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—Small-scale gillnet fishery—

A practical method for the effectual development of coastal fisheries

Gillnet fishery features a handy fishing method using a small one-man boat and the net of the simplest configuration of all. This fishery with a long history is widely operated in coastal and inland waters around the world.

In this issue we will take up this fishery, especially small-scale coastal gillnet giving specific emphasis to the following two points:

(1) Its fishing method is simple and outlay in fishing gear is relatively small. For this reason this fishery should be considered as a very practical method for the effectual development of coastal fisheries especially in fishery developing nations.

(2) While the fishing gear in use is simple in construction, its function must be sophisticated with high performance potential. Therefore, in any attempt of fishing ground development by this fishery, the fishing gear must be designed so that it fits the habit and behavior of the fish as sought and sea conditions of the fishing ground concerned as much as possible.

In this issue, we have illustrated the interrelation between the characteristics (body shape, size and behavior) of the fish as sought, and the corresponding function and performance of gillnet fishing gear as clearly as possible, based on actual examples.

In general, from its catching frequency the gillnet fishing gear has two different sorts of functions, emmeshing and tangling.

In designing a modern gillnet fishing gear, the following two points are taken into consideration:

(1) How to increase the catching frequency.

(2) In connection with the above, to what extent we should count the fish species selectivity of fishing gear.

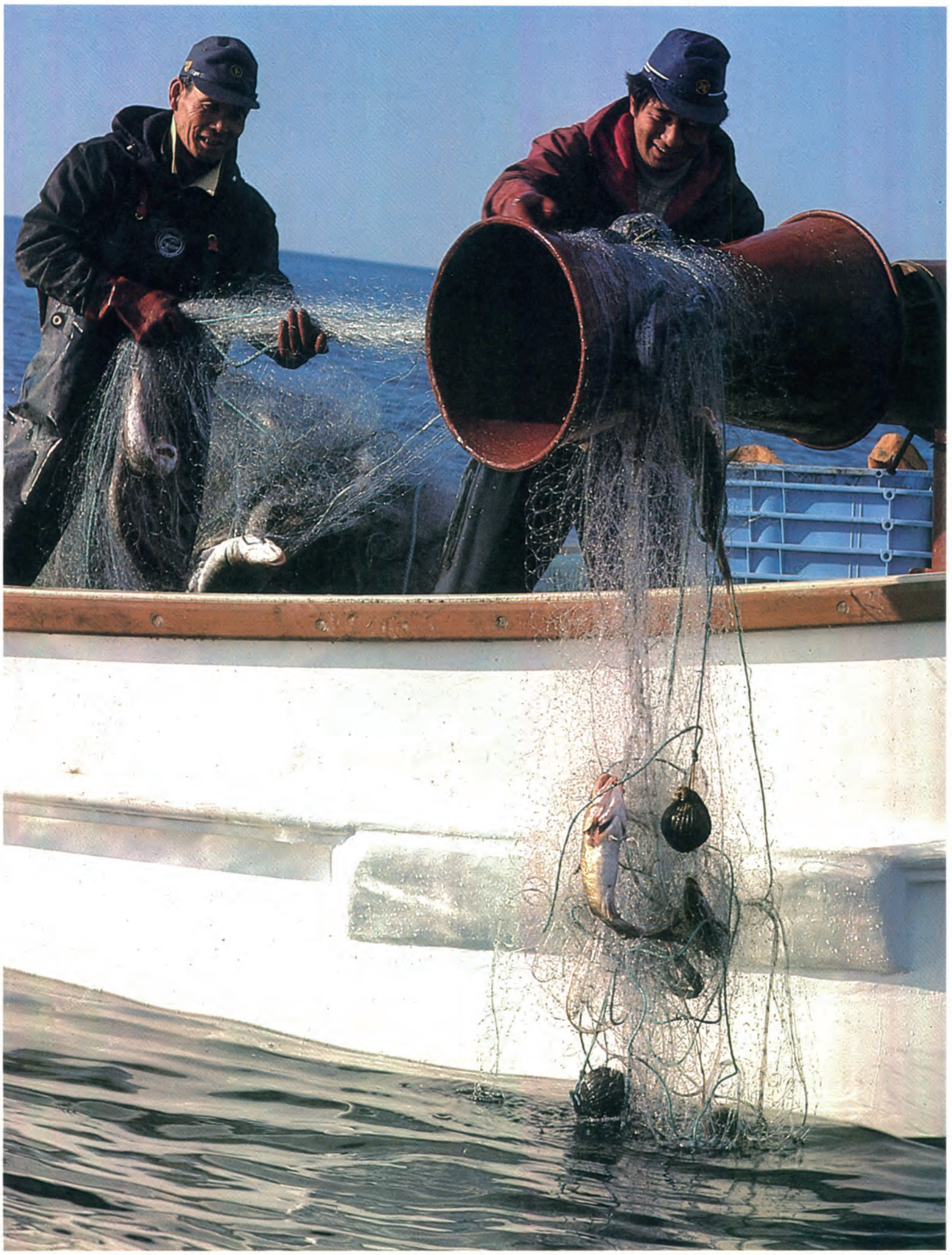
While the mesh size is a crucial factor in catching the fish, it also selects the fish caught by body size or shape. Therefore, in designing a gillnet fishing gear the fisherman designer must select a type that would serve his particular purpose best. In addition, much importance must be given to corresponding design particulars as well.

In this issue, since we will be discussing only small-scale coastal gillnet fishery, we will not be concerned with the following offshore and pelagic gillnet fisheries by middle and large-size boats:

a) Salmon and Trout Gillnet Fishery
b) Tuna and Swordfish Large-mesh Drift-gillnet Fishery
c) North Pacific Squid Drift-gillnet Fishery
d) Small-Scale Gillnet Fishery in Inland Waters

Small-scale coastal gillnet fishery in Japan is conducted by single-boat operations using powered boats of up to 10 tons, however, the large majority of the operations use boats of 5 tons or less, which make up 90% of the total in this type of fishery.

The scale of business that the coastal gillnet fishing family is engaged in can be divided into three levels; those operating powered boats of one ton or less, powered boats of 1 to 3 tons, and powered boats of 3 to 5 tons.



The Types of Fish Caught, Fishing Grounds, and Net Classification

The Fish Caught

Table 1 shows the amount of important fish catch by gillnet fisheries. With the exception of salmon, trout, tuna, and marlin family fishes, plus flying squid, these are all important types of fish caught by small-scale coastal gillnet fisheries.
The figures for flatfish, cod, Alaska pollack, and atka mackerel are far larger than other species because they include mass-catches made of these cold-current fishes in the waters of northern Hokkaido.
Small-scale coastal gillnet fishery is conducted in every region of Japan, and the fish that are caught cover an amazingly wide range of species from ocean-migrating surface fishes to bottom habitat fishes and crustaceans. However, the object of most fishermen involved in small-scale coastal gillnet fishery in Japan today is to commercialize their businesses by catching a particular kind of fish in particular water areas. (Of course, these catches still remain mixed with a considerable number of miscellaneous fishes.)

Table 1 Amount of catch by species for all gillnet fisheries

☐ **Coastal waters**

Species	Catch amount (tons)	Species	Catch amount (tons)
Skipjack	4,230	Black porgy	1,325
Shark	3,817	Spanish mackerel	2,264
Herring	1,350	Flying fish	3,352
Sawry pike	6,303	Mullet	4,646
Yellowtail	5,680	Ocean perch	2,926
Flounder	2,445	Lobster	1,058
Flatfish	37,513	Prawn	1,066
Cod	20,711	Blue crab	1,247
Alaska pollack	135,649	Other crab	1,958
Atka mackerel	15,561	Common squid	2,228
Sebastdobus marcochir	1,288	Octopus and other acuatic animals	3,630
Croaker	1,783		
Ray	3,170		
Sea bream	1,417	Shellfish	3,307

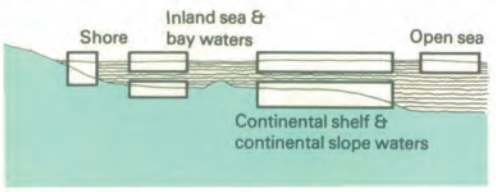
☐ **Off-shore and pelagic waters**

Species	Catch amount (tons)	Species	Catch amount (tons)
Tuna	1,337	Salmon	23,256
Albacore	12,511	Trout	18.594
Blue marlin	2,351	*Flying squid	132,322
Broadbill swordfish	1,257		

Note 1: Most of the flying squid catch (*) comes from pelagic gillnet fishery but the figure in this table includes a very small amount of catch by coastal gillnet fishery as well.
Note 2: This list includes only species whose catch totals more than 1,000 tons per year.
(Source: Official Statistics of the Ministry of Agriculture, Forestry and Fishery)

Fishing Grounds

Fig. 1 Types of gillnet fishing grounds



As shown in figure 1, the gillnet fishing grounds include both inland sea and open sea areas. The main fishing grounds for small-scale coastal gillnet fishery are "inland sea and bay waters" and "continental shelf and continental slope waters", and the nets are set either in the surface waters, middle depths or bottom waters, depending on the type of fish to be caught. In the case of bottom gillnet, a regular, sandy or sand and mud bottom area is chosen. Reef areas on shore waters can also be used as a gillnet fishing ground but care must be taken to prevent the net from being caught by a reef by taking into consideration such factors as reef configuration and current conditions.

Classification of Net Types

As is well known, there are three basic types of gillnet that the fisherman chooses from depending on the type of fish to be caught and the fishing ground conditions previously mentioned; 1) fixed gillnet, 2) drift gillnet and 3) encircling gillnet. In addition, each of these types can be divided into two sub-divisions; i) those used for surface fishes and middle-depth fishes, and ii) those used for catching bottom-inhabiting fishes and/or other demersal marine life (primarily Crustacea).
Therefore, as shown in table 2, there are actually six types of nets in use in gillnet fishery. Among these, the two which have proved to have the best catching capabilities and lend themselves best to a commercialised type of fishing operation are:

* Fixed bottom gillnet
* Drift gillnet for surface and middle-depth fishery

Two other types which must also be mentioned as noteworthy fishing methods are:

* Bottom drift gillnet for prawn
* Encircling gillnet

The former is an effective fishing method which makes use of the prawn's behavioral patterns, while the latter is mentioned as a representative type of gillnet fishery method that is easy to operate.
The variations of the encircling gillnet include the "hunting gillnet" and "rowing gillnet", but these methods are gradually disappearing to the point where they can seldom be found in use today.

Table 2 Classification of gillnets and their representative catch

Net Type		Representative catches
Fixed gillnet	Surface and middle-depth	Sardine, Halfbeak, *Blue Sprat,* Sandfish
	Bottom	Cod, Alaska pollack, Herring, Atka mackerel, Shark, Flounder, Flatfish, Sea bream, Lobster, Blue crab, Other crabs, Ray
Drift gillnet	Surface and middle-depth	Salmon, Trout, Horse mackerel, Mackerel, Sardine, Marlin, Spanish mackerel, Flying fish, Ocean perch
	Bottom gillnet	Prawn, Black porgy, Butterfish, Sand smelt, *Scurida undosquamis*
Encircling gillnet	Surface, middle-depth & bottom	Spanish mackerel, Juvenile yellowtail, Black porgy Mullet, *Grunt*

Fig. 2 Fixed-type floating gillnet

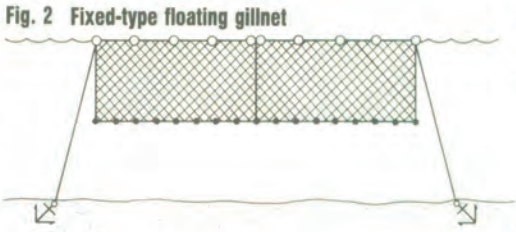


Fig. 3 Fixed-type bottom gillnet

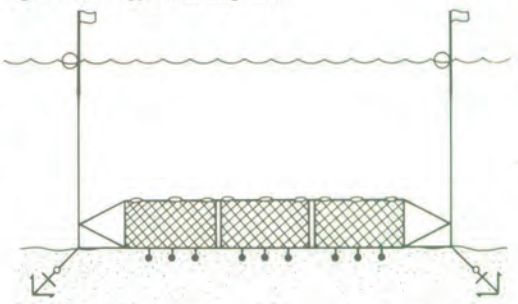


Fig. 4 Floating drift net

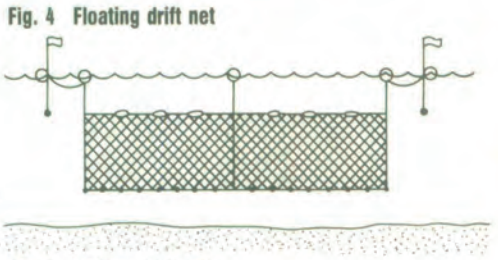


Fig. 5 Bottom drift net

Fig. 8 Rowing gillnet

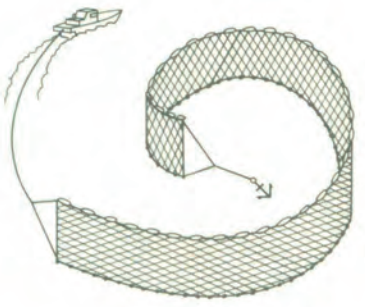


Fig. 6 Encircling gillnet

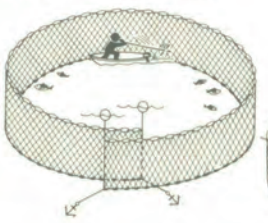


Fig. 7 Hunting gillnet (Drive in net)

Net design particulars for effective gillnet operation

The gillnet is a single sheet of netting that is extended out through the water with a float line and floats attached to the upper edge and a sinker line and sinker attached to the lower edge in a delicate balance that is designed to hold the net fully extended in a perpendicular plane in the water.
The net is constructed from a single piece of netting, called the body net, to which a selvedge is sewn along the upper and lower edges. The selvedge portion is made from a piece of netting with heavier twine and smaller mesh size.
The length of net that is used in gillnet fishery depends on the geographical nature of the fishing grounds and the fishing regulations of the given area, but as a rule, since the netting is manufactured in lengths of 150 meters, the most common net lengths used in small-scale coastal gillnet fishery are 37.5, 75, or 150 meters.
The width of the net (its hanging length in the water perpendicularly) is determined by such factors as the water depth, habitat of the fish to be caught and strength of the current. But the common width lies in the area of 4 to 6 meters in most shallow waters.
In addition to the common one-layer gillnet there is another type, called a trammel net, in use that consists of three layers of netting. This three-layer net consists of two nets of considerably larger mesh size attached to either side of the body net with the aim of increasing its ability to entangle fish. (These nets are prohibited in many regions of Japan where over-fishing is a concern.) Refer to pages 4~5.

Materials that are necessary for a gillnet, besides the body net material, include; ropes, sewing thread, floats, sinkers, buoys, buoy lines, anchors, and anchor ropes. In Japan, all netting and ropes are now being made of synthetic fibers. Floats are usually made of foam plastics today, and sinkers usually of lead.
Synthetic fibers have proved themselves to be superior to the traditional natural fibers from the standpoint of both lightweight and durability. However, with regards to floats and sinkers, because similar performance can be achieved with glass bulbs, cork and wood, or in the case of sinkers, natural stone, some regions still continue to use these traditional materials. In any event, it is always best to use those materials which are affordable and readily available.

Table 3 Gillnet specifications and function

	Specifications	Casual relation and/or interrelation	Function
Properties of the net twine	Material		Breaking strength
			Flexibility
			Elasticity
	Twisting and thickness of twine		Durability
			Recovery of elongation
	Knotting		Invisibility
Properties of the net as a whole	Mesh size		Size and shape of mesh
	Hang-in ratio		Tension on net twine
	Buoyant and sinking forces of net		Tangling performance

The basic aim of gillnetting is to get the fish to emmesh itself in the net. That is to say, when the fish enters a mesh in the net head-first the thread of the net must have enough elasticity to allow the fish to continue to move through the mesh to a point where the tension at the mesh threads equal the muscular strength and flexibility of the fish, after which the fish is held in place and caught. However, in the case of big fish like marlin or tuna, or fish with off body shapes such as flatfish and

flounder or various crustacea, which make it difficult for the body to enter a mesh eye, the main catching ability of the net is to make the fish "entangle" themselves in the net rather than emmeshing in one mesh.

Table 3 (page 2) shows the specifications that must be considered when designing the mesh of a net for a certain type of job. First of all, let us explain about the properties of the netting twine.

Invisibility

At first, anyone could guess that the less visible the netting twine in the water the more likely the fish are to enter the net and become emmeshed. Actually, we have reports of cases where the catch of salmon and trout in northern waters has been increased considerably by changing to a thinner, less visible twine in net construction. But we have long been faced with the problem of making netting twines that are not only as thin as possible but also as strong as possible.

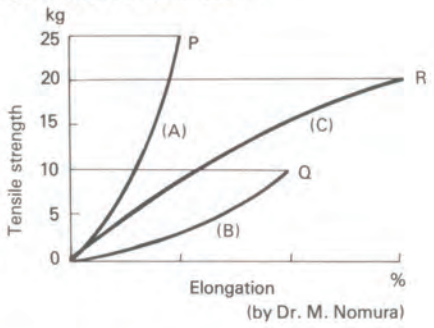
Thanks to advances in scientifically developed synthetic fibers in recent years, this problem is rapidly being solved. The elements involved in invisibility are color and tranparency. The twine used in the net should be such that it does not offer a contrast to the environment in which it will be used. For example, nets used for catching lobsters in reef areas are made of reddish twine; bluish twine is used for gillnets that catch flying fish in surface waters of high transparency; and dull gray or dark green twine is used for nets catching sardine or salmon in the dark middle-depth waters. Also, lately, nets made of nylon monofilament are performing very well because of their high transparency.

Stress-strain Curves

The dynamic characteristics of net twines are an extremely complicated matter. The reason is that a net's characteristics do not depend simply on the material from which it is made, but also on the structure of the twine (in other words, the thickness and number of yarns, the type of twining and the type of knotting used). All of these factors cause slight differences in the characteristics of the netting as a whole. It is clear that the catching capability of a net depends heavily on its elasticity, degree of elongation and return rate of elasticity. In regard to these factors, let us refer to a "stress-strain" curve (See Fig. 9). Here are three stress-strain curves, all of which include a "load at breaking point", "degree of elongation at breaking point", and "elasticity characteristics". Points P, Q and R in the following graph all indicate the "load at breaking point".

Now, if the tensile strength required to catch a certain fish is expected to exceed 10 kg, twine (B) would not be a suitable choice. A choice must be made from between either (A) or (C). And, if you wish to increase the overall weight of catch possible by means of a more elastic net, (C) would be the best choice. In this case the more elastic netting twine means that you also have a larger choice of mesh sizes for catching a given size of fish. However, if you wish to catch a type of fish that will require a tensile strength of close to 20kg, you should reject (C) in favor of (A).

Fig. 9 Stress strain curve



(by Dr. M. Nomura)

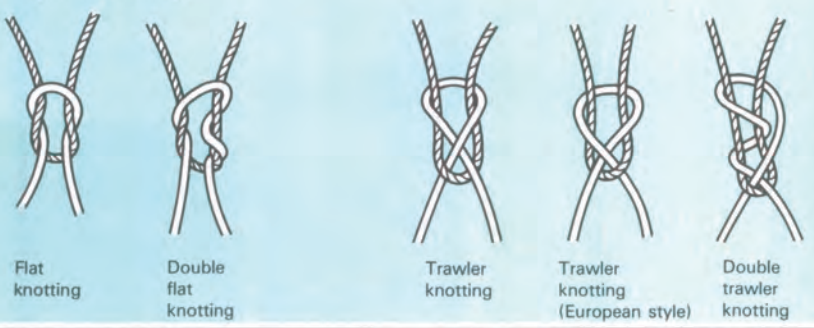
Types of Knotting

There are two different types of knotting available, that is, flat knotting and trawler knotting.

While the former features a compact, lowered knot suitable for net braiding with a relatively small amount of twines, knotting position is not completely stabilized. It can slide off easily when too strong a pulling is given to either knotting leg.

In the case of trawler knotting, its knotting position is completely fixed, thus making it suitable for a large-mesh net or a gillnet that must be free from any slip-off of knotting position.

Fig. 10 Types of knotting



Next, let us consider the factors involved in the net structure. There is very little meaning in trying to figure out on paper what shape a net will take in varying water condiditons. The only way to design a net that will perform as it should in actual fishing conditions is to base that design on knowledge that comes from years of actual experience. However, there are some principles that can be used in designing a net that will have a good chance of being successfull.

The catchability of a given net can be expressed in terms of such factors as mesh size and shape, rigidity of the mesh leg and entangling function, but the truly decisive factors are the following three:

* *Mesh specifications*
* *Hang-in ratio*
* *Tension applied to the netting*

Mesh Specifications

In other types of net fishery, such as boat seine, purse seine, lift net and set net, the net functions simply to strain the fish out of a certain area of water. So, any fish that is larger in length or girth than the mesh size will be caught by the net. However, gillnetting calls for a unique performance on the part of the net.

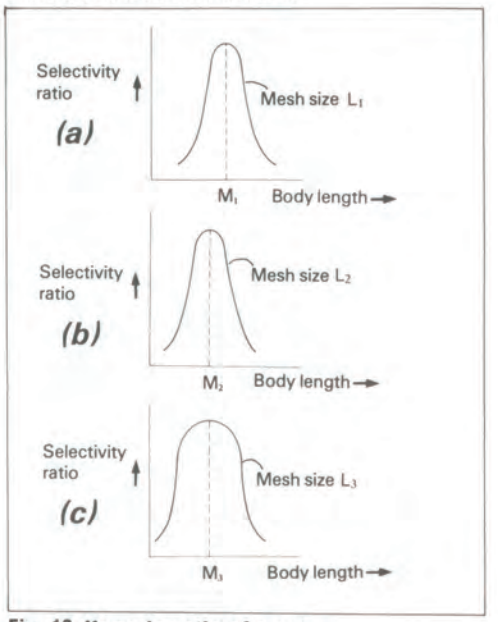
It is an obvious fact that any fish which is too small for the mesh dimensions will be able to slip through the net and escape, while any fish that is too large, on the other hand, will hit the net without getting emmeshed and be able to escape the way it came. For this reason, the size of the mesh becomes a factor in selecting the size of fish that will be caught. In other words, the fish that will be caught by a certain size mesh will fall within a certain size range. Because of this fact, the selective catchability factor will be reflected in the number of fish that will be caught within a given school. The percentage of fish that are caught in the net in a given school of fish is called the "relative catching efficiency".

The relative catching efficiency that will be produced by a given mesh size with regard to a certain size of fish will show a relatively normal distribution, and this efficiency has been confirmed both theoretically and experimentally. When the relative catching efficiency for different sizes of fish is graphed, we get a model curve like the ones shown in Figure 11.

In a certain gillnet, if the mesh dimensions are changed from L_1 to a smaller L_2, the mode (the body length most often caught) will inevitably move to the left (Fig. 11 — a, b). However, if at the same time the mesh size is decreased other measures, such as increasing the elasticity of the net, are taken, it is possible to increase the catching efficiency of the net (Fig. 11 — c).

The gillnets in use today vary greatly in mesh size from 4.2 cm (for prawn, flying fish, etc.) to 18 cm (for shark, tuna, marlin, etc.), but the common nets used to catch a variety of fish in shallow sea areas tend to fall into the 5 cm to 10 cm range.

Fig. 11
Relation of the catch selectivity curve to net twine characteristics and mesh size



Hang-in Ratio

In order to insure that the gillnet will hang with a proper mesh pattern that will effectively recieve the fish, the net is sewn to rope that is shorter than the net length in a suitable ratio. This ratio at which the net is shortened, in other words, the hang-in ratio, is a very important factor in the gillnet's operation.

$S = \frac{L - \ell}{L}$ S: hang-in ratio
L: cutting length of netting
ℓ: length of finished net

The netting's length, L, is expressed in terms of its length when the net twine is pulled into a straight line, which means, we would like to point out, that a hang-in ratio of 0.3 creates a mesh dimension that is almost a perfect square, as shown in Fig. 12.

The hang-in ratio is directly related to the body shape of the fish to be caught. Compared to the nets used to catch pelagic fishes with a basic (spindle) body shape, nets used to catch slim profile bottom-inhabiting fishes have a larger hang-in ratio. Furthermore in the case of nets for catching flatfish family fish and crustaceans, where it is easier to catch by means of entangling, rather than emmeshing, nets are usually made with a hang-in ratio of greater than 50%. Refer to Fig. 13.

Fig. 12 Hang-in ratio of a net

Hang-in ratio $= \frac{L - \ell}{L}$

When the shape of the mesh is a perfect square, the hang-in ratio is about 30%.

Since "ℓ" is inevitably the diagonal through a perfect square:

$\ell = \frac{1}{2} L \times \sqrt{2} = \frac{\sqrt{2}}{2} L$

Because of this, the hang-in ratio (S) is:

$S = \frac{L - \frac{\sqrt{2}}{2} L}{L} = 1 - \frac{\sqrt{2}}{2} = 0.2929$

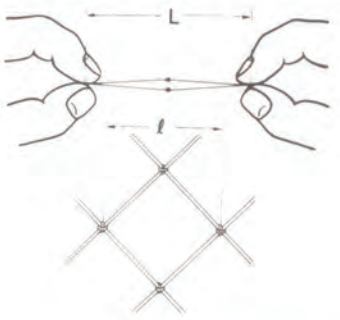
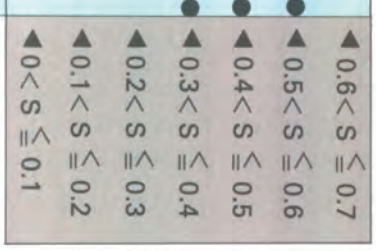


Fig. 13 Relation between body shape and hang-in ratio

Body shape	Fish caught	Hang-in ratio (S) histogram
Basic shape	Spanish mackerel, ocean perch, saury pike, flying fish, shark & sillaginoid	
Slim shape	Sea bream, grunt, opaleye, blue marlin & rabbitfish	
Flat shape	Sole, flatfish, cod & croaker	
Crustacea	Prawn, lobster & blue crab	



Source: 1. Fishery Branch, Kyushu and Yamaguchi Block Fisheries Experiment Station (1969)
2. Dr. Masatsune Nomura (1981)

Tension Applied to the Netting

There are two forces at work on the netting as it is suspended in the water, a floating force and a sinking force. In order to keep a net suspended in a given position there must be a balance of the floating force (created by the floats) and the sinking force (created by the sinkers, weight of the net itself and other ropes, etc.). In addition, however, a number of other factors, such as the weight and pulling force of the fish caught in the net, the force of the tide, etc., must also be taken into account.

Then, we must consider the most important factor of all; the effect of the tension applied to the legs of the meshes by the floating forces and the sinking forces. A gillnet holds the fish which have become emmeshed by means of the tension exerted by the legs of the meshes. If the tension applied by the legs is insufficient, it becomes easier for the fishes to work themselves free of the net. Gillnets used to catch bottom fishes such as flatfish and shark must be stretched with greater tension, while on the other hand, drift gillnets for Spanish mackerel or prawn gillnets, which catch mainly by entangling, should be set with as little tension as possible, allowing a large hang-in ratio and plenty of slack in the net overall.

Another extremely important factor in a gillnet's catching effectiveness is the way the net hangs in the water. The desired hang may be a straight vertical line or a loose curve along the sea floor, depending on the type of fish to be caught. These factors must be taken into account when designing the floating and sinking forces that will work on the net.

REFERENCE LITERATURE:
Fishing Techniques by Dr. M. Nomura (1975)

Examples of Small - Scale Gillnet

Fixed Type Gillnet

Example: Tongue sole fixed gillnet
Location: Shimabara City, Nagasaki Prefecture (Ariake-kai)

Ariake-kai

Geologically speaking, this is a subsidence sea area created by volcanic action, with a winding coastline forming a deep irregular bay area. The northern area at the inner part of the bay is a shallow sea area where inflowing rivers create a large alluvial plain. The Shimabara Peninsula lies in the southern part of this sea area and the sea depth in its eastern coastal area varies between 30 and 120 meters, with strong tidal currents. The coastline in the southern part of the bay is rugged with many inlets and the sea bottom topography varies from rock to mud or sand. The sea bottom in the central part of the bay, however, is primarily sand with some deep troughs dug by the tidal forces.

The whole northern area of the Ariake-kai has a long distance between its high and low tide lines, and the resulting tidelands are the sight of large-scale laver farming activities. Of the fisheries that are carried on in this area shellfish gathering is the most important.

In the southern part of the bay along the Shimabara Peninsula and the connecting offshore waters a variety of fishing activities are carried on using either 1 to 3 ton or 3 to 5 ton powered boats, with the main types of fishery being gillnet, small-scale trawling, longline and angling. The main catches include fish like flatfish, yellow sea bream, croaker, and flounder, and aside from these there are also considerable catches of shrimp and prawn, squid and octopus. In this issue we will concern ourselves with the gillnet fisheries that are being conducted in the southern part of Shimabara Bay.

Fishery Management in the Area

Shimabara City has six Fishery Cooperative Unions, the distribution of whose fishing boats by fishery type is shown in Table 4. The employment statistics for the different fisheries are shown in the following Table 5.

Although small-scale trawl and gillnet fisheries are the principle fishery types in the area, the individual fishermen engage in a variety of fishing activities which can be broken down into groups generally corresponding to the size of fishing boat they operate, as shown in Table 6.

Table 6 Patterns of Fishing Activities

Fishing Activity	Boat/Engine	Number of laborers
(1) Small-scale trawl + Licensed gillnet	4 ~ 6 tons/10 hp	2 ~ 3
(2) Licensed gillnet + Other misc. gillnet	3 ~ 5 tons/40 ~ 70 hp	"
(3) Licensed gillnet + Other misc. gillnet + Octopus potting + Squid potting	"	"
(4) Angling + Long line	0 ~ 2 tons/20 ~ 30 hp	1

Yearly Fishing Schedule

The fisherman we interviewed for this article was one holding licenses to conduct both small-scale trawl and gillnet, and whose annual production is considered average for the area.

The fishermen in this area who conduct both small-scale trawl and licensed gillnet fishery tend, in recent years, to own two fishing boats. For trawling, this fisherman owned a 4.6 ton class boat (Yamaha DY-48F-OC), and for his gillnet operation he owned a 3.3 ton (Yamaha DW-43A-1G).

Even though a boat which is used for small-scale trawl is sufficiently large to be used for gillnet fishery as well, because there is a 10 horsepower limit set on the motors used in small-scale trawl, most fishermen want a separate boat with a larger horsepower engine for their gillnet operations. We were told that the increased income of many local fisherman from increased catches of prawns resulting from the practice of stocking the area with prawn seedlings, has given many fishermen the ability to invest in a second boat.

Table 7 Yearly fishing schedule

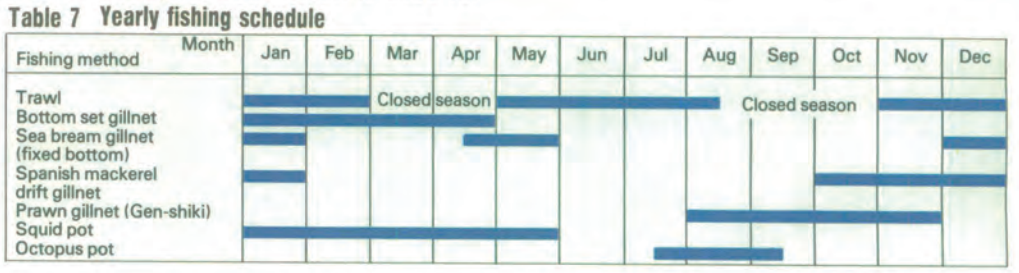


Table 4
Registered boats of the 6 Fishery Cooperatives of Shimabara area (1983)

Main fishery operation \ Tonnage	0 ~ 0.9	1 ~ 2.9	3 ~ 4.9	Over 5	Total
Shellfish gathering	45	7	0	0	52
Small set net	0	1	0	0	1
Angling	172	134	3	1	310
Long line	6	9	1	0	16
Gill net	65	101	127	5	298
Lift net	0	0	1	0	1
Small trawl	0	0	14	35*	49
Misc.	1	0	0	0	1
Total	289	252	146	41	728

Note: *indicates the average 5.5-ton class boat

Table 5 Employment Statistics of the 6 Cooperatives (1984)

Type of fishery	Permitted fishing season	Number of fishermen employed	Percentage of total fishery sales
Gillnet: 1. Bottom set gillnet	Year-round	150	40%
2. Spanish mackerel drift gillnet	"	60	
3. Sand smelt gillnet	"	50	
4. Prawn gillnet (Gen-shiki ami)	"	150	
5. Inshore misc. gillnet	"	50	
Small trawl	May 1 to Aug. 15 Nov. 1 to end of Feb.	50	30%
Long line	Year-round	15	30%
Angling	"	100	
Octopus pot	"	20	
Squid pot	"	20	

Note) Among these types of fisheries, the small-scale trawl and gillnet types 1 ~ 4 are licensed fisheries with the number of fishermen employed being controlled by the Nagasaki Prefectural Government. The other types of fisheries are not limited.

Income and Expenses

The fisherman involved in both small-scale trawl and licensed gillnet fishery averages between 7.5 and 10 million Yen a year in total fishery income. Table 8 shows a typical breakdown of this annual income by fishery type. Both the small-scale trawl and gillnet operations are performed by two or three workers, and in most cases the work is done by husband/wife or father/son teams, in other words, by family labor. The labor expenses listed in table 8 are to be regarded as "family labor expenses." With regards to fishing gear expenses, the gillnet is less expensive than a set of trawling gear, but most fishermen in this area maintain 4 or 5 nets, so the depreciation on these is a considerable amount.

Table 8
Annual Fishery Income and Expenses (presumed)

Number of fishing days per year	180 days
Number of workers needed	2
Gross income from fishery	7.5 ~ 10 million Yen
Fishery expenses	
Labor (estimated family labor expenses)	4 million Yen
Fuel expenses	800 thousand Yen
Depreciation on boat/engine	1.9 million Yen
Depreciation on nets	500 thousand Yen
Other fishing expenses	300 thousand Yen
Total	7.5 million Yen
Fishery profit	0 ~ 2.5 million Yen

Types of Gillnets

In this area, gillnet fishery is carried out with the following five types of gillnets:

(1) Bottom set gillnet: This net is set in open sea areas with a depth of 40 ~ 50 meters. The main fishes caught are tongue sole *(Rinoplagusia japonica* and *Areliscus joyneri),* and areas with sandy bottoms are chosen as fishing grounds. Depending on the season, the same nets are sometimes used to catch blue crabs, in which case the fishing grounds are muddy bottom areas near the shore.

(2) Sea bream bottom set gillnet: This is also a bottom set gillnet as in (1), using similar nets and fishing grounds. This method is used primarily to catch sea bream that migrate between deep and shallow water areas in the spring and winter seasons. Faltfish family fishes are usually found in the catches as well.

(3) Spanish mackerel drift gillnet: This is a fishing method very similar to the ex-

Fish are freed from the net as it is hauled in.

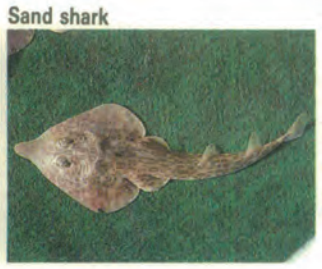
Net hauler

Tongue sole

Platycepiralus indicus

Croaker

Sand shark



Floats and float rope

Sinkers and sinker rope

Anchors

Office building of the Shimabara City Fisheries Cooperative. The first floor is the landing/selling facility. The second floor holds offices.

One of several wharf sites

Same as left

ample that will be introduced in the following pages. In these waters shark family fish are often included in the catches.

(4) Prawn drift gillnet: This fishing method is unique in that it catches Prawn by letting the net drift in the bottom waters of comparatively shallow water areas. This method will be introduced on page 8.

(5) Other misc. gillnet: This is a small-scale bottom fixed gillnet that is set in waters with a depth of less than 15 meters. The net can be set in either rock, sand or mud bottom areas, to catch a variety of fish, including tongue sole, flatfish, gray rock cod, scorpion fish, conger eel and squid.

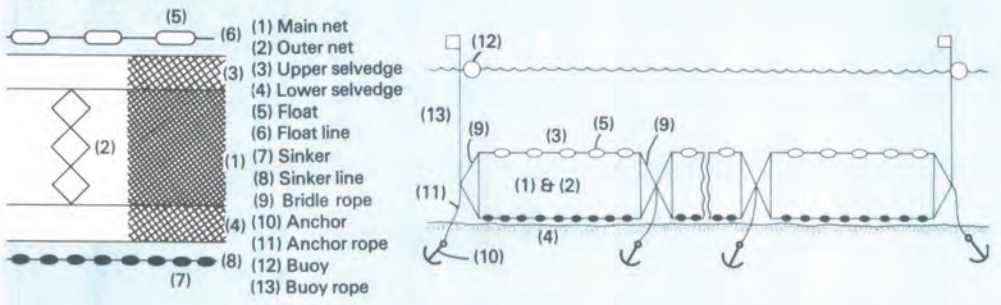
The following table shows the typical specifications of these different nets. Of the above mentioned fishing methods we will now loook at (1), bottom set gillnet in detail.

Table 9 Gillnet specifications

	Type of gillnet	Main net		Outer net		Outer net height	Net material length	Hang-in ratio for main net
		Material/ thickness	Mesh size	Material/ thickness	Mesh size			
1	Bottom set gillnet	Nylon mono-filament #3 (0.284 mm)	7.5 cm	Nylon mono-filament #12 (0.571 mm)	36.4 cm	9 meshes	35 sheets (3.150 mm)	60%
2	Sea bream gillnet (fixed bottom)	Nylon mono-filament #6 (0.403 mm)	12 cm	Nylon mono-filament #12 (0.571 mm)	42.4 cm	9 meshes	25 sheets (3.775 m)	60%
3	Spanish mackerel drift gillnet	Nylon mono-filament #12 (0.571 mm)	12 cm	—	—	100 meshes (14 m)	58 sheets (8.758 m)	52 %
4	Prawn drift gillnet	<< See page 8 for every particular >>						
5	Other misc. gillnet	Nylon mono-filament #4 (0.329 mm)	7.5 cm	Nylon mono-filament #12 (0.571 mm)	36.4 cm	3 meshes	120 sheets (18,120 m)	85 %

Fishing gear (Bottom set gillnet)

Fig. 14 Configuration of net



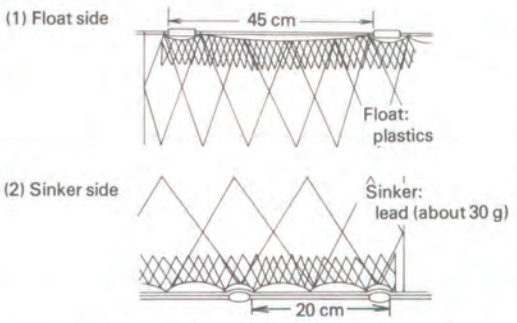
Net specifications

Part	Material	Tickness	Mesh size	No. of meshes	Length	Finished length
Main net	Nylon mono-filament	#3 (0.284 mm)	7.5 cm	20	35 sheets (3,150 m)	1,267 m
Outer net	"	#12 (0.571 mm)	36,4 cm	9	35 sheets (2,555 m)	"
Upper selvedge	Polyethy-lene	210D × 18 to 22	15 cm	5	"	"
Lower selvedge	"	"	15 cm	3	"	"

Lines and Ropes specifications

Part	Material	Thickness	Length
Float line	Dialon	9 mm	1.267 m
Sinker line	Pylen/ cremona	4.5 mm + 5 mm	50% longer than the above
Anchor rope	Dialon	9 mm	About 2 m
Bridge rope	"	"	About 8 m each
Buoy rope	"	"	Twice water depth

Net design

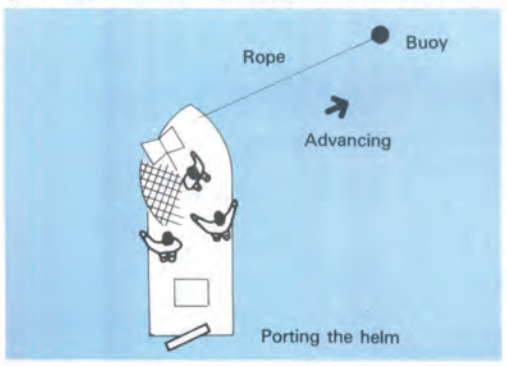


The Fishing Boat

FRP boat of 3.3 ton/diesel 195 hp.
Two or three workers needed for operation.

Fishing Method

Normally the fishing operation is begun at dawn. On arriving at the fishing ground, the net that was fixed at the bottom the day before is hauled in, freeing the fish that have been caught from the net as it is being hauled. When the hauling is completed, the same replacing net is set back at the bottom and the boat returns to port with the catch.



Hauling the net: The rudder is first turned to port and set in that position. The position of the boat in relation to the net should be as shown in the diagram. The main engine is then used to run an electric generator which powers the net hauler in the bow of the boat. When the float rope reaches the roller, the net is then hauled in hand over hand by two men, one on the float rope and one on the sinker rope. As it is hauled up the nets piled on the deck, folding it as it is piled. The anchors that are hauled in must be neatly lined up at one corner of the deck. During this process, the fish that have been caught are freed from the net. In the case of a three-man operation, the third man stands in the middle of the deck and frees fish from the net as they appear. The hauling of one unit km net takes between 60 and 90 minutes.

Setting the net: The net is set in a straight line at right angles to the flow of the tidal current. After throwing in a buoy at the site where the setting will begin, the boat backs away at a speed of 2 or 3 knots, feeding the net into the water from the port side of the boat. When dropping in an anchor, the anchor is first held at both ends, with the legs spread apart, and given a firm pull to stretch out the sinker rope before it is dropped in the water. The net setting operation should take just over 10 minutes.

Note) For a normal gillnet it is only necessary to use two anchors, one at each end of the sinker rope. In these waters, however, the tidal currenets are so strong that one anchor attached at every (150) meters along the sinker rope.

Fisheries Cooperative Union

There are six fishery cooperatives in Shimabara City, among which only the Shimabara City Fisheries Cooperative Union performs all the functions of landing catches, collective sales, collective purchasing and credit allotment as a fish-producing center.

Here is a look at the composition of the Shimabara City Fisheries Cooperative.

Union members

regular members 212
associate members 31

Executives and officers

Executives: 1 Chairman, 10 directors
2 auditors
Officers: 1 councilor & 1 assist councilor

	men	women	total
Sales	8	3	11
Purchasing	0	1.5	1.5
Credit	0	1.5	1.5
Total	8	6	14

Business (as of March 31, 1983)

(1) Credit
*Savings balance. . . . . 483 million Yen
*Loan balance . . . . . 128 million Yen
*Monies borrowed by Union . . . . . 81 million ¥
(2) Purchasing
*Monies spent on fishery . . . . 41 mil. ¥
(among this, fuel costs total 36 mil.)
(3) Sales
*Entrusted sales of catches by Union .
i) Fish. . . . . 470 mi. Yen
ii) Processed seaweeds. . 53 mil. Yen

Facilities

1) Ice making machine:
2.5 ton/day 1 machine
2) Refriegerator:
0 ~ 5°C 16m² × 1,6m² × 1,
capacity 10 tons
3) Freezer:
−35°C 30 m² × 1 15 m² × 1
capacity 20 tons
4) Fuel tank:
one 10 kl tank (filled every two days)
5) Storage facilities:
50m²
6) Vehicles:
two 2 ton trucks

Table 10 Fisheries Cooperatives of the Shimabara Area

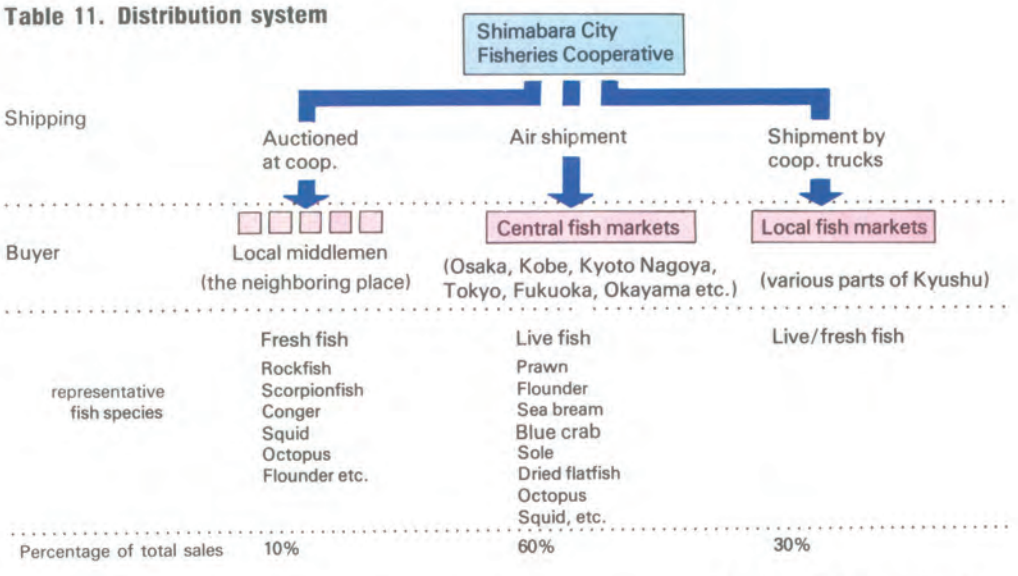
Name of cooperative	No. of members	Landing	Shipping	Sales	Purchasing	Crediting
1. Shimabara City Fisheries Cooperative	212	○	○	○	○	○
2. Shimabara City Central Fisheries Cooperative	113	×	×	×	○	○
3. " East Fisheries Cooperative	101	×	×	×	○	○
4. " Annaka Fisheries Cooperative	98	×	×	×	○	○
5. " North Fisheries Cooperative	91	×	×	×	○	○
6. " Mie Fisheries Cooperative	112	×	×	×	○	○

Sales specialities

All the catches by individual fishery cooperatives in Shimabara and its surrounding areas are landed at the market of the Shimabara City Fisheries Cooperative but these catches are sold collectively to the buyers for further distribution as shown in Table 11.

1. Fresh fish for local consumption are purchased by about 30 middlemen at auction for distribution to local fish retailers.
2. The Coop airlifts live fish to the central wholesale markets of large cities where these fish are consigned for auction to wholesale dealers.
3. The Coop trucks fresh and live fish to the wholesale markets of middle cities in Kyushu where these fish are consigned for auction to wholesale dealers.

Table 11. Distribution system



TYPE 2

Examples of Small-scale Gillnet

Drift Type Gillnet

Example: Spanish mackerel drift gillnet
Location: Uki district, Isahaya City, Nagasaki Pref. (Tachibana Bay)

Tachibana Bay

This is a bay lying between the two peninsulas of Nagasaki and Shimabara. The water depth throughout the bay is about 36 meters. The main current in these waters is the east west current of the tidal flow entering and leaving Ariake-kai, but there are also recognized to be branch currents that flow along the shore of the bay.

The Area's Fisheries

In the ten fishing villages along the shore of the bay there are about 1,300 families engaged in fishery. Some of these are engaged in longline and large-mesh drift net fishing in the East China Sea, but the majority are engaged in fishery within the bay and adjacent waters, using small-scale trawl, purse seine, gillnet, angling and longline. About 65% of the boats used are powered 1 ~ 3 ton and 3 ~ 5 ton class boats. In addition, some areas are involved in the culture of sea bream or yellowtail.

Table 12
Fishing boats in use around Tachibana Bay (1983)

Non-powered boats	7
Powered boats under 1 ton	196
Powered boats under 2 to 3 tons	332
Powered boats under 3 to 5 tons	509
Powered boats under 5 to 10 tons	73
Powered boats under 10 to 20 tons	24
Powered boats under 20 to 50 tons	16
Powered boats under 50 to 100 tons	10
Powered boats under 100 to 500 tons	5
Powered boats under over 500 tons	0
Small set net boats	50
Aqua-culture boats	76
Total	1,298

Source : Nagasaki Statistics and Information Center, Kyushu Agricultural Administration Board

The area we visited to research for this report, Uki district, Isahaya City, lies in farthest point in the bay from the ocean. In this district there are about 400 fishermen. The following table shows the fisheries in which they are presently employed.

Yearly Fishing Schedule

The fisherman we interviewed for this article was the owner of two boats, a 4.9 ton (max. cap. 215 hp) and a 2.45 ton (max. cap. 58 hp). As shown by Table 13, he is involved in three types of fishery; Spanish mackerel drift gillnet fishery, angling with lights and dive fishing. Of the 250 days a year he fishes, 170 ~ 180 days are spent at his main fishery, Spanish mackerel drift gillnet, and during the summer he angles for grunt, skipjack and mackerel. However, as the past year has been a poor catch year for Spanish mackerel, he has spent much of his time dive fishing in shallow waters for sea urchin and wreath-shell to supplement his income.

Table 13 Yearly fishing schedule

Fishery	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Spanish mackerel drift gillnet	■	■	■	■	■				■	■	■	■
Angling with lights						■	■	■	■			
Dive fishing	■	■	■	■	■	■	■	■	■	■	■	■

Float, float line and upper selvedge

Mets prepared on bow deck

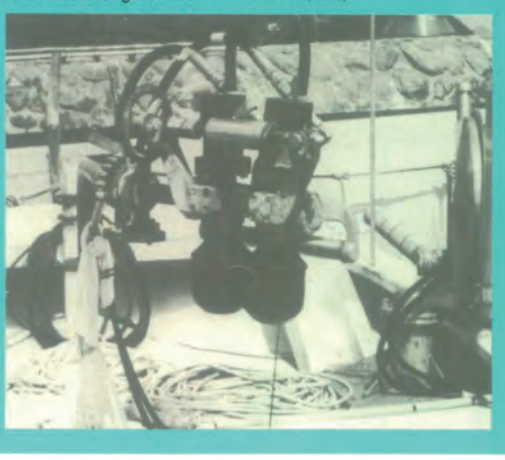
Swivel joint connecting float line and mooring rope.

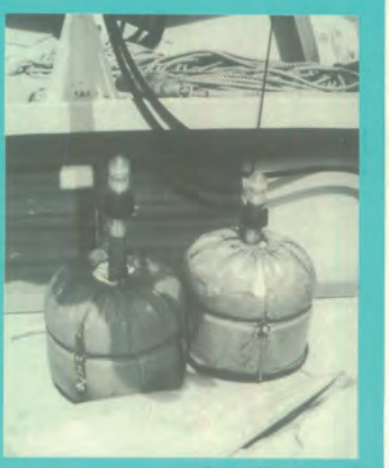
Remote control handle on front of bridge

Sinker: 18 cm in diameter, 1.5 cm thick and about 600g in weight.

Mooring rope and weights (10 kg)

Net hauler (right) and line hauler (left)





Buoy (with lamp)

Table 14
Distribution of Fisheries in the Uki Fisheries Cooperative

	Class	No. of boats
Small-scale trawl	3 ~ 5	16
Drift gillnet	3 ~ 5	4
Boat seine	4 ~ 5	2 (1 pair)
Surrounding net	3 ~ 5	4 (4 groups)
Surrounding net	5 ~ 20	25 (4 groups)
Angling	1 ~ 5	40
Inshore misc. gillnet	1 ~ 4	20
Small-scale set net	1 ~ 3	7
Miscellaneous fishery	1 ~ 4	45
Total		163 boats

Income and expenses

This fisherman works entirely at fishery and, working with his wife as a team, seeks to earn an income of one million yen per month by means of gillnet and angling fishery. When, however, their daily income fails to reach 30,000 yen/day for an extended period, the husband will engage in dive fishing in shallow water areas near their home, by himself. This is an economically sound decision based on consideration of fuel and net depreciation costs.

Table 15
Costs in drift type bottom set gillnet fishery

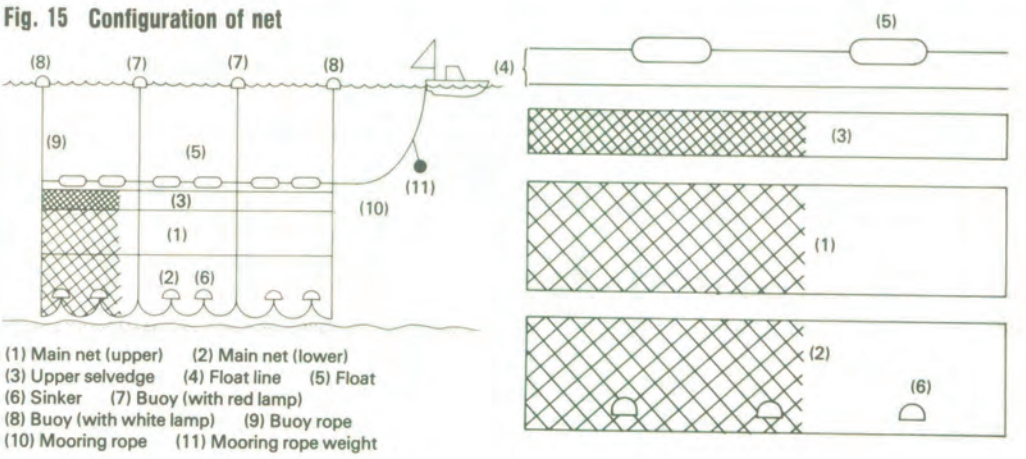
(1) Fuel costs : using 120 to 130 liters per day; 5,000 yen per day and 100,000 yen per month.
(2) Fishing net : material costs-high quality netting 85,000 to 86,000 yen per 151 meters (1 set = 151 m × 12 = about one mil. yen), low-cost netting 55,000 to 56,000 yen per 151 meters (1 set = 151 m × 12 = about 700,000 yen.)
net sewing cost - 15,000 yen per 151 meters (1 set = 151 m × 12 = 180,000 yen)

Note : Usually, (151 m × 3) of spare netting are kept.

(3) Fishing boat : boat 6 million yen
engine 7 million yen
equipment 2 million yen
Total 15 million yen

Fishing Gear

Fig. 15 Configuration of net



(1) Main net (upper) (2) Main net (lower)
(3) Upper selvedge (4) Float line (5) Float
(6) Sinker (7) Buoy (with red lamp)
(8) Buoy (with white lamp) (9) Buoy rope
(10) Mooring rope (11) Mooring rope weight

Nets specifications

Part	Material	Thickness	Mesh size	No. of meshes	Length of netting	Finished length
Main net (upper)	Nylon	12 yarns	11.5 cm	100	12 sheets (1,812 m)	1,044 m
Main net (lower)	Nylon monofilament	#12 (0.571 mm)	11.2 cm	100	12 sheets (1,812 m)	1,044 m
Upper selvedge	Nylon	50 yarns	11.5 cm	5	1,800 m	1,044 m

Lines and ropes specifications

Part	Material	Thickness	Length	
Float line	Cremona	8 mm	1,044 m	The floats are attached between two float ropes (above and below).
Buoy rope	Cremona	6 to 8 mm	40 m each	water depth plus 10 meters
Mooring rope	Cremona	10 to 12 mm	60 m	three times water depth

Net Construction

Float side: The floats are attached to the float rope at 1.5 meter intervals (60 floats per 151 m length of netting). And, the float line net is attached to the float rope with 25 meshes to one float interval.

Sinker side: This type of net is unique in that on the sinker side there is no sinker rope. With regards to attachment of the sinkers (made of cement), they are attached at 7.5 m (70 meshes) intervals. The points in the net at which they are attached are gathered up to a height of 10 meshes and the sinker is sewn with twine to the gather point.

Fishing Method

The fishing grounds for Spanish mackerel drift gillnet are found both in main tidal currents off-shore and the secondary tidal currents that run near the shore, both of which have an isobath at a water depth of 40, 60 or 70 meters along which the fish schools tend to migrate. Although Spanish mackerel drift gillnets are usually set in middle-depth or surface waters, in this area, for reasons that will be explained later, the fishermen set their nets to drift in bottom waters. The net is set perpendicular to the flow of the tidal currents, and because of the fact that schools of fish tend to gather in a current rip, the timing of the net hauling and net setting operation are decided on the basis of the speed of the tidal flow and the position of the current rips.

The fishing boats reach the fishing grounds about 30 minutes before sunset and cast their nets. Then the first hauling is done about 30 to 40 minutes after sunset. The reason for this is that at sunset the fish suddenly migrate from the surface and middle depths to the lower depths, and the fishermen see this as a chance to catch concentrated schools of fish. And likiwise, at the time of sunrise when the fish begin to migrate again to feed in the upper waters, is seen as another good time to make catches.

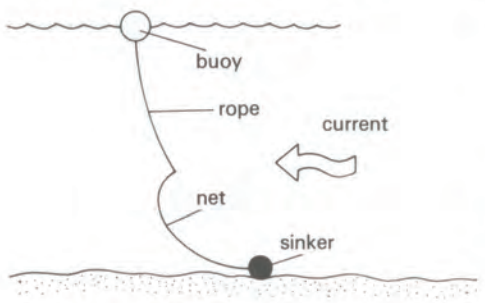
Setting the net: The net is cast into the water from the starboard bow of the boat while running backwards at a slow speed, about 2 knots.

If possible the net should be cast while proceeding in a downwind direction. The operation takes from 15 to 20 minutes. After the net is cast, it is determined time to haul the net.

Hauling the net: After raising the triangular sail (spanker) in the stern so that the boat will proceed straight forward, the net is hauled in by means of the net hauler on the starboard bow section of the boat. One man stands at the net hauler and guides the float rope side of the net, while the second man stands at the remote control handles located at the front of the engine housing to control the forward progress of the boat as he guides the hauling of the sinker side of the net.

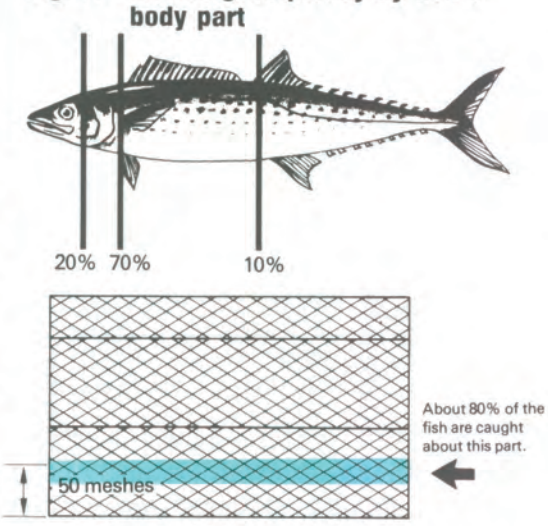
While it is drifting free, the shape of the net should resemble the diagram below. Although the speed of the tidal currents varies greatly, 6 knots in about the limit for keeping the net in a proper functioning shape.

Fig. 16 Shape of net in the water



The net hauling operation can be performed from 2 to 4 times a day, with more winter being the season for more haulings. Although the catch size varies with every hauling, the most to be caught in one hauling has been 870 kg. There are several peculiarities to the way Spanish mackerel are caught. The gill is by far the most common place for the fish to be caught in the net. The part of the net in which the most fish are caught is the lower fifty meshes of the lower net. Although it is not really a remarkable amount, the greater part of the catch seems to be caught in the central portions of the net rather than the ends. And, very few fish seem to be caught near the seams where the net has been sewn together.

Fig. 17 Catching frequency by fish's body part



Types of Fish Caught

The catches consist mainly of 1) Spanish mackerel, 2) Ilisha elougata and 3) sea bream in this order. In addition to these sardine, mackerel and harvest fish will also be found in the catches.

Once a Spanish mackerel has become emmeshed in the net, it will only live for about three minutes. Therefore, the entire catch is dead at the time of hauling. In order to preserve the freshness of the fish, they are put in ice water in the hatch for about 30 minutes as soon as they have been taken from the net. Then, after the body has become firm with the cold water, the fish are packed in boxes with ice.

Fisheries Cooperative Union

Here are the statistics concerning the Uki Fisheries Cooperative Union (as of March 31, 1983):

Cooperative members

Regular members 433

Executives and Officials

(1) Executives: 1 Chairman, 6 Directors, 2 Auditors

(2) Officials: 1 Councilor, 1 Accountant, 1 Credit officer, 1 Purchasing officer, 4 Sales officer

Total 8 officials

Business

(1) Credit
- Savings balance . . . . . 473 million yen (of this savings from non-member sources . . . . . 154 million yen)
- Balance on loan . . . . . 140 million yen
- Balance borrowed by Coop . . . . . 136 million yen

(2) Fishery purchasing
- Monies spent on fishery material. . . . . 94 million yen (of this fuels cost . . . . . 73 million yen) (netting + ropes. . . . . 4 million yen)

(3) Sales
- Sales of cooperative fishery products (volume of business)

Fresh fish 1500 tons . . . . . 495 mil. yen
Sardine (for processed foods) 500 tons . . . . . 60 mil. yen
Sardin (for aqua-culture feed) 1600 tons . . . . . 50 mil. yen
Processed seafoods (Sardine "niboshi") 200 tons . . . . . 132 million yen

(4) Ice making/Refrigeration
- Ice sales (ice made by Coop and purchased from outside) 2400 ton . . . . . 12 million yen

Cooperative Offices (3-story ferro-concrete building), Ice storage refrigerator, fuel tank, storehouse for marine products, storehouse for boats and fishing gear, Ice-making machine (3 ton/day), seafood processing factory, beaching slope for fishing boats, crane for boat repairs and maintenance (one each of 2 ton and 8 ton), vehicles (2 trucks of 2-ton load capacity)

Source:
1. *Uki Fisheries Cooperative Union*
2. *Mr. Hiroshi Hama (Isahaya city)*

Full view of Uki harbor

Office building of Uki Fisheries Cooperative

Fishing boat slope and maintenance shop (Cooperative facilities are leased to private organizations.)

Table 16 Variations of inshore misc. gillnet

Based on statistics of the Nagasaki Pref. Fisheries Experiment Station

			①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Region			Uome (Goto)	Arikawa (Goto)	Fukue (Go to)	Tomie (Goto)	Mine (Tsushima)	Nishidomari (Tsushima)	Ohnezaka	Shika-machi	Sasebo	Sasebo
Catch			Opaleye/sea bream parrot fish	Lobster/sea bream parrot fish	Blue crab	Lobster	Opaleye/yellowtail sea bream	Crimson sea bream/grunt/sea bream/opaleye	Opaleye/rabbitfish	Cuttlefish/flounder flatfish	Gizzard shad	Prawn kumaebi (Penaeidae)
Position of net setting			Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Water depth			About 10 m	Shallower than 50 m	5~15 m	20~30 m	15~20 m	30~80 m	15~70 m	Shallower than 50 m	7~15 m	Shallower than 40 m
Bottom type			Reef	Reef	Mud	Reef	Reef	Sand	Reef	Sand	Mud	Sandy mud/Sand
Netting	Main net	Material	Nylon	Nylon	Nylon	Nylon	Amilan	Nylon	Nylon	Nylon	Nylon mono-filament	Nylon
		Thickness	6 y.	10 y.	12 y.	20 y.	210 DX 8 y.	8~10 y.	8 y.	8 y.	#1.5~2	4 y.
		Mesh	9 cm	11.4 cm	11 cm	9.6 cm	9 cm	12 cm	8.5 cm	9 cm	6 cm	4 cm
		No. of meshes	33	22	10	14	50	50	33	24	50	33
		Length of netting	75 m	75 m	75 m	80 m	75 m	75 m	75 m	75 m	150 m	49.5 m
		Finish length	37.5 m	49.5 m	30 m	28.5 m	37.5 m	37.5 m	33 m	33 m	67.5 m	17 m
	Outer net	Material	Nylon	Nylon	—	Nylon	Amilan	Nylon	Nylon	Nylon	—	Nylon
		Thickness	12 y.	16 y.	—	36 y.	210 DX 16 y.	18 y.	16 y.	16 y.	—	8 y.
		Mesh	30 cm	36 cm	—	33 cm	45 cm	36 cm	39.4 cm	36 cm	—	18 cm
		No. of meshes	18	12	—	6	5.5	4	4.5	3.5	—	4.5
		Length of netting	75 m	75 m	—	69 m	62 m	53.6 m	70.5 m	60 m	—	32 m
		Finish length	37.5 m	49.5 m	—	28.5 m	37.5 m	37.5 m	33 m	33 m	—	17 m
Fishing boat/engine			Under 1 ton 10hp outboard	1.5 tons 25 hp	3 tons 10 hp	1~5 tons 4~60 hp	Under 5 tons 20~60 hp	5 tons 39 hp	4.4 tons 39 hp	3 tons 20 hp	1.8 tons 12 hp	1.8 tons 12 hp
Number of laborers			1	2	2	1	2~3	2	2	2	2	2

TYPE 3

Examples of Small-Scale Gillnet

Drift type gillnet with bag net for prawn

Example: A bottom drift gillnet for prawn **Location: Eisei, Aichi Prefecture**

This type of fishing gear, called "genshiki-ami", is a type of drift net used to catch mainly prawn, by making use of the tidal currents in shallow sea areas. Although at one time this method was used widely throughout Japan's inland sea areas having strong tidal currents, today its use is limited to the waters of the Ariake-kai and Mikawa bay.

In this type of fishery the catching ability of the net depends heavily on two important factors as they effect the shape of the net, especially the bag net, during operation. These two factors are (1) the speed of drift of the net in relation to the speed of the tidal current, and (2) the rigidity of the net material. The design of the net is determined by such factors as the tidal currents and the sea bottom topography, and additional adjustments are made in the way the net is set in the water with differing sea conditions by adjusting the number of floats and sinkers attached to the net.

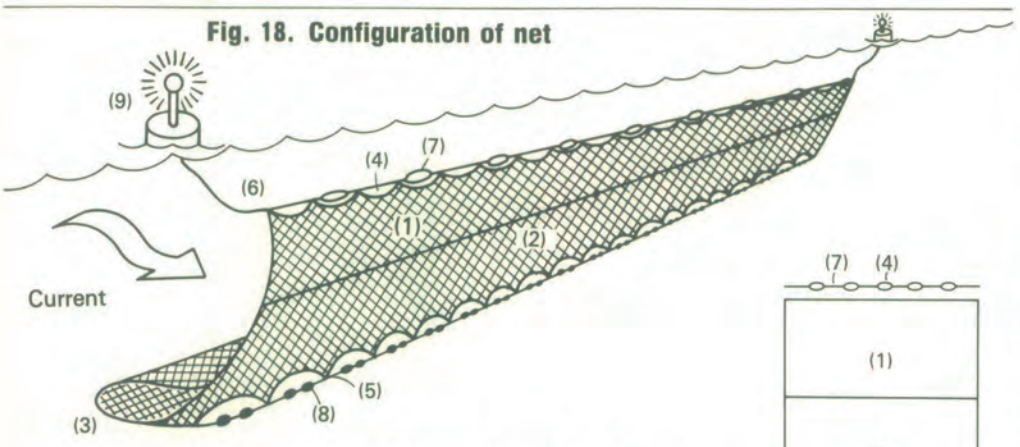
Net hauling

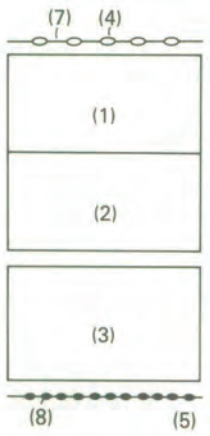
Kuruma prawn

Sifting out the catches on bow deck.

Fishing gear

Fig. 18. Configuration of net





(1) Body net (upper) (2) Body net (lower) (3) Bagnet (4) Float line (5) Sinker line (6) Buoy rope (7) Float (8) Sinker (9) Buoy

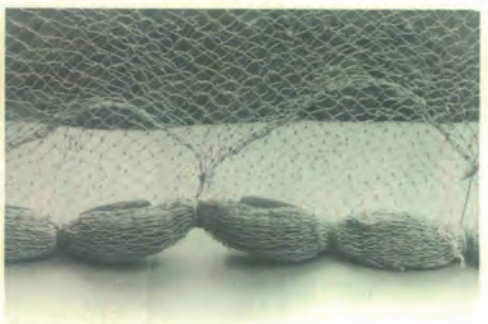
Nets specifications

Part	*Material*	*Thickness*	*Mesh size*	*No. of meshes*	*Length of netting*	*Finished length*
Body net (upper)	*Nylon*	*210 D/2y.*	*3.5 cm*	*200*	*168 m*	*150 m*
Body net (lower)	*Nylon*	*210 D/2y.*	*2.3 cm*	*100*	*168 m*	*150 m*
Bagnet	*Nylon*	*210 D/2y.*	*1.8 cm*	*130*	*214 m*	*150 m*

Lines and ropes specifications

Part	*Material*	*Thickness*	*Length*
Float line	*Nylon*	*5 mm*	*150 m*
Sinker line	*Nylon*	*5 mm*	*150 m*
Buoy rope	*Cremona*	*6 mm*	*15 m*

Float: synthetic foam resin, 7d × 30D × 142L, approx. 220 pieces (about 71 cm intervals)
Sinker: earthenware, 5d × 20D × 35L, approx. 2,660 pieces (about 17 cm intervals)



Mouth of bag net

Operation

The fishing operation begins just after sunset. This is because the fishermen wish to catch the prawn just at the time of day when they crawl out of the sandy bottom to begin their feeding activities.

With the fishing boat moving forward at slow speed in a perpendicular line to the direction of flow of the tidal current, the buoy, fitted with a light, the rope, and then the net are laid out in the water. After the entire net has been set out, the boat's anchor is thrown in and the boat brought to a stop. Then the net is set free to drift. As the net is pushed along by the tidal flow, the bagnet, with sinkers attached, drags along the bottom. After about half an hour of drifting the net is hauled in and the catch is shaken out of the bagnet. This process is repeated several times during a night.

The Action of the Bagnet

The configuration of the net during operation can be classified into four types, as shown by A-D in Table 17.

Condition A: This is the ideal net shape, with a large mouth opening. Because the relative speed of the net is slightly slower than the tidal current, the leading edge of the bagnet stretches backward for some distance from the sinker rope, resulting in a smooth upward curve of the bagnet. This makes it easy for the prawn to enter the net and hard for them to escape.

Condition B: This is an often seen condition of the net during operation. Because the relative speed of the net drift is almost identical to the speed of the tidal current, the bagnet inflates upward from the sinker rope. Since there is no backward stretch of the net from the sinker rope, this condition is inferior to A.

Condition C: In this case, because the bagnet is too soft, it is flattened out by the tidal force in the forward direction. The result is a depressed mouth opening.

Condition D: Both the body net and bagnet are pushed flat against the sea bottom, with part of the bagnet turning inside out.

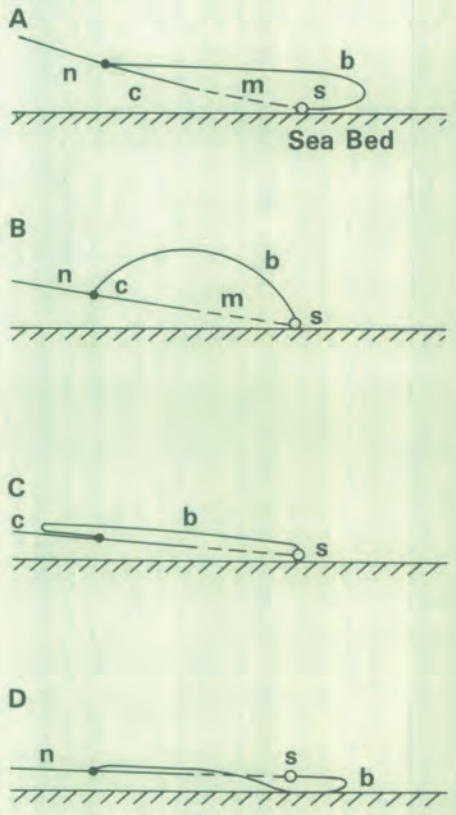
If this situation continues for some period of time, the bagnet becomes entangled in the sinker rope and the bagnet function is lost completly.

(Note) Reference: "Research concerning the performance of 'Genshiki-ami' fishing gear — I & II" by Ko Matsuda and Chikashi Masuda
—Bulletin of the Japanese Society of Scieutific Fisheries (1976)—

Catch

When sand and mud bottom areas with a sea depth of less than 10 meters are chosen as fishing grounds, the main catch is prawn, with other types of shrimp, blue crabs, conger eel, rock trout, and rock fish being caught as well.

Table 17
Configuration of the net during operation



b. Bagnet
c: Cover net
m: Mouth of bagnet
n: Body net
s: Sinkers and sinker line

(by Mr. Ko Matsuda and Mr. Chikashi Masuda)