

# Dormant live prawns flown daily Kyushu to Tokyo



Packaging for shipment

Containers are being loaded into "Jet Cargo".  
(Offered by All Nippon Airways)

In the handling of fish and shellfish, Japan's fishery and transport industries exercise special care to assure product freshness, being well aware that this is a prime consideration in determining their market price. The demand for freshness stems from, in part, Japanese dietary habits. They include large amounts of raw seafood, consumed in such dishes as "sashimi", which is nothing more than raw fish, sliced and dipped in a succulent sauce, and "sushi", which is sliced, raw fish placed on a bite-sized lump of rice lightly flavored with vinegar.

At fish farms along the coast of Japan's southern island of Kyushu, prawns are immersed in refrigerated water for two to three hours on the morning of the day they are to be shipped as a means to retard their normal physiological functions. The prawns are then packed in cardboard boxes filled with sawdust and flown hundreds of kilometers to the nation's urban consumption centers. On arrival they are promptly sold and, within hours, released in the water tanks of fish dealers and fashionable restaurants, the whole process requiring not more than half a day.

## World Resources of Decapod Crustaceans

Decapod crustaceans, including shrimps, prawns and lobsters, are found throughout the world from frigid to tropical zones in both fresh and salt waters, shallow and deep. The density of their distribution is greater in waters lying in the tropical, subtropical and temperate zones in latitudes from 40°N to 40°S. The Gulf of Mexico, the East and South China Seas and the east coast of Africa abound in these kinds of marine products providing vast hauls every year.

In Japan, spiny lobsters, prawns and shrimps of the Crustacea Decapoda Macrura family are collectively called "ebi", they represent one of the nation's primary marine products. Annual hauls range from 50,000 to 70,000 tons, of which 70 to 80 percent are "kuruma ebi", or "kuruma" prawns. In particular, the kuruma ebi enjoys a high market value because of its excellent quality.

Among the various ebi, lobsters, being caught only in limited habitats, amount to an annual haul of only a hundred thousand-odd tons worldwide. Conversely, world catches of prawns and shrimps have recently been experiencing a gradual increase, with 1.318 million tons recorded for 1974 and 3.359 million tons for 1982. And they are just as highly valued on the world market.

Des fermes marines de Kyushu, Japon, les crevettes "ebi" sont expédiées par avions sur les grands marchés des vastes agglomérations telles que Tokyo et Osaka que se trouvent à des centaines de kilomètres au nord. Le matin de leur expédition, après avoir été mises dans un état léthargique en les plongeant pendant plusieurs heures dans de l'eau réfrigérée, les "ebi" (crevettes, langoustines et autres) sont placées dans des cartons et recouvertes de sciure de bois. A la fin d'un voyage de dix heures en avion les "ebi" retrouvent vie dans les réservoirs et aquariums des restaurants de première classe. Très bientôt elles vont réjouir l'estomac des consommateurs.

### Ressources mondiales de homards, crevettes roses et grises

Le nom japonais "ebi" est une appellation générale donnée aux crustacés décapodes: langoustes, crevettes roses et crevettes grises.

La récolte annuelle mondiale de langoustes, qui occupe un terrain de pêche très restreint, n'excède pas cent mille tonnes. En ce que concerne la récolte annuelle de crevettes roses et grises, c'est la récolte de langoustines qui est la plus importante, elle se chiffrait à 1.318.000 tonnes en 1974 et à 1.259.000 tonnes en 1975, on a constaté un accroissement dans les deux années suivantes. Ce genre de fruit de mer est une marchandise internationale de grande valeur.

En Japón las langostas son enviadas por avión desde los criaderos en Kyushu a los grandes mercados de los enormes centros urbanos como Tokio y Osaka, a cientos de kilómetros de distancia. Las gambas, quisquillas y demás crustáceos, las cuales se han convertidas inactivas fisiológicamente mediante una sumersión durante varias horas en agua refrigerada a baja temperatura, en la mañana del embarque son empaquetadas en cajas de cartón, envueltas en serrín.

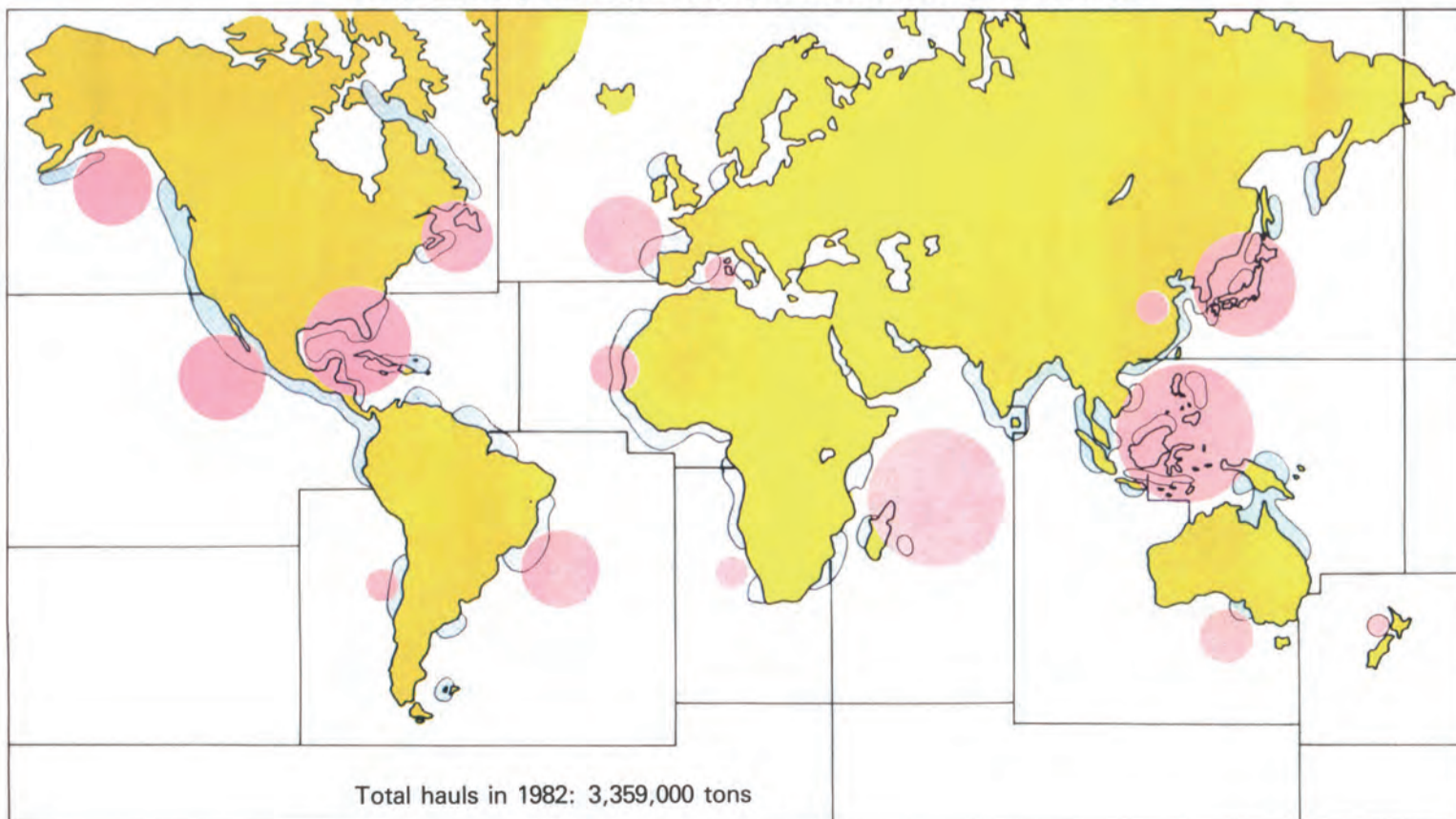
Después de unas diez horas de vuelo, las langostas llegan al final de su camino dentro de unos depósitos de agua instalados en los mejores restaurantes de la ciudad donde se van despertando de su letargo, nadando a sus anchas, para luego convertirse en succulenta cocina.

### Recursos mundiales de langostas, gambas, quisquillas

La palabra "ebi" en japonés se emplea para señalar más comunmente lo que llamamos langosta o gamba entre los crustáceos. La producción anual mundial de langostas, las regiones de pesca son muy restringidas, no excede de unas mera cien mil toneladas al año. Por lo tanto la producción mundial de gambas y quisquillas, de la que la langosta ocupa una gran porción, fué en 1974 de unas 1.318.000 toneladas y de 1.259.000 toneladas en 1975, con un aumento gradualmente apreciado en los dos años siguientes. Esta clase de producto marino es una mercancía altamente apreciada en el mercado internacional.

Yamaha Fishery Journal

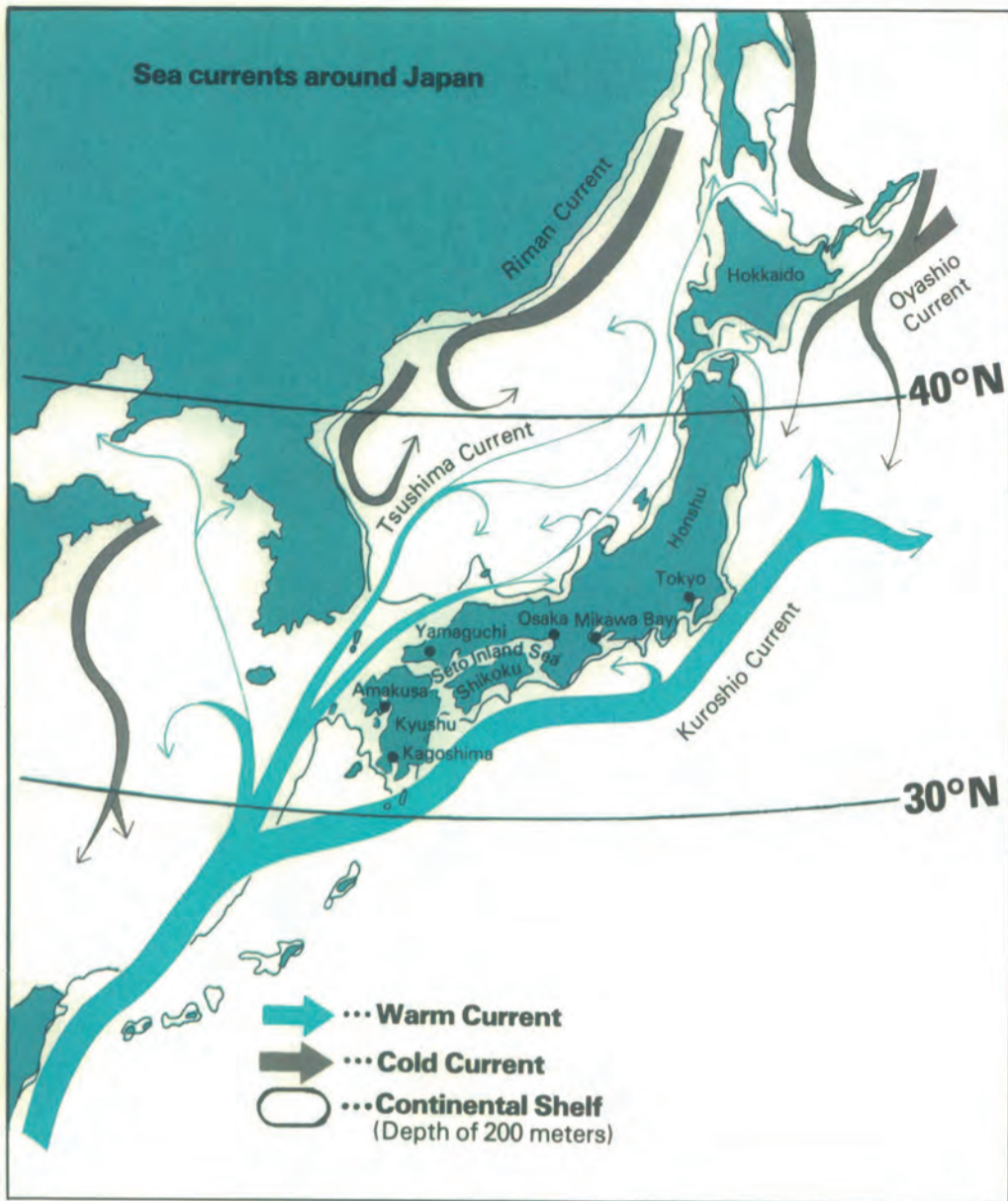
## Prawn, shrimp and similar species around the world



Total hauls in 1982: 3,359,000 tons

--- Geographical distribution of 'ebi' resources

--- Catch amount in sea area  
(Source: FAO statistics)



# Restoration or step 'Kuruma' pr farming, a n of fishery

In Japan, a very good haul of a variety of prawns and shrimps by distant-water trawlers is recorded every year, amounting to tens of thousands of tons per year. This article, however, will treat mainly coastal fishing of "kuruma" prawns.

First of all, it should be mentioned that this kind of prawn is highly valued on the world market. They lend themselves well to culture as they mature in a comparatively short period of time. (Although artificial hatching of prawns was developed some forty years ago, it was not until the 1960's that their culture began on a commercial basis.) As part of an all-inclusive program of research on prawn culture, efforts have been made to stock natural waters with their fry for later capture, and this sort of operation has been seeing full-scale application in Japan's Seto Inland Sea for several years. Thus, kuruma ebi is one of the key species in the recent emergence of culture-based fisheries taking advantage of the natural ecosystem of the sea.

## Stocking natural waters with prawns (Seto Inland Sea Fish Culture Center)

Stocking natural waters with fry is, of course, not a new means to cultivate fish. The method has long been utilized with respect to shellfish, inland water fish and salmon. Japan's Seto Inland Sea Fish Culture Center was, however, the first to employ the method with Kuruma ebi and sea-bream.

The Fishery Agency established five fish farming stations along the coast of the Seto Inland Sea in 1962 for the purpose of breeding prawn fry and raising them under protected and controlled conditions. The center produces 140 million prawn fry annually for the coastal areas of the Inland Sea and parts of Kyushu. Combined with fry produced by the prefectural fisheries ex-

perimental stations, fishery cooperative associations and private enterprises, a total of 180 to 200 million fry are released in the Seto Inland Sea every year.

Starting in 1970, we see the return of a normal level of production of prawns in the Seto Inland Sea area. The reasons behind this may be that fry resources, once damaged by contamination of coastal waters, were restored, or that the potential productivity of this area has been stimulated by the fry set free artificially. At any rate, it is clear that a close interrelationship exists between the catch and the number of fry released. (See Figs. 2 through 4) Figs. 5 and 6 depict a small-sized fishing boat with an outboard motor engaged in gillnet

Fig. 1 Life history of prawns

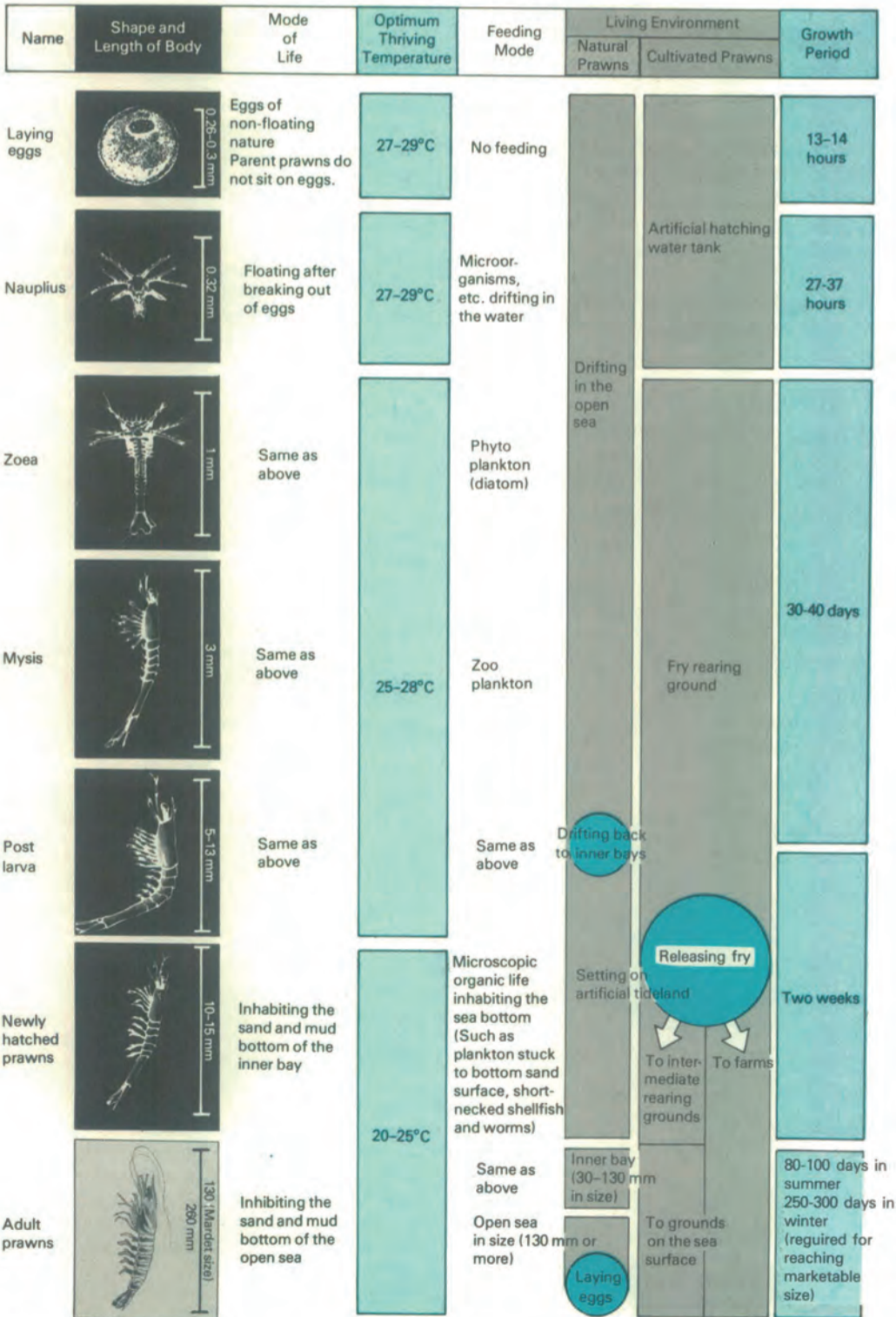


Fig. 2 Prawn distribution in the Seto Inland Sea area



Fig. 3

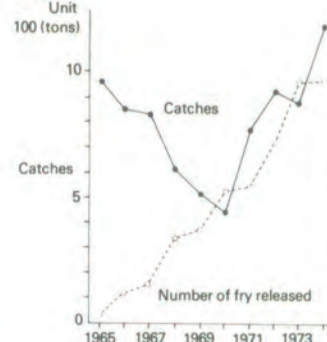
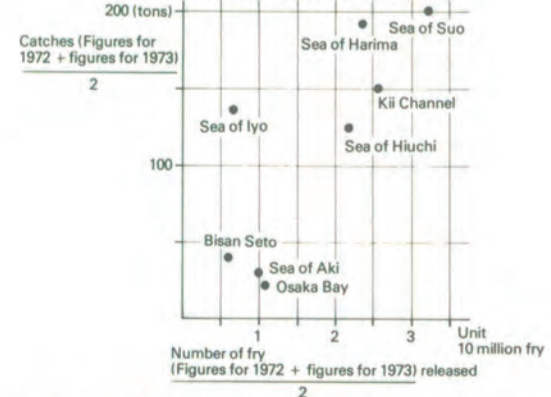


Fig. 4 Prawn catches vs. number of fry released, classified by sea area



## Fishermen have good catches once again

Fishermen engaged in gillnet fishing in the inner part of Ohmi Bay, Yamaguchi Prefecture, using small-sized outboard motors and boats up to two tons, are delighted at the number of fry that have been released in the Seto Inland Sea. The tideland along the bay, which once measured 400 ha, was reduced in half during the 1960's, resulting in a decrease in prawn catches from the

twenty tons per year once recorded to a mere five tons by 1970. In 1973 an "artificial tideland" was established as part of an overall development project in the Ohmi Bay area, and the beach was stocked with prawn fry. Since then, prawn catches here have been totaling ten to fifteen tons annually.

# -up development? awn ew system

fishing in the Ohmi Bay, while, on the open sea, a 4-5 ton diesel trawler is engaged in shrimp trawl net. The haul of prawns which have grown from fry set free on these waters consists of prawns of one year in age. The rate of recovery of the fry by local fisheries is estimated at approximately 10 per cent. (\*For details of the artificial tideland, see Dr. Kurata's comments on Page 6.)

Fig. 5 Location of Fishing Ground

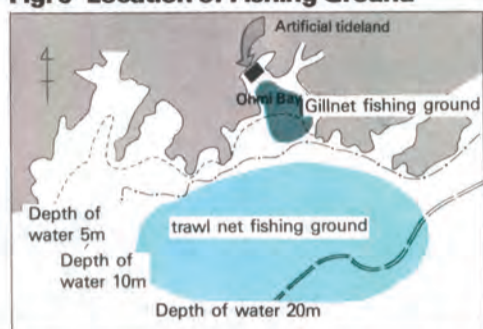
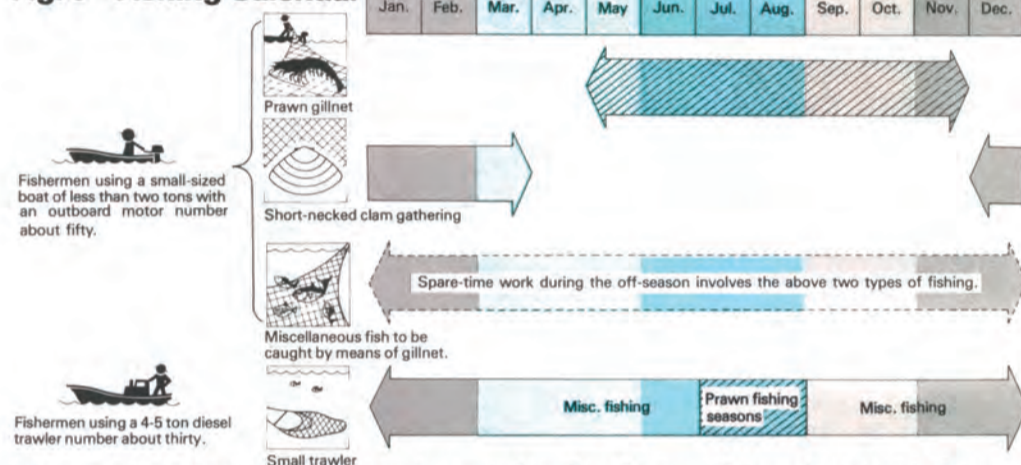


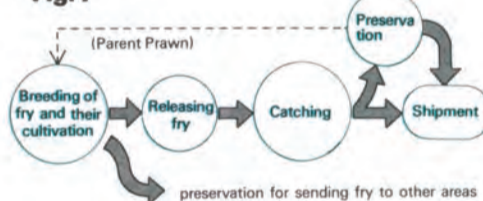
Fig. 6 Fishing Calendar



## A new fishing system is being developed by fishery cooperatives

A number of fisheries cooperative associations in Japan have been engaged in breeding prawn fry for the purpose of stocking. This system of culture-based fisheries, based on the protection of natural resources, and the reinforcement of their reproductive power, is usually to be developed by the fishery cooperative associations, as illustrated here.

Fig. 7



## Elevage de la "Langoustines" et possibilité d'une systématisation des pêcheries.

Le Japon utilise lui aussi une très grande quantité de chalutiers pour attraper sa quantité de crevettes nécessaire (des dizaines de milliers de tonnes par an). Dans ce rapport nous nous limiterons à la pêche côtière, spécialement de la kurumaebi.

Pour commencer, il nous faut mentionner que cette espèce est une marchandise internationale très estimée. Grâce à la rapidité de sa croissance, ce crustacé est idéal pour l'aquaculture. (Les premières incubations artificielles remontent à 40 ans, et l'aquaculture de production a vu ses premiers résultats positifs en 1960). En rapport avec les recherches sur l'élevage de la crevette, les méthodes de pêche comprenant le stockage des eaux et de leurs alevins sont entreprises sur une grande échelle dans la Mer Intérieure de Seto au Japon. Mais pour que la pêche à la kurumaebi puisse être adaptée avec succès à l'environnement marin, une attention particulière doit y être portée.

Cette édition présentera les cinq sujets suivants:

- (1) Alevinage de production dans la Mer Intérieure du Japon.
- (2) Rétablissement de la productivité de la pêche côtière avec l'emploi de "plages sèches artificielles". (Terrain d'élevage en mer)
- (3) Possibilité de systématisation de la pêche à la kurumaebi.
- (4) Pêche au chalut pour la prise des crevettes vivantes (voir page suivante).
- (5) Aquaculture industrielle pour le transport aérien de crevettes vivantes et son côté économique (voir page suivante).

## Cultivo de la langosta y posibilidades de pesca sistematizada

Tambien en Japón se hace uso en grande escala de escuadras de barcos equipados con redes de arrastre para la pesca en gran cantidad de toda clase de langostas, gambas, quisquillas. Se vienen a recoger miles de toneladas al año. Aquí nos vamos a limitar solamente a la pesca costal de la langosta americana. En primer lugar tenemos que hacer notar que esta especie de langosta es sumamente apreciada en el comercio internacional. Debido al hecho de que crece de un modo extraordinario en muy poco tiempo, la langosta es ideal para ser cultivada. Hace como unos 40 años que se consiguió con gran éxito la incubación artificial, y el cultivo de la langosta como empresa de base se puso en vigor en los años 1960. De paso que se fué investigando el cultivo de estos paraeidae, se fueron introduciendo nuevos métodos de pesca, incluyendo reservas de aguas marinas con crias de muestras en la región de Seto de la parte del mar interior del Japón. Las posibilidades de éxito de que el cultivo de la langosta por este medio sea factible es un asunto que está seguido con mucho interés y expectación por todos los interesados.

Este artículo comprenderá los siguientes cinco temas:

- (1) Reserva de muestras artificiales en el mar interior del Japón
- (2) Mejora de la producción de la pesca mediante el uso de playas secas artificiales.
- (3) Posibilidades de sistematización de la pesca de la langosta
- (4) Redes de arrastre para coger la langosta viva (vea la pagina siguiente)
- (5) Industria de cultivo y transporte por aire de la langosta viva y su economía (vea la pagina siguiente)

# Prawn Fisheries in Japan

## Outline of Production

The following is an outline of domestic production of prawns and shrimps by species in 1983:

(1) "Kuruma" prawn ( <i>Penaeus japonicus</i> )	6,000 tons	(a) 4,000 tons by fishing boats. (b) 2,000 tons by culture.
(2) "Ise" lobster ( <i>Panulirus japonicus</i> )	1,000 tons	
(3) "Taisho ebi" ( <i>Penaeus orientalis</i> )	ab. 8,000 tons	
(4) "Hokkoku aka ebi" ( <i>Pandalus borealis</i> )	ab. 8,000 tons	
(5) "Sakura" Shrimp ( <i>Sergestes lucens</i> )	ab. 3,000 tons	
* (6) Other various shrimps	ab. 40,000 tons	
(7) Fresh-water shrimp	ab. 5,000 tons	
<b>Total</b>	<b>ab. 71,000 tons</b>	

\* "Aka ebi" (*Metapenaeopsis barbata*), "Saru ebi" (*Trachypenaeus curvirostris*) "Tora ebi" (*Metapenaeopsis acclivis*), and "Yoshi ebi" (*Metapenaeus ensis*).

With respect to recent trends in these products, catches of lobsters, which inhabit reefy coastal zones, have been showing an annual decrease, possibly as a result of deteriorated environmental conditions through water pollution.

Catches of prawns, which predominate in the coastal areas, have also been undergoing a decrease since the 1960's, which, again, may be the result of pollution of coastal sea areas as well as the loss of natural habitats to industrial development. However, prawn production has recovered since its bottoming out in 1970, and is now at the same level as enjoyed during the 1950's, partly because of the recent fish

farming development, and partly because of increased fishing activities. The more precise reasons behind the increase in the trawler catches, though, have yet to be established.

Hauls of other species of ebi have fluctuated annually between 50,000 tons and 70,000 tons. Most typical among these are taisho ebi and hokkoku aka ebi. The former is caught by pelagic large-sized trawlers operating in the fishing grounds west of Long. 130°E in the Yellow and East China Seas, and the latter caught by offshore trawlers in the fishing grounds extending from the coastal areas along the northern Japanese islands to the North Pacific.

## Fishing Methods

Ebi fishing involves the use of various types of nets. In offshore fishing grounds, trawl fishing predominates, while, for catching prawns inhabiting coastal areas, gill net fishing plays a major role. The drift gill net method is important because of its advan-

tage in being able to catch the prawns alive (see the next page). The trawl net used by small trawlers, called "ebi kogi ami" is a beam-type which also nets squillas and aka ebi, together with prawns.

Table 1 Catches by fishing method (1983)

(Source: Ministry of Agriculture, Forestry and Fishery)

Unit: ton	Lobsters	Prawns	Others	Total
Offshore and pelagic trawlers	—	—	10,192	10,192
Coastal small trawlers	5	1,936	37,443	39,384
Other dragnet fishing (such as "Battch-ami" and boat seine)	—	20	4,865	4,885
Set net and beach seine	—	158	124	282
Others	1,174	1,464	6,192	8,830
Farming	—	1,949	—	1,949
<b>Total</b>	<b>1,179</b>	<b>5,527</b>	<b>58,816</b>	<b>65,522</b>

Fig. 8 Trend of domestic ebi production indices (1963=100)

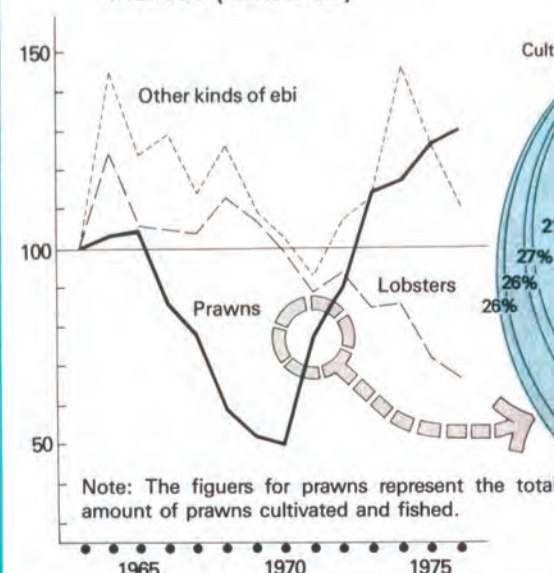
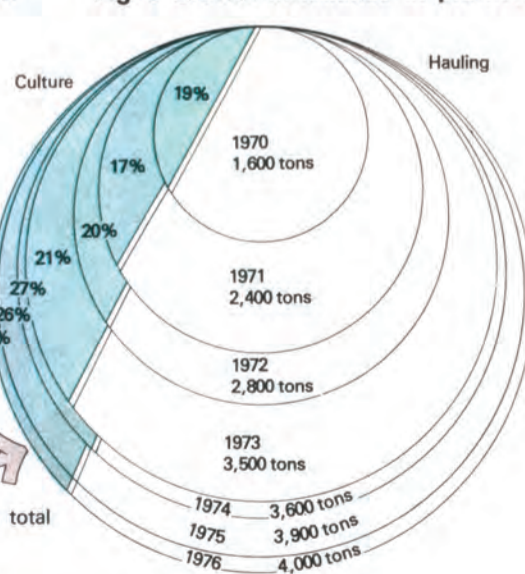


Fig. 9 Growth in catches of prawns



Note: The figures for prawns represent the total amount of prawns cultivated and fished.

## La pêche à la crevette au Japon.

De nombreuses méthodes de pêche à la seine sont employées pour la pêche à la crevette. Le chalut est principalement utilisé pour la pêche en haute mer. La pêche à la seine joue un rôle important dans la pêche à la "kurumaebi".

## Langosta cogida en Japon

Se emplea toda una variedad de métodos para pescar la langosta. Las redes barrederas son principalmente utilizadas en los sitios de pesca a distancia de la costa. Las redes de agalla juegan un papel importante en la pesca costera de la langosta.

# Drift gill nets used to catch prawns alive



Net hauling (a hauler is used to pull up a net while a searchlight is shown on the water surface)

The Bay of Mikawa, situated along the coast of the Pacific Ocean, is one of the foremost natural prawn fishing grounds off Japan. The waters are only 3-5 meters deep and extend over a soft sand and mud bottom.

The drift gillnet employed here, differing from an ordinary gillnet, features a double netting at the bottom designed to catch the product alive.

The fishing season lasts from May to Oc-

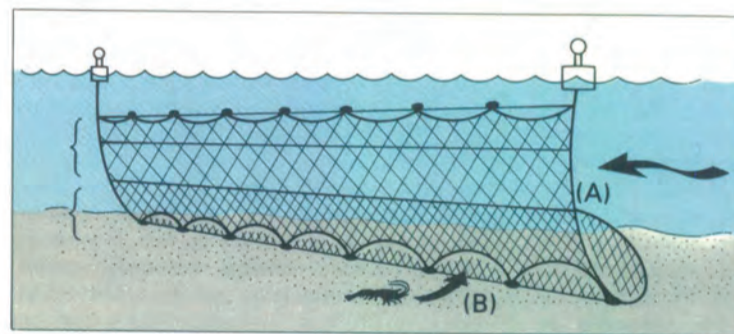
tober (spring, summer and autumn), and a bumper catch can be expected whenever there is an incoming full tide. The fishing operation is timed to begin as the ebi crawls out of the sand, immediately after sunset to search for food. Ebi movements are wide-ranging, thus demanding special care in the selection of fishing points. The haul of the first net will largely determine a day's productivity.

## Construction of the Net

- Nylon netting, 240m wide, 2-3m in height.
- The bottom of the net is folded back and woven together with the net at section (A) to form a double netting. The arch-

shaped openings at the bottom (B) allow the ebi to enter into the double netting.

- A drift gillnet will last three to four years.

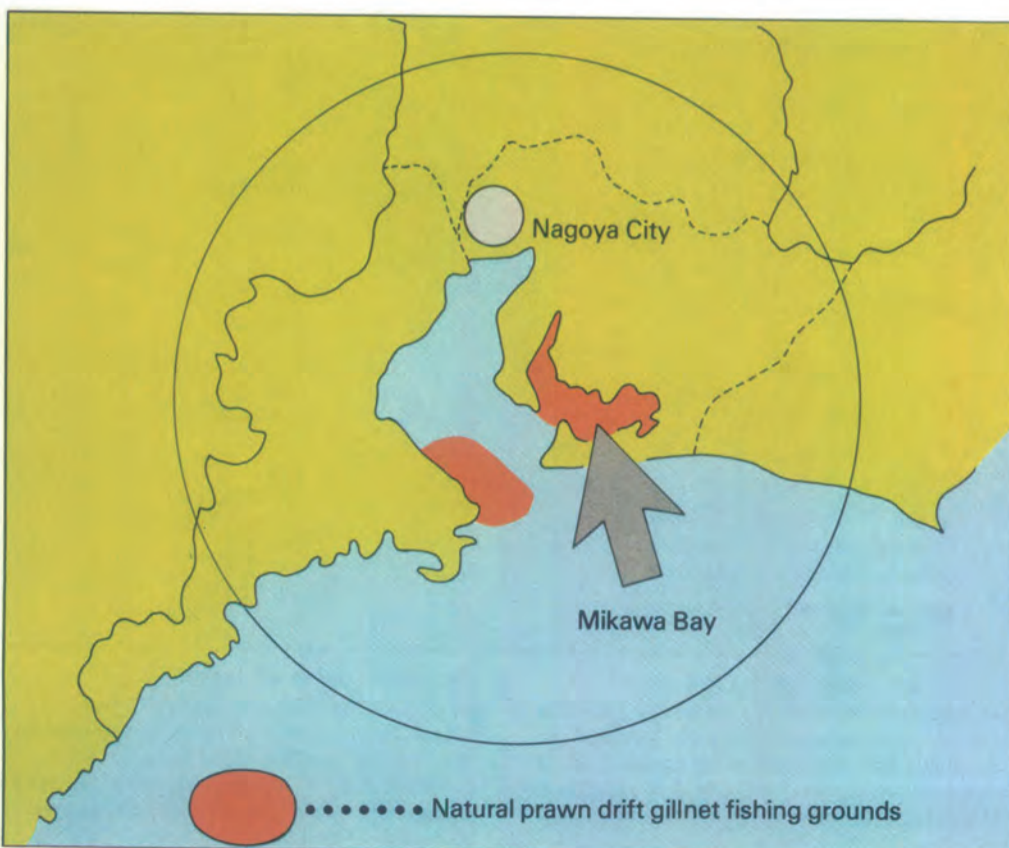


## Operation

- One floating light is cast on the sea surface.
- The net is cast from the stern of the trawler while it is moving at extremely slow speed, at right angles to the direction of the tide
- After setting the net, another floating light is cast on the water. Carried by the movement of the tide, the weighted dou-

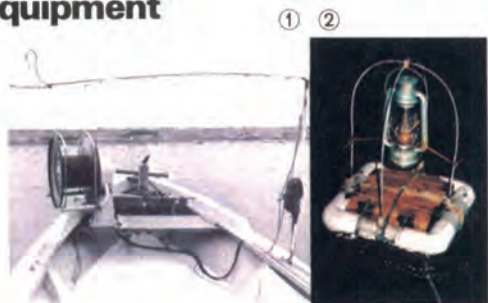
ble netting section slowly drifts over the bottom.

- After 30 to 40 minutes, the boat, taking into consideration the speed of the tide, advances close to the net to retrieve one floating light. Then it starts to haul the net by means of a motorized net hauler mounted on its fore deck.



## Major fishing equipment

1. Crawl: to transport live catches into port.
2. Net hauler: Motorized to conserve labor. (Photo 1)
3. Floating light: Flickering light to help locate the net during night operations. (Photo 2)



La Baie de Mikawa, Mer Intérieure sur la côte du Pacifique, est l'un des plus importants terrains de pêche pour la kuruma-ebi.

La mer y a une profondeur de trois à cinq mètres et le fond mou et boueux s'étend loin à l'intérieur de la baie. La méthode pêche au chalut utilisée ici, se différencie de la pêche au filet conventionnelle, par la prise des crevettes vivantes au moyen de nasses traînant sur le fond.

En la parte interior de la costa del Pacífico está la bahía de Mikawa. Esta es una de las regiones más privilegiadas para la pesca natural de la langosta en Japón. La bahía solo tiene una profundidad de tres a cinco metros, con un fondo de barro suave que se extiende muy adentro en el mar, con unas condiciones ideales para que se crían las langostas.

En lugar de la convencional red de peine se usa el método de la red de arrastre, cogiendo por este medio las langostas vivas en las bolsas que forma la red.

# Airlifting prawns

## An advantage of culture fisheries

Essentially, the aim of fish culture in Japan is to maintain the balance between supply and demand for a product and to market live fish, and not merely to augment the supply of the product.

The Japanese fish culture business has been stimulated by the desire (1) to fill the gap between supply and demand during the off-season period when natural fish and shellfish are in short supply, (2) to take advantage of the difference in prices between places of production and consumption, and (3) to profit by supplying markets with exceptionally fresh or live fish. In its early stages, fish culture was limited to seasonal short-period operation where in fish were

fed temporarily as a means to keep them and help them grow.

Since the 1960's, various types of fish culture, supported by an increased demand for more expensive fish and by the technical progress witnessed in artificial production of fishery, have been developed. Cultivated products included such expensive items as oysters, sea bream, prawns, scallops and "hamachi". The consumption of low-cost fish caught in large quantities is declining in line with the improvement of people's dietary life, while the demand for higher priced fish is on the increase, showing a definite relationship to the consumer's increasing income.

### Off-season

Natural prawns lay eggs in the Seto Inland Sea from mid-May to early September. Within five to six months the fry grow large enough to be marketable and disperse themselves along the coastal areas. The season for catching young-of-the-year prawns is September and October. Late-hatched prawns burrow into the sand for the winter and grow large enough for catching in April and May the following year. Thus, the fishing season is May through November.

The major farming grounds for prawns are in the Seto Inland Sea and the Amakusa district of Kyushu. In both, culture is programmed to permit shipment in winter, when natural prawns are unavailable. This has been made possible by the successful development of techniques for artificial breeding of prawns and water quality control. Shipments are timed for the end of the

year when prawns are in great demand and therefore demand higher prices. In actuality, however, the exact dates of the shipments vary according to market conditions.

With respect to the timing of shipment, the Hayato district in Kagoshima Prefecture, Kyushu, another place noted for the production of cultured prawns, differs from both the Seto Inland Sea and the Amakusa areas. Because the months of March through May afford neither natural nor cultured prawns, attempts were made here to put prawn farming into operation on a commercial basis to meet this need. (The Kagoshima district, characterized by open sea reefy areas, is intrinsically unsuitable for culture of prawns, and circular water tanks for prawn culture have been constructed on land.)

### Price gap between places of production and consumption

The price difference between large urban centers and the areas of production is not attributable to the supply-demand gap alone. Rather, the greatest contributing factor is the tendency of the Japanese people to give priority to seafood freshness in their dietary life.

According to the statistics for 1975 as prepared by the Ministry of Agriculture and Forestry, the variation in price between places of production and central wholesale markets in consumption centers is no more than 1.5 times in favor of the place of consumption, with respect to salted fish, but is more than four times, on the same basis of comparison, with regard to fresh fish. This difference stems from the high cost of distribution, that includes the expenses incurred in maintaining product freshness and also shipper's risks, which, in turn, are reflected in central wholesale market prices in the urban consumer districts.

### Average annual wholesale prices per kilogram (yen)

	A. 66 major fishing ports in producing districts	B. Central wholesale market prices in six large cities	B/A
Fresh fish	119	520	4.4
Salted fish (exclusive of salmon)	697	1,072	1.5

The price difference in consumer areas between live fish and fresh (dead) fish is even more conspicuous. In the producing fish-

ing villages, where dead fish is consumed with the same degree of freshness as live fish, the price differential is only 20 to 30 percent. Conversely, the difference in retail prices between the two types of products in the consumer cities is often two to three times more for live fish.

Actually, there are a number of different kinds of ebi which are caught in large quantity hauls. There are also imported frozen ebi, which are widely available on the market at reasonable prices for home use. Live Kuruma prawns, being rare and expensive items, tend to be supplied to more select consumers. Whichever the product, it is only natural that Japan's two largest cities, Tokyo and Osaka, which represent the most important consumers of live prawns, set the trend for pricing.

Producers of expensive cultured prawns usually ship them alive direct to the consumer area, bypassing the local fishery cooperative's market where daily shipments are determined. Destinations are decided by taking into consideration the trends of the other producer areas as well as conditions in the consumer markets.

The market for live Kuruma prawns does not compete with those of other kinds of ebi. As long as the high prices of live prawns are maintained in large cities, the producers find their shipments lucrative, in spite of the additional costs incurred.

Producers in Kyushu, for example, airship

live prawn to Tokyo, about 1,000 km away, at a cost of approximately 200 yen per kilogram. Naturally, some of the prawn die en route and then sell for only half as much. If the death rate grows too high the cultivators find their business in the red, thus efforts are being concentrated in rearing

prawns with greater vitality and in exercising special care in their transport. Air shipment of live Kuruma prawns is a unique practice and is supported only by the high level of consumption in the large cities.

Fig. 1. Seasonal Fluctuation in Prices of Live Prawns  
Trends of wholesale prices and arrivals by month in the central wholesale markets of six large cities



Fig. 2

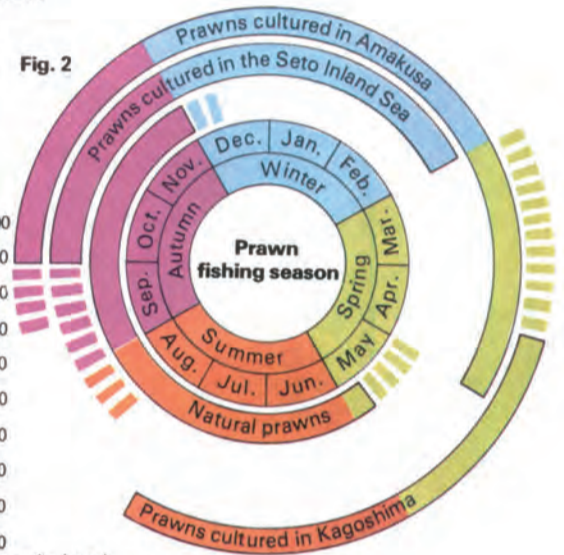
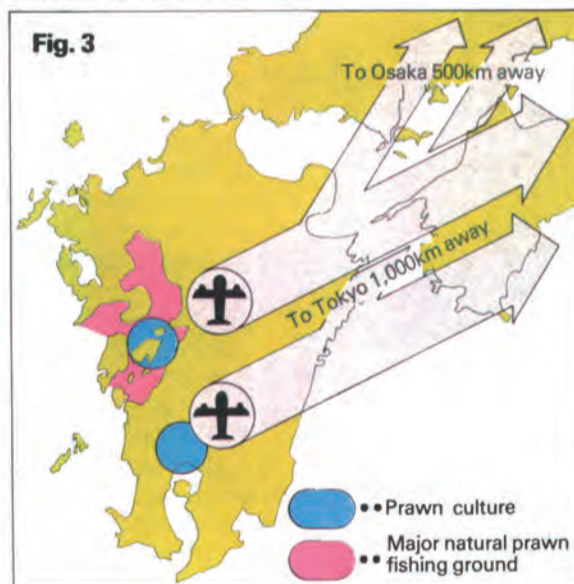


Fig. 3



### Les facteurs du développement de l'aquaculture au Japon.

Plutôt que de trouver des moyens pour augmenter leur production, les équipes de l'aquaculture japonaise ont cherché à diriger leurs travaux vers un équilibre entre l'offre et la demande des produits de la pêche.

Leurs travaux ont été encouragés par l'industrie qui a vu le moyen de faire un profit en disposant (1) d'un approvisionnement nécessaire pour équilibrer l'offre et la demande pendant la période précédant le récolte, quand les produits naturels de la mer se font rares; les avantages résident (2) dans une différence de prix entre les lieux de production et de consommation et (3) dans une marchandise de qualité supérieure offrant toujours des poissons vivants et frais. Dans les premiers stades, la priorité a été donnée au développement d'une culture sur un courte période, basée sur un accroissement saisonnier ou temporaire, ou en nourrissant les poissons pour leur donner un soutien physique pendant cette période.

Depuis le boom économique d'après-guerre, en 1960; encouragés par un accroissement de la demande pour une meilleure qualité de poissons, et par une plus grande provision d'alevins due à la technologie de leur production artificielle, d'importants projets de cultures ont été réalisés. Ces projets comprenaient diverses espèces de poissons tels que les dorades, les huîtres, les coquilles Saint-Jacques, les kuruma-ebi et bien d'autres.

### Factores envueltos en el desarrollo del cultivo de la pesca en Japon

Hasta la fecha, el papel del grupo encargado de los trabajos de investigación de la pesca de cultivo en Japón ha estado más bien preocupado por nivelar las peticiones de los productos de pesca más que de buscar medios para aumentar la pesca de estos productos.

Su trabajo ha sido llevado y motivado por el deseo establecido por la industria de conseguir unos resultados y un provecho que se avalasen por sí mismos de (1) tiempo entre pedidos y entrega durante el período anterior a la recogida, cuando la pesca natural se agota, (2) los diferentes precios entre las regiones de producción y las de consumo, (3) la superioridad y ventaja de que la mercancía este viva y sea fresca. Durante los períodos iniciales, se dió la prioridad al desarrollo de períodos cortos de cultivo planeados de acuerdo con el tiempo del año, o al cultivo temporal y también a la cría de pesca con el fin de engrosar físicamente su número durante este período.

Ayudado por las crecientes demandas desde los años 1960 de pesca de alta calidad, el crecimiento de la postguerra y la creciente aportación de las muestras como resultado del desarrollo técnico de la producción artificial, toda una serie de proyectos para el cultivo en grande escala ha sido puesto en acción. Varias especies de pescado están incluidos en este cultivo, entre estos las ostras, venera, langostas y otras muchas.

# Artificial tideland and its effects on prawn breeding



Dr. Kurata

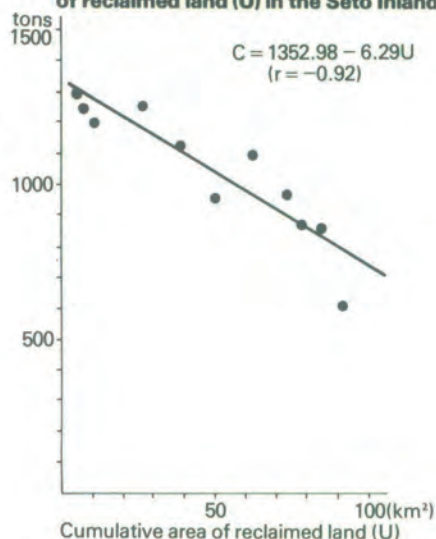
Dr. Hiroshi Kurata, shrimp biologist, Nansei Regional Fisheries Research Laboratory, Ministry of Agriculture and Forestry, explains as follows:

## The productive power of artificial tidelands

The tideland presents a unique ecosystem, different from those of either land or sea and is indispensable in maintaining fish resources because it plays a vital role in facilitating the growth of young fish. For example, as is shown in Fig. 1, Kuruma prawn have been decreasing in direct proportion to the amount of natural tidelands lost to land reclamation for industrial and agricultural purposes.

Fish culture centers were originally

Fig. 1 Prawn catches (C) vs. cumulative area of reclaimed land (U) in the Seto Inland



designed to make up for this loss of natural fish resources by means of stocking. The recent recovery of Kuruma prawn production in the Seto Inland Sea is considered to be the result of stocking efforts. However, the increased haul in recent years cannot be wholly attributed to these efforts; it is quite probable that both the ban imposed on the use of certain agricultural chemicals and the resulting effects in added reproduction have helped in this improvement.

## The critical periods for fry survival

The technique of stocking waters with Kuruma prawn fry undergoes a two-stage crisis. First, the number of fry shows a remarkable decrease during the twenty-four hour period following their release. The characteristics of the fry themselves plus the environmental conditions into which they are released greatly effect their rate of survival. Secondly, fry which manage to survive the first stage of the crisis settle on the tideland and, as they grow, disperse into the area off the coast, when they fall victim to gobies and other predators, resulting in a second major decrease in their numbers.

During a five year period from 1970 to 1974, the National Nansei Regional Fisheries Research Laboratory, in cooperation with the Prefectural Inland Sea Marine Experimental Station and the Agricultural Engineering Research Station, embarked on wide-ranging research concerning the development of supplemental fish farming grounds in shallow water regions. In the course of the project, the idea of forming an artificial tideland emerged as a means to rear Kuruma prawn fry. The idea was put into practice in 1973, and several attempts made during the ensuing years to release the fry in these sea areas have demonstrated the fact that this newly developed land greatly contributed to improved fry survival. At the same time, the new project was found to be helpful in the promotion of fisheries operating in nearby regions, as well.

Thus, the life of artificially hatched fry between the time they settle in the tideland and the time they grow to about 3 cm in length, is extremely unstable; especially when compared with the conditions over the same period for natural fry.

The mortality rate for natural fry is about 10 per cent per fifteen days, while that of artificially hatched fry is from 10 to a whopping 60 per cent, depending on the environmental conditions. Much more care should be given to the latter's adaptability to environmental conditions, as their distribution is sometimes rather uneven within the breeding ground.

## Artificial tideland reinforces natural reproductive power

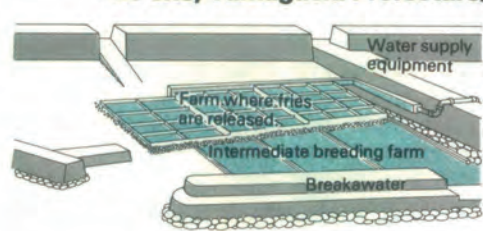
An artificial tideland duplicates a number of environmental conditions found on a natural beach at ebb tide which are conducive to the growth of Kuruma prawns—conditions such as the ground level relative to the tide level, the depth of the tide remaining, etc.

The artificial tideland is designed to control environmental conditions so that they will be the most favorable for fry to grow. The new system not only means the recovery of lost natural tidelands; it also promotes natural productive power as a means to enable scheduled production of Kuruma prawns. By stocking the waters with Kuruma prawn fry, the system provides the following three advantages:

- (1) Increased prawn production.
- (2) Stabilized production through adjustment of the time fry are released.
- (3) Prawns not caught are added to the natural reproduction resources.

The economic effects of artificial tideland on local fisheries can be assessed with fair certainty. However, the techniques for making quantitative analysis and controlling the production of marine life over a large expanse of sea has yet to be developed. Still, the artificial tideland certainly constitutes an essential technical base for the further development of Kuruma prawn farming.

Fig. 2 Artificial tideland (Ohmi Bay, Aio-cho, Yamaguchi Prefecture)



## Concept d'une "Plage Sèche Artificielle": Effet expérimental de l'aquaculture sur plage sèche

Pendant une période de cinq ans, de 1970 à 1974, le Laboratoire de Recherche pour les Pêcheries Régionales de Nansei en coopération avec l'Institut Expérimental des Pêcheries en Mer Intérieure de la Préfecture de Yamaguchi et l'Institut de Recherche en Agronomie, ont conduit leurs travaux vers l'aménagement de terrains de pêche pour l'élevage dans les régions peu profondes de la mer. Pendant ces recherches, "des plages sèches" ont été mises à l'étude. Lors d'une expérience qui a été réalisée pour la première fois en 1973 et qui depuis, s'est répétée plusieurs fois chaque année; on s'est aperçu, en stockant les alevins, que les plages sèches artificielles pouvaient contribuer énormément à la survie des poissons. Cette expérience a aussi donné un résultat non négligeable, la plage sèche apporte un accroissement régulier à la production piscicole des régions environnantes.

## Productivité d'une "Plage Sèche".

La plage sèche (= zone internationale sur fond peu profond) a un caractère écologique particulier qui na rien à voir avec ceux de la mer ou de la terre.

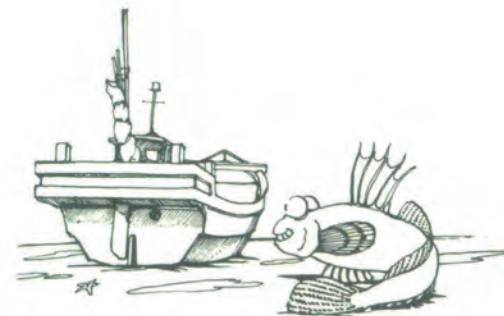
Elle offre un terrain pour l'élevage des poissons, des coquillages et des crustacés. Elle est indispensable à la survie des ressources piscicoles. Un exemple nous montre que la diminution des prises de la kuruma-ebi dans la Mer Intérieure du Japon est proportionnelle à la perte des régions de plages sèches causée par la construction de zones industrielles ou par des réclamations de l'agriculture.

Avec le stockage de plantes marines préparées par les centres d'aquaculture de diverses localités, on a tenté de suppléer artificiellement les ressources naturelles devenant rares; le rétablissement de la productivité dans la Mer Intérieure a été très concluant. Il est difficile, malgré tout, d'attribuer tout cet accroissement de la production au stockage seulement. L'interdiction d'utiliser certains produits chimiques pour améliorer l'environnement ou la reproduction des crustacés, a aussi été un facteur qui a contribué à l'augmentation des prises.

## Dangers pour les alevins.

Les kuruma-ebi placés sur plage sèche sont exposés à deux dangers. Premièrement, vingt quatre heures après le stockage des kuruma-ebi, on peut constater une nette diminution des alevins; le taux de survivance dépend spécialement des caractéristiques des alevins et de leur environnement. Les alevins survivants vont passer quelques temps sur la plage sèche, en grandissant ils vont étendre leur lieu de résidence. Malheureusement dès le début ils seront la proie des prédateurs.

Depuis leur placement sur plage sèche jusqu'à ce qu'ils aient atteint trois centimètres de longueur, la vie de alevins est beaucoup plus précaire que celle des alevins vivant en liberté. Le taux de mortalité chez les alevins libres se situe à un niveau de 10% pendant un cycle de marée de 15 jours, pour les alevins de production ce chiffre passera de 10 à 60%, tout dépend des conditions de l'environnement. L'adaptation à l'environnement des alevins de production ainsi que les dangers qui les menacent devront donc toujours être pris en considération.



## Concepto de la Playa Artificial Seca Efecto experimental de la playa seca en el cultivo

Durante un período de cinco años -desde 1970 hasta 1974- el Laboratorio de Investigación de la Pesca Regional NANSEI, en cooperación con el Instituto Experimental de la Pesca en el mar interior del Japón de la Prefectura de Yamaguchi y el Instituto de Investigación de Ingeniería Agrícola, realizó unos estudios sobre el desarrollo de sitios de pesca para la cría y el cultivo en regiones poco profundas del mar. Durante el período de esta investigación se ideó la "playa seca" en un experimento que se llevó a cabo en 1973 y que se ha ido repitiendo varias veces cada año desde entonces. Se encontró que a través de reservas de alevinos, estas playas secas artificiales marinas podían contribuir en gran manera a la preservación de los peces jóvenes. También se consiguió con estos experimentos el notable resultado de que una playa seca da lugar a un crecimiento estable de la producción de la pesca en las regiones cercanas del mar.

## Productividad de una playa seca

Una playa seca (zona internacional con playas de poca profundidad) tiene una ecología peculiar diferente tanto del mar como del continente.

Estas playas secas dan pie a la cría de peces de distinta variedad. Son también indispensable para el mantenimiento de los recursos de pesca. Para poner un ejemplo, la pesca de la langosta (kuruma-ebi) en el mar interior del Japón, va menguando en proporción con la mengua de playas secas, debido al resultado del incremento de las zonas industriales o de reclamación agrícolas. Las reservas de alevinos preparados por los centros de cultivo de pesca en varias localidades, están previstas para suplir artificialmente los recursos naturales en momentos de escasez y han demostrado ser de gran valor para el aumento de la productividad en el mar interior del Japón.

## Peligro de ataque a los alevinos

Las reservas de crías de las langostas "kuruma-ebi" están expuestas a dos peligros. En primer lugar se aprecia una notable reducción en el número de las crías dentro de las 22 primeras horas de su formación. La proporción que sobrevive fluctúa grandemente y depende en gran parte de las características de las crías que logran sobre vivir a través del proceso de crisis que sigue al período crucial de formación, éstas, se establecen por un tiempo en la playa seca. Conforme van creciendo se van moviendo hacia el exterior con el fin de extender el sitio en que viven. En estos dos procesos es cuando caen víctimas de toda serie de predadores que se alimentan de ellas.

Desde el momento en que se establecen en la playa seca hasta que llegan a crecer como unos 3 centímetros, la vida de estas crías cultivadas artificialmente es mucho más precaria que las de origen natural.

Mientras el valor de pérdida de las crías naturales se mantiene a un nivel constante de 10% todo el ciclo de la marea de 15 días, las crías cultivadas artificialmente se ven reducidas de un 10% a un 60% según sea el medio ambiente en que se desenvuelven. La adaptación de las crías artificiales al medio ambiente, así como el riesgo de su distribución en grupos debe de ser tenido muy en cuenta durante el cultivo.

# Particular Importance of Coastal Fisheries Development

Yamaha, recognising the importance of the promotion of coastal fisheries in developing nations, has been making major efforts for the spread of small-sized FRP fishing boats, outboard motors and marine diesel engines.



Grouping of Japanese fisheries

Water area	Classification	Size of fishing boat used (Gross tons)	Major fishing methods									Number of fishing boats	Production in quantity (tons)	Production in value (¥billion)	
			Shellfish alga gathering	Angling	Long line	Gillnet	Square net	Haul seine	Roundhaul	Trawl net	Skipjack tuna fishing				Whaling
Inland waters	Fishery with fishing boats and fish farming	0 - 3	Miscellaneous									19,000	211,038	179	
Marine Waters	Coastal fishery	Fish farming	0 - 5	Fish farming, shellfish farming, seaweed farming									393,000	3,485,092	970
		Set net, beach seine	0 - 20	Floating fish, like yellowtail, tuna, skipjack, mackerel, horse mackerel, etc.											
		Small-sized fishing boats	0 - 1	●	●	●	●	●	●	●	●	●	●	●	
		Medium-sized fishing boats	1 - 5	●	●	●	●	●	●	●	●	●	●	●	
	Offshore fishery	Small-scale fishery	20 - 50	●	●	●	●	●	●	●	●	●	●		
			50 - 100	●	●	●	●	●	●	●	●	●	●		
	Pelagic fishery	Small- and -medium scale fishery	100 - 1,000	●	●	●	●	●	●	●	●	●	●		
Large-scale fishery (Mothership type)		100 - 4,000	●	●	●	●	●	●	●	●	●	●			
		1,000 - 20,000	Mothership type (floating cannery and transport ship)									3,000	4,795,152	799	

- 1984 statistics of the Ministry of Agriculture, Forestry and Fishery
- 1983 statistics of the same

Note: There are several different ways to interpret the definitions of "coastal fishery", "offshore fishery", and "pelagic fishery", and therefore, Japanese fisheries are grouped, here, by the size of the fishing boats used. All data are precise enough to clearly show the general situation of Japanese fisheries.

Since the beginning of the twentieth century, the world's advanced nations with regard to fisheries, including England, Norway, America and Canada have made rapid progress in their marine fish production and processing techniques, resulting in the emergence of highly systematized marine fishery enterprises. At the same time, the emphasis has shifted from inshore to offshore and pelagic fisheries, with a trend toward large-sized fishing boats. As a result, the individual fishermen engaged in coastal fishing began to work as employees aboard fleets of these fishing boats, accelerating the decrease in small-scale, self-employed, coastal fishery operations. At present, such efficient fishing methods as otter-trawling and purse seining, which enable large quantity catches, are predominant in these nations. In the meantime, Japan has made remarkable progress in (1) mothership or independent ship type large-scale trawling (2) tuna and skipjack fishing, (3) mothership type crab fishing, (4) and mothership type salmon fishing. These are effective for pelagic fishing by large-scale fleets of fishing boats. Along with these developments, Japan has seen the development of medium-scale, offshore fishery using fishing boats of 30 to 100 gross tons. These include (5) trawlers, (6) purse seiners (7) saury pike stick-held dip netters, (8) squid angling boats, which now number in the thousands. Moreover, in the seas along the coasts of Japan, some four hundred thousand fishermen are now engaging in fishing along with shellfish and seaweed gathering using (9) small-sized motorized boats of 1-5 gross tons (in certain areas 5-30 gross tons).

The present Japanese methods of fishing are so varied that they include almost all types of fishing tools and boats now being employed in the world today. The Japanese fishing industry is characterized by the coexistence of a number of self-employed, small-scale fishermen with large and medium-scale fisheries. The history of Japan's development in fisheries clearly shows evidence that technology and social conditions must be in harmony from the early stages of development for the fisheries to reach a highly developed stage. The development, of course, has not always been well-balanced. However, Japan's fisheries, based on long traditions, have made steady progress to rise to a place among the highly industrialized nations. For fishing to emerge as an independent industry, it was necessary to meet the following conditions:

- Development of communities of fishermen with the aim of stabilizing the production and supply of marine products. In other words, organization of fishing villages, usually by means of fishery cooperative associations.
- Linking the fishing areas with the cities. This refers to the commercialization of marine products. In addition to these two conditions, another technical condition had to be satisfied. That is, linking the development of techniques for catching fish and preserving and processing the marine products.
- Motorization of fishing boats and development of related equipment.
- Improvement of fishing gear and methods.
- Development of processing and preservation techniques.

With these conditions fully satisfied, man has managed to turn the expanse of the seas into productive areas for fishing activities. However, in making efforts to promote fisheries in developing countries, first priority should be given to the fostering of small-scale coastal fisheries. For, this leads to the improvement of living conditions for a large number of fishermen operating on a smallscale, and this, in turn, makes possible a stabilized supply of marine products. Moreover, along with the efforts to promote coastal fisheries, efforts should also be made to consolidate distribution networks, and improve refrigerating and processing techniques. Then, the economic value of marine products will increase. With these basic conditions fully met, countries will find it easy to develop into offshore fisheries, based on primarily medium-scale operations. Medium-scale fisheries are oriented towards production in large quantities and selective production, with the result that marine products suitable for export will begin to contribute to the development of their national economies. With the advent of the 200 mile fishing zone, the marine resources located within a country's boundaries will represent a major economic resource which can greatly help in establishing a stronger national economy. However, in developing these resources, it must be remembered that, as mentioned earlier, technical progress should be made on the basis of planned schedules so that coastal fisheries may be gradually developed towards offshore fisheries.

## Yamaha Hokkaido's Full Go-ahead

### Specialized in fishing boat building

The photo shows the inside view of "Yamaha Hokkaido Manufacturing Co., Ltd." which was completed in the fall of 1977. The plant is located on the coast of Funka Bay, one of the traditional fishing grounds off Hokkaido, the northernmost of the four main islands of Japan. This marks the fifth plant specialized in the manufacture of FRP fishing boats established by Yamaha at sites selected from among the bases for coastal fisheries across the nation.

- The small-scale coastal fisheries off the Japanese islands are characterized by distinct regional differences, leading to varied methods used in catching fish, as well as differences in types of fishing boats, even though they catch the same kind of fish. This makes it necessary to promote service by area through the provision of such fishing boats which are not only easy to handle, but also meet the specific requirements of particular fishing methods employed by fishermen in different parts of the country.



Production process of Yamaha small-sized fishing boats

- The plants being located at the fishing sites help resolve the problem of transportation of products, and also contribute toward designing to local standards and towards stabilized supply of mass produced boats.
  - Yamaha's service personnel and planning staff are stationed in respective plants and are in close contact with their clients. As a result, more precise understanding of market trends as well as the requirements of clients may be immediately reflected in the production activities.
- The modernization of fisheries basically involves processes of promotion of improvement, with the existing conditions of the traditional fisheries being taken into consideration. Yamaha pursues the same approach both at home and abroad, in order to promote the spread of its FRP fishing boats, outboard motors and diesel engines.

### Le but de Yamaha est de connaître les besoins de toutes les sortes de méthodes de pêche.

La photo nous montre une vue générale de "Yamaha Hokkaido Manufacturing Co., Ltd.", qui a été inaugurée en automne dernier. Cette usine se trouve sur la côte de la Baie de Funka, l'un des terrains de pêche traditionnelle d'Hokkaido, la plus au nord des quatre grandes îles japonaises. C'est la cinquième usine spécialisée dans la fabrication des bateaux de pêche, que Yamaha a construit; ces usines sont toujours placées sur des sites choisis parmi les bases de pêche côtière à travers le pays.

Grâce à la zone de pêche des 200 miles, les ressources marines se trouvant dans les eaux territoriales représenteront l'une des plus importantes ressources économiques, elles seront une aide précieuse pour la fondation d'une économie nationale. Mais, pour développer ces ressources il ne faut pas oublier que des progrès techniques devront être fait sur la base d'un programme annuel de façon à ce que la pêche côtière puisse être graduellement dirigée vers la pêche en haute mer.

### El objetivo de Yamaha es satisfacer las más variadas necesidades de todos los métodos de pesca

En la foto puede verse una vista completa de la planta "Yamaha Hokkaido Manufacturing Co., Ltd.", la cual fue completada a fines del año pasado. Esta se encuentra situada sobre la costa de la bahía Funka, una de las tradicionales pesquerías frente a Hokkaido, la isla más septentrional dentro de las cuatro islas principales que forman el archipiélago japonés. Con la construcción de ésta, ya suman cinco las plantas especializadas en la manufactura de barcos pesqueros establecidas por Yamaha en lugares seleccionados a lo largo de la nación.

Con el establecimiento de la zona pesquera de 200 millas, los recursos marinos que se encuentran dentro de esos límites representarán una de las mayores fuentes económicas que ayudarán enormemente al establecimiento de una base económica nacional. Sin embargo, para la explotación de estos recursos marinos es necesario recordar que el desarrollo técnico debería hacerse sobre la base de programas anuales de modo que la pesca costera pueda ir cambiándose gradualmente a distancias más cercanas de la costa.

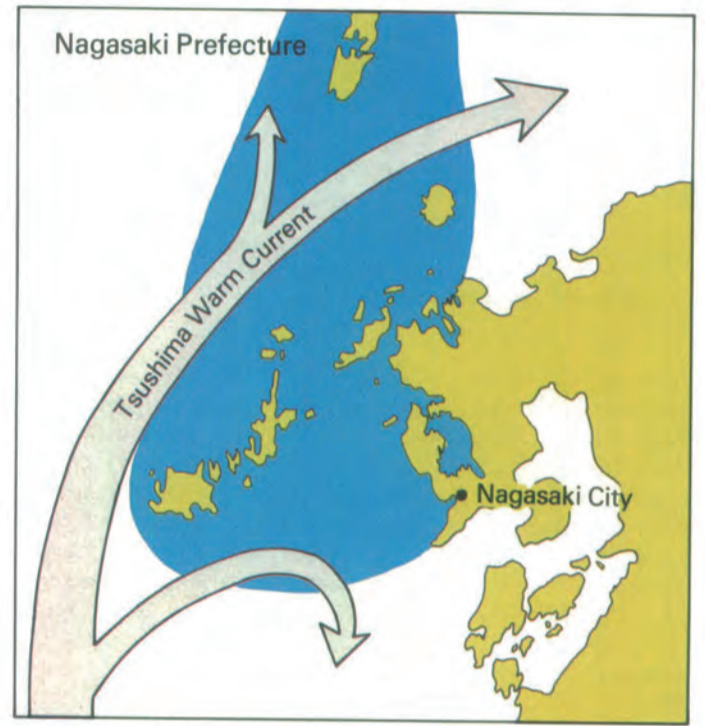


Yellowtail angling—Ohseto

# High Priced Fish

Geographical grouping of coastal fishing grounds

Open seas	Unbroken coastline
	Rias coastline
	Peninsula salient
	Inlets of a large bay
	Seas dotted with islands
Inland seas	Sand and mud zones
	Reef zones
	Lagoons
	Brackish waters
Inland waters	Rivers
	Lakes and ponds



**Red sea-bream**  
*Chrysophrys major*



**Yellowtail**  
*Seriola quinqueradiata*



**Grunt**  
*Parapristipoma trilineatum*



Spiny lobster gillnet  
—Ioh Island



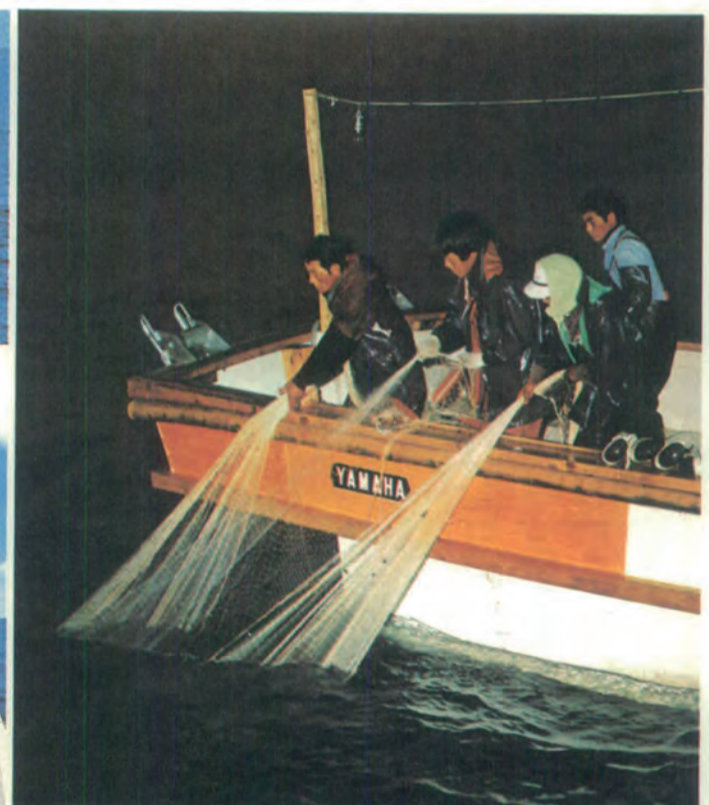
Parrot fish drive-in net (driving fish into a gillnet by throwing a heavy bat into the water)—Ioh Island



Small-sized set net — Gotoh Island



Yellowtail long line—Iki Island



Red sea-bream "gochi ami"  
( a kind of small-sized purse seine)—Hirato Island

Nagasaki Prefecture has an area measuring 4,086 Km<sup>2</sup>, about one ninetieth the total area of the Japanese islands (372, 488 Km<sup>2</sup>). Notwithstanding this, the prefecture has a total coastline of 2,700Km, indeed about one sixth of Japan's combined coastlines of 16,218 Km. The whole of the prefecture, as it were, forms a large peninsula, featuring the jagged coastline peculiar to Rias coasts and a number of detached islands, giving the prefecture a varied topography.

Nagasaki Prefecture constitutes a major fishery base for large and medium-sized purse seine fishing boats and trawlers, operating over the East China Sea and the Yellow Sea continental shelf areas. Also, small-sized fishing boats, with their bases dotted along the coastline of the prefecture  
Yamaha Fishery Journal

busily engage in coastal fishery, catching a variety of fish every day. Of these coastal fishing boats, an overwhelming percentage consists of small-sized boats of 1-5 gross tons, accounting, in all, for some 10 per cent of such types of fishing boats operating nationwide. These small-sized boats rely mainly on such fishing methods as angling, long line, gillnet, small trawling and shellfish and seaweed gathering. Boats from some of the detached islands operate set nets.

The fishing grounds of Nagasaki Prefecture are located where the Tsushima Current diverges from the Warm Black Current, with many upwellings resulting from the complicated coastal topography. These fishing grounds are rich in sardine, horse mackerel, mackerel, yellowtail, saury-pike,

squid, etc. The kinds of fish caught by the coastal fishery using small-sized fishing boats are mainly high-priced fish such as horse mackerel, yellowtail, "Isaki" and squid (these belong to pelagic fish resources) as well as the sea bream living near the sea bottom.

La Préfecture de Nagasaki constitue la plus importante base pour les bateaux de pêche à la seine et au chalut de gros et moyen tonnage, qui opèrent sur une vaste étendue allant de la Mer de Chine de l'Est à la Mer Jaune. Les petits bateaux de pêche, avec leurs ports d'attaches le long des côtes de la préfecture, sont eux aussi très utilisés pour la pêche côtière, attrapant chaque jour de nombreuses sortes de poissons.

La Prefectura de Nagasaki constituye una de las principales bases pesqueras para barcos de tamaño mediano o grande equipados con redes barrederas que operan sobre la extensa plataforma continental que se extiende en el Mar de la China Oriental y el Mar Amarillo. Los barcos de pequeño tamaño, con sus bases a lo largo de la costa de la prefectura, se dedican diligentemente a la pesca costera, jalando diariamente con sus redes grandes cantidades de peces de variadas especies.