

**764,000 tons**  
**(363,434 million yen)**  
**landed**

**Meat quality and freshness are crucial in Japanese skipjack and tuna fishery**



Landed fresh skipjacks are packed in adiabatic foamed plastics cases with ice one by one for shipment.

Japanese fishery landed 764,000 tons (363,434 million yen in value) of skipjacks and tunas\* in 1976. This accounted for 35 percent of the 2,209,000 tons (figures by FAO) of the world's total catch of these fishes in the same year.

\*The term "tunas" includes marlins. In Japan, marlins are generally called "Kajikimaguro" (marlin-tuna) and treated together with other tunas in marketing.

In fish markets, tunas are examined by auctioneers and middlemen in advance of the auction. That is, whole bodies of tunas are arranged orderly on the market floor after their tails have been cut off. Body shape, colour, quality and degree of fat composition of the meat of the inner abdominal wall

and the tails are examined carefully one by one. Based on this examination, bidding prices are decided.

In Japan, over ten species of skipjacks and tunas are marketed. The fishes landed include various products such as fresh whole body, fresh semidress, frozen semidress, frozen dress and frozen fillet. The prices to bid are carefully determined after considering the meat quality of each fish species and the degree of freshness. After purchase in auction, they are distributed for various uses including, the most expensive, fresh consumption, canning, and other forms of processing.

Skipjack and tuna production in Japan accounts for 7-9 percent of the total catch in quantity and 15-19 percent of the total value of landings from Japanese marine fisheries. Advanced techniques for keeping freshness and for treatment and processing of these fishes have developed at all the stages of handling from fishing, through processing and down to distribution.



Tuna as well as white meat fish is high-grade one for "Sashimi".

En 1976, 764.000 tonnes (production en argent: 363.434 millions de yens) de bonites et de thons ont été pêchées par les Japonais. Ce chiffre compte pour 35 pour-cent de la production mondiale totale de ces poissons durant cette année, laquelle s'est élevée à 2.209.000 tonnes (chiffre annoncé par la FAO).

Dans les eaux territoriales japonaises, la production de la pêche à la bonite et au thon compte pour 7 à 9 pour-cent de la quantité totale des pêches et de 15 à 19 pour-cent de la production totale en argent. De grandes techniques pour conserver la fraîcheur, pour le traitement et l'industrialisation de ces poissons ont été mises au point à toutes les étapes des opérations; de la pêche à l'industrialisation et à la vente.

En 1976 mas de 764.000 toneladas de bonito y atunes fueron cogidas por la flota pesquera japonesa, por un valor de 363.434 millones de yenes. Esta cantidad viene a ser el 35% de las 2.209.000 toneladas (según datos de la FAO) de la cantidad total mundial de la recogida de estos peces en el mismo año.

En Japón la cantidad de bonito y atunes conseguida por la flota pesquera equivale a un 7-9% del total de la pesca realizada y de un 15-19% de la producción pesquera en aguas nacionales. Toda una técnica muy avanzada es empleada para mantener el pescado fresco, así como la elaboración y proceso de la pesca están muy desarrollados a través de las distintas etapas desde la cogida del pescado, el reparto y la puesta en conserva.



Pre-auction examination by auctioneers and middlemen (marlins).



Middleman's shop front (tunas).

# Fresh or Frozen?

## Basic management strategy in skipjack and tuna fishery

Recently, 200-350 thousand tons of skipjacks, 350-400 thousand tons of tunas, and around 50 thousand tons of marlins (600-800 thousand tons in total) have been landed each year by Japanese skipjack and tuna fishery.

The main characteristics of Japanese skipjack and tuna fishery are as follows:

(1). Fishing method differ between skipjack and tuna: in Japan, skipjacks are generally caught by pole and line, and tuna by long-line. (Besides these, there are such fishing methods as purse seine and set net by which both skipjack and tuna are caught.)

(2). Skipjack and tuna fishing are conducted either by the same fishing boat or by boats specialized for skipjack or tuna, depending on the boat size: A small fishing boat operating in the coastal area catches

skipjacks and tunas alternately according to their migrating seasons. That is, both skipjack and tuna are caught by the same fishing boat. However, specialization is seen among fishing boats of over 10 tons, even in the case of coastal fishing. Most of the medium and large-sized fishing boats specialized either in skipjack pole and line fishing or in tuna long-line fishing.

(3). Three different storing methods, i.e. storage in ice, storage in iced water and quick freezing are employed on board fishing vessels depending on the type of boat and distance to the fishing grounds.

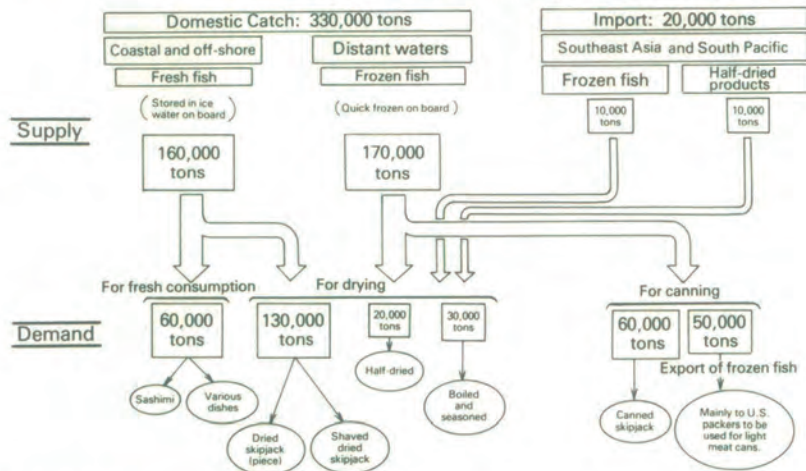
(4). Prices differ between fresh fishes and frozen ones: fresh fishes for "Sashimi" (slices of raw fish) are most expensive because Japanese people highly appreciate



Hauling operation by tuna long-line fishing boats (Bluefin tuna fishing in the North Atlantic Ocean).

### Catch and Consumption of Skipjack (1976)

Remarks: Excluding marlins. Figures are raw fish equivalent.



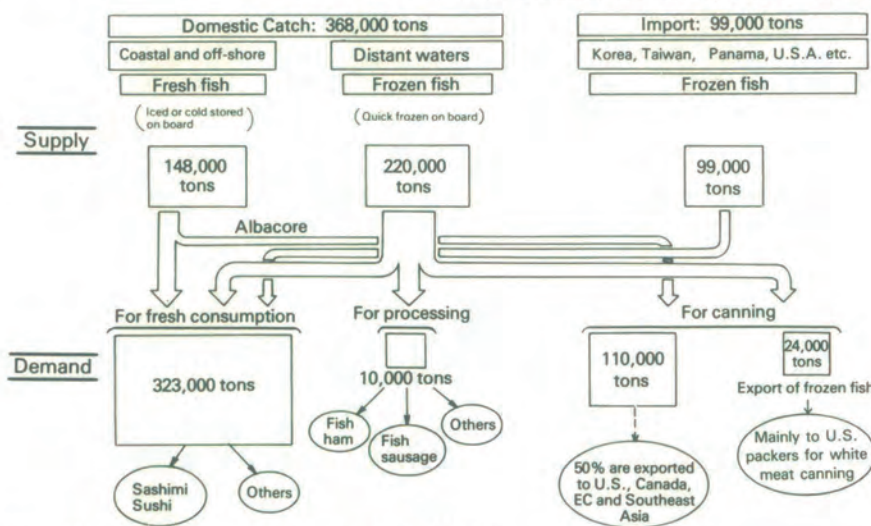
### Production of processed skipjack products (1976)

Source: Annual Marketing Statistics of Fish and Fish Products

- Products weight
- ① Hard-dried skipjack . . . . . 24,000 tons
  - ② Half-dried skipjack . . . . . 13,000 tons
  - ③ Dried Spanish mackerel . . . . 4,000 tons
  - ④ Shaved dried skipjack . . . . 49,000 tons
  - ⑤ Canned skipjack (Steak and flakes) . . . . . 22,000 tons
    - a) Boiled . . . . . 4,000 tons
    - b) Oiled . . . . . 13,000 tons
  - ⑥ Others (Boiled and seasoned) . . . . . Quantity not available
  - ⑦ Frozen . . . . . 165,000 tons
    - a) Frozen on land 11,000 tons
    - b) Frozen on board 154,000 tons
  - ⑧ Seasoned . . . . . 3,000 tons
  - ⑨ Others . . . . . 2,000 tons

### Catch and Consumption of Tunas (1976)

Remarks: Excluding marlins. Figures are raw fish equivalent.



### Production of processed tuna products (1976)

Source: Annual Marketing Statistics of Fish and Fish Products

- Products weight
- ① Fish sausage . . . . . 81,000 tons
  - ② Fish ham . . . . . 31,000 tons
  - ③ Canned tuna (Steak or flakes) . . . . . 71,000 tons
    - a) Boiled . . . . . 20,000 tons
    - b) Oiled . . . . . 30,000 tons
    - c) Seasoned . . . . . 17,000 tons
    - d) Others . . . . . 4,000 tons
  - ④ Others (Delicatessen) . . . . . Quantity not available
  - ⑤ Frozen . . . . . 224,000 tons
    - a) Frozen on land 10,000 tons
    - b) Frozen on board 214,000 tons

"Sashimi", while frozen fishes are comparatively cheap because they are used as material for dried skipjack or for canning.

(5). Skipjack and tuna boats of 20 tons and over are covered by the government fishing license system, in order to control the catch in accordance with the abundance of the fish population.

The most important problem faced in the management of this type of fishery is to decide whether the fishes should be landed and sold fresh or frozen. Depending on which one of these two methods is employed, the fishing ground, type of fishing boat, equipment and fishing method are all determined.

The different types of skipjack and tuna fisheries are summarized as follows:

The different operation types seen in skipjack and tuna fishery are due to the differences in the nature of their products. This can be understood by considering the following historical background:

\* In the old days, except for highly fresh bluefin tuna which is caught in coastal water, tunas were not highly rated as fresh fish. Because of their large size, they were distributed after having been cut into fillets and sprinkled with salt. But, their colour easily turned to an undesirable dark-red, and they were ranked as an inferior fish at the market.

After world War II, highly efficient freezing techniques were developed, and fresh tunas suddenly became highly valued food. The meat quality of tunas is not affected by freezing. Even after thawing, the taste remains very similar to that of fresh tuna. Therefore, demand for raw tunas for "Sashimi" or "Sushi" (fish slice on top of vinegared rice) has quickly increased throughout Japan, and the fish prices have maintained a high level.

\* Skipjacks have been eaten raw from around the 13th century, and especially in the Edo era (17th to 19th century) they were appreciated as delicacies by the common people. But, they have been called "Kata-uo" (hard fish) from old times, because they were mainly used as a preserved food and as seasoning (dried skipjack) after being hard-dried. This habit continues until the present day.

\* With the development of offshore and high seas fisheries in recent times, the amount of frozen skipjacks landed has increased. But, skipjack, unlike tuna, tends to deteriorate at low temperature, and the quality and colour of the meat easily change when thawed. Therefore, frozen skipjacks have been wholly used for making dried skipjack or for canning. Recently, however, improvements in the freezing method and a study of cooking methods for frozen fishes have been undertaken, and it is hoped these will increase the demand for fresh skipjack.

(See the description on page 6)

### Types of Skipjack and Tuna Fishery

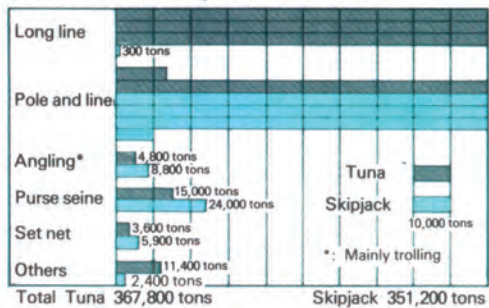
Type	Fishing grounds	Boat size	Tuna		Skipjack	
			Fishing method	Storage on board	Fishing method	Storage on board
I	Coastal Waters	Less than 20 tons	*Long-line (Main method) *Trolling *Pole and line (only for albacore) *Purse seine *Set net *Drift net	(a) 1-10 tons type: Storage in ice or ice water	*Pole and line (Main method) *Trolling *Purse seine *Set net	*Storage in ice or ice water
				(b) 19 tons type, long-line boat: Quick freezing		
II	Off-shore Waters	20-80 tons	*Long-line (Main method) *Purse seine *Large mesh drift net (Mainly for marlins)	Quick freezing	*Pole and line *Purse seine	(a) Fishing in coastal and off-shore waters Storage in ice water (b) Fishing in high seas Quick freezing
III	Distant Waters	80-500 tons	*Long-line (Main method) *Purse seine in southern seas	Quick freezing	*Pole and line *Purse seine in southern seas	Quick freezing



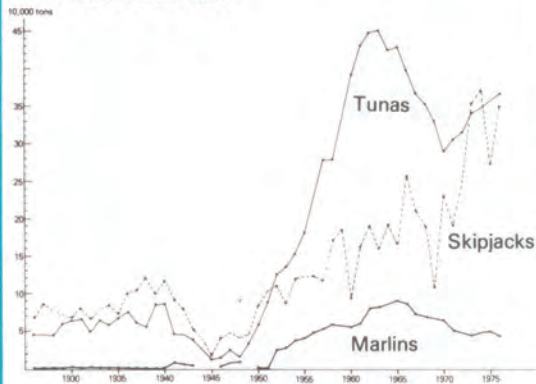
Photo: by Mr. Minoru Kurooka

## Fishing Methods

### Catch by fishing methods (1976)



### Trends of Catch



The following fishing methods are used in Japanese skipjack and tuna fishery.

#### 1. Haenawa: Long-line fishing

Many branch lines are attached to a trunk line, and a hook is tied to the end of each branch line. Floats and sinkers are also attached to the trunk line. The lines are stretched in the sea, for catching mainly tunas swimming in the middle depths.

A tuna long-line is generally very long, and the trunk line used in the high seas reaches a length of several tens to 100km.

Even a long-line used in the coastal fishing grounds often reaches a total length of about 10km.

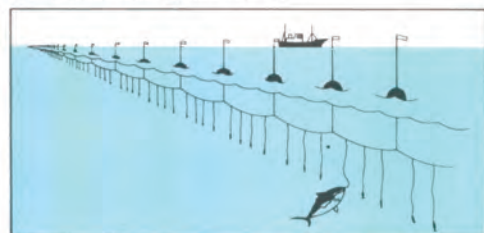
The fishes caught are mainly tunas, but marlins (about 10 percent) and sharks are also caught as well. Skipjacks are rarely caught.

Early in the 1930's, line haulers were put to practical use, and the hauling operation has thus been mechanized.

Since then, this method developed quickly into a main method in tuna fishing. At present, 60 percent of the total catch of tunas are caught by long-line.

Large-sized tuna long-line fishing boats of over 100 tons are operating in the important fishing grounds of the Pacific, Atlantic and Indian Oceans, and they work over a very long period of 100-300 days on one voyage. Each boat has a quick-freezer operating at 40° to -60°C. A suspension-type automatic freezing apparatus equipped with a conveyor has been put to practical use.

Japanese tuna fishing boats operating on the high seas catch mainly high-priced southern bluefin and bigeye tuna which are eaten with pleasure as "Sashimi" in this country, and this fishery is characterized as "a tuna fishing fleet for Sashimi".



Hauling operation by a 320 ton-type long-line fishing boat for tuna. (Seen on the left is a line hauler). Photo: by Mr. Minoru Kurooka

#### 2. Saozuri: Pole-and-line fishing

The pole-and-line method plays a leading role in skipjack fishing in all fishing grounds of the coastal, off-shore and high seas areas.

By this fishing method, 90 percent of the total catch of skipjack are landed.

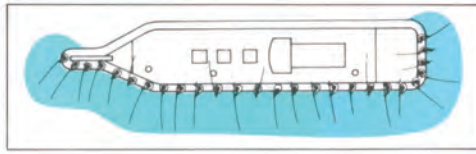
By this fishing method, albacore, a species of tuna, is also caught. Therefore, this might better be called "skipjack and albacore fishing".

When a school of fishes is found, the boat approaches the school quickly. Live bait (mainly anchovy) is used for chumming and water is sprinkled from the boat in order to attract the fishes and to keep them around the boat. After that, fishes are hooked up one by one into the boat with a lure in a short time.

It is a marked characteristic of this fishing method that live bait is used, but this is also a factor limiting the operation range of the fishing boats. At present techniques for long-term keeping and transporting of live-baits in sea areas with a high temperature, including the control of water temperature in a live fish tank and oxygen supply have been improved, and skipjack boats based on the Japanese mainland are going across the equator and operating even in the Coral Sea and

around the Solomon Islands.

Skipjack pole-and-line fishing depends on the schooling habit of skipjack. First skipjack migrate in schools in the surface layer of the sea. Next, during migration, they tend to gather in current rip waters having a gap in water temperature, and the following types of schools are formed; (a) a school associated with birds, hunting small surface fishes, (b) a school associated with driftwood or drifting seaweeds, and (c) a school gathering near islands and shallows. Therefore, although skipjacks are widely distributed throughout the world, fishing grounds are generally located near the land, island and shallows, and often confined to sea areas having a thermocline.



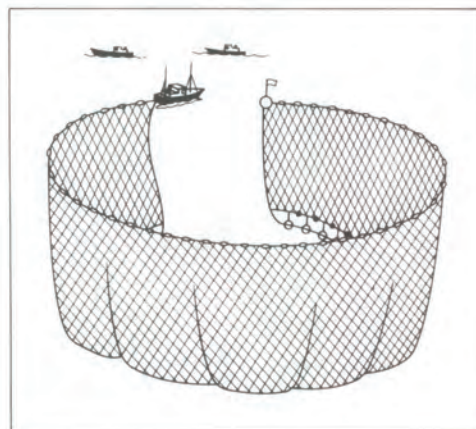
#### 3. Markiami: Purse seine

In the United States, large-scale purse seine fishing catching yellowfin tuna and albacore is actively conducted in the sea areas of the eastern Pacific Ocean from California to Ecuador via Panama.

In Japan, in the latter half of the 1950's, purse seine fishing for bluefin tuna began off the coast of Sanriku. Since, this method has become widely used in many regions. In 1963, one-boat purse seine fishing for tuna and skipjack was first tried in the South Pacific. At present, operation is gradually shifting from a type operating seasonally either off the coast of Sanriku or in the southern seas to that operating mainly in the southern seas year round.

Purse seine fishing is a very mobile and efficient fishing method which is growing in skipjack and tuna fishery. But, the catch by this method accounts for only about 4 percent of the total for tuna and about 6 percent for skipjack.

There are two kinds of purse seine: "two-boat purse seine" surrounding a school of fishes with "Kinchakumi" (purse seine in a narrower sense) having pursuing rings at the foot of the net. "Two-boat purse seine" is conducted by small and medium-sized boats of less than 80 tons, and "one-boat purse seine" is conducted by large-sized boats and the net used for this method is also large. The standard type of the most recent large-sized skipjack purse seiner (operating in the southern seas) is that of 499 tons.



#### 4. Hikinawazuri: Trolling

This fishing method is being actively used along the northwest coast of the United States and the west coast of South Europe. In these districts, however, it is largely enjoyed as a kind of sport fishing, catching albacore and marlins.

In Japan, this method is actively employed in many places along the Pacific coast. Mainly small-sized tunas are caught. Fishes are caught by putting out rods from the side and the stern of a boat and towing a fishing line attached to sinker board. A lure (artificial bait) is generally used. This fishing is conducted by coastal fishermen, and small-sized fishing boats of 3-5 gross tons to 10 gross tons are generally used. This type of fishermen do not devote themselves entirely to skipjack fishing. During the off-season for skipjack and tuna, they catch other kinds of fishes by various

#### Haenawa: Pêche à la palangre.

Cette sorte de pêche est surtout utilisée pour le thon et le merlan (environ 10 pour-cent) le requin est aussi attrapé en même temps. La bonite n'est que très rarement attrapée de cette façon. Jusqu'à maintenant, 60 pour-cent des prises totales de thons sont obtenues par la pêche à la palangre.

#### Saozuri: Pêche à la ligne et à la gaffe.

Cette forme de pêche joue le plus grand rôle dans la pêche à la bonite des régions côtières, au large et en haute mer. 90 pour-cent des prises totales de bonites sont obtenues de cette façon.

#### Makiame: Filet circulaire.

Le filet circulaire est une méthode de pêche mécanisée très efficace, c'est la méthode d'avenir pour la pêche à la bonite et au thon. Mais, pour le moment elle ne compte que pour environ 4 pour-cent dans les prises totales de thons et 6 pour-cent pour les bonites.

#### Hikinawazuri: Pêche à la traîne.

Au Japon, cette méthode est très répandue le long des côtes du Pacifique. Ce sont surtout les petits thons qui sont attrapés de cette façon. Cette méthode de pêche est utilisée par les pêcheurs côtiers, les bateaux utilisés sont en général des bateaux de petit tonnage de 3 à 5 tonnes ou de moins de 10 tonnes.

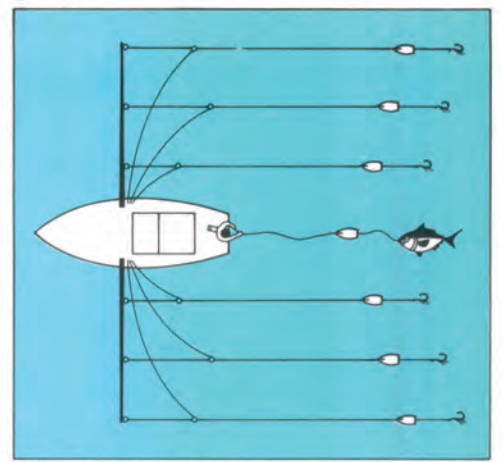
#### Teichiami: Filet fixe.

La pêche au filet fixe est l'une des méthodes de pêche traditionnelle, les bancs de poissons venant près des côtes sont attrapés vivants. Il y a plusieurs sortes de filets fixes, mais tous sont fixés à l'entrée d'une baie ayant un rivage profond, et les nasses sont remontées chaque jour à intervalles réguliers.

#### Autres méthodes de pêche.

La pêche au filet dérivant à larges mailles et le "Tsukinbo" (pêche au harpon) sont aussi utilisés, mais toutes deux sont des méthodes locales qui s'étendent à des régions très limitées et les prises ne sont pas très importantes.

fishing methods such as hook and line, long-line, and gillnet.



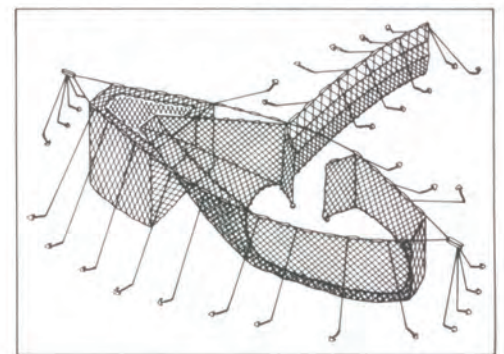
#### 5. Teichiami: Set net

This is one of the traditional fishing methods for catching a school of fishes alive when they come near the coast in migration. There are several types of nets, but most of them are fixed at the entrance of a bay with a deep shore, and the trap part of the net is hauled at regular intervals every day.

In Japan, in inverse proportion to the development of modern fishery using fishing boats, the comparative importance of the set net fishing has continued to decline. At present, a little less than 10 thousand tons of skipjacks and tunas are landed by set net fishing, and this accounts for 1 percent of the total catch. The causes for the decline are that (1) because of the passive nature of the fishing method, the set net can not cope with changes in the amount of fishes coming by migration, and (2) there is now shortage of the necessary manpower.

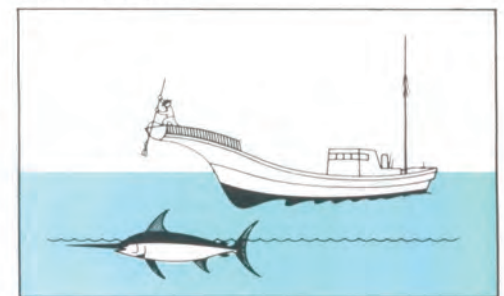
Recently, however, the merits of set net fishing have been reconsidered, because of the following background situations:

- (1) Advancement of fishing techniques including improved structure of the fishing net and effective attraction of schools of fish.
- (2) Overcoming a shortage of manpower by mechanization and labor saving devices.
  - (a) Wide use of lightweight and long-lasting synthetic fiber nets.
  - (b) Introduction of net haulers.
- (3) Increase of value added.
  - (a) Possibility of highly fresh fishes and the possibility of an increase in prices of fishes temporarily kept in live fish pens.
  - (b) Little effect from the price increase in fuel oil.



#### 6. Other fishing methods

"Oome-nagashiami" (large mesh drift net) and "tsukinbo" (dart fishing) are also employed, but both of these are local methods seen in limited districts and the catch is very small. Recently, however, large mesh drift net fishing mainly for marlins is actively conducted in some sea areas.



#### Haenawa: Pesca al cordel con anzuelos

Las partidas de pesca están mas bien centradas en el atún y el pez vela, alrededor de un 10%. También se cogen algunos tiburones con ellos. Con este método se coge raramente bonito. Actualmente un 60% del total de la recogida del atún es realizada por este método.

#### Saozuri: Pértiga y pesca con sedal

Este método juega un papel muy importante en lo que concierne la pesca del bonito a lo largo de la costa, mar adentro y en las regiones pesqueras de altamar. Con este método se obtiene un 90% del total de la recogida de bonito.

#### Makiame: Red de arrastre

La pesca con red de arrastre es un método mecanizado y eficiente de pesca y es una fuerza creciente para la pesca del bonito y del atún. Sin embargo, la cantidad de pesca conseguida con este método solo alcanza la cantidad de un 4% del total de la cogida de atún y también un 6% del bonito.

#### Hikinawazuri: Pesca con sedal y anzuelo

En Japon este método es muy corriente en muchas partes a lo largo de la costa del Pacifico. Lo que mas se recoge con él, son atunes de tamaño pequeño. Esta clase de pesca es llevada a cabo por los pescadores a lo largo de la costa en botes de pesca de tamaño reducido. Estos botes suelen ser generalmente de unas 3 a 5 toneladas en bruto y desde luego no suelen llegar nunca a las 10 toneladas.

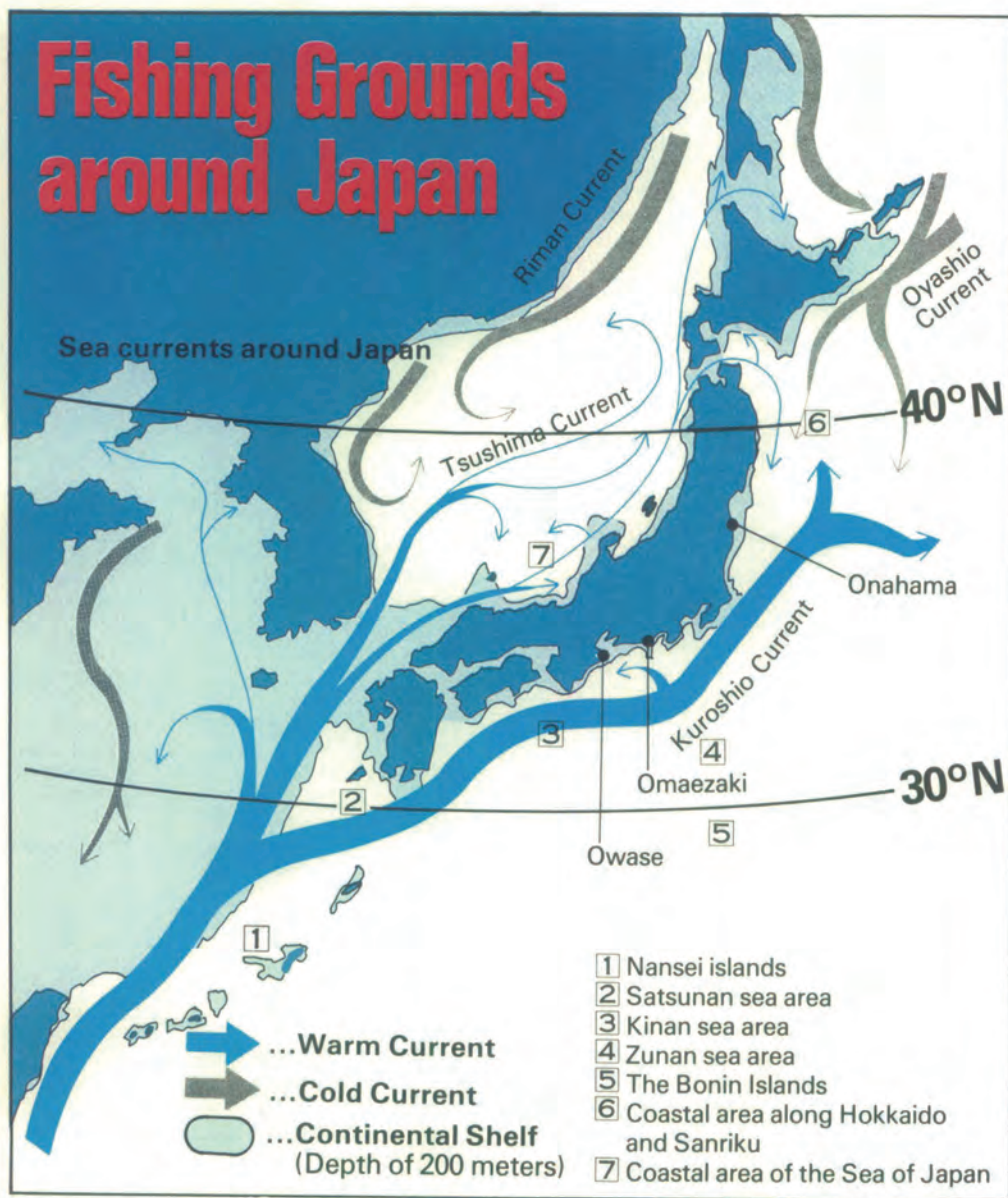
#### Teichiami: Red flotante.

Este es uno de los métodos de pesca tradicionales y los peces que vienen en bandadas emigrando a lo largo de la costa son cogidos vivos por este medio. Hay diferentes tipos de redes, pero todas suelen instalarse a la entrada de una bahía con aguas profundas, y cada día, a intervalos regulares, se suelen sacar para recoger los peces que han quedado presos.

#### Otros métodos de pesca

Redes rastreadas de malla ancha también son empleadas, así como el método "Tsukinbo" por medio de saeta, pero ambos métodos son mas bien locales y se ven en limitadas regiones y con ellos la cogida de peces es también muy escasa.

# Fishing Grounds around Japan



## Skipjack

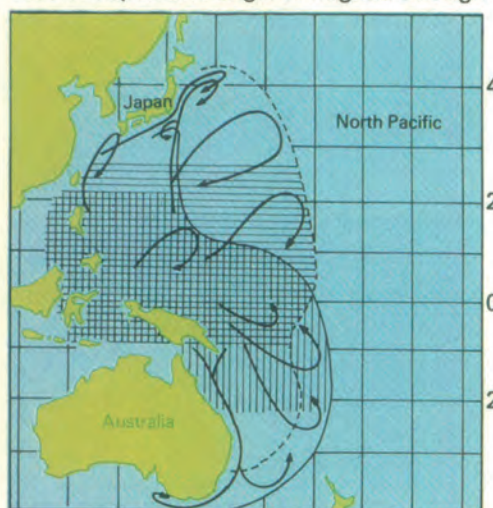
It is thought that there are two stocks of skipjack inhabiting the Pacific Ocean, i.e. one belonging to the western sea area and the other belonging to the central and eastern sea areas. Every year from spring to summer, skipjacks come to the offshore waters of Japan from tropical or subtropical sea areas by way of several migration routes. Skipjack pole-and-line fishing in adjacent seas begins operation in the Satsunan and Zunan sea areas in winter from February to March, and next in the fishing

grounds of the coasts of southern Kyushu and Shikoku in spring. Early in summer, fishing is operated off the coast of the central part of the Main Island. Lastly, in autumn from September to October it is operated off the coast of Sanriku, and the fishing ends in November. Besides pole-and-line fishing boats medium and large-sized skipjack and tuna purse seiners operate in the Pacific Ocean off the central and northern coasts of Japan.

## Bluefin tuna

In the adjacent seas of Japan, among the various tunas, mainly bluefin tuna is caught. Larva which hatched in the Satsunan sea area during May to June continue to grow to young fish (called "Yokowa", and these young fishes travel north along the coast of Japan. In autumn they turn and go back south. When they grow into yearlings (5~7kg), they leave the adjacent seas of Japan and begin to migrate through

the ocean. After spawning as mentioned above, adult fishes go up north from spring into summer reaching the sea areas off the coasts of Sanriku and Hokkaido. Location of fishing grounds varies seasonally with the rise and fall of the Kuroshio current, as seen in the following table and figure:



### Fishing grounds of bluefin tuna around Japan

Area	Fishing method	Season						
		Winter Jan. Feb.	Spring Mar. Apr. May	Summer Jun. Jul. Aug.	Autumn Sept. Oct. Nov.	Winter Dec.		
Nansei islands	Pole-and-line & long-line		■	■				
Kinan sea area	Pole-and-line & long-line	■	■				■	■
Coastal area of the Sea of Japan	set-net		■	■				
Zunan sea area	Pole-and-line & long-line	■	■				■	■
Coastal area along Hokkaido and Sanriku	Long-line & purse-seine			■	■	■	■	

## Full-time skipjack pole-and-line fishing boats of the 59-ton type

The main skipjack boats used in the coastal and offshore waters of Japan are those of 59 and 69 gross tons. The photograph shows the "Jintoku-Maru" belonging to Omaezaki Fishing Harbor, Shizuoka Prefecture. This is YAMAHA's FRP 59-ton type fishing boat, and over ten YAMAHA fishing boats of this type are in operation here, having their bases in Shizuoka or Mie Prefecture located on the central coast of Japan facing the Pacific Ocean. The "Jintoku-Maru" operates mainly in the fishing grounds of the offshore waters, and has 25 crew members on board. The boat is equipped with a live fish hold (volume: 19 tons) for sardines used as live bait and the skipjacks caught are stored in an ice hold, being immersed in cold water mixed with



Scattering live sardines around the boat to attract skipjacks.



Live fish hold for sardines

ice. After being landed, skipjacks are sold as fresh fish for "Sashimi". A main engine of 900 HP is installed.



The "Jintoku-maru", 59 tons type.

# Highly Economical Skipjack and Off-shore waters

### Fishing calendar of the "Jintoku-Maru"

Area	Fish	Season						
		Winter Jan. Feb.	Spring Mar. Apr. May	Summer Jun. Jul. Aug.	Autumn Sept. Oct. Nov.	Winter Dec.		
Satsunan sea area	Skipjack	■	■					
Zunan sea area	Skipjack		■	■	■	■		
Bonin Islands	Skipjack						■	■
Southwest Pacific	Skipjack Albacore							■

### Seasonal changes of fishing grounds for tuna long-line fishing around Japan. (Data: The Fishery Agency)



Les bonites et les thons attrapés dans les mers voisines du Japon ont leurs frayères dans les mers des régions subtropicales. Le frai remonte vers le nord avec le Kuroshio et arrive vers les côtes ou dans les mers voisines du Japon tout en continuant à croître durant sa migration. La route empruntée par les migrations diffère selon les espèces ou le lieu de naissance, et la place du terrain de pêche change avec la force du Kuroshio.

La recogida del bonito y del atún en los mares cercanos al Japón tiene sus terrenos de crías en las regiones del mar subtropical. Las crías son llevadas hacia el norte por la corriente marina de Kuroshio, llegando por este medio a la costa o a los mares cercanos a las islas del Japón, de paso que van creciendo durante la migración. La ruta de migración difiere según las especies o grupos de origen, además, las regiones de pesca van cambiando con la subida y bajada de la marea con la corriente de Kuroshio.

Pole-and-line skipjack fishing.



fishing in offshore and distant waters. Besides, in the coastal waters along this district, trolling and long-line fishing by small-sized fishing boats has actively been conducted since old times. The "Kiku-Maru" is used for trolling for small bluefin tuna and black marlin, and during one month of early summer, is used for collecting yellowtail fry for culture with a small purse seine. Since three years ago, this boat

has also been employed on a part-time basis in a fleet involved in two-boat purse seine fishing, and is working as an auxiliary boat in a medium-sized purse seine fishing operation for skipjack and tuna in the Kinan sea area. High-speed performance and mobility are indispensable because the "Kiku-Maru" is engaged in finding and chasing schools of fish and in feeding them with live bait during hauling.

**Fishing calendar of the "Kiku-Maru"**

Fishing method	Fish Caught	Season	Winter		Spring			Summer			Autumn		Winter
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.
Trolling	Tuna												
Small-sized Purse Seine	Yellowtail fry (for culture)												
Medium-sized Purse Seine (as auxiliary boat)	Tuna Skipjack												

**Multipurpose fishing boat of the 4.9 ton type for the outer sea (YAMAHA DT-09-0B)**



The "Yamasen-maru", 4.9-ton type.

In coastal boat fishery, generally the object of fishing is shifted boldly and promptly according to the season and fishing conditions. It is necessary for one fishing boat to be able to conduct several kinds of fishing operations.

In the coastal waters near Onahama, Fukushima Prefecture, the Kuroshio (warm) and the Oyashio (cold) currents meet. Therefore, this sea area is very productive, but both sea and fishing conditions change rapidly.

The photograph shows the "Yamasen-Maru", which is used for fishing by a single fisherman or by a married couple. As seen in the "fishing calendar", six kinds of

fisheries are conducted in turn. "Funabiki-ami" (boat seine) and flying squid pole-and-line fishing were introduced only two or three years ago. Generally, newly introduced fisheries are conducted mainly in offshore waters, and fishing grounds are sought in wide and distant sea areas. Therefore, it is necessary for these fishing boats to have both high-speed and ocean-going capabilities, and to be equipped with the same types of nautical instruments as those of the boats of 5~20 tons.



Line and lures for trolling (artificial bait).



The so-called "Bakudan" (a kind of lure which uses boat's motion to give it an up and down rythm).

**Fishing calendar of the "Yamasen-Maru"**

Fishing method	Fish Caught	Season	Winter		Spring			Summer			Autumn		Winter
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.
Trolling	Skipjack/Tuna												
Boat seine	Young sardine Sand lance												
Pole and line	Flying squid												
Two-boat seine	Halfbeak												
Diving	Abalone Sea urchin												
Gillnet	Flounder Crab												

Des thoniers hautement économiques pour les régions côtières et pour les mers voisines.

Type de 59 tonnes. Bateau de pêche professionnel pour pêcher la bonite à la gaffe et à la ligne

Les principaux thoniers utilisés pour la pêche à la bonite dans les mers voisines du Japon sont des bateaux de 59 et 69 tonnes. La photo nous montre le "Shintoku-Maru" dont le port d'attache se trouve à Omaezaki dans la préfecture de Shizuoka. Il s'agit d'un bateau de pêche Yamaha en FRP du type de 59 tonnes, dix autres bateaux de pêche Yamaha du même type sont en opération, leurs ports d'attaches se trouvent à Shizuoka ou à Mie, préfecture côtière du centre, sur l'Océan Pacifique.

Type de 7 tonnes. Bateau pour la pêche à la traîne (Yamaha DY-50-0A).

Ce genre de bateau est utilisé pour pêcher de petits thons ainsi que le merlan noir. Pendant le premier mois de l'été il est utilisé pour récolter le frai de la bonite, pour cela on se sert de petits filets circulaires. Depuis trois ans on utilise aussi ce type de bateau par couple en tant que bateaux de pêche au filet circulaire. Dans les régions de la Mer de Kinan il est utilisé comme bateau auxiliaire de moyen tonnage pour pêcher la bonite et le thon au filet circulaire.

Type 4,9 tonnes. Bateau de pêche du type océan à usages multiple 5 (YAMAHA DT-49-0B).

Pour la pêche côtière avec des bateaux, le genre de pêche change très rapidement d'après la saison et les conditions de pêche. Il est donc nécessaire de pouvoir répondre à plusieurs sortes de pêches à partir du même bateau.

Barcos de pesca rápidos y muy económicos para la pesca del bonito y del atún a lo largo de la costa y mares cercanos.

Barco de pesca para la pesca profesional del bonito mediante pértiga y sedal de 59 toneladas de peso

Los principales thoniers pesqueros para la pesca del bonito en los mares cercanos al Japón, son barcos de 59 a 69 toneladas de peso. La fotografía muestra el barco pesquero "Shintoku-Maru" del puerto de Omaezaki de la prefectura de Shizuoka. Este es un barco de pesca YAMAHA (FRP) de 59 toneladas. Actualmente diez de estos barcos Yamaha están en operación. Todos estos barcos tienen sus bases en Shizuoka o en la prefectura de Mie, situadas ambas en la costa central del Océano Pacífico.

Barcos para pescar con sedal y anzuelo, modelo YAMAHA DY-50-0A de 7 toneladas de peso

Este barco es utilizado para la pesca con sedal y anzuelo del atún y del pez vela negro. También durante un mes a principio del verano para la recogida de bandadas de peces pequeños para el cultivo por medio de redes pequeñas de arrastre. También es empleado desde hace unos 3 años en flota compuesta de dos barcos para la pesca con sedal y como auxiliar para la pesca del bonito y del atún en la región de Kinan.

Buque de pesca para alta mar de múltiples aplicaciones de 4.9 toneladas de peso el modelo YAMAHA DT-49-0B.

En la pesca costera donde se emplean botes de pesca, el objeto de la pesca tiene que poder ser cambiado simple y rápidamente según lo pida la estación del año y las condiciones de la pesca.

Es muy conveniente que un mismo buque pueda adaptarse a distintas variedades de pesca.

**and Tuna boats for Coastal**

**Trolling boat of 7-ton type (YAMAHA DY-50-0A)**



The "Kiku-maru", 7-ton type.

The photograph shows the "Kiku-Maru" belonging to Mikiura Harbor of Owase City, Mie Prefecture. This boat can make 16 knots at maximum speed. This district is well known as a base for skipjack and tuna



Live fish tank at the fore deck (equipped with a water sprinkler).



Bridge equipped with all nautical instruments.

**A remark by Mr. Chuhei Morita, President of Omaezaki fisheries Cooperative Association**



"We, fishermen in Omaezaki being engaged in offshore fishery for skipjack, are blessed with a good access to good fishing grounds and operate mainly in the sea areas around the Izu Seven Islands. Up to now, by making the best use of this geographical advantage, we have carried out our basic policy of operation, i.e. to land highly fresh skipjacks and to maintain their quality and high prices. Most of the boats from other prefectures operate according to the principle of "return with full load". But, we have been making efforts to increase economic efficiency by making the operation period per

voyage as short as possible and thereby maintaining quality and price high. When we have obtained a catch exceeding the break-even point, we return quickly to our port. Therefore, we consider the speed of the boat very important. Recently, YAMAHA FRP fishing boats of the 50-ton type have been widely used. This seems to be due to the high-speed performance and simplicity of maintenance which meets the demands of local fishermen."

## Problems in skipjack fishery

# Development of Demand for Fresh Skipjack

In Japan, skipjacks have been used for processing dried skipjack since old times, because its meat hardened by heating is considered suitable as a preserved food. Dried skipjack is made by a roast-drying method. The aims of this method are (a) to remove water gradually from a fillet and harden it like wood, (b) to remove the excess fat, (c) to prevent the propagation of harmful microorganisms, and (d) to give it a special flavour as a seasoning food. Of course, in the districts where a large quantity of skipjacks are landed, they have been eaten with pleasure since old times as fresh fish of the season in early summer. They are served in the form of "Sashimi", "Tosazakuri" (lightly roasted skipjack served with grated radish) and daily dishes such as grilled fish, fish boiled with soy, and "Tsukudani" (food boiled down in soy). But compared with tuna, the eating ways of skipjack vary with the district, and fresh skipjack is consumed in large quantities in some districts but not so much in others. Fig. 1 shows changes in the amount of fresh fishes consumed in Japanese homes. Among the consumption of high-grade fishes tuna and yellowtail have gradually increased, but that of skipjack as fresh fish

is small and show no increase. Recently, however, the landing of skipjack has increased greatly with the increase in the amount of frozen skipjack brought in from the distant seas. It is expected that skipjack resources are still fairly great. There is a good prospect in Japan that improved methods of processing of skipjack will increase consumption.

What is the trend in demand for processed skipjacks? The demand for traditional dried skipjack has decreased with the increased use of chemical seasonings. In recent years, however, considerable efforts have been made to develop new demand for processed skipjack, as seen in the increased sales of flakes of dried skipjack packed in small bags as a seasoning and other new products, e.g. smoked and half-dried skipjack which can be produced in a short time. Canned skipjack labeled as "Sea Chicken" is now popular, and frozen skipjacks are exported to packers in the United States as mixing material for canned light meat.

Basically, expansion of domestic consumption is the primary problem. In this connection, it is highly important to remove the regional differences in the quantity of raw

## Processing of fish in a frozen state (processing to a fillet)

.....Cooked soon after thawing at the home.....

About half of the skipjack caught is frozen on board the fishing boat. Future expansion of consumption depends on the improvement of processing methods for frozen skipjack and, at the same time, development of new products.

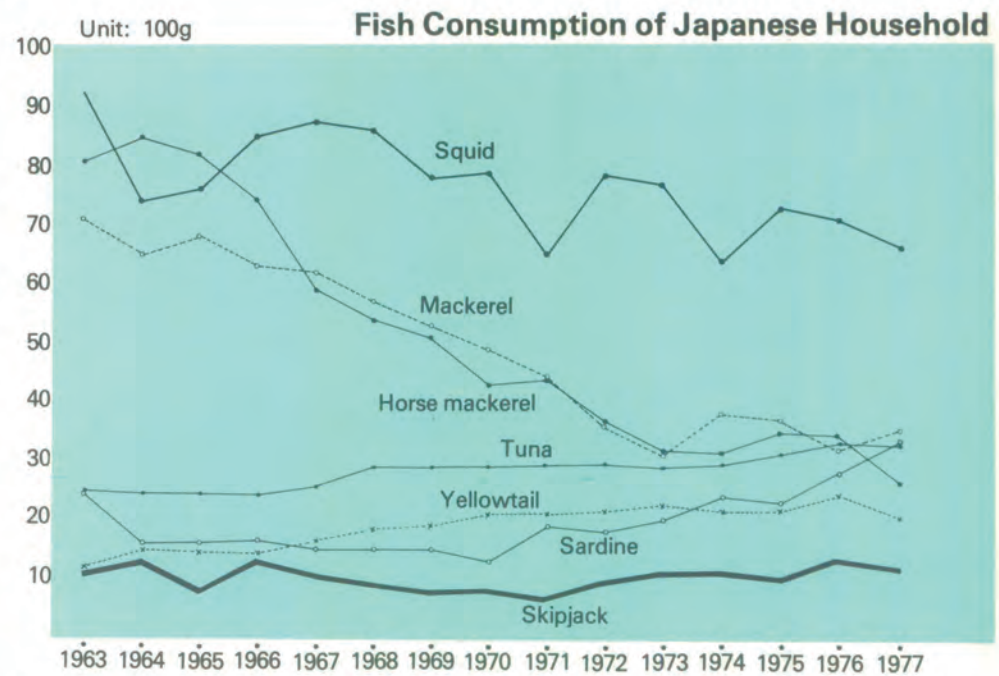
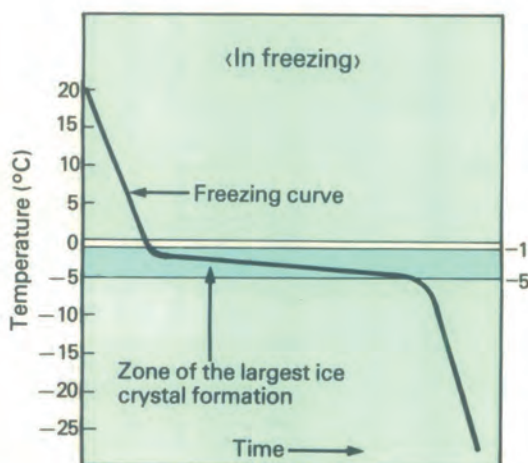
Freezing of skipjack on board the fishing boat engaged in high seas fishing has been usually carried out by a brine freezing method (at  $-20^{\circ}\text{C}$ ) since around 1970. At the same time fishing in more remote fishing grounds and the use of larger fishing boats began. The brine freezing method played an important role in mass treatment on board and in saving labor. On the other hand, however, this method has a major fault in that deterioration in quality by salt penetration and the browning of meat occur after thawing, and skipjacks frozen by this method have thus not been desirable for fresh consumption. They have been used mostly for manufacturing dried skipjack, "Tsukudani", canning and also exporting as frozen skipjack (see pp. 2~3). Since two or three years ago, fishing boats have been equipped with a new air-cooled freezer ( $-50^{\circ}\text{C}$ ). The aims of the use of

this method are to maintain the best possible meat quality by passing through the zone of the largest ice crystal formation ( $-1^{\circ}$  to  $-5^{\circ}\text{C}$ ) as quickly as possible and to sell as high-priced fresh fish. But the problem of changes in meat color to a brown color during the retail stage after thawing remains to be solved. Now, it is reported that a new processing method for frozen skipjack has been developed in Yaizu City, one of the main landing ports for skipjacks from distant waters. That is, the cooperative association of marine product wholesalers and processors in Yaizu City has developed "frozen skipjack cutter" in cooperation with the Fisheries Experimental Station of Shizuoka Prefecture and a local machine shop. The main



Mr. Eiichi Tanaka  
Chairman, Yaizu Fish  
Middlemen and Marine  
Products  
Processors Co-operative

characteristic of this machine is that skipjacks can be processed in a frozen state. Frozen skipjacks are processed into a size suitable for the consumers, and are shipped after being packaged. This makes it possible for consumers to eat fresh and delicious "Sashimi" by serving after thawing in the home. This machine is already in operation by some processors, and it is believed that as a result of it, now, "distant sea fishes" can easily be served in the home. This method can be applied not only to sale of skipjack for "Sashimi", but also to the processing of half-finished materials to be used for making dried or half-dried skipjack.



Remarks: Extracted from the survey of agriculture, forestry or fishery households and single-man households. The graph shows time series of average fresh fish consumption (excluding processed fish) for 4 person households.

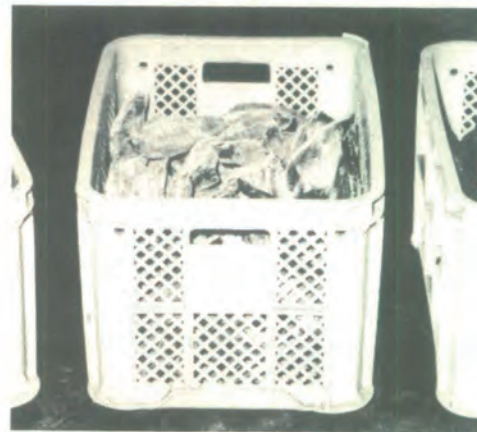
"Annual Household Survey 1976", Statistics Bureau, Prime Minister's Office.

skipjack consumed, and to take measures for promoting the consumption of fresh fishes by improving the thawing method for frozen skipjack.

The following flow chart shows a distribution system for frozen skipjack to be realized by the introduction of the automatic cutter. This is the same system as the "cold chain" (a system of refrigerated transport-

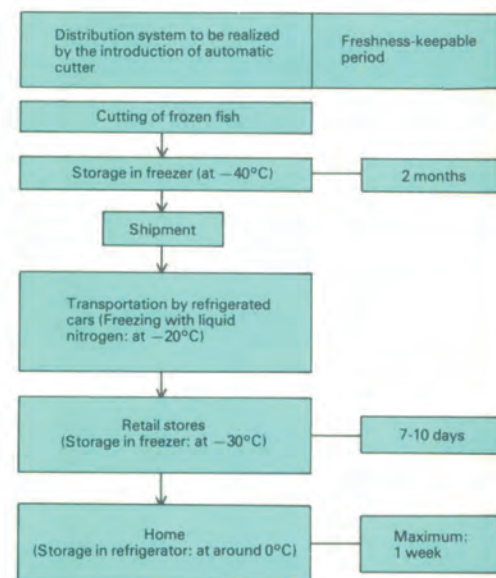


Flakes of dried skipjack packed in small bags.



Dried skipjacks.

tation) which already exists in the case of frozen tunas. The aims of this technical innovation include (1) to increase the value of the products and (2) to strengthen the distribution channel directly connecting the producing areas with the consuming areas by adding attractive new products to the existing "cold chain".



Half dried skipjacks.

### Problème dans la pêche à la bonite.

#### Accroissement de la demande en poissons frais.

Depuis déjà très longtemps au Japon la bonite est consommée sous sa forme séchée, ceci parce que la viande durcie à la chaleur a toujours été considérée comme étant le meilleur moyen de conservation.

De nos jours la pêche à la bonite a tendance à s'accroître considérablement, il en va de même pour les bonites congelées provenant des mers lointaines. On prétend que les ressources en bonites futures devraient être très importantes. C'est pour cette raison que les Japonais sont pressés d'améliorer les méthodes d'industrialisation de la bonite et d'augmenter l'échelle de la consommation. A peu près la moitié des bonites pêchées sont congelées à bord. L'accroissement future de la consommation dépendra de l'amélioration des méthodes d'industrialisation de la bonite congelée et du développement de nouvelles denrées alimentaires.

Maintenant, la nouvelle méthode de traitement de la bonite congelée qui est réalisée à Yaizu, l'un des plus importants ports pour la bonite provenant des mers lointaines, est un nouveau sujet de conversation.

### Problema que presenta la industria pesquera del bonito.

#### Desarrollo de la demanda de pescado fresco.

En Japón, desde tiempos antiguos, el bonito ha sido empleado para la elaboración del bonito desecado porque se considera que la carne endurecida por el calor es más apta para ser conservada como alimento.

Ultimamente, la cantidad de bonito recogida tiende a crecer en gran manera gracias al aumento del bonito congelado enviado desde regiones del mar muy distantes. Se espera que en el futuro los recursos de bonito se mantendrán suficientemente amplios. Por eso, en Japón se siente la necesidad urgente de mejorar el método de la elaboración, así como el extender la escala de consumo del bonito. Alrededor de la mitad del bonito pescado es congelado a bordo del buque. El futuro incremento de la consumición depende de las mejoras realizadas con los métodos de elaboración del bonito congelado y también, a la par, del desarrollo de nuevos productos.

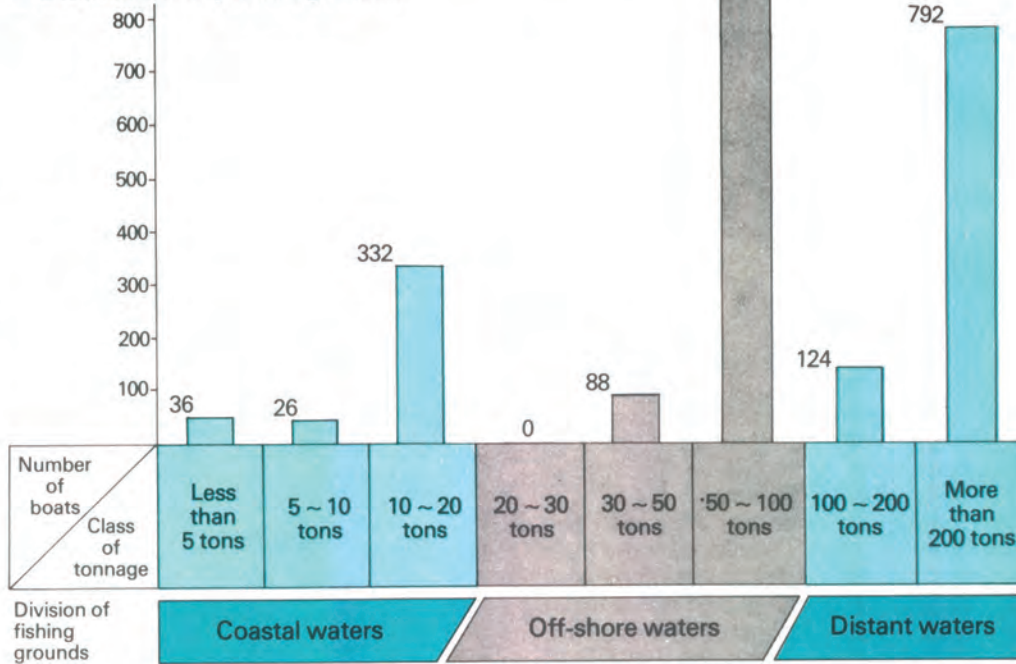
Actualmente se encuentra ser el tópico de las conversaciones un nuevo método introducido para el tratamiento de la carne congelada del bonito, puesta en la práctica en la ciudad de Yaizu, uno de los puertos principales de descarga del bonito llegado de mares distantes.



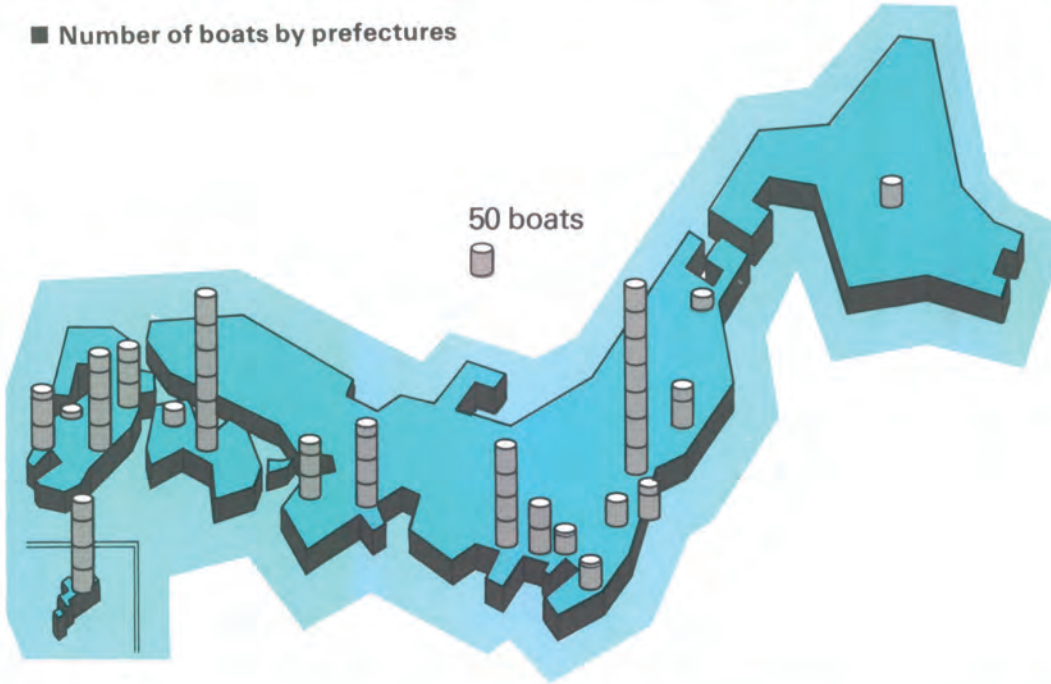
## Japanese skipjack and tuna fishing fleet

[Source: Statistics on Registration of Fishing Boats (1983)]

### ■ Distribution by tonnage class



### ■ Number of boats by prefectures



# Trends and problems of management

## Flourishing coastal and off-shore fisheries and the distant water fishery faced with "200-mile regime of the sea"

After World War II, Japanese skipjack and tuna fishery achieved a remarkable rate of development.

Productivity of tuna fishery has increased at a quick pace since the 1950's. This has been brought about by increased catch resulting mainly from expanding the range of fishing operations, because tuna is a highly migratory fish. Tuna long-line fishing boats became larger year by year, and have developed new fishing grounds all over the Pacific, Indian and Atlantic Oceans. Expansion of domestic demand as well as the increase of consumption of canned tuna in the European and American markets have stimulated aggressive fishing efforts by the fishermen.

On the other hand, skipjack fishery is carried out mainly by the pole-and-line method, and originally its operation range was confined to the fishing grounds in the coastal or adjacent seas of Japan. Since around 1966, however, fishing grounds in the South Pacific south of 20°N have been opened up, and fishing grounds have gradually been sought in other remote areas, following the trend in tuna fishery. Recently, with respect to skipjack and tuna fishing boats, a shift from tuna long-line to skipjack pole-and-line fishing as well as specialization in skipjack pole-and-line fish-

ing is in progress. One main characteristic of Japanese fisheries is that they have developed through expansion of fishing in distant waters. However, skipjack and tuna fisheries in coastal and offshore waters have continued to focus their efforts on the supply of highly fresh fishes, improving their boats and equipment to make their operations as well as small-to-medium-sized enterprises specialized in offshore and high seas fisheries, the number of fishing boats engaged in skipjack and tuna fishing is about 6,000 (out of this, 2,600 ~ 2,700 fishing boats are over 20 tons).

Regarding the financial position of these fisheries, the coastal and offshore fisheries are comparatively well off, while the condition of the distant water fishery has continued to worsen. Fishing cost has increased by going to more distant fishing grounds, and by the increase in depreciation on modern equipment investment and rise in prices of fuel oil and materials. Lately, proceeds from the catch as opposed to fishing costs are increasingly unbalanced. Demand for fish is remaining continuously at a low level and consumers are turning away from fish. In addition, Japanese fisheries are faced with the "200-mile problem",

and negotiations with many coastal countries are pending.

From now on, Japanese skipjack and tuna fishery must continue its efforts (1) to use fishing grounds in negotiation with the coastal countries concerned, (2) to promote economic and technical cooperation with these countries, (3) to improve its financial and managerial position, (4) to ad-

just demand and supply and to increase demand, and (5) to maintain adequate fish prices. It is hoped that fishing and managerial knowledge and techniques accumulated by Japanese skipjack and tuna fishery for many years can be used for the development of skipjack and tuna fisheries of developing countries within their 200-mile limits.

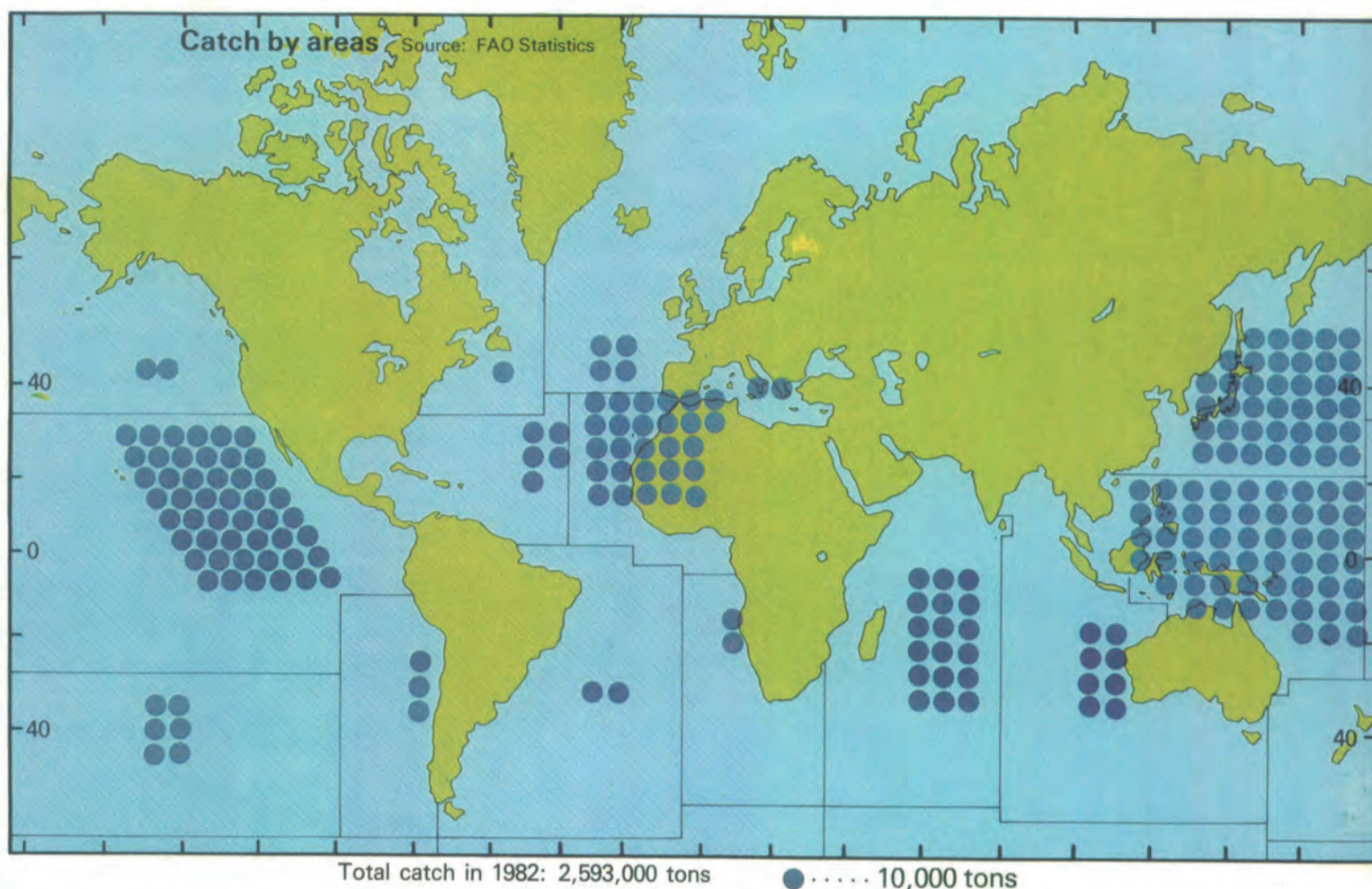
L'accroissement de la pêche en mer lointaine est la particularité principale du développement de la pêche japonaise. Mais d'un autre côté, pour la pêche à la bonite et au thon du littoral et des mers voisines, on continue à diriger tous les efforts possibles vers l'approvisionnement en poissons frais et vers la réalisation de bateaux de pêche et de leur équipement pour répondre aux exigences de chaque terrain de pêche. Il serait souhaitable que les techniques de pêche et d'organisation accumulées depuis de nombreuses années par les entreprises japonaises de pêche à la bonite et au thon puissent être utilisées pour le développement de cette pêche dans la zone des 200 milles des pays en voie de développement.

Se puede considerar como una característica principal de la industria japonesa el haber desarrollado el incremento de la pesca en mares lejanos. Por otro lado la industria pesquera del bonito y del atún a lo largo de la costa y en los mares cercanos al Japón viene realizando unos esfuerzos continuos, centrados estos mas especialmente en el abastecimiento de pescado bien fresco y también en completar su flota pesquera, y el equipo de sus buques dentro de los límites de cada una de las regiones donde operan. Es de desear que tanto la pesca, así como la administración técnica acumulada durante la experiencia de muchos años en la pesca del bonito y del atún llevada a cabo por los pescadores japoneses sean utilizadas eficazmente para la pesca del bonito y del atún dentro de los límites de las 200 millas establecidas y según el desarrollo económico de las naciones en vía de progreso.

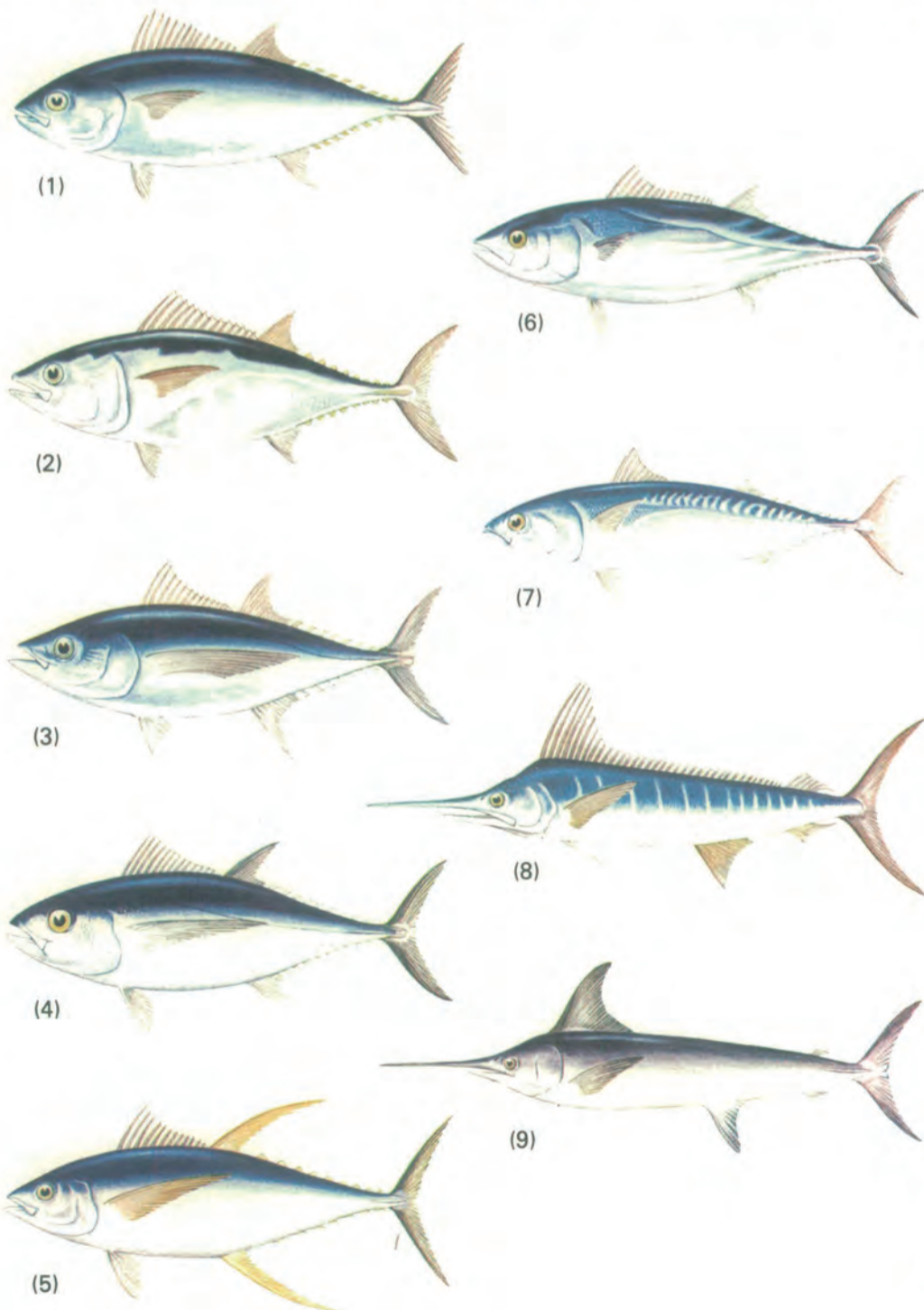
# Skipjack and tuna fisheries in the world

The total catch of tunas and similar species (skipjack and marlin) in the world has fluctuated within the range of 1,500~2,000 thousand tons in recent years. These fishes are highly migratory, migrating widely from coastal areas to the mid-oceans. Main fishing grounds are distributed in sea areas between 40°N Lat. and 40°S Lat. in the Pacific, Atlantic and Indian Oceans.

The main producing countries are Japan and the United States. The catch by these two countries accounts for about 50 percent of the total for the world. The rest is taken by Taiwan, Spain, Peru, France, Sri-Lanka, the Philippines and the Republic of Korea, in this order. Catches by Japan and the United States have tended to stagnate, but those of Taiwan, Sri-Lanka, the Philippines and the Republic of Korea have been on a quick increase. In Taiwan and the Republic of Korea, long-line fishing for large-sized tunas in mid-ocean is prevalent. On the other hand, in the Philippines and Sri-Lanka, various methods of coastal fishing are employed to catch small-sized tunas living near islands, as well as skipjack, Pacific bonito and frigate mackerel.



## Representative species of tunas and similar fishes



Species	Distribution area
(1) Bluefin tuna ( <i>Thunnus thynnus orientalis</i> )	Pacific Ocean in the northern hemisphere. [Allied species, <i>Thunnus thynnus thynnus</i> , is found in the Atlantic Ocean]
(2) Southern bluefin tuna ( <i>Thunnus maccoyii</i> )	Pacific Ocean in the southern hemisphere and Indian Ocean.
(3) Albacore ( <i>Thunnus alalunga</i> )	Pacific, Atlantic and Indian Oceans. *Widely distributed from low to high latitudes.
(4) Bigeye tuna ( <i>Thunnus obesus</i> )	Pacific Ocean --- Areas around 30°N Lat., and areas near the equator. Atlantic Ocean --- Areas from 20°N Lat. to 20°S Lat. Indian Ocean --- Areas near the equator.
(5) Yellowfin tuna ( <i>Thunnus albacares</i> )	Pacific, Atlantic and Indian Oceans *Distributed in the low latitudes from 20°N Lat. to 20°S Lat.
(6) Skipjack ( <i>Katsuwonus pelamis</i> )	Widely distributed from tropical to subtropical waters in the world. Habitat of adult fish is generally confined to waters of a temperature 20°C and above.
(7) Frigate mackerel ( <i>Auxis thazard</i> )	Distributed in almost all of the warm waters of the world.
(8) Striped marlin ( <i>Makaira mitsukurii</i> )	Same as above.
(9) Swordfish ( <i>Xiphias gladius</i> )	Same as above.

La cantidad de thons et d'autres poissons de la même famille (plusieurs sortes de thons, bonitos et merlans) qui a été pêchée dans le monde ces dernières années varie entre 1.500 et 2.000 tonnes. Ces poissons sont de grands migrateurs qui ont l'habitude de voyager en larges bancs du littoral jusqu'en plein océan. Les principaux terrains de pêche pour le thon se trouvent dans les régions situées entre le 40° de latitude Sud et le 40° de latitude Nord du Pacifique, de l'Atlantique et le l'Océan Indien.

Les deux plus grands producteurs sont le Japon et les U.S.A. La quantité de poissons pêchés par ces deux pays compte pour 50 pour-cent de la récolte mondiale.

La cantidad de pesca del atún y de otras especies (varias especies de atunes, bonitos y peces vela) llevada a cabo en el mundo está fluctuando dentro de la escala de 1.500 ~ 2.000 miles de toneladas en estos últimos años. Estos peces son muy activos en cuanto a la migración y tienen la costumbre de emigrar en grandes cantidades, desde la costa hacia el centro del océano. Las principales regiones de pesca del atún está diseminadas dentro de los límites entre el grado 40 latitud sur y grado 40 latitud norte de los mares situados en el Pacífico, en el Atlántico y el Océano Indico.

Las principales naciones productoras son el Japón y Estados Unidos de América. La cantidad de pesca realizada por estas dos naciones se estima en un 50% de la producción total en el mundo.