dent began learning more about the marine environment than ever before. The reason: a Sea Grant education project of the University of Delaware became available for the first time.

Thirty Delaware schools received the university's brand new marine environment curriculum collection, and Sea Grant projects in nine other states—Rhode Island, Maine, New York, North Carolina, Maryland, Georgia, Mississippi, Alabama, and Hawaii—also purchased them. Each set consists of a collection of 65 "learning experience" folders, or packets of teaching materials. Each folder deals with a specific topic for teaching, along with reference materials. Where appropriate, such aids as discussion outlines, laboratory experiments, suggested field trips, tests, and visual aids are included.

Sponsored by the National Oceanic and Atmospheric Administration, the Marine Environment Curriculum Study is designed to relate specific problems of the marine environment to general fields of knowledge and study, in accord with the responsibility of the Commerce Department agency's National Sea Grant Program to encourage education and training related to wise use and development of marine resources.

"We have designed these lessons to be infused into a wide variety of courses," explained Robert W. Stegner, Professor of Biology and Education and director of the study. "Although a particularly marine-oriented school could use the Sea Grant collection as a nucleus for a unified course of study or for mini-courses, we think its major use will be to provide marine orientation—and awareness of the importance of our marine environment—in the standard curriculum."

Each of the 65 lesson packets is built around a single subject showing some aspect of ocean-atmosphere-land interaction. Concepts and lesson plans are keyed to subjects studied from kindergarten through twelfth grade, and encompass general science, biology, chemistry, earth science, mathematics, social studies, reading, art, language arts, and even home economics. The overall theme emphasizes that ocean-atmosphere-land relationships are critical and that improved knowledge of the marine environment is required for intelligent decision-making about environmental problems.

"One purpose of the study," says Stegner, "is to interweave throughout a student's school career an awareness of how important the oceans are to life, through lessons that supplement or reorient rather than displace ongoing courses of study."

The Sea Grant packets contain extensive visual material including slides and masters for making transparencies. Examples from the Delaware region are frequently used, but the lessons can be adapted to school systems throughout the United States.

Each lesson is related to one or more of four basic propositions—that an abundance of water makes the earth unique in the solar system; that the oceans interact with the earth and its atmosphere; that marine organisms interact in complex ecosystems; and that man is part of the marine ecosystem. Among the topics covered by individual lessons are:

1) Seaside Nature Trail—general science, grades kindergarten through 4;
2) The Not-so-common Oyster—general science, grades 3 through 5;
3) Useful Plants of the Sea—reading, grades 4 and 5;
4) The Sun, Moon, and Tides—earth science and mathematics, grades 6 through 12;
5) The subsets of Coastal Zone—mathematics, grades 7 through 9;
6) The Oil Spill Problem—earth science, grades 9 and 10;
7) Physical Properties of Water—biology and chemistry, grades 10 through 12;
8) Simulation Game: Superport!—social studies, grades 10 through 12.

A wide variety of readily-available reference materials are listed in the lessons, ranging from *Scientific American* to Thor Heyerdahl's books and *NOAA* quarterly. A 24-page bibliography of popular books on marine-related topics was prepared by James Schweitzer and published at the outset of the project.

The Marine Environment Curriculum Study is part of a comprehensive Population-Environment Curriculum Study, initiated by Delaware in 1968. Basic guidelines for curriculum development are incorporated in a Conceptual Scheme for Marine Environment Studies—prepared by marine biologist Maura Geens and Stegner—which also serves as a means of evaluating a marine environment education program.

Most of the teaching resource packets in the collection were prepared by Delaware teachers working with the project staff. New subjects are being developed and produced, so that teachers interested in developing awareness of the marine environment will have a more varied collection of teaching materials from which to choose. Continuous growth of the collection is planned and a means of commercial distribution is being sought.

In addition to Sea Grant Program support, the project has been aided by the Office of Environmental Education of the Department of Health, Education, and Welfare; the Delaware Department of Public Instruction; and the College of Education at the University of Delaware.

Foreign Fishery Developments

Japan's 1972-73 Fishery Exports Detailed

Japanese exports of fishery products in 1973 totaled 173,493 million yen (US$636 million, based on exchange rate of 273:1) on a customs clearance basis. This is an increase of 20.7 percent (in terms of US dollars) over the 1972 exports[1] worth 162,178 million ($527 million at 308:1). Canned mackerel, valued at $96 million, was the most important product, comprising 15.1 percent of the total value of fishery exports, followed by canned tuna, $89.5 million (14.1 percent); and frozen tuna, $78.9 million (12.4 percent).

The United States continued to be the chief market for Japanese fishery products. Exports to the United States totaled $226 million (35.5 percent), followed by Great Britain, $39 million (6.1 percent), and by West Germany,

[1]See also, "Japan Tells 1972-73 Fishery Product Trade," Foreign Fishery Developments, *Marine Fisheries Review*, 37:1, p. 55.

Japanese fishery exports, 1972 and 1973.

Fishery Product	1973 Quantity Metric Ton	1973 Value Y1,000	1973 Value $1,000[1]	1972 Quantity Metric Ton	1972 Value Y1,000	1972 Value $1,000[2]
Fresh, frozen						
Tuna						
Skipjack	102,686	13,478,991	49,374	52,281	6,914,997	22,451
Albacore	20,884	5,973,026	21,879	30,596	8,139,396	26,427
Yellowfin	13,885	1,904,833	6,977	15,095	2,479,420	8,050
Bluefin	0.3	1,880	7	25	5,690	18
Other tuna	1,051	181,167	664	1,310	200,466	651
Total tuna	138,506	21,539,897	78,901	99,307	17,739,969	57,597
Saury	23,066	3,367,899	12,337	21,481	3,722,770	12,087
Rainbow trout	2,315	1,099,584	4,028	2,519	904,047	2,935
Shark	2,122	577,491	2,115	4,715	1,558,848	5,061
Shrimp	4,086	3,504,047	12,835	3,939	3,755,906	12,195
Squid	25,707	4,765,508	17,456	25,729	3,999,613	12,986
Others	138,560	53,005,784	194,161	206,050	40,439,703	131,298
Total, fresh and frozen	334,362	66,320,313	242,932	264,433	54,380,988	176,562
Canned						
Tuna in oil						
Albacore	9,588	6,052,464	22,170	6,860	3,591,272	11,660
Skipjack	12,319	6,154,669	22,545	8,390	3,566,755	11,580
Other tuna	2,365	1,094,264	4,008	3,630	1,440,293	4,676
Total	24,272	13,301,397	48,723	18,880	8,598,320	27,916
Tuna in brine						
Albacore	9,160	5,879,599	21,537	20,609	13,195,777	42,844
Skipjack	6,143	2,787,436	10,210	4,882	2,372,906	7,704
Other tuna	68	30,598	112	465	178,710	580
Total	15,371	8,697,633	31,859	25,956	15,747,393	51,128
Tuna Specialty Packs						
Albacore	184	99,212	363	78	38,708	126
Skipjack	6,118	2,257,408	8,269	7,593	2,589,651	8,408
Other tuna	190	84,233	309	303	117,314	381
Total	6,492	2,440,853	8,941	7,974	2,745,673	8,915
Total, canned tuna	46,135	24,439,883	89,523	52,810	27,091,386	87,959
Salmon	13,446	10,418,665	38,164	30,350	17,196,075	55,831
Pacific mackerel						
Natural	79,369	11,071,532	40,555	81,570	8,805,832	28,590
Tomato Sauce	88,892	12,730,524	46,632	89,562	11,424,725	37,093
In oil	9,202	2,343,088	8,573	10,276	2,447,688	7,947
Other packs	499	107,758	395	3,045	596,009	1,935
Total, mackerel	177,962	26,252,902	96,165	184,453	23,274,254	75,565
Other fish	17,997	6,105,416	22,364	15,874	7,948,280	25,807
Total, canned products	255,540	67,216,861	246,216	283,487	75,509,995	245,162
Other products						
Whale Oil	20,626	1,692,707	6,200	31,646	1,554,992	5,049
Pearls	48	17,866,834	65,446	68	14,188,968	46,068
Pet Food	6,941	1,009,355	3,697	9,180	1,381,646	4,486
Fish meal	17,754	2,312,727	8,472	28,561	1,987,112	6,452
Other products	52,111	17,074,794	62,545	49,691	13,174,878	42,775
Total	97,480	39,956,417	146,360	119,146	32,287,596	104,830
Grand total	687,382	173,493,591	635,508	667,066	162,178,579	526,554

[1]273 Yen = US$1
[2]308 Yen = US$1

$32 million (5.1 percent). Principal products exported to the United States (excluding Puerto Rico) were frozen tuna ($54 million), canned tuna ($31 million), and canned mackerel ($11 million). In quantity, the 1973 fishery exports recorded 687,382 metric tons, up 3 percent compared with 667,066 metric tons in 1972.

Sources: *Suisan Shuho* and "Japanese Fisheries Trade in 1973 and Outlook" prepared by U.S. Embassy, Tokyo.

Republic of China, Saudi Arabia Okay Fishing Pact

The Republic of China (Taiwan) and the Kingdom of Saudi Arabia have entered into an agreement for fishing cooperation. Pursuant to that agreement, the Yung Hsin Fishing Company at Kaohsiung sent two 180-gross-ton fishing vessels to operate in the Red sea according to a 30 August 1974 report. The Kaohsiung Fishing Company reportedly will pay Saudi Arabia NT$3.2 million (approximately US$84,200) for fishing operations over a 20-month period. The Saudi Arabian government will send fishermen aboard the two vessels to receive training. The fish catch will be sold to the local markets.

Source: *China Post.*

Canadian Government Buys Canned Perch

A $1.5 million purchase program of canned ocean perch under the provisions of the Fisheries Prices Support Act was announced last fall by Canadian Fisheries Minister Roméo LeBlanc. The product, to be canned from stored stocks of Canadian ocean perch, will be used to meet the requirements of relief and development programs administered by the Canadian International Development Agnecy and the World Food Program.

All five Atlantic provinces are significant producers of ocean perch. Landings in 1973 exceeded 350 million pounds. The 1974 catch was significantly reduced partially because of the existing marketing situation. The purchase program will reportedly help reduce large inventories of ocean perch accumulated as a result of heavy landings in late 1973, coupled with a general decline in world demand for fishery products. The program is being administered by the Fisheries Prices Support Board which set a price of $1,200 per metric ton for the canned fish.

Japan and Colombia Set Skipjack Venture

The Japanese trading firm Kanematsu Kosho and Colombian interests have formed a joint skipjack tuna fishing venture in Cali, Colombia. The joint company, named International Maritimo Pesquera, was organized with a capital of 1 million pesos (approximately US$39,000), invested 40 percent by the Japanese and 60 percent by the local partners. This is the first instance of Japanese participation in a joint fishing venture in Colombia.

One baitboat sent from Japan, to provide technical training, and four other vessels (three Ecuadorian and one Colombian) will conduct fishing for the company out of Buenaventura. The planned catch during the first year is 3,000 tons of skipjack worth about $1.5 million. The new company plans to build in Buenaventura a 1,000-ton capacity cold storage plant, which reportedly will be the largest cold storage in Colombia.

Source: *Suisan Keizai Shimbun.*

JAPAN IMPORTS LESS SALMON

Japanese salmon imports were sharply down last year owing to poor harvest in the United States and Canada, the two major suppliers, and the depressed market in Japan. In recent years, between 5,000 and 8,000 tons of salmon were imported annually, and in 1973 the purchases jumped to 15,000 tons. Sharp gains in 1973 were attributed to increased consumption in Japan of salmon and other North Pacific species which gained popularity as "clean" fish amidst the uproar over local fish contamination by PCB, mercury and other pollutants, and to heavy buying by trading firms speculating on sharp price increases for salmon.

However, in 1974, the Japanese salmon market weakened, adversely affected by the tight money situation and consumer resistance to high-value seafood. This situation, coupled with high prices in the salmon producing countries because of poor fishing, discouraged the trading firms from importing the product which they could not sell at above cost. Total Japanese salmon imports in 1974 to 30 September 1974 were 2,990 metric tons.

Source: *Suisan Keizai Shimbun.*

Publications

Recent NMFS Scientific Publications

NOAA Technical Report NMFS SSRF-677. Gilmore, Gil, and Lee Trent. **"Abundance of benthic macroinvertebrates in natural and altered estuarine areas."** April 1974. 13 p.

ABSTRACT

The abundance of benthic macroinvertebrates during March-October 1969 in West Bay, Tex., was compared between 1) a natural marsh area, 2) an adjacent marsh area altered by channelization, bulkheading, and filling, and 3) an open bay area. Animals representing four phyla were caught. Abundance indices (areas combined) of the four groups in terms of numbers were 66.4 percent polychaetes, 29.6 percent crustaceans, 2.5 percent pelecypods, and 1.5 percent nemerteans; volumes were 44.0 percent polychaetes, 40.8 percent pelecypods, 10.7 percent nemerteans, and 4.4 percent crustaceans.

When all organisms were combined, they were slightly more abundant numerically and over twice as abundant volumetrically in the marsh than in the canals and were least abundant in the bay. Polychaetes were most abundant in the canals and least abundant in the bay; abundance was highest at stations with low to intermediate amounts of silt and clay or where vegetative matter was composed mostly of live sea grasses or detritus. Crustaceans were more abundant in the natural marsh than in the other two areas and showed a definite preference for sandy substrate in marsh areas. Pelecypods were numerically most abundant in the bay but volumetrically the marsh had the highest standing crop. Nemerteans were most abundant in the marsh and least abundant in the bay.

In general, the seasonal abundance of polychaetes and nemerteans varied little during the study, whereas crustaceans and pelecypods were abundant only during the spring and early summer. An exception to this seasonal abundance pattern was the reduction in numbers of polychaetes at the uppermost canal station where the habitat was apparently unsuitable due to low oxygen levels during the summer and early fall.

NOAA Technical Report NMFS SSRF-678. Ellis, Robert J. **"Distribution, abundance, and growth of juvenile sockeye salmon,** *Oncorhynchus nerka,* **and associated species in the Naknek River system, 1961-64."** September 1974. 53 p.

ABSTRACT

The Naknek River system contains eight interconnected and generally biologically discrete basins, each with a different ratio of spawning grounds to rearing area for sockeye salmon, *Oncorhynchus nerka,* and different densities of juvenile sockeye salmon and associated species of fish. Juvenile sockeye salmon and other pelagic species were sampled with tow nets at night. Sockeye salmon were the most common and abundant species in all basins, followed by threespine sticklebacks, ninespine sticklebacks, and pond smelt. Eighteen other species of potential competitor or predator fish were present.

In the summers of 1961 to 1963, juvenile sockeye salmon in the pelagic areas had a characteristic pattern of abundance for the entire system: abundance (catch per tow) of age 0 increased from early summer to midsummer and then declined to late August. The abundance in late August varied about threefold and, in general, was independent of variations in the number of parents from 1960 to 1963.

In July the abundance of age 0 fish in each basin was proportional to the amount of known contiguous spawning ground, but by late August this relation no longer existed. This change was at least partly due to migration of the age 0 fish—generally from basins of greater abundance of fish to those of lesser abundance. The larger and faster growing fish were the first to migrate. Not all basins were involved in these migrations.

The production of sockeye salmon smolts in the Naknek system is relatively stable. At least three major factors probably contribute to this stability: (1) the presence of several major spawning units or races in widely separated spawning grounds of different types, (2) the presence of several connected lakes, and (3) the migratory behavior of juvenile sockeye salmon during the first summer.

A mechanism which prevents the population of juvenile sockeye salmon from exceeding some upper limit is not apparent in the Naknek system. A reduction in growth in areas of high density was not apparent in the Naknek system in 1961-64 and apparently did not occur in 1957-65. Many kinds of predators on juvenile salmon are present but probably are not limiting production of smolts.

The data on abundance and growth of juvenile sockeye salmon and the distribution of the escapement and spawning grounds indicate that it should be possible to increase the production of sockeye salmon in the Naknek system. Two of the major basins, North Arm and Brooks Lake, which constitute about 35 percent of the system, are now