

45.—THE FISHERIES OF JAPAN.

BY THE JAPANESE BUREAU OF AGRICULTURE.

INTRODUCTORY REMARKS.

The series of exhibits of the fisheries and fishing resources of Japan was brought together in order to give the visitor a glimpse into the fishing industries of the Japanese Empire. When the varieties of objects sought after are so numerous, and the methods employed for obtaining them are so diverse, as is the case in extensive fisheries, it becomes a serious question how appropriate selections may be made so as to form a sufficiently comprehensive and representative collection. In the present case, after much deliberation, the following plan has been adopted: Of the animals and plants found in our waters, those were at first selected whose respective annual yield exceeds 10,000 yen. As this, however, was found to exclude many objects of peculiar interest, exceptions have been freely made in favor of such special cases. The final selections as displayed in the present series consist of 138 species of animals and plants, as follows: Mammals, 3 species; reptiles, 2 species; fishes, 85 species; mollusca, 33 species; crustacea, 11 species; algae, 4 species.

By an unfortunate circumstance a species of Echinodermata, *Stichopus japonicus*, one of the important fishery products of Japan, was not included in the collection.

Of these species, alcoholic specimens, as far as possible, or photographs from actual specimens where they are too large, are displayed. In one or two cases of exceptional nature it has not been possible to follow this rule. The species are arranged in order of scientific classification, beginning with the *Cetacea* and going down the animal scale. Four species of seaweeds which are of great commercial interest are placed at the end.

Out of the 138 species mentioned above, those which are of great economic or social importance and are likely to interest the American and European public, have again been selected and made the subjects of a somewhat exhaustive display. Of each of these kinds, in addition to the alcoholic specimens or photographs, are given a map showing the distribution of the species, the various devices employed for catching it, such as hooks, traps, lines and nets, together with methods of culture where there are such, and finally the different articles manufactured from it. In some cases, where this full treatment is not possible or essential, only a part of the program has been carried out. The following subjects have been treated in this full manner, viz, the

NOTE.—This paper has been abstracted and arranged from a descriptive catalogue of exhibits illustrating the fisheries and fishery resources of Japan, at the World's Columbian Exposition; the catalogue emanates from the bureau of agriculture of the department of agriculture and commerce of the Imperial Japanese Government. There is added an article on the fisheries of Japan by K. Ito, reprinted from the Transactions of the American Fisheries Society for 1887. The compilation has been made by Dr. H. M. Smith, assistant in charge of the division of methods and statistics of the fisheries.

whales and dolphins, the edible turtles, the "tai," the mackerel, the tunny, the bonito, the cod, the soles and flounders, the carp (with the goldfish), the salmon, the "ayu," the sardine, the herring, the oyster, the shrimps and lobsters, and the algae before referred to. By the adoption of this plan, it is hoped that a fairly representative display of the fishing industries of Japan has been secured.

The models of nets, boats, etc., have been made with the strictest fidelity to the originals, even in minute details, so that the actual things may again be constructed from them. Only, as it is impossible to reduce the size of the meshes in nets on the same scale with other parts of the models, the proportions of meshes in different parts of large nets are alone intended to be displayed.

When the size of the meshes is given in the description of the nets, it is to be understood as the distance between every two knots on the same straight line, when they are pulled as far apart as possible.

The prices given are all wholesale prices in the Japanese market. A yen (= 100 sen) is equal at the present rate of exchange to \$0.65½ U. S. gold.

THE WHALE AND DOLPHIN FISHERIES.

The whales found in the seas adjacent to the Japanese coasts are the finback whale (*Balæna japonica*), the semi-kujira of the Japanese; the California gray whale (*Rhachianectes glaucus*), known among the Japanese as the ko-kujira; the humpback whale (*Megaptera boops?*), whose Japanese name is the zato-kujira; the rorqual (*Balænoptera arctica*), known in Japan as the iwashi-kujira or katsuwo-kujira; the sulphur-bottom whale (*Sibbaldius sulphureus?*), called nagasu-kujira in the language of the country; the sperm whale (*Physeter macrocephalus*), known as makko-kujira; and the sperm-whale porpoise (*Hyperoodon rostratus?*), whose Japanese equivalent is tsuchi-kujira. Of the porpoises and dolphins found in the waters of the country are the sunameri (*Neomeris phocaenoides*), the goto-kujira or blackfish (*Globicephalus sieboldii*), the sakamata or grampus (*Grampus sakamata*), and the iruka or dolphin (*Delphinus longirostris*), the last named being the most common.

Dolphins and other small cetaceans are captured by means of nets. A dolphin net, exhibited by model in the Japanese section of the fisheries building, used at Tago in the province of Izu, consists of three separate nettings, called respectively the "closer," the "seine," and the "tuck-seine." The first is used for closing the mouth of the bay when the dolphins have entered it. It is made of straw ropes and the meshes are about 2 feet and 5 inches. The seine is used for encircling the dolphins and drawing them near the land. Its central portion is made of hemp, and the meshes are here about 8½ inches; while the two lateral portions are made of straw ropes with meshes of from about 2 feet to 2 feet and 5 inches. The tuck-seine is used for finally landing the dolphins. It is made entirely of straw and the meshes are about 8½ inches. Six boats are attached to it as floats.

The prepared products of this group of marine animals represented at the exposition consist of dolphin oil and crude and refined rorqual oil, manufactured by the Tokyo Fish Oil and Wax Company and exported to London, the price received being about 6 yen per 100 pounds. There were exhibited also crude and refined sperm whale oil, refined rorqual wax, and crude and refined spermaceti. The oil and wax of the sperm whale are produced only in small quantities. The price for the oil is 6 or 7 yen per 100 pounds; for the spermaceti, 15 or 18 yen per 100, and for the rorqual wax, 13 to 16 yen per 100.

SNAPPING-TURTLE CULTURE.

The snapping turtle (*Tryonix japonicus*), known in Japan as the suppon, is found in all parts of Japan in rivers and marshes, and is highly esteemed for the flavor of its flesh. Recently special attention has come to be given to its cultivation. The specimens exhibited were from the hatching-grounds of Mr. Kurajiro Hattori, of Tokyo. They comprised examples representing the stages of growth in the first, second, third, and fourth years after hatching. The breeding season is from the latter part of May to the first part of July, and the same individual is said to deposit eggs more than once in the course of a single season. The food consists of fish, shellfish, and worms. From about the middle of October to April of the next year the snapping turtle hibernates in the mud. Specimens two years old weigh from 10 to 13 ounces. Those weighing about 80 ounces are more than ten years old.

A map of the snapping-turtle farm of Mr. Kurajiro Hattori, of Tokyo, was exhibited. The pond has a muddy bottom, and its depth is about 1 foot near the banks and about 3 feet in the central part. The eggs are deposited in the sunny part of the bank. In the sandy area around the pond, which easily becomes dry, fences are erected to prevent the escape of the turtles. When the season for depositing the eggs is over, wooden boards of about 1 foot in height are erected on the lower margin of the bank and, between these, sheets made of reed or bamboo splints are placed to protect the broods from the attacks of their parents and other foes. Within the barrier are buried numerous pots to afford shelter to the newly hatched turtles.

The canned meat of the snapping turtle has a large demand, owing to its fine flavor and nutritious properties. The sample exhibited was made in the province of Chikugo. The price per dozen cans is 3.60 yen.

THE TAI FISHERY.

The tai,* as the Japanese call the scup, is the most highly esteemed of all the food-fishes of the country, and no feast can be complete without it. Of the four species of tai in Japanese waters, *Pagrus tumifrons* (called hanaore-dai), *P. cardinalis* (kasukodai); *P. major*, and *P. ruber*, the second named is the most abundant. The tai of the market is generally from 1 to 2 feet long. The price of a fresh tai a foot in length is often more than a yen. The tai is a bottom fish preferring sandy or muddy places. It feeds on other fishes, shellfish, and annelids. In the early part of summer it migrates from the deeper to the shallower seas, where it spawns, and in the autumn it again seeks its deep-water haunts. In the southwestern provinces the chief supply of the market-fish comes from the Inland Sea, the middle portion of which is a favorite spawning-ground. The tai enter the sea through its eastern and western channels, and returning seek the ocean by the same route. In the northeastern part of the country the spawning season is July and August. The tai is found in all parts of the country.

In fishing for the tai long lines or set lines, hand lines, and several forms of nets are used. The box of long line exhibited represents such an apparatus as is used at Misaki in the province of Sagami. It is a long line bearing a certain number of snoods about 20 feet long. A section of about 1,900 feet of the line bearing 85 snoods is put into a shallow round wooden box. A single boat manned by six or seven men often works a line of as many as twelve of these sections. A stone and a barrel buoy are

* Changed into *dai* for the sake of euphony when compounded with a prefix.

attached to each section of the line as it is let down, except the first, to which is attached, instead of the stone, a wooden grapnel to fasten it to the bottom. When the whole line has been let down, a stone and a buoy are tied to its end; the boat is then rowed back, and the line is taken up from its beginning. For bait spoon-worms (*Echiurus*), sardines, and squids are used.

The whole length of the tai hand line is 160 feet, of which the leader, 100 feet in length, is made of silk-worm gut, the remaining part being of silk. At three points a lead of one-tenth to one-fifth ounce is tied to hold line against the currents. When the line is used, the bamboo rod on which the line is reeled when not in use is employed as a fishing rod.

For bait, shrimps covered with *Mysis* are used, the *Mysis* serving as a toll bait.

Tai hooks of different kinds are used in various parts of Japan. Those made of brass are mostly used with the long line, while those of iron are generally used with the hand line. They are of various shapes; some angular, others are curved; some possess barbs, others have none, while in still others the end is bent laterally at an angle. Some are made simply by bending a wire, while others are carefully tempered.

The principal net used in the tai fishery is the scare-cord seine.

This net is called "katsura-ami" by the native fishermen, from the idea that its scare-cord resembles in appearance the stem of the ivy (katsura=ivy, ami=net). The meshes are largest near the ends of the two wings, where they measure about 5 feet, and gradually diminishing in size become at last about half an inch in the central portion. The portion with smaller meshes is made of hemp, while those portions which have larger meshes are made of straw. The net is divided along its middle line into portions which are joined together when used.

The scare-cord is made of hemp and is about 3,750 feet long. To it are attached, at intervals of 2 feet, thin rectangular pieces of wood. Also to keep the cord in a horizontal position at a proper depth, stones and barrel buoys are tied to it.

To work the net, each end of the scare-cord is kept by a boat. The two boats, keeping at a convenient distance from each other, row in conjunction, and, gathering together the scattered fish, scare them on the net, which is kept spread by two other boats which also gather it in after the fish have entered.

In addition to being extensively consumed in a fresh condition, the tai is preserved in various ways, viz, with salt, by being opened and dried; or by being boiled and crushed; or again by being made into wafers. Salting is, however, the chief means of preservation. Salt tai is largely made along the southern Pacific coasts of Japan, more than 10,000 casks being produced every year. The price varies according to the size and quality of the fish salted, but about 5 yen per 100 pounds may be taken as the current wholesale price.

Tai wafers are excellent for making soup. Neither taste nor color is affected by lapse of time. Mashed tai (Japanese, tai-dembu) is excellent for making broth. It has a delicate flavor which is very delicious. The price is about 50 sen a pound.

THE MACKEREL FISHERY.

The species of mackerel sought by the Japanese is *Scomber colias*, which is known by the name saba.

Fishermen distinguish several kinds of "saba," such as "maru saba," "hira saba," and "goma saba," but they are probably to be regarded merely as varieties of the species named above. This species is always found in or near the Kuro-Shiwo or

Black Stream; but nothing is as yet known about its migration. In its pursuit of prey it comes into bays and shallow waters near the coast, and can then be caught with ground-seines. At night it is easily attracted by light, and the fishermen take large shoals by burning torches in their boats.

The food of the mackerel consists principally of sardines, small crustaceans, squids, and pteropods; but it is not very fastidious in its taste and takes even salt fish. Spawning takes place in April and May. Large specimens often measure about 2 feet in length and weigh about 6 pounds.

Mackerel fishing is carried on in all parts of Japan. Both nets and lines are used for the purpose, but the latter are by far the more effective means.

A mackerel long line used at Misaka in the province of Sagami, which may be taken as a type of this form of line, is about 350 feet long, bearing 85 snoods of about 2 feet. Fourteen baskets of this line are usually worked by a boat of 6 or 7 men. When being used, the line is kept floating at some intermediate depth by means of five barrel buoys attached to the principal line by means of ropes 300 to 350 feet long. As ballast a small stone is tied to the lower end of each hanging rope. Beside these, nine smaller stones are attached at intervals to the whole line.

A mackerel hand line, locally called *bishi*, used in the same place, consists of a piece of brass wire bent in the middle so as to form a loop, the two ends of which diverge from each other. The wire is then attached by the loop to a line consisting of three strands coiled together, and measuring about 250 feet in length. Each end of the wire bears a snood of silk-worm gut, and to the loop are attached a conical piece of lead and a bag containing bait. This line is worked by night and at a depth of 10 to 50 fathoms with good tidal currents; large shoals being made to gather by torch or lamp light.

For bait, sardines and mackerel are chiefly used. When these can not be obtained fresh, salt sardines or salt mackerel are used; the small bag attached to the loop contains minced flesh of these fish, which acts as a toll bait.

The mackerel is caught in considerable numbers in the spring and autumn, but also more or less throughout the year.

A mackerel torchlight net is used near the coast of the southern parts of Japan. The whole is a rectangular net 60 feet by 210 feet, the central portion being made to hang down slack and form a sort of bag. Its meshes vary in different parts from half an inch to about 6 inches. Four ropes made of straw are tied to the short sides of the net and five to the long sides. At the junction of the net and the rope a stone (of 8 to 10 pounds) is attached. The net is first of all kept spread flat by four boats holding the ropes tied to the sides. Two boats with dragons then row on to the middle of the net. A large number of mackerel, attracted by the lights, follow them. Then the men in the four boats begin to work in the ropes, and the boats with dragons extinguish them and row out of the net. This mode of attracting large numbers of the mackerel with torchlights has been in use in Japan for 400 years.

There are three ways of preserving the mackerel, viz, drying, canning, and salting. Of these, salting is carried on on an extensive scale in every part of Japan. In recent years various improvements, such as the use of specially selected salt, have been introduced, and fine salt mackerel is now not a rare article in the market. If there should be any demand for exportation in future, this mode of curing would doubtless attain a still higher degree of perfection.

Salted mackerel are put on the market in casks of several sizes; a small cask, containing 8 or 9 fish from 1 to 1½ feet in length and weighing about 10 pounds, commands the price of 1 yen; a larger cask, holding 14 mackerel weighing twice as much as the first cask, sells for 2 yen. The value of the salt mackerel packed in 1890 was 234,561 yen; and in 1891 it was 183,686 yen.

THE TUNNY FISHERY.

The tunnies—*Thynnus sibi* and *T. albacora*, the shibi and kiwada-shibi, respectively, of the Japanese—move in large schools in the Kuro-Shiwo but never enter bays or inland seas. They are carnivorous and feed on small fishes and squids, being often seen dancing around shoals of small fish and eating them. They are very quick in their movements and are good swimmers. Specimens 5 feet long and weighing over 124 pounds are quite common. The tunnies are caught throughout the year, but summer is the best fishing season. They are caught with trawl lines and in pound nets.

The tunny long line is a cord of about 1,250 feet with 10 snoods about 5 feet long, and is worked at a depth of more than 400 feet. Both the cord and the snoods are made of hemp, and put into shallow baskets. Two boats, with 8 or 9 men each, usually work 12 basketfuls of the cord. To use it, 5 stones weighing about 27 ounces apiece are tied to the cord; also at each end of it is attached, by means of a cord about 300 feet long, a rod of *Paulownia imperialis*. To these again is tied at right angles a long stem of bamboo, at the top of which some easily observable signals are placed. The principal cord does not reach the bottom of the sea, but is kept suspended at some intermediate depth. For bait, squids and horse-mackerel are used.

The hooks are made of brass castings.

The pound net used in tunny fishing is a fixed net made of straw on a large scale and with great art. It is used at the extremities of wooded promontories in the vicinity of Nagasaki. It consists of two principal parts, the leader and the bowl. The leader, which is set near the coast, has 1-foot meshes. In the bowl the meshes at first are also about 1 foot, but become smaller as they approach that portion which is made of ropes of straw. The net is fixed by stones, some of which are attached to the lower margin of the barrier, and others are put into nets and suspended by ropes of straw from the floats consisting of bundles of bamboo tied to the upper margin of the net. The leader is about 1,150 feet long and 20 feet high, while the bowl is about 350 feet long and 280 feet wide. Two watchmen are always placed on a watchtower to keep a lookout. When the fish enter the bowl along the barrier, a net which is placed at the entrance of the bowl is in the first place drawn up, and the fish are caught in the inner pound by gradually raising up the net of the pound. When, however, they do not enter the bowl directly, the entrance into the pound is closed with another net and the fish are driven into the bowl.

A double pound net set for tunnies is used in the seas near Sendai in the northern part of Japan. It consists of a leader and a pouch. The former is about 1,750 feet long and its meshes are about 5 feet; the latter is about 1,740 feet in circumference and its two blind ends form the inner pound. There are five intercepting nets, viz, one at the entrance of the pouch, another on each side of this, and others at the entrance of each inner pound. These nets are usually allowed to hang down; but when the fish enter the pouch they are successively raised and lowered, so that the fish are gradually driven into the inner pound. The whole net is provided with stones

and with floats of unhewn timber. The meshes of the pouch vary from about 1 foot 4 inches to about half an inch in length.

This net proves itself to have been constructed with a full knowledge of the habits of the fish for which it is intended. Owing to the presence of a rectangular bend in the barrier and the curvature of the pouch, the fish which have once entered the net can not possibly get out of it again. Moreover, if a second shoal of fish comes after the first has entered the pouch the latter is driven beyond the second intercepting net, and the net at the entrance of the pouch is opened; then the second shoal merely swims to and fro between the barrier and the entrance of the pouch for any length of time, and there is no fear of their escape.

In the watchtower 2 men always keep a lookout, while below is a boat with 6 men. When the fish enter the net, word is given from the tower to the boat and the intercepting nets are put into action. Moreover, signals are made to the fishermen's huts on the shore, according to the number of fish.

The tunny drift net is used in the vicinity of the Bay of Tokyo. A single netting is about 275 feet long and 20 feet wide. Twelve such pieces (or "mogai," as the fishermen call them, are joined into a single net. The meshes are about 7 inches, and the knots are made so as to prevent sliding in either direction. A big rope is tied to the upper margin. In order to make the net float on the surface, the rope is made from the fibers of the palm (*Trachycarpus excelsa*), and floats are attached to it at a distance of about every 1 foot 4 inches. The rope of the lower margin is made of hemp, and no stones are attached to it.

This net is worked in the spring and in the open sea at a depth of 500 to 1,000 feet. Many boats form a line and intercept the route of the fish, and the net is shot down the tidal current. While being drifted, one end of the net is kept tied to the boat, while the other end is attached to a float, with a floating signal and a lighted lamp.

Tunnies are mostly eaten raw in Japan. Until recently the only methods of preservation were by salting, and by smoking and drying; but now they are also canned and preserved in oil according to European methods. The only method which offers any peculiarities is smoking. As preliminary to that process, the flesh is first boiled in water, and after being smoked is dried. It can be kept for any length of time without any alteration in its taste. It is daily used in Japanese households as a condiment, and is especially excellent as a stock for soup. One hundred pounds cost 12 to 15 yen.

THE BONITO FISHERY.

The fishes embraced by the name bonito include a number of scombroid species, chief among which in Japan are *Thynnus pelamys*, called Katsuwo,* and *Auxis tapeinosoma*, called Soda-gatsuwa.

These two fishes, especially the first, are of prime importance in the fisheries of Japan; and the amount of their catch directly affects the monetary condition of the fishing villages. They are both migratory fishes. Coming in the spring in large shoals along with the *Kuro-Shiwo* from the southern seas, they pass the summer about submarine rocks near the coast, and go back to the south in the autumn; but of the details of their routes, their habits, and the time and place of their spawning, nothing accurate is known. Large specimens often measure about 1 foot and 5 or 6 inches in

* Changed into gatsuwo when compounded with a prefix.

length and weigh about 12½ pounds. The bonito as well as the *sōda* feeds on smaller fishes; but they have a very fastidious appetite, so that dead fish can not be used for bait. The *sōda* comes nearer the coast than does the bonito.

Both nets and lines are used in bonito fishing; but angling with bamboo rods is the chief means of fishing, and it has attained a high degree of perfection. The bonito being found chiefly near hidden rocks and in rapid currents, nets can not be used to advantage.

The hooks for fishing bonito are of two kinds, viz, those used with true baits and those with artificial baits attached to them. In the latter the artificial baits are made to resemble both in form and color either sardines or squids.

A fishing scene off the Shiwono-Misaki, in the province of Kii, illustrated in the Japanese section, represents the method of angling for bonito. The man in the middle of the boat, lifting up his right hand and holding a dipper in his left, is casting sardines into the water to attract the fish; 2 men near the stern with fishing-rods in their left hands and with long bamboo rods in their right hands, are throwing water on the bait by means of spatulas attached to the end of the bamboo rods, so that the fish may not see the line and the hook above the bait; a man near the prow has succeeded in catching a fish and has just freed it from the hook by holding it under his arm; a man at the stern has caught a large fish, and a boy is about to raise it up with a hook. The man at the stern with his face turned toward the right side of the boat is the master. He is using a hook with artificial bait.

A bonito circle net is used at the entrance of the Bay of Tokyo from the latter part of autumn to the early part of winter. The bunt is made of hemp, but the wings are made of straw. The net is made up of two halves, each measuring about 1,550 feet in length. The meshes are from about 2½ inches to 5 feet. To work this net 4 boats with 48 men are required. Of these the 2 smaller boats serve as leaders, searching out the shoal of fish and giving orders. When the signal is given, the other boats, which have hitherto carried the two halves of the net separately, join them together and encircle the shoal. The wings are gradually tucked in and the fish are driven into the bunt.

The bonito is to a certain extent eaten raw; but nine-tenths of the fish caught are smoked and dried for preservation. Some are also preserved in salt, but very rarely. The fish is mashed for food, like the tai, and oil and scrap are also prepared from it.

In smoking bonito, the fish is cut lengthwise along the spine and the lateral lines into four pieces, and the head, tail, fins, and bones are removed. The pieces are then well boiled, smoked, and dried. The bonito thus treated can be kept for any length of time without any change in its taste. It is shaved into small pieces and used as a condiment, smoked dried bonito being one of the necessities in Japanese culinary art. The shavings are also eaten by themselves with a little sauce added. Smoked dried bonito is also esteemed by some as a stock for soup. For this purpose the shavings are boiled with water, and the broth is then cleared by filtering. To the filtrate is then added sauce or other condiments, and an excellent soup is made.

THE COD FISHERY.

Two species of cod are objects of fisheries in Japan; these are *Gadus brandti* (Japanese tãrã*) and *Gadus chalcogrammus* (Japanese suketo-dãrã). The cod are gregarious bottom fish living at a depth of more than 500 feet and limited to those seas which are within the reach of cold currents. Cod fishing is mostly carried on in January and February, when the fish come near the shore for spawning. In some places they come up to a depth of about 100 feet, but in others are never found at a depth of less than 650 feet. They feed on herrings, lampreys, squids, and lobsters. The first-named species is the more abundant and important, the other being found chiefly near Niigata.

Cod fishing is carried on with long lines, hand lines, gill nets, and pound nets. The long line is more commonly used than the hand line, and the gill net than the pound net, the latter being restricted to a single locality.

The two baskets of long lines exhibited are such as are used near Niigata in fishing for *Gadus chalcogrammus*. It is a line 225 feet long, bearing 55 snoods of about 2 feet each. Such a line is put into a shallow basket made of bamboo, and is called a "maki." A boat of 6 men uses 80 such "maki" tied end to end into a single line; at each end and in the middle are tied a stone and a barrel buoy, the latter by means of a cord; also at the end of each "maki" are attached alternately a small stone and a float, so that the whole line may not lie flat on the bottom, but be kept floating at intervals. For bait, sardines and squids, cut into pieces of convenient size, are used.

The cod gill net is a hempen net used along the shores of the Sea of Japan for catching *Gadus chalcogrammus*. For this purpose it is sunk to the bottom of the sea. A single piece is about 1,212 feet long and about 5 feet high, and the meshes are about 3 inches. For floats, pieces of varnish-tree or of *Paulownia imperialis* are used, and for grapnels stone and wood. A single boat uses several pieces joined together. For *Gadus brandti* nets with larger meshes and made of bigger cords are used.

The cod is but little eaten in a fresh condition. The fish is cured in different ways and exported to various countries. Pressed cod is made in Hokkaido after the American method. One hundred pounds cost about 12 yen. Split cod are slightly salted and then dried in the sun. A hundred pounds cost 5 or 6 yen. The yearly produce represents from 40,000 to 50,000 yen, or over 800,000 pounds.

Cod-liver oil is manufactured in Hokkaido and sold in bottles containing a pound each. This is used exclusively for medicine. A dozen of such bottles cost about 2 yen and 4 sen. The yearly produce is increasing.

THE SOLE AND FLOUNDER FISHERIES.

Many species of flatfishes are found in the waters of Japan. Among the most important are *Pseudorhombus cinnamoneus* (called kanzõ-hiramé), *P. olivaceus* (hiramé), *Parophrys cornuta* (meita-garei), *Pleuronectes scutifer* (ishi-garei), *P. variegata* (hoshi-garei), and *Plagusia japonica* (ushinoshita-garei). They are all bottom fishes and spawn mostly in winter.

In the capture of these fishes both nets and lines are used; but the former, of which gill nets, trawls, and dredges are employed, are the chief means by which most of the market fish are obtained. The lines are either the long or the hand line.

* Changed into dara when compounded with a prefix.

The plaice hand line is a double coil line about 50 fathoms long bearing 30 pieces of lead each weighing about $2\frac{1}{2}$ ounces. These pieces of lead serve to hold the line against the current. The distances between them grow less and less as we approach the hook. To the hook is attached a flat circular piece of lead, and beside this there is a long line for tying the bait, for which sardines, either fresh or salted, are used.

A form of pole-trawl for soles and flounders, such as is used in the seas near the province of Owari, was exhibited. It consists of a pouch with two wings and a netting stretched between their upper margins. The pouch is about 21 feet long, and its meshes are from a little less than $1\frac{1}{2}$ to about 2 inches. The wings are about 30 feet long and their meshes are about 2 inches. To prevent any damage to the pouch, a hempen netting with meshes of about $3\frac{1}{2}$ inches is spread below it; this is worked with full sail at a depth of 100 to 200 feet. To keep the pouch and the wings open, a long pole is projected from each end of the boat, and to these the drag-ropes are tied.

The plaice gill net is made of hemp. A single netting is about 165 feet long and 6 feet high, and the meshes are about 6 inches. To the upper margin is attached a strong rope of straw with wooden buoys, and to the lower a similar rope with stones. When being used, from ten to twenty of such nettings are joined into a single net, to one end of which are then tied a wooden grapnel and a float. The net is used on sandy bottoms at the depth of 50 to 60 feet.

The flatfish are mostly eaten raw, only a small proportion being dried for preservation. They are also pressed for oil. Dried flounders are chiefly prepared on the coasts of the inland sea. They are mostly sold to the mountain villagers. Flounder oil is a by-product in the preparation of the preceding; it is used for lighting purposes in some retired localities. A scrap, made by pressing flounders, is used in agriculture.

CARP AND GOLDFISH.

The carp (*Cyprinus carpio*) is a food-fish of considerable importance in parts of Japan. A form of weir intended for the capture of carp and crucian carp is used in Lake Biwa in the province of Omi. It is made of bamboo splints and for posts bamboo poles are used. The weir consists of three inclosures which, however, have no intimate relation with one another, but are complete each by itself. Of these three, that nearest the bank is small and low, being about 10 feet high, and the intervals between the splints being a little over one-fourth of an inch wide. The next one is a little larger, being about 12 feet high with the intervals between the splints about $\frac{3}{4}$ of an inch. The last inclosure is largest, and is about 15 feet high with the intervals between the splints about $1\frac{3}{4}$ inches. It is intended mainly for carps and crucian carps.

Of the goldfish (*Carassius auratus*) we distinguish three varieties, viz, *ryukin*, *wakin*, and *maruko*. Various other names are given, according to the form of the caudal fin. The most costly form is the so-called "lion-head" variety of Maruko; which has numerous warts on its head. A pair of this variety, male and female, often costs more than 100 yen; and even the most common specimen can not be obtained for less than 5 yen. The goldfish spawns from the latter part of April. The cultivators usually make their fish spawn three times with intervals of about one week.

THE SALMON FISHERY.

The spring salmon (*Oncorhynchus perryi*) and fall salmon (*O. haberi*), called sàké by the Japanese, are found in the northern parts of Japan, especially in Hokkaido. They ascend the rivers of those parts for spawning, and at that season undergo a great change in shape as well as in color. They usually attain the length of about 3 feet, and weigh 12 to 17 pounds, but large specimens sometimes measure about 4 feet in length and weigh about 20 pounds.

In fishing for salmon drift nets, tow seines, circle nets, and pound nets are used; the first and the last most commonly.

The salmon pound net is employed along the coast of the province of Tokachi in Hokkaido. It consists of a large bowl made of hemp and a leader made of straw. The latter is 750 to 1,500 feet long and its meshes are $2\frac{1}{2}$ to 7 inches. Intercepted by the leader, the fish follow it and enter the bowl. At this time a netting which has hitherto been kept lowered is raised, and the mouth of the bowl is closed. The fish are landed by gradually tucking in the bowl.

The salmon drift gill net exhibited is such a form as is used in the provinces of Uzen and Ugo. It is made of hemp, and a single netting is about 175 feet long and $8\frac{1}{2}$ feet high. Floats are tied to the upper margin, but the lower margin has no weight attached to it. It is worked by night at the mouths of rivers from about the middle of October till the first part of December. Eight or ten nettings are usually joined into a single net, and are shot down the stream.

In addition to being consumed in a fresh condition, salmon are placed on the market in a salted, smoked, and canned state. Salt salmon forms the greater bulk of the salmon cured for preservation. The price has risen in recent years in consequence of exportation, and a single fish now costs 30 to 40 sen. Salmon are not smoked in large quantities, as the demand is not very great. The price is accordingly high, a single box containing 10 fish costing about 2.50 yen. Canned salmon is largely made in Hokkaido; more than 200,000 cans, amounting in value to about 24,000 yen, are sold every year.

THE AYU FISHERY.

The ayu (*Plecoglossus altivelis*) is very highly esteemed among the fresh-water food-fishes. It lives in sandy rivers, and is found in almost all parts of Japan. It feeds chiefly on diatoms and other lower algae. Large specimens measure sometimes more than a foot in length. It spawns in autumn, in shallow rapids.

In fishing for the ayu, lines provided with fly hooks and ordinary hooks are used; scare-cord and casting nets are also employed. Beside these there is a peculiar mode of fishing with tame cormorants, called *ukai*.

The ayu scare-cord net consists of a receiving net and a scare-cord. The former is made of hemp, and its meshes are about an inch. The scare-cord is also made of hemp and is from 200 to 250 feet in length. It bears at intervals short branch lines, also of hemp, to the extremities of which are attached feathers of the cormorant. A single man keeps the receiving net open against the current, while four men scare the fish down the stream with the cord and drive them into the net.

A graphic model of the method of ayu fishing with tame cormorants, or *ukai*, shown in the exposition, represents a single *ukai* boat of the River Nigara, in the prov-

ince of Mino. A dragon is placed at the prow to help the maneuvers of the cormorants. The men are four in number, of whom two manage the boat and the other two the cormorants. The skill with which the men handle the birds is truly wonderful. The man near the prow usually manages 12 birds, and when one of them swallows four or five fish he draws it to him by the cord with which it is tied, and by pressing its throat squeezes the fish out into a tray beside him. In doing this, he is always sure to pick out the right cord, and not the least entanglement occurs. The large basket with the wooden cover is used for keeping the cormorants in. This mode of fishing is said to have begun more than a thousand years ago.

The ayu is highly esteemed in the fresh state; but it is also boiled and dried, or preserved in salt and *saké* dregs, so that it may be kept for a long time or transported to distant countries. The ayu thus treated is highly esteemed and is sold at a high price. When preserved in the dregs of *saké*, or Japanese wine, the fish is stuffed with its own roe. The value of a single fish is about 50 sen.

THE SARDINE FISHERY.

The sardine or iwashi (*Clupea melanosticta*) is the most important of the useful fish of Japan, and the economic condition of the whole fishing industry is intimately connected with the amount of its catch. This is due to the fact that the sardine always comes in enormous shoals and is caught almost everywhere along the coast. Large areas of the surface of the sea are sometimes changed in color by the presence of a single shoal. The sardine is a migratory fish, going from south to north in spring and returning again to the south in autumn. The shoal usually swims at the surface, against the current, but is said also to sink at times to the bottom. The sardine feeds on small crustaceans, such as *Mysis*, and is attracted by torchlight. Spawning takes place in the spring.

Both nets and lines are used for sardine fishing. The latter are, however, limited to certain small districts, while the former are extensively used and have been greatly improved, there being no less than twenty different types of them, the most important of which are the ground seine, circle net, eight-armed net, tack seine, dip net, and drift net.

The sardine ground seine is used at Kujūkuri in the province of Kazusa. It consists of a pocket and two wings. The pocket is made of hemp, with meshes of from $\frac{3}{4}$ to $\frac{7}{8}$ of an inch, and is about 150 feet long. The wings are about 1,150 feet long, and are made partly of hemp and partly of straw. The hempen portion has meshes of from $\frac{3}{4}$ of an inch to about $2\frac{1}{2}$ inches, and the straw portion has meshes of about 1 foot. The wings and the pocket can be separated from each other. The drag ropes are made of three strands coiled together, and are a little over an inch thick and 105 or 110 feet long. From 60 to 80 such ropes are usually provided ready for use. If a shoal is detected, two boats row out with the separate portions of the net. A little before reaching the shoal, the pocket and the wings are joined together; the former is then cast first and the shoal is gradually encircled with the wings. When these come to an end, the drag ropes are cast and the net is hauled on shore.

The circle net is called hassaku-ami by the native fishermen. It is used off the coast of the province of Hidachi. It consists of a central portion and two wings. It is usually separated at the middle into two equal portions, and these are joined together when the net is being used. The central portion is made of hemp and is 400

feet long, the meshes being from about five-eighths of an inch to a little over 1 inch (about $1\frac{1}{8}$ inches). The wings are made of straw and are about 700 feet long, the meshes being 1 foot. To work the net 4 boats with over 50 men are required. Two of the boats carry the net separately and act according to the orders of the other 2 boats, which go in search of the fish.

The eight-armed net is a flat net used on the Pacific shores of Japan. It is almost square in shape, and the meshes are from a little over half an inch to about $1\frac{1}{2}$ inches. To one side of the square are attached floats and to the remaining three sides ropes are tied. To the bottom of the ropes of the lower margin large weights of lead are attached. When in use the ropes of the three sides are held by 3 boats and the net is lowered obliquely against the current. When the shoal of fish comes over it the ropes are raised and the net is gradually drawn up, the fish being finally transferred to the boats.

The tuck seine is employed on the Pacific shores of the main island and closely resembles the purse net of the American fishermen. It is about 600 feet long and 65 or 70 feet wide at the two ends. The meshes are from about $\frac{3}{4}$ of an inch to a little over 1 inch. When not in use the net is carried in equal portions by 2 boats.

The dip net is operated on the Pacific shores of the main island. It is nearly square, each side about 35 feet, and the meshes are from about half an inch to about $1\frac{1}{2}$ inches. To prepare it for use one side is stretched and made fast lengthwise to a bamboo rod, and to the opposite side 3 ropes, with stones attached, are tied. To each end of the bamboo rod another rod of bamboo is made fast.

To work this net the right side of the boat is, in the first place, turned against the current and the net is made to dip down from the left side; the bamboo rod to which one side of the net has been made fast is kept horizontal at a short distance from the boat by means of the two other rods. Some shrimp (*Mysis*) are then strewn on the right side, and the fish are called together; some more are then strewn on the left side, and when the fish come over it the net is drawn up by means of the ropes. This net is used in getting the sardines used as bait for the bonito. It is therefore made on a small scale, and the fish caught are kept alive in the well of the boat.

The sample of sardine drift net exhibited represents the form in use in the Bay of Tokyo. A single netting is about 150 feet by about 35 feet, and is made of hemp. The meshes are from about $1\frac{1}{2}$ inches to about $1\frac{3}{4}$ inches. The cord of the upper margin is made of hemp, and a lead is attached at every 3 feet. The rope of the lower margin is made of the fibers of the palm (*Trachycarpus excelsa*), and at about every 4 inches a wooden float is attached. A single boat with 6 or 7 men uses 7 or 8 nettings joined together. Fifty or 60 such boats usually form themselves into a line and the net is shot across the course of the sardines. This net is worked at night.

The sardines are caught in enormous numbers, and the greater part are dried and made into fertilizer, either entire or after the oil has been extracted. Recently, however, sardines have been canned and smoked, and their value has consequently increased. Smoked sardines promise to become a valuable article of export. "Gill-struck" and "back-split" sardines are used for food in the mountainous districts of Japan. Refined sardine oil, a by-product in the manufacture of scrap, is a very valuable exported product; over 2,500,000 pounds are annually made and sent to various parts of Europe and America.

THE HERRING FISHERY.

The herring or nishin (*Clupea harengus*) is economically a very important fish in Japan. From the latter part of spring to the beginning of summer, it comes in large shoals to the adjacent seas and deposits its eggs on stony bottoms overgrown by seaweeds. The most famous fishing ground is the west coast of Hokkaido; but the fish is found more or less in all parts of our northern seas where there is a cold undercurrent in winter and spring.

Herring fishing is carried on only by means of nets. Of these, gill nets, flat nets, and pound nets are used.

The model of the pound net shown in the Japanese section represents a fixed net used in Hokkaido. The pound is rectangular in shape and its nettings are made of hemp. The longer side of the pound is about 170 feet long, and its meshes are about 3 inches in the front part, while in the greater portion of the back part they are about 1 inch. On both sides of the entrance of the pound are the wings made of straw rope with the meshes about 3 inches. The leader is perfectly straight, and is 500 to 1,500 feet long. It is also made of straw rope, and the meshes are about 5 inches.

The most striking feature of this net is the so-called bag-net boat (Jap. waku-*āni-buné*), that is, a boat with a flat bag shaped net suspended under it from the sides. It is placed at the closed end of the pound, and the bag net is joined to the pound by one of its sides. When a shoal of herring enters the pound, a boat at its entrance takes up the rope and draws up the net, and on its approaching the end of the pound, the fishermen in the bag-net boat allow the joining line of the bag net and the pound to sink somewhat below the surface of the sea, and the fish are passed on into the former. The joining line is then again raised, and when, after repeating this process a number of times, the bag net is filled, the boat leaves its post to be taken by another, and rows for the coast, where the fish are bailed.

A single herring gill net is about 20 feet by 7 feet, and the meshes are about 2 inches. A single boat of 2 or 3 men uses usually twenty-five to fifty nettings, and five nettings are joined into a single group. Between each netting a weight of 4 to 5 pounds is attached, and to each group a float and a weight are tied. A number of these groups are set in a single line parallel to the coast.

The forms in which herring are put on the market are various. For food purposes the fish are prepared by salting, smoking, and drying. The yearly production of salt herring is increasing. The price per barrel is 1 yen. Smoked herring is put up in Hokkaido and the northern provinces of the main island. The sample exhibited has been prepared by the German method. The current price is 20 sen for ten fish. Dried herring slivers, dried split herring, and dried back-split herring are used for food in retired districts among the mountains. They are all sun-dried. The dried sliver is most largely used. Herring scrap is the substance that remains after boiled herrings have been pressed for oil. It is the best fish fertilizer, and is consequently highly valued and produced in large quantities. In 1889, 4,002,145 yen's worth was produced. Price per 100 pounds, 2.50 yen.

The dried refuse from slivered herring is used abundantly as fertilizer. Crude and refined oil and wax are produced in large quantities, 17,500,000 pounds of the oil being produced yearly. Both the oil and the wax have a large demand in Japan, and are also exported in large quantities.

OYSTERS AND OTHER MOLLUSKS.

Among the mollusks of economic importance in Japan, the following, represented in the exhibit by specimens, photographs, etc., may be mentioned:

Octopus octopodia (Jap. Ma-Dako). *
Octopus megalocyathus (Jap. Yanigi-Dako).
Octopus ocellatus (Jap. Ii-Dako).
Ommastrephes oualaniensis (Jap. Surumé-Ika).
Loligo vulgaris (Jap. Yari-Ika).
Sepioteuthis lessoniana (Jap. A wori-Ika).
Sepia sp. (Jap. Hari-Ika).
Rapana bezoar (Jap. Aka-Nishi).
Triton saulice (Jap. Hora-Gai). †
Turbo cornutus (Jap. Sazai).
Haliotis gigantea (Jap. Awabi).
Haliotis verginea (Jap. Tokobushi).
Lutraria nuttalli (Jap. Mirukui).
Siliquaria constricta (Jap. Agemaki).
Mactra sulcataria (Jap. Baka-Gai).
Trigonella sachalinensis (Jap. Uba-Gai or Hokki-Gai).

Cytherea meretrix (Jap. Hamaguri).
Dosinia troscheli (Jap. Manju-Gai).
Tapes philippinarum (Jap. Asari).
Corbicula atrata (Jap. Shijimi).
Cardium japonicum (Jap. Tori-Gai).
Tridacna gigas (Jap. Shako-Gai).
Arca inflata (Jap. Aka-Gai).
Arca subcrenata (Jap. Sarubō).
Arca granosa (Jap. Hai-Gai).
Mytilus crassitesta (Jap. I-Gai).
Pinna japonica (Jap. Tairagi).
Pinna sp. (Jap. Kuro-Mabé).
Avicula martensii (Jap. Akoya-Gai).
Pecten yessoensis (Jap. Hotate-Gai).
Pecten laqueatus (Jap. Itaya-Gai).
Ostrea cuoullata (Jap. Kaki). ‡
Ostrea denselamellosa (Jap. Itabo-Gaki).

These shellfish are useful for food and for various industrial purposes. The oyster, *Avicula martensii*, *Arca granosa*, *Mactra sulcataria*, and *Cardium japonicum* are cultivated in various parts of Japan. Canned oysters are prepared in Hiroshima and Hokkaido. Price per dozen yen, 1.50.

The *Trigonella* is also canned, and has the same value as the oysters.

CRUSTACEAN FISHERIES.

Shrimps, lobsters, prawns, crabs, and other kinds of crustaceans are taken by the Japanese for food. Chief among the economic species are the following:

Palinurus japonicus (Jap. Ise-Ebi).
Peneus canaliculata (Jap. Kuruma-Ebi).
Peneus ensis (Jap. Shiba-Ebi).
Palæmon longipes (Jap. Tenägä-Ebi).
Palæmon sp. (Jap. Numä-Ebi).
Squilla oratoria (Jap. Shäko).

Mysis sp. (Jap. Ami).
Porhenas pelagicus (Jap. Gazami).
Lithodes camtschatica (Jap. Ibara-Gani). §
Inachus sp. (Jap. Taraba-Gani).
Grapsus japonicus (Jap. Mokuza-Gani).

Besides these there are still many other species of shrimps and lobsters in Japan. They are all used for food or bait, and are economically very important. *Palinurus japonicus*, or the spiny lobster, lives on stony bottoms of the Pacific shores washed by warm currents; but the other species are mostly found in bays, and prefer sandy or muddy bottoms. They usually hide themselves during the day, and go out in search of food at night.

The spiny lobster is caught with gill nets, while the other smaller forms are caught either with trawls or flat-nets, or with traps.

The lobster trawl is a hempen net extensively used in the Inland Sea, and closely resembles the trawl for catching soles already described. The only points of difference

* *Tako* = cuttlefish, changed into *Dako* when compounded with a prefix.

† *Kai* = shellfish, changed into *Gai* when compounded with a prefix.

‡ *Kaki* = oyster, changed into *Gaki* when compounded with a prefix.

§ *Kani* = crab, changed to *gani* when compounded with a prefix.

are the comparative lightness of the weight used and the stem of bamboo used for keeping the mouth of the trawl open. The former circumstance is due to the fact that this trawl is used on muddy bottoms. The purse is about 14 feet long, and the wings are about 18 feet in length. The meshes are a little less than half an inch in the posterior part of the purse, and from half an inch to a little over five-eighths of an inch in the remaining portion. The drag rope is from 300 to 400 feet long. This trawl is worked under a good wind, and two or three are usually attached to a single boat containing two men.

The lobster gill net is a hempen net sunk to the bottom for catching the spiny lobster. It is about 35 feet long and only about 3 feet wide. The meshes are 1 or 2 inches. A single boat usually carries two men, and uses several dozens of nettings joined into a single net, to one end of which are then tied a stone and a float. The whole is then sunk in the evening in rocky places 10 to 50 feet deep, and taken out the next morning.

Prawn pots are used in Lake Biwa in the province of Ōmi. They are made of bamboo splints. At the entrance is a funnel-shaped piece with its smaller end projecting into the interior, so that any shrimp that has once entered it can not get out. When being used, dozens of these traps are tied to a long rope, and crushed shellfish (*Corbicula* or *Paludina*) are put within each; then the whole is sunk to the bottom. They are taken out from time to time and the shrimps are caught.

Among the important preparations from this class are canned spiny lobster and shelled shrimp. Canned lobster is made after the manner of the boiled lobster of the Americans; one dozen 1-pound cans cost 1.20 yen. Shelled shrimp consists of the boiled bodies of *Peneus canaliculata* and *P. ensis* which have been deprived of their shells. About 300,000 yen's worth is produced annually. It is one of the chief exports to China.

UTILIZATION OF ALGÆ.

Among the seaweeds found on the coasts of Japan there are several having considerable economic value, of which the chief are amanori (*Porphyra vulgaris*), tengusa (*Gelidium corneum*), funori (*Glæopeltis coliformis*), and fukuro-funori (*G. intricata*).

The first named grows near the mouths of rivers in various parts of Japan. It is cultivated on a large scale in the bay of Tokio. About the time of the autumnal equinox, branches of bamboo and of various trees are stuck into the bottom of the sea, and the seaweed is allowed to grow on them, the fronds being cut away from the top as they grow. The alga wholly dies away about the time of the vernal equinox. The article prepared for commerce is known as *asakusa-nori* and is highly esteemed both for food and as a condiment. The weed is but seldom eaten fresh and nearly always is made into thin sheets like paper, and dried for preservation. This is heated over the fire and eaten with broth, or by itself with a little sauce. It is also used for various other culinary purposes. One hundred sheets cost from 50 sen to 1 yen.

The *Gelidium* grows on the coasts of various parts of Japan, on rocky bottoms, at a depth of from about 10 to 125 feet. It grows in clusters and is never found in bays that have no open communication with the ocean. It is said to germinate in early spring and die away in autumn. The best harvesting season is summer. A jelly is made from this species which is largely used both for food and as glue. It has also recently come to be used for purifying *saké*, or Japanese wine. Added to the already

large demand for home use, its exportation has recently increased. In 1891 the exports alone amounted to 454,000 yen.

The species of *Glæopeltis* are employed in the manufacture of glue. They grow on rocks near the coasts of the warmer parts of Japan. The glue is made indiscriminately from the two species, and is largely used to impart luster and stiffness to various textile fabrics. It is also used for various other purposes, according to which it is refined in various degrees. The price of a single sheet (about 5 feet by 3 feet) of the most refined form is 50 sen.

THE FISHERIES OF NORTHERN JAPAN.

By K. ITO.

Fish constitutes the chief article of food in Japan, and the fishing industries are necessarily the most important pursuit of the Japanese. It gives employment to 1,654,178 men, and yields \$35,000,000. The peculiar features of the country afford every kind of fishing, and a great many varieties of the marine animals and plants are collected and utilized. It is not possible, however, without some previous preparation, for me to enumerate them or to give any account of the methods used for catching and curing them. I will, therefore, limit my subject to the fisheries of northern Japan, or Hokkaido, with which I am more familiar.

Hokkaido, more familiarly known to you under the name of Yesso, is one of the islands constituting the Japanese Empire, and is situated between $40^{\circ} 21'$ and $45^{\circ} 30'$ north latitude. It covers an area of about 319,000 square miles. The fisheries industry is the oldest and most important of the island. I will give a brief description of some of the principal fisheries of the Hokkaido.

First in the order of importance are the spring herring fisheries. The spring herring (*Clupea harengus*) approaches the western coast of the island in tremendous groups in the spring and early summer, and fishing is carried on from the first part of April to the last of June. The implements used for the capture of this fish are of two kinds—the gill net and the moored trap net. The fish caught are gutted, and the bones and head taken off and dried upon the scaffoldings. They are then made into bundles and sent to the southern part of Japan for food, while the roes, which are left, are dried on the flake or pickled and used for food. The head, bones, and gills left, after making the boneless herring, are also dried and used as fertilizers. But since the introduction of traps, about thirty years ago, and also the introduction of the pocket attachment, after that, the catch became so enormous that all the fish caught could not be utilized in the old way, and so the guano and the oil industries were inaugurated. This industry has grown from year to year and at present is the most important of the fisheries of Hokkaido. At present the total amount of the dried scraps manufactured reaches the enormous quantity of 90,000 tons.

Next in importance is the salmon fishery. Our salmon belongs to the same genus as the Pacific coast salmon. There are two principal species of salmon, namely, the spring salmon (*Oncorhynchus perryi*) and the fall salmon (*Oncorhynchus haberi*). The spring salmon ascend the waters for the purpose of spawning in the months of May and June, and the fall salmon in the late fall months. The fall run is the more numerous of the two, but inferior in flavor.

The methods used in the capture of this fish are several, but the principal kinds of nets used are the drag seines, traps, and gill nets in the seas, while only the drag seines are used in the rivers. Some of the chief salmon rivers in the island can still compare with any salmon rivers in this country. The most important river for salmon is Ishikari, emptying into Strogon of Bay, on the western coast. Curing in salt used to be the only way of preparing salmon for the market, but about eight years ago the Government employed Mr. Treat, of Eastport, Me., to introduce the method of canning; the new industry is growing constantly, and some of the articles are now sent to France. About three years ago a gentleman commenced a smoking business there, and this we hope will soon become one of the principal industries in the salmon fisheries.

Now, I will make a few remarks on the cod fisheries. The cod are most abundant in the winter and early spring. The fishing-ground at present is limited more to the inshore, being from 5 to 25 miles from the shore, and in water from 100 to 200 fathoms deep. The gear used for capture is the trawl, exclusively, the construction of which is on the same principle as the trawls used in the New England fisheries of this country. The vessel used in this work is very small. It is an open, flat-bottomed boat, about 36 feet in length, and is furnished with a single mast and one large, clumsy rectangular sail. The most common method of treating the cod is to take off the head and bones and dry them very hard, like the Norwegian stockfish. The second way is to split and thoroughly cure them with salt. Still, some of the fish of the early catch are just gutted, slightly cured, and sent away for more immediate consumption.

Another important fishery is the iwashi (*Clupea melanosticta*), a kind of herring that comes into the open sandy beach of the eastern coast in the months of June and July. The schools are not so large as those of the spring herring, and are sometimes mixed with "seven dots" (*Etrumeus micropus*) and also with the young of the spring herring. The principal contrivance for the capture of this species is the drag seine. The fish are all made into scrap and oil.

Next, I will mention the trepang fisheries. Trepangs, or sea-cucumbers, occur in the sandy bottom of the sea, all along the coast, and are gathered by use of a dredge. The fish caught are gutted and boiled in a decoction of mugglewolts, or artemesia, and are then spread on a sort of cleat, with bamboo bottom, and dried for exportation to the Chinese market.

Another fish for the Chinese market, and of great importance, is the awabi. The awabi is a gigantic gasteropod, which is known on the Pacific coast of this country as "abalone." It is speared from an open boat, just like the dories used by the New England cod fishermen, in water from 2 to 4½ fathoms deep. The fishermen formerly used cod oil in order to look into the bottom of this deep water, but water glass is now almost universally used for this purpose. About five years ago some adventurous fisherman introduced the diving apparatus, but, in consequence of its injurious effect upon the propagation of the shellfish, it was finally prohibited by legislation. The fresh product of this fish is separated from the shell, cooked, slightly smoked and dried, and then sent to the Chinese market.

Next comes the squid, which has its run in the fall, lives in big schools, and is caught with the jig. It is split open, pressed, and dried, and sent over to China.

Another product of the sea I would like to mention is the *kombu*. The *kombu* is a kind of algæ, belonging to the species of *Laminaria*. They occur in great abundance all along the coast, but the best kind is obtained on the northeastern coast, where the cold current comes down from the north. They are taken from the rock upon which they grow by the use of the wooden hook; they are then dried on the sandy beach, made into bundles, and exported to China.

Now, let me say a few words in reference to the fishermen on the island. They are divided into three classes: (1) outfitters; (2) fishery proprietors; (3) employés. Outfitters are those who furnish the fishing gears, or capital, or food supply to fishermen who can not fit out for themselves; the fishery proprietors are those who own the fishing vessels, fish-houses, and all fishing gears; the employés are those employed by the fishery proprietors for the prosecution of the fisheries. Some of the fishing is done on shares, like the cod fishery of this country, while others are part in shares and part in wages, and in some cases certain parts of the entire catch are given to the gang of employés, besides regular wages.

The fishermen of my country are a very open-hearted and frank set of people, and are sometimes superstitious. Among the fishery proprietors there are a great many well-educated, intelligent, and progressive men. They have formed associations there for the purpose of preventing the manufacture of inferior articles and to adjust any disputes arising between fishermen. They have a fishery society there, under the name of Hokusui Kyokwai, for the promotion and improvement of the fisheries. They publish monthly reports and distribute among the fishermen important and useful information in regard to the fisheries. They also publish the translated account of valuable information from this country. I think it will be of some interest to you to know that a recent number of a publication which I have received contains a translation of the paper read before the Fishery Convention in London, by one of your prominent members, Dr. Goode. This society holds fairs for competing in the kind of articles manufactured by the different fishermen.

Now, I will say a few words in regard to the measures adopted by the Government for the promotion of the fisheries on the island. Under this head there are only a few laws for the protection of salmon. The principal features of the legislation protecting salmon is that no stationary apparatus is allowed in the river, and the only kind of net allowed is the drag seine. The next feature is that all nets must be taken out of the water from sunset to sunrise; that is, every night they must cease fishing. The next prominent feature is that fishing of any kind is prohibited in the spawning tributaries, and during the spawning season the Government appoints fish wardens to protect the fisheries from the poachers. In addition to this legislation in regard to salmon there is also a law, which I have already mentioned, against the use of diving apparatus for the capture of awabis.

Next, let me refer to the measures adopted for encouraging the fishermen. The Government has a fund which is loaned to the fishermen when they meet a bad season and when they can not borrow the capital to furnish their outfit. The Government also exempts for a certain length of time from the fishery tax all those fishermen who open new fishing-grounds or who make new fishing establishments, wherever it is impossible to make them without the expenditure of large sums of money.

Lastly, let me just touch on the legislation for regulating the fisheries. Under this head I may mention the method which has been adopted by the Government to govern all fishing-grounds. In every fishing locality, the position of all traps and seines is located on a map, and this map is filed in the county offices for the reference of fishermen, so that when they have any quarrel in regard to the position of nets it can be settled very easily. Under this head comes the regulation for inspecting the manufacture of *kombu*. The manufacture of *kombu* lately became inferior, and to check this evil the Government has made a regulation requiring that all kinds of *kombu* must be inspected and branded before it is exported, just as the mackerel are branded in this country.

Now, before I finish my remarks, let me read a few statistics concerning the fisheries of the island, which I prepared some time ago for the U. S. Fish Commission Bulletin:

Number of persons, boats, seines, and nets engaged in the fisheries of Hokkaido in 1884.

Items.	Hakodate district.	Sapporo district.	Nemuro district.	Total.
Fisheries proprietors.....	3,218	3,324	1,338	7,880
Employed hands.....	17,440	33,836	14,793	65,773
Boats.....	15,100	16,800	3,473	35,373
Seines.....	498	297	320	1,089
Trap nets.....	935	1,828	355	3,088
Gill nets.....	150,820	33,365	65	184,250
Miscellaneous nets.....	6,406	40	65	6,511

Value of the principal fishery products of Hokkaido in 1884.

Fishery.	Hakodate district.	Sapporo district.	Nemuro district.	Total.
	<i>Yens.*</i>	<i>Yens.</i>	<i>Yens.</i>	<i>Yens.</i>
Herring.....	1,412,762	2,023,883	108,003	3,544,648
Fall salmon.....	31,389	221,993	231,874	535,856
Spring salmon.....	1,528	5,017	118,075	125,820
Cod.....	16,396	85,048	712	102,156
Iwashi.....	116,577	15,434	1,640	133,651
Trepang.....	5,061	23,210	14,623	43,494
Ear-shell.....	25,818	95,123	.....	121,941
Squid.....	35,250	2,817	.....	38,067
Kombu.....	49,993	189,811	184,440	404,244
Sea otter.....	.....	.....	3,150	3,150
Oyster.....	.....	.....	13,413	13,413
* Total.....	1,696,974	2,662,936	706,530	5,066,440

*One yen equals about 80 cents.

I will remark here, however, that the figures just given are rather smaller than the average, on account of the poor catch and low prices during the year; but I think they will give an idea of the amount of the fish caught on the island.