use of spotter airplanes by California's commercial swordfishermen** will be allowed at least two more years, according to the Fish and Game Commission. Airplane use beyond 1976, however, will depend on results of a DFG study of swordfish status and the effects of airplane spotting. An immediate ban on air spotting had been proposed by the DFG, while air proponents recommended a quota system if swordfish proved to be in danger. . . .

. . . . **Young blueback herring, alewives, American shad, and hickory shad were sampled** in Virginia's James, York, Potomac and Rappahannock Rivers late last summer by biologists with Virginia Institute of Marine Science. The VIMS and NMFS funded study provides data for estimating the number of young fishes produced in 1974. Prediction of stocks available for the commercial fishery are based on the data. . . .

. . . . **Prototype gravel salmon incubators** at Crooked Creek on Alaska's Kenai Peninsula have produced nearly

half a million sockeye and silver salmon fry during the first year of operation, reports the Department of Fish and Game. Operated by the Division of Fisheries Rehabilitation, Enhancement, and Development (FRED), the facility is designed to enhance Cook Inlet salmon stocks. It began operation over a year ago (December 1973) with 1.3 million sockeye eggs in 16 incubators. In July 350,000 sockeye fry and 40,000 coho fry were transplanted. . . .

. . . . **Brine Shrimp could provide fish food and crop fertilizer** while keeping algae in a continuous state of exponential growth in sewage, according to *Science and Engineering News* (NOAA). Meanwhile, such sewage components as phosphates could be reduced to levels similar to those from conventional secondary or possibly tertiary treatment. . . .

. . . . **Crab farming may bolster diminishing Dungeness crab supplies**, reports *Sea Grant 70's*. In a 3-year Humboldt State University study, crabs on a "natural" bottom of sand and oyster shell thrived on Dover sole and shrimp discards. Early maturity, good flavor, and lower mortality were noted, and crab culture economics is now being eyed. . . .

. . . . **A joint U.S.-USSR board to resolve claims of damage** to U.S. vessels or gear by Soviet vessels off U.S. coasts has begun work in Washington, D.C. Normally, parties may bring claims before the board within one year after a relevant incident, says NMFS Director Robert W. Schoning, though a provision allows discussing claims for incidents that occurred as early as February 1971. . . .

. . . . **Production and dollar value of landed fish from the Great Lakes gained in 1973**, according to NMFS statistics in the *Great Lakes News Letter*. The catch totalled 111.4 mil-

lion pounds, 15 percent above 1972 poundage and the highest since 1969. Landed value gained 23 percent over 1972 to \$17.7 million. Production from 1972 to 1973 rose in most areas of the lakes while minor declines occurred in the Canadian sections of lakes Ontario and Superior and the U.S. waters of Lake Huron. Lake Erie again led, with a landed fish value of \$8.5 million, 48 percent of the total, and a catch of 48.2 million pounds, beating Lake Michigan for the first time since 1969. . . .

. . . . **A year-long American lobster study off Virginia's coast** by the Virginia Institute of Marine Science under a \$41,000 NMFS contract, seeks data for estimating relative abundance, growth rates, dependence or independence of the stocks, and establishing a minimum legal size, according to VIMS scientists. . . .

. . . . **The crown-of-thorns starfish is probably still moving southward** on Australia's Great Barrier Reef according to a preliminary survey report in *Australian Fisheries*. Of 14 reefs reported clear of the starfish in 1970, three had large and widely-distributed starfish populations and a large aggregation was found in one small area of a fourth. . . .

. . . . **Successful completion of a two-year buoy test program** in the Arctic ice pack has been announced by NOAA. Seven 340-pound drifting buoys were emplaced, three of which operated 1½-2 years. A more sophisticated Arctic data buoy prototype is being developed and better weather forecasting and safer navigation is hoped for. . . .

. . . . **Instruments which may help answer questions about the size and speed of waves**, their effects on weather and pollution, and their impact on the shore, and coastal and offshore structures, are being tested by NOAA's National Ocean Survey. Items tested range from bottom-mounted acoustic devices to large, vertically oriented electrical cables and include a wave measuring system on a deep-ocean buoy. . . .
