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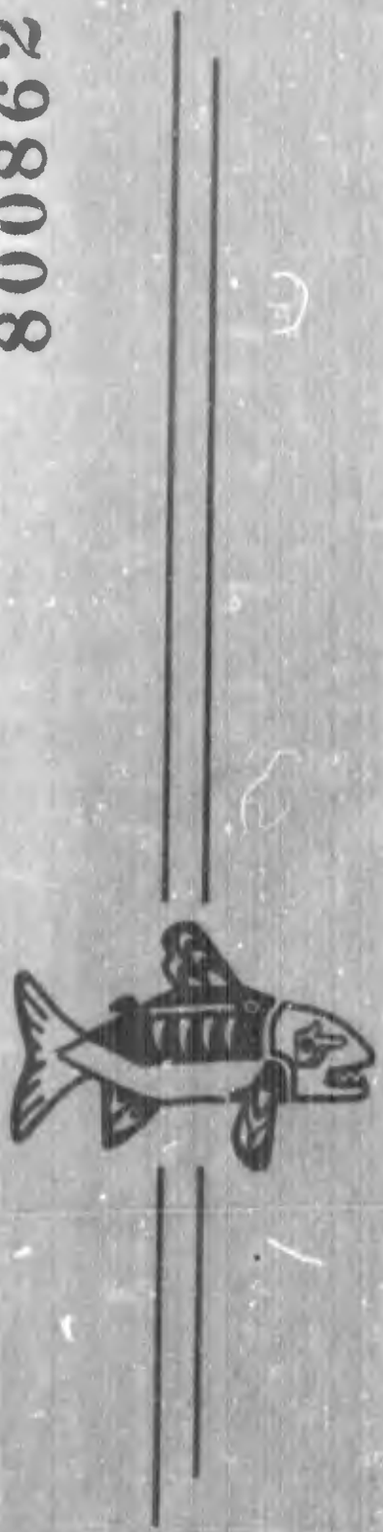
by

Jan J. Solecki



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ECONOMIC ASPECTS OF THE FISHING INDUSTRY IN MAINLAND CHINA

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PREFACE

The recent expansion of mainland China's fisheries to the point where she may be the second or third greatest producer in the world has naturally aroused a great deal of interest. Unfortunately, there are very few data documenting this phenomenal expansion. The literature on mainland China's fisheries is widely scattered. Consequently, when Mr. Solecki of the Faculty of Asian Studies approached me with the suggestion that he review the state of Chinese fisheries, I was pleased to support his efforts. Solecki's report summarizes the scattered literature and reviews the history of the freshwater and marine fisheries of mainland China and places into perspective the social and economic features affecting this resource. Not of inconsiderable importance is his estimates on contemporary production which are based upon a number of cross-checked sources.

It is a pleasure to acknowledge the Biological Sciences Division of the Office of Naval Research, U. S. Navy, for their support toward the completion of this project.

Norman J. Wilimovsky
Institute of Fisheries
The University of British Columbia

ABSTRACT

This study of the fishing industry in China resulted from a survey of the available information published by Chinese, Russian and western sources on the fisheries of China. The report covers mainly the period from 1949 to the present, with a brief survey of the developments prior to that date. The post-1949 period is treated in two ways; first, in relation to the overall national economic development, and second from the point of view of the development of various branches of the fishing industry in the country. The freshwater fishery is based on natural stocks as wellas on fishes cultured in ponds and paddy fields. The marine fishery consists of deep-sea fishing (carried out by governmet vessels with modern equipment), coastal fishing (done mainly with junks), and the culture of kelp and other organisms.

The fishing industry is considered from an economic point of view as a means of satisfying the rapidly growing demand for food. Social, political and economic measures were taken by the government to ensure the growth of the productive capacity of the industry and the preservation of the natural resources of the country. In order to estimate the output of the fishing industry in China, statistical data were examined and on the basis of these a projection was made for the period since 1959 (as well as from 1957). Using various methods it appeared that the current output of aquatic products in China is between five and seven million tons. It seems that China will not be able to concentrate sufficient trained manpower to resolve some of the most urgent fishery problems, and that research centres should be created outside of China. It is suggested that Chinese students be brought to North America for academic and technical training.

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ACKNOWLEDGEMENTS

The author wishes to express his thanks to Dr. Norman J. Wilimovsky, Director of the Institute of Fisheries of the University of British Columbia, for his encouragement and personal interest in this research project as well as for reading and editing the manuscript. Without his assistance, the research would never have been undertaken. It is to be stressed however, that the author is wholly responsible for the selection of the material included, and for any errors and or omissions.

Though many people were involved in typing the many drafts, special thanks are due to Gail A. Sandercock for her assistance in editing, organizing and typing.

Finally, the author wishes to acknowledge a very deep debt and sincere thanks to his wife who bore patiently with his visits to libraries and universities and who has read and helped organize the manuscript into readable form.

Jan J. Solecki

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Department of Asian Studies

and

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INTRODUCTION

Between 1949 and 1965 the population of China increased by over 200 million. The reasons for this population explosion, as well as the dangers that it generates for the future peace of mankind, have been discussed often. However, very little has been said to explain how the Chinese Communist Government and administrative system dealt with the enormous task of feeding this growing population.

This report is intended to provide an outline of the efforts made in one particular industry - fisheries. It must, however, be seen against the broader scope of overall national economic development. The ten-fold growth in the output of the fishing industry during the past fifteen years has been in response to an urgent demand for food, since the level of food supply has sometimes fallen below the subsistance requirement. In spite of enormous efforts the problem of food supply has not been solved. Over the last four to five years China has been forced to import increasingly larger quantities of grain in spite of good harvests at home. Although China has been expanding as fast as possible, it is falling behind - not only in comparison to other more industrialized countries, but also in terms of its own needs.

It is essential for China to continue to increase its food production at a greater rate than before. Undoubtedly this will also be reflected in its efforts in the fishing industry. It is very likely that during the next fifteen years China will make every effor to acquire equipment that would allow fishing wherever food is to be found, and not only close to home ports. This will undoubtedly conflict with the interests of the fishing industries in other countries. In order to avoid difficulties in the future, the governments and industries concerned should immediately begin to study the development of the fishing industry in China, firstly, to prepare public opinion at home for

the coming Chinese expansion, and secondly, to try to work out with the Chinese the best ways of supplying this urgently needed food, while at the same time conserving the natural resources of the world's seas.

HISTORY OF THE CHINESE FISHERIES

Historical Survey of the Chinese Fisheries up to 1949

Contrary to implications contained in publications of the present day government of mainland China, the fishing industry played an important part in the economic life of the country long before the present regime came into power. The importance of the fishing industry had already been recognized in the 12th century B. C., when Chiang Tsu-ya developed fishing and salt industries during the reign of Wen Wang. The first pisciculturist is believed to have been Tao Chu-kung, who lived in the fifth century B. C. (Yen 1910). Fish culture in paddy fields dates back to the third century A. D.. The fishing laws in old China were very strict and the fishing industry enjoyed protection. Even in the earliest days there were restrictions on fishing at spawning time (Radcliff 1921).

Writing in the early 1880's, J. Duncan Campbell stated: "No country shows the commercial value of fish in a stronger light than China. As an almost universal, or at any rate as a widely distributed article of food, fish is a more important staple in China than in any other country. The whole country displays an extraordinary development of industry and commerce in marine and freshwater fish. The latter is cultivated in rivers, lakes and ponds, and made use of as a common article of food throughout the empire. Fishes of a kind which in Europe are scarcely deemed worthy to be caught, and then for sport rather than food, are in China utilized and form the subject of an extensive commerce as the staple food of the large section of the inhabitants. Even the repulsive and hostile shark of the western nations becomes an article of commercial value in China and is habitually treated as

an article of food for the millions without dismay by the ancient oriental wisdom" (Campbell 1883). A native of China wrote in 1908: "Traditionally Chinese people preferred soft fine-flesh fish of freshwaters and spurned the sea fish. Salmon does not appeal to them ... on the other hand they like fins of the shark, beche-de-mer, cuttlefish, jelly-fish, and the awabe" (Yen 1910).

With the decline of the last imperial dynasty there was a deterioration in the administrative apparatus which hindered the growth of enterprises and particularly the accumulation of capital. The situation became worse with the forceful penetration of China's coast by Europeans, whose presence undermined the authority of the existing system and added to the general confusion. There was no introduction of foreign technology, mainly due to lack of recognition of its importance by the Chinese.

It is true that during the last few years of its rule the imperial government tried to do something to modernize the fishing industry, but this was late and inadequate. During the first decade of this century a Bureau of Fisheries, modelled after the west, with headquarters in Shanghai, and branches in Mukden, Tientsin, Chefoo, Canton and Foochow was established. Ice-storage plants were built for keeping fish and western-type fishing craft were purchased, but they were said to have been unprofitable because of the Chinese dislike for marine fish (Yen 1910). At the same time the erection of of navigation lights, buoys, beacons and light-houses by the Inspector General of Customs made for safer navigation along the coast, and benefited the fishing population as well (Campbell 1883). Still these measures were late and had little influence on the industry as a whole because of subsequent disruptions.

The fishing industry in China continued to be antiquated, using

sailing junks which could handle only a limited range of equipment, were dependent on vagaries of weather to a much greater extent than modern fishing vessels, and which operated mainly in the coastal waters. Inland fishing was in an equally bad state, while fish culture, although widespread was based on traditional methods, unmindful of the developments in artificial propogation.

With the fall of the dynasty, the situation became still worse. The parcelling up of China by war lords, the struggle between the Kuomintang and the Communists, the struggle against Japan, and the final civil war, all contributed to a waste of capital resources which could have been used for economic development. Fishing craft, being means of transport, were sought by all the warring parties and arbitrarily requisitioned or destroyed (to prevent their being used by the enemy). In addition there are reasons to believe that during their invasion of China the Japanese deliberately acted to cripple the competitive capacity of the Chinese fishing industry. These circumstances left China without a modern fishing fleet, processing plants, or the transportation needed for moving and distributing a highly perishable commodity. Because of the lack of a centralized administration and funds, there was also lack of research and training facilities.

Another restrictive force to modernization of the fishing industry was the social structure in pre-1949 China. "Fishermen were classless. Socially ostracized to a certain extent they clung more and more to themselves, forming colonies of their own along the coast on isolated and rocky islands. They lived in a world of their own, knowing nothing of the affairs of their country and caring less" Yen (1910) stated : "To this day they do not come into direct contact with

their countrymen on the mainland or in the interior, disposing of their catches to fishmongers, who go out to them during the fishing season with silver or with the necessities of life in exchange for their fish" (Yen 1910).

Heavy and indiscriminate taxation necessitated by the foreign and domestic wars, as well as various other levies, created in China an atmosphere of insecurity for investments, especially in traditionally taxed items such as fishing craft, fishing gear, fish culture ponds and fish-processing enterprises.

There were also other causes of backwardness in the industry. Over-population tended to hinder any individual accumulation of capital by reducing profits. Lack of capital to finance processes for preserving fish catches from periods of overabundance to periods of scarcity led to price fluctuations. The industry became less attractive for investments, and this led to the non-utilization of by-products which could be used to produce oil, fertilizers and other marketable commodities. The traditional predilection for fish culture in inland waters tended to discourage investments in marine fishing, and in parcticular, deep-sea fishing. Because of the general backwardness of the country the fishing industry did not enjoy benefits such as available transportation, communications, skilled manpower and shipbuilding.

Finally, the absence of a steady, centralized government which would be aware of the importance of research and capable of providing the necessary facilities also militated against the development of the industry.

Because of the circumstances described above the Chinese Communist Government inherited in 1949 a fishing industry that was at a very low ebb. Present day Chinese economists are quite right in stating that at the time

of the formation of the Chinese People's Republic the fishing industry in China was far behind the more industrialized fishing nations. The unutilized inland and marine resources offered the new centralized government opportunities for development. A new readiness to accept modern technology favoured rapid development, as well as construction of the domestic iron and machine-building industry, modernization of transport, availability of a ready market due to a growing population, and the need for increasing food production. Whether the growth has been as rapid as could be expected is discussed under "Production".

Period of Fisheries Development after 1949

As in other branches of the economy, the fishing industry underwent sweeping organisational changes after the Chinese Communist Government came to power in 1949 (Table 1).

I. 1949-1952 Period of Economic Reconstruction and Rehabilitation

In keeping with the general policy during the first two to three years the government not only was prepared to tolerate privately owned and operated fishing vessels, but was even prepared to extend credit for their operations and repairs (Anon. 1951c). However, as early as the first half of 1951 the Minister of Agriculture who had jurisdiction over the fishing industry, urged various government and other fishery agencies to organize fishermen's mutual aid teams such as were being formed in agriculture (Anon. 1951a). Thus the period from 1949 to 1952 was one of reconstruction and the formation of mutual aid teams.

During this period government participation in the industry grew

rapidly. Already at the beginning of 1951 the government handled the bulk of purchasing and shipping to markets and in this way controlled prices (SCMP 105)*. To foster growth in the domestic fish industry and to save foreign exchange, imports of fish products were prohibited and the tax on fish fry for culture was abolished (SCMP 130). In June 1951 a State-operated Marine Products Company was inaugurated in Tientsin. This enterprise extended its activity over marketing, processing, ice-making, cold storage, fishing boat and equipment building and repairing, as well as the culture and catching of fish (SCMP 202).

At the Second All China Marine Products Conference held on January 30, 1951, goals were set for the fishing industry. These were to restore the industry sufficiently to reach an output of 1,500,000 tons, the highest ever attained in the pre-war years, within two years (Anon. 1951b). For 1951 the Ministry of Agriculture and the People's Bank of China granted the fishing industry a loan of approximately three million dollars (U. S. equivalent), which was to be used for the following purposes:

(a) to organize fishermen and those engaged in rearing fry and pond fish;

(b) to help fishermen to repair their old craft and gear and to purchase new equipment;

(c) to subsidize state-operated Marine Products Companies, Marine Products Transportation Companies and Marine Products Marketing Companies;

*SCMP = Survey of China Mainland Press Publications, U. S. American Consulate General, Hong Kong. Listed numerically under Literature Cited.

Table 1. Periods of Fisheries Development in China after 1949.

YEARS	
1949 - 1952	I. Period of Economic Reconstruction and Rehabilitation
1953 - mid-1957	II. First Five Year Plan
mid-1957 - 1958-(1st quarter)	III. Period of Indecision
(1st quarter)-1958 - 1959 and 1960	IV. The Great Leap Forward
1960 - Present Day	V. "Post" Great Leap Forward (Period of Recovery from Natural Calamities and from Organizational Chaos brought about by Great Leap Forward)

(d) to assist merchants and dealers engaged in processing, marketing and transporting aquatic products;

(e) to finance operations of privately owned fishing vessels.

The recovery period targets were in fact achieved. In 1952 production exceeded 1.5 million tons (JPRS 3214)*.

II. 1953 - mid-1957 The First Five Year Plan

The modernization of the fishing industry began in earnest during the First Five Year Plan. During this period the fishing industry was reorganized into fishermen's cooperatives and state Fishing Enterprises. The industry was administered by five Central Administrative Offices at Luta**, Yen-t'ai (or Chefoo), Tsingtao, Shanghai and Nanhai, and twenty local government administration centres.

Over the years of the five year plan the output of the fishing industry continued to expand, reaching three million tons in 1957. The annual increase of this five year period was 13.3 percent or 290,000 tons, compared with 3.0 percent or 150,000 for Japan, 2.8 percent or 70,000 tons for the United States, and an actual decrease in England (JPRS 3214).

The rapid growth in output of the fishing industry during 1954, 1955 and the beginning of 1956, attained through exertion of more and more pressure on the now collectivized industry, ran into difficulties by the middle of 1956. The hoped for output for 1956 was somewhat less than planned, but was almost at the level of the target for the last year of the Five Year Plan

*JPRS = Joint Publications Research Service, U. S. Dept. Commerce, Office Tech. Serv.. Listed numerically under Literature Cited.

**Note : The name Luta (modern Chinese) = Lushan + Talien (Old Chinese names): Lushan = Port Arthur (Russian) : Talien = Dairen (Japanese) = Dal'nii (Russian).

(Chiang 1956).

The first two years of the First Five Year Plan saw the emergence of cooperatives. In the fall of 1955 the cooperatives were consolidated and control over them tightened. Members of the cooperatives had to accept the collective responsibility system of the three guarantees: "guaranteed output, guaranteed storage, guaranteed attention to repair of vessels". At the same time to increase landings the cooperatives were encouraged to diversify their activity both in terms of equipment and methods used and in terms of areas fished, the latter depending on weather conditions (SCMP 1135).

One of the periodic changes at the organizational level occurred during this period. In the fall of 1955, fish processing and transportation of aquatic products was subordinated to the Ministry of Commerce, and the Aquatic Products Administration Bureaus were transferred from the Ministry of Agriculture to the Ministry of Commerce (SCMP 1177). Another change took place the following year when a Ministry of Aquatic Industry was formed to handle marketing.

In autumn 1956, the First Representative Conference of Fishermen of Kwangtung Province was convened; and this conference pointed out some of the weaknesses of the industry. First of all it was shown that the past preoccupation with the growth of deep-sea fishing had led to neglect of the construction of small sized craft. The conference then recommended halting the expansion of the cooperative movement and increasing the amount of loans for fishing craft and gear for shallow waters (SCMP 1388).

In October the newspaper the Jen Min Jih Pao echoed the Kwangtung

resolution (SCMP 1398). Pointing out that the masses accounted for 90 percent of fisheries production, the paper acknowledged that in the past the government sector had been unduly favoured and that of the masses neglected. It also described as unjust taxation by which "some fishermen were taxed five times". The paper publicised some of the malpractices of the fishing industry, such as the use of poison, explosives, depletion of spawning stocks, and insufficient attention paid to fish culture. The paper called on party organizations to give leadership to the masses. They were to see that joint fishing and farming cooperatives received funds for construction of boats and purchase of gear. The government was enjoined to provide funds in the form of loans.

In November 1956 the government admitted that many people were transferring out of the fishing industry into agriculture. Earlier in the year on instructions from the party many cooperatives which had engaged in both agriculture and fishing handed their land to neighbouring cooperatives and specialized in fishing. However, with a decline in fish prices and a consequent decline in income, members of fishing cooperatives transferred to agriculture cooperatives. Then the Marine Production Bureaus stressed that multispecialization was desirable (SCMP 1423).

A series of concessions to the fishery cooperatives was started late in the summer of 1956, and continued until the beginning of the "Great Leap Forward" in 1958. Their purpose was to mitigate some of the abuses that had developed in the course of two rapid years of reorganization.

The Fifth Working Conference on Fisheries held earlier in Kwangtung, between June 2 and 9, 1956, declared that "it is wrong to overlook the

improvement of material livelihood for cooperative members and blindly expand the communal accumulation of the cooperatives (Anon. 1956a). The conference stated that "to guarantee that 90 percent of the cooperative members increase their income is the main objective of the present readjustment work of fishery producers' cooperatives ... The total income including food expenses, of the members of cooperatives for large deep-water fishing trawlers shall not be less than 45 percent of the total value of output; for small shallow-water boats not less than 60 percent; of middle-size fishing boats not less than 50 percent" (Anon. 1956a). Income deductions to reserves and welfare funds were to be limited to 7-10 percent of the value of the output, and the share paid by each member was not to exceed 10 percent of his annual income. It was also decided that the past owners of boats should not be burdened with the share of current repair costs to the boats they once owned, and that members of cooperatives should not have to cover the depreciation and repair charges on fishing craft and gear (Anon. 1956a).

III. mid-1957 - 1958 (1st quarter) Period of Indecision

The time between the termination of the drive to attain a spectacular conclusion to the First Five Year Plan and the beginning of the "Great Leap Forward" can be considered the third period in the development of the fishing industry. Half-way throught the First Five Year Plan, ruthless policies pursued in the course of forming cooperatives resulted in considerable pressures. Lack of progress in industry during 1956 attributed to administrative chaos, lack of raw materials and overproduction in heavy industry.

In agriculture the response to the pressures of 1955 and 1956 was general apathy and in some cases even sabotage. Partly in response to the events taking place at the time in Eastern Europe, and partly from the necessity to stop and readjust the disproportions in the economic development, the government decided on certain measures of economy.

Two things should be noted about this period. First, it appeared that the government was prepared to consider economy measures as being either desirable or necessary; second, that the Second Five Year Plan, prepared during this period showed signs of moderation, with targets providing for a rate of growth not much different from those attained during the First Five Year Plan. These were quite unlike the targets outlined later within the programme of the "Great Leap Forward".

It is not possible to include in this paper a thorough discussion of the events that may have led to the change in attitude leading to the "Great Leap Forward". It is suggested that it may have been brought about by the fact that Mao Tse-tung had failed to secure financial backing for the Second Five Year Plan during his visit to Russia, and as a consequence decided to effect an "economic break-through" by means of unprecedented mobilization of the abundant factor of production, labour. That the Russians were not prepared to finance China's industrialization can be seen from the fact that the agreement signed by Mikoyan during his visit to Peking in 1956, providing for the supply of machinery and equipment for the Second Five Year Plan, stipulated that China was to pay for the deliveries within the same period (Solecki 1964).

IV. 1958(2nd quarter) - 1959 and 1960 The Great Leap Forward

The year 1958 saw the emergence of the "Great Leap Forward" and the formation of the communes. The main characteristics of the Great Leap Forward were the proposed and claimed very rapid expansion in fishing and fish culture and output of other aquatic products. Organizationally changes occurred not only on the production side, where the fishing units were increased by the amalgamation of cooperatives into communes, but also on the processing side, which in the long long run probably was more important. Plants for processing fish and other products were organized in communes. For example, in Chekiang thirty-nine communes were said to have established 186 such plants (SCMP 1923). It is very likely that many of these plants serving commune needs survived subsequent reorganizations and difficulties, and became part of the food industry of the country.

During the Great Leap Forward the area for freshwater fish culture was to have been expanded from 1.05 million ha. to 2.33 million ha., and for marine culture from 60,000 ha. to 130,000 ha. (JPRS 12253). There was a rapid increase in targets set before the industry. For example, in February 1958 (SCMP 1711), the plan for 1958 landings in Kwangtung provided for a 17 percent increase over 1957, but in March the figure was raised to 37.3 percent (SCMP 1741).

There was a tremendous pressure to produce more. In spring 1958 the fishermen of Liaotung peninsula went out 15-30 days earlier than usual to increase landings by 60 percent over 1957. Stress was laid on mobilization and training of manpower to increase productivity. For example, in Chekiang, over fifty"fishery schools" were set up in cooperatives to bring"modern

scientific information about the sea and its products to the fishermen (SCMP 1773a).

The power capacity of fishing vessels was to be increased by several million horse-power within five years. Hundreds of medium and small fishing ports and processing plants were to be built to establish a mechanized fisheries and a modern processing industry (SCMP 1805).

In the fall of 1958 it was actually claimed that the area for freshwater and marine fish culture would reach 2.3 million ha. by the end of the year, and the output of the fishing industry would be brought to 8.2 million tons, or 2½ to 3 times the level of the previous year (SCMP 1871). However the estimates of actual output varied from a claimed 8 million tons to 4 million tons (see Production).

Under relentless pressure for greater output in the winter of 1958-1959, the fishermen continued to operate without respite in the northern part of the Yellow Sea, in the East China Sea, off the Choushan Islands, and along the Chekiang coast. It was also reported that one whaling boat went out in mid-winter (SCMP 1942).

The National Aquatic Products Conference, held in January 1959, was an important point in the history of the development of the fishing industry in China, for it appears to have put a restraint upon the galloping enthusiasm of the previous autumn. The official report for the 1958 output was restated as being twice that of 1957, and the expected output for 1959 was simply stated to be "bigger than 1958". It was pointed out that the output from fish culture increased from 22 percent of the total in 1957 to 44 percent in 1958.

The importance attached by the government to the fishing industry can be judged by the fact that in spring 1959 the State Council instructed the Deputy Governors of the provinces to personally organize provision of requirements for the fishing industry, including men, ships, lumber, fuel oil, tung oil and other supplies. They were instructed to organize the necessary transport to ensure the distribution of fish; what could not be transported was to be processed on the spot (SCMP 1998a).

By May 1959 the impetus of the Great Leap Forward was slowed down and enthusiasm cooled. The official announcement was made that "the output of China's aquatic products last year amounted to six million tons, nearly double the 1957 figure" (SCMP 2026). The claim of 8.2 million tons was quietly forgotten.

The Conference of the Honan Provincial Committee held in mid-July 1959 constituted another turning point so far as the fishing industry was concerned. It advocated close coordination between multiple-purpose undertakings and agricultural communes to ensure that labour was available for all areas of activity (SCMP 2065).

The dismantling of past claims continued into 1960. The output for 1959 was then given as 5 million tons of aquatic products, more than three times the output of the peak year before 1949 (SCMP 2201). However, an attempt was made to maintain the facade about the Great Leap Forward at the same time. The average increase given for 1957 and 1958 was 26.9 percent, with 90 percent of landings made by communes (SCMP 2201). The area suitable for fish cultivation was given as 8.7 million hectares. The same report stated that China had 3,000 "scientific workers" engaged in the fishing industry

compared with 300 before 1949.

This moderation in respect to claims of high achievements did not at all signify that the government or the party held the fishing industry to be of less importance. In spring 1960 the Central Committee of the Chinese Communist Part and the State Council of Fishing once again issued instructions that the Party Committees were to take a special interest in preparations for the spring fishing season and make sure that labour, craft, gear and supplies were available (SCMP 2201). The Party Committees were to ensure unified command for all fishery operations and adequate communications between vessels. The Committees' attention was also drawn to inland fisheries and the need to reinforce marketing, purchasing, processing and storage facilities for the catches (SCMP 2215).

V. 1960 - Present Day Post Great Leap Forward

The Great Leap Forward has never been disavowed in China, and it is difficult therefore to speak of the Post Great Leap Forward period. For convenience however, it is better to consider 1958 and the first half of 1959 as the time when a deliberate effort was made to storm economic difficulties by means of enthusiasm as expressed in the slogan "The Great Leap Forward". Since the initiative, the spirit and the slogans of the movement came from the Party, it was not possible to abandon it, nor was it possible to continue with it. As a result the name of the Great Leap Forward was retained, and some of the framework of organizational changes, but the operative structure after 1960 returned to a considerable degree to its pre-1958 form.

One of the features of the Great Leap Forward was to create large

units, the communes, to reap the advantages of large scale operations. It was soon found that this led to the elimination of attributable responsibility and thus a drop in efficiency. Another target was to eliminate differential remuneration for work and by introducing egalitarianism at a lower level of consumption to provide savings for capital investments. This too proved impossible; with egalitarianism* there was also loss of incentive for efficient performance. Finally, a great increase in production was to have resulted from the harnessing of the abundant labour-force. But the demands on other factors of production, such as transport, raw material inputs, and energy resources necessary to make use of labour were found to result in great expenditures, which outweighed any economies arising from mass use of labour. This was particularly so because of the dogmatic choice of industries in which the mobilization of labour was carried out, viz: heavy industry.

With the gradual retreat from the policies of the Great Leap Forward more provisions were made for incentives to produce. The inland waters were now often allocated to communes, within which they were to be used by brigades and teams in accordance with the principle "whoever plants shall take care of the fertilizer and reap the benefit" (SCMP 2585a). In view of the difficult food situation, food growing was to be put ahead of cash crops, fuel or commodities for daily use (i.e. the order or priority should be food, fuel, fertilizers, tools) (SCMP 2691).

In the face of continuing food shortages in 1960 the government called for greater efforts from the fishing industry. Fishing teams were sent out earlier (in Tientsin fishing teams started out earlier by breaking

* egalitarianism = a social system envisaging equal consumption by persons of all classes.

ice) and stayed longer. Normal purchasing organizations were supplemented with mobile purchasing teams (JPRS 6781).

One of the characteristics of the commune organization has been a return to specialization in production, and just as in the days of cooperatives, this led to a decline in the fishermen's incomes and an exodus from fishing communes and brigades. To stop this trend it was advocated once again that diversification of production would be aimed at in the communes and even in the brigades (JPRS 11957a).

The end of the years of natural calamities in agriculture did not automatically bring the solution to the food problems facing the Chinese government, and as a result their interest in the fishing industry remained keen. The Party continued to stress the importance of fish as a raw material for the export industry and also as food for domestic needs. It called upon prty officials to look into the fishing industry problems personally (JPRS 19116).

Present Fisheries Organization

The State controlled Fishery Corporation was first established in 1950 when its output was 34,000 tons, or approximately four percent of the total output. Over the years both the absolute volume and the share the state enterprises contribute to the total output have gradually increased (Table 2).

The role of the state enterprises has changed gradually so that today they are primarily engaged in deep sea fishing, leaving coastal areas to the communes. They also act as centres for industrial research and as innovators of new techniques in fishing, fish culture and processing. In

mid-1955 State enterprises accounted for 80 percent of deep sea landings (SCMP 1148). In more recent years their contribution amounted to about 10 percent of the total output of the fishing industry, while communes accounted for 90 percent. To help to increase the output of the latter, efforts are being made to modernize coastal fishing by equiping sail boats with engines and modern communication and fishing aids. Although there were only 3,000 motorized sail boats in the fishing industry in 1959 it was planned to increase the number to 15,000 "in the near future" (Saburenkov 1961).

Some of the communes have all of their members engaged in the fishing industry, others have only part of their membership engaged in fishing, organized into brigades equivalent to the old-time cooperatives. In the latter case the fixed equipment belongs to the commune while mobile equipment is the property of the brigade.

The fishing population in China is organized into approximately 200,000 fishermen's communities, in which the number of professional fishermen is estimated to be approximately one to one and a half million (JPRS 9817b), while the number of people employed in the fishing industry altogether was estimated at four and a half million (Saburenkov 1961).

In recent years the fishing industry has been subdivided into centres of national, provincial and local importance, the last category numbering two or three to a "hsien" (a group of villages). To qualify as one of national importance the centre must have a good harbour, a catch of 50,000 to 60,000 tons per year, a cold storage and ice plant, a processing plant, ship-building and repair facilities, a fish net factory and a

Table 2. Output of the State controlled fishing enterprises (JPRS 12253).

YEAR	VOLUME (in thousand tons)	PERCENT OF TOTAL
1950	34,700	3.7
1951	60,600	4.0
1952	87,833	5.0
1953	118,660	5.9
1954	149,040	6.4
1955	162,500	7.2
1956	230,000	8.9
1957	252,900	9.0
1958	400,000	10,0
1959	500,000	10.0

training school. First class inland fisheries centres must in addition have hatcheries and research facilities.

The first class marine centres of national importance are as follows: Yen-t'ai, Choushan, Lien-yun-chiang, Shanghai and Wenchow; and the first class inland centres: Hungtze and Pai-ma-chiang. The Hungtze Lake Aquatic Products Corporation was established in 1958. It has ship-building facilities, a fish oil plant, an ice plant (capacity 2,500 tons of ice per year), a fish meal plant, a fish net factory, a pond culture farm of 9,000 ha. (150,000 mow) and a fish hatchery of 36 ha. (600 mcw) (JPRS 12253).

There are eight second class centres. As an example of this group can be given Kiu-kiang in Kiangsi. It has a ship-repair dock, an ice plant, fish processing plant and a training school. A large fish culture farm has been built on the Ch'ih Lake (Red Lake).

The third class centres are generally established in communes. They handle the distribution of fry, purchasing, processing and transportation of the catch. They have fish net factories, ship-repair facilities, processing plants and sometimes they run training courses.

Administratively the industry is divided into Fishing Industry Departmentsand Bureaus which were formed together with the Ministry of Aquatic Products in 1956. Fisheries Departments exist in the provinces of Shantung, Chekiang, Fukien, Kwangtung, Hupeh, Hunan, Kiangsi, Chinghai and in Shanghai City. They are subordinate to the Provincial People's Councils. Fisheries Bureaus subordinated either to the Provincial People's Council or to Agricultural Bureaus have been set up in the provinces of Liaoning, Kiangsu, Szechuan and Hupeh (JPRS 12253, JPRS 9817b). These government

agencies prepare basic plans for production and construction, supply goods needed by the fishing industry and handle distribution. They also decide on the proportion of income to be either consumed or saved within the communes (Saburenkov 1961).

Position of the Fishing Industry in the National Economy

"Plus un pays produit des poissons, plus il produit d'hommes" (de Thiersant 1872). During the last few centuries China appears to have belied the hypothesis of de Thiersant by first producing people, and then expanding the fishing industry. Between 1949 and the present day the population of mainland China is estimated to have increased by approximately 214 million, that is roughly equivalent to the population of the Soviet Union. The immensity of the problem of feeding this increased population can be seen from the fact that China has only one-seventh of a hectare of land under cultivation per individual of the population, whereas Canada has approximately two hectares, and the United States and the Soviet Union have one hectare. Out of this meagre endowment of land, Chinese agriculture has had to provide, in addition to food for the population, raw materials (for the rapidly growing industry at home), and export commodities (to pay for imports of machinery and equipment, oil products and other goods from the Soviet Union and other countries).

The doctrinaire Marxian approach by Chinese Communist authorities to the problems of economic development resulted in the neglect of agricultural investments. Impromptu measures to break through the bonds of backwardness, epitomized in the Great Leap Forward, resulted in chaos in all branches of the economy including agriculture. The post Great Leap Forward years have

brought about a certain improvement in agriculture, but not sufficient to provide the necessary quantities of food, as is witnessed by the imports of foodstuffs from abroad.

Although there are no spare reserves of readily usable land an increase in quantity of food can be obtained by increasing the yield of land presently cultivated through use of fertilizers, better seeds, and more efficient scientific methods of cultivation. Food supplies can also be increased through bringing marginal lands under cultivation by means of capital investments in irrigation and land melioration. More food obtained from imports must be paid for with goods that can be marketed abroad. In view of the low level of industrial development and the growing demand generated by an increasing population, marshalling export commodities is by no means easy.

At present the solution to the food problem is being sought through a combination of the above courses, that is, by increasing the yield, by increasing the area under cultivation, and by promoting the manufacture of goods for export.

Developments in the fishing industry in China should be considered against the broader economic considerations outlined above, as an additional method of providing food. The rapid growth of the fishing industry is proof that the authorities in mainland China believe that investments in this industry are likely to be more rewarding or at least as rewarding as those placed in other fields of the economy.

THE FRESHWATER FISHERIES

Freshwater Fish Resources

In China the freshwater fishing industry occupies a very important place in the total fishery output. In 1953 an estimate of inland landings was given as 1½ million tons (SCMP 522). In 1955 45.6% of all fish taken were from freshwater (JPRS 12253). The total area of freshwater in China (excluding paddy fields) has been estimated at 20 million ha. (Saburenkov 1961, JPRS 11475), of which one third could be used for fish culture (SCMP 1815a). The 20 million ha. include 1,600 rivers, 70-80 lakes with areas from 0.6 to 14,000 ha.. In another report the area of rivers and lakes was estimated at 18 million ha. (300 million mow), giving an expected yield of 1.5 million tons of fish. In addition it was estimated another 1.5 million tons of fish could be produced in paddy fields, covering an area of 18 to 24 million ha. (300 to 400 million mow) (Anon. 1956c). In addition there were another 80 reservoirs under construction or planned in 1961 with areas from one to 230,000 ha. (Denisov 1961, JPRS 11957b). In 1963 the inland water area was estimated between 12 to 18 million hectares (200 to 300 million mow) (SCMP 2959).

Rivers over 2,000 km. long are the Yangtze, the Hwang Ho, the Pearl, and the Amur. In China there are 500 rivers with basins in excess of 100 square kilometers (JPRS 9817a). In the freshwater areas of China there are over 500 species of fish, of which thirty to forty are of commercial importance (Table 3). All inland water resources in China are the property of the government which took possession of them at the time of the agricultural reforms of 1950-1952 (JPRS 9817a). Important freshwater fishery

Table 3. List of names of the more important freshwater fish of China.

CHINESE	ENGLISH	SCIENTIFIC NAME	RUSSIAN
	Amur sturgeon	Acipenser schrencki Brandt	"Amurskii osetr"
	-	Huso dauricus (Georgi)	"Kaluga"
	Taimen	Hucho taimen (Pallas)	"Taimen"
鮭	Humpback salmon	Oncorhynchus keta (Walbaum)	"Keta"
	Rainbow trout	Salmo gairdneri Richardson	-
	-	Coregonus muksun (Pallas)	"Muksun"
	Amur whitefish	Coregonus ussuriensis Berg	"Amurskii sig"
	Bleak	Alburnus alburnus (Linnaeus)	"Ukleika"
	Big head	Aristichthys nobilis (Richardson)	-
	Aral barbel	Barbus brachycephalus Kessler	"Sugön"
鯽	Goldfish	Carassius auratus (Linnaeus)	"Karas"
	Cruscian	Carassius carassius (Linnaeus)	"Karas"
	Mud carp	Cirrhinus chinensis Gunther	-
草魚	Grass carp	Ctenopharyngodon idellus (Cuvier & Valenciennes)	"Amur"
鯉	Carp	Cyprinus carpio haematopterus Martens	"Sazan"

Table 3. continued.

CHINESE	ENGLISH	SCIENTIFIC NAME	RUSSIAN
	Culter	Erythroculter erythropterus (Basilewski)	"Verkhoglyad"
	Red fin	Erythroculter mongolicus (Basilewski)	"Krasnoper"
	Sharp-belly	Hemiculter leucisculus (Basilewski)	"Vostrobryushka"
	Silver carp	Hypophthalmichthys molitrix (Cuvier & Valenciennes)	-
	Chinese ide	Leuciscus brandti Dybowski	"Krasnoperka'"
	Amur ide	Leuciscus waleckii (Dybowski)	"Amurskii yaz' "
	Black carp Snail carp	Mylopharyngodon piceus (Richardson)	"Kitaiskaya plotva"
	White Amur bream	Parabramis pekinensis (Basilewski)	"Belyi Amuskii leshch"
	Tench	Tinca tinca (Linnaeus)	"Ukleika"
	Weatherfishes	Misgurnus spp.	"V'yun"
鮎魚	Amur catfish	Parasilurus asotus Linnaeus	"Amurskii som"
	-	Bagrid catfish family (Bagridae)	"Kosatka"
狗魚	Amur pike	Esox reicherti Dybowski	"Amurskaya schuka"

Table 3. continued.

CHINESE	ENGLISH	SCIENTIFIC NAME	RUSSIAN
	River perch	Perca fluviatilis Linnaeus	"Okun"
	Chinese bass	Siniperca chua-tsi (Basilewski)	"Aukhà"
	Tilapia	Tilapia spp.	-

provinces are indicated in Figure 1.

The Yangtze basin (Figure 2) is the richest area of inland fishing since it incorporates nearly 50 percent of the inland water resources. The Yangtze is linked with the great lakes of Taitungting, Poyang, Hungliantze and others. Within the basin lie the two most productive provinces of Kiangsu and Hupeh. The main species caught are carp, gold fish, mackerel, lien and white fish (JPRS 11957b).

The second most important river is the Pearl, of which Sikiang is the area of primary production. It has about 17 percent of the nation's inland waters and fish species are the same as those of the Yangtze, plus some tropical species (JPRS 11957b). The Hwangho and the Haiho Rivers have water areas similar to the Pearl in size. Carp, gold fish, pien and chueh fish are found. The lakes of Inner Mongolia, Tsinghai and Tibet are Lulan, Talai, Taihui, Wuliangsuhai, Tsinghai and Poszut'eng. The main species caught are gold fish, carp and sturgeon.

Perhaps artificial propogation in inland waters is of even greater significance than fishing. The stocking of lakes and reservoirs with fry is proving effective. Silver carp or amur (Denisov 1961), big head, grass carp and Cirrhinus chinensis (SCMP 2524) are the main species stocked.

Fishing Gear and Craft Used in Inland Waters of China

1.8 million fishermen and 300,000 fishing craft were engaged in inland fishing at the beginning of this decade. The craft were mainly oar and sail propelled with capacities of three to ten tons. Because of inadequate mechanization and primitive methods of fishing, productivity is still low. At present mechanization is being introduced to reduce the extent of manual

Figure 1. Map of important fishery provinces and fishing grounds in China.

Figure 2. Map of freshwater lakes, reservoirs and rivers in the Yangtze Basin.

labour used and to speed up operations.

About 200 types of fishing gear are used in all types of inland waters, consisting of traps, hooks (baited and baitless), shore sweep-nets, deep and purse seines, electro-fishing, stationary traps, the fencing-off type of fishing known as sanch'ang, as well as a number of small gear of local importance.

The equipment and techniques used in lake fishing are more diverse than those used in reservoirs and rivers, but the use of long sweep-nets is common. For example, on Lake Huangjentang a sweep-net 3,300 m. long and weighing 6.5 tons was used. The net was divided into sections 100 meters long, each one pulled independently (Figure 3). On Liangtsehu Lake a sweep-net of 800-1,200 meters was employed (Denisov 1961). On large lakes two, three and even four sweep-nets are used together, sweeping the area enclosed (Figure 4). The sanch'ang method of fishing on lakes consists of fencing off a section of the lake with bamboo screens, and the area is fished out (Denisov 1961).

The characteristic peculiarity of river fishing is that no sweep-nets are used in the south, due to high-velocity currents and the great seasonal variation in water level. The main types of gear used in the south are baitless hooks, stationary nets and cast nets.

A special type of equipment is used on narrow rivers. Across the river a bamboo screen is placed with the sides affixed to a trap. Against the trap a boat is placed equipped with a shaft, with a paddle wheel at one end and a scoup net at the other. The current rotates the wheel which drives the scoup net. The latter takes out fish amassed in the trap and sends them through a chute into a specially prepared pond. This

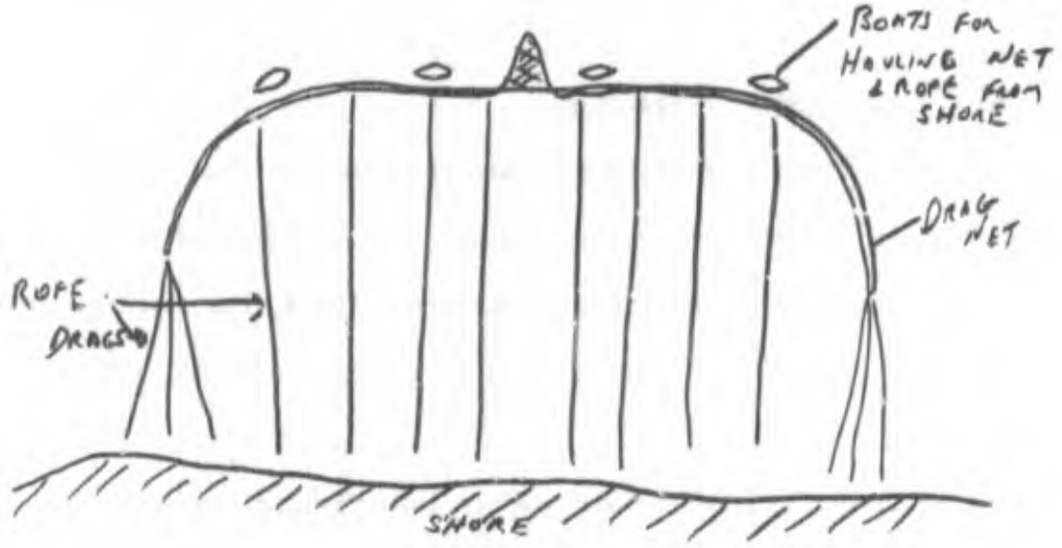

Figure 3. Lake drag-net operated from the shore.

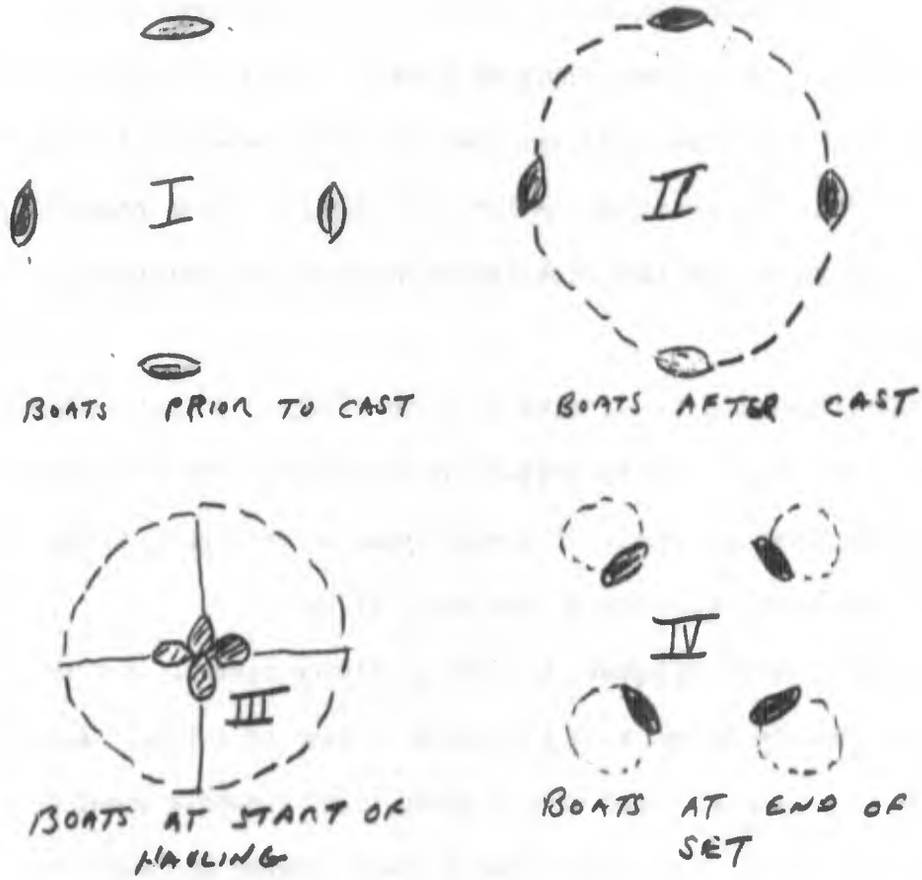

Figure 4. Operation of four drag-nets simultaneously from four boats.

arrangement can be used for fish going up or down river (Denisov 1961). This gear is not unlike the trap used in Alaskan rivers.

Development of Pond Culture in China

The development of fish culture in China is attributed to Tao Chu-kung, who lived during the fifth century B. C.. The methods were elaborated over some time, but remained in essence the same until very recently. The fish eggs of fry were collected and placed in earthenware vessels, in rearing pools or paddy fields. Whymper (1883) stated that "To stock their vivaria the Chinese pisciculturalists do not, as we do, practice artificial fecundation, preferring to collect the already fecundated eggs at spawning time, or to catch young fry just after they are hatched ... The whole of the natural river and lake fisheries belong to the state and the right to collect spawn or fry or fish is farmed to individuals or corporations at a fixed annual rate which is paid either in money or in kind".

The middle and lower reaches of the Yangtze and the Sikiang areas on the Pearl River are said to be the most important natural spawning areas and sources of fish fry for stocking in the world. The Yangtze accounts for 70 percent of the total fry output (JPRS 11957b).

The rearing ponds were traditionally 5-12 feet deep. They had a slight elevation on the north side to prtect them from northern winds. Around the pond various plants were cultivated, including hibiscus (Hibiscus rosa-sinensis), which were supposed to be beneficial fo the fish. In the ponds were placed tortoises, freshwater crustacea and molluscs (Whymper 1883). Pisciculture was confined to freshwater only. The fry was fed

on the ydk of egg, very fine bran, or beans ground to powder. When the fish reached the length of a foot or so they were transferred to a pond where they were fed young grass (Yen 1910). The fish that were reared were herbivorous fish of the carp family which are characterised by their fast growth. They were given the all embracing name of "kia-yu" or family fish, while all other species were referred to as "ye-yu" or wild fish. Being slow growing "ye-yu" were considered unsuitable for pond culture (Whymper 1883).

Prior to 1949 inland waters accounted for 25 to 30 percent of the total fishing industry output, while before 1949 fish culture accounted for less than 10 percent of the total output. Due to investments and technical assistance by the government, coupled with exhortations and material incentives, fish culture increased in importance. This has been particularly true after the introduction of the Great Leap Forward (SCMP 2824). By 1957 the share of fish culture jumped to 31 percent of the total output, by 1959 to 36 percent, and by 1960 to 50 percent (Table 4) (JPRS 9817a). In 1959 the volume of fish rearing was 168.8 percent above the 1957 level, while the catch was only 32.3 percent above 1957 (JPRS 3214).

To increase fish culture production, authorities assisted by establishing fry rearing grounds. One such area was built in the hilly area of Hupeh in spring 1953 to serve local needs (SCMP 573). A further thirty-one rearing grounds were built in other counties. The government initiated research in fish culture, and the Academy of Sciences began parasite research (SCMP 580). Initially the development of fish culture was encouraged along traditional lines. The government did its share by

Table 4. Origin of the inland fish landings (JPRS 9817a).

YEAR	Total Output (in Thousand Tons)	Fishing Output (in Thousand Tons)	% Fishing of Total	Fish Culture Output (in Thousand Tons)	% Culture of Total
1957	1180	810	69.0	370	31.0
1959	2280	1470	64.0	810	36.0
1960	4000	2000	50.0	2000	50.0

financing the construction of facilities and by supplying fish eggs and fry (SCMP 522). For example, in 1955 the government established marine and freshwater institutes to investigate resources, rearing methods and fish diseases. It also established twenty fishery organizations and 85 rearing enterprises in addition to those organized by the local authorities (SCMP 1177). In 1956 the State-owned fisheries were to supply seven billion fry. The government establishments also planned to rear one billion fish. For this purpose new grounds were laid and the old ones expanded (SCMP 1260).

In response to exhortations and pressures the area of waterbodies used for fish rearing grew from year to year. In 1955 the area of freshwater fish culture ponds reached 312,000 ha. (5.2 million mow), in addition to which a certain amount of stocking was done in lakes and reservoirs (Anon. 1956c). By 1957 the freshwater fish culture grounds covered an area of 660,000 ha. or 40 percent more than in 1955 (SCMP 1470). In the fall of 1958, in the Great Leap Forward programme, it was suggested that the area should be expanded to 2,330,000 ha. (SCMP 1858). By mid-1958 reports stated that the area used had reached 2 million ha., double that of 1957, and six times the 1952 level. The figure given for 1958, the entire year, was 2,010,000 ha. (Chang 1959). In 1958 the total area suitable for freshwater fish culture was estimated at 6.67 million ha., all of which it was planned would be used by 1962 (SCMP 1815a). By 1960 the area used for fish culture had grown to 7.8 million ha. (130 million mow) and was continuing to grow.

The pressures for higher output generated by the atmosphere of the

Great Leap Forward led the authorities to advocate the abandonment of the centuries old tradition of rearing only the fast growing "family fish". To quote the official statement: "The first problem is to change people's thinking, that is, to abolish the superstition of relying on "family fish" and follow the principle of breeding whatever kind of fish is locally available (Anon. 1959a).

In 1958, which was a bumper year, a little more than 35 billion fry of the "family fish" were reared in the whole country, representing less than 20 percent of the total amount of fry obtained. There is a very high mortality rate among "family fish" fry in transportation. In 1958, out of 160 million fry purchased by Szechwan Province from Hupeh, only 36 million survived until March 1959. In 1958 the number of carp artificially hatched numbered 140 billion, four times the amount of "family fish" reared (Anon. 1959a).

Perhaps in response to the transportation difficulties ensuing from the dislocation of transport by water, conservation and small scale production campaigns in industry, in 1959 the National Aquatic Products Conference advocated development of fish culture grounds near large cities (SCMP 1946). As a result of government exhortations, by mid-summer 1959, 11,000 hectares of an available 16,000 hectares in the vicinity of Peking were utilized for rearing fish. In the Shanghai area 15,000 out of 226,000 hectares were utilized. The government estimated that 886,000 hectares were available for fish culture around twenty-five major cities of China (SCMP 2039).

The shortage of and high demand for fry also resulted in a search for alternative sources: "Facts have proved that natural spawning places

are not confined to certain sections of the Yangtze River, the Hsiang River (湘江), and the West River (西江), and that, if only penetrating investigations are made, new ones will be found one after another. In Hupeh Province, more than 1,000 million fry were caught last year after discovery of the new spawning place along the Han River (漢江); at the same time, spawning places have also been discovered and fry caught in many sections along the Sungtzu River (松滋). Similar results were obtained along the Huai River (淮江) in Anwei and Kiangsu Province" (Anon. 1959a).

The mortality of fry caught varies from 10 to 90 percent of the stock. If the country is taken as a whole, the rate of survival is still rather low, being below 30 percent on the average. The optimism of the time can be seen from the following statements: "If we can produce about 100 billion fry this year and raise the survival rate by 10 percent, then we can boost our production of fish by 10,000 billion, which amount will be sufficient to meet the requirements of one million fish ponds capable of raising 10,000 fish each. After one year, let us assume that 50 percent of them live and grow to one catty (500 gr.) each in weight, then we will have produced 2.5 million tons of fish" (Anon. 1959a). Truly an excellent example of catching fish before they are hatched.

Thus it can be seen that there are two sources of fry used in fish culture. The first, and by far the most important at present, is the fry caught in the rivers. The Yangtze and the West River (a tributary of the Pearl) are the main fish fry collecting centres in China. The second source of fry is from fish reared in captivity, using the old methods. The

annual output amounts to about 10 billion fry. The main species are silver carp, big head, grass carp and Cirrhinus chinesnsis (SCMP 2702).

Apart from rearing fish native to China, scientists have been trying to popularize culture of the African fish Tilapia. It is claimed that this fish has been reared successfully in a number of communes of Hupeh. The advantages of culturing this species are that it is prolific, it breeds at 3-4 months, and it will spawn in captivity and will eat anything (SCMP 2757).

It has been pointed out that the benefit of fish culture is that it permits a much higher yield of fish from the area available. It is possible to obtain 25 kg. of fish from 0.06 ha. (one mow) by rearing, and only 5 kg. without rearing. Yet in 1961 only 14 percent of the water areas suitable for fish culture were utilized. Ponds were most commonly used because they are the easiest to manage (JPRS 11957b). In 1957 the average output from ponds under culture was 57.5 kg. per 0.06 ha. (per mow), whereas it was only 15 kg. per 0.06 ha. from lakes and reservoirs. Other writers were even more optomistic about the great advantages accruing from fish culture, estimating the yield from lakes without stocking at 10 kg. per 0.06 ha., and from ponds under culture at 125 kg. per 0.06 ha. (SCMP 2691).

As late as the eighteen seventies the Chinese did not know of artificial propogation, although it was already widely practiced in Europe (Radcliff 1921), nor was it extensively used until after the initiation of government research and popularization under the present government.

The first experiments to induce spawning of silver carp and big head were carried out in China in 1956 but were unsuccessful. Experiments

were resumed in 1958 and with the aid of Russian experts approximately half a million live fry were delivered to collective farms out of 10 million hatched. In the course of that year the main causes of loss were identified and eliminated. In the south similar experiments were carried out by the Chinese team who succeeded in artificially rearing 30,000 fry (Sonin 1959).

The South Sea Aquatic Products Research Institute in Kwangtung and a similar institute in Chekiang conducted successful experiments on the artificial propagation of the fry of both silver carp and big head. The parent fish were made to release milt and eggs by artificial means. The results of the experiments were said to hold promising prospects for the future (Chang 1959).

With the assistance of Russian experts, from 1958 on more and more fish were spawned artificially. The additional species bred included grass carp and snail carp. Rainbow trout from Korea, bullfrogs from Cuba, and Tilapia from Vietnam were introduced to Chinese waters. More than 600 government operated fish culture enterprises and 170 stations supplying fry and fingerlings had been established to help expand and develop cultivation in the communes (Anon. 1964a). By the fall of 1962, two-thirds of China's freshwater fish production resulted from fish culture. By 1964 the target planned for the end of the Second Five Year Plan was more or less achieved, and 6 million ha. (100 million mow) of inland bodies were used for rearing fish.

Fish Culture in Paddy Fields

Fish rearing in paddy fields dates back to emperor Wu of the Wei Dynasty (Third Century A. D.). It was, therefore, both known and practiced in pre-war China. During the last ten years the present government has pursued a steady campaign to encourage first cooperatives, and later communes, to culture fish in paddy fields. A number of articles have appeared stating that fish rearing does not harm crop cultivation and is in fact beneficial, as the fish in digging the bottom of the paddy field aerate the soil, and also eliminate harmful mosquitoes and other insects. In addition the fish fertilize the soil with their feces (SCMP 2526).

There appear to be two methods of paddy field fish culture used. A "deep-water" method is practiced in Szechwan, Kweichow, Kwangsi and Hupeh, where the water depth in the paddy fields reaches up to two feet. The yield of fish is said to be between 35 and 75 kg. per 0.06 ha. (per mow). The species reared are common carp and gold carp. In Hunan attempts are being made to culture grass carp, silver carp and big head.

In the south, in Kwangtung and other provinces "shallow water" culture is practiced. In the paddy field cross-shaped ditches (+ 田 ++) are dug about eight inches deep with fish holes of two to three feet deep. The holes provide a place for fish to escape to where the water is cooler. Sometimes in Kwangtung the holes are covered with reeds and wood to provide a nest (JPRS 17798). It is recommended that the number of fish in the paddy field be 1,000 to 1,500 per 0.06 ha. (per mow). By harvest time the fish would be three to four or even five to six inches in size (SCMP 2526). The same species are reared as in the deep water method, plus African carp. Grass

carp, which is likely to attack young plants, is recommended only for fields lying fallow.

The minimum depth of water considered to be sufficient for fish culture is two to three inches. It was recommended that the nature of the rice fields should be taken into account when planning fish rearing. For this purpose the paddy fields were divided into:

(a) winter water fields which never dry and which were said to be ideal for culture;

(b) wild fields near lakes and rivers, also suitable for all year culture;

(c) irrigated flat land fields which may either be drained after the harvesting, or the water left for the following crop; and

(d) terraced fields in which fish culture depends on the water level (SCMP 2568).

The rate of growth of fry in the paddy fields depends on geographic location and the type of fish bred. According to the results obtained from experiments carried out by the Hupeh Agricultural Research Institute and the Chinese Academy of Science, fry placed in paddy fields measuring three inches weighed one-quarter or even one-half a kg. within three months (SCMP 2686).

In 1961 it was reported that the paddy field acreage used for fish culture had steadily expanded in Chekiang, Hunan, Kiangsi, Szechwan and Keichow, where the farmers have traditionally used their wet rice fields this way. In 1960 200,000 ha. of rice fields in Hunan and 66,000 in Chekiang and Szechwan were utilized for fish culture (JPRS 17798).

In the spring of 1959 it was reported that in Chekiang Province fry were being placed in 170,000 ha. of flooded rice fields for the first time. This was stated to be thirty times more than in 1958, and amounted to one-tenth of the total area of the fields in the province under rice (SCMP 2002).

Reservoir Fisheries

The development of fishing in reservoirs is still in the initial stages. With the construction of a number of reservoirs before, during and after the Great Leap Forward, hopes were high that these could be used for fish culture (JPRS 6755a). However most of the reservoirs are in mountainous areas and as a rule little fishing or fish culture has been practiced in the past. Also during construction of the reservoirs the needs of the fishing industry were not considered, and the bottoms of the reservoirs were left cluttered with debris and tree stumps, making the use of sweep-nets difficult. As a result the main types of equipment used are baitless hooks, purse seines and traps.

To make the use of reservoirs possible it was recommended that small areas 576 to 1,153 meters (1 to 2 li) in circumference should be cleared on the reservoir bottom, and that this area be used for fishing. Wherever natural coves existed it was recommended that these be cleared to serve as future traps for fish.(JPRS 6755a).

To overcome difficulties arising from the shortage of trained personnel specific stocking instructions were published. It was advised that the fish fry introduced into reservoirs should be five inches or longer and should number 100 to 150 per 0.06 ha. (per mow). The species

recommended were black silver carp (which it was said would reach 5 to 10 kg.), silver carp (capable of attaining 2.5 to 3 kg. or even 5 kg.), and grass carp (reaching 3.5 to 4 kg. and sometimes even 7.5 kg.) (JPRS 6755a).

On the whole the results of fishing operations in reservoirs in the first few years were disappointing, but it was hoped that matters would improve with the increase in the number of fry introduced. In 1955 fish stocking was started in China's biggest reservoir, the Kwanting Reservoir near Peking. 200,000 fish fry were released in October 1955 and by the end of the year the number of fish released was to reach one million (SCMP 1153).

The Futseling Reservoir on the Huai (approximately 200 km. northwest of Wuhan) of 500 million cubic meters has a considerable fishery developed. In 1956 280,000 fish fry were placed in the reservoir, to be increased tenfold in 1957. It was planned to obtain 1,500 tons of fish annually (SCMP 1289). The total catch in 1959 was 220 tons of fish of which 56 percent was taken with hook gear, 36 percent with sweep-nets, 6 percent by electrical methods and 2 percent with other types of nets. Fish below one kg. in weight were not taken (Denisov 1961).

Another example of a reservoir fishery is that of the Shihtsetan Reservoir in the upper reaches of Chialing Chiang, which enters the Yangtze in the north. The maximum area of the reservoir is 4,700 ha. and the average depth 40 meters. Located in the mountains the reservoir is V-shaped, forming two sections along the valleys of the tributaries, and has a winding shore line. The reservoir is not used for irrigation and therefore has

been handed over to the fishing industry. In 1958 a State Fishery Enterprise was established and at the beginning of 1959 a Scientific Institute of Aquatic Industry was added. The first year of operation was not a success. The catch for 1958 was only 35 tons for the first eight months, or 8 kg. per hectare (Borutskyi 1959).

By and large however China has favourable conditions for developing reservoir fisheries. Investigations carried out in the reservoirs in the Soviet Union have shown that the factors influencing the output per hectare in reservoirs are the geographic location of the given reservoir, and the variation in the water level. The Russians divided reservoirs into five categories according to yield (Turin 1962):

Class	Productivity	Yield
I	Very High	over 60 kg. per ha.
II	High	30 to 60 kg. per ha.
III	Average	15 to 30 kg. per ha.
IV	Less than Average	7 to 15 kg. per ha.
V	Low	2 to 7 kg. per ha.

The group distribution by zones in Russia was found to be:

Zone	Class of Reservoir
Taiga	V, IV
Mixed Forests	III, II
Forest Steppe	III, II, I
Steppe	III, II, I
Mountain Regions	V, IV, III

Since most of the Chinese reservoirs are situated further south the Russian data apply only in China to reservoirs in northern areas, where conditions are comparable. However, the majority of China's reservoirs have been created in the course of flood control and water conservation schemes in geographic zones with high possible productivity.

The situation is also favourable with respect to water level fluctuations. Generally the winter and spring are dry in China, and the summer and fall account for the bulk of precipitation. Since these are also the seasons of highest temperatures leading to the greatest depletion of water resources, the two factors tend to cancel themselves out. However, since fish culture in reservoirs is definitely secondary to the utilization of water for irrigation, fish stocks may suffer during the late spring, when the water level is likely to drop prior to the beginning of the rains, and in more arid areas when water reserves are rapidly depleted during dry spells in the summer.

Problems in Fish Culture

The expansion of fish culture did result in problems, some of which it was not possible to resolve. The most important among them were:

(a) shortage of fry (which was being solved through artificial spawning);

(b) maintaining the water level in ponds during the dry season. (The solution to this problem is sought in digging holes for fish to gather in during such a period: this produced another problem, overcrowding);

(c) with industrialization of the country the problem of water

pollution has become urgent and must be solved before serious damage results.

Solutions to the problems were sought through the mobilization of the general public with mass campaigns, which as a rule were conducted in terms of slogans, such as were used for economic problems in other branches of the economy. The rules for fishing and fish culture were summed up in a slogan containing the instructions which have since been referred to as "One-four, Two-eights" (SCMP 1955). These are the following:

I. Four General Principles

(1) Fish culture should be practiced everywhere.

(2) The necessary manpower should be made available.

(3) Supply of manpower for single undertakings should be provided.

(4) Labour efficiency should be improved through harder work and better organization.

II. Eight Principles for Fish Culture

(1) Make the pool sufficiently deep.

(2) Eliminate stagnation of water.

(3) Ensure the close laying of eggs and prolific spawning.

(4) Promote good breeds.

(5) Provide sufficient food.

(6) Modernize tools.

(7) Eliminate disease.

(8) Strengthen the management of pools.

III. Eight Principles for Fishing

(1) Practice multiple-purpose operations.

(2) Locate fishing grounds.

(3) Renovate techniques.

(4) Observe safety measures.

(5) Encourage growth of resources.

(6) Mechanize operations.

(7) Use steel cables for net hauling.

(8) Direct operations by modern means of communication.

The Freshwater Fisheries by Province

Honan Province

The extensive water control schemes along the low-lying river plains (Huang-Huai and Nan-yang) provide favourable conditions for increases in fish culture in this province. The area of ponds, lakes and reservoirs was to be increased four-fold during 1958 alone and the increase in fish culture to be nine and one-half times. In that year, one billion fry were to be reared in the province, ten times more than in 1957. To accomplish this 20,000 fish culture experts were to be trained (SCMP 1762). By mid-1959 it was reported that Honan had 200,000 ha. set aside for fish culture. In the province at that time there were 446 culture areas containing more than 1,500 million fish fry (SCMP 2059).

Shansi Province

Over eleven thousand reservoirs and ponds have been built in the province in the course of the water conservation effort of 1958. These

provided 40,000 ha. of inland waters for fish culture. To these were to be added another 100,000 ha., to be created in the course of the winter water conservation projects. Of the available water resources 5,000 ha. were utilized for fish culture in 1958 and in them four million fish were being reared. The output of fish for 1959 was expected to be between 2,400 and 3,000 tons (SCMP 1917).

Shensi Province

Between 1957 and 1961 the fisheries in this province have been gradually developed. The largest fishing area is on Lake Hsiao-chih, in which fishing started in 1958 (SCMP 2643). In 1959 one million fry were released in the lake. The annual output of fish in 1961 was four times the 1958 level. In 1961 3.8 million carp fry were reared in the lake, plus 1.4 million imported from Wuhan (SCMP 2643). In 1961 construction of a motorized boat of 60 HP was begun (SCMP 2643).

There are also government culture areas in Yulin which provide fry for the province and for lakes in Inner Mongolia (SCMP 2608). Another centre of fish culture is in Sian, which up to 1962 had produced some 200 million fry. The province has over 34 state fish culture grounds and hatcheries. In 1962 over 100 million fry were released in the province (SCMP 2793).

The species reared in Shensi Province are black carp, grass carp, big head and others. Fry is brought from the south or artificially hatched in local districts. Artificial propagation of common carp has been practiced in the province since 1959.

Heilungkiang Province

The fishing industry of Heilunkiang Province was already developed to a certain extent before 1949, although little statistical data are available for the whole province at that time. Fishing was done in the Amur, the Sungari, and the Nunkiang (or the Nonni) Rivers, as well as on the lakes of the province.

In the province of Heilunkiang rivers and lakes cover an area of four million hectares. This includes three large lakes, Hsing-k'ai (or Khanka), Chingp'o, and Lien-kuan; 1,700 named rivers and streams (SCMP 1295b); 4,000 named reservoirs and many small ponds (JPRS 8550). In these water bodies 30 varieties of fish of economic importance are found. The main species of fish are sturgeon, ma-ho fish, t'an-t'ou fish and cold-water fish (che-lo) and hsin-lin (JPRS 8550).

Fishing on the Sungari River near Harbin was developed on a commercial scale by Chinese immigrants from Shantung, who brought their own methods of fishing with them (Lukashkin 1929). These were the use of cast nets (large and small) and baitless multiple-hook lines.

By 1929 approximately 30 boats were operating in the area of Harbin. The season lasted seven months and the catch per boat for the season was 1,100 to 1,300 kg.. All of the fish were sold to middlemen. For economic reasons fishermen did not as a rule keep any fish for their own consumption. The fishermen lived on board with their families during the fishing season, and in the winter, having placed their boats on blocks, moved over to the land and engaged in transporting passengers and goods across the river on manually propelled sleighs.

The principal fish species caught on the Sungari River were the Amur sturgeon, kaluga, Amur sig, Amur ide, culter, konyok, Amur bream, Cruscian carp, Amur sheat fish, kasatka, Amur pike, grass carp, slow fish and others. As a result of indiscriminate fishing and the absence of restrictions during the spawning period, the fish population in Heilungkiang Province was on the decline by 1929 (Lukashkin 1929, Nikol'ski 1956).

The development of the fishing industry was actively supported almost from the beginning of the present government rule in the area. In 1952 fish from the Yangtze basin were being brought to Hilunkiang (SCMP 1300), and in 1954 four million fry were taken by train from the Yangtze and released in the breeding grounds in the Sungari, the Nunkiang (or Nonni) and the Small Khanka Lake (SCMP 1300).

In 1956 four new state-owned fisheries were established in Heilungkiang. Together with those already existing and the fish-ponds belonging to peasants they covered an area of 50,000 hectares. In 1956 they were expected to produce 70 million fish (SCMP 1295b). As in other places and other branches of the industry the years of the Great Leap Forward were the ones of high claims and ambitious plans. In 1959 the province was planning to expand fish culture by forty times. Communes were instructed to catch 10 million fry (SCMP 1984a). In 1960 the total volume of fish being reared in the province increased by 44 percent over 1959 and the area stocked with fish expanded by more than fifty percent (JPRS 8550).

By this time there existed in the vicinity of the six major cities

alone 13 state-owned fish farms, several dozen commune fish farms and over 400 fish culture groups. 130,000 tons of fish were produced in 12,540 ha. (209,000 mow) (JPRS 8550). In addition in the province there were 12 fish hatcheries and fish farms owned by the state and 70 fish culture stations run by local authorities. In 1960 the 12 state fish farms accounted for 30 percent of the output. As elsewhere efforts were made to popularize new techniques and production methods (JPRS 8550).

In spring 1961 it was reported that over 40,000 people with 10,500 fishing boats and 20,000 nets were engaged in fishing in Heilungkiang. The daily catch increased from about 100 tons in early spring to 190 tons later on in the season (JPRS 11957c). By mid-1962, according to the official announcement, the province was rearing a dozen times more fish than in 1957 and 20,000 hectares were being used for fish culture (SCMP 2762).

The growth of the output of the fishing industry in Heilungkiang can be seen from the following index (JPRS 8550):

Year	Index
1952	100
1957	205
1959	318
1960	548

Kirin Province

Kirin Province has 100 rivers, the longest of which, the Sungari, runs some 800 kilometers within the province. It also has 5,000 reservoirs and a number of lakes and ponds. The total area of fish ponds in the

summer of 1961 was 60,000 ha. (one million mow), with more ponds of 720 hectares(12,000 mow) under construction at the time.

The output of fish in the province reached 2,500 tons at the beginning of the present decade. The Aquatic Products Department in Kirin was working on developing a fish culture industry in the province and also studying potential resources for the fishing industry. Restrictions on fishing have been introduced in the province to insure rational exploitation of the fish reserves (JPRS 10353).

Liaoning Province

The freshwater resources of the province include the Liaoho, Liaoring's largest water way, which empties into the Po-hai at Yingkow.

Kiangsu Province

This province is often referred to as the "water country". It is dotted with lakes and criss-crossed with rivers and canals. Within the province are located two famous lakes: the Tai-hu (2,213 sq. km.) and the Hung-tze (240,000 ha.) (Jen 1964). These freshwater resources make it possible for the province to be the second largest producer of freshwater fish. Planned output for 1955 was given at 172,000 tons, which was 60 percent more than the output in 1952. This makes the output in 1952 equal to about 107.5 thousand tons (SCMP 1044).

Endowed with natural conditions for rearing fish, the province has always exported a certain amount of fish fry. With the development of the fishing industry and the growth of government support, the trend has increased. In 1956, six state fish ponds with the capacity to rear 30

million fry were dug in the province. The total output of fry from the old and new ponds was to amount to 100 million fry by the end of the year, to be delivered to various parts of the country (SCMP 1251). In 1958 it was reported that the province planned to build or expand 26 fish culture areas in the course of the year (SCMP 1711).

In 1961 the total area used for fish culture and cultivating aquatic products amounted to 150,000 ha. (2½ million mow). However the province has 1½ million ha. of freshwater areas, which were planned to be given to the communes for cultivation in accordance with the principle: "Whoever plants shall take care of fertilizer and reap the benefit" (SCMP 2585a).

As an example of productivity it was stated that between April and mid-July 1961 2,048 tons (4,096,000 chin) of fish and 1,280 tons (2,560,000 chin) of snails, clams and other products were landed at Hung-tze Lake (about one chin of fish and ½ chin of other products per mow of lake surface area) (JPRS 10745).

Anwei Province

The Yangtze and Huai Rivers cut through Anhwei Province, dividing it into three areas from north to south: Huaipei, Huainan and Wannan. The Huaipei and Huainan areas both have conditions favourable for fish culture: warm climate, abundance of water and moderate elevation. Huainan in particular abounds in lakes and minor waterways which crisscross the Chouhu Plain. The larges of the lakes bears the same name as the Plain - Chouhu.

In 1958 the province's output in aquatic products was planned at

400,000 tons which was said to be three times the output of the previous year (SCMP 1805). Later on in the year it was reported that the output had already reached 400,000 tons by the end of November (SCMP 1926). The province is said to have had at the time 60,000 people engaged in fishing with 20,000 boats at their disposal.

Chekiang Province

Although small the province also has valuable freshwater resources for the development of fish culture and fishing. The Hangchow-Kashing-Huchow Plain has many lakes and ponds stocked with fish. By 1953 the fish culture areas of the province amounted to 40,000 ha., and the area was to be expanded by 16 percent in 1954 (SCMP 796).

Kiangsi Province

The province has an area of 1.2 million hectares (20 million mow) of freshwater (JPRS 15376). The largest lake in the country is Lake Poyang, spreading over 5,100 sq. km. in the flood season (Jen 1964). Almost all rivers in Kiangsi belong to the Lake Poyang drainage system. 24,000 fishermen and 10,000 fishing craft were working on Lake Poyang in 1960: they caught 500 tons of fish daily, which was 10 percent more than in the previous year (SCMP 2437). In 1961 the fish culture area in Kiangsi amounted to 132,000 ha. (2,200,000 mow). The main fish species popularized in the province have been red carp and hung-ho-pao (紅荷包).

As in other provinces difficulties developed in Kiangsi during the period of the Great Leap Forward. This, plus difficulties with respect to the food situation led to the publication of the following

recommendations (SCMP 2698):

(a) All-round development of multiple undertakings should be practiced with grain as a leading product.

(b) An average output of fish equal to 50 catties per mow of water area in general, and 100 catties per mow in ponds, should be aimed for.

(c) Fry suitable for local conditions should be selected for culture.

(d) Proper methods of fishing should be observed.

Analysis of the situation in the province's fishing industry have shown past mistakes which led to the curtailment of labour and equipment available to the fishing units. To remedy the difficulties arising from this the following recommendations have been put forward (JPRS 15376).

(1) That production units in the fishing industry should be smaller than in agriculture to allow for greater mobility.

(2) That the ownership question should be carefully considered. While equipment should be owned centrally by the communes the production teams should be allowed to retain tools. To increase incentives to produce more, bonuses on overproduction should be safeguarded.

(3) Cost accounting should be practiced.

(4) Distribution of income should be on the basis of the amount of hours worked.

(5) Due regard whould be paid to those of the labour force with special skills who have important functions in production.

Hunan Province

The province has within its borders the second largest lake in the country, Lake Tungting, into which most of the rivers in the province drain, and which is linked with the Yangtze. The lake consists of a number of smaller lakes that can successfully be fenced off. Fifty thousand hectares of the lake are used for fish culture. In 1961 teams from communes adjoining the lake caught two billion fry from the Yangtze. Artificial propagation has also been tried, and in 1961 200,000 silver, black, and grass carp and big head were reared. The fishing industry here is being modernized and in 1961 motorized junks were used on the lake for the first time (SCMP 2574).

In Hunan Province during the Great Leap Forward the volume of fish culture was to increase 9½ times due to a four-fold increase in the area of lakes, reservoirs and ponds created as part of the water conservation campaigns (SCMP 1762). Hunan Province planned to catch 600,000 tons of fresh fish in 1958, a six-fold increase over 1957 (SCMP 1805). In the winter of 1959-1960 six million workers were engaged on irrigation projects within the province, and over 30,000 reservoirs were built (JPRS 3828).

Hupeh Province

The greater part of eastern Hupeh Province is the Yangtze-Hunshui Plain which is a natural fish spawning area, and an important freshwater fish centre for the whole country. Here the western section of the Yangtze is well known for the export of fish fry. The main species exported are black carp, silver carp, big head and the Chinese ide.

Since the development of the freshwater fisheries, other parts

of the country have come to depend to a great extent upon the supply of fish fry from the traditional centres located in the middle Yangtze, and the fish culture areas have received government support. In 1954 it was planned to expand the spawning areas along the middle course of the Yangtze by 10 percent (SCMP 796).

By the spring of 1955 the government had established 1,400 rearing areas to help the growth of the fishing industry, and established a dozen fry-supplying centres and a curing plant (SCMP 1000). The plan announced at the end of 1955 for the following year provided that Hupeh was to produce 2,110 million fish fry, 1,700 million of which were to go to other provinces. It was reported then that the government had provided funds to establish 68 fish rearing areas, three fish culture centres, one fish rearing company, and over twenty fish-processing plants. The state-operated rearing areas were to increase during the year from 37 thousand hectares to 50 thousand (SCMP 1176a).

At the beginning of 1956 it was reported that ten state-owned fish culture areas capable of producing 100,000 tons of fish a year were being planned in the province, ranging in area up to 43,000 ha., and to be completed in 1957 (SCMP 1237). The plan for 1958 provided for an increase in the area used for freshwater fish culture from 180,000 ha. to 533,000 ha. (SCMP 1915a), while the total freshwater resources of the province were estimated at 960,000 ha. (16 million mow) (SCMP 1711).

In 1959 Hupeh sent 4,100 million fry to other provinces, compared with 3,000 million in 1958; and 4,000 million carp were reared, compared with 700 million in 1958 (SCMP 2042). Between the latter part of April

and the 20th of May 4.4 billion fish fry were caught in Hupeh Province, equal to 29.5 percent of the year's quota, and an increase of 60.5 percent over the previous year. To do this the province employed 21,000 fishermen with 4,000 fishing boats and 120,000 fish nets. Monetary incentives were provided to encourage the use of measures leading to a higher survival percentage of fish fry delivered to their destination (JPRS 10563).

In 1956, 33,000 households in the province of Hupeh derived their income from the fishing industry. The number probably increased over the years. No data are available of the fishing industry output in Hupeh in the earlier years. In 1954 landings were planned at 96,500 tons, which was 17 percent above the 1953 landings, making the latter 82,000 tons (SCMP 796). The plan for 1955 was to produce 109,000 tons (SCMP 1176a). The plan for 1958 provided for an increase of 22.8 percent over 1957 (SCMP 1711). In 1959 20,000 million fry were netted during six weeks, which was stated to be 136 percent of the annual catch in 1958; of these, 4,100 million were sent to other provinces, compared with only 3,000 million in 1958. To insure the future growth the number of available boats was to be increased from 30,000 to 70,000 (SCMP 2042).

Fukien Province

Fukien Province specializes in fish rearing inland, as well as along the coast. The production from the rearing of freshwater fry was given as being 40 times greater in 1959 than in 1958.

Kwangtung Province

Kwangtung ranks first of all provinces in the output of aquatic

products. Apart from the marine fishing resources, the province has by no means insignificant inland resources. The broad expanse of the Canton delta is covered with a network of rivers, canals and ponds. Pools are dug in the midst of farmland to rear fish in combination with such agricultural pursuits as growing sugar cane and mulberry (Jen 1964).

In 1956 it was reported that four state-owned fish culture areas had been built in the province (SCMP 1285a). Between 1953 and 1957 freshwater culture areas nearly doubled in size (SCMP 1696). In March of 1958 it was reported that Kwangtung had 70,000 ha. of freshwater ponds and that more were being built (SCMP 1741). In November the area for freshwater culture was given as 200,000 ha., which was stated to be 60 percent more than in 1957. This would indicate that in 1957 the area for freshwater culture of all types was 125,000 ha. (SCMP 1910).

During the Great Leap Forward the area used for fish culture in Kwangtung was to be increased six times over the area used in 1957 and 100,000 tons of fish were to be produced from 330,000 ha. (SCMP 1774). The output from freshwater cultivation in 1958 was given at 500,000 tons which was stated to be three times the 1957 level (SCMP 1910). The catch for 1959 was given as 292,000 tons from freshwater fish culture, and as 77,000 tons from freshwater fishing (Saburenkov 1961).

Chinghai (or Tsinghai) Province

In keeping with the general trend for the development of the fishing industry, efforts are being made to utilize the salt water lakes of Chinghai which are reported to have sizable reserves of scale-less fish which were considered edible. According to Chao (1962) the lake also

abounds in a species of carp.

By far the most important centre of the fishing industry in Chinghai is Lake Kokonor (Lake Chinghai or Blue Sea), which is 4,200 sq. km. in area, and has an average depth of 25 meters. (Chao (1962) gives the area of the lake as 4,456 sq. km.). During 1958 and 1959 the provincial government established four government fishery enterprises at the lake. The first group of fishermen sent by the provincial aquatic products department arrived at Heimaho, a small town on the southern bank of the lake in the autumn of 1958. Since then Heimaho has become a regular fishing town with its own shipyard, small power station, fish processing plant, fishing equipment workshop and weather station. The town now has a wharf 120 meters long. However operations are not yet mechanized, as can be seen from the fact that the workers have to use shoulder poles to carry fish.

In the winter, when the temperature falls to 30°C below zero, fishing is done through holes in the ice with nets or hook lines. Nets have been introduced for winter fishing only recently. The fish are dried (Chao 1962) or canned in a factory completed in 1959 which is attached to a cold storage plant with a capacity of 9,000 tons (SCMP 2051a). There is also a plant for the production of fish oil (SCMP 2521).

In 1959 the first group of twenty Tibetans, who normally do not touch fish, was organized into a fishing team. By 1962 there were five teams made up of 140 members, some of them women.

In August 1959 the first motorized fishing junk was launched on Lake Kokonor. It is 19.5 meters long, 4.8 meters wide, and can take a load of 60 tons (SCMP 2083). The boat building yard was set up here in

1958. By 1961 it had produced twenty-two fishing boats for inland waters, the largest one built being as described above. A road 449 km. long has been constructed around the lake. It is to be used primarily by the fishing industry (JPRS 4484).

In 1959 it was expected that about 3,000 tons of fish would be landed from the lake (SCMP 4484). Although the subsequent landings are not known there must have been a considerable increase judging by the rise in the number of fishermen in the province: from 200 in 1959 to 4,000 in 1960-1961 (SCMP 2437).

Ninghsia Hui Autonomous Region

The total water surface of the Ninghsia Hui Autonomous Region is 53,000 hectares or 205 square miles. Fish culture in this province was started only at the time of the Great Leap Forward (SCMP 1984b). The first fish fry brought here from the Yangtze weighed 5 to 9 kg. by 1962, while local species of the same age weighed only 1½ kg..

In 1963 over three million fry were flown to Ninghsia Hui Autonomous Region from the Yangtze basin. The fry were first acclimated in the government fish farms in Ninghsia at an altitutude of 1000 meters and then distributed to state agricultural farms and people's communes. The main species brought were the fast-growing grass carp, as well as black carp, silver carp and big head. Indigenous fish to the area are common carp, crucian carp and culter (SCMP 3032). Fish from the Yangtze also thrive in the reservoirs built in 1958 in the southern part of the Autonomous Region, where before 1958 the inhabitants rarely ate fish (SCMP 3032).

Sinkiang Province

In 1961 forty-six times more fish fry were released in the rearing pools of Sinkiang Province than in 1960, when the number released was stated to have been ten times greater than in the previous year. A large proportion of fish fry including carp were bred artificially (SCMP 2533a).

Inner Mongolia

In reading current Chinese literature one is often left with an impression that the development of the fishing industry in Inner Mongolia was really begun in earnest after 1949. In view of the lack of statistical data for the preceding years it is difficult to challenge such a contention. A clear picture of the situation before 1949 is obtained from an examination of the reports of Karamazova (1926) and Sapelkin (1929).

The abundance of fish on the Hulupeierh tableland has been known in China for a very long time. As far back as 1220, Chan Chun, the teacher of the Emperor Tai Chi wrote as follows: "The Lake (Pu-yu-erh) possesses a tremendous quantity of fishes. In the third and fourth moon the hu-tse-yu fish returning from the northern current of Delainor Lake (Pu-yu-erh) fills the rivers and canals to such an extent that there is almost no free space left, so that men and horses cannot cross over them".

The information supplied by local fishermen in 1925 but referring to the turn of the century is no different: "One travelled on the River Urshun and it boiled with playing fish which jumped about and even into the boat ... with but a pike or a sharpened stick and with no special arrangements the visiting Cossacks used to get a ton of fish or a cartload in five hours".

Fishing in the waters was forbidden by the Mongol Chiefs and the Emperors of China, but without much success. In 1903-1904, Russian fishermen leased from the Mongolian Chiefs the right to fish the waters, and until the revolution in Russia a fishing industry gradually built up in the region. Fishing first began on Lake Buyernor, then on the River Urshun, and finally on Lake Dalainor. By 1910 the catch was 6,550 to 7,370 tons (400 to 450 thousand poods) per season.

The volume of fishing continued to grow until 1917 when, due to events taking place in Russia, a certain amount of property destruction and loss of markets occurred. A further reduction in landings was due to the dry spell from 1917 to 1924, when fish could not go to the more fertile Lake Dalainor to spawn because of the low level of the River Urshun.

In 1920 the Russian monopoly on fishing in Lake Dalainor ended and the lake was opened to all on payment of a permit fee. Lake Dalainor is located on the upper Amur. Into it flow the Kerulen (also known as Kululun), the Orchun-gol, and the Mutnaya Protoka. The Orchun-gol and the Mutnaya Protoka connect Lake Dalainor with Lake Buyr Nor and the Khailar Khe River (or the Upper Argun).

The fishermen on Lake Dalainor had to pay a "chufan" or tax equal to 25 percent of the market value of the fish. Between 1920 and 1929 the number of fishing enterprises owned by the Chinese grew so rapidly that at a later date they were in the majority.

Qualified fisheries specialists were trained in the area. In addition a number of permanent buildings used such as dormitories,

storehouses, bakeries and smithshops were constructed. Some of the fishing enterprises had mobile dormitories which were moved across the ice in the winter to different fishing sites. To provide for the needs of the workers dairy farming and poultry breeding were developed, although the bulk of dry goods needed were brough. in by rail.

The principal fishing season was in the winter. Some fishing was also done in the summer, when the fish coming in to spawn were caught and placed in storage pools to be kept until winter, when they could be caught and frozen simply by exposing them to the cold air. All fishing was done with drag nets. In the summer smaller nets, 150 to 180 meters long, were used in the rivers primarily for catching fish for the storage pools. In the winter the nets were much larger (850 to 1,630 meters long and 6½ meters high). They were dropped under the ice, and horses were used to pull the nets by rotating poles.

The early exploitation of fishing resources was wasteful and irrational. Absence of restrictions on fishing, even during the spawning period, resulted in a rapid deterioration of the fish population. Retaining fish in pools through the summer resulted in heavy mortality. Processing of fish by drying or salting was considered uneconomical, because of the low price for dried fish and high cost of salt. Only in the late 1920's was the idea of canning fish entertained by some of the leading Russian fishing enterprises. However, no data are available as to whether any canning in fact was done.

The landings by sector are available for the years 1923-;926 (Table 5). Different prices for carp were set for the following weight

Table 5. Landings by sector in Lake Delainor area from 1923 to 1926.

SECTOR	FISH LANDINGS (in tons)					
	1923-1924		1924-1925		1925-1926	
	Summer	Winter	Summer	Winter	Summer	Winter
River Urshun	-	-	262.0	-	491.4	-
Mutnaya Protoka	-	-	81.9	-	81.9	-
Kerulen	-	-	376.7	-	196.6	-
Lake Delainor	-	3,832.0	98.3	4,095.0	81.9	3,342.0
Total per Season	-	3,832.0	818.9	4,095.0	851.8	3,342.0
Total per Year	3,832.0		4,913.9		4,193.8	

classes: over 1½ kg., ½-1½ kg., and less than ½ kg.. Prices for verkhoglyad were also differentiated: over ½ kg., ¼ to 1/8 kg., less than 1/8 kg..

During the period from 1921-1922 to 1925-1926, the percentage of large fish in the landings declined from 28.6 percent to 18 percent, of medium sized fish from 43.3 to 33.0, and the share of small fish increased from 14.6 to 42.0 percent.

The main species caught in the past were sazan carp, cruscian carp, Amurskii som, verkhoglyad, taimen, konyok, small bream, vyun and shrimp.

In 1958-1959 when the campaign for the development of the fishing industry in Inner Mongolia was intensified, the areas of freshwater were said to include more than 1,000 lakes and ponds, 78 rivers, as well as many new reservoirs (SCMP 1996). A report published in 1962 stated that Inner Mongolia has 5,000 lakes and 400 rivers with an aggregate water surface of 1.3 million ha., half of which was utilized in 1962 (SCMP 2705). Yet another report stated that the area of freshwater suitable for fish culture amounted to two-thirds of a million hectares (SCMP 2617). Another report stated that there were 500 freshwater lakes with areas varying from one to 400 hectares in the Maowusu Desert region alone.

Between 1957 and 1961 24 million fry were released in these waters. They were provided from the state culture ponds in Yulin. In 1961, 41 million fry were brought from Hupeh (SCMP 2505).

In 1959 the area for fish culture was to have been increased to 300,000 hectares, which would have been ten times the 1958 level. In

the spring of 1959 one and a half billion fry of yellow river carp, silver carp, and big head imported from the south were being reared. Landings in Inner Mongolia for the third quarter of 1961 amounted to 5,500 tons (SCMP 2617). By the spring of 1963 Inner Mongolia was catching four times more fish than in the pre-war peak year of 1941.

At present Lake Dalainor is the most important fishing industry centre in Inner Mongolia. Within the last decade a state fishing company was established, employing 1,200 people in 1962. The company ran a cannery capable of handling 500 tons of fish. In 1961 11,000 tons of fish were caught during the year. The main species landed were common carp, silver carp and golden carp (SCMP 2705). Of the eighteen species of fish found in the lake the following are of commercial importance: carp, bleak, silver carp, Amur sheat fish, and Amur pike.

At the town of Dzalai (or Chalinoerh) on the lake there is a government fishing industry organization. Around the lake there are five fishing areas, from which landings are delivered to Chalainoerh. Most of the catch, in particular the carp, is exported. The principal production season is still the winter, from the end of November to the beginning of February. The fishing is done with drag nets which are up to 720 meters long and four to five meters high, with a mesh size of 40-45 mm.. In spring fishing is done primarily for control purposes to determine the number of fish going into Lake Dalainor to spawn. Autumn fishing is equally small. The spring and fall fishing is done with nets of smaller mesh. In the summer fishing is forbidden (Svetovidova 1960).

The following regulations are of particular interest since they

indicate the policy with respect to stock preservation (Svetovidova 1960):

(1) It is forbidden to exceed the plan by more than five percent.

(2) Fishing is stopped upon the completion of the plan or at the end of the winter season.

(3) Undersized fish may not exceed 0.5 to 1.0 percent of the overall catch.

(4) To keep in the fish that entered in the spring, the lake is blocked in the summer across the Kurulen and the Mutnaya Protoka. As the fish do not go out the Orchun-gol River there is no need for a barrier there.

The annual catch in Lake Dalainor was 805 tons in 1938 and 5,298 tons in 1955. With the exception of bleak, the population of which was being reduced deliberately, only mature fish are taken. The catch consisted of the following: herbivorous fish - 45 percent, omnivorous fish (e.g. bleak) - 42 percent, and predatory fish - 13 percent. Until recently sharp-belly fish was not taken, although it was present in large quantities. The fishing industry of the lake was quoted as a good example of well-organized lake management (Svetovidova 1960). Since 1958 three billion fry were brought to the lake from the south and 40,000 were reared locally.

Other Freshwater Products

In the plans for fisheries development it was also pointed out that freshwater areas could be profitably used for growing a number of valuable plants. An area of one mow can produce 500-800 catties of lotus or water caltrop, or 1,000 or 3,000 catties of reed, rushes and other

plants used for the manufacture of paper and matting, as well as medical herbs such as pu-huan (蒲黃), wu-hsien (蓮芯), rush floss (or pu-jang - 蒲絨), and lotus water nuts (or shui-fu-lin - 水浮蓮) (SCMP 2593, SCMP 2675). It was stated that one mow can produce enough fodder to raise three hogs, or 5,000 catties of a fragrant plant (蒿草) which is a good fodder for animals and for grass carp and can be harvested three to four times a year (SCMP 2691).

In Kiangsi Province the plants cultivated include water caltrop, lotus roots, water chestnut, arrowhead, water oat, reeds, rushes and algae. In 1961 in Kiangsi Province approximately 13,200 ha. (220,000 mow) were used to grow lotus, from which about 100 million catties of lotus roots were harvested; 9,600 ha. (1,600,000 mow) were used to grow water chestnuts, from which 32 million catties of chestnuts were produced; 3,600 ha. (60,000 mow) were used to grow aquatic grass from which 10 million catties of grass were collected.

River crabs are another aquatic product of some importance. They are caught by making use of their reactions to light. To catch them inclined bamboo screens are placed in the river. The crabs climb up over the screens to reach the light and are gathered by the fishermen.

THE MARINE FISHERIES

Marine Fisheries Resources

Mainland China faces the sea over a distance of 14,000 kilometers. In addition, there are along the coast approximately 5,000 islands, which bring the length of the coastline to between 20 and 21 thousand kilometers.

(JPRS 11957c, Saburenkov 1961). Along this coast the area within twenty miles of the shoreline amounts to 150 million hectares (430,000 sq. miles), comprising 23.7 percent of the total fishing grounds of the world. The sea zone up to 124°E longitude is estimated to be 82.6 million ha. (320,000 square miles). The area of the sea shelf suitable for fish culture amounts to one million ha.. Chinese territorial waters lie between latitudes 3°N and 41°N, and consequently extend over both temperate and tropical zones of marine resources.

The estimates of possible landings from the Chinese fishing grounds have varied from time to time and from person to person. An early estimate given in 1953 gave the possible landings at 4½ million tons from marine fishery resources (SCMP 522). Speaking of the near-shore fishing grounds, Ma Ching-t'ung gave the possible catch at 4½ to 5 million tons (JPRS 12253). Another estimate (given in April 1956) of the possible fishery landings stated the area of the fishing grounds to be 148 million ha. (436,000 sq. nautical miles) with 340 ha. (one sq. nautical mile) yielding approximately 10 tons of fish, and the possible total output of 4,360,000 tons.

The total possible catch including freshwater landings was estimated at 7.36 million tons. In weight this was stated to be equivalent to 20 million head of cattle, 70 million pigs or 300 million sheep (Anon.1956c). In 1955 only 14 percent of the shallow areas and 11 percent of lakes were said to be under exploitation (SCMP 1177), and at the end of 1962 only one-eighth of freshwater areas and one-tenth of the coastal ports and bays were said to be utilized. The middle and surface

layers of the East China and Yellow Seas have been poorly exploited and fishing has been in only a small portion of the total South Sea fishing grounds (JPRS 19139).

In the period of the Great Leap Forward estimates of landings were more optimistic. Describing the earlier period Saburenkov (1961) states that "according to Chinese scientists not less than 20 to 25 million tons of fish and other marine products could be obtained from the fishing grounds". (In recent Soviet literature, stressing the fact that the estimate is made by Chinese scientists or authorities can be taken generally to mean that the Russian author has reservations with respect to the figures). At the peak of the Great Leap Forward one Chinese writer gave an estimate of possible landings from the Chinese fishing grounds at 30 to 40 million tons. This was said to be possible through the utilization of the available resources for fish culture (Chang 1959).

According to the statement of the Ministry of Aquatic Products, by the end of the Second Five Year Plan (1958-1962) the annual output of the fishing industry was to have reached 20 million tons. The enormous increase was to have been achieved by shifting emphasis from marine to freshwater industries and to fish culture. Also fish rearing by cooperatives rather than state enterprises was to be stressed (SCMP 1805).

It was stated that although the six major deep-sea fishing grounds (Pohai, Yah-sha, Choushan, East Kwangtung, West Kwangtung and Pei-pu-wan; Figure 1) and a dozen smaller ones could yield only about 3 million tons, a total of 30 million tons could be obtained by using

shallow seas and inland freshwater areas (SCMP 1805).

One of the most persistent notes in the government statements has been that the fishing resources of the country have not been sufficiently utilized. By mid-1958 it was said that only one-half of the continental shelf and only one-sixth of the inland waters were used, and in addition there were the paddy fields still to be utilized (SCMP 1805). In the spring of 1962 the Mintung fishing grounds in East Fukien were investigated and the findings showed that a large potential for fishing existed in the area. Frigate mackerel, dolphin and basking shark were said to be plentiful in the surface waters of the sea but only small quantities had been landed (SCMP 2800). In the spring of 1963 it was once again emphasized that the intermediate layers and surface of the sea were not sufficiently utilized, particularly in the South China Sea (SCMP 2959).

In the marine fishing ground over 1,000 species of fish are found. There are approximately 250 species in Pohai Bay, 400 in the East China Sea, and 800 in the South China Sea. Approximately 80 of the species of fish found in Chinese waters are of commercial significance (Saburenkov 1961). Among the most important of these are large and small yellow croaker, hairtail fish, bream, globefish, eels, sharks, mackerel, and others (Table 6) (Anon. 1964b).

In the northern area of the coast the fishing is distinctly seasonal. In spring the commercial species move into warmer coastal waters to spawn. A winter fishery is based on fish which gather in shoals and move to winter grounds. South of the Yangtze the seasonal character of

Table 6. List of names of the more importatnt marine fish of China.

CHINESE	ENGLISH	SCIENTIFIC NAME	RUSSIAN
姥 鯊	Basking shark	Cetorhinus maximus (Gunner)	акула
鱭 魚 時 , 鱭 勒	Ilisha (Chinese herring)	Ilisha elongata (Bennett)	
鱓 魚 , 鱔 魚 , 鱓 魚 , 鱓 魚 ,	Eels	Anguilla spp.	угорь
海 鮀	Arüd catfish	Arius thalassinus (Rüppell)	Морской сом
	Sea sheat	Plotosus anguillaris (Forskal) (?)	
	Saury	Cololabis saira (Brevoort)	
鯔 魚	Grey mullet	Mugil cephalus Linnaeus	кефаль
鰆 魚 台	Japanese mackerel	Pneumatophorus japonicas (Houttuyn)	Японская сайра
鯖 魚	Frigate mackerel	Auxis thazard (Lacépède)	макрель
	Bonitos	Sarda sp.	
青 甘 金 木 枪 魚	Longtail tuna	Thunnus tonggol (Bleeker)	тунец
帶 魚	Cutlass	Trichiurus haumela (Forskål)	сабля рыба
	Dolphin	Coryphaena sp.	Дельфин
	Pomfret	Pampus sp.	
	Flagfish	Kuhlia taeniura (Cuvier & Valenciennes)	
鯛 科 魚 周	Porgies	Sparus sp.	Карп

Table 6. Continued.

CHINESE	ENGLISH	SCIENTIFIC NAME	RUSSIAN
摩鹿丝非鱼里	Goat fish	Upeneus moluccensis (Bleeker)	
大黃魚	Large yellow croaker	Pseudosciaena crocea (Richardson)	
小黃魚	Small yellow croaker	Pseudosciaena polyactis Bleeker	
短鰭紅娘魚	Gunard (sea robin)	Lepidotrigla microptera Günther	

the fishing is carried on all through the year, with the exception of the typhoon season. Catches here depend on weather rather than the time of year.

Until recently many pelagic fish were not utilized in Chinese coastal waters and little fishing was done in remote areas, mainly due to the shortage of deep-sea fishing craft. In Kwangtung Province only 13 to 15.5 million ha. (50 to 60 thousand sq. miles) of 116 million ha. (448,000 sq. miles) are exploited. Even in coastal waters no fishing is done at depths exceeding 120 meters. Thus of 330,000 ha. of shallow seas suitable for the harvest of various marine products, only 52,000 were being utilized in 1959 (Saburenkov 1961).

One of the characteristics of the fishing industry in present day China is the unusually great importance occupied by the freshwater fish landings in spite of the long coast line. The reason for this is that the investments to develop freshwater fish culture are much lower than those required for the development of marine fish culture and fishing. This holds only as long as there are freshwater areas not being utilized for fish rearing. Thus marine fishing, which before the war accounted for two-thirds to three-quarters of the output, declined to 61.9 percent by 1957 and to 54.4 percent by 1959 (JPRS 12253).

The main marine fishing areas in China are the Pohai Sea, the Yellow Sea, the East China Sea and the South China Sea.

The Pohai Sea

This the smallest of the four seas includes three large bays: Liaotung, Pohai and Laichou. The Lio-ho, Luan-ho, Ta-ch'ing-ho, Hai-ho

and Yellow Rivers empty into Pohai. The Pohai seabed has much sand and mud and the water has low salinity. The Pohai Sea includes the important fishing grounds of Luta (Lushun-Talien), Chinhsien and Changhaihsien.

Food is abundant for fish, shrimps and other marine species found here (JPRS 11957c). In spring shoals of yellow croaker, and the long-rayed anchovy are found, as well as over ten kinds of crustacean, including prawns and crabs. In this Sea, seal, dolphins, whales and sharks are also encountered. The coast is ideal for growing seaweed and molluscs. There are 99,000 ha. (990 million sq. meters) of shallow waters within 10 miles of the shore; in an area of 34,000 ha. (340 million sq. meters) are found beche-de-mer (sea cucumbers), campoy, abalone, limpets, oysters and periwinkles. Beche-de-mer live in an area of 8,400 ha. (84 million sq. meters), with an annual output prior to 1957 of 1,200 tons (2.5 million catties). Another 7,400 ha. (74 million sq. meters) suitable for growing beche-de-mer, campoy, limpets and seaweed have not been exploited because of lack of knowledge and suitable equipment. There were signs of overfishing in some areas, for example in Chinhsien the oyster catch of 100 tons resulted almost in its extinction (SCMP 1463).

The Yellow Sea

The Yellow Sea extends from the mouth of the Yellow River to the mouth of the Yangtze. It has an area of 4 million ha. (40,000 sq. km.) and an average depth of 50 meters. Its sandy bottom is suitable for spawning. The major fishing grounds here are the Haiyang Islands, the estuary of the Yalu River, the waters outside Chefoo (or Yentai) and

Weihaiwei, Cheng Shan-tou, the Shih Islands, Hai-chou Bay and Lu-su-yang (JPRS 11957c).

The East China Sea

The East China Sea stretches from the mouth of the Yangtze to the Taiwan Straits. It is shallow at the estuary of the Yangtze. The Yangtze, Yung, Ling, Ou and Min Rivers empty into it. The sea has many islands including the Choushan archipelago. Within it are the richest fishery areas of China (JPRS 11957c): the mouth of the Yangtze, the Choushan Islands and the Yui-san fishing grounds (Saburenkov 1961).

The South China Sea

This sea stretches to the south of the Taiwan Straits. Largest in size, it covers an area of 270 million ha. (2.7 million sq. km.). The Chuan-chou, Chiu-lung (or Kiu-lung), Han (or Shan-t'ou), Pearl, San-ya-chiang and the Ying-lo are the principal rivers that flow into it. There are many off-shore islands and coral reefs. Prospects for developing a deep-sea fishing industry are good. This is the only tropical fish producing area in China. The main species found are tuna, flag fish, shark and flying fish. The South China Sea region includes the fishing grounds at the mouth of the Pearl River, off Hainan Island, in the Gulf of Tonkin and the Si-sha Islands (JPRS 11957c , Saburenkov 1961).

Fishing Vessels

In 1959 to 1960 the Chinese commercial fishing fleet consisted of 430,000 units. Of these 131,000 were non-motorized seagoing vessels, and 297,000 were non-motorized inland vessels. Thus only 2,000 vessels were

motorized operating on inland waters and open seas (Saburenkov 1961, SCMP 1687). Kenji (JPRS 9817b) estimated the number of steel-hull motorized vessels in China in 1959 at 5,000 and wooden-hull motorized vessels also at 5,000. These figures however include marine and inland fleets. Of the seagoing vessels in existence in 1959-1960, only 6,300 were of more than 20 ton capacity, and of the inland water fleet only 6,600 had a capacity of more than 5 tons (Saburenkov 1961). The total number of marine vessels in China around 1908 was estimated at 200,000, one-fifth of which were along the coast of Chekiang (Yen 1910). It would appear that the number of seagoing vessels has declined by some 70,000 during the turbulent half-century preceding 1959.

This is not surprising since the Chinese fishing fleet suffered greatly during the years of war with Japan. It was said that one-half of the fishing fleet available in 1936 was destroyed in the following years, and another quarter badly in need of repair (SCMP 522). In spite of this by the end of 1953 reconstruction of war damage in the shipping industry was complete, and new construction had begun (SCMP 462).

Although the Chinese fishing fleet is still far behind those of her immediate neighbours, Japan and Russia, and still very far from adequate for her needs, some construction and conversion has been achieved. In 1949 there were only 60 vessels with engines of more than 160 HP, but by 1959 the number had increased to 563 vessels with engines of more than 450 HP and another 150 vessels of 80 to 450 HP, the latter mostly of old Japanese construction (Saburenkov 1961). The motorized vessels belong to state enterprises located in Talien, Yentai, Tsingtao

and Shanghai, and to five local enterprises subordinated to provincial authorities.

According to the method of use the seagoing vessels existing in 1957 could be classified in the following manner: 414 vessels for two-boat seine trawling, 18 stern and 4 deck trawlers, 8 purse seiners and 3 whalers (Saburenkov 1961). A year later the distribution by port of operation was as follows: Talien-Lushun 229, Tsingtao 117, Shanghai 70, South China Sea State Company (Hainan Island) 47, making a total of 463 compared with 447 the year before (Saburenkov 1961).

With the increase in the number of fishing vessels built and the experience thus gained, the length of time required for construction has been reduced substantially. While in 1954 300 days were needed to build a fishing boat of 250 HP, in 1958 the number of days dropped to 82 (JPRS 2704, JPRS 6519). According to Russian experts the common shortcoming of the fishing craft now available is the absence of refrigeration holds and freezing installations, as well as poor living conditions for crews. The general trend in China is toward increasing the size of motorized and non-motorized carft, and toward increasing the horse-power of the former. Fishing and "fish-transporting" vessels of 500 to 1,000 HP are being built, as well as a large number of vessels with cargo capacities from 12 to 20 tons (Saburenkov 1961).

In 1961 in a discussion of the advantages of motorized junks the following points were brought out to show why they are superior to sail-propelled ones (SCMP 2564, JPRS 11029):

(a) They could better withstand stormy conditions.

(b) They had greater fishing capacity and higher labour productivity because: they reach the grounds faster, they spend a greater proportion of their time in actual fishing, they can more easily be sent to selected areas, they can locate fish shoals better, and they can use bigger nets.

(c) They are labour saving because: the operation of sails is dropped, sweep and other nets can be handled mechanically, they are roomier thus providing better working conditions and living quarters, and they are better suited for women participating in this work.

(d) They permit mutual assistance actions: motorized boats can locate fish shoals for sail boats, they can tow sail junks to the shoals, and they can tow sail boats to safety in case of emergency.

(e) Motorized junks have advantages over trawlers because of their simplicity; they require small investments; they permit utilization of sail drive when winds are favourable and thus save fuel; because costs of building a motorized junk are only 1/4 to 1/5 of those needed for steam driven vessels funds can be accumulated within the communes themselves; and hulls for junks can be built in communes.

It has been estimated that a trawler of 250 HP costs about 500,000 Yuan (250,000 U.S. $) to build, a motorized junk only 50,000 Yuan (25,000 U.S. $). Thus for the junk the recoupment period is only two years, because the fishermen can catch two to three times more than

sail boat crews (Yen 1965). As a result in 1959 the state provided the fishing industry with motors of an aggregate capacity of 100,000 HP (JPRS 9817b), and continued to allocate large numbers of diesel engines for motorized junks (JPRS 11029).

According to the newspaper Jen Min Jih Pao, in March 1963 the number of motorized fishing boats in the country was double the 1957 figure. The increase in motorized junks during the same period was three-fold (JPRS 18826), but the increase differed from area to area. For example, Chekiang Province had only nine motorized junks in 1956, and 1,400 of them by the winter of 1962 (JPRS 18826). In 1963 there were ten times as many motorized junks in the East China Sea as in 1957, and three times as many trawlers (SCMP 2980). The fishing fleet also appeared to have attained a better state of repair, for although the number of motorized junks in 1963 was three times the 1957 number, the number actually in use was four times as great (SCMP 2980).

The motorized fishing fleet also has its disadvantages and difficulties. Seldom mentioned openly, the fuel situation constitutes a real problem. China's known resources of oil are modest, although she has much larger expected or potential ones. During the last few years the output at home has been sufficient to cover only three-quarters of the meagre six million tons consumed annually. One quarter of her oil needs, imported in the past from the Soviet Union, constituted by far the largest single import item. Any increase in the number of motorized junks also leads to an increase in consumption of costly fuel oil requiring either large domestic investments for the development of the oil industry or

expensive imports from abroad.

In addition there are other difficulties, attributable to lack of skilled and experienced manpower, lack of equipment and facilities for repairs, and lack of spare parts, all of which contribute to high costs of repair. As expressed by one Chinese expert: "the existence of these problems not only retards expansion in the use of motorized fishing boats but tends to raise doubts in the minds of fishermen and of other commune members as to their advantages"(JPRS 11029, SCMP 2564).

There are other problems as well. Because crews are inexperienced and inadequately trained, maintenance work is of poor quality and serious breakdowns are allowed to occur. The available power units are often poorly designed (some are unnecessarily complicated) and badly made. With the installation of motors, nets are often not increased in size. Fishermen are unskilled in manipulating nets when the installation of motors interferes with their use, and are frequently unfamiliar with the increased fishing grounds made newly accessible to them.

Repair services are poor and slow and in addition the number of yards carrying such service is insufficient, which means that broken-down vessels have to sail or be towed long distances in search of facilities for overhaul.

To improve matters it was suggested that:

(a) Shipyards should practice division of labour, with larger ones concentrating on new constructions and smaller ones on repairs. In addition mobile repair units should be organized.

(b) Greater standardization should be enforced to simplify repairs and to ensure the availability of spares and the maintenance

of stocks.

It was also advocated that the authorities should ensure timely availability of supplies for the needs of the fishing industry, bearing in mind seasonal needs, that control of materials and supplies be made the responsibility of appointed individuals, and that accounting should be strengthened in enterprises. Finally, to save materials in short supply, it was urged that locally grown substitutes should be made use of whenever possible (JPRS 11029, SCMP 2564).

To summarise, during the first decade of Communist rule in China, an effort was made to expand the deep-sea fishing industry and to improve efficiency of coastal fishing through construction of vessels with engine capacity from 75 to 350 HP, refrigeration vessels (for transporting fish) and industrial research vessels. As a rule such vessels were built in series of up to 50 units.

Until recently China has made no reference to buying fishing vessels from abroad, although it is likely that she did purchase some. In the years 1959 to 1963 for which details of Russian exports to China are available (Anon. 1965b), Chinese imports of equipment for ships and marine diesel motors were substantial (Table 7). It is, however, impossible to say how much of the equipment was destined for the fishing industry. In view of the requirements for transportation the allocations to the fishing industry may well have been very small. However, since the average capacity of the marine diesel engines imported in 1963 was 28 HP, and since the engines are classed as marine diesels, it is reasonable to assume that at least some of them were small capacity diesel engines

Table 7. Imports of ship equipment and diesel marine engines into China from Russia.

YEAR	IMPORT OF SHIP EQUIPMENT	IMPORT OF DIESEL MARINE ENGINES		
	Value (1000 R.)	Number of Units	Value (1000 R.)	HP
1958	1859	61	563	13,300
1959	4247	111	1307	31,100
1960	2869	105	595	13,400
1961	382	42	123	3,100
1962	203	2	3	-
1963	175	50	62	1,400

ideally suited for installation on junks.

In September 1964 it was reported that the Central Trust Corporation of Mainland China planned to accept bids in that month for the construction of three 1,000 ton trawlers to be used in Yellow Sea fishing. The corporation hoped to buy the vessels from Japan (Anon. 1964c).

The Chinese Communist authorities do not as a rule publish a great deal of information relating to their construction of fishing vessels. From the little information available it can be seen that some building does take place all the time, and the numbers built increase from year to year. It was reported in 1953 that 52 motorized vessels were under construction (SCMP 582), in 1954 that 150 fishing boats in the 100 ton class (and above possibly) were built (SCMP 1148), and in 1955 that 20 modern trawlers were built, and 62 in 1956 (SCMP 1470). Twenty-nine fishing boats were built in Shanghai in 1961. These were equipped with telecommunications equipment, fish detecting sonar equipment, electrically operated winches and haul nets, and electrically controlled steering. Apart from this the ship-yards were said to be building refrigeration ships, ocean refuelling ships, and special research ships for survey of aquatic resources (SCMP 2613).

Since little information is available on the types of fishing vessels being built it is necessary to draw conclusions from isolated cases where reasonable detailed descriptions have been provided. One source reports that in June 1960 a fishing vessel, Hu-yu No. 357 was launched and gives the following data (JPRS 9817b): Length = 32.57 m.; Width = 6.6 m.;

Average Draught = 2.70 m.; Displacement = 255.8 tons; Distance between masts = 28.7 m.; Speed (fully loaded) = 11.5 knots; Depth = 3.63 m.; Crew = 22 persons.

The same source provides a description of a slightly larger vessel, 350 HP, with a drum net on the stern which was shown in Shanghai at an international exhibition. It was built at Chihsin dock. The particulars of the vessel, which was stated to be of standard construction, were as follows (JPRS 9817b): Length = 35.4 m.; Average draught = 2.9 m.; Load Displacement = 7.5 m.; Distance between masts = 31.0 m.; Speed = 11.3 knots; Depth = 3.7 m.; Maximum cruise = 20 days.

There is equally little information on the construction of refrigeration and special purpose ships. It was reported in the fall of 1955 that two refrigeration ships were to be completed by the end of the year (SCMP 1127). In March 1959 a refrigeration ship "Bumper Harvest" was launched in North China. The ship was described as having a displacement of 1,000 tons, a carrying capacity of 300 tons of aquatic products, and had been assigned the task of collecting the catch from boats operating off the coast (SCMP 1483).

In July 1960 what appears to be another refrigeration ship, with displacement 1,770 tons, dead weight capacity 650 tons, was launched in northeast China. It was launched on 26th of July in Dairen. It had four refrigeration units, two high-speed, with temperatures of -18°C, and two others with temperatures of -2°C. Its sailing speed was given at 10.2 knots. It was said to be the biggest refrigeration ship made in China (SCMP 2312).

In November 1959 the first oceanographic ship designed and built in China was completed in Shaghai (SCMP 2137). In June 1959 another research vessel for oceanography was launched. Called the "Golden Star" (金星 or Kin-sing or Chin-hsing), its particulars are: Displacement = 1,500 tons; Average speed = 13 knots; the vessel was to be fitted with instruments in Tsingtao (SCMP 1548).

Marine Fishing Gear and Methods of Fishing

The fishing gear used in marine fishing by the Chinese is varied. It includes hooks (baited or baitless), stationary and drifting trap-nets, purse seines, twin-trawl nets, enveloping and shore-sweep nets, traps and pots.

Up to 1960 ropes and nets were chiefly made from natural fibre. The most common of these were sisal, manila, hemp, silk, various local plants (such as chi-ma, puluma, taiwanma), kenaf, and rice straw. Synthetic materials were used in small quantities for the production of traps. The main manufacturing centres were located in Dairen, Shanghai, Yent'ai, Chefoo, Canton, Mukden (or Shenyang) and Tsingtao.

The fish nets were preserved through the use of local preparations, the main ingredients for which were tannin, tung oil, soya-bean oil, coal tar, pig blood and white of chicken egg. The most commonly used were tung oil and soya-bean oil. Since 1956 preparations described by VINRO (The All Union Scientific Research Institute of Marine Fisheries of the USSR) are being used as well (Saburenkov 1961).

Fishing nets have a long history in China. Thus, for example, purse seines were used in China one hundred years before they were known

in Europe. Purse seine methods are used for mackerel and saury in the northern part of the Yellow Sea, and for sea sheat, saury and other pelagic fish of the Gulf of Tonking. In 1959 the industry had 165 large purse seines of 500 to 600 meters long and 50 to 60 meters deep (Saburenkov 1961). When trawling the Chinese lift only the trawl board and the sack with the catch on deck.

The Shanghai company building trawlers has introduced a horizontal roll or drum for bringing in the cables and nets of the trawl. It is mounted in the rear of the trawler perpendicular to the diametrical area. This shortens the time of lifting the trawl from thirty to ten minutes.

In China twin-trawling has been in use since 1921, side trawling since 1905 and stern trawling since 1956. In twin-trawling a method was introduced in 1958 in which a mobile board is affixed to the bulwark by hooks and kept in a horizontal position by guy ropes. The trawl is placed on the board and at the required moment is quickly unwound overboard by releasing the guy ropes.

As a rule the trawlers fishing in the open seas go out for trips lasting from eight to twenty days, and usually make thirty trips a year. The annual catch per vessel is from 450 to 800 tons (Saburenkov 1961). The most popular trawls used are from 560 to 840 mesh, used on boats from 100 to 250 HP. The size of the trawl in Chinese practice is determined by the number of meshes in the perimeter of the trawl along the lower warp. The speed of trawling is from 1.4 to 3.0 knots, depending on the vessel and the type of fish sought. Yellow croaker is fished at 1.4 to 1.8 knots. Shortly before 1959 the speed at which some of the ships fished was

increased to 2.5 to 3.0 knots. Because of the increase in speed, catches of cutlass fish were 1½ to 2 times greater in size. An increase in cable length for stern trawling from 75 to 126 meters had a favourable effect. For stern trawling and purse-seine fishing, trawlers of 250 to 300 HP built in Canton shipyards are preferred.

Characteristic of the Chinese method of trap-net fishing is the setting of nets against the tidal currents, making possible their use with incoming and outgoing tides. Special equipment permits the mouth of the trap to rise at low tide. The trap-nets can be subdivided into drift nets and stationary or anchored nets. With drift nets various devices are used to regulate the speed of the drift at different depths.

In their fishing methods the Chinese make good use of the traditional knowledge of the idiosyncrasies of fish. For example, yellow croaker is located with the aid of listening devices that receive the sounds emitted by the fish at spawning. Sharks are harpooned during the time when they remain immobile on the surface of the water, and flying fish are enmeshed in outstretched nets dyed the colour of seaweed which the fish choose for spawning. Octopi are caught by lowering earthenware jars: the creatures get into these to spawn and normally will not get out again until finished, thus they can be pulled to the surface and captured (Saburenkov 1961). Extensive use is made of light in catching cuttle fish, molluscs (Ammastrephus pacificus), some herring varieties, anchovy, sardines and others.

With modernization of the fleet modern fishing aids and communication equipment were introduced. For example, in 1957 a radio

station was established on the Choushan Islands which broadcasts weather reports to the fishing vessels (SCMP 1637). Each team in the fishermen's cooperatives has been provided with a receiver set. Fish locating hydro-acoustic equipment has been gradually introduced since 1954. The shallowness of the majority of the fishing grounds has led to the development of narrow depth-range equipment. By 1959 ten types of sonar gear were in use on motorized vessels.

In the spring of 1964 it was reported that a new ultra-sonic wave apparatus for detecting fish shoals, suitable for large and medium-sized fishing vessels, had gone into production in Shanghai. The new apparatus first constructed in early 1963 was tested at a number of coastal fishing grounds and was readily accepted as one of the best models used in China (SCMP 3194). The transmission of ultra-sonic waves locates and determines the density of a fish shoal within a radius of 300 meters.

In addition to sonar sounding sets other modern equipment produced in China includes electrically operated net-weaving machines, winches, improved pulleys and tackle, nylon nets and equipment for processing plants (Yen 1965).

Fish Culture in Marine Waters

When in 1958 and 1959 the party put forth the slogans: "Where there is water there must be fish" (Saburenkov 1961), and "March toward the lakes and reservoirs and take a still bigger leap forward in freshwater fish farming" (Anon. 1956a), it was not thinking only of freshwater fish culture. At a conference of fish culture experts held

in Changchiang in Kwantung Province in March 1959, the advantages of fish rearing in the sea were summarized under the following headings:

(a) Some important species can be reared only in salt water.

(b) Marine fish culture does not encroach upon the use of farm land.

(c) Marine fish production is stable, and therefore consumers are assured of regular supply.

(d) Marine fish are plentiful and easily transported.

(e) Sea water is rich in plankton, which simplifies the feeding of the fish.

(f) Sea water is constantly circulating and therefore fish rearing areas are constantly being replenished with oxygen by tides (JPRS 12253).

As a rule the fish rearing enclosures are built anew every year. Work starts in April and is completed in May. A selected area is enclosed by a wall and is washed out by the tide several times. The exits are then closed and fry put in. It was stressed that the water must be at least two meters deep, that there must be a sufficient number of fry, and that the survival rate must be over 70 percent for the operation to be considered a success.

By the beginning of the present decade the total fish culture production accounted for 32 to 36 percent of the total output, with over 55 percent of the output from fish culture being obtained from the sea. Total marine areas suitable for culture were estimated at 450,000 ha.. Of these 60,000 ha. were utilized by 1957; 120,000 ha.

by 1958; and 250,000 ha. by 1959. However Chang (1959) gave the total salt water area suitable for culture as 900,000 ha. (15 million mow), and the area utilized as 90,000 ha. (1.5 million mow). By mid-1958 the area for marine fish culture was said by another source to have reached 62,660 ha. which was double the 1957 figure, and the estimated production was 330,000 tons, a three-fold increase (SCMP 1815b).

The share of aquatic culture in the total output of marine products increased from 3.8 percent in 1957 to 8.6 percent in 1959 (Saburenkov 1961). The increase was mainly due to new areas for seaweed cultivation along almost the entire coast. By 1959 in addition to seaweed; oysters, trepangs, grey mullet, shrimp, prawns, scallops, crabs, octopi and sea slugs were also being cultivated in the sea. A dozen large culture farms were built by the government for the cultivation of beche-de-mer, campoy and others (SCMP 1815b).

Other Marine Products

Cultivation of Seaweed

There are about 200 varieties of seaweed in China's coastal waters (JPRS 11957c). According to Chinese scientists, among them there are three main types: Rhodophyceae (red algae), Chlorophyceae (green algae) and Phaeophyceae (brown algae) (JPRS-L-1862D). Of the three, the last two constitute the mainstay of the seaweed industry. Ulvaceae, Hutai and Chiao-mo of the Chlorophyceae can only be partially used as food and they have little commercial value. Some of the members of the Rhodophyceae, such as Gelidium cartilagineum and Gracilaria confervoides, are found in plentiful supply along the southern coast

and are used in the production of agar-agar. Gloiopletis fureata and Ceramium rubrym are not useful as solidifying agents, but are good material for use in the textile industry. Until 1949, according to the Institute of Oceanology of China, the Rhodophyceae were not sufficiently utilized.

Kelp (Laminaria japonica, of the Family Phaeophyceae) has had a long history as an industrial raw material, having served as a source of potassium salt and iodine. Kelp has in the past been imported from Japan, north-east Korea and Siberia, where coastal conditions are similar to the north coast of the Yellow Sea. The belt of warm water separating the areas prevented the kelp from spreading down to the Yellow Sea region. Since 1957 kelp has been growing naturally around Talien where the Japanese began cultivating it. They also started cultivation of kelp in Yen-t'ai (Chefoo) in 1943.

The first Chinese efforts to cultivate kelp began in 1946. In 1950 the Shantung Provincial Aquatic Products Cultivation Farm was set up to investigate the methods of kelp cultivation. In the same year studies of the biology of kelp were also initiated at the Tsingtao Marine Biology Laboratory (now the Institute of Oceanology) of the Chinese Academy of Science, and at the Central Marine Products Institute (now Marine Products Institute of the Ministry of Aquatic Products).

Today kelp is cultivated all along the coast from the mouth of the Liao to Fukien. Cultivation is carried out in bays where the water is about ten meters deep. The seaweed grows on ropes tied to floating bamboo poles staked to the sea bottom. In late autumn spores

are collected from mature plants and lodged on short "ladders" of bamboo splints hanging from the poles. In January the spores, now grown into sporelings, are fixed to ropes at regular intervals. They require four to five months to grow to three meters or more in length.

The government operates glass roofed, temperature controlled cold beds and also undertakes research on the control of algal weed that tends to hamper the growth of kelp. Fertilizer, when considered necessary, is introduced through porous pottery vessels from which it seeps out very slowly. One kilogram of ammonia nitrate results in an increase of four kilograms of kelp (a similar ratio to that observed in agriculture).

Kelp will grow in water from 0°C to 13°C. Off the Chekiang coast the water temperature at the surface remains below 13°C for five months, and off Fukien for four months. Consequently kelp transplanted there can grow to marketable size (Tseng 1964). Due to its variety of functions as a good emulsifier, stabilizer, dispersing agent, thickening agent and coagulating agent, kelp is used by the food, medical, textile, rubber and mineral industries. Many maritime countries, including Great Britain, Japan, Norway, Russia, France and the United States have established brown algae industries, using Laminaria japonica and Sphacelariales sp..

Research in China on the many uses of brown algae was started only in 1952, when artificial fertilization of kelp had just begun, and production was barely 20 to 30 tons per year. It was found that one species of algae, Sargassum enerve, showed promise although it is not generally used in other countries. In 1953, 1,000 tons of it were grown

for the production of algic resin. In the course of experiments carried out during 1954 it was found that "Hai-sung-tse" (the North China variety of Sargassum enerve) was a good industrial raw material for the production of brown resin. In 1954 experimental production was carried out in cooperation with the Tsingtao Light-Industry Department. The results were said to be quite satisfactory and the by-product used as stamp paste.

Commercial production of brown algic resin from Sargassum enerve was started in the first part of 1957. In 1958, during the Great Leap Forward, the quantity of artificially grown kelp was greatly increased. It was planned to use part of it as an industrial raw material. On the recommendation of the party a new method of integrated processing was introduced, allowing for step by step extraction of six chemical products: algic resin, glycerol, potassium chloride, iodine, brown algic powder (containing brown algic sugar gel) and brown algic viscous agent. It was recommended that:

(a) Kelp and Sargassum enerve should be cultivated as the principal raw materials.

(b) That a use be found for products such as algic resin powder and sugar gel.

(c) That ways be found to make use of the root of the plant, which does contain valuable chemicals.

It was considered that the output of Sargassum enerve could be raised to 100.000 tons (dry) per year. It was suggested that in the southern provinces brown algae resin could be produced by an integrated process of natural fermentation in hot weather which could yield at the

same time acetone, alcohol, potassium and iodine. It was also suggested that kelp be used to produce tar (a good insecticide), ammonia aqua, potassium chloride, iodine, and activated carbon through distilling.

In addition it was pointed out that in the south, goose-palm algae (with an iodine content only less than in kelp), Ulopteryx pinnatifidia, Padina arborescens, Homis sp., Ascolicheses sp., wang-ti algae, and horn algae were also available. In the north are found Nemalion vermisculare and Scytosiphon lomentarius. All of the above could be mixed with Sargassum enerve and used as a raw material (Tseng 1964).

The development of the method of planting in areas where the water remains suitably cold only for part of the year gave a new impetus to the seaweed cultivation industry. Along the coast of Kwangtung and Fukien Laminaria sp. is now cultivated. The seedlings for Fukien, where seaweed growing was started in 1958, are cultivated in Pohai Bay and then transported to Fukien by rail in wagons cooled with ice. On arrival the seedlings are handled by the seaweed artificial culture stations which have been established in Amoy, Lien-kiang and Hsia-p'u (JPRS 18237).

In the summer of 1958 it was reported that seaweed was being grown in 118 places along the coast. The coastal provinces were to cultivate 100,000 ha. of seaweed during the Second Five Year Plan, with an annual output of six million tons (SCMP 1810). In November 1958 success was claimed in developing new methods for growing seedlings of edible seaweed (SCMP 1901). During 1959 the output of seaweed in the Lushun-Talien area was to go up from 23,000 to 220,000 tons (SCMP 1975a).

By mid-1959, as in other branches of the fishing industry, a more realistic picture was presented. An output of 45,000 tons of dry seaweed (8 times more than the 1958 level) was reported, compared with 12,000 tons in 1957. It was also reported that in 1959 cultivation would be increasing tenfold, and that 40,000 people were to be engaged in growing seaweed (SCMP 1984). By January 1960, the reported output for 1959 was only four times the 1958 level and the area used for culture had increased six times (SCMP 2177).

In 1960 the output of kelp was stated to be double the 1959 figure, which was then reported to be 20,000 tons, while the 1959 output was said to be seven times greater than in 1957. The yield per acre in 1960 was given as follows: 15 tons per hectare in Liaoning Province, 30 percent more than in 1959; 7.5 tons per hectare in Fukien. Before 1949 the output in Pohai Bay was stated to be 2.6 tons per hectare (SCMP 2413).

By 1962 the number of people engaged in in seaweed cultivation was stated to be 20,000 (SCMP 2687a). In the spring of 1963 it was reported that a new variety of seaweed had been developed by Chinese scientists, which was named "Hai-tsing No. 1". It was developed by Fang Tsung-hsi and Wu Chao-yuan under the guidance of Tseng Cheng-kuei, Vice Director of the Institute of Oceanology. Its advantages are stated to be that it gives 20 percent higher yields and can withstand higher temperatures (SCMP 2984). The last characteristic is particularly valuable since for the greater part of the year, the water along most of the China coast is too warm to grow kelp.

Seaweed is being put into industrial use as raw material in the manufacture of glue, paste used in the textile industry, paper-making and film industries. Hai-jen seaweed (Che-ku-t'sai) is said to be very effective for the extermination of parasites (JPRS 11957c).

Pearl Industry

The pearl oyster industry in China dates back to the Han dynasty (206 B. C. to 220 A. D.), when natural pearls were gathered. In 1499, a Ming emperor is reported to have ordered 1,000 boats in Kwangtung to gather pearl oysters (SCMP 1732). The industry was destroyed when the Japanese burned the Chinese boats. This also resulted in the decline of the Pailu port (SCMP 2533b).

In 1958 China started work to re-establish the pearl industry in the south Chinese port of Hoppo, which in the past had five oyster culturing grounds. Two oyster beds had been set up in 1958. On harvesting the pearl oyster beds in 1961 it was found that 90 percent of the treated oysters were thriving. More recent reports confirm that the industry is growing well (Ta 1964).

No specific reference is made in recent Chinese publications of the natural distribution of oysters, but Campbell (1883) stated that they were found in the northern shores of the Shantung Peninsula, in the mouth of the Yangtze and the Ningpo Rivers, as well as all along the coast of Fukien and Kwangtung Provinces and on the seaboard of Taiwan.

Mussels

In the fall of 1961 successful artificial breeding of edible

mussels was reported by the Institute of Marine Products and Oceanology in Lushun-Talien (SCMP 2578). The first three million mussels reared were reported to have grown two to three cm. in size.

Sea Cucumbers

In 1956 it was reported that 100,000 sea cucumbers had been artificially inseminated and that the survival rate was being studied (SCMP 1344).

Sea cucumbers or beche-de-mer are found mostly along the coast of Shantung Province, and also off the coasts of Liaoning, Hopeh, Fukien and Kwangung Provinces and on Sisha Islands. Containing 61 percent protein, sea cucumbers are of great nutritional value.

Other Invertebrates

Prawns are found in the Pohai Sea and the northern part of the Yellow Sea. The peak season is in spring. Shrimp are caught mainly in the coastal areas of the Pohai Sea, and are usually dried. Abalone is found in both northern and southern waters. Apart from the above, also of economic importance are crabs, clams, limpets and scallops (JPRS 11957c, Anon. 1965a, Campbell 1883).

Whaling Industry

The development of the whaling industry in China is a recent phenomenon. The industry appears to be centered on Canton and Dairen (Saburenkov 1961). The first Chinese whaler started operations in April 1955, when it went out on its first voyage from Dairen (SCMP 1037). Two new whalers were expected to enter operations in 1958. During the

same year it was reported that a plant to render down the whales to blubber was under construction on Hai-yang Island (39°3'N, 123°10' E) outside Talien (SCMP 1768).

In 1962 it was reported that the whaling fleet already numbered six vessels (SCMP 2777). In the spring of 1964 a new whaler "Yuan-lung" built in Shanghai was added to the fleet (SCMP 3187). It has engines of 1200 HP, modern telecommunications system, power generating equipment, electrically operated winches and other modern equipment. The whaler was designed and built by the Shanghai Chin-hsin Shipyards.

The output of the whaling industry can be judged by the following: in 1958, 53 whales were caught during the first quarter of the year (SCMP 2034); the catch during the first half of 1962 was 104 whales, which was said to be more than the catch for all of 1961 (SCMP 2777).

Minerals

The extraction of salt and other minerals from sea water has been of great economic significance in China. 1000 grams of sea water contain 35 grams of salt, 90 percent of which is table salt. The main salt-producing areas in China are Lushun-Talien in Liaotung, Changlu in Hopeh, Tsingtao in Shantung and Huaipei in Kiangsu (JPRS 11957c, Jen 1964).

The Marine Fisheries by Province

Hopeh Province

The increase in the fishing industry of Hopeh Province was due to three factors: the proximity of the Pohai fishing grounds; the

availability of salt from the Changlu salt works (an essential ingredient in fish preserving processes, particularly of the traditional type). Situated close to the capital, the city of Tientsin has been in the forefront of the reforms introducing cooperatives and later communes (SCMP 1257).

The production target for Hopeh for 1951 was 100,000 tons. The most important species landed here are yellow croaker, mackerel and prawns (Jen 1964). In 1963 restrictions were enacted in the province against fishing during the spawning time of fish and shrimp (JPRS 23622).

Shantung Province

In Shantung Province the fishing industry is in an even better position than in Hopeh Province. This province has 2,400 km. of coast line, along which are located such important fishing industry centres as Yen-t'ai (or Chefoo), Weihaiwei (growing in importance with the establishment of new fishing grounds) and Tsingtao (SCMP 1939a). As in Hopeh the availability of salt has favoured the development of fish processing industries.

The most important commercial species in Shantung is the cutlass or hairtail fish (Saburenkov 1961). In the large fishing grounds in Laichow Bay, giant croaker and prawns are plentiful. The fish are concentrated in six areas covering 13,600 ha. (400 nautical sq. miles) (SCMP 1285b).

Between 1949 and 1962 the number of motorized boats along the coast increased eight-fold and by the latter date one-third of the catch

in the province came from motorized boats (SCMP 2846).

A new fishing harbour was planned in Yentai to accomodate 120 trawlers (SCMP 1711). A later report stated that the new fishing base was to have a refrigeration plant with a capacity of 9,400 tons, a slicing section to turn out 25 to 30 tons of fish daily, a sorting workshop for handling 130 tons of fish daily, and an ice plant to produce 180 tons of ice per day, plus an ice storage-house for 5,000 tons of ice. The harbour was to have a railroad spur line and a wharf of its own for transporting ice (SCMP 1780).

The total output of the province is not known, but in 1958 landings were reported at 550,000 tons, 83 percent more than in 1957 (SCMP 1939a).

Shantung Province now accounts for about one-third of the seaweed cultivation in China, although no seaweed was grown here prior to 1949. Initially the cultivation of seaweed was undertaken by the state, but by the end of 1963 three-quarters of the province's output came from the communes (SCMP 3139). The province has set up a research institute for the cultivation of marine plants. The Institute of Oceanology under the Chinese Academy of Sciences in Tsingtao is also interested in research on the cultivation of edible seaweed.

There appears to have been a constant increase in the prawn catch. 1956 was reported to have been a good year (SCMP 1285b), as was 1959, when landings of prawn during the first quarter were five times greater than during the same period the preceding year - amounting to 1,700 tons by mid-April (SCMP 2007). The rapidly increasing output

may have led to the depletion of prawn stocks. In 1963, as in Hopeh, instructions were issued restricting fishing during the spawning time of fish and shrimp (JPRS 23622).

In 1959 the first successes in the artificial incubation of prawns were also reported by the Yellow Sea Aquatic Producers Research Institute (SCMP 2007). However, since no subsequent claims were made in this field, it can be assumed that the success was not very startling in the long run.

Liaoning Province

In the south the province is flanked by the Pohai and the Yellow Seas. The coastline is rugged and rocky, providing many inlets and harbours, and also providing favourable conditions for the fishing industry. The fishing industry of the province is centred on Lushun-Talien (or Port Arthur-Dairen).

Details of the output of the province are difficult to get, but the planned output for 1958 was said to be 300,000 tons (SCMP 1768), reported to be 60 percent more than the actual output in 1957. Thus the output for 1957 would be about 190,000 tons. The output of crustaceans for 1956 was given at 80,000 tons and the output planned for 1957 as 100,000 tons (Chang 1959). If the plan was fulfilled or nearly fulfilled, this would mean that 90,000 tons of fish and marine plants were produced. Since the cultivation of kelp did not develop on a wide scale until 1958 (SCMP 2062), it can be assumed that the bulk of the 90,000 tons was made up in fish. Clams are also important in the fisheries output. It was

reported that in 1961, 610 fishing boats with 3,600 men (production staff, workmen and fishermen) were employed in Ching-chou Bay, where 14 million "mao" clams were obtained over the period from the 10th of March to the 20th of April (JPRS 11957e).

The output of seaweed in the first half of 1959 was stated to be 70,000 tons, more than the total for 1958 (SCMP 2062). Of this, however, only 29,000 tons were said to have been edible (SCMP 2051b). It can be assumed that the output of seaweed in the first half of 1959 was not too much above the 1958 level, or the percentage would have been given by how much the output exceeded the previous year. It would appear that in 1959 more than half of the seaweed was of non-edible varieties.

During 1961, from the beginning of the year until about mid-April, 34,000 tons of fish and prawns were landed in Liaoning Province in spite of unfavourable weather (SCMP 2488). As in the other provinces restrictions were imposed in 1963 on fishing during the spawning period of fish and shrimp (JPRS 23622).

Shanghai City Area

In Shanghai City state-operated fishing vessels accounted for 87.6 percent of the total output in 1961, and for 57.7 percent of the aquatic products sold in fish markets (SCMP 2687b). In 1961 the output of aquatic products in Shanghai City was double the 1957 level and the average growth for intervening years has been 29.6 percent per annum. With the growth of the industry new plants were constructed to

meet requirements. In 1956 a new processing plant designed to employ 1,300 workers was built in Whampoa (SCMP 1292).

The area's main fishing harbour is on Fushing Island where, according to a report published in 1962, considerable room for expansion was still available at the time. The island is situated along the lower stream of the Whampoa River. The harbour has facilities for repairing fishing vessels, production of ropes and nets, maintenance workshops for telecommunications equipment, facilities for loading and unloading fishing boats, transport equipment, refrigeration facilities, and fish processing plants. The wharf of the fish market at Kiangsu Road and the wholesale department of the Aquatic Products Supply and Marketing Company at Wangchia Wharf can handle 1,500 tons of aquatic products per day.

Apart from being the most important trading port in the province, the city of Shanghai is also an important fishing industry port and processing centre. The main species landed at Shanghai are small yellow croaker and hairtail fish (Saburenkov 1961). In 1956 a fish processing plant employing 1,300 workers was built in Shanghai. The plant was located on the Whampoa and trawlers were able to come right to the plant to unload their catch. The plant's output is for both export and home consumption (SCMP 1292). The fish processing factories of Shanghai and the East Sea Pharmaceutical Company have processed not only large quantities of aquatic products and cooked food for fish mark s, but also have found ways of making comprehensive use of fish waste.

However, the city of Shanghai's fishing harbour has not kept up

with current growth. The wharf facilities and ship repairing yards are backward. There are only 400 meters of anchorage space available for fishing vessels. The supply of oil and ice is not sufficient to meet peak demands. Ice in particular is in short supply during the summer (SCMP 2687b).

In 1962 the Shanghai Research Institute of Aquatic Products and the Shanghai Marine Products College undertook investigations of the aquatic resources of the city. An area of sea of 13.6 million ha. (40,000 nautical sq. miles) off Shanghai, and 120 sq. km. of beaches, bays, lakes and ponds were examined. 440 species of salt water fish, 100 species of freshwater fish, 150 types of shell-fish and 60 types of aquatic plants were found in the waters surveyed. On the basis of the investigation charts of fishing grounds have been drawn up for future use (SCMP 2852).

In the spring of 1963 ten new trawlers put out to sea from Shanghai. They had better crew quarters and sanitary conditions than those previously in existence. They also had telecommunications, net handling machinery and fish detecting equipment (SCMP 2952).

The cold storage ships "Haifong" and "Haiou" have played a definite role in transporting aquatic products from fishing vessels and in return supplying them with needed materials.

Kiangsu Province

The province of Kiangsu is also a prime producer of marine fish. Lu-su-yang fishing grounds off the coast of Kiangsu are among the most

important ones in the country. In the summer of 1957 they yielded 62,400 tons of fish, caught by fishing fleets from Kiangsu, Chekiang, Shantung, Fukien and Shanghai (SCMP 1546). In 1956, 2,500 fishing boats put out to sea during the spring fishing season, 11 percent more than during the previous year (SCMP 1268).

In the summer of 1957 the province began the construction of a harbour at Lien-yung which was designed to handle 300 fishing trawlers. It was planned to have a fish processing plant, a boat building yard and a refrigeration plant (SCMP 1711).

Chekiang Province

Endowed with a rugged coast line and many off-shore islands, Chekiang Province has very favourable conditions for the development of the fishing industry, which has grown especially rapidly on the Choushan Islands, lying across from the northern part of the province's coastline. In the south lies the port of Wenchow, which is an important base for the fishing grounds of the same name. The main species caught off the Chekiang coast are cutlass fish, large yellow croaker, small yellow croaker and cuttle fish.

The Choushan archipelago, the most important marine fishing ground in China, deserves special consideration. During the war the fishing industry of the Choushan Islands was badly disrupted, so that the 1950 output amounted to only 2 percent of the prewar output, but by the following year the landings climbed to 70 percent of the prewar level. In that year the government spent five billion Yuan (2½ billion U. S. $)

on a fish processing and fish preserving plant on the island (SCMP 134).

In the years that followed, with government support, the Choushan Islands built up an integrated fish processing industry centre capable of handling 50,000 tons, or over half of the marine products output of Chekiang Province. It has facilities for canning, freezing, drying and converting fish into fish meal. The Choushan marine products cannery has a capacity of 75 tons a day. Apart from this plant, fish processing is carried out in communes which produce dried fish, fish sauce and fish glue. The islands also produce for export eels in tomato sauce, croaker in oil, spiced hairtail fish, braised cuttle fish and other delicacies (SCMP 2721).

Some intuitive appreciation of the growth of the Choushan fisheries can be gained from the following: during May 1951, 10,000 tons of fish were landed (SCMP 134). In 1953, 45,000 men and 10,000 boats landed 19,000 tons of large croaker (SCMP 582). In August 1958 it was reported that the fishermen landed 150,000 tons of yellow croaker, shad, pomfret and seaweed (SCMP 1832). In November 1958, 24,000 boats and 100,000 men off the Choushan Islands caught 250,000 tons of fish (SCMP 1906). This was exceeded in 1959 in spite of the weather being exceptionally windy (SCMP 2361). In May and June alone the catch off the Choushans was 65,000 tons (SCMP 2056).

In 1953 the first two motorized junks were introduced in the Choushan fishing grounds. They operated together as a pair with 10,000 other boats (SCMP 582). By 1957 the number of motorized junks had increased to 76, in 1958 to 150 (SCMP 1727), in 1959 to 200, by 1962 to

415 (SCMP 2715), and by 1963 to 1,200. The motorized junks by 1963 accounted for 40 percent of the landings (Yen 1965).

The combination of pressures for higher output and modernization of the fleet and gear led to a growth in the industry's output in Chekiang Province as a whole. In 1955, for example, the spring landings of shark and cuttle fish were reported to have been 75,000 tons, which was more than was caught in 1954 (SCMP 1062), and by the middle of November the landings of croaker had reached 41,000 tons. This was achieved by starting the fishing season half a month earlier than in previous years. The total output of the fishing industry in 1955 was expected to reach 386,000 tons (SCMP 1176b). Part of the success was attributed to the fact that by the fall of 1955 31 percent of the fishermen had joined cooperatives and another 44 percent were in mutual aid teams, which made it possible to use larger sized fishing equipment (SCMP 1176b).

As in other provinces 1958 was the year of great plans to move ahead. The initial plan provided for an increase of 20 percent, but later the figure was changed as optimism grew (SCMP 1711). The expected catch of small croaker was announced to be 60,000 tons (SCMP 1727), and landings of sharks were expected to number 1,000 (150 fish were claimed to have been caught by the beginning of May) (SCMP 1773b). There was also to be an increase in the amount of seaweed grown: 1,859 million edible plants (of Laminaria sp.) were to be grown in 1958.

Development of the industry can be seen in that out of 10,000 boats which put out to sea in the middle of May 1958, 200 were motorized

junks, which was stated to be seven times more than in the previous year (SCMP 1905). To meet the demand for skilled labour 50 fishery schools were set up in cooperatives to instruct fishermen in modern scientific information about the sea and its products (SCMP 1773a).

Fukien Province

Fukien appears to specialize in fish culture more than any other province. In the spring of 1955 four new fish rearing areas were established along the coast and within the province (SCMP 1105). Together with two previously existing ones they were expected to provide 3,000 tons of fish and marine products by the end of the year. Two more fish culture areas were under construction at that time.

The province has a coastal fishing area of 140,000 sq. km. (SCMP 1160). The area utilized for marine cultivation was 66,000 ha. in 1957 and 110,000 ha. in 1958 (JPRS 12253). The area of fish rearing grounds along the coast was 3,000 ha.. In 1958 it was planned to enclose another eight to thirteen thousand hectares, of which more than seven thousand were to be open by the end of the year to produce 100,000 tons of aquatic products. In Amoy in 1958 1,000 fishermen were engaged in catching one billion fry, 10 percent of which had been caught by mid-February (SCMP 1959).

In 1957 the province produced 300,000 tons of marine products, 10 percent more than in 1956 and 50 percent more than the highest output before 1949. The production plan for 1958 was 360,000 tons (SCMP 1783). In July 1958 it was reported that 175,000 tons of fish

had been netted during the first half of the year, which was 60,000 tons more than during the same period the previous year. The output of algae and couch products amounted to another 85,000 tons (SCMP 1808).

In September it was reported that the total output of the fishing industry in Fukien was 580,000 tons (SCMP 1858). Another report gave the following analysis of the total: 240,000 tons were derived from marine fishing, 50,000 tons were of molluscs and cultivated seaweed. The report pointed out that the acreage for seaweed cultivation increased 300 times compared with 1957, reaching an area of 4,000 hectares. Rearing areas for oysters, mussels and other products comprised 23,300 hectares, 4,000 ha. more than in 1957 (SCMP 1880).

In 1959 it was reported that the output during 1958 was 1,200,000 tons of fish, shell-fish and seaweed (SCMP 1959). The output for the first half of 1959 was given at 205,000 tons, with an area of 2,000 hectares opened for cultivating fish and seaweed (SCMP 2062).

Kwangtung Province

Kwangtung's coastline is ideally suited for the development of marine fishing industry. It is long and rocky, indented with many bays and inlets. More than 700 islands of various sizes are scattered throughout the South China Sea. Hainan Island, 34,000 sq. km. in area, is also within the administrative jurisdiction of Kwangtung Province. According to the Kwantung Marine Products Cultivation Company, the province has 106,000 ha. (1,060 million sq. m.) of shallow sea suitable for cultivation, of which only one-third is being used.

At the beginning of 1955 five state owned culture grounds for shell-fish and edible seaweed with a combined area of 5,800 ha. (58 million sq. m.) were enclosed off the coast. The expected annual output from this project was around 10,000 tons. It was planned to start culturing pearls, abalone, shrimp, crabs and sea cucumber in 1956 (SCMP 1053).

The principal fishing grounds of Kwangtung Province are those of Hainan Island and the Gulf of Tonking. According to Chinese and Vietnamese scientists, in the Gulf of Tonking alone it would be possible to catch 800,000 tons of bottom fish and 80,000 tons of pelagic fish annually. The principal species caught are sea sheat, saury, Ilisha sp., cutlass, shark, large yellow croaker, shrimp, prawn, cuttle fish and molluscs (Commasrephys pacificus) (Saburenkov 1961).

There are considerable areas of fishing resources not utilized in the province. Of the 116 million ha. (448,000 sq. miles) of fishing grounds, only 13 to 15 mil. ha. (50,000 to 60,000 sq. miles) are utilized, and of 330,000 ha. suitable for cultivation of various products only 52,000 ha. were made use of in 1959 (Saburenkov 1961). Another source gave the freshwater pisciculture area of the province at 300,000 ha. (5 million mow) and the areas of shallow seas at 360,000 ha. (6 million mow) (JPRS 24593).

From the earliest days the government has supported the province's fishing industry. In 1953 it granted the fishing industry in Kwangtung 53 billion yuan and set up 54 typhoon and alarm stations (JPRS 24593). In 1956 work began on the construction of 17 sheltered areas to accomodate

20,000 vessels; dredging of the main fishing harbours and shallow coastal waters; erection of navigational markers and typhoon signs; and provision of facilities for the supply of freshwater. The work was planned to take two years (SCMP 1390).

A modern fishing industry centre was initiated near Canton in 1955 by the State South Sea Marine Products Company. The plan included the building of shipyards, machine workshops, ice making plants, a combined processing plant and a storehouse. The area of the project was to have been 300,000 sq. meters, and it was to be completed in 1957. In all it was to include 36 units, among them a factory for the production of cod-liver oil, fish bone meal and a meat canning plant. The base was to provide maintenance facilities for 30 trawlers. Scores of motor fishing boats in the 100 ton class were to be built here annually. Completion during 1955 was planned for the following main units: shipbuilding yard, machinery plant, fishing gear warehouse and a fishing office (SCMP 986). In 1956 it was also reported that a cold storage plant was under construction in Canton with a planned capacity of 1,600 tons of ice (SCMP 979). In May of the same year another report stated that the overall project had been reduced from 36 to 23 units and that 12 items of the first stage were completed. The building capacity of the shipyard was then specified to be 12 motorized vessels of 100 ton capacity (SCMP 1064).

The fishing population of the province was reported in 1955 to be 560,000 (SCMP 1038). Although the number of people engaged in the fishing industry has not changed appreciably, the output has grown from

year to year due to capital investments in the construction and modernization of the fleet and the introduction of more modern methods of fishing.

The fishermen along the coast landed approximately 193,000 tons in 1953 and 290,000 tons in 1954 (SCMP 967). The total landings for the province in 1954 was 376,000 tons and the plan for 1955 was to produce 406,000 tons or 8 percent more than in 1954. To achieve this it was decided to build an additional 190 deep-sea fishing boats for fishermen organized into cooperatives and mutual aid teams (SCMP 982). Two months later the figure planned was raised to 446,000 tons (13 percent above the 1954 figure) (SCMP 1024), of which 300,000 tons were to come from marine fishing (SCMP 1038). It was reported that 250 new fishing boats were to be built compared with 190 stated two months earlier. In 1954 316 boats, 12 typhoon shelters and 59 warning stations (SCMP 1038) were built with government aid. 240 trawlers were reported under construction in April.

Kwangtung fishermen, who at the time accounted for 25 percent of the national landings, received loans in 1954 amounting to 2.6 million yuan (SCMP 1032). At the end of 1955 it was reported that the government was spending seven million yuan in loans to fishermen, 30 percent more than in 1954. During the first three years of the First Five Year Plan the state lent fishermen 19 million yuan, most of it to deep-sea fishing enterprises (SCMP 1137).

More cold storage facilities and refrigeration ships were provided and eight more cold storage plants and ice producing plants

were to be completed by the end of the year. Two refrigeration ships were to join the fleet (SCMP 1127). Between 1949 and the autumn of 1955 the number of deep-sea fishing vessels in Kwangtung increased from 1,600 to 2,500. Between 1953 and 1957 the number of fishing boats in the province increased by 16,000 (SCMP 1696).

The marine landings for 1955 amounted to 400,000 tons, 130,000 tons more than in 1954, more than twice the 1953 figure, and 40,000 tons more than the 1936 output. The plan for 1956 provided for landings from marine waters of 477,000 tons (SCMP 1244).

The overall output for 1956 was stated to be 520,000 tons, which was 50 percent more than in 1949. This gives a 1949 figure of 345,000 tons. The target for 1956 was set at 620,000 tons (SCMP 1388). It was not realized, for in 1958 it was reported that the output for 1957 was 630,000 tons, and that this was 18 percent above the previous year; thus giving the output for 1956 at about 535,000 tons (SCMP 1696) - as against the target of 620,000 tons. The growth of the industry for the country as a whole kept pace with Kwangtung, which still accounted for 25 percent of the total (SCMP 1696).

The initial version of the plan for 1958 provided for an increase of 17 percent over 1957 (SCMP 1711), but a month later it was stated that the expected output was 920,000 tons, 37.3 percent above the previous year, for which the output was now stated to be 677,000 tons. The increase was to be achieved through the construction of more boats, mechanization of operations, cultivation of more seaweed and other marine products, and an expansion of deep-sea fishing. It was stated

that at the time only 20.4 million ha. (60,000 nautical sq. miles) out of 153 million ha. (450,000 nautical sq. miles) were being utilized (SCMP 1741).

The catch for 1959 was reported at 1,127,000 tons, of which 567,000 tons was from sea fishing, 191,000 tons from marine cultivation, 292,000 tons from freshwater culture and 77,000 tons from freshwater fishing (Saburenkov 1961). In 1959 50 percent of the catch in Kwangtung was salted, 20 percent was dried and 30 percent sold fresh (Saburenkov 1961). It is very likely that the figures for 1958 and 1959 were grossly inflated, for in 1964 it was stated that the output of marine products in the province amounted to 677,000 tons, which was the highest among the provinces (JPRS 24593).

As can be seen from the figures for 1959, fish rearing and cultivation of aquatic products occupy an important place in the fishing industry of the province. This is a result of deliberate efforts to expand fish culture in marine waters. In 1956 six cultivation centres were planned to be established along the Kwangtung coast (SCMP 982). At the end of 1958 the output of marine cultivation in Kwangtung Province was 250,000 tons, which was said to be 5½ times the 1957 level, or a jump from about 45,000 to 250,000 tons. At the same time the area under cultivation had increased tenfold, reaching 253,000 ha. (SCMP 1910). (However according to Saburenkov (1961) the area used for marine culture amounted to 30,000 ha. in 1958 and only 50,000 ha. in 1959).

In addition to fish, marine cultivation included lobsters, mussels, abalone, sea cucumber, crabs, razor clams, sheath clams, purple

larvae and edible seaweed.

In Kwangtung Province trawl gear accounted for 60 percent of the fishing industry landings, enveloping sweep-nets for 10 percent, hook gear for 9 perecent and trap gear of all types for 9.5 percent (Saburenkov 1961).

SOCIAL ASPECTS OF THE FISHERIES

Resettlement of Fishermen on Land

The reasons for resettling fishermen and their families on land are many and complex and differ depending on area and circumstance. The presence of family members on board reduced the capacity of the boats, since personal belongings and food for the non-working members of the family had to to be carried as well. With motorization this became a real problem.

The resettlement of fishing families on land made it possible to utilize boats as means of transportation, and also to use formerly unproductive or unemployed family members in various agricultural and industrial ventures on land, such as rope manufacturing, textiles, agriculture and fish culture. The fact that fishermen with families on board felt freer to escape may have prompted the government to press for the settling of families on land. These families thus became hostages left by those who went out fishing. This aspect may have become even more important with the motorization of the fishing fleet which increased the range and the speed of the vessels.

The government in the past has committed itself to the policy

of improving the position of the poorer boat dwellers and is trying to redeem its pledge. The party and the government have persistently striven to pursue a policy of mass education. Without resettling the families on land the accomplishment of this policy was made more difficult, although some attempts have been made to provide mobile floating schools (SCMP 2044, SCMP 3035, SCMP 3276).

Employment

The volume of the catch combined with low productivity of labour, due to the low level of mechanization, are responsible for the large numbers of people employed in the fishing industry. The total number is given at 4.5 million, of whom approximately 1.5 million were actually fishermen, about half of whom were employed in freshwater fishing (Saburenkov 1961, JPRS 12253).

Political Indoctrination

Political indoctrination of labour, as can be expected, varies depending on the economic and political situation in the country. During the Great Leap Forward there was a great deal of political indoctrination. This was reduced during the years of crop failures when for obvious reasons the main emphasis was on the production of food. During recent months, when the difficulties following the Great Leap Forward and natural calamities have been overcome a greater amount of attention is once again being paid to political work. This takes the form of political discussions on board fishing boats, circulation of reading material, and the inclusion of political considerations into production discussions

(SCMP 3449a, 3449b).

Welfare

Fishermen had but an inferior status before the war, and experienced deterioration of their welfare during decades of disruption, civil wars and the struggle against the Japanese. However, relatively speaking, fishermen have enjoyed improved conditions under the present regime.

A general improvement in health, welfare and education have resulted from measures introduced by the state. Special considerations have been accorded fishermen, and in particular deep-sea fishermen, who have become an essential component in the government's schemes to solve the food problem. In 1964 there were five hospitals on the Choushan Islands for use of fishermen, in addition to clinics in communes and emergency stations on the boats. The popularization of hygiene and sanitation, the provision of drinking water, the elimination of insects and rodents, the preventative measures for people handling fish and crabs to reduce accidental infection, and the treatment of trachoma and injuries from fish bones all have contributed to some improvement for the poorer classes of fishermen (Fang 1964).

FISHERY REGULATION

Regulations for Conservation of Stocks

With the increased capacity and efficiency of the fishing fleet the problem of rational exploitation of fish reserves became increasingly more important, as some of the species were being rapidly depleted.

Although, as frequently stated by the government, the resources of the fishing industry are abundant, the authorities have found it necessary to issue warnings against overfishing the more accessible fishing grounds (SCMP 2959). In August 1957 clear demarcation lines were drawn between the fishing grounds to be used by the deep-sea trawlers and those of the fishing junks, in order to protect fishing resources and to avoid disputes. The Chinese waters west of the line linking the 17th point (29°N, 122°10' E) and the 18th point (27°30' N, 121°10'E) were closed to trawler fishing (SCMP 1595). The area used by state enterprises is generally taken to extend up to 124° E longitude.

In January 1963 it was reported that the average age of the small croakers caught dropped from 4.48 years in 1956 to 3.65 years. As a result it was found necessary to declare the main spawning grounds of the small croaker closed to fishing (SCMP 2900).

At the VII Plenum of the International Commission for the Study of Economic Resources of Fish of the Western Part of the Pacific Ocean, China's representative Cheng Chu-feng stated that the variation in the stocks of large yellow croaker in the waters of Kwangtung Province were due to irresponsible fishing of small sized fish in past years. He stated that in 1963 efforts were being made tc rebuild the stocks of fish (Anon. 1963).

In the summer of 1964 the State Council approved Draft Regulations for the Propagation and Protection of Aquatic Products, drawn up by the Ministry of Aquatic Products. The regulations had

three main purposes (SCMP 3287):

(a) To resolve contradictions between agriculture and fisheries.

(b) To prevent damage to the fishing industry through overfishing and pollution.

(c) To safeguard fishing industry interests in the realization of water conservation projects.

To prevent overfishing studies were to be made of age and sizes of adult fish, while local authorities were to determine the percentage of under-sized fish that could be landed. It was decreed that: "All sexually mature adults, young and eggs of aquatic animals, and spores of plants of commercial value, as well as the environmental conditions necessary for their propagation and growth should be protected" (SCMP 3287). The regulation specifically listed species of particular commercial value which were to be protected. These were: yellow croaker, cutlass, silver carp, grass carp, black carp, big head, Tui shrimp, seaweed, bech-de-mer and turtles (SCMP 3287). The regulations were to ensure that in the course of catching fry from spawning grounds enough fish was left in the rivers to ensure propagation. Fishing methods harmful to stock preservation, such as the use of poisons, explosives and electrical methods were to be discontinued or modified.

International Fishery Regulations

In the early days there was frequent friction between China and Japan due to conflict of interests between the Chinese and Japanese fishing vessels. However, for over a decade now there has been an

unofficial agreement in force between private Japanese fishing firms and Communist China (Anon. 1955a). As far back as 1955 it was reported that the agreement worked to mutual advantage. Japanese firms were able to increase their catches and also avoid paying various fines to China as a result of the agreement. Although the prices of fish dropped due to increased landings, Japanese firms were still better off than before (Anon. 1955a, Anon. 1956b).

At the beginning of 1963 a memorandum on certain problems of fishery relations between China and Japan on the Yellow Sea, and on the East China Sea was signed between the China Fishery Association, the Chinese People's Association for Cultural Relations with Foreign Countries and the Japan-China Association of Japan (JPRS 22088).

RESEARCH

Research Institutes

Research in the fishing industry is conducted by special scientific institutes of national and local significance, by the institutes and laboratories of the Academy of Sciences, and by the Ministries and academic institutions. In 1958 it was reported that there were in China twelve institutes devoted to aquatic and marine research, and three laboratories working under the Chinese Academy of Sciences.

There are a number of important research centres (Table 8). The Aquatic Products Research Institute in Canton is said to be engaged in investigating fishery resources in south China. It also does research into freshwater fish diseases and preventative measures (Saburenkov 1961).

Table 2. List of important research centres of the fishing industry in China (1958-1971).

Aquatic Products Research Institute in Canton

Chekiang Freshwater Products Experimental Institute*

Chekiang Fisheries College of Oceanography

Chekiang Research Institute for Ocean Fishing

Fukienkiang Province Scientific Research Institute for the Fishing Industry in Canton

Institute of Hydrobiology of the Academy of Sciences at Tsingtao

Institute of Oceanology of the Chinese Academy of Sciences in Tsingtao (formerly Tsingtao Marine Biology Laboratory)

Institute of Water Industry of the Yangtze in Nanking

Kwangtung Province Scientific Research Institute for the Fishing Industry in Canton

Liaoning Province Scientific Research Institute for the Fishing Industry in Dairen

Liaoning Research Institute for Freshwater Fishing

Liaoning Research Institute for Ocean Fishing

Peking Scientific Research Institute of Zoology

Shanghai Institute of Marine Industry and its Scientific Research Section

Shanghai Marine Products Institute

Shantung Provincial Aquatic Products Cultivation Farm (Tseng 1964)

Yellow Sea Scientific Research Institute in Tsingtao

* = probably the same as the Chekiang Research Institute for Breeding Freshwater Fish.

The number of staff at the Shanghai Marine Products Institute reached 200 persons in 1962, double the number employed in 1958. Director of the Institute in 1962 was Professor Chu Yan-ting, author of a book on cartilagenous fishes, "Fish of the East and South China Seas", and "Classification of the Chinese Spot Fish (Sciaenidae)" (SCMP 2682).

Apart from the scientific research institutes listed in Table 8, the industry also operates experimental research stations for fish industry enterprises in various parts of the country. In terms of manpower, before 1949 there were only 200 to 300 specialists in the fishing industry, but by 1961 the number was 3,000, of whom 500 were engaged in research (Saburenkov 1961).

Fisheries Surveys

The main efforts of research teams in China until recently have been directed at assessing the available resources of the fishing industry, both for the marine and freshwater fisheries. In the summer of 1958 in accordance with general plans for a rapid expansion of the fishing industry, the Ministry of Aquatic Products sponsored a survey of Pohai Bay, the Yellow Sea and East China Sea, with a view of opening new fishing grounds and estimating the resources of the small croaker. Participants in the project were the Shanghai, Tsingtao, Chefoo and Lushun-Talien Aquatic Products Companies; the Hopeh and Chekiang experimental ground stations for Marine Products Cultivation; and research units to make simultaneous oceanic observations and to conduct a general oceanic

survey (SCMP 1786).

In August 1961 it was reported that scientists from the Institute of Hydrobiology of the Academy of Sciences were carrying out yet another survey of the aquatic resources of the country. They were reported to have surveyed 1,000 lakes including Tungting, Taihu, and Po-yang as well as a number of rivers and reservoirs (SCMP 2571).

To provide data for increasing fish output, controlling lake waters, and reclaiming lakeside lands Professor Shih Cheng-hsi investigated the lakes of East China for the Institute of Geography and the Chinese Academy of Sciences (SCMP 2957).

In spring 1963 it was reported that Professor Ni Ta-shu of the Institute of Hydrobiology had worked out ways to counteract the effects of mould. In view of the fact that freshwater fish accounted for one-third of the total landings, the finding was said to be of great significance (SCMP 2965).

At about the same time scientists of the South China Sea Aquatic Products concluded a survey of fish resources of the South China Sea and found that there were 860 species of fish within an area of 214 million ha. (630,000 nautical sq. miles), of which 100 species were considered to be of commercial value, and 30 species were found to be abundant. The most important among these were pomfrets and mullets, followed by croakers, hairtail fish, Chinese herring, sea eel and green pilchard. Maps and charts of the fishing grounds were prepared for use by the fishing industry (SCMP 2992). The survey lasted eight years. It was pointed out that in this area fishing operations were possible all year as the temperature

of water does not vary and the fish do not migrate.

In the fall of 1964 a team of scientists led by Chang Yu-sheng, Assistant Professor of the Shanghai Aquatic Products Institute completed the survey of freshwater fishery resources of the middle and lower Yangtze, which together account for more than half of the annual freshwater fish landings in the country. The project is part of a larger one, intended to survey all the major rivers in China. The team found 150 species inhabiting the middle reaches of the river, including anadromous fish from the west Pacific. The most common species encountered were grass carp, common carp, snail carp and big head, as well as mandarin fish, anchovy and anadromous river shad (SCMP 3327).

International Scientific Cooperation in Research

In June 1956 China signed an International Fisheries Agreement with the USSR, North Korea, Vietnam and Mongolia, to last ten years. A joint study was to be made of the resources of the western Pacific, including the Sea of Japan, the Yellow Sea, the East China Sea and the South China Sea, as well as bodies of water which are found along the frontiers of the countries concerned. The Commission was to have four sections dealing with fisheries, oceanography, freshwater fisheries, and limnology and the protection of fishery resources.

The Commission was charged with the tasks of: drawing up plans for scientific research; organizing exchange of information; mapping out measures to protect and increase fishery resources; preparing plans for scientific and technical cooperation in the field of fisheries; and convening conferences (SCMP 1310). Peking was chosen as the permanent

seat of the Commission (SCMP 1312).

By the spring of 1958 the Chinese, Russian and Korean teams had concluded their survey of the fishery resources of the Yellow and East China Seas (SCMP 1740). At the spring session of 1958 the Commission discussed the productivity of fisheries and the protection of resources in the Tumen River, lying on the border of the three participants, and in the Heilunkiang (or Amur) River (SCMP 1747).

In August 1958 a meeting was held in Pyong-yang where the Chinese delegation was headed by Hsu Te-heng, Minister of Aquatic Products (SCMP 1837). The fifth session of the Commission was held in November 1960, but no details were released of the discussions that took place (SCMP 2385). It was then decided that the sixth meeting be held in Ulan Bator (SCMP 2389), and the seventh in Moscow (SCMP 2585b). The ninth Congress was held in Hanoi, and appears to have been devoted primarily to political considerations, namely condemnation of the United States policy in Vietnam. It was agreed to hold the Tenth Session in Moscow (SCMP 3338).

Between 1957 and 1960 a joint expedition was made by the Zoological Institute of the Academy of Sciences of the USSR (headed by Professor Ye. F. Gur'yanova), and the Institute of Oceanology of the Academy of Sciences of the Chinese People's Republic (headed by Professor Chang-hsi). They studied areas around Talien and Tsingtao in the Yellow Sea, Pu-to Shan in the Choushan Archipelago in the East China Sea, the area of the city of Chankiang (a newly developed port), and the area of Nanchow Island in the South China Sea. They noted that the biomass

decreased from 50 grams per sq. meter in the Yellow Sea to 10 grams per sq. meter in the East and South China Seas. In the north it was 1 kg. per sq. meter. The phytoplankton similarly decreased in both quality and quantity as one moved southward (JPRS 4872).

Fisheries Training

The first fisheries school in China was built with the support of the Imperial Court (Yen 1910), at the beginning of this century, at which time it was realised that the development of a modern fishing industry would require trained personnel. The problem of training labour did not, however, get sufficient attention in the years that followed. Before 1956 only two centres for fisheries training existed in China. These were: the Shanghai Institute of Marine Industry and the Faculty of Marine Industry of Shantung University in Tsingtao. In addition to these there were four fishing industry technical schools in Kwangtung, Fukien, Shantung and Liaoning Provinces (Saburenkov 1961).

During 1958-1959 there was a rapid growth in the number of training centres. Over 100 schools were organized to provide workers for the fishing industry, and 48 new institutions of higher and secondary learning were established during the first half of 1958 (Saburenkov 1961). Newly organized marine fishery institutes were developed in Lushan-Talien, Tientsin, Chingwangtao, Chefoo, Amoy, Yung Kong in Kwangtung, and the Chushan Islands. Freshwater institutes were built in Hupeh, Anhwei, Honan and Hunan (SCMP 1939b).

In Hupeh the San-hu (Three Lake) University was established with four departments: fish culture, fishing, processing and aquatic plants.

The Pohai Fishery University near Lushun has departments of navigation, fishing, marine fish culture and processing. Students at the universities maintain themselves with work they do concurrently with their studies (SCMP 1939b).

At the end of 1963 it was stated that there were in mainland China 23 research institutes and 17 colleges and secondary schools which conducted aquatic studies and also undertook training of personnel for the fishing industry (Anon. 1964d).

In Chekiang Province alone more than three thousand fishermen were reported to have been trained between 1956 and 1962 (Ta 1964). In September 1956, 214 persons were being taught to operate 54 newly-built motorized junks (SCMP 1368).

The development of fishing communes also led to the establishment of training facilities within them to provide skilled labour for more modern craft and equipment. For example in Weishan-hsien (in Shangtung) nine mobile and eight stationary schools have been established for the children of the boat-dwelling fishing population. These are partly schools and partly production units, with the proceeds from the sale of fish and water plants helping to defray the costs of training (SCMP 3452).

Another example of a school organized by a brigade is the one in the Tatse brigade of Chungwu Commune in Huaian-hsien in Foochow, where a school was established to train engineers for fishing vessels. The students spend half of their time in training and half working on board ships. On completion of their training they have to do three months probationary practice aboard a fishing vessel. The school started with 49

students in the spring of 1965 (SCMP 3457).

MARKETING AND INDUSTRIES

Marketing Methods

Buying and selling, and in part processing of fish and other aquatic products, was first done by special purchasing-selling State Enterprises subordinated to the Ministry of Marine Industry established in 1956.

In the fall of 1956, discussing the government policy the fisheries conference in Kwangtung concluded that "in respect to prices, the purchasing price of fishery products was too low and there was a phenomenon of pressing down grades and prices. On the other hand the prices of fishing implements kept rising year after year. All these brought great dissatisfaction to the fishermen" (SCMP 1388).

In the fall of 1956 as another step towards relaxation of government control of marketing, aquatic products markets were opened. As a result the supply of aquatic products increased in large cities such as Sunkiang, Soochow, Yangchow, Chekiang and Anhwei, where fish dealers went to make purchases. The government withdrew its marketing agencies from smaller ports. After the establishment of the markets the prices for the main species (black carp and culter) were raised, but remained fixed and under government control. Prices were left free to fluctuate for secondary types of fish.

It was admitted that "State companies, because of too many trading links, had to spend more on trading charges and their services

was poor. ...After opening of the markets fish dealers do their business in a flexible and better way. Peking dealers offer prices 10 percent below the official price" (SCMP 1414).

In the northern part of the country 70 to 75 percent of the catch is sold in live, fresh or frozen form. In subtropical regions 70 percent of the catch is deep-salted and dried (Saburenkov 1961). The quantity of fish being frozen has increased at the rate of approximately 60,000 tons a year. The freezing facilities have been installed mainly by the Department of Commerce. Since 1949 freezing plants have been installed in Tsingtao, Yent'ai, Choushan, Wenchow, and a small plant built at Lin-yuan-chiang. By spring 1957, with the completion of 14 meat packing and cold storage houses China's refrigeration capacity was said to have reached 4½ times the 1949 level (SCMP 1483). Not all of it, however, was available to the fishing industry. Eight cold storage and ice producing plants were already completed in 1955 (SCMP 1127). Since 1959 China has not suffered from a shortage of ice plants (JPRS 9817b).

The fishing industry prepares about 100 products, the more important of which are various fish oil preparates (concentrates of vitaminized oil), capsules, vitamin emulsions, sweet pastes and multi-vitamin candies. By 1955 cod liver oil capsule factories were in operation in Shanghai, Tsingtao, Lushun-Talien and Fukien. Their output was stated to be sufficient to satisfy the home demand (SCMP 1148). In order to increase exports and also to improve the quality of products supplied to domestic markets, standardization is being introduced,

something which was sadly lacking in the past (Saburenkov 1961).

In the summer of 1965 a new note appeared in the discussions of the problems of the fishing industry. For the first time it was stated that difficulties existed in disposing of the growing supply of fish. In May 1965, the Minister of Aquatic Products called on managers of Provincial and Municipal Aquatic Products Supply and Marketing Enterprises to sell more aquatic products to the countryside, to promote sales, to price according to quality, and to speed up the handling (buying, transferring, loading and unloading) of aquatic products. He also called for the organization of rural markets, for lower prices, and also for a reasonable margin of profit to cooperatives (SCMP 3470a, SCMP 3470b).

Up to the present time the government has paid more attention to increasing production than on how to deliver it to consumers, a phenomenon characteristic of all planned economies where the enterprises have the tendency to concentrate on the aspects of production that are more easily shown by simple numerical figures indicating growth. The non-spectacular but necessary measures are usually forced by necessity and are done inefficiently and late.

Canning Industry

Since 1949 the canning industry in China has expanded rapidly to meet the needs at home and in particular to satisfy the requirements of the export trade. By 1955 canned fish was specifically listed as an important export commodity (SCMP 1058). The output of canned goods in 1955 was reported to be 284 percent above the 1951 level, while by 1955 the export of canned food increased 25 times compared with 1951 (SCMP 1240).

In 1956 there were over thirty food processing plants in China producing canned goods. These plants included those in Shanghai, Swatow (pineapple and pork, 30,000 tons total output), Port Arthur (plums), Nanking, Sunkiang, Kirin and Talai. Some of these plants had been in existence for some time. Thus in this Report to the Fourth International Fisheries Congress in Washington, U. S. A., in 1908 Wei-ching W. Yen reported that "the canning, and preserving in other ways, of fish with new and improved methods is growing gradually into importance. In Canton in particular it is becoming a valuable industry" (Yen 1910).

It was planned to increase the export of sea foods in 1956 by 87 percent. In 1958 it was reported that the output of the canning industry was to be double the 1957 level, which was already 30 times greater than the highest prewar output. Exports in 1957 were 17 times the 1953 level (SCMP 1753).

One of the most important canning plants as far as the fishing industry is concerned is the Choushan Marine Products Cannery with a capacity of 75 tons per day. Eels in tomato sauce, croaker in oil, spiced hairtail fish, braised cuttle fish are canned here and exported (SCMP 2721).

Since 1956 a new plant was constructed in Canton (fruit and vegetables, capacity 20,000 tons per year) and completed in 1957. Located in the eastern suburbs of the town the plant was to have a bottle and jar factory of its own (SCMP 1350). Haihou cannery was expanded to produce 5,000 tons per year (SCMP 1929).

Consumption of Fish

During the last fifteen years there probably has been a considerable increase in the volume of fish products consumed in China. There are several reasons why this should be so. The shortage of other food products made people more willing to turn to alternative sources of nutrition, although these were not familiar to them. Government loans and other forms of encouragement and assistance have led to a widespread increase in fish culture and fishing, and better organization of transportation have provided increased supplies of fish in areas where they were not available in the past. Improved techniques of processing (such as modern freezing), and better canning and processing equipment also contributed to an improved product for consumption.

Finally, widespread education, an increase in the mobility of the population and the introduction of mass feeding in the communes and during mass projects have caused people to overcome prejudices against fish-eating or the eating of fish formerly unfamiliar to them. This is particularly true of inland areas and areas inhabited by lamaists where fish was often not eaten at all by tradition or on religious grounds.

Fishing Industry Exports

By far the clearest statement on the contribution to exports by the fishing industry comes from Soviet sources, which provide data on imports of fish products into Russia. Otherwise information on the subject is very scarce.

In 1955 it was stated that large cold storage facilities were being installed in Canton to help foreign trade (SCMP 979). In that

year China was already exporting fish meal to Great Britain and Czechoslovakia. The meal was produced in a newly built fish meal plant on Choushan Island (SCMP 1063). In 1956 it was reported that exports of fish and aquatic products were to be increased 50 percent. Dried fish was to be added to the salted and refrigerated prawns and fish which had been exported in the past (SCMP 1295a). More recently it was reported from Choushan that among important export products were eels in tomato sauce, croakers in oil, spiced hairtail fish and braised cattle fish, all processed in the Choushan Canning Plant (SCMP 2721).

Future Exports

As stated above, one of the most important buyers of Chinese fish has been the USSR. Exports of fish from China to the USSR are listed (Table 9), and also exports of canned goods in general. The figures for pre-1957 are not available (SCMP 1243a). 1959 was probably a peak year and since then there has been a drastic decline in exports to the USSR of both fish and canned goods.

This decline in exports to the USSR indicates that a canning capacity of some 60 million cans has now become available for China's internal and other markets, together with a quantity of fish. Undoubtedly some of the canning volume will be retained for canning meat and poultry products, but it is likely that some of the volume will be fish products. It is reasonable to expect, therefore, that more canned fish products will be available for the internal Chinese market and for export in the future.

According to Chinese sources, in the earlier years the main problems were low quality production and high costs in canning plants.

Table 9. Export of fish from China to the USSR and export of canned meat products from China to the USSR (Anon. 1965b)*.

EXPORT OF FISH FROM CHINA TO THE USSR

YEAR	VOLUME (1000 tons)	VALUE (1000 Rubles**)
1957	10.4	5571
1958	18.7	10620
1959	13.0	1785
1960	18.0	2049
1961	4.9	613
1962	6.6	832
1963	5.3	689

** = One Ruble = U. S. $1.10

EXPORT OF CANNED MEAT PRODUCTS FROM CHINA TO THE USSR

YEAR	VOLUME (million conventional cans**)	VALUE (1000 Rubles)
1957	37.5	48957
1958	95.4	105117
1959	62.6	14789
1960	21.9	5459
1961	4.3	10001
1962	0.009	3
1963	0.003	1

** = a conventional can = approximately 400 grams

* 1957 and 1958 figures from Vneshnyaya Torgorla SSSR za 1958g. (Foreign Trade of the USSR during 1958). Vneshtorgizdat. Moscow. 1959. p. 123-132.

Undoubtedly with the construction of more modern factories and the experience gained, some improvement can be expected. However the fact that in industrial accounting practice enterprises in communist countries are permitted to add a fixed percentage of costs as profits, and that targets are fixed in quantitative terms, will both militate against quality improvement and cost reduction. To obtain foreign exchange Communist countries have often sold below cost-price, being guided by the comparative advantages of trade as a whole, rather than the cost structure of a particular industry.

Since a shortage of imported commodities, such as modern machinery, equipment and oil products will persist, it can be assumed that the Chinese will find it necessary to export whatever they can, and that they will probably include the better quality products of the fishing industry high among the list of goods earmarked for the international market.

FISHERIES PRODUCTION

Production per Labourer

One of the most difficult types of information to obtain on Communist countries is the productivity per labourer. Only the production figures of outstanding firms are given, and in addition the term "productive workers" is usually given without further explanation. The figures below give output per member of the community engaged in fishing.

The Marine Production Brigade of Ch'eng-tung Commune consisted of 39 households with 185 persons. Between 1959 and 1963 the brigade produced 635 tons (12,700 tan) of fish and shrimp and over 650 tons (13,000 tan) of shell fish, i. e. 1,285 tons altogether. The output per member of the community was

7 tons per five years, or 1,400 kg. per year. Calculated in terms of labour power units the output was 2.5 tons per year, or just under 7 kg. per day. The value of the output was given at 616,000 yuan, or about 478 yuan per ton. This makes therevenue per member of the commune equal to 669.2 yuan per year, before any deductions for taxation, administration or other expenses. The Brigade was reported to have had assets worth 75,000 yuan (SCMP 3276).

Another example for which he calculation of output and revenue per person is possible is the case of the Tanku Island Brigade of the Yangshan People's Commune. The brigade has eight motorized junks, and was cited as an example of a modernized unit. It numbered 140 families or approximately 560 people. The output in 1962 amounted to 1,580 tons or 2.8 tons per person per year. The slightly higher per capita catch compared with the first case can be explained by the apparently greater degree of mechanization (SCMP 3443).

Another example of productivity can be given from the Ch'ingpu-hsien of Shanghai. Of a total population of 310,000, 1,685 families were classed as fishermen (approximately 6,740 people). The annual catch in 1958 was 2,730 tons (54,600 picules) or 400 kg. per inhabitant per year, and in 1959 was 5,816 tons (116,320 picules) or 863 kg. per inhabitant. In 1958 the fish pond area was 12 hectares (200 mow) in which there were 2½ million fish of three inches and over. After the Great Leap Forward the pond area increased to 84 ha. (1,400 mow) with 40 million fish. The

output for the hsien was given as follows (JPRS 6755):

Year	Output (in picules)	Output (in tons)
1949	11,800	590
1957	29,200	1,460
1958	54,600	2,830
1959	116,320	5,816
1960	200,000	10,000

The equipment available in 1959 consisted of 4,000 nets, 1,000 boats, and 153 crab traps.

Total Fisheries Production for 1934 - 1965 (estimated)

The highest output of the Aquatic Products Industry before 1949 was 1,500,000 tons (Table 10) attained in 1934 (Berezina 1958). By 1949, however, the output fell to 450,000 tons (Chiang 1956). The plan for 1950 provided for an output of736,000 tons, one-third of which was to come from the eastern parts of the country (Anon. 1950). By the end of the year 911,000 tons of aquatic products had been produced (Anon. 1951c).

The plan for 1951 provided for an output of 1,100,000 tons, of which 500,000 tons were to come from east China, 360,000 tons from central and south China, 140,000 tons from the north-east, and 100,000 tons from the Hopeh-Tientsin area (Anon. 1951c). Once again the plan was overfulfilled as the output for the year was given as 1,330,000 tons (JPRS 12253). Only 29,000 tons were accounted for by the state controlled enterprises (JPRS 12253).

The output in 1952 is given as 1,660,000 tons (JPRS 12253, Anon.

Table 10. Output of aquatic products in China.

YEAR	PLANNED OUTPUT (metric tons)	ATTAINED OUTPUT (metric tons)
1934	-	1,500,000
1949	-	450,000
1950	736,000	911,000
1951	1,100,000	1,330,000
1952	-	1,660,000 (1,710,000)*
1953	-	1,890,000 (1,900,000)*
1954	-	2,160,000 (2,290,000)*
1955	-	2,500,000
1956	2,580,000	2,550,000 (2,640,000)*
1957	2,807,000 (2,816,000)*	2,950,000 (3,100,000)* (3.120,000)* (2,980,000)*
1958	-	4,060,000 (6,020,000)* (8,200,000)*
1959	-	5,020,000

* = estimates of output given by alternate sources.

1960) and also as 1,710,000 tons (Chiang 1956). (The figure of 1,710,000 probably originated from a statement by the Vice-Minister of Commerce, who gave the figure for the 1955 output at 2,500,000 tons, which he said was 40 percent more than in 1952. This would make the 1952 figure equal to 1,710,000). The discrepancy between the two figures is not serious, since it is small relative to the total. It was reported that 980,000 tons came from coastal areas (SCMP 1687).

The figure for 1953 was given as 1,890,000 tons by Asakawa Kenji (JPRS 12253) and as 1,900,000 tons by the Union Research Service (Anon. 1960). The output for 1954 was given at 2,160,000 tons (JPRS 12253) and also as 2,290,000 tons (Anon. 1960). No further details are available with respect to these two years.

There appears to be general agreement with respect to the 1955 output, which was stated to be 2,500,000 tons or thereabouts (Anon. 1960, SCMP 1470, SCMP 1480, SCMP 1243b, JPRS 12253).

The planned output for 1956 was 2,580,000 tons (SCMP 1177). The realized output was given at 2,640,000 tons by Asakawa Kenji and at 2,550,000 tons by Hsu Te-heng (Scmp 1470). Of the total output, 940,000 tons came from inland waters and the rest from the sea (Denisov 1961). The latter included 80,000 tons of crustaceans (Chang 1959).

1957, being the last year of the First Five Year Plan, is described with greater thoroughness. The planned 1957 output was given as 2,807,000 tons by Hsu Te-heng (SCMP 1470) and elsewhere reported as 2,816,000 tons (SCMP 1480), in the account of the National Marine Production Conference. It was planned to obtain one million tons of freshwater fish,

and one million tons of marine fish, leaving 800,000 tons or approximately 28 percent to be of non-fish products (SCMP 1558).

The figures for the realized output at the end of the year 1957 have varied from 2,950,000 tons reported in Ta Kung Pao (SCMP 1711), to 3,100,000 tons reported by Asakawa Kenji (JPRS 12253), to 3,120,000 tons reported by Chang (1959). The first and last of the three figures were also reported by the Union Research Service, based on reports in Ta Kung Pao given on the 6th of February 1958, and the 23rd of September 1959, respectively (Anon. 1960).

In 1957 680,000 tons or approximately 22 percent of the output came from fish rearing (Chang 1959), and of this 472,000 tons came from pond culture (Denisov 1961). It was reported that the total for the year included 1,180,000 tons from inland waters (Denisov 1961), approximately 1,700,000 tons from coastal marine waters (SCMP 1687), and approximately 100,000 tons from state enterprises operating away from the coast (SCMP 1975b). According to Saburenkov (1961), 58.6 percent or 1,810,000 tons of the 1957 output came from marine fishing (which agrees with other statements giving coastal landings at 1,700,000 tons and deep-sea landings as 100,000 tons), 3.8 percent or 120,000 tons from culture in marine waters, 19.2 percent or 620,000 tons from freshwater fishing, and 18.4 percent or 570,000 tons from freshwater fish culture.

The figures for the output in 1958 varied greatly depending on whether they were given at the height of the Great Leap forward or afterwards. Thus in March 1959 it was reported officially that the output during 1958 amounted to 8.2 million tons (SCMP 1971). However,

only a week later, Chang (1959) gave the output for 1958 as 6,020,000 tons. At the end of November the total output of the fishing industry was given at 7.14 million tons: approximately 4 million tons of fish and 3 million tons of shell-fishand seaweed. The rapid increase was explained by the use of paddy fields, use of deeper nets, and the greater number of modern boats available (SCMP 1909). In September of the same year it was reported that the output was 4,060,000 tons (Anon. 1960). This remained the official figure in subsequent years.

As with the figures for the total output there is disagreement on the estimates of output from any one particular form of production in 1958. Thus Chang (1959) gave the figure for fish culture as being 270,000 tons or 42.6 percent of the total output. Saburenkov (1961) on the other hand gave the following analysis of the total output: total from fishing = 2,740,000 tons or 67.5 percent, and from fish culture = 1,320,000 tons or 32.5 percent. Marine fishing accounted for 2,100,000 tons or 51.8 percent (of this 160,000 tons came from state enterprises operating in open seas and the rest from communes fishing mainly along the coast (SCMP 1975b)). Marine fish culture contributed 330,000 tons or 8.1 percent. Inland fishing accounted for 640,000 tons or 15.7 percent and inland fish culture for 990,000 tons or 24.4 percent (Saburenkov 1961).

By the time the output figures for 1959 were published the extravagant claims of the Great Leap Forward had been discontinued and the output for the year was given at 5,020,000 tons. Of this, 2,740,000 tons or 54.7 percent came from marine waters and 2,270,000 tons or 45.3

percent from inland waters (Saburenkov 1961).

Of the marine output, 2,310,000 tons or 46.1 percent of the total came from marine fishing and only 430,000 tons or 8.6 percent from marine fish culture. In the inland waters, however, fish culture accounted for a higher output, providing 1,380,000 tons or 27.5 percent of the total, while fishing accounted for 890,000 tons or 17.8 percent (Saburenkov 1961).

There is a considerable discrepancy in the figures cited for marine fish culture as given by Saburenkov (1961) of 330,000 tons and as given by Asakawa Kenji (JPRS 12253) of 990,000 tons. On the whole Saburenkov's figure would appear to be more in keeping with data from other years (Figure 5). For example, Chang (1959) gave the 1957 output from rearing as 680,000 tons or 22 percent of the total. By accepting Asakwawa Kenji's own figure of 430,000 tons for marine fish culture in that year, one is forced to accept the figure for inland culture of 250,000 tons, which is not in keeping with the generally accepted view that the inland rearing was of considerable importance at the time.

Since 1959 the Chinese authorities have published no statistics of the output of the fishing industry. Asakawa Kenji (JPRS 12253) gives the planned output for 1960 at 6,526,000 tons in June 1961, and the actual output as 5,800,000 tons in his report in October of the same year. His estimate for 1962 was 8,000,000 tons (JPRS 12253). These figures are difficult to accept.

In 1963 an increase in fisheries production was still considered to be more important that the preservation of stocks. In accordance with

the prevailing philosophy, solutions to food shortages were sought through mechanization and modernization as well as by traditional methods. The principal tasks necessary to raise the output listed at the time were said to be (SCMP 2959):

(a) Survey of available resources.

(b) Summing up of past experience and drawning useful conclusions.

(c) Dissemination of information.

(d) Preparation of long-term plans.

Four least square regressions of fisheries production in China are given in Figure 5. Curve I is a projection of the trend prevailing during the period 1949-1959 inclusive. Thus it can be seen that even if we accept the claims of very rapid increases during 1958 and 1959, the experience of the previous years pulls down the curve and the output in 1965 is estimated at about 7,000,000 tons. When only the first year of the Great Leap Forward is included the regression suggests an output in 1965 equal to 6.3 million tons (Curve II). When both years of the Great Leap Forward are disregarded, and the regression is made on the basis of figures going up to the end of the First Five Year Plan, the projected output for 1965 is 5,440,000 tons (Curve III). Curve IV shows the output projected on the basis of the figures for the First Five Year Plan only. In other words, Curve IV disregards the period of rehabilitation, since the rapid increase during this period was possible only because of a latent capacity initially unused due to wartime disruption. It also disregards the later period, as being not wholly reliable, since it has been admitted that statistics during this period were grossly exaggerated.

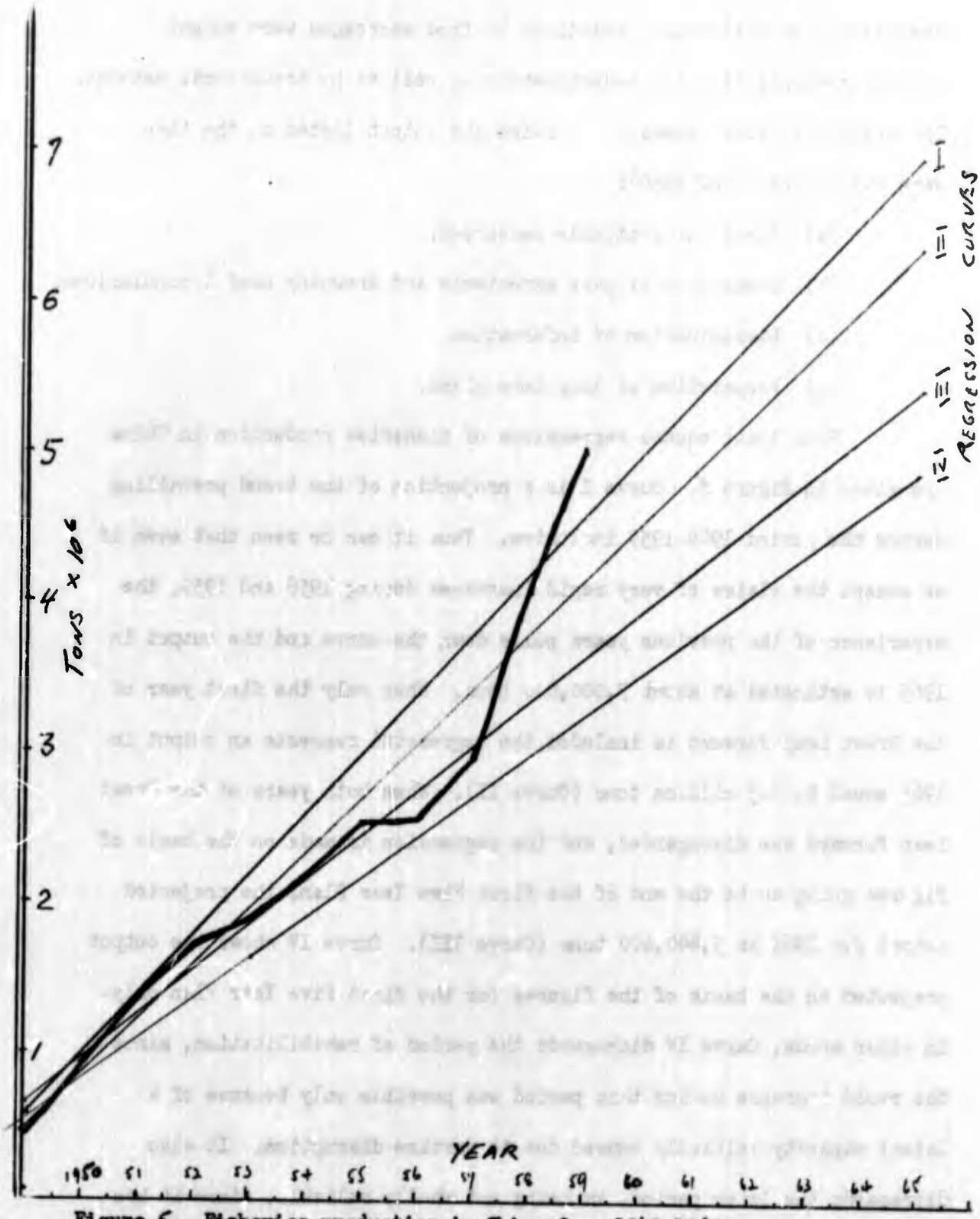

Figure 5. Fisheries production in China from 1949-1965.

On the basis of this regression the output is estimated at around 5,000,000 tons in the period 1962-63.

A careful consideration of the material suggests that the output line lies somewhere between Curve I and IV, and probably is located between II and III.

The slowing down in industrial development during the period of agricultural calamities (1959-1961) and the years following it probably acted as a retarding influence on the development of the deep-sea fishing industry. The rapid increase in freshwater fishing and fish culture during the 1955-1958 period undoubtedly was achieved by utilizing first the resources that could be brought into production at least cost. Consequently the laws of diminishing returns must have been in operation more forcibly in the years that followed. However with food being scarce, and in particular protein food, it was reasonable for the government to stress in every possible way the development of the fishing industry. Given the regime's predilection to publicize success, the fact that no claims of success have been made recently by the fishing industry can perhaps be taken to indicate that the achievements have been rather less that startling.

Factors Which Increased Production

Although the official claims for the output of the fishing industry were brought down from 8.2 million tons in 1958 to 4 million tons, and for 1959 to 5 million tons, the growth in the output of the fishing industry during the first decade of Communist rule in China was probably quite substantial. Writing in the paper Hung Chi (The Red Flag), Kao Wen-hua listed the following factors that contributed to the growth of the

fishing industry (JPRS 3214):

(a) Expansion of the fishing industry took place not only along the coast, but also in all areas of China.

(b) New varieties of aquatic products were introduced and uses found for them.

(c) Whereas in the past the main product was fish, the emphasis is now spread to include fish, clams, marine plants, with aquatic products being used widely as raw materials for industrial processing.

(d) Modernization of craft and gear accounted for some increase.

(e) A systematic summary of past experience was made and put in an easily acceptable form of eight character slogans ensuring their popularization and application.

(f) There was an increase in the number of experts available to advise the fishing industry.

(g) There was a rapid increase in the area used for fish culture which reached 7.8 million hectares by 1960 and was still increasing.

The factors listed by Kao Wen-hua although somewhat exaggerated in magnitude are nevertheless valid. To them can be added several more. First, centralization and other new developments in the organization of the industry resulted in greater mobility for the fishing fleet, which now operated all along the coast, with each fishing ground fished by fleets from different provinces along the coast. The second innovation was a greater participation of women who came out in the fishing boats only after the formation of the communes (SCMP 1906). Better utilization of existing

fishing gear through the introduction of modern devices for locating fish shoals and communicating information to other fishing craft was of great importance. Finally, with the formation of training centres in the communes, more skilled workers, prepared to try new methods of fishing rather than pursue traditional ones, became available to the industry.

It was believed that it would be both easier and faster to develop freshwater resources than marine ones. Freshwater fish culture is relatively simple and is easily taught, especially in a country where the tradition of fish culture is as deeply ingrained as it is in China. All that was necessary was the introduction of modern methods of rearing. During 1958-1959 freshwater production climbed steeply, exceeding the previous year's level by 93.2 percent, the actual increase being 1.1 million tons. During the same period salt water production went up by 41.7 percent, with an actual increase amounting to 800,000 tons (JPRS 3214). But it must be remembered that the marine fishing industry development was hampered by warfare waged with Nationalist Chinese naval units off the coast, and that in the long run the potentials of the marine fisheries are probably greater.

There is very little doubt that during the first decade of the Communist regime [illegible] the capacity of the fishing industry increased considerably in every respect. There were by 1960 more than 1,000 fish rearing and processing enterprises, the most important among these operated by the state. State enterprises accounted for only 10 percent of the total output, but they acted as leaders in introducing new technology, installing new machinery and equipment, surveying fishery

resources and supplying young fish. Communes were allocated the role of supplying labour to state enterprises, of safeguarding new resources and working materials, and performing duties of various coordinated efforts (JPRS 3214).

The measure of success attained in coordinated organization and advanced planning on a wider scale can be seen from the report on the preparations for the fishing season beginning in November 1961. The mobilization of the fishing fleets from the fishing zones along the entire coast, the advance organization of supplies, the assembly of repair facilities and transport, centralized communications and weather services, the marshalling of personnel by the government purchasing agencies, all testified clearly that the days of fishing by individual boats or small groups from a single village are over (JPRS 12249).

As is usual for Communist states, new organizational changes took place by decrees to improve efficiency. By the beginning of 1961 the importance of markets appeared to have declined again, for it was raported that during the winter fishing season off the Choushan Islands "the Trading Departments purchased 80 to 90 percent of the catch, even sending boats to sea" (SCMP 2419). On the other hand to stimulate efforts it was stressed that the communes should be allowed to retain fish obtained from spawning grounds for their own use (SCMP 2437).

Future Production

There is little doubt that there has been a very rapid increase in the output of the fishing industry in China during the last fifteen

years. This is mainly due to the fact that China falls into that category for which "the whole problem of economic development can be reduced to the question of how to secure food for the population" (Anon. 1955b).

Kirby and Szczepaniak (1958) point out that lack of animal protein is often the main cause of malnutrition in poor countries. This is very true in the case of China where animal husbandry has been habitually poor because of other demands on the land. Also the reorganization of agriculture through collectivization and later through the formation of communes (as in the Soviet Union, although to a lesser extent) resulted in a drastic decline of animal stocks.

It is important to note that the expansion of the fishing industry leads to a balanced economic development, since unlike heavy industry or transport, growth does not lead to inflation or higher prices for consumer goods. If anything, an increase in output leads to a reduction of prices. Development of this industry is a way to utilize abundant manpower.

However the statistics of growth supplied by the Chinese government should be treated with caution. Prior to the formation of cooperatives and especially communes, the data obtained by the government on landings and the number of fry and fish reared served as a basis for levying taxes. It was of interest to the producers to minimize the returns, while lack of trained personnel and of efficient administrative apparatus made verifications virtually impossible. The reorganization of industry into cooperatives and later communes made supervision easier, especially if due

allowance is made for the presence of an independent checking body such as the Party. Pressures for the fulfillment of plans and the type of incentives also resulted in some exaggerations of outputs.

The fulfillment of plans in Communist states is generally measured in terms of the number of tons, often regardless of quality of output. The 1958-1959 figure may have been enlarged to meet the demands of the plans for the Great Leap Forward, or may have been inflated due to the inclusion of fish and other sea foods in the total which were unsuitable for consumption.

A considerable amount of the increase in the fisheries output is due to the extension of the industry into previously unexploited areas. Such an expansion cannot be continued once the opportunities within the borders are exhausted. It would be unwise, therefore, to extrapolate the past record to calculate future trends. Also in those areas where resources had been utilized extensively, replacementof available stocks would require both time and investments. It should not be assumed that areas will yield the same catch in the future as that obtained in the first few years of their exploitation or that the rate of increase can be sustained.

Modernization of junks through the installation of motors also has been instrumental in increasing output. However, a saturation point may be reached in the fishing grounds available close to shore, thus making it necessary to build costly deep-sea fishing craft, and then only with increased cost would it be possible to maintain the same rate of increase in output.

Despite an increase in production there remains a serious problem in the fishing industry. The 1949 catch was obtained primarily by fishing

junks which used few imported materials. The 1964 output is swelled by the landings from motorized junks using fuel and equipment, part of which was purchased abroad. Unless the fishing industry can produce goods with which to buy imports, the growth in output will be difficult to sustain. Meeting the requirements of foreign buyers may necessitate large investments in processing.

CONCLUSIONS

In spite of a very appreciable increase over the past fifteen years the per capita output of aquatic products in China is less than 20 lbs. per year, compared with approximately 120 lbs. in neighbouring Japan*. For a considerable time to come China will urgently need to expand the output of the aquatic products industry to meet the growing demand for food, for industrial raw materials, and to provide fertilizers for agriculture. The necessary expansion will have to take place through freshwater culture of aquatic products, seaweed cultivation and deep-sea fishing. The possibilities for increasing landings from the coastal fishing grounds and inland waters (without stocking) are by now probably limited.

It is very unlikely that China will be able to solve the food problem through expanding agricultural production, and consequently aquatic products and imports will remain important food sources.

China's present development of the aquatic products industry is hampered by a shortage of trained manpower, capital, and technical knowledge. The first two problems China will probably have to cope with internally; it can be assisted with the third.

The most likely area of significant expansion is deep-sea fishing,

*obtained by dividing the gross landings of the industry by the population

which has shortages of trained personnel, fishing craft, fuel, and reliable engines. To this must be added a shortage of modern equipment.

The present efforts in education and labour training will overcome some of the difficulties, but not those arising from the shortage of fuel or reliable engines.

China needs an engineering programme to develop and produce on a large scale a marine engine that is easily installed and operated, and which does not use diesel fuel (which China lacks). It could run on coal-dust, or another form of fuel derived from coal by some inexpensive process.

China has considerable coal reserves located close to the coast which could be mined especially for the needs of the fishing industry. A marine engine of the type described could be used with equal success in agriculture for irrigation.

Given the present nationalistic and political circumstances, China is unlikely to divert highly trained experts for work on this particular problem. Nor can she borrow the knowledge she needs from the West, because in the West there is no necessity to use coal in the manner described. When it is desired to make use of coal reserves available in the West, it is likely that an engine more sophisticated than that required in China would be designed.

China is not alone in this predicament. There are other underdeveloped countries that need the same type of technical assistance. The United Nations organization and other international bodies, as well as the major advanced nations should consider this problem as one of the most pressing and deserving of their attention. If possible the research project should be organized in a country like Canada which enjoys good relations with China.

Once the research is under progress it may be possible to persuade the Chinese government to contribute a number of students to participate in it. The students, after undergoing suitable training, could take new technical knowledge back to China, together with the equipment received or purchased if need be.

This may be one of the ways of drawing China towards participation in the programme for the conservation of marine resources of the world. It may also be one of the channels through which technical knowledge amassed on this continent may be passed on to China to be used in solving the problems of providing for their growing population. From the point of view of peace, and the welfare of future generations, the solution of food problems in China is just as important to the rest of the world as it is to China.

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