

Three Questions on Octopus

A View of Octopus Fishery from Japan, the Largest Consuming Country in the World

According to the FAO's statistics, 193,000 tons of octopuses were landed by the fisheries of the world in 1978. A study of octopus fishing shows that fishing grounds are concentrated in specific waters such as the northwest coast of Africa, adjacent seas of Japan, and the Mediterranean Sea.

Octopuses are being landed by 31 countries in the world, and 87 percent of the total catch is being landed by five countries with large production; Spain, Japan, the Republic of Korea, Italy and

Portugal. Official statistics by the Japanese Government show that 137,000 tons of octopuses were supplied to Japan in 1978. This total consisted of 42,000 tons of octopuses from the adjacent seas of Japan, 21,000 tons from pelagic fishery and 74,000 tons from imports.

Only certain peoples of the world eat octopus namely, the Japanese, the Italians, the Spanish and the Greeks.

Is it possible to continue using octopus as a stable game fish?

Here, we shall review the conditions in

Developed & potential fishing grounds for octopus (by Prof. Okutani)

(Remarks) FAO's statistical data of 1979 has not yet been obtained up to Feb. 1, 1981. The amount of supply to Japan during 1979 reached 114,000 tons in total consisting of 52,000 tons of catches by domestic fishery and 62,000 tons from imports. See the article on the next page.



Japan, where now 70 percent of the worldwide catch is being consumed. In editing this issue, we decided to treat the following three questions.

- (1) Why are fishing grounds for octopus, unevenly concentrated in the specific sea areas? What conditions are necessary for developing a new fishing ground for octopus?
- (2) Is the demand for octopus stable? What changes are forecasted in the future consumption especially in Japan?
- (3) Is it possible to conduct small-scale octopus fishery by small fishing boats at a commercial profit, at the same time, is trawling fishery by large fishing boats being carried on?

- (2) ¿Es estable la demanda de pulpo? ¿Qué cambios se pronostican para el futuro, particularmente en el Japón?
- (3) ¿Es posible realizar pesca de pulpo en escala reducida usando botes pesqueros pequeños, además de la pesca a rastra de los grandes botes de pesca?

La pêche à la poulpe vue du Japon, le plus grand pays consommateur de mollusques au monde.

D'après les statistiques de la FAO, il a été pris 193.000 tonnes de poulpes dans le monde en 1978. Les conditions favorables de pêche aux mollusques suivant les zones côtières montrent qu'elles sont situées dans les eaux particulières comme celles du Nord Ouest de la Côte d'Afrique, les mers contiguës au Japon, et dans la Méditerranée.

Il n'y a que certaines races dans le monde telles que les japonais, les italiens, les espagnols et les grecs qui mangent couramment de la poulpe.

Est-il possible d'attraper des poulpes en tant que méthode de pêche régulière?

Voyons d'abord les conditions au Japon où l'on compte environ 70% de la pêche mondiale des mollusques consommée dans ce pays. Considérons à ce propos trois facteurs.

- (1) Pourquoi les zones de pêches pour les poulpes sont-elles principalement réparties dans des secteurs maritimes particuliers? Et quelles sont alors les conditions requises pour développer de nouvelles zones de pêche pour les poulpes?
- (2) La demande pour la consommation des poulpes est-elle stable? Quels sont aussi les variations prévues pour la consommation de ces mollusques en particulier au Japon dans l'avenir?
- (3) Est-il possible de se livrer à la pêche des poulpes sur une petite échelle au moyen de petits bateaux de pêche, en plus de la pêche massive au chalut avec de gros bateaux de pêche?

La pesca del pulpo vista desde el Japón, el mayor país consumidor del mundo

Según estadísticas de la FAO, en 1978 las pesquerías de todo el mundo subieron a tierra un total de 193.000 toneladas de pulpos. Las condiciones de pesca por áreas de mar muestran que los campos de pesca se localizan principalmente en aguas específicas, tales como la costa noroccidental del Africa, los mares adyacentes al Japón, y el Mediterráneo.

Solamente razas específicas del mundo, como japoneses, italianos, españoles y griegos, comen pulpo.

¿Es posible continuar la pesca de pulpo en forma estable?

Vamos a revisar aquí las condiciones del Japón, en donde hoy se consume el 70 por ciento de la pesca mundial de pulpo. En esta edición hemos decidido abordar las tres cuestiones siguientes:

- (1) ¿Por qué se distribuyen en áreas marinas específicas los campos de pesca de pulpo? ¿Qué es necesario para desarrollar nuevos campos de pesca de pulpo?

Coastal Octopus Fisheries

Rich in Variety

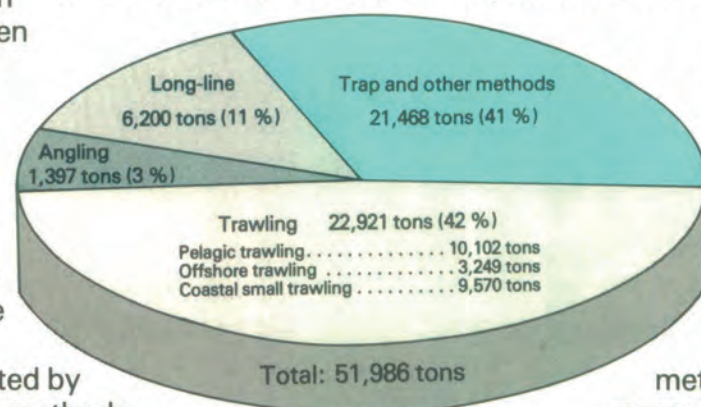


Shown here is the catch according to fishing method in Japan in 1979. About half of the total catch has been caught in the trawling method, and about one-fifth of the total has been caught by pelagic trawlers in the fishing grounds along the north-west coast of Africa.

However, octopus fisheries in the coastal waters of Japan are conducted by a variety of fishing methods. In a normal year about 10,000 tons of octopuses together with various demersal fishes

are landed by small trawlers. Besides this, various special fishing methods for capturing octopuses have been used in many districts since old times. The fishing methods for octopuses can be classified into two types: (1) fishing methods which hook octopuses by attracting them with baits as in angling and long-line, and (2) various trap methods catching octopuses by taking advantage of their instincts or taxis.

Catch of octopuses by fishing method (1979)



[Biological characteristics]

Octopus belongs to the class Cephalopoda of the phylum Mollusca among the Invertebrata, allied to the squid (the squid belongs to the order Decapoda and the octopus to the order Octopoda).

The body is divided into three portions; the head, trunk and arms. There are eight arms extending from the anterior periphery of the head. The globular body, which looks as if it were the head, is a muscular bag called the mantle containing the viscera. The octopus has well-developed eyes and jaws.

There are many chromatophores containing black, red or yellow pigment in the skin. These chromatophores are controlled by the nervous system, and the color of the body changes depending on the environment, creating so-called protecting coloration. When alarmed, the octopus also exhibits change in color tone and color spots on the body. The dead octopus turns light grey, as a result of the contraction of all the chromatophores.

[Species]

The octopods are comprised of surface-dwellers such as *Argonauta argo* and *Tremoctopus violaceus* and bottom-dwellers such as *Octopus vulgaris*, *Paroctopus dofleini dofleini*, and *Octopus minor*. Octopuses are widely distributed in the seas from the Frigid to the Torrid Zones, and also vertically from the coastal shallow waters to the deep sea of more than 1,000 m.

It has been estimated that the order Octopoda includes about 200 species distributed throughout the world. However, there remain many problems taxonomically unsolved, and all the details of the taxonomy of octopuses are not yet known. Among these varieties of octopuses, the benthic species with well-developed muscles are used for food. In the opinion of Dr. Takashi Okutani, several species of octopuses suitable for food are living in the waters off each continent.

The main species of edible octopuses living in Japanese waters are *Octopus vulgaris*, *Paroctopus dofleini dofleini*, and

Octopus ocellatus.

(1) *Octopus vulgaris*: This is the most popular octopus and has the highest commodity value. This species is widely distributed in the Pacific and Atlantic Oceans, the North Sea, the Mediterranean Sea, the Red Sea, and the Indian Ocean, i.e., in many seas from the subtropical to the temperate zones. The maximum size is 60 ~ 70cm in body length.

(2) *Paroctopus dofleini dofleini*: This species lives in cold waters. In Japan, this octopus is captured abundantly in Hokkaido and the Tohoku district. This species is characteristically large and individuals more than 3m in length are landed on rare occasions. It is said that this octopus, whose muscles contain much water is not so delicious compared to *Octopus vulgaris*, but this species is one of the important aquatic resources next to *O. vulgaris*.

(3) *Octopus ocellatus*: In Japan this species is distributed from southern Hokkaido to Kyushu, and especially abundant in the Inland Sea. This is a small species of about 10 ~ 15cm in body length. During spawning season (winter), the trunk becomes filled with eggs. When boiled, ellipsoidal eggs coagulate turning white. Because this white coagulated egg reminds us of a grain of boiled rice, the individuals having well-developed ovaries have been appreciated by Japanese people since old times.

[Life Cycle]

The life cycle of benthic octopuses, especially of *Octopus vulgaris*, shall be explained here.

The spawning season of *O. vulgaris* is very long extending from the early summer when the water temperature begins to rise until autumn. Hatched juveniles first spend a planktonic phase, and about one month after hatching they sink to the bottom to start their benthic phase. After entering the benthic phase, they begin to show negative phototropism. During the daytime they hide in the spaces between or under rocks or other objects, and during the night they move about seeking food. They feed voraciously on crabs, shrimps, shellfishes, nereides and fishes which they can catch at random.

The habitat of *O. vulgaris*

	Water Temperature	Salinity
Favourable Sea Conditions	6 ~ 30°C	18 ~ 38 ‰
Optimum Sea Conditions	22 ~ 25°C	18 ~ 30 ‰

Octopuses live only in the sea, and not in fresh water or brackish waters. *Octopus vulgaris* likes sea water with a salinity of Cl 18 ‰. In sea water with a salinity of Cl 15 ‰, the octopus shows abnormal behavior and in sea water below this salinity it dies. *O. vulgaris* has a low degree of tolerance to low water temperature, and the lowest water temperature in which *O. vulgaris* can live is 6 ~ 7°C.

As to the bottom composition of its habitat, the octopus inhabits both rocky shores and sandy mud zones. Except during the reproductive season, octopuses do not form groups, and each individual has his own territory. In rocky shores, the case where a dominant octopus occupies a specific hole is sometimes observed.

[Fishing season]

The growth rate differs with the environment, but generally the octopus reaches a body weight of over 1kg at one year of age and becomes sexually mature. From the summer of the year after hatching, the octopus begins to grow quickly and begins to be caught.

There are two fishing seasons in a year for octopuses in Japan. For example, along the coast of Ise Bay located in the central part of the Japanese Islands, major fishing seasons are from April to August (summer) and from October to February (winter). This has a relationship with the migration of octopuses between deep and shallow waters. As mentioned before, octopuses prefer warm waters. Therefore, when the water temperature drops in winter, they move to deeper waters, and when summer comes they come back near the coast from offshore seeking warm water.

The migration of *O. vulgaris* is generally limited to a small area, but in some districts they migrate over a wide area depending on the sea conditions or submarine topography. A change in salinity of the sea water induces the octopus to migrate. In the Inland Sea, when the salinity of the sea water drops due to the increase in the amount of inflowing freshwater from rivers in the rainy season in summer, many individuals of *O. vulgaris* escape to the offshore waters of high salinity sometimes causing a poor catch in the coastal fishing grounds.

Fishing gear and fishing methods

The trawling method shall not be explained here because it is already well known, instead other fishing methods for octopus by small fishing boats in coastal waters shall be introduced here.

A. Octopus long-line using traps

This is a trap method taking advantage of the fact that the octopus likes to enter holes. An unglazed pot, a wooden or

plastic box, or a concrete block with a lid is used as a trap. Shells are used to catch small *Octopus ocellatus*. These traps are tied with a branch line about 30cm long, and these branch lines are further tied to a main line. This set of traps are laid on the sea bottom.

The size of pot or box differs according to the size of octopus being caught. Moreover, the total length of the main line and the distance between the pots also

differ with the environment of the fishing ground, but generally the total length of one main line is about 1km and traps are attached at intervals of about 10m.

This fishing gear is laid on the sandy mud bottom or on the peripheral zone of reefs at a depth of 10 ~ 40m. After one to three days, traps are pulled up by hauling in the main line hand over hand, and after taking out the octopuses from the traps the emptied traps are set again in the sea. This process is repeated throughout the fishing season.

This fishing gear is not suitable for use under conditions where the traps will be constantly rolled by strong tidal currents or an irregular surface on the bottom.

B. Long-line and cask drift-line using hooks

Pot fishing is inappropriate for operation along rugged rocky shores, so the angling method is employed. A bait is us-

ed in some techniques, and in other techniques the octopus is caught by piercing it with a multiple hook without bait by making a reverse use of the movement of octopus. In both techniques, a hook without barb is characteristically used.

In cask drift-line, 10 ~ 20 sets of fishing gear are cast into the sea at a time by a single fishing boat, and these fishing gears are allowed to move by the force of tide or wind while dragging hooks along the bottom. When the octopus is captured with hooks, the cask stops moving. Therefore, a fisherman on a fishing boat will keep on looking out for the movement of casks, and when the cask stops moving, the fishing gear is hauled in to land the octopus.

C. Octopus hooks and spears

These fishing gears are used to catch octopuses hiding in the shade of rocks by hooking or piercing. When the octopus is

hiding in a hole, such an octopus is lured out with a shore crab fixed to the tip of the hook.

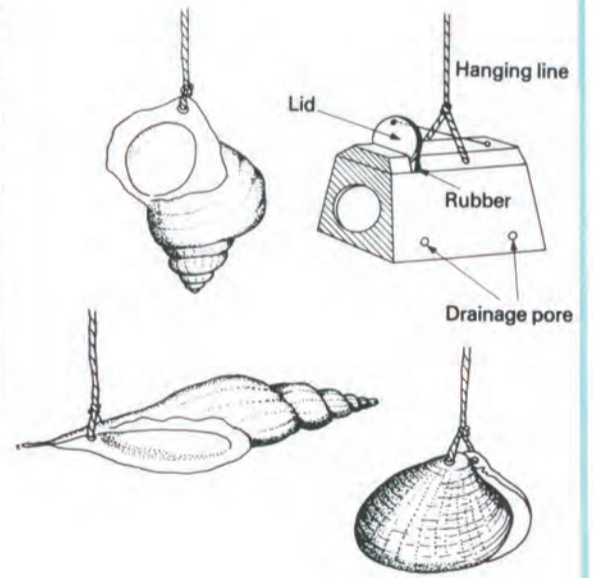
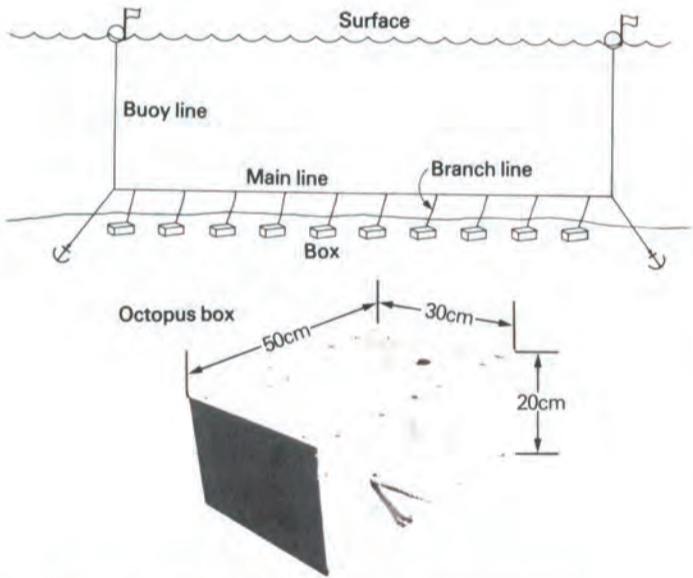
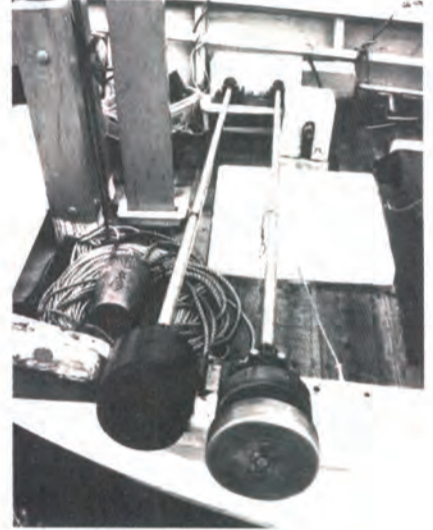
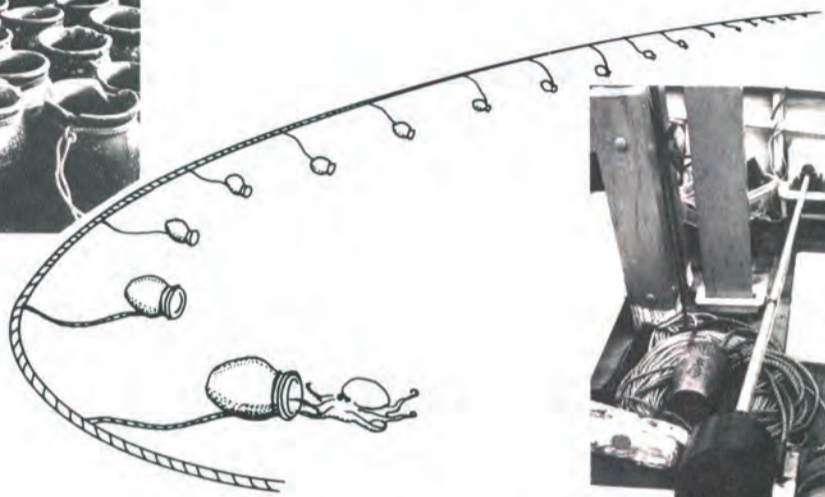
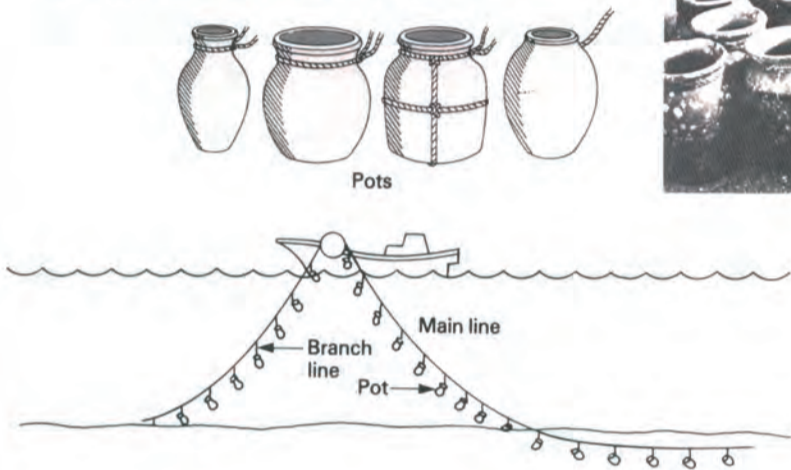
La pesca costanera de pulpo es de rica variedad

La pesca de pulpo en aguas costaneras del Japón se hace según varios métodos. En años normales unas 10.000 toneladas de pulpo y varios octópodos son sacadas a tierra por pequeños buques pesqueros de rastreo. Además de esto, desde muy antiguo y en numerosos distritos se han desarrollado métodos especiales de pesca para capturar octópodos. En cuanto a métodos para capturar pulpo, se puede hablar de dos tipos, a saber: (1), el anzuelo después de atraer a los pulpos con carnada usando varilla, línea y línea larga; (2), la trampa, aprovechando el instinto o taxis del pulpo.

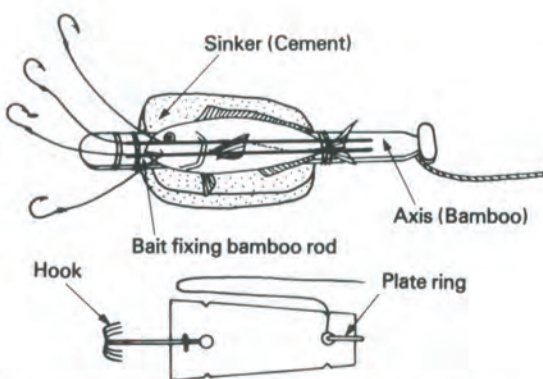
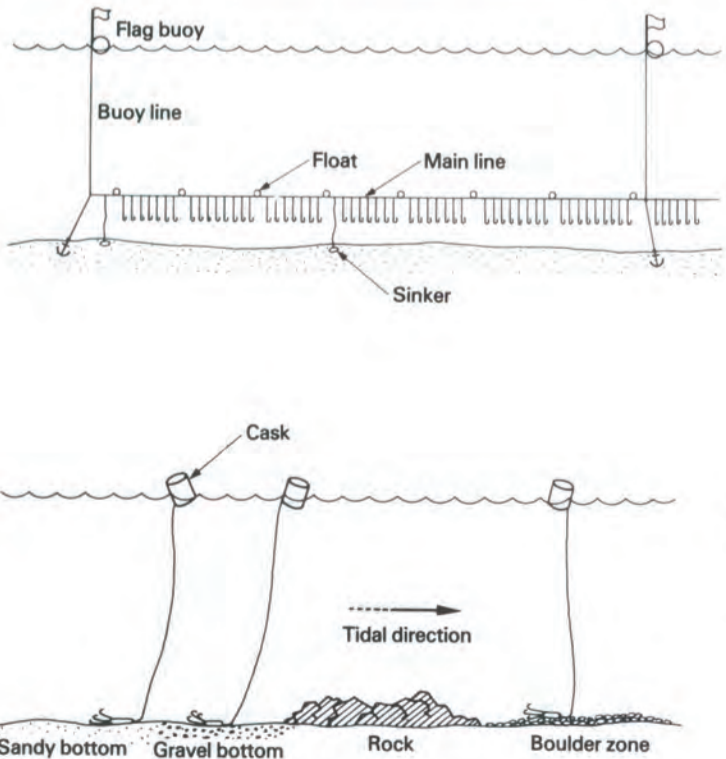
Les pêches côtières à la poulpe sont riches en variété.

Les pêches à la poulpe dans les eaux côtières du Japon s'effectuent par des méthodes de pêche variées. Dans une année normale, on compte environ 10.000 tonnes de poulpes et pêches démersales variées prises par de petits chalutiers. Outre de telles pêches, de nombreuses méthodes de pêches particulières ont été mises au point pour attraper les poulpes dans plusieurs secteurs depuis les temps anciens. En ce qui concerne les méthodes de pêches pour les poulpes, on peut noter deux types: (1) les méthodes de pêches consistant à attraper les poulpes avec hameçon et de l'appât comme pour la pêche à la canne et la ligne ainsi que la longue ligne, et (2) les méthodes variées de piège et filet pour attraper les poulpes en profitant de leur instinct ou de déplacement.

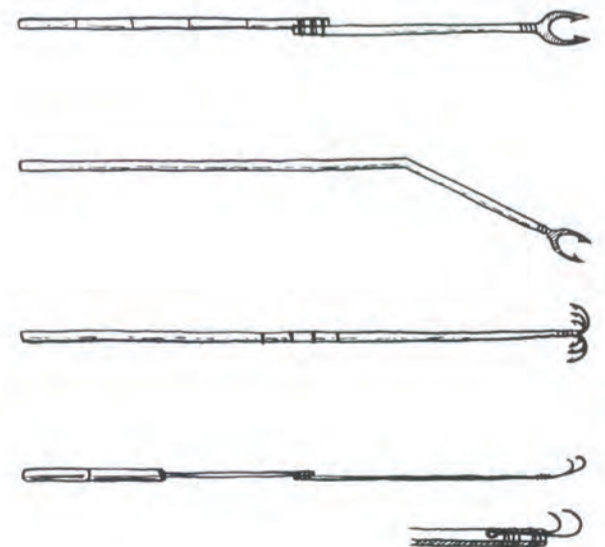
A. Octopus long-line using traps



B. Long-line and cask drift-line using hooks



C. Octopus hooks and spears



Notes: A long line is hung down from a cask, and a hook and bait are fixed to the line end.

*Illustrations of fishing gear and methods were prepared in accordance with the "World Squid and Octopus Resources and Their Usage", published by the Japan Marine Fishery Resources Research Center.

Fig. 1 Processing and division of utilization of octopus

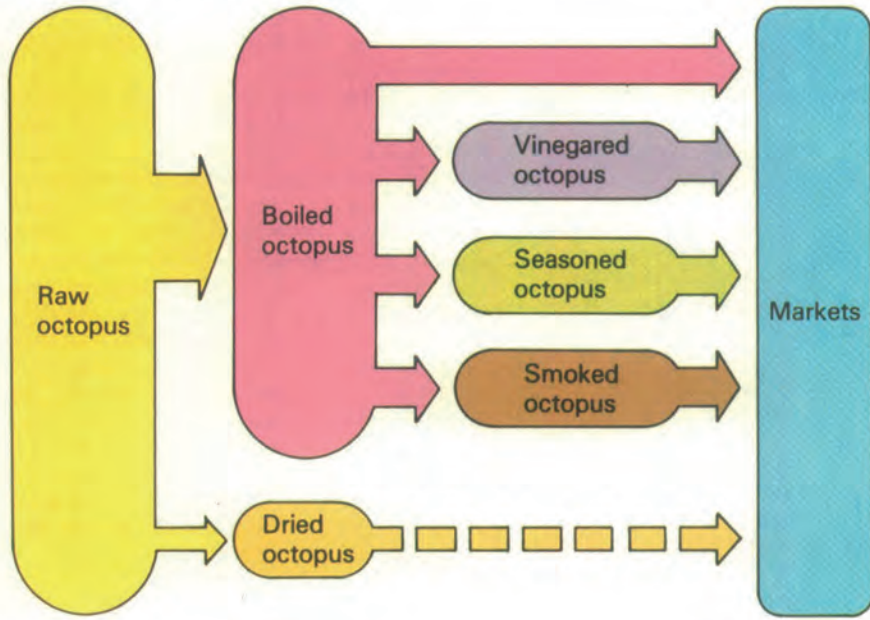


Fig. 2 Division of utilization and its percentage

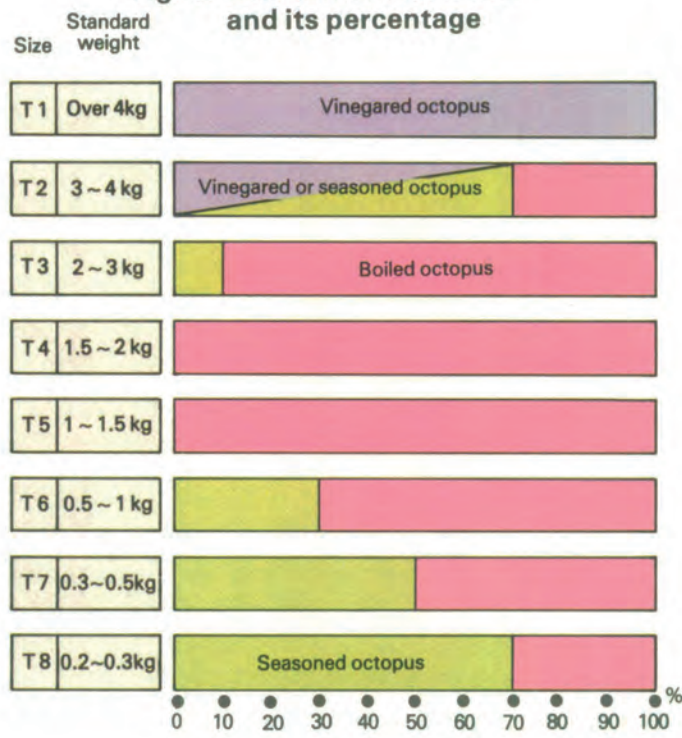
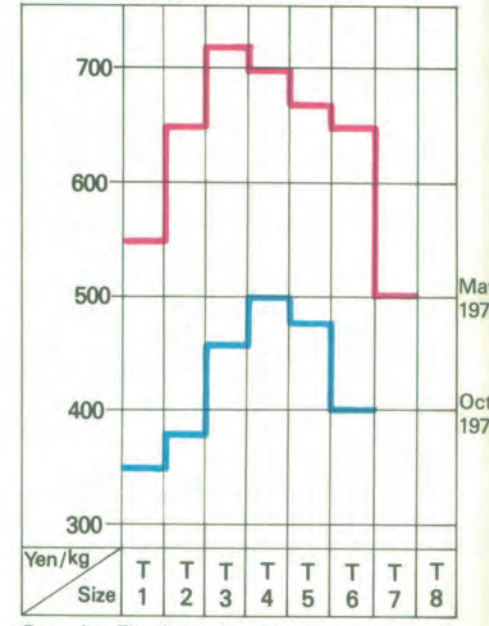


Fig. 3 Imported frozen octopus: price in Tokyo Wholesale Market



Remarks: The above prices fluctuate depending on the balance between the supply and demand of octopuses in the interior of Japan, and is also influenced by the quality as well as the size; thus, please note this fact.

Processing for Food

Japanese people consider the octopus as one of the delicacies among aquatic foods. They do not eat raw octopus, but they eat it after boiling or with further seasoning and processing.

For use as raw materials for processing, octopuses caught in the distant seas and imported ones are transported as frozen products made by rapid freezing, but those caught in the adjacent seas are landed live at the fishing port.

As the primary step in processing, almost all of these octopuses are boiled by processors. Then, some of them are shipped to the markets in consuming areas as (1) boiled octopus, and others are shipped to markets after secondary processing into various products such as (2) vinegared octopus, (3) seasoned octopus, and (4) smoked octopus.

1. Boiled octopus

After the viscera are removed, small and medium-sized octopuses are processed as a whole, while large ones are processed after being divided through a process to be mentioned in another paragraph.

In order to make the flesh firm in the boiling process, heat must be applied sufficiently to the central portion. But, when overboiled, the flesh becomes hard, the flavor is lost, and the external appearance is marred by desquamation. If the octopus is boiled for many hours at a lower temperature, the taste is spoiled and the arms become extended and dangly giving the impression of a loss of freshness. The treatment process before boiling, the



temperature and time of boiling are important know-how for the processors.

In markets, an octopus which has been boiled up into a glossy purplish red and having arms whose anterior portions have coiled into a spiral are valued most highly.

How is boiled octopus cooked by the

consumer? In Japan one cooking method for boiled octopus is to cut the octopus into small pieces and boil them well with soybean and potatoes, but the most popular dish is "sliced raw octopus". That is, boiled octopus is washed and cut into slices which are eaten with soy sauce seasoned with grated Wasabi (a Japanese horseradish). Therefore, storage of boiled octopuses with ice or at a low temperature during the distribution is a very important problem from the point of food sanitation.

2. Vinegared octopus



A large-sized species, *Paroctopus doffeini doffeini*, and large individuals from among imported octopuses are processed into "vinegared octopus" to keep their freshness during the distribution and to make the slightly insipid flesh more tasteful. In this process, boiled octopus is

cut into a fixed size, immersed in a mixture of vinegar, salt and sweetening, and stored and transported in this state. When placed on the market, these vinegared octopuses are sold after being packed into vinyl bags with the vinegar mixture, or sold in the same style as boiled octopus after being taken out of the vinegar mixture.

3. Seasoned octopus



Small-sized octopus less than 500g in body weight does not have as good a taste and its market price is very low. Since around 1965 a large quantity of small-sized octopuses have come to be imported from African waters, and a processing method has been devised to make these small octopuses marketable. After it is cooled and the surface water is removed, the boiled octopus is sealed in a small vinyl bag with a mixture of water, soy

The process for making boiled octopus

Thawing

Washing in water

Cutting the base of the arms

Washing with salt water

Boiling

Vibrated vigorously in a tank to remove mud and sand or mucus attached to the suckers.

The portion between the eyes is cut with a kitchen knife to improve the penetration of hot water into the body and to curl the anterior portion of the arms.

This makes the external appearance good. Contraction rate of the skin and flesh during boiling varies with the extent of this treatment.

Boiled in hot water of 70 ~ 80°C over ten minutes. Temperature and time is varied according to the body size.

*Imported octopuses are brought into Japan as frozen products made by quick freezing after removing the viscera. Shown here is the processing method of these products.



shaped octopus is sun-dried for several days by hanging it in an airy place.

Dried octopus is eaten with soy sauce after being torn into pieces and roasted or immersed in boiling water for a short time. Nowadays, dried octopus is processed for personal consumption by fishermen, and only a small quantity appears on the local markets as a local speciality.

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Since a large quantity of octopuses have begun to be imported to domestic markets, the designation of market size by weight has been employed for octopus. Fig. 2 shows utilization by size along with the percentage. Octopuses of the T3 or T4 size group are in greatest demand, and the market conditions are influenced mainly by the balance between supply and demand of the octopuses of this size group.

Procesamiento para alimento

El japonés emplea el pulpo para alimento como una delicadeza de productos acuáticos. No lo come crudo, sino después de hervirlo, sazonarlo o someterlo a ulterior proceso.

El pulpo que se usa como materia prima para procesamiento es cogido en aguas distantes de la costa, o es importado y transportado como producto congelado por congelación rápida; pero el pulpo cogido en mares adyacentes se saca al puerto todavía vivo.

Luego, como procesamiento primario, casi todo este pulpo es hervido por los procesadores. Después una parte se envía a los mercados en áreas de consumo, como (1) pulpo cocido; y otros pulpos se despachan después de procesarlos secundariamente en diversos productos, como (2) pulpo avinagrado, (3) pulpo sazonado, y (4) pulpo ahumado.

Traitement pour la consommation

Parmi les produits du mer, les poulpes sont considérées comme nourriture de gourmet par les japonais. Cependant il ne les mangent pas crues mais après les avoir fait bouillir puis assaisonnées ou traitées.

Quant aux poulpes destinées à être traitées, il s'agit de celles prises dans les mers lointaines et celles importées qui sont alors transportées comme produits congelés par congélation rapide, mais les poulpes prises dans les mers voisines arrivent au port encore vivantes.

Ensuite, le premier traitement qui s'impose est de faire bouillir toutes les poulpes quelle que soit leur provenance dans des appareils processeurs spéciaux. Puis, une certaine quantité de pulpe est expédiée directement sur le marché de consommation tandis qu'une autre partie est distribuée après avoir subi un autre traitement comme le marinage, l'assaisonnement spécial ou le fumage.

sauce, salt, sweetening and artificial seasoning. In several days the seasoning solution will completely penetrate the flesh. Consumers eat this product in the same way as boiled octopus and vinegared octopus.

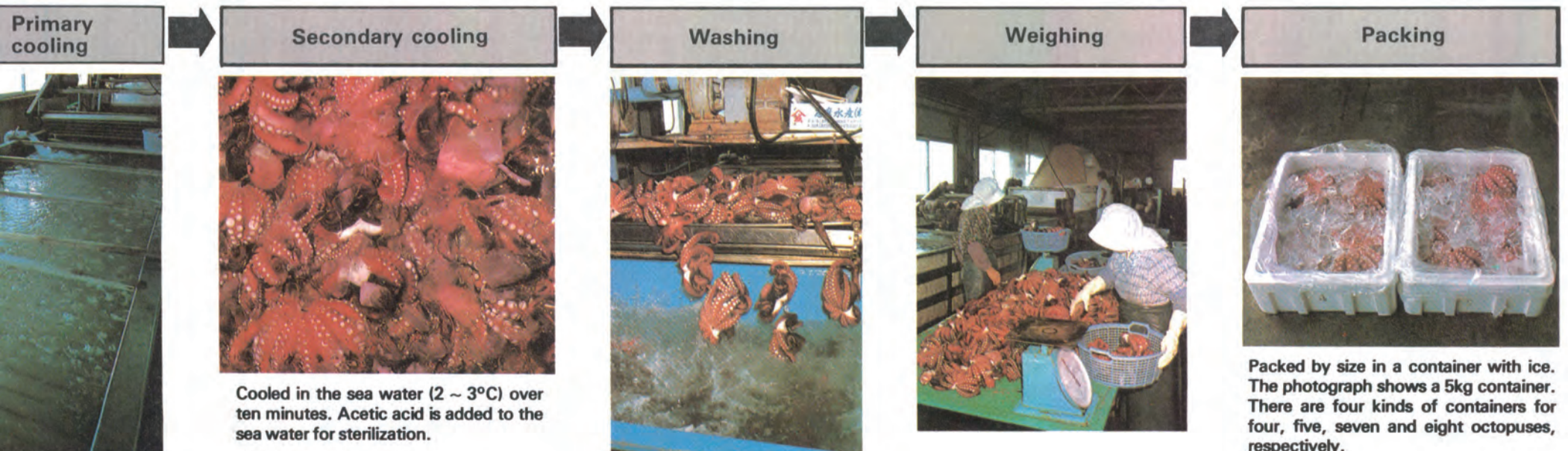
4. Smoked octopus



A small species, *Octopus ocellatus*, is mainly used as raw material for this process. After seasoning, boiled octopus is air-dried and smoked in a smokehouse at 50 ~ 90°C for several hours. This smoked octopus is cut into slices which are packed into small vinyl bags and sold as processed delicacies.

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In some districts "dried octopus" is produced as a traditional processed food. The head of a small (1 ~ 3kg) octopus is cut open, the viscera and eyeballs are removed, and after washing the base of the arms is cut open. Then, a U-shaped piece of split bamboo is inserted into the trunk to expand it into a spherical shape, and split bamboo is stuck into the arms to open them into a good shape. This



Cooled in sea water (about 20°C) for a few minutes.

Cooled in the sea water (2 ~ 3°C) over ten minutes. Acetic acid is added to the sea water for sterilization.

Washed with clear water.

Packed by size in a container with ice. The photograph shows a 5kg container. There are four kinds of containers for four, five, seven and eight octopuses, respectively.

An Attempt To Develop Small-scale Commercial Fishery

Commercial Fishery

A Development Project of Octopus Fishing Grounds in the West Coast of Australia



What conditions are necessary for conducting fisheries on a commercial basis?

First, the appearance of large-scale octopus fishing grounds along the northwest coast of Africa was due to the discovery of large resources which were suitable for capitalized fisheries using large fishing boats, and this was also supported by the facts that the seafloor composition of the fishing grounds were suitable for trawling and a transportation system to markets (Japan) had been made ready for use.

Next, in the coastal waters of Japan, various types of octopus fisheries have been conducted by many small fishing boats since old times. In this case, the catch is small, but the commodity value is high because there are fixed consuming markets near the fishing ports and octopus is listed as a perishable food. Fishermen engaging in this octopus fishery can keep a steady fishery income because the management of fishery is conducted by family labor and fishing is conducted throughout the year by combining a variety of fishing methods.

To develop commercial octopus fishery, the following necessary conditions must be examined. First, the degree of difficulty and economic value of a fishery development must be judged by considering (1) the quantity of resources and (2) location of the fishing grounds and the distance to markets.

After that, (3) the size of fishing boat, (4) fishing method and fishing gear, and (5) methods of storage and transportation must be concretely investigated.

In the coastal waters extending about 300 miles from Fremantle to Geraldton in Western Australia, 800 lobster-basket fishing boats are in operation. This lobster fishing has been troubled with predation by octopuses for several decades.

In 1977, the Federal Government of Australia requested the cooperation of the Japanese Government in getting rid of the octopuses. Japan decided to work together under the lead of the National

Federation of Fisheries Cooperative Associations and with financial help by the Foundation for Overseas Fishery Cooperation. Technical assistance by the Hoko Fishing Co., Ltd. was also contracted. An investigation committee was dispatched three times during the period from March 1978 to April 1980, and the survey of the fishing grounds and experimental fishing of octopuses were conducted for a total period of three months.

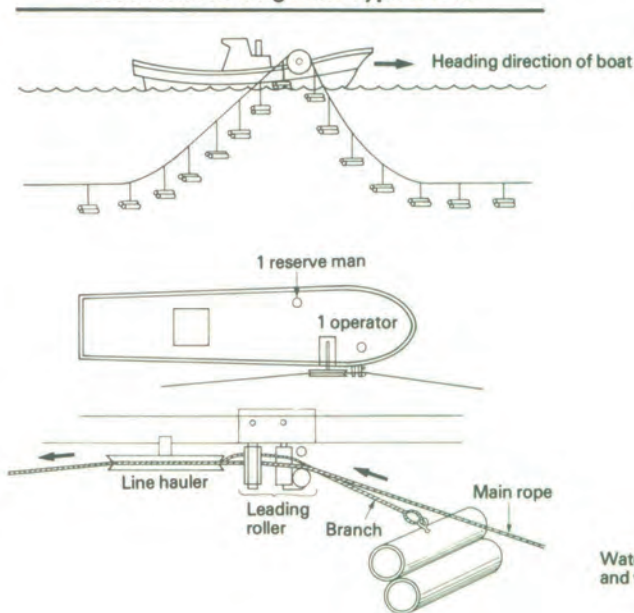
The purpose of this survey was to examine the potential of commercial octopus fishery. However, to assure long term success it is essential to awaken the interest of local fishermen and to establish octopus fishery in that country.

Australian people do not eat octopuses. Therefore, octopuses caught must be sold to Japan. Samples brought back by the first investigation committee are confirmed to have sufficient commodity value in Japanese markets. Considering the expenses of catching and bringing the catches to Japanese markets, against the market price of *Octopus Vulgaris* from Japanese coastal waters, it will be necessary for the successful realization of commercial fishery in Australia that they be able to produce at four times the rate of Japanese coastal octopus fishermen.

In these coastal waters, trawling is prohibited to conserve the lobster resources. The investigation committee has tackled the problem of developing octopus fishing by means of small fishing boats (under 5 tons). The aims of this project are to develop a fishing gear which produces the largest possible catching rate while making the best use of the advantages of a small fishing boat, namely its low cost and the fact that it is operated by less manpower, and further to raise the productivity per fisherman by striving to radically reduce labor. If it can be confirmed that fishery production per day by one fishing boat is profitable, it is expected that many octopus fishing boats can begin to operate in this area.

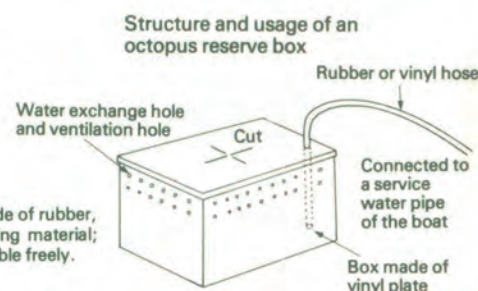
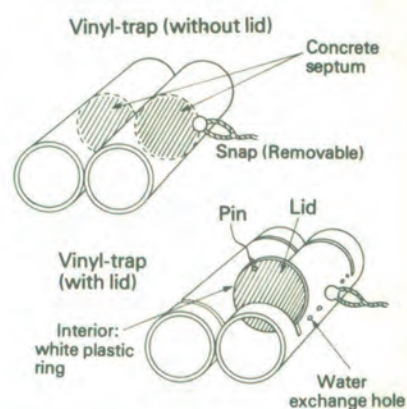
The investigation committee has tried trap fishing. Because trap fishing catches

Diagram showing experimental fishing by a YAMAHA fishing boat Type DT-46



Only the upper part of the lid should be made of rubber, and the bottom part made of some packing material; and the lid should be insertable and removable freely.

Sketches showing fishing gears



The aperture for throwing captured octopuses in the box. (The lid should be made of thick rubber plate and the aperture cut into a cross; so, the aperture can close automatically after throwing in without leaving an opening).

octopus alive, traps can be hauled in at one's convenience. Therefore, this type of fishing has a high degree of freedom of operation and is suitable as a side fishing job. Moreover, one-man fishing is possible by using a line hauler. Various traps such as a pot, a piece of vinyl pipe, and a used tire were tried out; and the fishing gear made of a piece of vinyl pipe shown in the figure obtained the best results.

The third problem, next to increasing the catching rate and reducing labor, is how to maintain the freshness of octopuses once they are caught. A fish box of simple structure was made for transportation of live octopuses to the fishing port. For freezing and cold storage it was possible to use land facilities already constructed for lobster fishery.

The boat for experimental fishing caught 200kg of octopuses per day in one fishing ground. This catch exceeds by several times the standard catch in Japanese octopus pot fishery. The last investigation revealed that fishery production per day per fisherman is better than those of octopus fishery in Japanese coastal waters and trawling in northwestern Africa. Now, there is a strong possibility of developing octopus fishing grounds for small-scale fishery.

Proyecto de desarrollo de campos de pesca de pulpo en la costa occidental de Australia

¿Qué es necesario para la pesca en base comercial?

Primero, la aparición de grandes campos de pesca de pulpo en la costa noroccidental del África se debe al descubrimiento de grandes recursos lucrativos en la pesca capitalizada a base de botes pesqueros de gran tamaño; contribuye también el que los materiales de fondo de los campos pesqueros son adecuados para la rastra y el sistema de transporte hacia los mercados (japoneses).

En segundo lugar, en las aguas costaneras del Japón desde muy antiguo se han venido efectuando varios tipos de pesca de pulpo mediante numerosos pequeños buques pes-

queros. En este caso, la captura es pequeña; pero el valor del artículo es elevado por la presencia de mercados fijos del consumidor cerca a los alimentos perecederos. Los pescadores que se dedican a la pesca del pulpo pueden contar con rentas fijas de pesca, porque el manejo de ésta depende del trabajo de familia, y la pesca se realiza a lo largo del año mediante la combinación múltiple de métodos pesqueros.

Como tercer caso presentamos aquí un esbozo del proyecto de desarrollo de pesca comercial de pulpo mediante pequeños botes pesqueros en la costa occidental de Australia.

Projet de développement des pêcheries pour la poulpe sur la côte ouest d'Australie.

Quelles sont les conditions nécessaires pour développer les pêches sur une base commerciale avantageuse?

D'abord, le développement des zones de pêche à la poulpe sur une large échelle dans les zones côtières du nord ouest de l'Afrique découle des larges ressources qui s'avèrent profitables pour l'industrialisation des pêches au moyen de gros bateaux de pêche, et il est un fait aussi que le substratum des zones de pêche dans ces régions qui sont favorables pour la mise en place des infrastructures de chalutage et de transport jusqu'aux marchés en particulier celui du Japon est à point.

Ensuite, dans les eaux côtières du Japon, les types de pêches variées à la poulpe reposent sur une expérience reculée et mettent à profit de nombreux petits bateaux de pêches bien aménagés. Le cas cité ne permet qu'une faible prise en quantité, mais la valeur commerciale de la poulpe est élevée car les marchés de consommation sont fixes et à proximité des ports de pêche et la poulpe est considérée comme denrée périssable. Les pêcheurs qui se consacrent à la pêche à la poulpe sont en mesure de rapporter un revenu de pêche fixe car ils mettent à contribution toute leur famille et la pêche a lieu tout le long de l'année en combinant des méthodes de pêche variées et multiples.

Enfin, un aperçu du développement des pêches à la poulpe au point de vue commercial et industriel au moyen de petits bateaux de pêche sur la côte ouest d'Australie fait l'objet de cet exposé.

Increasing Dependence on Import

The system and actual conditions of the supply of octopuses to the Japanese market are shown in Figs. 1 ~ 3. The catch in Japanese waters shows a stable transition. Pelagic trawling fisheries went into the fishing grounds of western Africa in 1952. Since the beginning of the 1960's, the octopus and a cuttlefish, *Sepia officinalis*, have become the main fishing games of pelagic trawling resulting in the largest catch in around 1968. However, since 1971 the scale of this fishery has reduced because of a drop in payability.

On the other hand, since around 1970 octopus fishing by the fishing boats of Spain and other countries has become active in the same fishing ground, and the Japanese trading companies and major fishing companies have started to buy and import octopuses from fishing boats of foreign countries. In 1969, imported octopuses totalled 36,000 tons, but since 1969 the quantity of imports has steadily increased reflecting the increase in demand within the Japanese market. In 1973 it totalled 54,000 tons reaching nearly the same level as at present.

On the coast of northwestern Africa, the promising octopus fishing grounds are off Morocco, West Sahara and Mauritania. Japanese fishing companies have conducted fishing in the fishing ground off Mauritania since 1971. However, in July 1980 negotiations on the renewal of the contract of piscary with the Government of Mauritania ended in failure, and presently the operation of Japanese fishing boats in that fishing ground is suspended. Depending on the future circumstances, there is a possibility that about 20,000 tons of the recent catch by pelagic trawling may be lost.

* * * * *

Background of the Increase in the Import of Octopuses

The octopus is rather a delicacy compared with fish, and the overall quantity of demand is not so large; however, the consumption rate has remained constant. Future increase in the total amount of demand in Japan probably depends upon the demand for processed octopus. On the other hand, in order to see the trend of demand for octopus in the Japanese markets, it is necessary to survey the demand and supply relation of aquatic products in recent years and to consider the role of imported aquatic products in their relationship.

During about a 20 year period from 1955 to 1975, the so-called "period of high fish prices" had existed in Japan. The prices of aquatic products continued to rise year after year at a rate exceeding the general price index.

The rise in fish prices was supported by "modernization (change into Europeo-American style)" of eating habits with the rise of income. There is a tendency com-

mon to all the countries in the world that with the increase of income the principal food changes from starchy foods to protein and, as to the protein taken, the rate of intake of animal protein increases rather than that of vegetable protein. Japan also followed the trend, but in Japan a characteristic change in the consumption style of aquatic products has occurred.

Into the traditional menu of the Japanese people mainly consisting of rice, vegetables and aquatic products, Europeo-American style meals consisting of bread as the staple food with meat, eggs and dairy products as subsidiary foods have appeared. These new eating habits have penetrated mainly into the young generation; however, coexistence of both new and old eating habits stimulated the improvement of the quality of foods. As a result, consumption of meat, fish and shellfish, eggs and milk has increased in parallel. Changes in supply-demand relationships of these foods in the last ten-odd years are as follows:

- The form of consumption of fishes and shellfishes by the Japanese people is divided into the two types. Firstly, fresh fishes (including frozen fishes thawed) are eaten after cooking, and secondly, they are eaten after processing. As to the former, the consumption of medium and high quality fishes has increased. As to the latter, demand for fish-paste products (boiled fish-paste, fish-ham, fish-sausage, etc.) has exceeded that of the traditional salt-dried products.
- With the spread of bread eating, demand for meat has increased. As a result, demand for the so-called popular fish (mass-catch fishes) has gradually decreased due to competition by pork and chicken which have a comparatively low price among meats.
- Since the partial liberalization in 1962, import of aquatic products has come to get into full stride and grow rapidly. Under the support of steady demand in domestic markets, prawn, tuna and fish eggs were the main items of import from the 1960's to the 1970's. Since the latter half of the 1970's, in addition to the existing commodities, new commodities have appeared, and trading items and buying markets have gradually been expanded.

Since the turning point of 1971 when 1,533 hundred million yen of aquatic products were imported and 1,466 hundred million yen exported, Japan has transformed into "an importing country of aquatic products". The actual import in 1979 is recorded to be 947,000 tons in

quantity [Note] and 8,658 hundred million yen in value. Main import items are prawn (160 thousand tons), squid (150 thousand tons), tuna (90 thousand tons), octopus (60 thousand tons), and salmon and trout (50 thousand tons).

[Notes] This corresponds to about 9% of the recent total catch within the country, and to about 13% of the amount used for food.

In the last twenty years, the form of consumption of aquatic products, reflecting the eating habits of the Japanese people, changed into the following three patterns:

- (1) Increase in the use of fresh high quality fishes ----
The consumption has consistently increased and the high price has been maintained. The balance between supply and demand has been supplemented by import (tuna, shrimp, etc.) or culture (yellowtail, etc.).
- (2) Appearance of medium quality fishes ----
Facilities for freezing and cold storage were constructed throughout Japan, and long-term storage of fresh fishes became possible increasing the rate of supply of fresh fishes to the consuming areas. As a result, the commodity values (fish prices) of some fishes such as squid, octopus and salmon have risen along with the high quality fishes. The demand for this group of fishes as raw material for processed foods as well as for use as fresh fish can be expected.
- (3) Increase in the use of popular fishes for purposes other than food ----
Consumption of mass-catch fishes such as sardine, mackerel and Pacific saury as fresh fish has decreased, in spite of the recent increase in catch, and the widening difference in price with medium and high quality fishes. A study of new utilization methods for food such as ground meat processing has been conducted, but at present these fishes are mainly used for other purposes than food like feed for culturing and raw material for fishmeal.

* * * * *

The rise and fall of the consumption of aquatic products in Japan is closely related to the future rise and fall of the rice-eating habit and the progress of the supply of livestock products, but the consumption of fresh fishes mainly consisting of medium and high quality fishes will probably remain at a fixed level. The reasons are that eating habits have already become diversified adequately in both urban and rural areas, and the increase in the intake of animal protein seen until the first half of the 1970's has leveled

off in the second half of the 1970's. While some fears regarding "over nutrition" are beginning to be seen in the developed nations, a turn from fatty beef and pork to chicken and aquatic products will probably be seen among some people in Japan as well.

Imported aquatic products have already become built-in to the structure of demand in Japan. In 1977, there occurred an overheated import race and the prices of specific items rose suddenly. This caused an "avoid eating fish" mood by consumers, but later the rise in price was stopped. It is thought that, under the economic condition of low growth rate, the sudden rise in price does not occur. Under the 200-mile fishery zone, Japan is now striving for the following countermeasures to secure the necessary supply to correspond with the demand for aquatic products necessary for domestic use.

- (1) Simple purchase.
- (2) A special contract with foreign producers on the purchase of fishes.
- (3) Intensification of the conclusion of a special contract on the purchase of fishes accompanied by investment and financing.
- (4) Payment method of charges for fishing in another country's piscary.
- (5) Joint venture.
- (6) Economic cooperation or support for development between governments.

Fundamento del auge de las importaciones de pulpo

El pulpo es un alimento favorito en comparación con el pescado, y la cantidad absoluta de la demanda no es tan grande. Pero se ha mantenido un consumo estable. El aumento de la cantidad total de la demanda en el Japón depende probablemente de la demanda de pulpo procesado. Por otra parte, para comprender la tendencia de la demanda de pulpo en los mercados japoneses, es preciso investigar la relación de demanda y suministro de los productos acuáticos en los últimos años, así como considerar el papel de los productos acuáticos importados en dicha relación.

En esta emisión presentaremos la tendencia de la demanda y suministro de productos acuáticos en el Japón durante 20 años desde la década de 1950 a la de 1970.

Données relatives à l'accroissement des importations de la poulpe

La poulpe constitue plutôt un met de préférence si on la compare aux poissons, et ainsi la quantité absolue de la demande pour ce mollusque n'est pas très forte. Mais on doit noter qu'une consommation stable est maintenue. L'accroissement futur de la quantité totale de la demande au Japon dépend probablement des préférences en poulpe traitée. D'un autre côté, pour se faire une idée plus exacte de l'évolution de la demande en poulpe sur le marché japonais, il est nécessaire d'étudier le rapport entre la demande et l'offre des produits de mer dans les années récentes et de considérer aussi le pourcentage des produits de mer importés.

Nous allons ainsi voir ensuite les tendances de la demande et de l'offre en produits de mer au Japon au cours de plus de vingt années depuis 1950 jusque dans les années 1970.

Fig. 1 The amount of supply of octopus

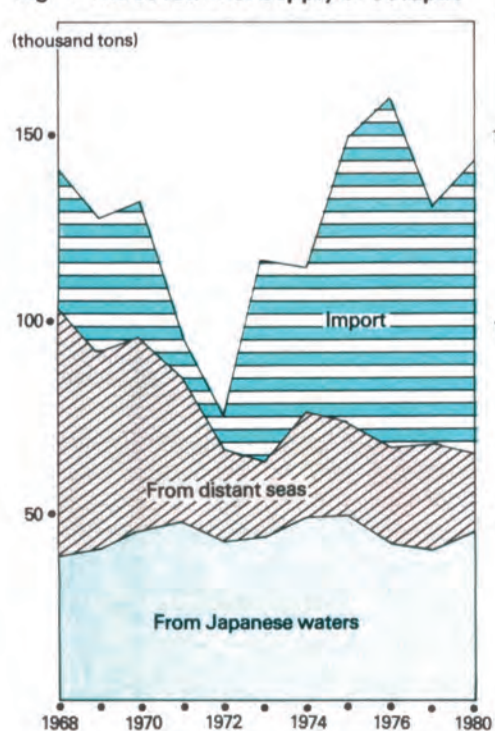


Fig. 2 The amount of import

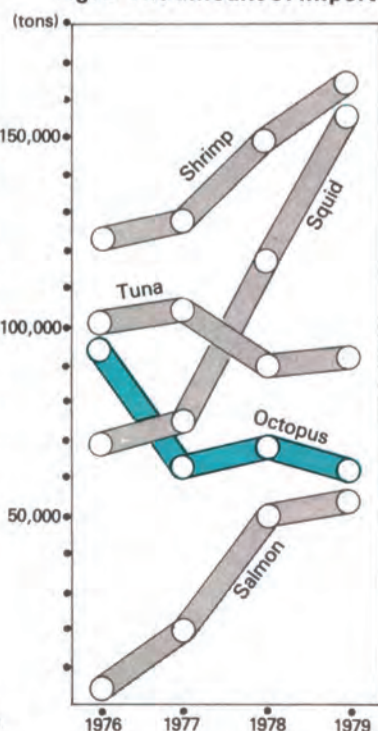


Fig. 3 Distribution route of octopuses from foreign countries

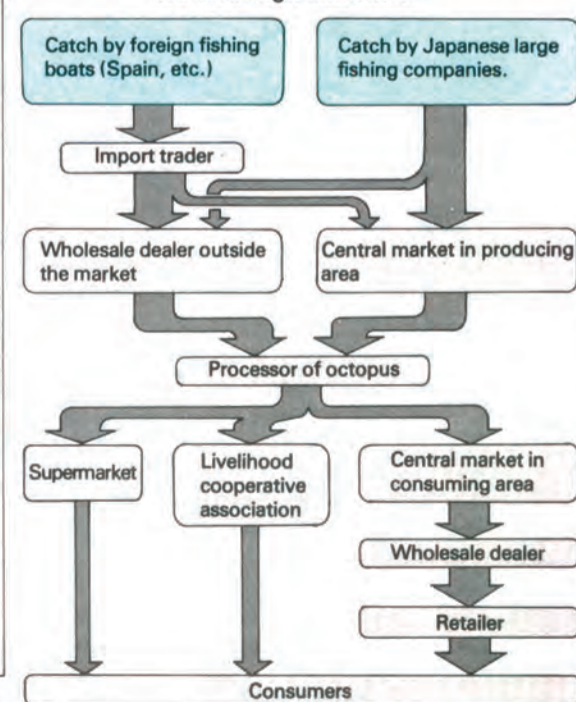
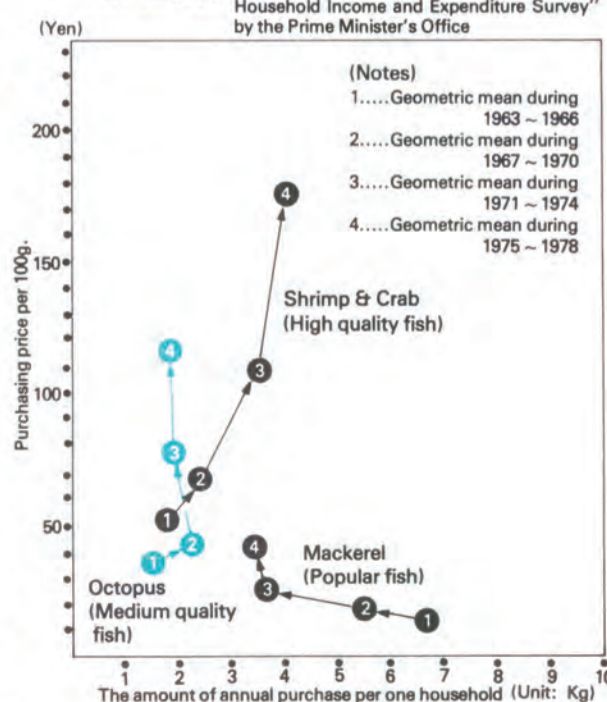
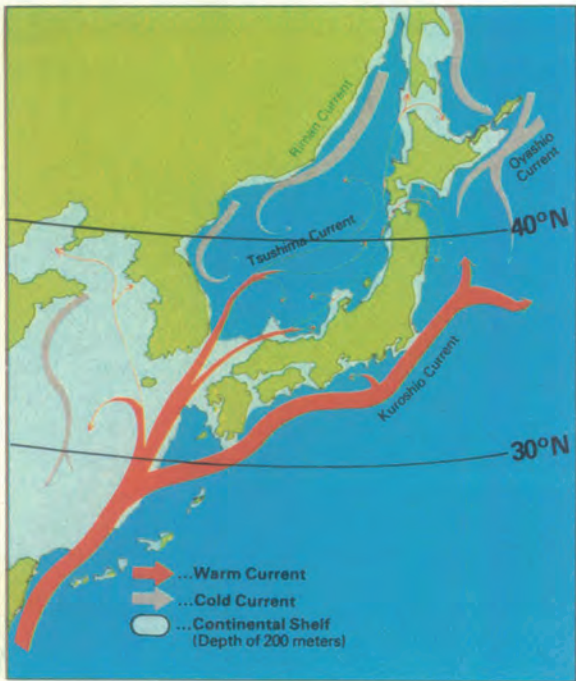


Fig. 4 Changes in the purchase condition of fresh fishes





Types of Coastal Fishermen Catching Octopus in Japan

Japanese coastal fishermen are not specialized only in a single kind of fishery. Equipped with fishing gear and techniques for conducting several types of fishing, they go fishing after selecting the type of fishing which seems to be most profitable in consideration of the migrating conditions of fishes in each season or the daily fishing conditions and market fish prices. Fishermen do not consider themselves tied to any one kind of fishery. They are always trying to add profitable new types of fishing to their own repertoire, and also they will abandon types of fishing which have become unprofitable due to changes in the environment and fishing methods.

The fishery system that is carried on in some parts of Japan are also determined by social conditions such as the established fisheries system and local custom. The fishing schedule of each fisherman also depends on the condition of his local community, in this case, the fishing village.

The form that coastal fishery takes in any given district is not merely the result of the isolated efforts of the individual fishermen in that district, but rather there is an interrelation between the individual fisherman and the regulatory body in his community that determines what use is made of all the available fishery resources.

The "fishery system" of a given district means in short what fish are caught and how the catches are exchanged for money. This system comes into existence, changes, and develops within a social and economic environment, with the primary objective of the individual fisherman and his local cooperative body being to insure steady production and an economically stable income.

There are many fishing villages engaged in octopus fishing in various districts of Japan. Among these two examples which are considered standard shall be introduced here. It is difficult to evaluate the general economic value of octopus fishery by looking at individual examples separately. It seems, therefore, proper to try to grasp an understanding of the types of octopus fishery by looking at the form



of fishery which octopus fishing takes as a whole. Coastal octopus fishing is generally operated by fishing boats of 2 tons or more, mostly, of 3 ~ 5 tons. Why is this so?

The tonnage of fishing boat is one of the most important factors in determining the form of fishery it is used for. A boat with an outboard motor or a small boat of about 1 ton can be used only for fishing in shallow waters, and larger fishing boats of 5 tons or more are mainly used for mass-catch fishing operated in a group by several fishermen in comparatively offshore fishing grounds.

Boats of 3 ~ 5 tons comprise the core of coastal fishing boats, because they are of the maximum size which can be operated by one person or by two persons of the same family and moreover these boats are large enough to ensure safe operation in offshore waters from 3 to 6 miles. Enlargement of fishing grounds gives the fisherman a wide selection of various types of fishing, and being operated by a small crew makes for quick adaptability with regards to the use of a fishing boat.

Octopus pot fishing and octopus box fishing are best carried out by fishing households using fishing boats of 3 ~ 5 tons. The reason can be explained by the characteristics of the resources and fishing methods.



(1) Because resources (octopuses) are benthic, introduction of mass-catch fishing methods by large fishing boats causes the rapid exhaustion of resources.

(2) Octopus fishing is a passive or waiting-type fishing method, and it can be carried out on a flexible schedule worked around the schedule of other fishing activities; thus it is suitable for the family management.

(3) At present because the line-hauling work has been mechanized, the fishing operations can be conducted easily by labor power of one family.

A fishing boat of 3 ~ 5 tons can lay 500 ~ 1,000 pots (or boxes) in the fishing ground in one trip. This number corresponds to the maximum daily labor power of a family.

(4) The percentage of a fisherman's total income that octopus sale will make up varies with the district, changes in the yearly fishing conditions and the form of fishery that the fisherman is otherwise engaged in.

(5) A fisherman having a fishing boat of 3 ~ 5 tons will average a gross fishery income of 8 ~ 10 million yen per year, creating a net income of 3 ~ 4 million yen. A fisherman engaging in octopus fishing is not an exception. His household income is at the same level as that of the household of a city worker.

La pesca costanera de pulpo se hace por lo general con botes de 2 toneladas o más; usualmente, 3 a 5 toneladas.

Los botes de 3 a 5 toneladas forman el núcleo de los botes de pesca costanera, por ser del tamaño máximo para operación de una o dos personas de la misma familia; además estos botes son lo bastante grandes para ofrecer seguridad en la pesca a 3 ~ 6 millas de la costa. La ampliación de los campos de pesca provee a los pescadores selección de varios tipos de pesca; y la operación por una tripulación pequeña ofrece la ventaja de una rápida adaptabilidad respecto al uso de los botes pesqueros.

La pêche côtière aux mollusques s'effectue généralement par des bateaux de pêche de 2 tonnes ou plus, allant ordinairement jusqu'à 3 ~ 5 tonnes.

Les bateaux de 3 ~ 5 tonnes constituent le noyau de la flotte de pêche côtière, car leur tonnage maximal leur permet d'être exploités par une ou deux personnes de la même famille, et de plus, ces bateaux sont assez grands pour assurer des opérations sans danger au large de 3 à 6 milles. L'élargissement des zones de pêche rend possible au pêcheur d'entreprendre un grand nombre de pêches variées et ces bateaux ayant un équipage très réduit, cela leur confère une adaptabilité rapide.

Atsuga	Shore		Offshore					
	Surf clam beam trawl net	Flatfish gill net	Largemouth smelt mid-water trawl	Octopus box	Horse hair crab basket	Alaska pollack gill net	Salmon-trout drift gill net	Shrimp basket
5 ~ 7 ton fishing boat								
3 ~ 5 ton fishing boat								
Under 3 ton fishing boat								

Toshi	Shore		Offshore					
	Undaria gathering	Diving (shellfishes)	Pole-and-line	Octopus pot	Silver whiting gill net	Shrimp small bottom trawl	Sand lance boat seine	Spotted mackerel drift gill net
5 ~ 10 ton fishing boat								
3 ~ 5 ton fishing boat								
2 ~ 3 ton fishing boat								
1 ton-type fishing boat								
Outboard motorboat								