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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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SEP 10 1976

The Honorable Robert L. Leggett, Chairman
Subcommittee on Fisheries and Wildlife
Conservation and the Environment
Committee on Merchant Marine and Fisheries
House of Representatives

Dear Mr. Chairman:

As you requested, we have developed information on the Japanese aquaculture program. The enclosure summarizes the highlights of the Japanese aquaculture program and discusses the proposed expansion of the program under Japan's Fisheries Agency's 7-year, $667 million plan, approved in April 1976, for developing its coastal fisheries.

We obtained this information during our limited visit to Japan in response to the joint request, dated November 19, 1975, of the House Committee on Merchant Marine and Fisheries and your Subcommittee that we study the policy issues, options, and costs of revitalizing the U.S. commercial-fishing industry.

We are sending a copy of this letter and the enclosure to the Chairman of the House Committee on Merchant Marine and Fisheries.

Sincerely yours,

ACTING Comptroller General
of the United States

Enclosure

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HIGHLIGHTS OF AQUACULTURE IN JAPAN

INTRODUCTION

Recent developments, including spiraling fishing costs, moves to establish international economic zones, and growing demands for fish products, are causing a gradual shift throughout the world from conventional fishing to fish farming.

Japan, one of the most advanced countries in the field of aquaculture, has made great progress in the culture of finfish, shellfish, and seaweeds. Aquaculture plays an important role in Japan, helping to fill the gap between supply and demand for certain fish species and creating a market for fish formerly discarded. Being woven into Japan's national food policy, aquaculture promises to play an even more important role in the future. Japan's 7-year coastal fisheries development program allocates $333 million, about half of its estimated total cost, to developing aquaculture areas.

Freshwater and marine aquaculture activities in Japan are generally divided into three categories: aquaculture with feeding (e.g., yellowtail and red sea bream), aquaculture without feeding (e.g., oyster, scallop, and seaweeds), and culture-based fisheries (e.g., Kuruma shrimp and red sea bream). The latter category includes the artificial propagation, rearing, and release of juveniles to natural fishing grounds. Aided by recent developments in seed production techniques, this stocking type of aquaculture is expected to predominate over the feeding type in the future.

AQUACULTURE PRODUCTION

Because of the urbanization and industrialization of coastal districts during the period 1954-74, Japan's coastal fisheries production stagnated at about 1.9 million metric tons annually. Due to technical developments and the steady demand for medium- and high-priced fish and shellfish, marine aquaculture production increased during this period from 145,000 to 880,000 metric tons and inland water cultures production increased from 9,000 to 67,000 metric tons.

Although aquaculture represents less than 10 percent of the total Japanese fisheries production, it contributes greatly to the supply of several popular fish species. Aquaculture meets over 50 percent of Japan's shellfish demand. Similarly, cultures supply 70 percent of seaweeds and yellowtail and 90 percent of eel consumption.

The following table illustrates the trend in Japanese aquaculture production from 1970 to 1974.

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Species	Production 1970 (metric tons)	Production 1974 (metric tons)	Percent increase
Marine:			
Yellowtail	43,300	92,685	114
Red snapper	454	3,298	626
Oyster	190,799	210,583	10
Scallop	5,674	62,651	1,004
Nori seaweed	231,464	339,314	47
Wakame seaweed	76,360	153,762	101
Others	1,031	17,468	1,594
Total	549,082	879,761	60
Inland water:			
Trout	10,632	17,631	66
Carp	17,253	27,164	57
Eel	16,730	17,077	2
Others	3,837	5,277	38
Total	48,455	67,149	39

As shown above, the important marine cultures of yellowtail, scallop, and the seaweeds increased greatly. Compared with marine cultures, the freshwater cultures increased, but at a slower rate. This is attributed to the competition for inland water use by other industries, including agriculture.

Yellowtail

Yellowtail, accounting for approximately 95 percent of marine fish aquaculture production, had a value of over $240 million in 1974. More than 3,000 family-run coastal farms located in southern Japan produce the yellowtail from seed larvae using floating and submerged growing cages.

Seed larvae, although artificially spawned on an experimental basis, are commercially collected from natural sources. As a conservation measure, the Japanese prefectural (State) governments issue special licenses to collect and sell yellowtail larvae. The governments strictly regulate the location of growing facilities, primarily for sanitation and health reasons.

Cage-cultured yellowtail grow remarkably fast. Generally seeds are placed in growing cages in May or June and harvested at weights of 1,000 to 1,200 grams from October through December of the same year. Feeding is required for the culture of yellowtail, with 40 to 70 percent of the budget of the average grower being spent for feed. White-meated fish, such as sand eel, horse mackerel, and saury, are the most suitable feeds. With the increased production of yellowtail, certain fish previously considered trash have become marketable as feed.

The average grower harvests from 10,000 to 20,000 yellowtail annually, the profits from which provide a middle-class-family income.

Oyster

Japan's 1974 oyster production (valued at $55 million), although an increase over the 1970 level, was well below the record production of about 270,000 metric tons in 1968. This decreased production level is attributed to the deterioration of culturing

grounds caused by pollution and to the reclamation of coastal lands for industrial use. Additionally, the number of growers decreased from about 8,800 in 1964 to 5,800 in 1973.

Because of its advantages over other types of cultures, hanging culture has become the most important type of oyster culture in Japan. By using hanging cultures, including raft, rack, and long-line types, the crop for each unit area of sea bottom is increased, the growing period is shortened, the meat is of a higher quality, and the oysters are out of reach of predators.

Oyster farms located in Hiroshima Bay, a major oyster-producing area, use the raft-hanging culture method. There are about 9,000 rafts in the bay, each measuring about 200 square meters and supporting 600 wires 10 meters long. Each wire contains 40 separated scallop shells to which naturally spawning oyster seeds cling. After a growing period of about 2 years, each raft yields from 3 to 7 tons of oyster meat.

Besides producing food oysters, Japan produces oyster seeds for domestic use and for export, mainly to the United States and France. The techniques each of Japan's oyster-farming areas uses are highly developed. The growers have special-purpose culture grounds for seedling, hardening, growing, and fattening stages of development. Recent technical advances are aimed primarily at shortening the growing period.

To prevent food poisoning from raw-oyster consumption, Japan's Food Sanitation Law was amended in 1967 to raise the health standards for processing and distributing oysters up to the levels prevailing in the United States and in European countries.

Scallop

The remarkable growth of scallop culture in recent years (1,000 percent in 4 years) was caused mainly by a sudden drop in natural scallop production from 50,000 to 60,000 tons to less than 10,000 tons a year. Through Government-sponsored research efforts, resulting in the stabilized collection of scallop seed and new culturing techniques, scallop farmers have been able to increase production from less than 6,000 tons in 1970 to over 60,000 tons in 1974.

Scallops, preferring cold water, are grown in northern Japan, primarily in Aomori Prefecture and on Hokkaido Island. Mutsu Bay, located in Aomori Prefecture, produces over half of Japan's scallops. About 80 percent of the bay's scallops are grown in hanging cultures and the remainder in bottom cultures. Scallops grown in hanging cultures are harvested in 18 months to 2 years, whereas bottom-cultured scallops are harvested in 3 to 4 years.

The Aomori Aquaculture Center, a research center funded by the prefectural government, does experimental research and provides supportive services to Mutsu Bay area fishermen and scallop farmers.

With a computerized system of five robot buoys, the center monitors hydrographic conditions in different bay areas. Using the data transmitted by these buoys, the center forecasts the date of scallop spawning and informs the approximately 2,000 local growers when to put out their seed collectors. The center has also helped to increase scallop production through its studies of optimum culture densities, natural seed collection, and areas suitable for bottom and hanging cultures.

In 1975 Mutsu Bay had an abnormally high scallop mortality rate due to a disease causing physiological disorders. Production dropped from 47,000 tons in 1974 to about 30,000 tons. At the time of our study, the Aomori Aquaculture Center was studying the causes for this disease. Preliminary results indicated that mass production techniques, along with the unusually high water temperatures in Mutsu Bay during 1975, were responsible.

GOVERNMENT MEASURES TO PROMOTE AQUACULTURE

Since 1970 the Japanese Government has subsidized projects aimed mainly at promoting fish farming (108 areas in all) throughout Japan. At the urging of the National Federation of Fisheries Cooperatives, on May 17, 1974, the Coastal Fishing Ground Adjustment and Development Law (law number 49) was enacted. The law provides for the large-scale improvement and development of coastal fishing grounds. Using national financing and investment, the Japanese Government plans to stabilize and increase the production of coastal fisheries.

Japan's Fisheries Agency's 7-year plan for developing coastal fisheries, authorized by this law, was approved in April 1976. The plan's objective is to increase coastal fishing grounds from 10,000 square kilometers to 11,000 to 12,000 square kilometers. About half of the plan's estimated cost of $667 million will be for installing artificial reefs and for developing large-scale aquaculture areas. Developing aquaculture areas includes constructing sand and eelgrass beaches, artificial rocky sea bottoms, and wave absorption facilities. By the end of the seventh year (1982), the Fisheries Agency expects to increase coastal fisheries production by approximately 300,000 metric tons, or by more than 10 percent over recent production.

National fish-farming centers

Since 1962 the Japanese Government has commissioned the experimental farming of Japan's Inland Sea. This has been a joint effort of Government and fishery cooperative associations to increase fish resources. The project has tried to artificially control and increase resources of important fish species, such as prawns, sea bream, and blue crabs, and has developed mass production technology for artificially propagating these and other species. It has made considerable progress in releasing artificially grown seedlings into the Inland Sea and in controlling their subsequent growth.

In addition to the 6 fish-farming centers operating in the Inland Sea area, 38 more prefectural centers are to be established.

ENCLOSURE I

The Japanese Government will subsidize 75 percent of the cost. Since fish farming in the Inland Sea faces many difficulties, the project is not as yet considered to be totally successful.