

AD-A068 151

OFFICE OF THE CHIEF OF ENGINEERS (ARMY) WASHINGTON D C F/G 6/3
CHINESE FISH CULTURE. CHARACTERISTICS OF RIVER INLAND SYSTEMS, (U)
MAY 79 Y CHANG

UNCLASSIFIED

| OF |

AD
A06851

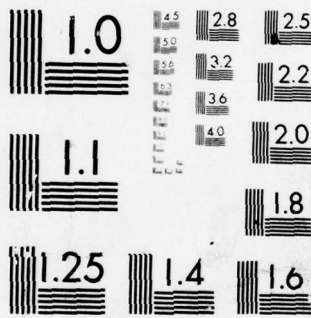


MI

END
DATE
FILMED

6 --79

DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS
BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) CHINESE FISH CULTURE, CHARACTERISTICS OF RIVER INLAND SYSTEMS,		5. TYPE OF REPORT & PERIOD COVERED
7. AUTHOR(s) Yuh-Farn Chang, et al. Edited by E. O. Gangstad and Charles Walker		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Office of the Chief of Engineers (ARMY) Washington, D.C.		8. CONTRACT OR GRANT NUMBER(s) 12 22p.
11. CONTROLLING OFFICE NAME AND ADDRESS Office of the Chief of Engineers Washington, D.C.		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) N/A		12. REPORT DATE 11 May 79
		13. NUMBER OF PAGES 20
		15. SECURITY CLASS. (of this report)
16. DISTRIBUTION STATEMENT (of this Report) Approved for public distribution		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Translated by Dr. T. Y. Koo, Department of Fisheries, Solomons, MD		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Chinese river system Cyprinids Fish culturing		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) There are about 46 million acres of inland waters in China. This accounts for 1/50 of the total area of China. Of these inland waters, 50% are represented by rivers, streams and creeks, 31% are lakes and seas, 10% are reservoirs, and 9% are miscellaneous water bodies. The principal river systems are the Amur, the Yellow, the Hwai, and Yangtze, the Pearl, the Tsangpu, the Lu, the Lantsang, and the interior river systems		

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE

401 248
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)DDC
RECEIVED
MAY 2 1979
AFC

DDC FILE COPY AD A068151

of the dry northwest areas. In addition, there are approximately 30 fairly large rivers, such as the Hai River in Hopeh Province, the Liao River in Liaoning Province, and the Chientang and Min Rivers along the southeast coast. Associated with these river systems are many streams, tributaries, lakes and reservoirs.

*China's lakes total 23,700 square miles which includes the 760,000 acre Tsinghai salt lake, the 71,300 acre Tien Lake and the 45,500 acre Fuhsien Lake.

Aside from natural water bodies, China has a large number of reservoirs. In 1958, the total area of all reservoirs reached 5,452 square miles and this reservoir area is continuing to increase.

The fish species composition of the Chinese river system not only differs from river to river, but also from upper to middle to lower sections of the same river. Many fish species are present including cyprinids, catfish, chinese perch and others.

ACCESSION for	
NTIS	White Section ☒
DDC	Buff Section ☐
UNANNOUNCED	☐
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
SPECIAL	
A	

CHARACTERISTICS OF RIVER INLAND SYSTEMS

Introduction

The total surface area of inland waters in China is very large, amounting to about 46 million acres. This is 1/50 of the total area of the Chinese territory. Of all the inland water areas, about 50% is represented by rivers, streams, and creeks, 31% by lakes and seas, 10% by reservoirs, and the remaining 9% by miscellaneous water bodies. Due to the rapid development of recent years, numbers of reservoirs of various sizes have been increased, accounting for more and more water areas.

The river networks spread over all of China. The principal ones are the Amur, the Yellow, the Hwai, the Yangtze, the Pearl, the Tsangpu, the Lu, the Lantsang, and the interior river systems of the dry areas in the Northwest. In addition, there are 30-odd fairly large rivers, such as the Hai River in Hopeh Province, the Liao River in Liaoning Province, and the Chientang and Min rivers along the southeastern sea coast. Densely interwoven everywhere are numerous small streams. Closely knitted with the major river systems are various tributaries and many lakes and reservoirs of various sizes. All these water ways and bodies are interwoven like a spider's web, forming a complex water system. Some of the rivers flow several thousand kilometers, traversing through different topographical regions, different climates, and different natural habitats. Consequently, the species composition of

fishes differs not only from river to river, but also from upper to middle to lower sections in the same river.

The Amur system

There are two sources to the Amur River: the northern branch originating from the eastern side of Mt. Henteyn in the People's Republic of Mongolia; the southern branch originating from the Hailar River. The total length from the southern source to the river mouth is 4,370 km, of which 3,774 km traverse in Chinese territory. This river forms the natural boundary between USSR and China. The annual flow volume is 130 billion cubic meters. Although the river remains frozen for 4-6 months of the year, water temperature in the summer reaches above 20 C. In its drainage area, a large amount of soluble organic material enters into the river. In the vicinity of the Black River, dissolved oxygen content measures up to 34.4 mg per liter. Fish food is abundant in the river. On the Chinese side, there are three major tributaries and five lakes and reservoirs. There are about 90 species of fish found in the river. Although the number is not large, the species composition is quite complex. About 50 species belong to the family Cyprinidae, among these are many species that are typical of the Chinese plains and that are transplanted here from the south. Species that have economic value are Cyprinus carpio, Carassius auratus, Ctenopharyngodon idellus, Hypophthalmichthys molitrix, Mylopharyngodon piceus, Erythroculter ilishaeformis, Hemibarbus

maculatus, Xenocypris argentea, Elopichthys, Bambusa, etc.

Because the Amur system is located in the temperature and arctic-temperate zones, the climate is characterized by severe cold. It contains, therefore, a variety of cold species. Those that are common and are of economical importance are: Hucho taimen, Brachymystax lenok, Coregonus Essuriensis, Thymallus arcticus grubei, Esox leucius, Huso dauricus, and the anadromous chum salmon, Oncorhynchus keta autumnlis. In addition, there are typical northern species in Lamnatra iaponica, Osmerus dentex, Pungitius sinensis, Lafusa costata, Mesecottis haitei, and Cottus poecilopus.

Fishery production in the Amur River is fairly high. In recent years, the annual production is about 60,000 tons. The upper reaches are still underdeveloped and their potential has yet to be fully exploited. Catch statistics for 1956 and 1957 show that in 1956, Heilungkiang Province produced 31,318 tons; Kirin, 14,050 tons; Inner Mongolia, 11,055 tons, for a total of 56,423 tons. The 1957 production figures are 33,010, 15,592, and 8,085 tons, respectively, for a total of 56,687 tons. Outstanding features are: the catch of chum salmon in Heilungkiang Province in 1957 alone amounted to 600 tons; Dalai lake in Inner Mongolia produced 4,600 tons of fish in 1956.

The Liao River system

The Liao River system. The total length of the Liac River is 1,440 km. These are east and west branches at the head water. The East Liao River originates from the eastern side

of Mt. Sooksheru. Both are in Kirin Province. In the lower section, the Liao River is joined by the Hwei River and then drains into Po Hai (sea). The reservoir on the Hwei River has now been completed. Its surface covers 112 square kilometers. There are only about 70 species of fish found in the Liao River system. Due to the more southerly location of the Liao River, climate here is not as cold as in the Amur River system; consequently there are fewer northerly species. Only in the upper reaches of the river, are there such species as Gobio sobio, Leuciscus waleckii, and Lampetra japonica. On the other hand, those species that are typical of the plains become greater in number. For example, species that are absent in the Amur River system but are present here include: Zacco platypus, Aphyocypris chinensis, Hemibarbus longirostris, Misgurnus mizolepis, Eleotris oxycephala, Monopterus albus, and Anguilla japonica. Downstream in the brackish water area occurs Coilia nasus.

The water volume in the upper section of the river and its tributaries is relatively small and therefore contains relatively fewer species of fish. Fishery is more concentrated in the lower section of the river. The total annual production from the entire river system has fluctuated a great deal over the years. In 1953 it reached a high of 8,372 tons, but generally the production is between 3,000 and 4,000 tons.

The Hai river system

The Hai River is a major river in the Lopeh Province. In the headwater, five major tributaries come to join

together into one main stream, which receives many other tributaries and more than fifty lakes, ponds, and pools, including the large Pehyang Lake. In addition, the Kwangting Reservoir, which covers 144 square km, has long been completed, and other smaller reservoirs number over 1,000. The ichthyofauna is much like that of the Yellow River system. There are carp, goldfish, grasscarp, green carp, smallhead carp, bream (Megalohrama terminalis), Chinese perch, catfish, and others. In recent years, the annual production reaches 40,000-50,000 tons. The major fishery is concentrated around Tiensin area.

The Yellow River system

The Yellow River is the second largest river in China. Its source comes from Tsinghai Province. At the source are many lakes and ponds. Its total length is 4,845 km. After meandering through the southeastern part of Tsinghai Province, it passes through the northern part of Szechwan Province, and enters into Kansu Province, where it receives four big tributaries. Here there is a huge irrigation zone made up of a network of streams and canals. Then it forms the famous Loop in Inner Mongolia and spreads over the great plains. Draining into the river here is the Wuliangsu Lake. After passing through Inner Mongolia, the river flows in a southerly direction, making itself a natural boundary between Shansi and Shensi provinces. Here there are many rapids, and the river is joined by several tributaries. At one section the canyon

runs between nearly vertical cliffs, with a cataract falling as much as 20 meters. After this, the river turns eastward, separating Shansi from Honan Province. Below the Shen District, two rocky islands stand in midriver, dividing the river into three branches and creating a very precarious situation. This is the famous strait of Three Gates. Further down, the Yellow River flows through the northeastern part of Honan Province and finally enters into Shangtung Province, where it is joined by the Grand Canal before emptying east into the sea.

There are about 140 species of fish in the Yellow River system. The upper section above Kweiteh is located in the high arctic zone, and is dominated by mountain ranges and meadowy plateau. Fish fauna comprises only a few rare species, which are typically cold water varieties. Examples are Leuciscus waleckii, Gymnodiptchus dybowskii, Gymnocypris maculatus, Chuanchia labiosa, Phoxinus sp. and a few unique species of catfishes. Most of these species are of economic importance. The middle and lower sections of the river lie in the warm temperate zone, and are inhabited by many more species of fishes. The natural habitat differs from section to section, and the species composition of fish fauna also varies markedly. The middle section (from Kweiteh to Mengchang) is mainly in the highlands composed of clay but with large amounts of sand at places. Canyons and rapids are frequent. The width varies greatly, with the narrowest section rarely over ten meters wide. The water level also

fluctuates tremendously. During the dry season, the river-bed may become exposed. Such complex conditions are not favorable for the growth, migration, and propagation of fishes. Consequently fish species are not numerous, and fish populations are also limited. The more important economic species include the carp, goldfish, Squaliobarbus curriculus, and some special gobies. In the lower stream below Mengcheng, the river enters into the wide flat basin. Here, both the variety and quantity of fish increase. Aside from the same species that are found in the middle section, there are Hemibarbus maculatus, Erythroculter ilishaeformis, Parabramis pekinensis, Hypophthalmichthys molitrix, Xenocypris argentea, Elopichthys bambusa, Ctenopharyngodon idellus, Monopterus albus, Anguilla japonica, Siniperca chautsi, and Coilia nasus.

Fishery production in the upper stream of the Yellow River is rather scanty; that in the middle stream is much higher. Lake Wuliangsu in Inner Mongolia alone produces up to 4,000 tons annually. In Honan Province, the production of carp in 1957 reached 80 tons. In the lower section, fishery is more productive. Tungping Lake is rich in carp and Erythroculter. These two species provided 600-700 tons annually in 1956 and 1957.

The Hwai River system

This is a big river sandwiched between the Yellow River to the north and the Yangtze River in the south. It originates from Honan Province and ends up in Kiangsu

Province, draining into Lake Hungtzeh. Finally it connects with the Yangtze River via the Shan River. Its total length is 900 km. It receives many tributaries and is connected with several large lakes. Since the communists came to power in China, several reservoirs have been built in the upper stream as well as in Anhwei Province. These hydraulic reconstruction works not only serve to control flood but also create new habitats for the development of freshwater fisheries.

Basically, fish species in the Hwai River are similar to those in the Yellow River. Important economic species include Cyprinus carpio, Carassius auratus, Parabramis pekinensis, Elopichthys bambusa, Xenocypris argentea, Siniperca chautsi, Erythroculter ilishaeformis, Coilia nasus and a salangid. It also produces the four domestic species of carps; Ctenopharyngodon idellus, Mylopharyngodon piceus, Hypophthalmichthys melitrix and Aristichthys nobilis. In recent years, the spawning grounds of these fishes have been discovered. Fishermen living by the Hwai River started to collect young fish from the river and transfer them to their ponds for culturing purpose.

Fishery production in the Hwai River system is large. In Honan Province, the river runs for 280 km, and the fisheries produced therein reached 7,147 tons in 1957. This river area is the largest fish producing area in the province. In Anhwei Province, the Hwai flows through 400 km of territory

and it accounts for one of the three large fishing areas in the province. The 1957 production was around 20,000 tons. Very high fishery production was achieved in the fishing area of Hungtzeh Lake in Kiangsu Province, where the 1957 yield reached 40,763 tons.

The Yangtze River system

Spanning a length of 5,590 km, the Yangtze is the largest river in China. Its source is found at the foot of the Kokoshili mountains in Tsinghai Province. At the headwater are numerous tributaries which, after converging into one main stream, form the Tungtienho (River to the Heaven). It now runs southward through the borderlands of Sikang and Szechwan Provinces and is known as the Kinsha (Golden Sand) River. Running between high rising mountains, the water flows at a high velocity. In Szechwan, it receives several large and small tributaries. After this it becomes the main stream. East of Wan District in Szechwan the river runs through a deep canyon for about 200 km which is dotted with precarious rapids. This is the well-known Three Gorges section. Below Ichang, Hepeh, the river enters into a large plain. Then at Chenlingchi Hunan Province, it receives Tungting Lake. Because of the extensive meandering, water flow is slowed down considerably. Back middle and lower sections of the river, there are many lakes that drain into the river. Some of the larger lakes are Hupeh's Hung Hu, Kwangkai Hu, Tarsar Hu, Hwangtong Hu, Tzun Hu, Lu Hu, Liangtze Hu, and Tsangtu

Hu; Kiangsi's famous Poyang Hu; Anhwe Tsao Hu and others; and Kiangsu's three or four lakes. Lake Tungting and Poyang are the largest lakes in China; each is over 3,081 km (2) in surface area. These lakes also receive the Hsiang River and Kang River, which are the largest tributaries draining into the lower Yangtze. The Yangtze joins with the Grand Canal at Chinkiang east of Nanking. Then it spreads over the wide,

fertile Delta area before it is finally divided into two arms by the Tsungming Island before emptying into the sea. The south arm is joined by the Hwangpu River at the mouth.

The Yangtze valley is one of the richest areas in China. It is also an area with the highest development in freshwater fisheries. In the middle and lower sections, the climate is favorable and the river never freezes. Organic material measures 0.76-18.48 mg/liter. Rich in nutrients, the river is heavily populated with various forms of aquatic lives. Besides fish, there are the well-known Yangtze alligator and porpoise. Freshwater prawns and crabs are also widely distributed.

There are about 300 species of fish in the Yangtze River; two-thirds of these belong to Cyprinidae. From Kinsha River upwards, the river is in the high arctic zone and fish species are few and peculiar. The more important ones are only a few cyprinids of the subfamily Schizothoracini and some catfish-like species. Also, because this wide area is

sparsely populated, the fishery is very little developed. The main Yangtze below Kinsha River is located in subtropical zone and it contains large populations of a large number of fish species. Here also lie the major spawning grounds and fingerling producing areas for the four domestic carps of Ctenopharyngodon, Mylopharyngodon, Hypophthalmichthys and Aristichthys. The important economic species consist of, besides the above four, Cyprinus carpio, Carassinus auratus, Barabramis pekingnsis, Megalobrama terminalis Xenocypris argentea, Ochetobius elongatus, Soualiobarbus curriculus, Myxocyprinus asiaticus, Siniperca chautsi Biopichthys bambusa, Psephurus gladius, and others. There are also some peculiar species. In the upper stream above Ichang, fish of the family Homalopteridae are very abundant. In the family Cyprinidae, peculiar species are also plenty; e.g., Spinibarbusichthys sinensis, Onychostoma laticeps, Garra imberbis, Chuanchia, and a few species belonging to the subfamily Schizothoracini. Most of the above peculiar fishes are also of economic value. Still another coldwater fish, Hucho bleekeri, a salmonoid, is also well established in this upper stream.

In the mid and lower stream of the Yangtze, there are a lot of species of fish that are only rare or absent from the upper stream. These include Coilia nasus, Siniperca chautsi, a salangi Ophipcephalus argus, Eleotris oxycephala, Anguilla Japonica, Mastacembelus aculeatus, Claris pulicaria, etc. There is also the well known anadromous shad, Hilsa reevesii.

In the lower stream are still some inshore marine forms such as Mugil cephalus Lateolabrax japonicus, Anabas scandens, Spheroides ocellatus, Cynoglossus gracilis, and Platycephalus indicus. Most of the above species are not seen north of the Yellow River system.

The total catch from fishing wild species in the Yangtze River system accounts for nearly half of the total freshwater fisheries production in China. The largest producing areas come from Kiangsu, Anhwei, and Hupeh. In 1957, the total freshwater fish catch in China was 614,457 tons; Kiangsu accounted for 150,760 tons, Anhwei, 73,033 tons, and Hupeh, 70,000 tons, which is about half of its total freshwater fisheries production. Kiangsi landed 34,973 tons. Catches from the various lakes also made some impressive showings. The Tai Lake in Kiangsu, having a surface areas of about 208 km (2), landed 10,370 tons, averaging 57 kg/ha. Anhwei's Tsao Lake has a surface area of nearly 75 km (2); its annual catch is 6,000 tons, averaging 95 kg/ha. Hupeh's Liangtzeh Lake has a surface area of only 40 km (2), and it landed 2,500 tons, averaging 75 kg/ha.

The Yangtze River system not only produces heavily adult fishes, but also is an important producing and supplying center for fingerlings of the four cultured carps. The fingerling production in the Yangtze River accounts for 70% of the nation's total. Since the beginning of the People's Republic of China, the fingerling production has been on the

increase every year. In 1957 the combined production of fingerlings from the five provinces of Hupeh, Hunan, Kiangsi, Anhwei, and Kiangsu totaled 13 1/4 billion fish. This number was increased to 23 1/2 billion in 1958.

The Pearl River system

The Pearl River, the large river in southern China, has a total length of 2,100 km. It has three main branches: the West River, East River, and North River. These three rivers join together only in the lower stream, where numerous branches, in a dense network of waterways form the Pearl River Delta and drain into the South China Sea via several mouths. Of the three branches, the West River is the longest and many tributaries are connected with it. The North River is about 500 km. long and the East River is 480 km. long.

Most of the Pearl River area is located in the subtropical and tropical zones. The rainfall is the heaviest of the country and the fishery is quite well developed. There exist about 260 species of fish. Aside from the commonly distributed economic species such as the carp, goldfish, bream, the four domestic carps, Chinese perch, etc., there are some species that are indigenous to this area. These are Rasbora and Megalops cyprin Cyprinids number about 150 species, some of which are native to southern China, such as Cirrhina

molitorella, Yaoshanicus arcus, Discogobio tetrabarbatus, Rectoris poshensis, Tanichthys albonub and Cyprinus carpiotangli. Of the above, Cirrhina molitorella is a widely cultured species in the south, and Cyprinus Capriotangli has some special economic importance also. There are also a larger number of Ophiocephalids and Homalopterids. Entirely absent are the northern salmonids and the Yangtze River white sturgeon.

The two provinces of Kwangtung and Kwangsi in the Pearl River system are one of the major freshwater fish culture areas in China. Landings of natural species are relatively small, but have increased quite a bit in recent years. The total freshwater fisheries landing in Kwangtung in 1957 was 182,063 tons, of which 17,147, or nearly 10%, came from non-cultured species. This percentage compares with less than 1% in 1956. Kwangsi's total freshwater/fisheries landing in 1957 was 24,947 tons, of which less than 9% was derived from wild species. The West River produces large numbers of fingerlings, comprised mainly of Cirrhina molitorella, and secondarily of Ctenpharyngodon Idellus, Hypophthalmichthys molitrix, and Aristichthys nobilis.

The Chientang River and Min River system

Along the southeastern coast of China, these are the two largest rivers. The Chientang is 380 km. in length; its total drainage area covers 2/5 of the Chekiang Province. In the upper stream are three branches, each carrying its own name.

The main stream is called Fuchan River until it reaches Hanchow. It is only from Hanchow downstream that the river acquires the name of Chientang.

The Chientang River has about 90 fish species, of which half are cyprinids. They are mostly the same economically important species that are present in the Yangtze River, such as the grass carp, green carp, smallhead carp, bighead carp, carp, goldfish, bream, mullet, shad, etc. A few coastal species are unique to the river, such as the long-tail shad (Hilsa sinensis), tongue fish, and several kinds of puffers. The production of freshwater fisheries has been on the increase since 1954. In 1957, landings from non-cultured species amounted to 11,842 tons, which comprised 45% of the total production of all freshwater fisheries of the River.

The Min River is 614 km. long. Its drainage area covers half of Pukien Province. The upper stream also has three branches all originating from mountainous areas with elevations in excess of 1,000 meters above sea level. When the river reaches Nanking, it has dropped to only 70 meters above sea level. The upper stream therefore has very rapid flow. There are 70 - 80 species of fishes, mostly the common kinds that are widely distributed in inland China. There also are a few species of clupeids and Eleotris that are similar to those found in Taiwan and Hainan. The fishery in the Min river is fairly well developed, with the annual landings in the vicinity of 10,000 tons. For example, in

1957, the freshwater fisheries landings amounted to 11,842 tons, of which 7,492 tons came from wild species and 4,350 tons from cultures.

The Tsangpu, Lu, and Lantsang River system. The Tsangpu River is the largest in Tibet. It flows into India and drains into the Indian Ocean. Its total length is 2,900 km., about 2/3 of which lies within the territory of China.

The Lu River originates between Tibet and Tsinghai. It flows through Sikang and Yunnan and finally enters into Burma, where it drains into the Indian Ocean. Its total length is about 2,000 km., of which 2/3 is inside China. It is a typical mountain stream of southwestern China.

The Lantsang River is located east of the Lu River. Like the Tsangpu and Lu, it also runs in a north-south direction. After passing through Sikang and Yunnan provinces, it enters into Laos, Thailand, and Cambodia, where it is known as the Mekong River. It drains into the South China Sea. The above three rivers, all in the highlands of southwestern China, are situated mostly in the subtropical zone. Because of the mountainous topography, the water velocity is very rapid in many sections. Fish species are rather peculiar and the fishery resource is relatively poor. The Tsangpu River is more or less dominated by cyprinids belonging to the sub-family Schizothoracini. The Lu and Lantsang rivers in Yunnan Province contain some peculiar and native species,

such as Cyprinus pellegerini, and Barbus grahami. In short, the fisheries resources and fish species in southwestern China are scanty, but at the same time, they have not been fully utilized.

The Tarim and Irtysh River systems

The Tarim is China's interior river in Sinkiang Province without an exit. It is 2,700 km. in total length. There are four branches in the upper stream; its lower stream ends up in Lop Nor. Having only a very scanty annual rainfall, the area is the driest in China. The Tarim River suffers a long dry season every year. Fish, consisting mainly of sturgeon and bullhead, are produced in Passuteng Lake, with an annual landing of approximately 700 tons.

The Irtysh River, located in northern Sinkiang, originates in the Altai mountains and flows into U.S.S.R. It flows for 580 km. inside China. The principal fishery occurs in Bulunto Lake, with an annual landing of about 700 tons. Most of the fish are typically northern species: pike, goldfish, sturgeon, European catfish, and the redfish (Salmonidae).

Taiwan and Hainan

Taiwan, being surrounded by the sea, is especially rich in marine fishes. It also has many rivers and streams and has a large-scale freshwater fishery. Freshwater fishes number 80 - 90 species, of which about half belong to Cyprinidae. Aside from the common carp, goldfish,

Plagiognathus microlepis, etc., most of the species are not found in mainland China. Strictly local species include Liobagrus formosanus, Iskikauia macrolepis, Oncorhynchus formosanus and two species of Leuciscus. The major part of freshwater fishery in Taiwan lies in culturing, which lands approximately 10,000 tons a year. This is only 5% of the total fish landings. The principal cultured species is the goldfish, which is followed by the grass carp, the smallhead carp, and finally the common carp.

In Hainan Island, the principal Fishery is marine. Only the Nantu River has a freshwater fishery of some significance. There are 70 - 80 freshwater fish species, of which cyprinids account for more than half. Aside from the common carp, goldfish, bream, and Plagiognathus microlepis, most species are peculiar to the region. The species composition is even vastly different from that in Taiwan. There are quite a few unique kinds, such as Glyptosternon hainanensis, Garra schismatorhyncha, Sinogastromyzon leveretti. In short, the species composition reflects strongly tropical ichthyofauna. Most fishes are small in size and relatively few have any significant economic value. The annual landing is between 1,000 and 2,000 tons.

The Inland Lakes

China has numerous lakes, totaling 23,700 square miles. The great majority of lakes are connected with the major river systems, but in Yunnan, Sinkiang, Inner Mongolia,

Tsinghai, and Tibet, there are quite a few closed inland lakes and seas. The better known ones are the Tsinghai Lake in Tsinghai, and Tien and Fushien lakes in Yunnan.

The Tsinghai Lake is China's largest inland salt lake, having a surface area of 760,000 acres. Its average salt content is 15 ppt, with a pH of 9.3. For 4-5 months of the year, it remains frozen. Fishery resource, mainly consisting of species belonging to the subfamily Schizothoracini, has a good potential, but because the local people do not have a fish eating habit, the fishery resource had not been developed before 1950. Since then development of the fishery has pushed the production rate from 500-600 tons annually to 1,200 tons in 1957. Continued exploitation of its potential will, no doubt, further increase the tonnage.

Tien Lake is situated in the lowlands of southwestern Yunnan. It is a sunken lake, with a surface area of 71,300 acres. The water is only around 5 meters deep and is slightly alkaline with a pH of 8.0 - 8.7. The lake is rich in aquatic life and is Yunnan's important fishing area. The major commercial species are the common carp, goldfish, and Barbus grahami. In 1957, the catch totaled 60 tons. Since 1958, culturing has been developed around the lake and it should substantially increase the production in the future.

Fushien Lake is an oligotrophic lake situated in the limestone zone of the highlands in Yunnan Province. Its

surface area is only 45,500 acres, but its bottom reaches 150 meters. The water is very clear, with a visibility of 6.5 meters. Poor in nutrients, the lake has a small fishery along the northern and southern shoal areas, yeilding annually about 26 tons.

Aside from the natural water bodies that are discussed above, China also has a large number of reservoirs that have been developed. In 1958, the total area of all reservoirs has reached 5,452 square miles and the reservoir area has continued to increase at an even more rapid pace. These newly created aquatic habitats afford an excellent opportunity for increasing fisheries resources.