

TAIWAN'S USE OF FISHERY RESOURCES

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The fishing industry is among Taiwan's most vital assets. Exploitation of fishery resources has grown rapidly during the past decade. The annual average production growth rate is about 11.6%. This article examines the industry's place in Taiwan's economy, development trends, and the major factors that may account for the industry's rapid growth.

Fisheries in Taiwan's Economy

Fish production affects income, foreign markets, employment, and food intake.

In 1969, fishery landings increased to a record 560,918 metric tons worth about \$146 million--about 3.07% of the Gross National Product. Between 1960 and 1969, catch and value more than doubled.

In 1969, fish exports were more than 146 times those of 1960. They totaled 101,284 metric tons valued at \$44.7 million and produced a favorable balance of trade of marine products of about \$38 million. The larger the export surplus, the more foreign exchange is available to purchase capital goods necessary for fishery development. Moreover, the expansion of fish markets, both internal and external, is a powerful income generator that stimulates the growth of supplementary industries. In 1969, some of those to benefit were: 60 ship building and repair yards, 417 fish-processing plants, 341 ice-making plants, and 275 cold-storage and freezing plants.

Fishing operations provide many jobs. In 1969, nearly 286,404 people were fully or partly employed, about 6% of all workers. Moreover, the fisheries are an alternative livelihood for the farm population living in and around coastal villages.

The increase in fish production also assures Taiwanese of an adequate supply of an important source of nutrition. The Food Bal-

ance Sheet of 1962-1968 shows that fish consumption accounts for about 55% of animal protein intake.

Development Trends

There are four classifications of fisheries in Taiwan: deep-sea, inshore, coastal, and culture. These classifications differ primarily in the relative distance from shore of the fishing areas, and in craft and gear used. Deep-sea fisheries use powered vessels of 50 or more tons and operate as far out as the Southwest Pacific, the Indian, and Atlantic Oceans. Inshore operations use primarily medium and small powered craft usually within 30 nautical miles of shore. Sampans and bamboo rafts--the working fleet of coastal fisheries--operate along shores and on rivers and lakes. Fish culture concentrates on the resources to be found in brackish and fresh-water ponds, shallow water, and paddy fields.

Decade of Progress

Between 1960 and 1969, the total catch more than doubled (Table 1). Intensified exploitation of deep-sea and inshore fisheries accounted for the large increase. Deep-sea and inshore fishery production increased 199% and 134%, respectively, between 1960 and 1969; production of these two fisheries was about 85% of the total 1969 production compared with 70% in 1969. The relative importance of coastal fisheries is declining because of the limited fish resources in inner coastal areas and increased competition from the rapid expansion of deep-sea and inshore fisheries.

Table 2 indicates that the number of fishermen declined between 1960 and 1969 primarily because of the mechanization of fishing operations. However, the number of full-time fishermen shows no significant change. This implies that the number of part-time fishermen decreased. The expanding powered fleet has permitted the transfer of many part-time fishermen to full-time status.

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TABLE 1
ANNUAL FISHERIES PRODUCTION,^a 1960-1969
(in thousand metric tons)

Year	Total	Deep-sea Fisheries	Inshore Fisheries	Coastal Fisheries	Fish Culture
1960	259 (100)	85 (100)	95 (100)	30 (100)	49 (100)
1961	312 (121)	106 (125)	117 (123)	32 (105)	57 (117)
1962	327 (126)	114 (133)	132 (140)	32 (107)	49 (99)
1963	351 (135)	120 (141)	144 (152)	37 (123)	50 (102)
1964	376 (145)	127 (149)	161 (170)	32 (107)	56 (115)
1965	382 (147)	136 (160)	161 (170)	31 (102)	54 (110)
1966	425 (164)	169 (199)	172 (182)	25 (84)	59 (119)
1967	458 (177)	189 (222)	187 (197)	26 (88)	56 (115)
1968	531 (205)	241 (283)	208 (219)	25 (83)	57 (115)
1969	561 (217)	255 (299)	222 (234)	27 (90)	57 (116)

^aNumbers in parentheses are indexes, 1960 = 100.

Source: Taiwan Fisheries, published by Taiwan Fisheries Bureau, 1969.

TABLE 2
INDEX OF FISHERMEN AND VESSELS, 1960-1969
(1960 = 100)

	Fishermen		Vessels			
	Total	Full-Time	Total Number	Number	Powered Tonnage	Horse Power
1960	100	100	100	100	100	100
1961	97	102	98	105	107	111
1962	96	102	94	109	111	117
1963	95	103	95	117	117	126
1964	94	99	89	138	130	147
1965	88	85	88	147	150	173
1966	86	90	89	160	181	213
1967	87	94	91	174	224	283
1968	89	101	90	182	261	302
1969	90	101	97	189	294	337

Source: Derived from Fisheries Yearbook, Taiwan Area, 1969, published by Taiwan Fisheries Bureau, 1970.

Since production more than doubled between 1960 and 1969, while number of fishermen declined 10%, productivity per man increased significantly. Similarly, a decrease in total number of fishing vessels and a large increase in number of powered boats indicate the substitution of powered for nonpowered craft; also they suggest an increasing capital-labor ratio as the chief reason for increased productivity.

Examining the composition of Taiwan's fishing fleet during these years, Table 3 verifies that the change in new technology was more capital-using than capital-saving. That is, all tonnage classes of powered vessels showed increases in number except the 50-99.9 class; the largest increase was in over-100-ton class.

A sharp rise in the number of vessels over 100 tons can be explained by the high profitability of investment in large ships. This con-

clusion is verified by the results in Table 4 based on a sample survey in 1965 of production costs of private fishing.

There is no significant change in the average product per boat-ton for the class over 100 tons. The production cost per boat-ton, however, is much lower for boats in the large classes. In addition, the large vessels typically exploit fish of high value, which usually are exported at high prices and generate greater net profit.

Moreover, ships in fishing operations not only increased in size between 1960 and 1969, but also in power per gross tonnage (Table 2). The number of powered vessels increased 89%; gross tonnage increased 194%; and horsepower increased 237%. A more powerful engine increases the potential number of fishing trips at the margin, thereby increasing potential profit.

TABLE 3
INDEX OF POWERED FISHING VESSELS BY GROSS TONNAGE, 1960-1969

	Less than 5 tons	5-19.9 tons	20-49.9 tons	50-99.9 tons	Over 100 tons
1960	100	100	100	100	100
1961	101	110	106	99	125
1962	105	117	110	93	140
1963	111	128	100	93	153
1964	127	164	104	110	162
1965	131	186	110	84	223
1966	138	198	117	85	351
1967	144	226	133	88	477
1968	147	233	155	80	575
1969	150	228	232	78	662

Source: Derived from Fisheries Yearbook, Taiwan Area, 1969, published by Taiwan Fisheries Bureau, 1970.

TABLE 4
AVERAGE PRODUCTION AND COSTS PER BOAT TON BY VESSEL SIZE

Size Class (tons)	Average Production Per Boat Ton (M.T.)	Average Production Cost Per Boat Ton (N.T. \$) ^{a/}
50 - 100	2.5	26,000
100 - 200	3.7	23,000
200 - 500	3.5	20,000
500 - 1000	3.4	20,000

^{a/} New Taiwan dollars. \$1 = N.T. \$40.10.

Source: Report on the Sampling Survey of Production Costs of Private Fisheries in Taiwan, 1965, published by Taiwan Fisheries Bureau, 1966.

Factors Favorable for Rapid Growth

The trends of industry development have resulted in the modernization of equipment and technique. Emphasis was placed on substitution of capital for labor. This is a costly process. It cannot be accomplished on a large scale with rapid growth unless the basic resource, fish stock, is plentiful enough to justify large investment; the government is willing and able to provide technical and financial aid and to assist in research and training; the institutional structure is favorable for development; and markets, domestic and foreign, show promise for expansion.

Abundant Natural Resources: Taiwan's 1,600-Km.-long coastline and its favorable marine environment leave little doubt as to the abundance of fish resources. Deep water abutting precipitous cliffs along the Eastern Coast forms a favorite highway for migratory fish from both South and North; and a gradually inclining western shelf, abounding in biological nutrients, provides an excellent habitat for fish propagation. This convenient access to fish resources, limited arable land, and a rapidly growing population largely account for the increasing attention toward exploitation of marine resources as an important part of Taiwan's economic reconstruction.

Government Assistance: Rapid fishery growth also has benefited from an active and vital role played by the government.

The significant addition since 1960 of powered fishing boats, for example, is a direct result of a governmental plan: "Concentrative Utilization of Capital for the Exploitation of Marine Resources." By 1968, more than 100 new ocean-going fishing vessels, 150-1,500 tons, were built with government funds. According to a 5-year program launched in 1968, the projected fish catch in 1972 is 800,000 metric tons; to achieve it, \$29 million will be invested in 131 new fishing boats. The loans are obtained primarily by, or through, the government from the World Bank, Asian Development Bank, American Aid funds, or authorized bank loans.

Government funding also has been important in financing technological innovations in fishing technique and equipment. During the 1940s, most fishing boats used semidiesel, electric-ignition engines; at present, nearly 80% of all powered boats are equipped with diesel engines. The substitution of electric generators for conventional batteries and the use of synthetic fiber net also have enhanced fishing efficiency. Most deep-sea fishing craft contain the most up-to-date navigation

and electrical equipment, including fish finders, directionfinders, radiotransmitters and receivers, line haulers, cold-storage and freezing facilities, and radar and loran.

Government services used by the fishing industry are an equally important factor in the rapid fishery growth. For example, the fishing harbor at Kao-Shiung in Southwest Taiwan has been expanded and its facilities improved by the government to accommodate 600 vessels in the 100-ton class. Radio stations have been established with government assistance to disseminate oceanographic, meteorological, biological, and marketing information. To further the development of deep-sea fishing, the government has established 50 foreign bases in the South Pacific, the Indian and Atlantic Oceans, and in the Mediterranean Sea. Fishermen using these facilities can unload and resupply locally and thereby reduce operational costs.

Government impact on fishing-industry success is noted too in recent attempts to coordinate fishing development programs with education, training, and research. At present, 3 colleges, 5 fishery vocational schools, and 3 fishery research institutes exist in Taiwan to further marine studies. The colleges emphasize navigation, marine engineering, fish processing, shipbuilding, fishing technology, and fish management. Research and experimentation in fishing techniques, fishing biology, fish preservation, exploration of fishing grounds, and collection of fishing data are carried on at fishery research institutes.

Also, the Taiwan Fisheries Bureau has conducted short-term training classes to impart fundamental knowledge and skills to potential fishermen, and to those transferring from inshore to deep-sea fishing. These courses include instruction for deep-sea long-liner skippers, deep-sea mechanical technicians, deep-sea fisheries' radio operation of new navigation and fishery apparatus. These classes have improved the productivity of the labor force and increased the supply of skilled workers for mechanized high-sea fishing.

Fishermen's Associations: The extent to which fishermen have organized to enhance their own welfare has contributed much to the success of the fishing industry.

As in agriculture, there is often a feeling that the producers of raw materials are not adequately rewarded for their labor, while wholesalers and retailers receive more than their share of profit. The fishermen's desire to increase their bargaining power has been a major factor in the formation of 68 fishermen's associations at the district/city level, and one at provincial level. These associations have influence, as can be seen in the "Regulation Governing the Wholesale Market of Agricultural Commodities in Taiwan Province." According to this law, all first-hand sales of fish must be made through a wholesale fish market near where the fish are caught; an exception is remote fishing villages, where the catch generally is sold at landing site.

Wholesale marketing is one primary function of fishermen's associations, which operate the market and provide the site and facilities. The market transaction generally is by auction, and only licensed dealers can bid. If the owner is not satisfied with the bid price, he retains the right to reject it and place his fish into cold-storage provided by the association. After the transaction, the association deducts 2.5% of sales value to cover operation, improvement of marketing facilities, and fishermen's welfare activities.

The associations are required to collect another 2.7% of sales value to cover stamp tax, business taxes, the fishermen's share of a harbor maintenance fee, and collective fishermen's insurance in contract with the Labor Insurance Bureau of the Taiwan Government. Covered by the fishermen's insurance are child birth, sickness, death, old age and disability.

The associations serve other functions. They assist fishermen in purchasing fuel and oil from government-operated Taiwan Petroleum Company; they assist fishermen in negotiations with manufacturers for the purchase of engines, fishing gear, and navigational equipment; they negotiate loans from the government and banking institutions, and re-extend at their own risk to members who cannot provide sufficient collateral to meet the requirements of banks. Bait fish is bought and sold within the association by member fishermen. In foreign purchasing, applications for import permits and foreign exchange usually are made through the associations.

The associations also are extension services through which the government can help the fishermen increase efficiency. Study groups may be set up to exchange information on fishing grounds, fishing gear, and techniques. Fishing contests, navigation safety facilities, net-treating facilities, cold-storage facilities, harbor improvements, etc., are other services contributing toward improving fishing efficiency and boosting fishery production.

Expanding Markets: Expanding foreign markets and high export profitability reflect Taiwan's growing fishing industry.

Traditionally, Japan has been the world's leading country in fish export. The competitive position of Japanese fish exports is based mainly on cost factors. Production costs (largely labor cost) of the Japanese tuna fleet have risen sharply in recent years with general rise in Japan's economy. Japan faces increasing competition from Taiwan and South Korea. The latter's lower labor costs have strengthened their competitive positions in world markets. Also, domestic consumption of tuna in Japan is rising as income rises. A larger proportion of its catches is consumed at home. Therefore, Japan, has lost part of its world market, especially U.S., to South Korea and Taiwan. Due to increased world demand for fish, the world prices of frozen tuna and shrimp have become much higher than domestic prices in Taiwan. The high profitability of tuna and shrimp export to the expanding world market contributes much to the rapid expansion of Taiwan fisheries.

A Look Ahead

Whether or not Taiwan's fisheries continue to grow rapidly in the future will depend upon their ability to adapt to changing conditions. Biological studies indicate that the potential increase in the world tuna production, excepting skipjack, is very limited. Also,

fleet labor costs have risen significantly in recent years due to the rapid growth of the industrial sectors. These suggest: (1) Taiwanese fishermen, if they are to increase their share of a limited supply must rely upon superior technique and efficiency to reduce production and marketing costs; (2) Since the potential yield of albacore, yellowfin, and bluefin is limited, deep-sea fisheries development should be diversified; and (3) Attention should be directed toward exploitation of skipjack resource, which remains underexploited.

Whatever direction the industry takes, it will always have to operate under the constraint of being part of a worldwide fishing community. After all, commercial fishing is carried on primarily in international waters where producers from all countries compete for a limited, fugitive resource. The fish belongs to no one until captured. Exploitation in any region may exceed maximum sustainable level of catch. The effect is to raise the aggregate costs of fishing. This dissipates the potential economic rent through a larger effort than is necessary to catch the allowable maximum yield; it results in a loss to everyone's economic welfare. Therefore, it is desirable to encourage international cooperation and coordination of research efforts--as well as international regulatory measures to limit catch in a region to a level that would maximize the potential economic yield.

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