

Familiar Demersal Fishes, Crustaceans and Mollusks, and the Modernization of Small-Scale Gill Net Fishery

Gill net fishing is playing an important role in the promotion of coastal fisheries

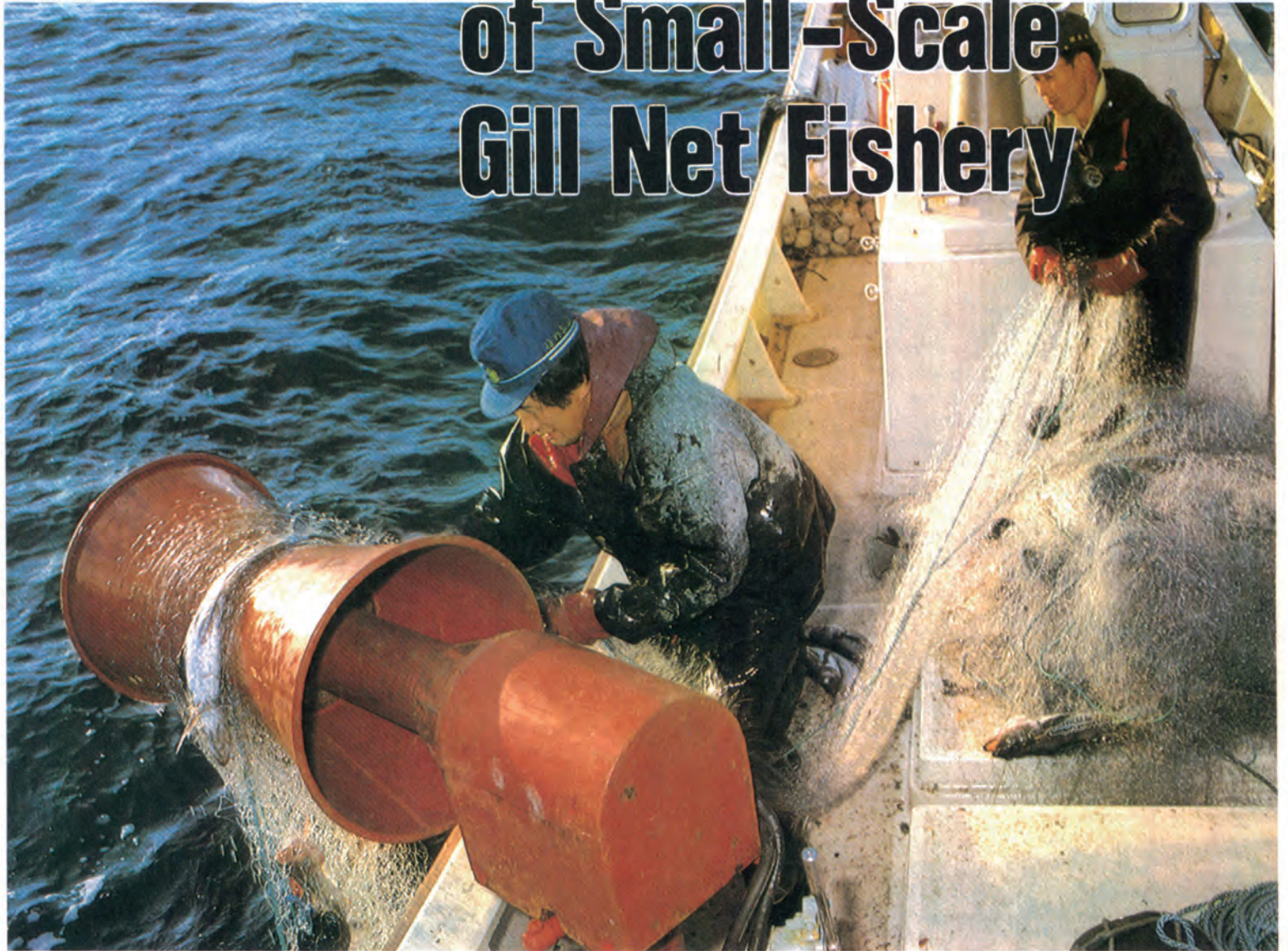
Pelagic fishes such as sardine, herring, horse mackerel and mackerel; migratory fishes such as salmon, trout, skipjack and tuna; and fresh water fishes such as carp and crucian carp are the most familiar types of fishery resources. These three groups of fishes account for a little over 65% of the total catch in the world.

However, demersal fishes such as flounder, flatfish, cod and Alaska pollack; and benthic aquatic animals such as lobster, shrimp, crab, squid and octopus are equally important fishery resources as the above-mentioned fishes. The annual catch of these so-called 'Sokomono' (bottom-dwelling animals) is over 20 million tons and amounts to one third of the total catch in the world.

The fisheries catching demersal fishes, crustaceans and mollusks in greatest quantity are the various types of small, medium and large-scale trawl fisheries, and large fishing grounds have been exploited on the continental shelves around the land masses of the world and the majority of such submarine fishery resources still remain to be surveyed, and these unused fishery resources will be further exploited in the future.

In this issue, we would like to give attention to demersal fishes, crustaceans and mollusks inhabiting coastal waters along the developing countries in abundance and to emphasize the necessity of making effective use of gill net fishing (especially bottom gill net), in addition to trawling, for the promotion of coastal fisheries.

In the coastal waters along the developing countries, there seems to exist a considerable amount of demersal fishery resources which have not yet been surveyed and ex-



ploited. From a technical viewpoint, catching of these resources by the gill net fishing method is relatively easy, and besides, its initial cost is low, and the catching rate can usually be improved by the proper use of this fishing method.

The following introduces the present situation of Japanese coastal fishermen who are enjoying a stable fishing life by mainly catching coastal demersal fishes and the like using gill net.



El uso de la red rastrera juega un papel importante en la promoción de la pesca costanera

En este número se introducen los peces, crustáceos y moluscos que abundan en las profundidades de las aguas costaneras de los países en desarrollo. Asimismo, se indican las razones de la necesidad de adoptar la pesca con red rastrera vertical (especialmente la de uso en el fondo del mar) además del método de pesca a la rastra, a fin de promover el desarrollo de esta actividad en aguas costaneras. Se cree que los países en desarrollo cuentan con una abundante riqueza pesquera en el fondo de sus aguas costaneras, que se halla aún sin inspeccionar ni explotar. Desde el punto de vista técnico, es comparativamente fácil capturar estos recursos por medio de la pesca con red rastrera vertical. Por otra parte, el costo inicial de este método de pesca es reducido y permite mejorar la proporción de captura si se adopta el mismo debidamente.

La pêche à l'araignée joue un rôle important dans la promotion des pêches côtières

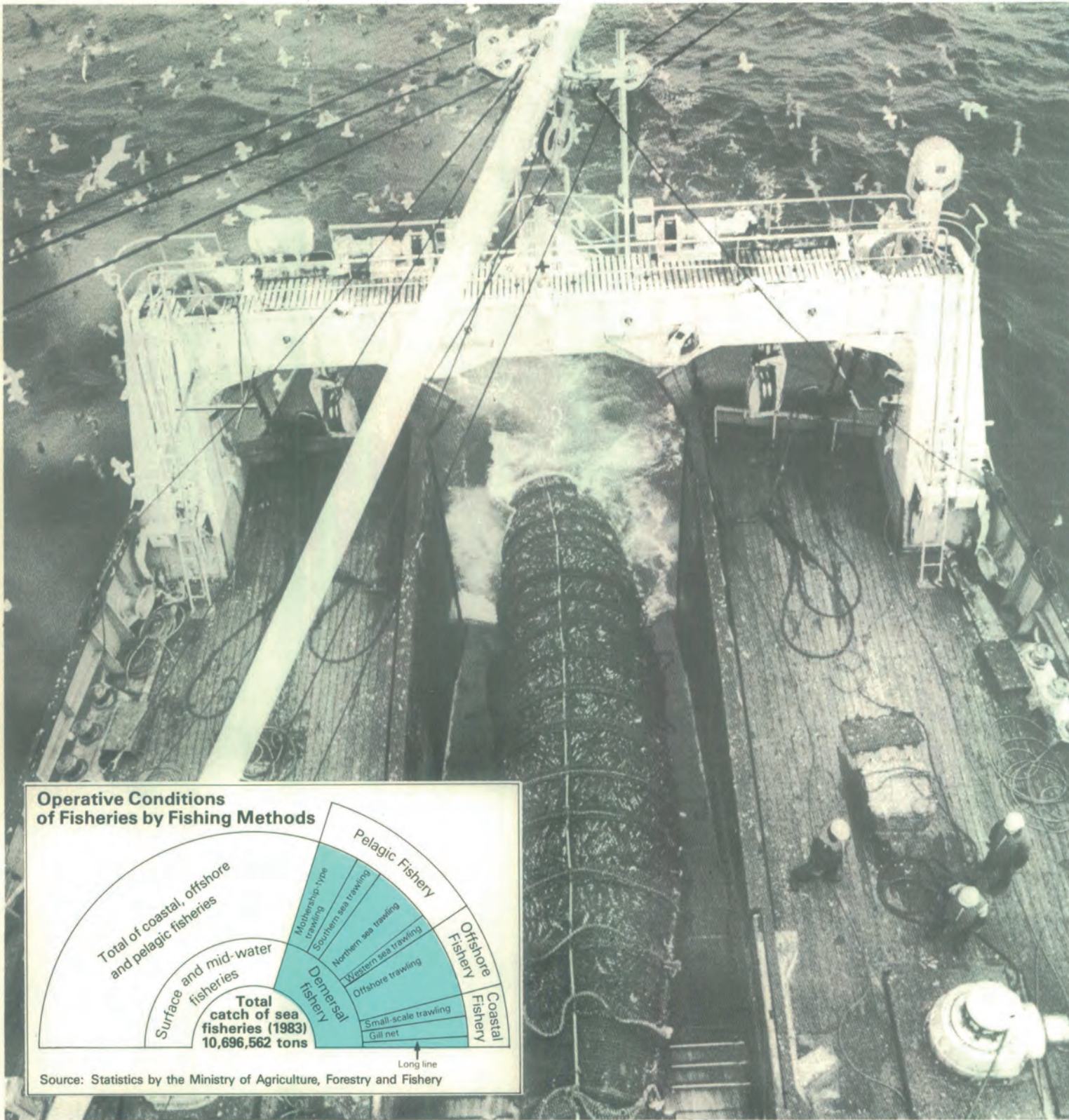
Dans ce numéro sont traitées les pêches benthiques, les crustacées et mollusques que l'on trouve en abondance dans les eaux côtières des pays en voie de développement. Et l'on y souligne également la nécessité de mettre à profit l'usage efficace de la pêche à l'araignée (en particulier de l'araignée de fond), outre la pêche au chalut pour la promotion des pêches côtières.

Dans les eaux côtières baignant les pays en voie de développement, il semble y exister des ressources considérables de pêche benthique qui n'ont pas encore fait l'objet d'exploitation ni d'étude approfondie. Du point de vue technique, ce sont des ressources relativement faciles à saisir en appliquant la méthode de pêche à l'araignée. En plus, le coût initial de cette pêche est plutôt faible, et le rendement de prise peut être amélioré par l'emploi rationnel de cette méthode de pêche.

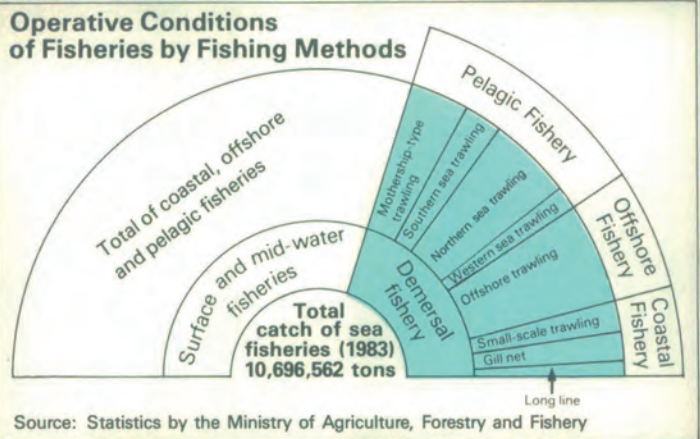
Large Meat

The situation of Alaska pollack fishery in Japan has undergone a considerable change in the past years. The Japanese catch increased gradually from a level of 400 thousand tons to a level of 800 thousand tons a year in the 1960's. From 1966 on, however, it showed a more rapid increase reaching a peak of 3 million tons in 1972. From 1973 on, the production curve has shown a downward tendency. A major factor in the above-mentioned increase in production is thought to be that, with the success of an experiment in commercialization of the "frozen ground meat processing of Alaska pollack" at the Hokkaido Central Fisheries Experimental Station around 1961, a new demand as a raw fish for fish-paste products arose, and the price of Alaska pollack rose and became stable. The latter decrease in the production is, needless to say, due to the fact that, as a result of the gradual advancement in expansion of territorial waters and establishment of the 200-mile economic zones, international catch restriction has been tightened in the Northern Pacific, which is the main fishing ground for Alaska pollack.

In the Japanese processing industries of the 1960's raw fishes for fish-paste products (which must have white meat with less fat) tended to be in short supply, causing the rise of fish prices. As a result, substitute raw fishes were sought. At the same time, in the fishing industries, ways to use effectively the resources of Alaska pollack which are abundant in the Northern Pacific area were being studied. These two problems were solved by the invention of the method of processing "frozen ground meat". Meat of Alaska pollack is white meat with little fat. The significance of the invention of this method of process-



Bottom trawling by a pelagic trawler (Offered by Nippon Suisan Kaisha, Ltd.)



Source: Statistics by the Ministry of Agriculture, Forestry and Fishery

Demersal Fishery in Japan

About 3 million tons of demersal fishes and benthic aquatic animals are caught by Japanese fishermen every year. The representative ones are cods (especially Alaska pollack), flounders, flatfishes, Atka mackerel, ocean perches, croakers, porgy, hairtail, sharp-toothed eel, shellfishes, octopus, squids, shrimps and crabs. About 40% of the total catch are caught by coastal and offshore fisheries and about 60% by pelagic fishery.

[Coastal fishery by small fishing boat]
On the continental shelf surrounding the Japanese Islands, various types of small-scale bottom trawl, gill net and bottom long line fisheries are operated. In bottom trawling, besides demersal fishes, shellfishes, shrimps, crabs and squids are also important fish species.

[Offshore fishery by medium and large trawlers]
The two main fisheries which boast the largest catch are offshore bottom trawling, which is operated on the continental slope surrounding Hokkaido, and western bottom trawling which is operated on the continental shelf of the Yellow Sea and the East China Sea west off Kyushu. The former is a "few-kind mass-catch type" fishery catching Alaska pollack, flounder, flatfish and Atka mackerel, and the latter catches various species of fish such as croaker, lizardfish, porgy, flatfish, flounder, sharp-toothed eel and squid, in addition to prawn, which has the highest value.

[Pelagic fishery by large trawler and mothership-type trawling]
A large catch is obtained by northern sea trawl fishery operating in the Sea of Okhotsk, Bering Sea and Alaska Bay, but from the 1960's on, fishing grounds in the southern sea area have also been exploited one after another by Japanese fisheries. At present, off the northwest and south coasts of Africa, in the North Atlantic of North America, in the northern coastal sea area of South America, off the



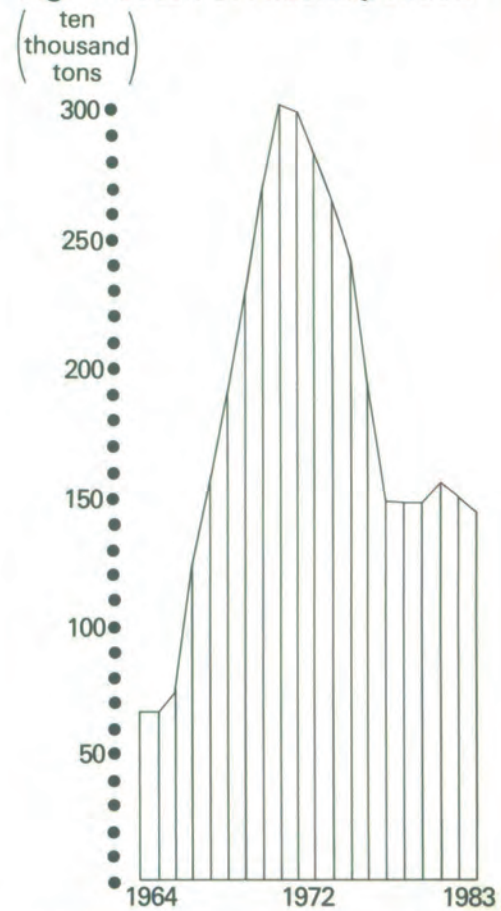
Under 5-ton trawlers (Yamaha FRP fishing boats)

coast of New Zealand and in the Arabic Sea, trawlers are catching tiger shrimps, squids, octopus, merluza and so on.

Pesca de Variedades que Viven en las Profundidades de las Aguas en Japón
Los pescadores japoneses capturan anualmente alrededor de 3 millones de toneladas de pescado y otros animales acuáticos que viven en las profundidades de las aguas. Entre las variedades más representativas se pueden mencionar los bacalao (especialmente los denominados gados de Alaska), platijas, lenguados, caballas de Atka, percas oceánicas, roncadors, anguilas de dientes afilados, mariscos, pulpos, calamares, camarones y cangrejos. Un 40% de la cantidad total de captura se obtiene a través de la pesca en aguas costaneras y en alta mar y el 60% restante por medio de la pesca oceánica.

Pêche démersale au Japon
Environ 3 millions de tonnes de poissons démersaux et espèces aquatiques benthiques sont pris annuellement par les pêcheurs japonais. Les espèces les plus représentatives sont les morues (en particulier le colin d'Alaska), les carrelets, les poissons plats, les maquereaux Atka, les perches océaniques, les croakers, porgy, nairtail, l'anguille à dents acérées, les coquillages, la poulpe, le calmar, les crevettes et crabes.
Environ 40% de la prise totale sont obtenues par les pêches côtières et au large et environ 60% par la pêche pélagique.

Fig. 1 Catch of Alaska pollack



Fluctuations in "Ground from Alaska Pollack

Fig. 2 Main fishing grounds of Alaska pollack in the Northern Pacific



Source : Data of Fishery Agency

ing "frozen ground meat" is as follows: Meat of Alaska pollack has several peculiar characteristics. First, when the meat is boiled, its elasticity is increased as a result of the heating effect on protein, but once fresh meat has been frozen, viscosity is not produced even by later heating because of the protein denaturation induced during freezing. Second, when frozen Alaska pollack is thawed, water molecules which have been combined with the protein separate markedly and the meat becomes spongy. Because of these two faults, Alaska pollack frozen on ship had not been used as material for fish-paste products. The Hokkaido Central Fisheries Experimental Station succeeded in solving this problem by a method of processing the meat into "frozen ground meat".

- (1). Inorganic substances such as magnesium and calcium are washed away by a washing process in order to avoid protein denaturation.
- (2). In the process of manufacturing ground meat, additives such as sodium phosphate are added to the ground meat, which is kneaded together before freezing. By this treatment, it becomes possible to store ground meat for a long time and to avoid dehydration phenomenon (making the fish meat spongy) usually seen in thawing.

Alaska pollack is a fish which has been widely used for many purposes. In addition to use as a fresh fish, it is also used as material for traditional processed foods such as (1) sun-dried fish, (2) salt-dried fish, (3) salt-preserved (ovary), (4) pickled fish, and (5) other delicacies. Further, when the catch is large, it is used for making (6) feed and fertilizer, (7) fish meal and (8) fish oil. Since the invention of the "frozen ground meat" method, large quantities of (9) "frozen ground meat" are produced and these have become the largest single raw material for fish-paste products.

There are many kinds of fish-paste products, e.g., (1) "Kamaboko" (ground fish meat is attached to a small wood plate in a semicylindrical shape and steamed), (2) "Chikuwa" (ground fish meat is formed into a slender, hollow cylindrical shape and roasted), and (3) "Fried Kamaboko" (ground fish meat is formed in a small ellipsoidal or spherical shape and fried in oil). Besides these traditional processed foodstuffs, ground fish meat is also used to make (4) fish meat

ham and sausage which have been marketed since around 1952. Fish-paste products are widely consumed as an important food source by the Japanese people, and at present a total of about 1 million tons of all kinds of fish-paste products are produced annually.

"Frozen ground meat" of Alaska pollack is produced in large quantities in factory ships or mother ships at sea, in addition to the production in processing factories on land. Production in 1977 was as follows.

- (1). Processing on land
.....234 thousand tons (59%)
 - (2). Processing on board a ship
.....162 thousand tons (41%)
- Total 396 thousand tons

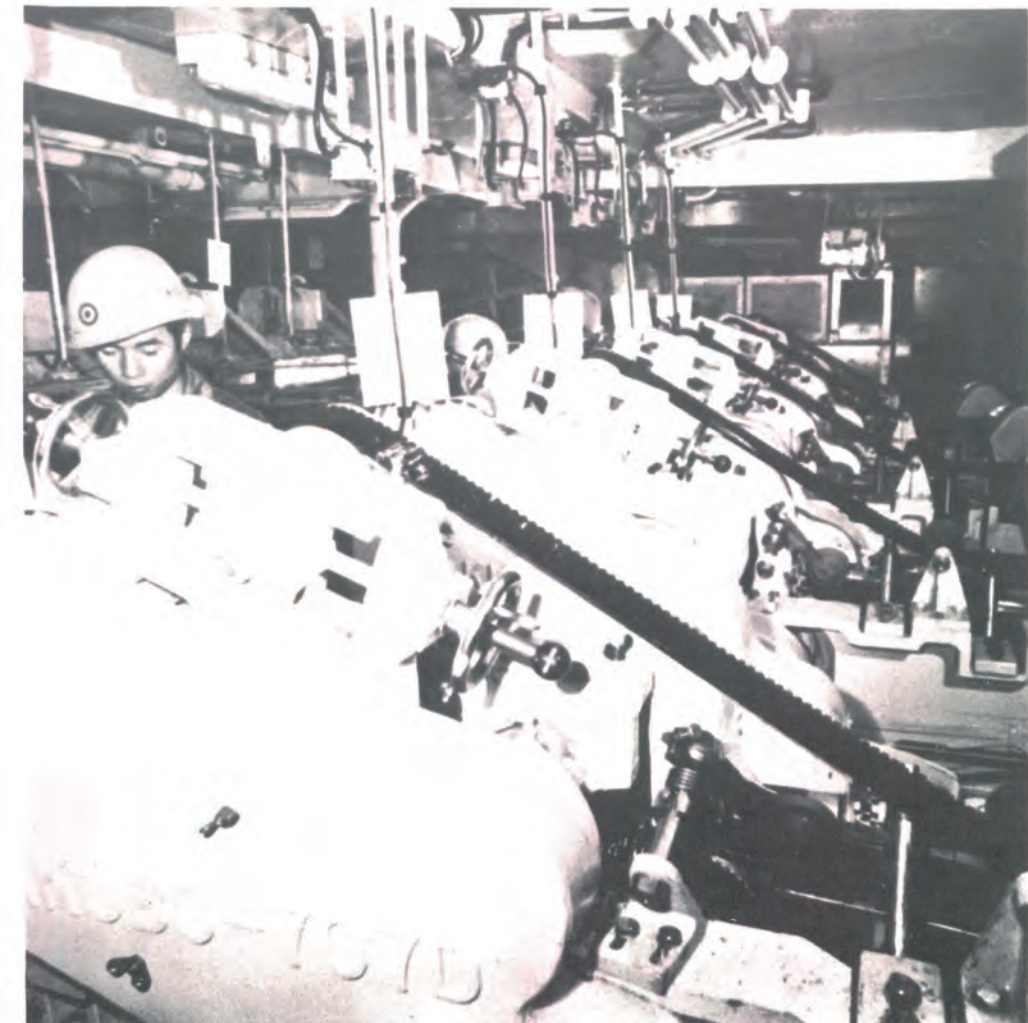


"Kamaboko" processing (boiled fish-paste processing at a small-scale factory)

Tal vez no hay ninguna otra variedad cuya situación haya cambiado tan drásticamente como el gado de Alaska. En la década de 1960 la captura de esta variedad por barcos japoneses se incrementó gradualmente desde el nivel de 400 mil toneladas a 800 mil toneladas anuales. Sin embargo, a partir de 1966 se registró un rápido aumento y alcanzó el punto máximo de 3 millones de toneladas en 1972. Pero desde 1973, la curva de producción muestra una tendencia descendente. El factor principal que influyó en el incremento de la producción arriba mencionada se cree que fue el éxito de un experimento para comercializar la "carne molida congelada del gado de Alaska", en la Estación Experimental de Pesca de Hokkaido Central en 1961. Como resultado de ello, se incrementó la demanda de pescado crudo para la elaboración de productos de pasta de pescado y aumentó el precio del gado de Alaska, manteniéndose el mismo estable desde entonces. El otro factor es el descenso en la producción debido, naturalmente, a la expansión gradual de las aguas territoriales y al establecimiento de la zona económica de 200 millas, con la consecuente restricción internacional de la pesca en el Pacífico Septentrional, la zona pesquera principal del gado de Alaska.

Il n'y a probablement pas d'autre poisson que le colin d'Alaska du Japon dont la situation a changé si radicalement. La prise au Japon de cette espèce s'est accrue progressivement du niveau de 400 milles tonnes jusqu'au niveau de 800 milles tonnes par an dans les années 1960. A partir de 1966 et après, on a pu cependant noter un accroissement rapide avec une pointe atteignant 3 millions de tonnes en 1972. A partir de 1973 et après, la courbe de production a eu tendance à baisser.

Un facteur majeur de l'augmentation mentionnée ci-dessus dans la production est apparemment le succès des expériences de commercialisation "du traitement de produits surgelés pour le colin d'Alaska" à Hokkaido dans la station expérimentale de pêches centrale aux environs de 1961, une nouvelle demande de poisson cru pour les produits de pâtés de poissons s'est fait sentir, et le prix du colin d'Alaska s'est élevé et est devenu stable. La diminution de ce dernier en production est sans dire, par suite de l'extension progressive des eaux territoriales et l'établissement d'une zone économique de 350 km, causée par la restriction internationale du contingentement qui s'est vue imposé dans la région septentrionale du Pacifique constituant le principal terrain de pêche du colin d'Alaska.



Ground fish-meat processing aboard a pelagic trawl factory ship (Offered by Nippon Suisan Kaisha, Ltd.)

Fundamental Knowledge of Gill Net Fishing

Among net fisheries, gill net fishing is an "efficient fishing method" using a fishing gear of comparatively simple structure, and it has a characteristic of being possible to operate easily even with a small fishing boat.

Function and Characteristics of Gill Net

Gill net is a netting gear used to catch fishes and crustaceans by allowing the fish body to penetrate a mesh opening and become caught or legs of a crustacean get entangled in the net.

- * The net is spread out in the water, and it is left as it is for fairly long time waiting for fishes to get caught in the net. (Generally, the net is set at slack water and hauled in at the next slack water.)
- * Fine, strong and elastic netting thread is used in order to increase the entangling rate.
- * This is a "waiting type" fishing method, which involves waiting for a school of fish for a certain period of time. But unlike a fixed net, which is left set in a fixed place for a long period, drift gill net moves with the tidal current. Even fixed gill net is set out for only not much more than a night, and it is frequently moved according to the fishing conditions.
- * The setting cost of coastal gill net is far lower than that of a fixed net.
- * Setting method differs according to the species of fish to be caught. The net is laid in the surface layer or mid-water part

of the sea for pelagic fishes, and it is laid in the bottom layer for demersal fishes. Selective fishing is also possible by changing the structure and operation method of the gill net, i.e., by selecting proper mesh size which allows aimed fishes to penetrate easily, and by constructing a net structure which causes shrimps and crabs to get entangled easily.

Classification of Gill Nets

Gill nets are classified into three types according to their operation methods.

- (a). Fixed-type gill net: netting gear is fixed in the sea with an anchor or the like.
- (b). Drift gill net: netting gear is not anchored in a fixed site; it is left floating in the sea and drifts with the wind or tidal current.
- (c). Movable-type gill net: the gill net is cast in a circle and a fish shoal is encircled with the net by means of a fishing boat; or after the gill net is laid in the fishing ground, fishes are driven into the net.

Gill nets are classified into the following three types according to the water depth

at which they are laid:

- (1). Floating gill net: this net is laid in the surface layer of the sea.
- (2). Mid-water gill net: this is laid in the middle depths of the sea.
- (3). Bottom gill net: this is laid on the bottom of the sea.

Furthermore, as regards the operation time, gill nets are distinguished between nets being operated during the daytime and these being operated during the night. (See Table 1)

Composition and Webbing of Gill Nets

Gill nets are constructed by attaching ropes to both the upperside and the lowerside of a long narrow band of netting, and by tying floats to the upperside rope and sinkers to the lowerside rope in order to keep the net vertical and stretched in the water by the buoyant force of the floats and sinking force of the sinkers.

We will now explain the webbing composition of the various parts and important conditions affecting its function, taking the most simple type of fixed-type bottom gill net as an example:

- (1). Component parts (See Fig. 8)
- (2). Side view of gill net (See Fig.9)
- (3). Netting (See Fig. 10)

The netting is the most important part of a gill net for catching fishes, and there are two kinds of nets: single walled nets consisting of a single sheet of netting and trammel nets consisting of a sheet of main net sandwiched by two sheets of large-mesh outer nets. Trammel nets are mainly used for bottom gill net aiming to increase the efficiency of entanglement, and it tends to catch small fishes, shrimps and crabs indiscriminately. Therefore, in some districts, the use of trammel net is forbidden from a resources conservation standpoint.

The makeup of a net is determined by the quality of material, thickness of thread, mesh size, knotting method, mesh depth (indicating the number of meshes or the width of netting) and color. Fishermen must decide the most appropriate makeup of net according to the species of fish to be caught and conditions of the fishing ground, and constructs by himself a finished net, buying the desired kind of standardized netting and other parts from a net shop.

In webbing, it is an important point to select an optimum "hanging ratio" of netting. "Hanging" means the tying of the

netting in a shortened state to the floating and sinker lines in order to give the surface of the net flexibility and to increase the efficiency of entanglement. The hanging ratio differs with the aimed fish species. It is also closely related to several other conditions such as bottom topography, conditions of buoyant force of the floats and decisively affects the shape of the net when laid in the water. Therefore, a fisherman should carefully determine the hanging ratio based on his empirical knowledge. (See Table 2).

General Operation Methods for Gill Net

After arriving at the fishing ground and the setting site for the gill net is decided, the gill net is cast from the fishing boat as it sails from the windward to the leeward across the tidal current. Casting is generally carried out on the quarter deck. The duration of setting in the water varies with several conditions, such as the species of fish to be caught, distance of the fishing ground, and the demand for keeping catch freshness, e.g., several hours during the daytime, from evening until the next morning, or for 2-3 days. However, in most cases of a single day coastal operation by small fishing boats, gill net is set in the evening and hauled the next morning (during the time from setting to hauling, the fishing boats usually stay afloat nearby). Hauling is generally carried out on the forecastle deck. Fishes caught are put into a fish hold together with the net. Generally, fishes are sorted and shipped on the beach after the boat returns to the port.

Popularization of Synthetic Fiber Netting and Introduction of Net-haulers

The first important step in the technical development of gill net fishery has been the "material revolution" in netting, and the second has been the mechanization of hauling work by the introduction of net-haulers. In the past, net was made from straw, hemp palm, and hemp, but cotton net became widely used during the "period of modernization" beginning in the Meiji era. With the development of the chemical industry, synthetic fibers were introduced as materials for rope and netting in 1948. In 1952, synthetic fiber was first tried for gill nets. At present, all of the various kinds of

Fig.1 Fixed-type bottom gill net

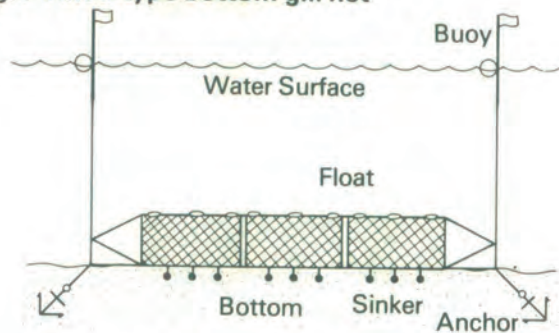


Fig.2 Fixed-type floating gill net

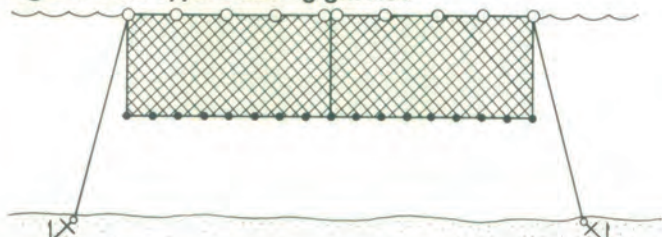


Fig.3 Floating drift net

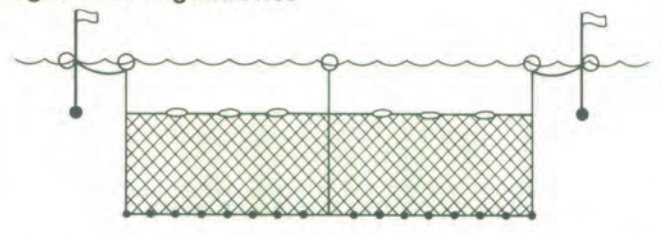


Fig.4 Bottom drift net



Fig.5 Encircling gill net

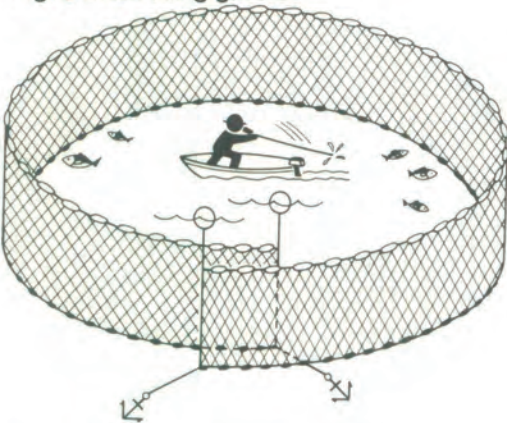


Fig.6 Hunting gill net (Drive in net)



Fig.7 Rowing gill net

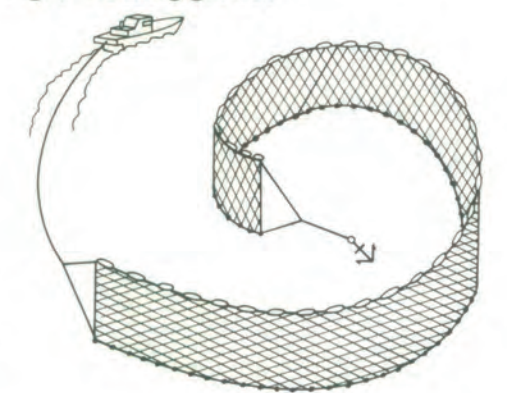


Fig.8 Component parts

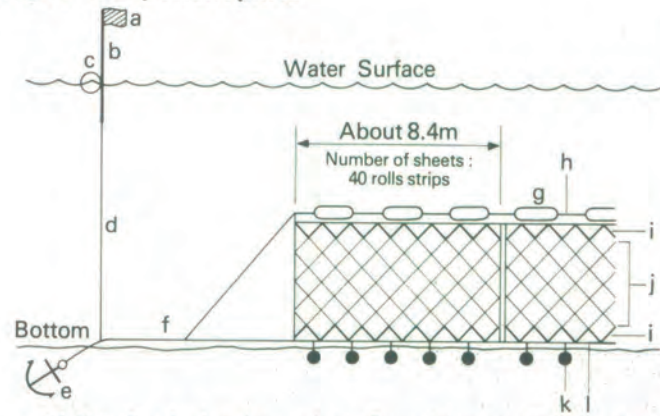


Fig.9 Side view of gill net

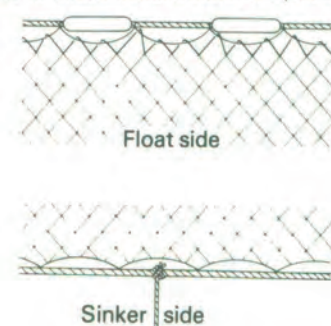


Fig.10 Netting

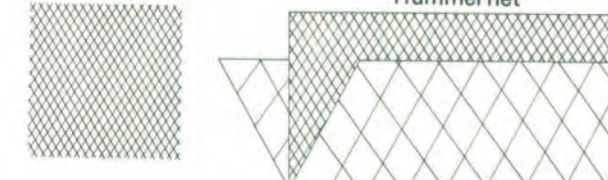


Table 1

Type	Layer in the sea
a. Fixed-type gill net	Bottom
b. Drift gill net	Surface or middle
c. Movable-type gill net	Encircling gill net
	Hunting gill net
	Rowing gill net

Table 2

Aimed fish species	Kind
Right-eyed flounder	Single walled net
Slime flounder	Single walled net
Alaska pollack	Single walled net

fishing nets are made of synthetic fibers. Merits of synthetic fiber nets are as follows:

- (1). They keep well without decaying in the water. — They have long durable life, and the cost of the fishing net is reduced.
- (2). They are light in weight. — The nets are easy to handle in casting and hauling.
- (3). Thread is fine and strong. — In addition to the improvement in durability, fishing efficiency rises because fishes are more easily entangled.
- (4). Selection of netting color is possible. — By selecting a color that fishes can not sense the fishing efficiency can be improved.

As regards the mechanization of labor, there has been considerable mechanization from early times in Japanese large-scale salmon trout drift net fishery. In recent years, receiving this influence, mechanization has extended to the field of small coastal fishing boats, and the use of net-haulers in the hauling work has been spreading. The reason for this is that, in coastal fisheries as well "reduction of labor" in fishing work became desirable in order to cope with several problems, such as the fishing ground becoming more distant, increase in the number of strips of net used, and difficulty in obtaining labor power, especially that of young men.

As regards the power source for mechanization, power can be obtained from the main engine in a diesel fishing boat. In a fishing boat fitted with an outboard motor, the net hauler is driven by a small multipurpose engine on board.

Conocimiento Fundamental del Método de Pesca con Red Rastrera

Entre las diversas clases de pesca con redes, la que emplea redes rastreras verticales es considerada como un "método eficaz", ya que utiliza equipos de estructura comparativamente simple y permite operar con facilidad, usando embarcaciones pesqueras de más o menos 1 tonelada.

Operación de la Red Rastrera

La red rastrera vertical es un equipo utilizado para capturar peces y crustáceos, que permite a los mismos pasar a través de las mallas pero que luego los sujetan por las agallas cuando intentan escapar.

Clasificación de las Redes Rastreras

Las redes rastreras verticales se clasifican en tres tipos, según su método de operación:

(a) Red rastrera tipo fijo: el equipo de pesca con red

se asegura en el mar con anclas u objetos similares.

(b) Red rastrera flotante: el equipo de pesca con red no se asegura en un lugar determinado, sino se deja a flote en el mar para que se mantenga a la deriva por la acción del viento o la corriente de la marea.

(c) Red rastrera tipo móvil: se lanza la red para pescar, rodeando un banco de peces, con el uso de una embarcación pesquera, o después de colocar la red rastrera en el lugar donde la pesca es abundante, se obliga a los peces a entrar dentro de la red. Las redes rastreras se clasifican en los siguientes tres tipos, de acuerdo con la profundidad del mar en el lugar de uso:

(1) Red rastrera para la superficie del mar: se coloca en la capa superficial del mar.

(2) Red rastrera de profundidad media: se coloca en la parte intermedia de la profundidad del mar.

Notions fondamentales de la méthode de pêche à l'araignée

Parmi les diverses méthodes de pêche au filet, la pêche à l'araignée constitue un moyen de pêche très efficace car les appareils utilisés à cet effet sont de structure relativement simple, et cette méthode se distingue par la facilité avec laquelle on l'applique avec des bateaux de pêche de petit tonnage d'environ 1 tonne.

Mode d'opération de l'araignée

L'araignée est un filet de pêche permettant d'attraper les poissons et crustacés de telle sorte que le corps des poissons traversent les mailles ou bien que ces mêmes poissons et pattes de crustacés se prennent dans le filet.

Classification des araignées

Les araignées sont classées en trois types suivant leurs méthodes d'utilisation

(a) Araignée du type fixe: Le filet de pêche est fixé à la mer avec des ancrages ou autres moyens similaires.

(b) Filet traînant: Le filet n'est pas ancré dans un endroit fixe, mais flotte plutôt à la mer et dérive selon l'action du vent ou du courant de marée.

(c) Araignée du type mobile: On imprime à l'araignée un mouvement circulaire de sorte que le banc de poissons se trouve encerclé par ce filet en utilisant un bateau de pêche pour le traîner, ou bien une fois que l'araignée est posée dans le terrain de pêche, les poissons sont entraînés dans le filet.

Les araignées sont classées également suivant les trois types ci-après en fonction de la profondeur de l'eau dans laquelle ces filets sont posés.

(1) Araignée en surface: Le filet est posé à la surface de la mer.

(2) Araignée à profondeur moyenne: Le filet est posé à profondeur moyenne dans la mer.

(3) Araignée de fond: Le filet est posé au fond de la mer.



Gill net fishing — flatfish



Net-hauler



Casting net



Gill net fishing — Alaska pollack



Gill net fishing — squilla

Fishes caught	Illustration
Sea bream, flatfish, flounder, yellowtail, herring, cod, spiny lobster, crab, sand fish, shark, etc.	Fig. 1
Halfbeak	Fig. 2
Yellowtail, saury pike, horse mackerel, mackerel, salmon, trout, skipjack, marlin, etc.	Fig. 3
Tiger shrimp	Fig. 4
Mullet, gizzard shad, sand borer, striped pigfish, yellowtail, black sea bream, etc.	Fig. 5
Barracuda, sea bream, horse mackerel, sand borer, etc.	Fig. 6
Tilefish, sand borer, sand lance, etc.	Fig. 7

Comparison of fixed-type bottom gill nets

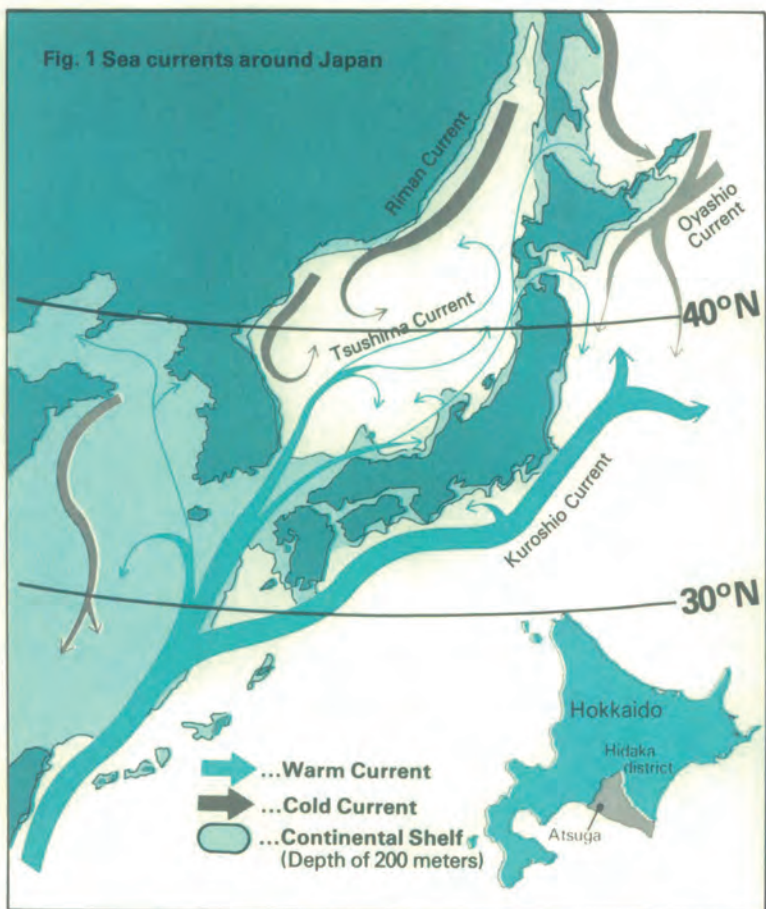
(Atsuga, Monbetsu-cho, Hokkaido)

Thickness of thread	Mesh size	Mesh depth (No. of meshes)	Hanging ratio	Colour of net
Nylon monofilament 880 Denier	4-4.2 sun (1 sun 1.193 in.)	25-30	60%	Light gray (colour of fish body)
880 — 1,100 Denier	4.8-5.8 sun	20-25	60%	Same as above
770 — 880 Denier	2.9-3 sun	65-90	50%	Same as above



Gill net fishing — flatfish

Japanese Fishermen Eng



Amidst the present international oceanic system where 200-mile economic zones are being set up worldwide, Japan is trying to reconsider the use of the fishing grounds within 200 miles of the Japanese Islands. Along with this second look, the technical value of small-scale fishing methods developed based on traditional techniques by coastal fishermen has been reevaluated, and the promotion of new coastal fisheries is being seriously considered.

Each fishing method being used in a certain district has been developed to harmonize various conditions, such as the local marine resources, environment of the fishing grounds, local labor force, and production means, such as fishing boats and gear, as a result of experience and studies conducted over many years. During the past 20 years, Japanese coastal fishermen have endeavored to enrich their lives step by step by the modernization of management, including adoption of large fishing boats with improved mechanization, improvement of fishing gear and methods, and improvement of the methods of maintaining the freshness of catches, under the guidance and assistance of the administration. It is a characteristic of gill net fishery that it can be operated easily even by a small fishing boat using comparatively simple fishing gear. As new

fishing gear and methods have been devised to better meet the particular habits of the demersal fishes, shrimps and crabs to be caught, and as the netting material has changed from cotton to synthetic fiber, and as stronger, light-weight gill nets have appeared, fishing efficiency has gradually improved.

In Japan, large-scale drift net fishing (mainly for salmon and trout) are presently being operated. Japanese coastal gill net fisheries catch about 300 thousand tons every year from about 40,000 small fishing boats. Although this catch accounts for only 3% of the total catch in Japan, it accounts for 15% of the 2 million tons of catch from the coastal waters. Thus, the role of gill net fishing plays is not a small one. Out of the total of 328,000 fishing boats under 5 tons, about 38,000 (12%) fishing boats operate mainly gill net fishing. Also, the fishermen engaged in gill net tend to earn a higher fishery income than those engaged mainly in pole-and-line or longline fishing.

Fishing boats under 5 tons are usually operated year round with an effective combination of various fishing methods such as net, angling and longline, according to the habitats of the fish, crustacean, and mollusk which migrate to the local fishing grounds. As regards the various kinds of net fishing, small-scale trawl, purse seine, boat seine and fixed net are licensed fisheries, and the number of fishing boats which

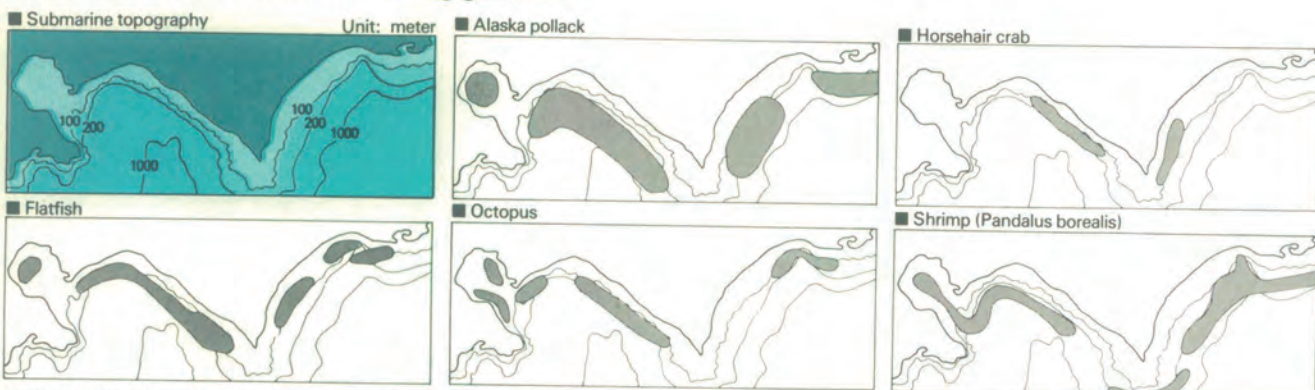
can be operated is limited. However, although gill net fishing is a licensed fishery in some districts, it is not so in many other districts. Thus, gill net fishing is the most popular method among coastal fisheries, and an important method in that it contributes greatly to the fishery income of fishermen.

An Example of Coastal Demersal Fishery (Hokkaido, Hidaka District)

1. Fishing conditions in Hokkaido
 A little over 30% of the total catch of Japanese fisheries are landed in Hokkaido. The reason for this is that there exists an extremely good off-shore fishing ground where cold and warm currents meet, bringing about the abundant growth of various species of fish along with abundant inshore propagation of seaweeds and shellfishes. An examination of the component ratio of species of the fishes caught in Hokkaido shows

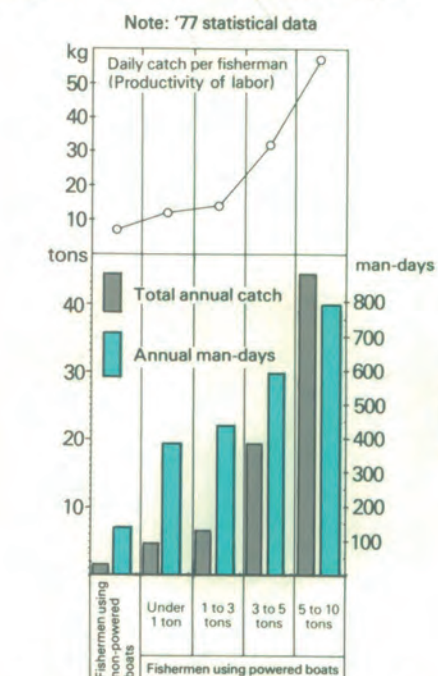
that demersal fishes form a large proportion of the total catch (Fig. 3). The main species of demersal fishes caught are cod, Atka mackerel, flatfish, ocean perch, channel rock fish, sand fish and ray. These fishes are caught by trawling in offshore waters and by gill net, longline and pole-and-line fishing in coastal waters.

Fig. 2 Distribution of coastal fishing grounds



Reference material: From documents of the Hokkaido Fishery Resources Technical Development Association

Fig. 4 Productivity by boat size



* Except for fishermen engaging in small-scale fixed net fishery
 (Economic Survey Report on Fisheries by the Ministry of Agriculture, Forestry and Fishery)

Fig. 5 Fishing calendar

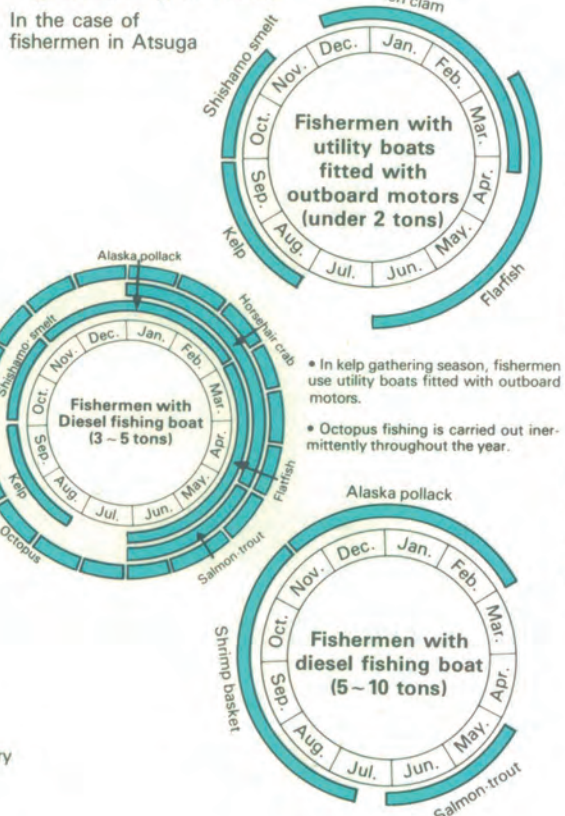


Fig. 3 Catches of coastal and offshore fisheries (1977)

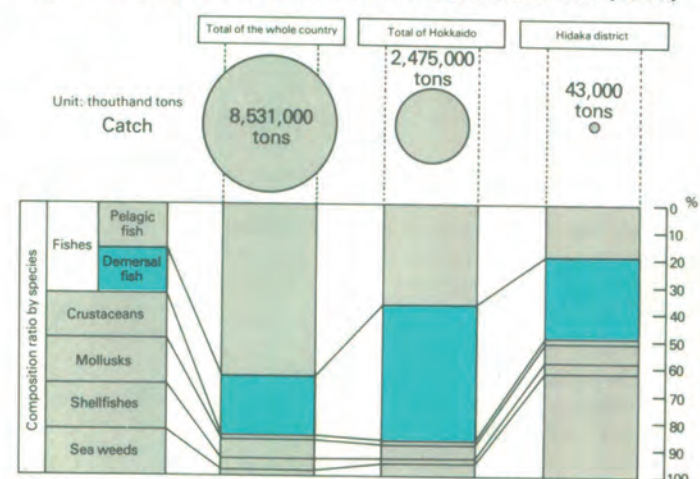


Fig. 6 Distribution of fishing grounds shown by water depth

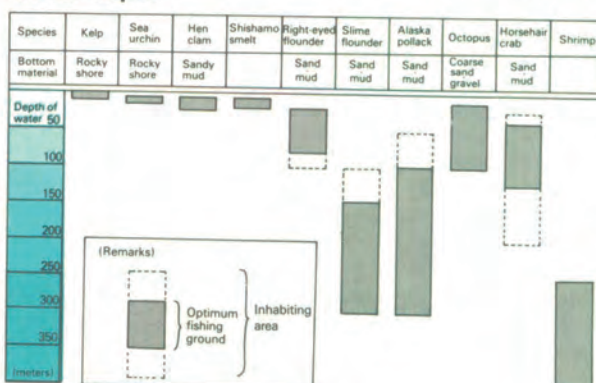


Table 1 Kind of Fishery by Size of Fishing Boat

Fishing boat	Utility boat with outboard motor Under 2 tons	Diesel fishing boat 3-5 tons	Diesel fishing boat 5-10 tons
Kelp gathering	●		
Hen clam (Shellfish beam trawling)	●		
Shishamo smelt boat seine	●	●	
Flatfish gill net	●	●	
Octopus pot (Octopus line)		●	
Horsehair crab basket		●	
Alaska pollack gill net		●	●
Salmon-trout drift gill net		●	●
Shrimp basket			●
Bottom material of inshore fishing ground	Sandy mud zone		

Remarks: For shellfish beam trawling of hen clam, a drum reeler for rope and a power source for the reeler are installed. (besides the outboard motor)

aging in Efficient Coastal Gill Net Fishery

2. The present situation in Hidaka district, Hokkaido

In the coastal waters of the Hidaka district facing the Pacific (Fig. 1), natural kelp is produced in abundance, and 40% of the total marine products of this district are formed by kelp. However, during the off-season for kelp gathering, fishermen engage in boat fishing (mainly using gill net) catching mainly bottom fishes, crustaceans and mollusks. The distribution of fishing grounds for the main coastal fishes in this district is shown in Fig. 2, and the distribution of their habitats in relation to bottom materials and water depth is illustrated in Fig. 6.

3. The fishermen engaged in boat fishing in Atsuga, Hidaka district

The type of fishery operated by coastal fishermen is determined by both the above-mentioned natural conditions and by the power of their own fishing boats. Here, we will introduce as an example the situation in Atsuga, Hidaka district, where various types of boat fishing are soundly operated. Coastal fishermen in this district are classified into the following three categories by the size of their fishing boats.

- (1). Fisherman operating a utility boat under 2 tons fitted with an outboard motor.
- (2). Fisherman operating a diesel fishing boat of 3-5 tons.
- (3). Fisherman operating a diesel fishing boat of 5-10 tons.

The type of fishing conducted, as well as its operational ability and the fishery regulations involved are determined by the size of fishing boats used. This fact shows itself clearly in Table 1. In order to carry on fishing as a main occupation, an effective operation plan for fishing must be drawn up to cover the entire year. The fishing calendar for Atsuga is shown in Fig. 5. It is needless to say that a fisherman must adopt the most appropriate fishing plan according to the size of fishing boat he uses.

- (1). Utility boat fitted with an outboard motor—This is mainly used for gathering kelp along the shore. Moreover, by using this boat also for shellfish gathering and gill net fishing in shallow waters, fishermen can make a sufficient living throughout the year.
- (2). 3-5 ton diesel fishing boat—Because of higher power, this boat can go to fishing grounds several kilometers off the coast. Therefore, it becomes possible to increase the catch per boat and to operate various kinds of fishing in many different ways. This makes it possible to select the fishing object and fishing method which seem to be most profitable judging from the daily fishing conditions, and, thus, to achieve a stabilized business.
- (3). 5-10 ton diesel fishing boat—This class of fishing boat is engaged in only a few kinds of fishing and fishermen are specialized in this line of fishing. Although the productivity of each fishing boat is high, in case of a poor catch, it is not so easy to convert to fishing for other fishes as in the 3-5 ton class. Therefore, it is necessary for this class of fishermen to have the capability to change their fishing grounds from coastal to offshore and to have the ability to obtain outside labor when necessary.

En Japón, la pesca en gran escala con redes rastreras (especialmente de salmón y trucha) se efectúa en lugares oceánicos con abundante riqueza pesquera. Además, en las zonas pesqueras costaneras se utilizan extensamente muchos tipos de redes rastreras verticales. La pesca con redes rastreras verticales en Japón contribuye con una captura de unas 300 mil toneladas anuales, utilizando algo así como 40.000 pequeños buques pesqueros. Esta captura representa sólo el 3% del total de la pesca en el Japón, pero equivale al 15% de las 2 millones de toneladas correspondientes a la pesca en aguas costaneras. De ahí la importancia que se le da en Japón a la pesca con red rastrera vertical en aguas costaneras. De un total de 328.000 buques de menos de 5 toneladas, unos 38.000 (12%) son destinados principalmente a la pesca con redes rastreras verticales. Los pescadores que utilizan este método obtienen por lo general un ingreso más elevado que los que se dedican a la pesca con palangre.

Ejemplo de Pesca de Especies que Viven en las Profundidades de Aguas Costaneras

La distribución de las zonas de pesca abundante en aguas costaneras del distrito de Hidaka, Hokkaido, se indica en la Fig. 6, y la distribución de su hogar natural en relación con los materiales del fondo del mar y la profundidad del agua se ilustran en la Fig. 7. Tanto las condiciones naturales arriba mencionadas como la potencia de sus embarcaciones pesqueras determinan el estilo de operación de los pescadores costeros. Los pescadores costeros se clasifican en las siguientes tres clases, según el tamaño de sus embarcaciones pesqueras:

- (1) Pescadores que operan buques pesqueros diesel estilo japonés de menos de 2 toneladas, dotadas de motores fuera de borda.
- (2) Pescadores que operan buques pesqueros diesel de 3 a 5 toneladas.
- (3) Pescadores que operan buques pesqueros diesel de 5 a 10 toneladas.

El objetivo de la pesca difiere según el tamaño de la embarcación pesquera utilizada y depende también de la habilidad de operación así como de los reglamentos de pesca. La situación actual se describe en la Tabla 1.

Au Japon, la pêche de grande envergure à la traîne ou filet traînant (principalement pour le saumon et la truite) a lieu dans les pêcheries pélagiques. D'autre part, dans les pêcheries côtières, de nombreux types de pêches à l'araignée sont mises à profit. Les pêches côtières à l'araignée au Japon permettent une prise annuelle d'environ 300 milles tonnes au moyen d'environ 40.000 petits bateaux de pêche. Cette prise ne compte que pour 3% seulement de la prise totale au Japon, mais représente 15% des 2 millions de tonnes de la prise dans les eaux côtières. Par conséquent, la pêche à l'araignée prend toute son importance quand il s'agit des pêches côtières japonaises.

Sur un total de 328.000 bateaux de pêche de moins de 5 tonnes, environ 38.000 (12%) des bateaux de pêche utilisent principalement la méthode de pêche à l'araignée. Ils permettent en principe d'obtenir un revenu de pêche plus élevé pour les pêcheurs qui l'appliquent que pour ceux utilisant surtout la canne à pêche ou la ligne longue.

Exemple de pêche côtière démersale

La répartition des pêcheries suivant les principaux poissons dans les eaux côtières dans la région de Hidaka, dans l'île d'Hokkaido, est montrée dans la Fig. 6, et la répartition de leurs habitats en rapport avec les matériaux de fond et la profondeur des eaux est illustrée dans la Fig. 7.

Les conditions naturelles mentionnées ci-dessus et la puissance de leur propres bateaux de pêche déterminent le mode d'opération mis à profit par les pêcheurs côtiers.

Les pêcheurs côtiers sont classés suivants les trois catégories ci-après en considérant la taille de leurs propres bateaux de pêche.

- (1) Pêcheurs opérant avec bateau de style japonais de moins de 2 tonnes équipé d'un moteur hors-bord.
- (2) Pêcheurs opérant avec bateau de pêche à diesel de 3 à 5 tonnes.
- (3) Pêcheurs opérant avec bateau de pêche de 5 à 10 tonnes.

Les objectifs de pêche envisagés varient suivant la taille du bateau de pêche utilisé, tout en considérant aussi l'habileté atteinte et les règlements de pêche en vigueur. La situation actuelle est montrée dans la Table 1.

Unity in A Community: Another Basis of Sound Production

It is an important task in promoting coastal fisheries to encourage the comprehensive and full use of fishing grounds while simultaneously cultivating and conserving the fishery resources. In an environment where many fishermen are forced to compete for catch using various types of fishing boats and gear within a small fishing ground near shore, a system for controlling the fishing ground and fishing methods becomes necessary. Moreover, a much more fundamental task is to find the way toward better mutual understanding among local fishermen and to strengthen unity between fishermen as a community. When this problem is solved, i.e., when the consciousness of cooperation in maintaining fishing order and effective utilization of fishing grounds is cultivated, the mutual desire to avoid excessive competition will arise. It will also become easy to settle any problems arising during operation.

In the following is introduced an actual example from the Hidaka district, Hokkaido, where a group of small scale fishermen who had been competing with one other within a limited fishing ground using the same type of fishing boats succeeded in developing their fisheries into a cooperative type operation through a spirit of cooperation. In Atsuga port of Monbetsu-cho, 26 fishing boats are presently operating.

- * Small boats (under 2 ton, utility boats fitted with an outboard motor)6
- * Medium boats (3-5 ton, diesel fishing boats)16
- * Large boats (5-10 ton, diesel fishing boats)4

The water area in between the two lines, P and Q, shown in Fig. 1 is the fishing area where fishermen of this district are permitted to operate. Around 1962, however, by mutual agreement of the three groups of large, medium and small boat owners, this area was divided into three sections according to the capacity of each group of fishing boats as shown in Fig. 1. Out of these three groups, a group consisting of 16 medium boats is conducting cooperative fishing. They operate in the zone within the four points, A, B, C and D, shown in Fig. 1. They began working cooperatively partially in some kinds of fisheries from 1970, and from 1976 they have begun to work cooperatively in all their bottom fisheries (except for salmon drift net), including right-eyed flounder bottom gill net, oc-

A story of fishermen who solved the problem of overcrowding in fishing grounds by means of cooperative activities

topus pot, crab pot and Alaska pollack bottom gill net. The details of cooperative operation are as follows:

(United action of operation) The propriety of fishing, selection of kind of fishing and operation site are decided after a consultation with the union chairman and an offshore fishing boss who are elected from the members of fisheries cooperative association.

(Distribution of earnings to members) Earnings are distributed to members by dividing them into sixteen equal parts after the following expenses are subtracted:

- Expenses
- (1). Cooperative selling commission paid to the

- fisheries cooperative association (5.5%)
 - (2). Fuel expenses (10%)
 - (3). A reserve for fishing gear depreciation
- (Cooperative buying of materials)** Investments in fishing boats and engines are made by each fisherman, but fishing gear is distributed to each fishing boat after the cooperative buys them using reserve funds.
- (Agreement of employment wages)** Salary for crew members is paid under an agreement.

Fig. 1 Division of Fishing Ground by Size of Fishing Boat

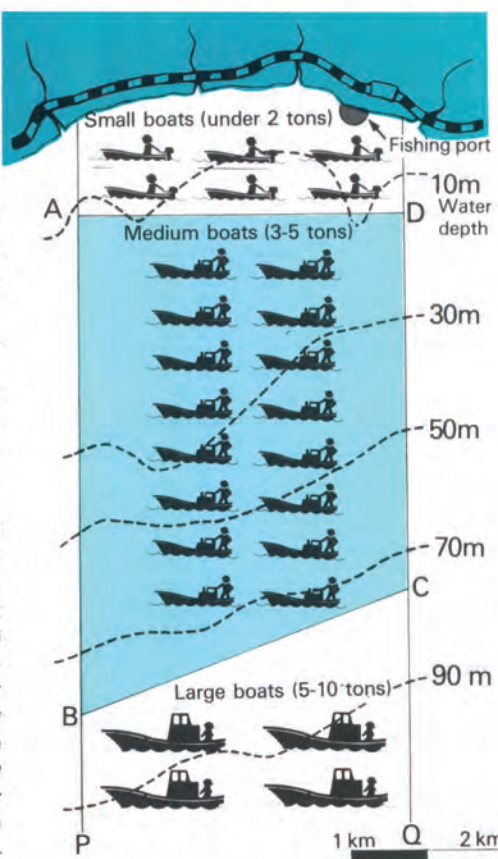
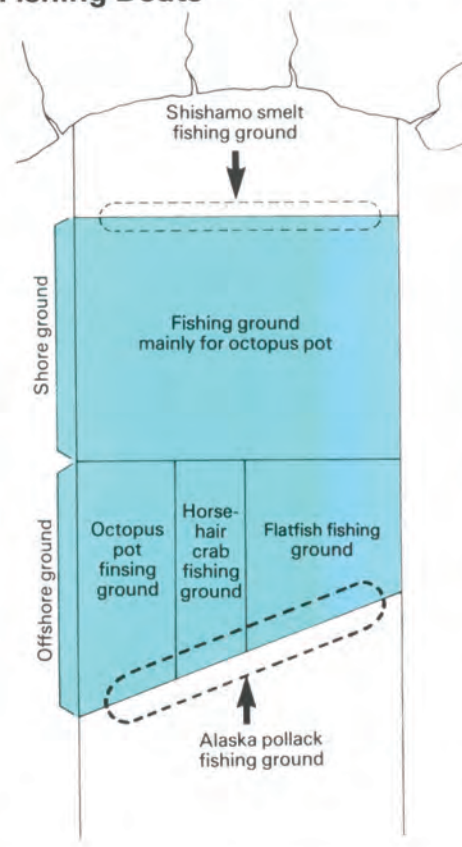


Fig. 2 Utilization Plan of Fishing Ground by Medium Fishing Boats



In the days of free operation, each fishing boat randomly laid its own chosen fishing gear, resulting in the hindrance of operation by frequent entanglement of nets. Moreover, during the winter season, days of fishing in offshore fishing grounds were greatly restricted by severe weather conditions, and fishermen under private management tended to proceed in dangerous fishing trips. These two points were the chief motives which encouraged fishermen to begin cooperative operation. At present, their fishing grounds are divided according to the condition of resources and fishing methods, and they are seeking to utilize fishing grounds as effectively as possible (Fig. 2). The name of their community is "Atsuga Medium Diesel Boat Association". Mr. Tadayuki Ishizaki, the present chairman, offered his opinion on the significance of cooperative operation: "By putting this system into practice, our views of life and fishery have been gradually altered. At the beginning, we were troubled mutually by conflicts of ego and by slander, but we began to exchange opinions at meetings held at least twice a month. As a result, even quiet men began to speak up gradually, and a basis for confidence and solidarity was founded."

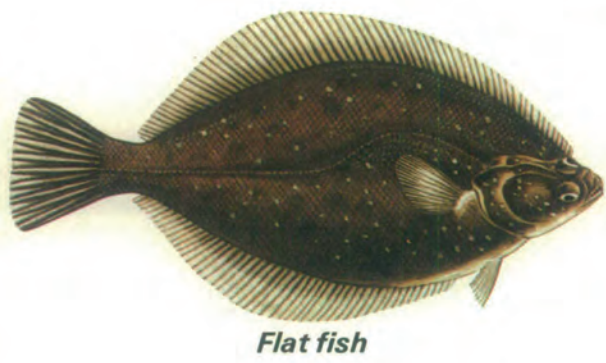
El relato de un pescador que resolvió el problema de la aglomeración en las zonas pesqueras a través de actividades cooperativas.

Una de las labores más importantes en la promoción de la pesca costanera es la de llevar a cabo el aprovechamiento completo y total de las zonas pesqueras conservando simultáneamente la riqueza pesquera. En el distrito de Hidaka, Hokkaido, un grupo de pescadores en pesquera, utilizando embarcaciones del mismo tipo, tuvieron el éxito de desarrollar un sistema de operaciones cooperativas que ostenta un elevado espíritu de trabajo en equipo.

Histoire des pêcheurs qui ont résolu le problème d'encombrement des pêcheries grâce à leurs activités coopératives.

C'est une tâche importante pour la promotion des pêches côtières de rationaliser complètement l'exploitation totale des pêcheries en cultivant et en conservant simultanément les ressources de pêche. Dans la région de Hidaka à Hokkaido, un petit groupe de pêcheurs qui se condamnaient une concurrence sans merci dans un secteur limité de pêcherie en utilisant le même type de bateau ont réussi à surmonter leur difficulté en mettant au point une association coopérative de pêche très fructueuse et en faisant preuve d'un esprit de solidarité bien développé.

Bottom fishes, crustaceans and mollusks in Japan



Flat fish



Lizard fish



Tanner crab



Cod



Hair tail



Short-necked clam



Croaker

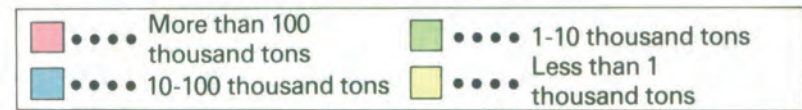


Tiger shrimp



Scallop

Fishing conditions by kind of fishing (1983)



Kind of fishery	Species																				B. Total catch by kind of fishery thousand tons									
	Flounder	Flatfish	Cod	Alaska pollack	Atka mackerel	Ocean perch	Croaker	Lizard fish	Butter fish	Sharp-toothed eel	Hairtail	Ray	Red sea bream	Yellow sea bream	Black sea bream	Tiger shrimp/ Other shrimps	Tanner crab	Blue crab	Other crabs	Japanese common squid		Cuttlefish	Other squids	Octopus	Short-necked clam	Scallop	Herf clam	Ark shell		
Mothership-type bottom trawl																													450	
Northern sea trawl																														379
Southern sea trawl																														198
Western sea bottom trawl																														161
Offshore bottom trawl																														724
Coastal small-scale bottom trawl																														391
Mothership-type crab fishery																														0
Northern sea tanner crab fishery																														1
Northern sea longline & gill net																														45
Coastal gill net																														307
Squid angling																														263
Pole and line																														86
Coastal longline																														96
Fixed shore net																														166
Shellfish gathering																														198
A. Total catch by species	6	251	104	1,434	56	12	27	15	4	12	35	8	15	7	4	62	8	6	87	192	8	339	42	160	128	5	5			

Source: Statistics by the Ministry of Agriculture, Forestry and Fishery