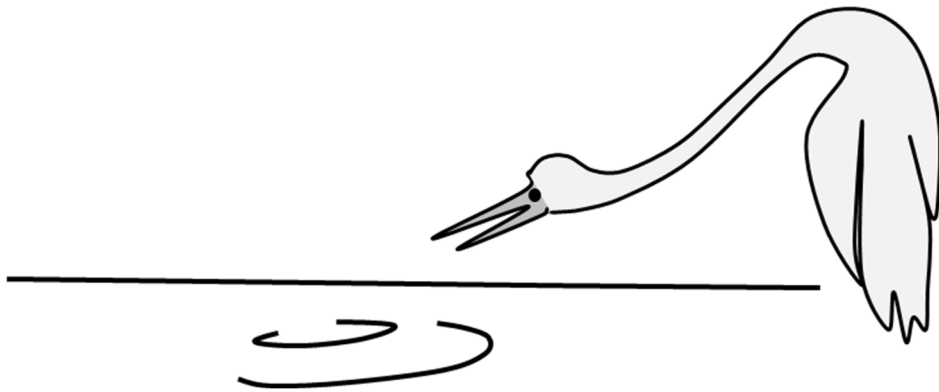


**Specified Skills**  
**Educational Textbook for the Fishing Industry Skills Proficiency**  
**Test (Fishing)**  
**(General Fishing Section)**



**Japan Fisheries Association**  
**(First Edition: December 2019)**

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## 1. Global Fishing and Aquaculture Yield

The combined global yield of fishing and aquaculture continues to increase. This combined yield has reached 205.59 million tons (as of 2017), although the fishing yield from fishing vessels has stayed around the same level since the second half of the 1980s. The countries with the highest fishing and aquaculture yields, starting with the highest, are China (approximately 80 million tons), Indonesia (approximately 22 million tons), and India (approximately 11.5 million tons).

(Figure 1)

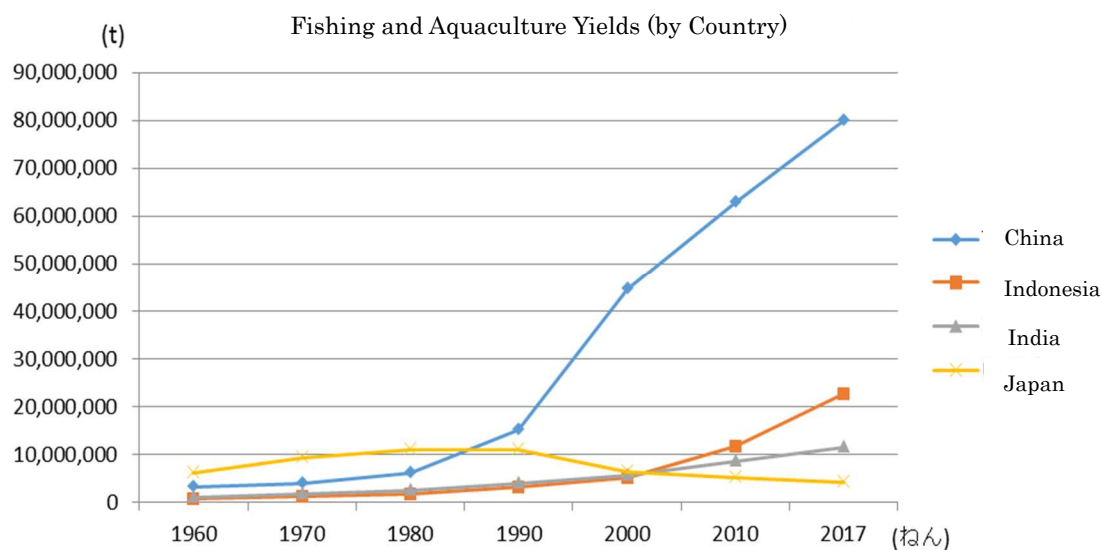


Figure 1: Fishing and Aquaculture Yields (by Country)

(Source: Based on the FY2018 White Paper on Fisheries)

## 2. Japan's Fishing and Aquaculture Yield

Fishing developed as an industry that widely supplies seafood as animal protein sources to the people of Japan, and has formed a unique culinary culture. In addition, fishing, which involves collecting and catching living creatures underwater, is strongly influenced by natural conditions. Accordingly, due to the variations in fishing tools used depending on the targeted species, fishing techniques also vary. Japan's fishing industry mainly consists of coastal fishing, offshore fishing, deep-sea fishing, sea aquaculture, and inland fishing and aquaculture. Yields peaked in 1984, then dropped rapidly until around 1995. A gradual decreasing trend has continued ever since (Fig. 2, Fig. 2-1).

- Coastal fishing

Fishing conducted along the coast using a small fishing vessel. This includes fixed netting and aquaculture.

- Offshore fishing

Mainly refers to fishing operations carried out in waters within 200 nautical miles of Japan.

- Deep-sea fishing

Mainly refers to fishing operations carried out over 200 nautical miles from Japan.

- Sea aquaculture

Fishing involving using fish tanks and similar equipment arranged in the sea to artificially raise and catch seafood.

- Inland fishing

Fishing conducted in fresh water (rivers and lakes).

- Inland aquaculture

Fishing involving using fish tanks and similar equipment arranged in fresh water (rivers and lakes) to artificially raise and catch seafood.

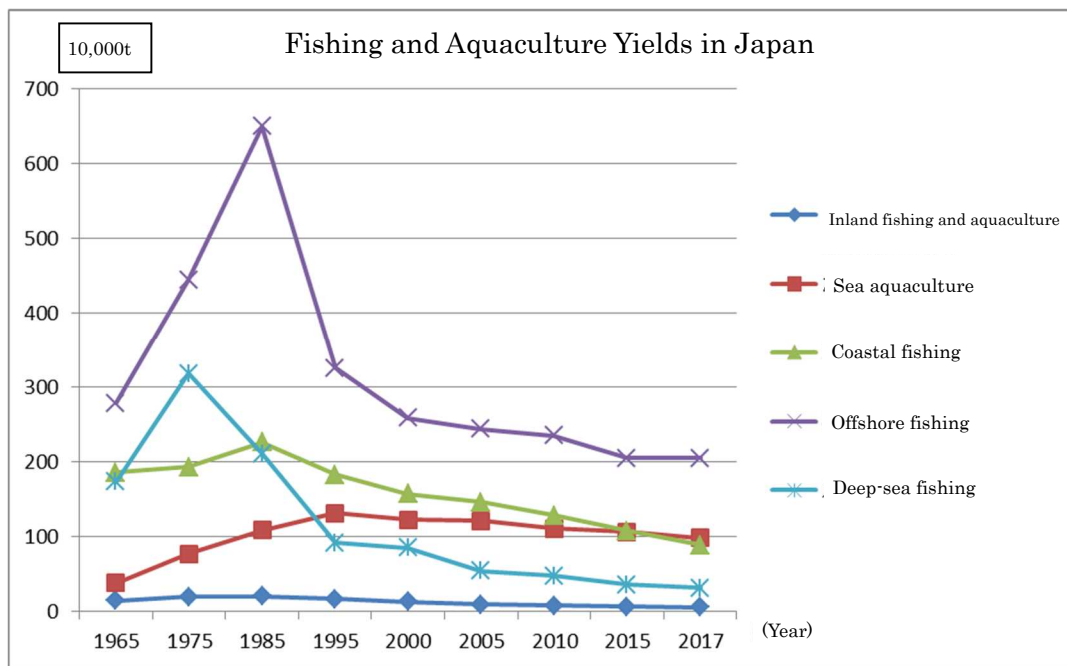


Figure 2: Japan's Fishing and Aquaculture Yield

(Source: Based on the FY2018 White Paper on Fisheries)

Fishing and Aquaculture Yields in Japan (2017)




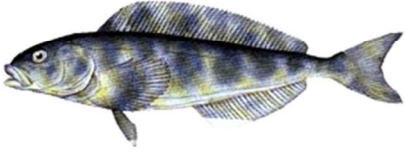






	10,000t
Inland fishing and aquaculture	6
Sea aquaculture	99
Coastal fishing	89
Offshore fishing	205
Deep-sea fishing	31











Figure 2-1: Fishing and Aquaculture Yields in Japan(2017)  
 (Source: Created from FY2018 White Paper on Fisheries)

### 3. Main Fish Caught in Japan

Japan's coasts stretch a long distance from north to south, with many warm and cool ocean currents flowing together along them, and various kinds of fish are caught in the surrounding waters. Different fish species inhabit different ocean depths. Bonito, sardines, tuna, and sea bass are some of the main inhabitants near the surface, while crabs, cod, shrimp, and squid, areas are the most common species near the ocean floor.

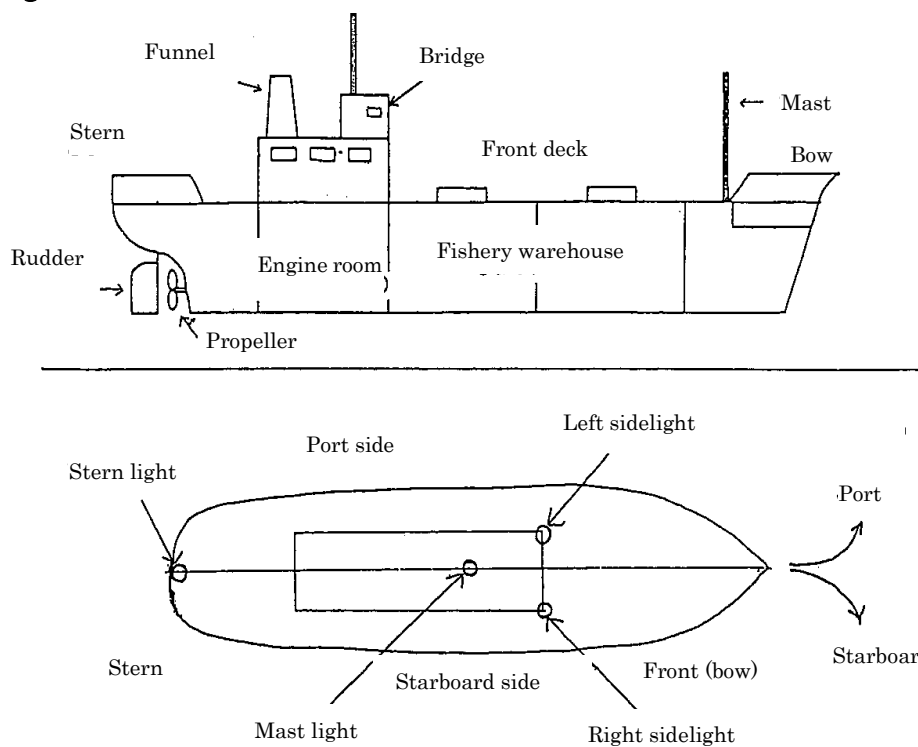
Below are some of the main types of fish caught in the oceans off the coast of Japan.

	
Monkfish	Herring
	
Crab	Atka mackerel
	
Shrimp	Yellowtail
	
Horse mackerel	Mackerel
	
Sardine	Sea bream

	
Salmon	Halibut
	
Cod	Bonito
	
Tuna	Blowfish
	
Swordfish	Saury
	
Spanish mackerel	Squid



## 4. Fishing Vessels



### Steering

Starboard: steer the rudders to the right

Port: steer the rudders to the left

### Colors of navigation lights

Masthead light: white

Stern light: white

Left sidelight: red

Right sidelight: green

### Ship swaying

Vertical swaying: pitching

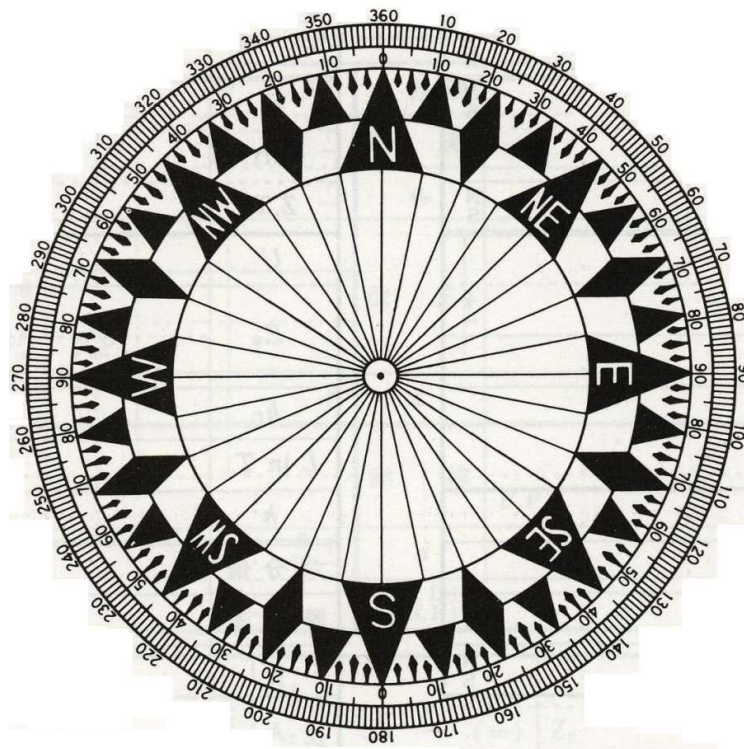
Horizontal swaying: rolling

## 5. Fishing Vessel Crew

Chief fisherman	The person responsible for overall operations. The captain may double as the chief fisherman.
Captain	The person responsible for navigation of the ship.
Chief engineer	The person responsible for the engine, the refrigeration system, and other equipment.
Navigation officer	Assists the captain in performing ship navigation tasks.
Engineer	Assists the chief engineer in managing the machinery.
Chief radio operator	The person responsible for radio communications.
Boatswain	Directs the deckhands.
Chief of refrigeration	Processes caught fish and manages the refrigerator(s).
Chief steward (Head cook)	Prepares meals for the crew members.
Deckhand	Conducts ship watches and performs fishing tasks, refrigeration tasks, and other work.
Engineering crew	Performs engine tasks and assists with fishing and refrigeration tasks.

## 6. Compasses, Nautical Charts, and Navigation

### (1) Compasses



Compasses are essential tools that assist in calculating the location of the ship and determining the course (route). The main positions are marked with letters of the alphabet.

N: (north)

E: (east)

S: (south)

W: (west)

NE: (northeast)

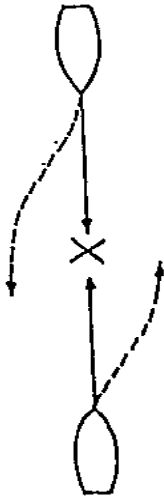
SE: (southeast)

SW (southwest)

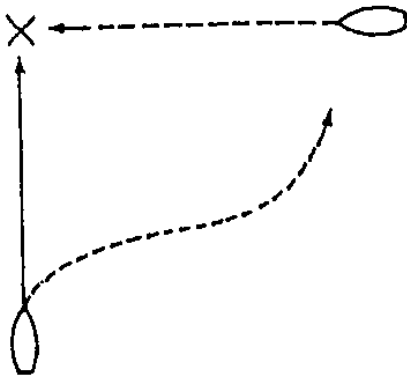
NW (northwest)



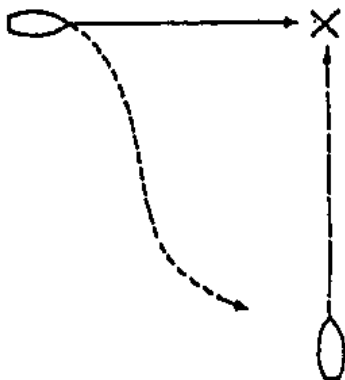
### (3) Navigation



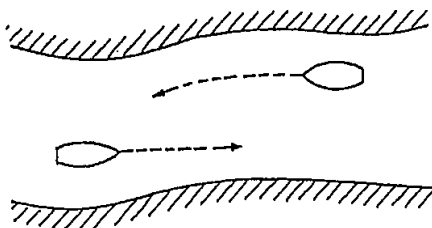
- When a ship is approaching from the front, steer the rudders to the right to avoid it.



- When a ship is crossing in front, avoid it by either steering the rudders to the right when the ship is to the right of your vessel or by slowing down your speed.



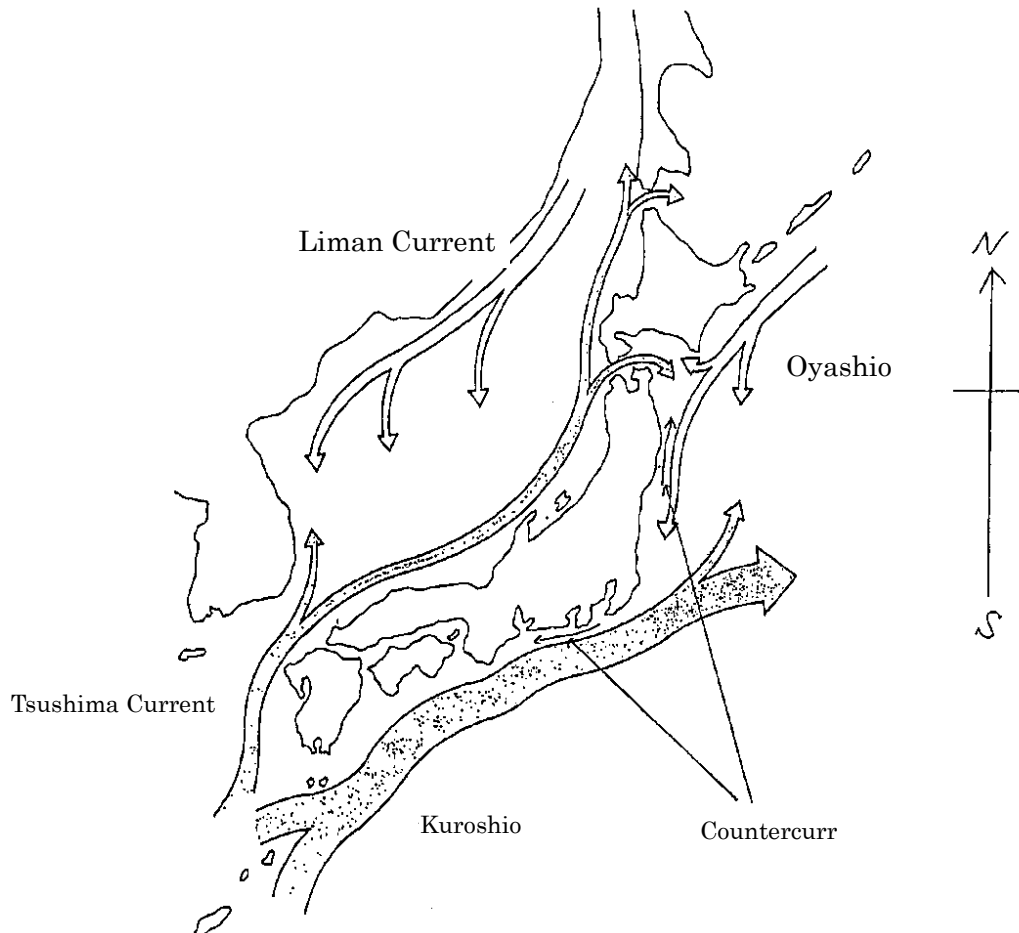
- When a ship appears from the left, proceed straight ahead as this ship will avoid yours. However, sufficient caution should be taken to ensure that the other ship correctly avoids your ship.



- Generally speaking, ships keep to the right.

## 7. Ocean Currents and Continental Shelves

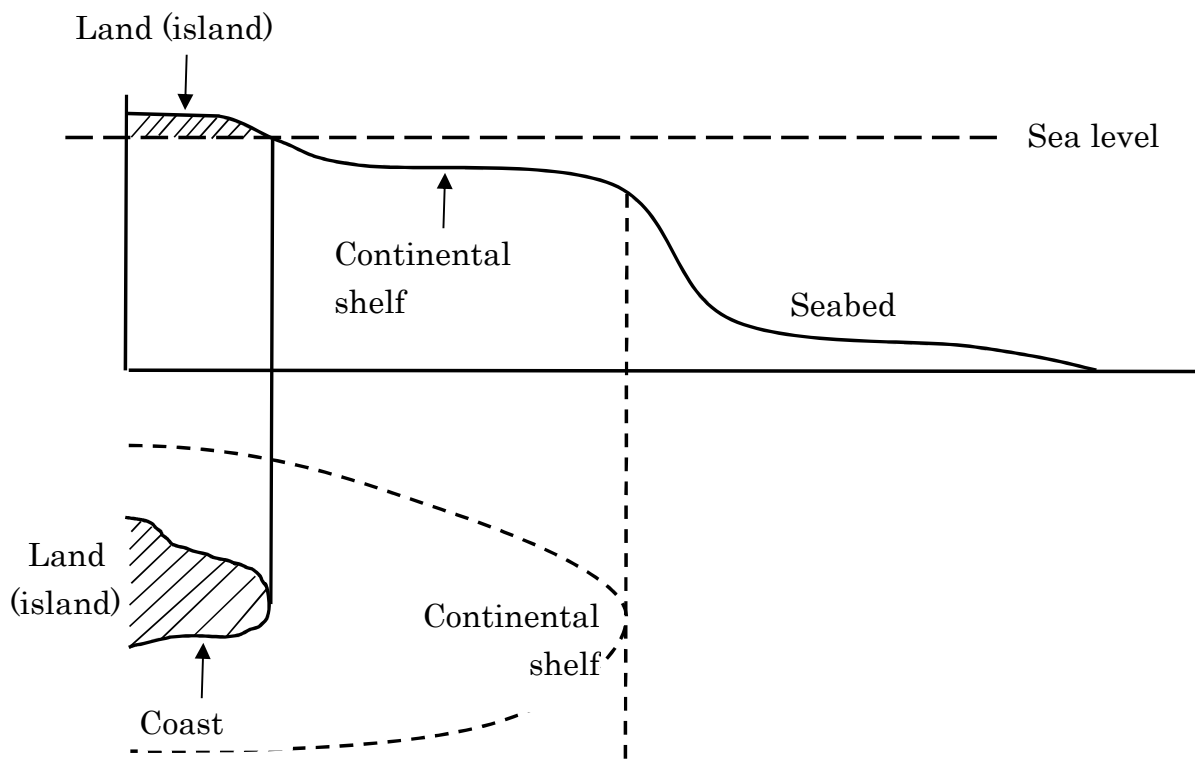
### (1) Ocean currents



There are four currents which flow in the oceans around Japan: the Kuroshio Current and the Tsushima Current, which are warm currents from the south, and the Oyashio Current and the Liman Current, which are cold currents from the north. At the coasts, there are currents which flow in a direction opposite to the main current of the open sea which are called countercurrents.

## (2) Continental shelves

The areas around islands and continents are surrounded by shallow seas called continental shelves. Continental shelves are important locations for a country, and they are also spots with good fishing grounds.



## 8. Fishing Terms

Red tide:

A state in which plankton (particularly phytoplankton) are present in excessive numbers and the color of the water changes to red or brown is called a red tide. This has a major impact on fishing due to the increased plankton using large amounts of oxygen in the water, which can cause fish and shellfish to die due to the plankton becoming stuck in their gills.

Nutrient salt:

Nutrient salt refers to minerals such as nitrogen (N), phosphorus (P), silicon (Si), which are essential for sea life to survive.

Eutrophication:

Eutrophication refers to an excessive increase in minerals such as nitrogen (N), phosphorus (P), and silicon (Si). This state is caused by the disposal of water from factories or households which contains an abundance of these minerals.

Prevention of marine pollution:

The disposal of contaminants such as oil, dirt, plastics, garbage, and fishing equipment no longer in use into the ocean causes water pollution. In order to prevent pollution, disposal of these types of items into the ocean is prohibited by law.



Upwelling current:

An upwelling current refers to water near the ocean floor rising up to the surface. The water that has risen to the surface has a low temperature and is high in nutrient salt. Due to these factors, large quantities of plankton gathers, which makes the surrounding area a good fishing ground.

Salinity of sea water:

This refers to the amount of salt contained in sea water. It is displayed as a number of grams (‰, per mille) in 1 kg of sea water. Generally, the salinity of sea water ranges from 33 to 37‰ (33 to 37 g per kg).

## 9. Netting Fabric

### (1) Netting fabric structure

Netting fabric is categorized knotted netting and knotless netting depending on whether there are knots present. Knotted netting is made up of four knots and four legs per mesh (Fig. 3). Knotless netting has an intersecting portion of netting threads in place of the knots. A flat knot slips out of place easily, while an Englishman's knot tends to stay in place.

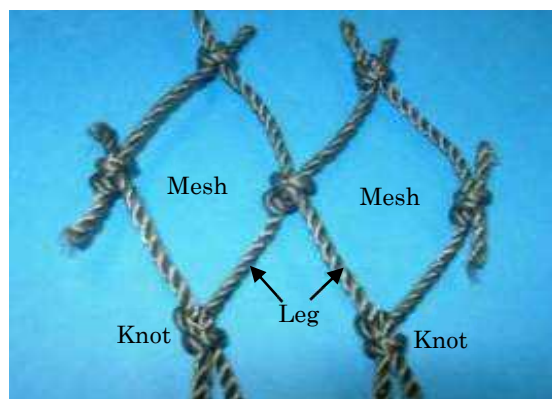


Figure 3: Name for each part of knotted fabric

## (2) Methods for tying threads

The simplest and most common tying method is shown in Fig. 4. It results in an Englishman's knot, which is the same as a sheet bend for a rope. In the case of threads that tend to slip, a double knot with the ring in (2) of Fig. 4 formed twice is used.

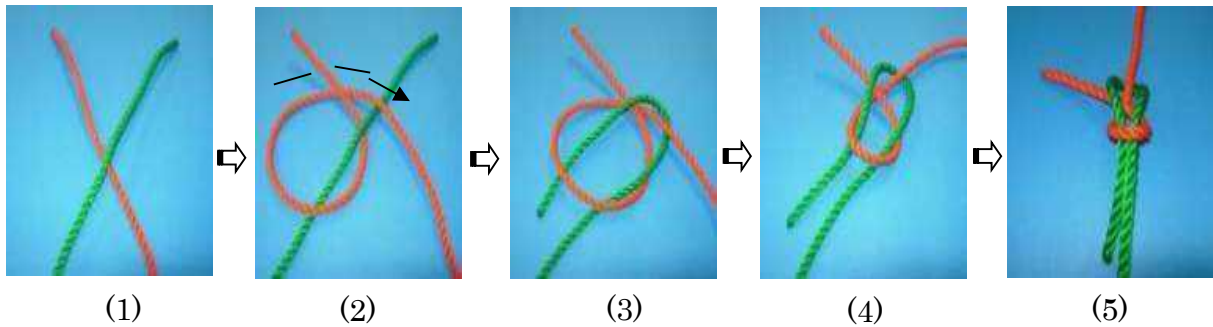


Figure 4: Common tying method

## (3) Direction for connecting netting fabric

*Hana* joining (lengthwise direction):

When joining the lengthwise directions together as shown on the left in Fig. 5, the netting threads on the knotted portion of the ends of the netting fabric are one continuous thread. In this case, tie the material with an Englishman's knot, using a double Englishman's knot for the first and final knots. For fishing line, since the knots tends to slip out of place, so tie the thread firmly using a double Englishman's knot.

Side-joint joining ("yarn over" direction):

When tying in the "yarn over" direction as shown on the right in Fig. 5, tie with a flat knot, and for the first and final knots, use a double Englishman's knot. In this case, the threads of the two legs for the knots on the end are not continuous, so be sure to tighten by interposing the knots.

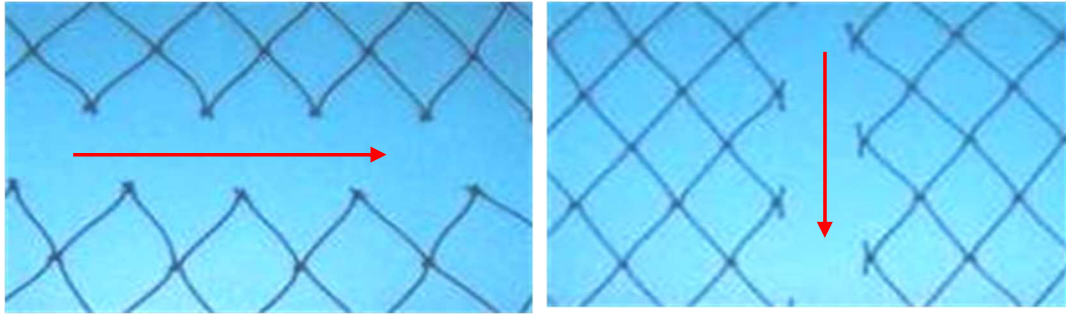


Figure 5: Way of tying netting fabric: *hana* joining on the left, and side-joint joining on the right

#### (4) Netting fabric sewing method

There are two main methods of sewing together two pieces of netting fabric: "joining" and "wrap-joining." Joining is a method of sewing together the two pieces of netting fabric with the end knots tied together, while wrap-joining is simply sewing without tying. Different methods of connecting the two pieces are used, and some examples are "mountain," "mountain-valley," and "valley" methods (Fig. 6).

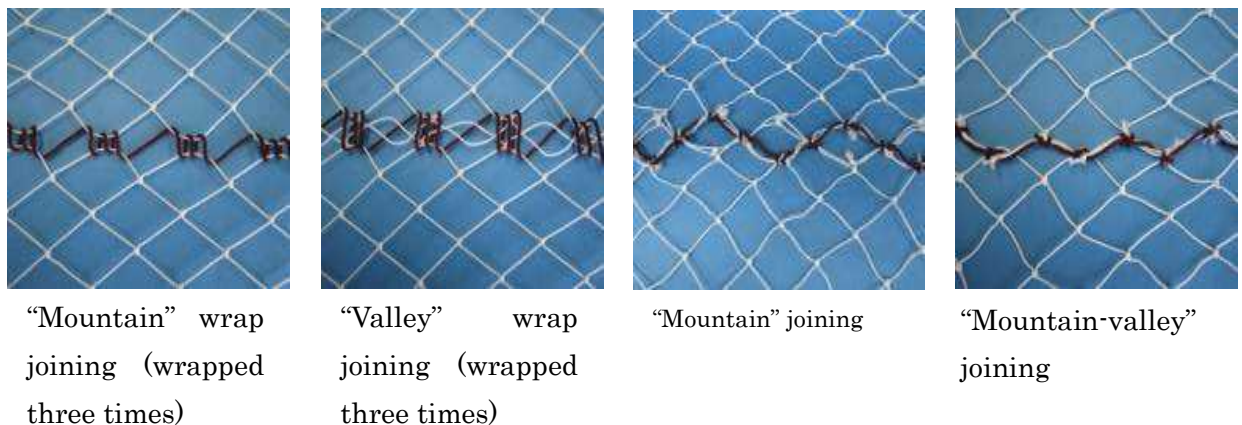


Figure 6: Wrap-joining method for sewing netting fabric

In addition, the basic repair methods for regular and crossing repair of torn netting fabric are as shown below.

- Regular repairing

Using a thread the same thickness as the netting fabric, conduct a repair using the same knots and mesh sizes. The sewn portions blend in with this method, but the repair process is time-consuming (Fig. 7).

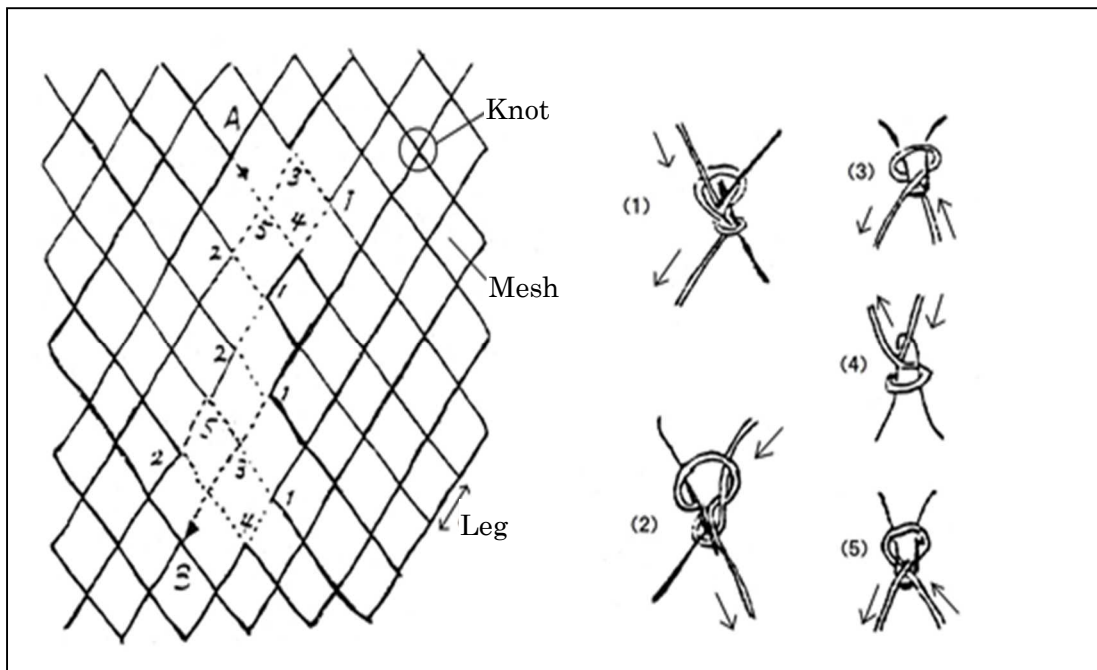


Figure 7: Regular repairing and netting needle movement

- Crossing repairing

This is a method of repairing without organizing the area around the torn netting. The sewn portion stands out, but repairs can be completed more quickly with this method (Fig. 8).

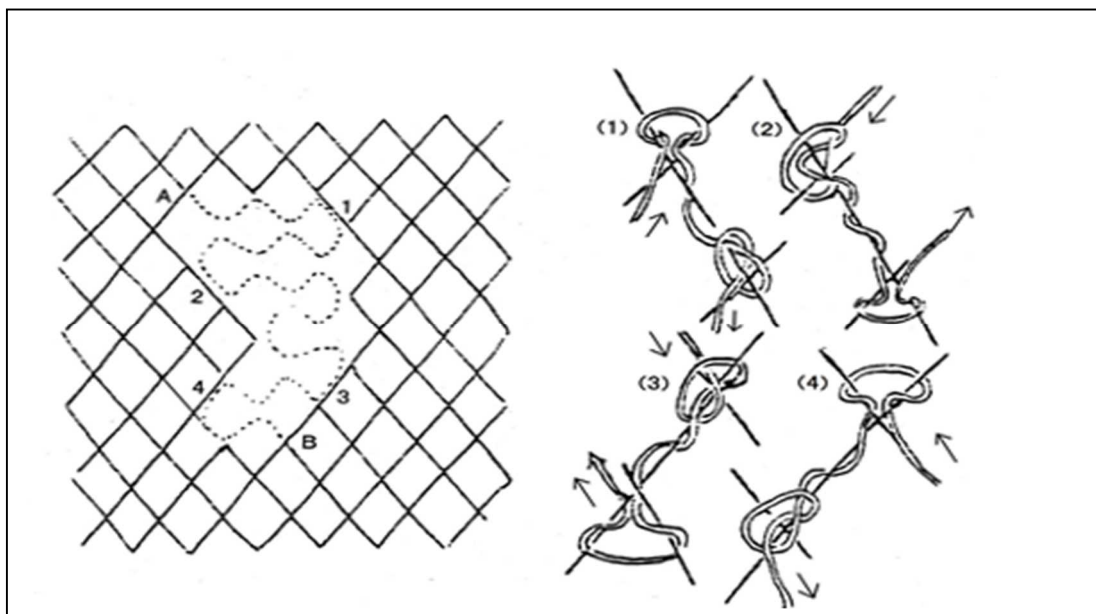
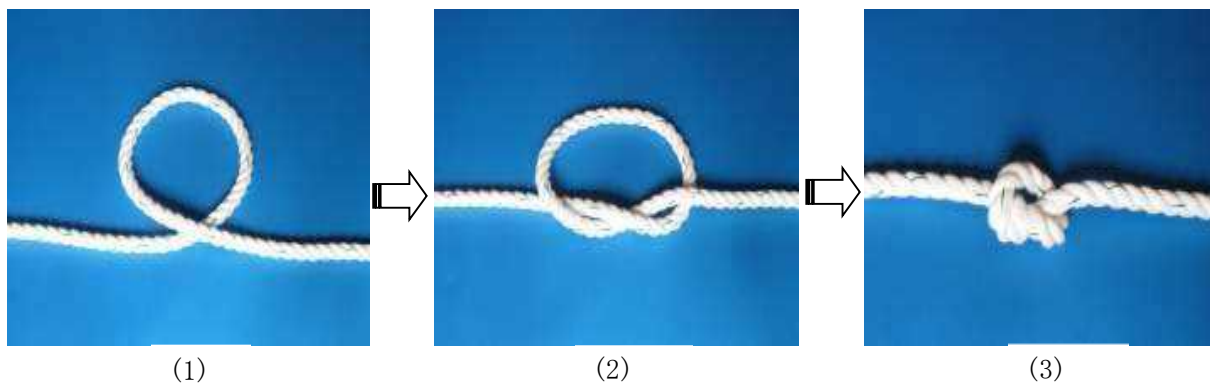


Figure 8: Crossing repairing and netting needle movement

## 10. Rope Knots

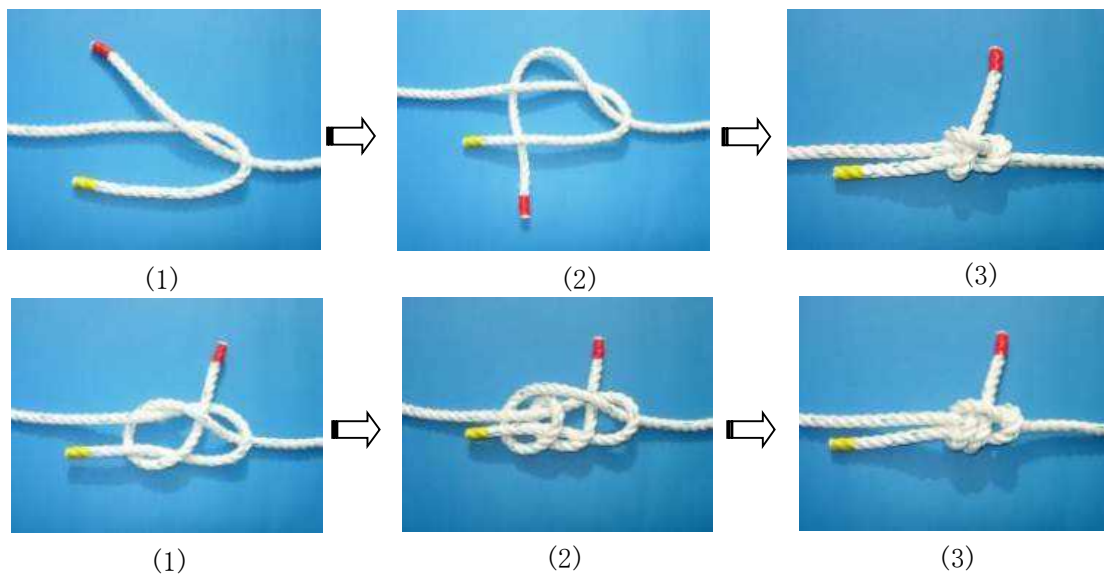
### (1) Single knot

This is a simple knot in a basic shape. Once the rope is tightened, this knot is difficult to untie.



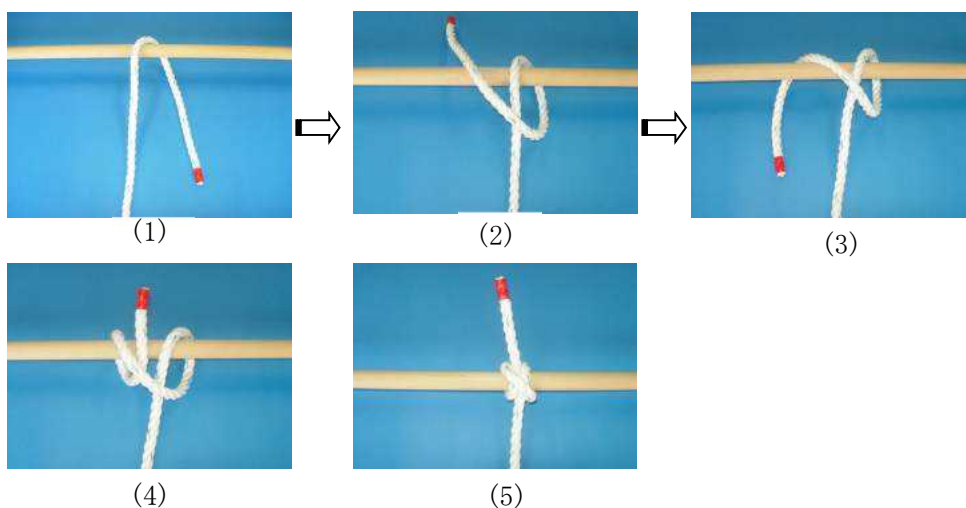
## (2) Sheet bend

This knot is used when tying the ends of two ropes with the same thickness. It is an important knot that is used often. The top photos show a single sheet bend, and the bottom ones show a double sheet bend. In the case of ropes with different thicknesses or ropes that tend to slip, a double sheet bend is used.



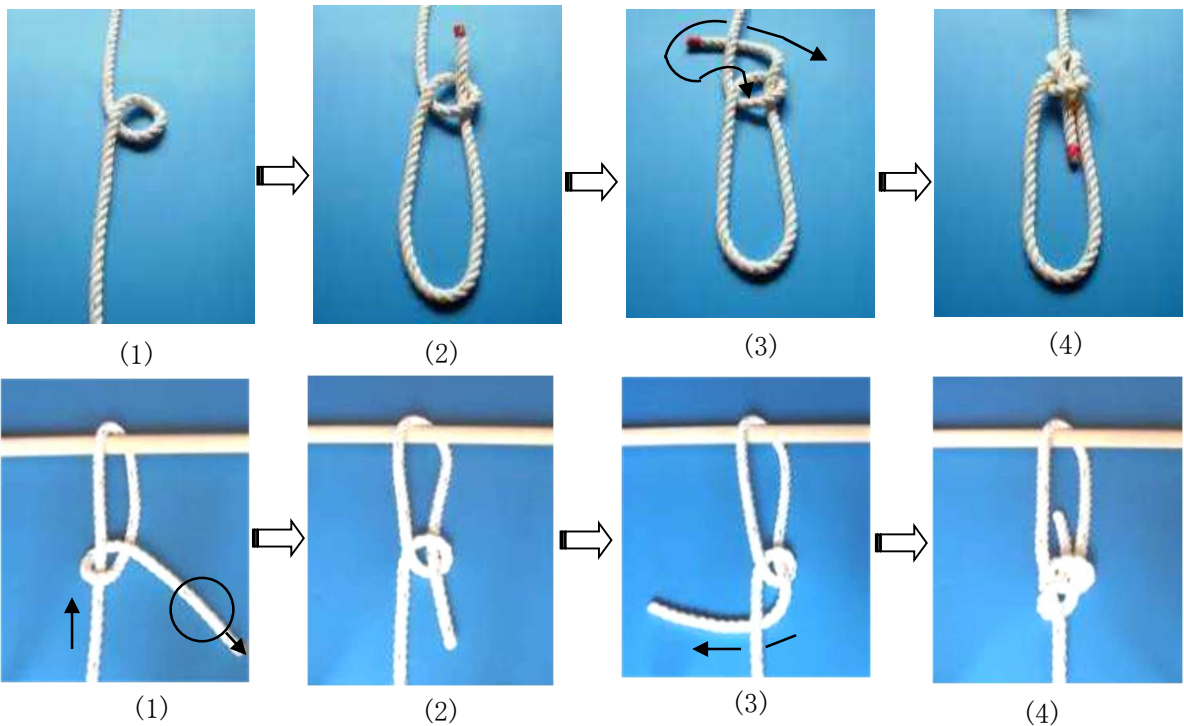
## (3) Clove hitch

This knot is often used when temporarily tying the end of a rope to a pole-shaped object. One example is temporarily tying the rope to a bit or similar structure on a small ship. It may be difficult to untie once it is tightened.



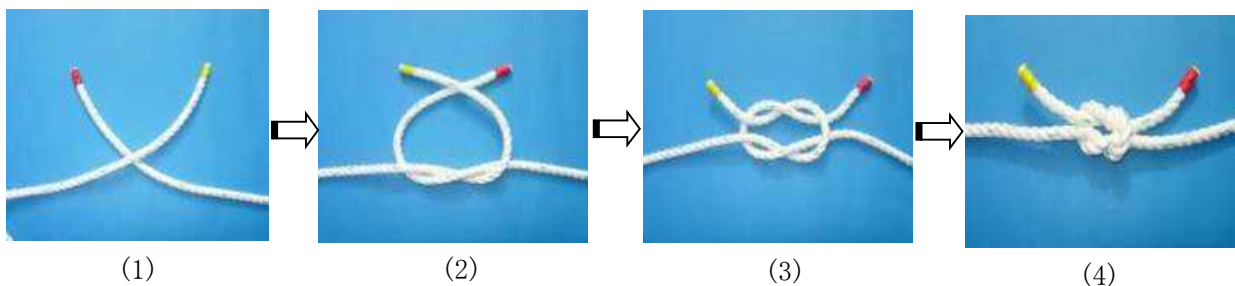
#### (4) Bowline knot

This knot is used for applications such as tying a rope to a bit. It is a safe, reliable knot. Another reason it is often used on ships is because it is easy to untie. The hand movements differ depending on whether the knot is used to drape the rope over an object or not.



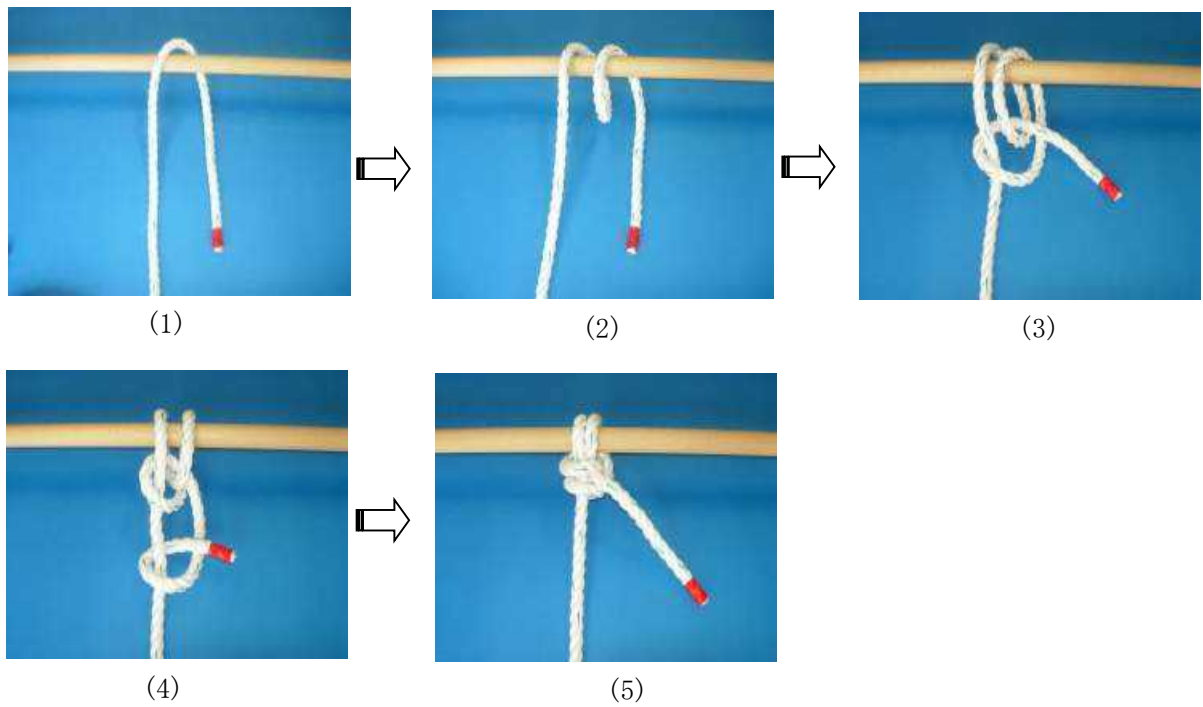
#### (5) Reef knot (regular knot or true knot)

This is an important knot used when tying together two ropes of the same thickness as a temporary measure, such as when repairing cut sections on a rope.



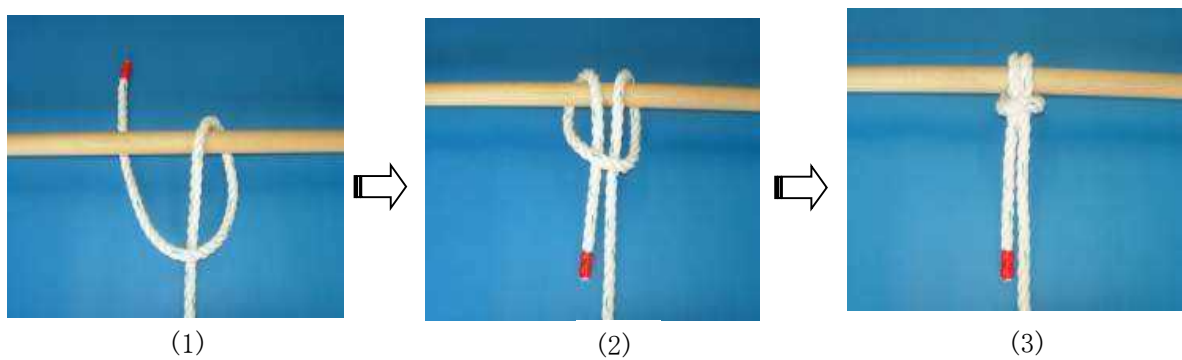
### (6) Anchor knot

This is also called a fisherman's knot, and it is used when tying a rope to the ring of a small anchor.



### (7) Cow hitch

This is effective when temporarily slinging the middle of a rope over an object.

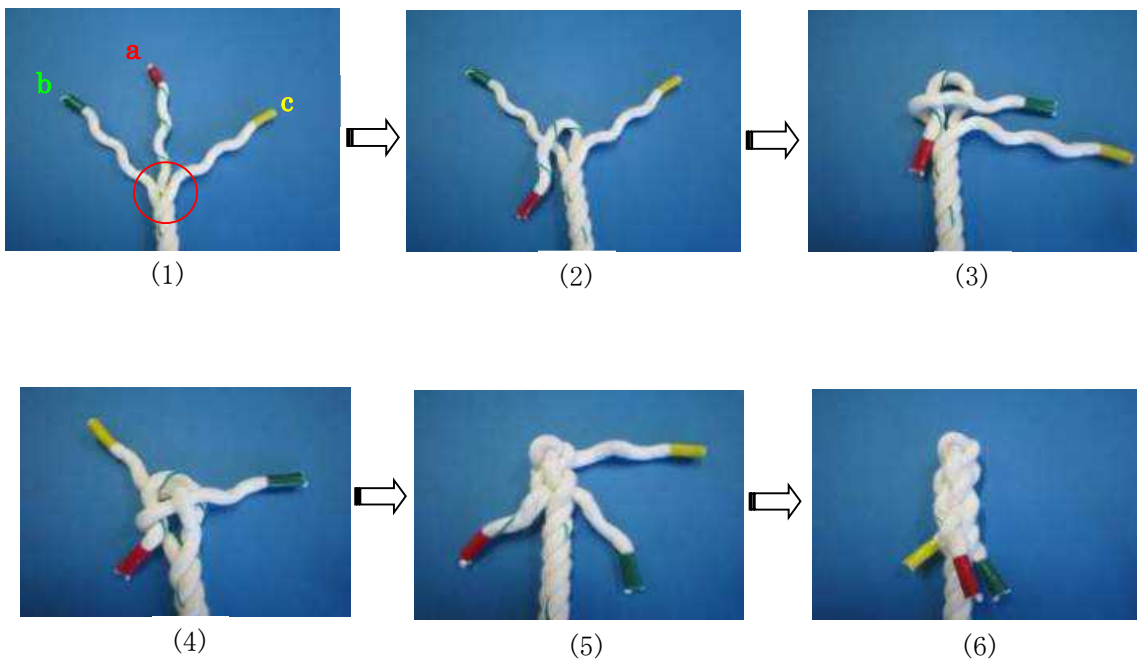




## 11. Treatment of Rope Ends

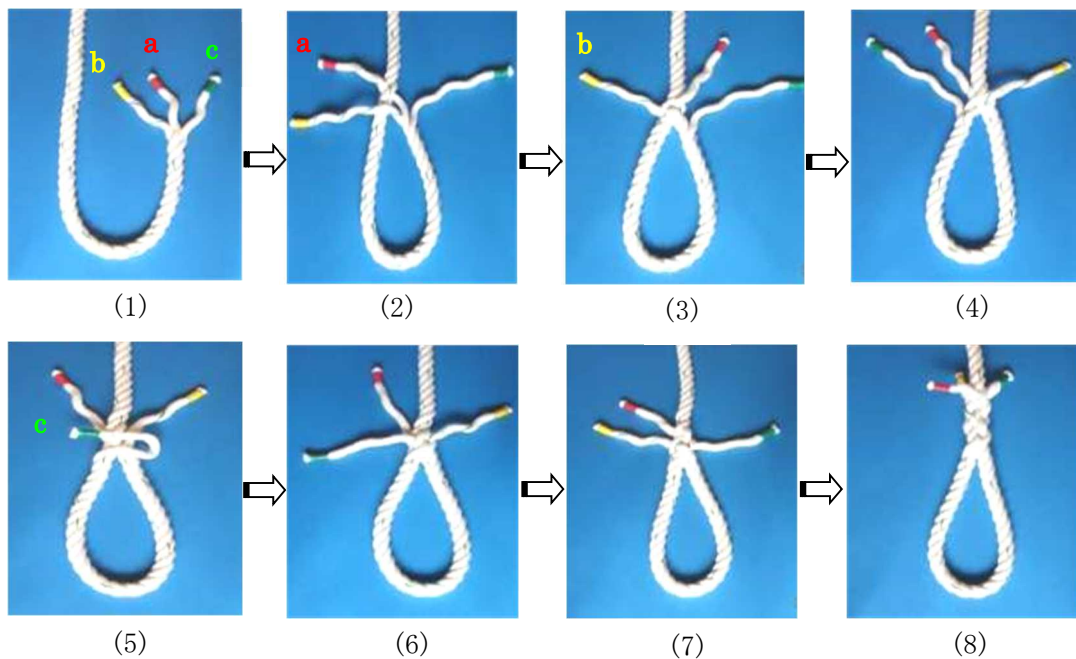
### I. Back splice

- (1) Separate the strands into "a," "b," and "c."
- (2) Bring "a" to the front.
- (3) Wind "b" around strand "a" starting from the outer side.
- (4) Wind "c" around strand "b" starting from the outer side, then insert it into the ring of "a." This is called a "crown knot."
- (5) After securely tightening the combined strands, bring each strand around and insert them into each of the other strands.
- (6) Insert each strand three or more times to finish.



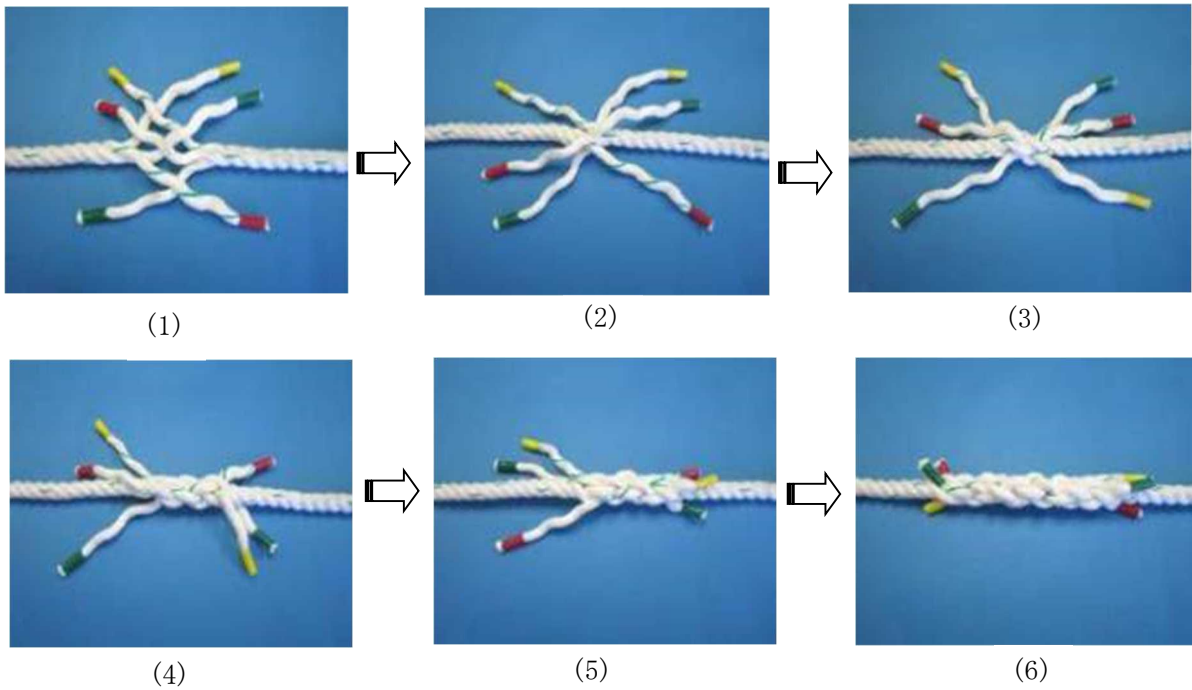
## II. Eye splice

- (1) Separate the strands into "a," "b," and "c."
- (2) Insert "a" into the strands.
- (3) Insert strand "b" under the strand into which "a" has been inserted.
- (4) Turn the rope over.
- (5) Insert "c" into the other strands in the direction of the arrow.
- (6), (7) Firmly tighten each of the three strands, then insert them a second time.
- (8) Insert each strand three or more times to finish.



### III. Short splice

- (1) Separate the strands for both ropes.
- (2) Combine each of the strands.
- (3) Insert each of the strands of the rope on the right into the left,
- (4) for a total of three insertions.
- (5) Insert the strands of the other rope three times.
- (6) Insert each strand from each of the ropes three or more times to finish.



## 12. Fish Hooks

In Japan, many types of fishing hooks are made and used for different sizes and species of fish.

The general structure of a fishing hook and the names of each part are as shown in Fig. 9.

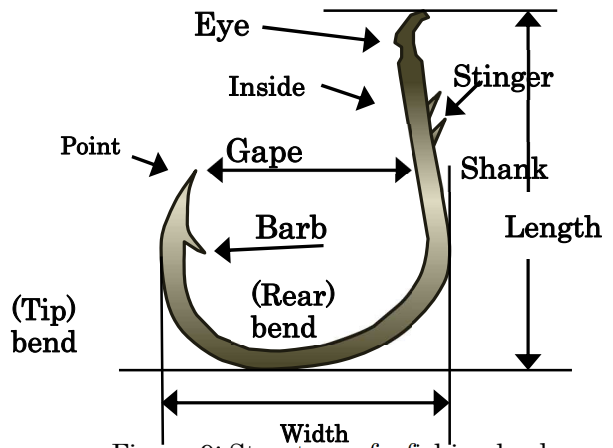


Figure 9: Structure of a fishing hook

### (1) Methods for tying a hook onto a snell

The thin thread tied to a fishing hook is called a "snell." It serves the purpose of connecting the fishing hook to the main line directly or by way of a branch line. When fishing for fish species with sharp teeth such as parrot bass, blowfish, or hairtail, a metal wire is used for the snell. In this case, the wire is used for the portion closest to the fishing hook (10 to 30 cm) and fishing line is attached from there, forming a two-part snell for the hook. Two simple methods of tying which are commonly used to connect a snell to a fishing hook are shown in Fig. 10.

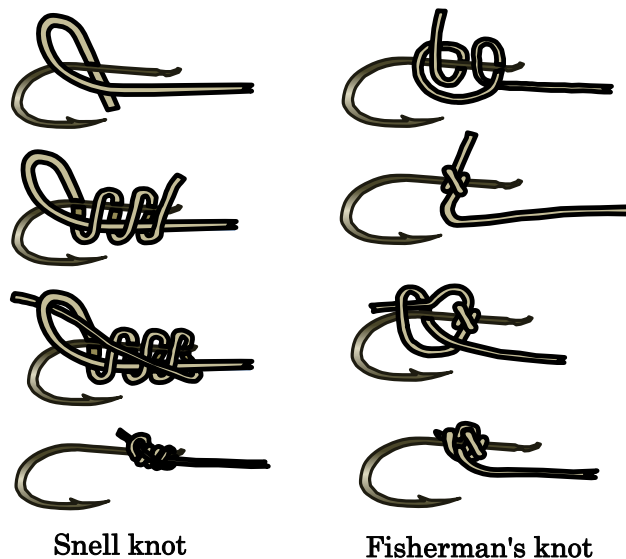


Figure 10: Simple tying methods for fishing hooks

## (2) Methods for tying on a fishing swivel

A fishing swivel is a component that prevents twists from entering into main lines, branch lines, and snells. In Japanese, large swivels are generally called a *yorimodoshi*, and small ones are generally called a *sarukan*. Two simple methods for tying a fishing swivel to a fishing line are shown in Fig. 11.

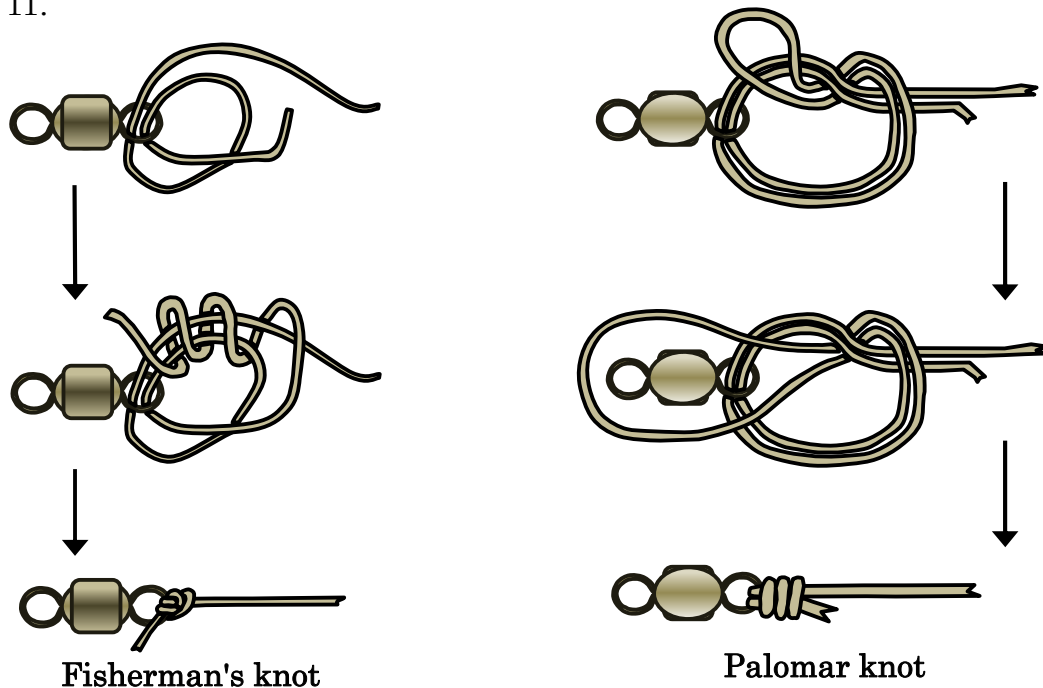


Figure 11: Tying method for a fishing swivel

## 13. Fishing Devices

For modern fishing vessels, mechanization has advanced, allowing for streamlining through the use of large fishing devices with a small number of crew members. Equipment such as derricks, cranes, and capstans are installed relatively commonly, but the direct fishing devices differ depending on the type of fishing. Some of the main types are as shown below.

## Longline fishing

### (1) Line hauler

A device for hauling in the main line of a longline.



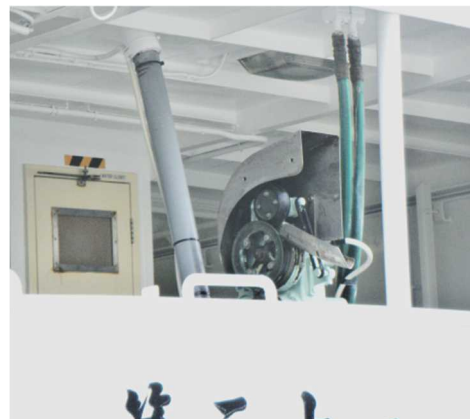
### (2) Branch line winder

A device for winding a branch line into a coiled shape.



### (3) Line caster

A device for casting a longline from a ship with a branch line is attached to a main line.



## Gill net fishing

### (1) Net hauler

A device for hauling in a gill net. Generally, the float side and the sinker side are hauled in separately, but they may also be hauled in together in some cases.



### (2) Net transfer pipe

A pipe used to transfer a gill net that has been hauled onto the ship to a storage location on the stern side.



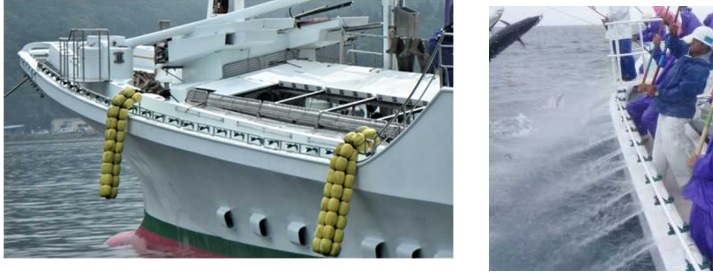
### (3) Net carrier for gill net storage locations and netting production.



## Pole-and-line bonito fishing

### (1) Sprinkler system

A sprinkler for attracting bonito and causing them to stop in place.



## Roundhaul fishing

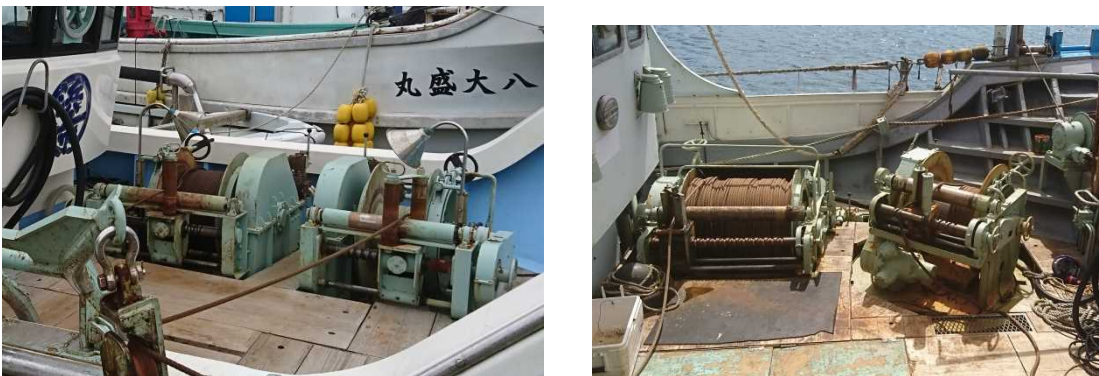
### (1) Net hauler

A device that hauls in a roundhaul net.



### (2) Purse winch

A wire-winding winch for taking in the net hem of a roundhaul net.





### (3) Winding davit

A davit that reels in a wire to tighten the net hem.



### (4) Net-handling power block

A device that suspends a net hauled using a net hauler and is used for netting production work.



### (5) Sideroller

A rotating, bar-shaped net hauler attached to the ship's side for hauling nets onto the deck.



## Trawl net fishing

### (1) Warp winch

A winch that winds a warp or towrope that draws in a net.



### (2) Otter board

A net-spreading board that spreads the mouth of a net.



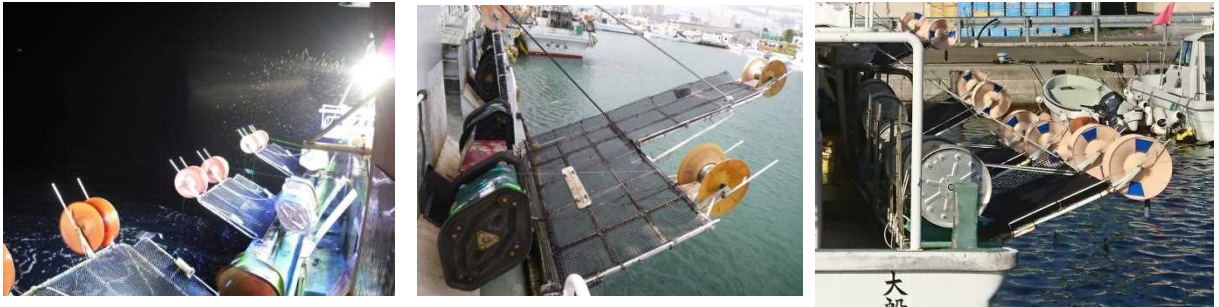
### (3) Net storage area



## Squid fishing

### (1) Automatic squid fishing machine

A device that hangs a fishing line with multiple squid fishing implements attached in the sea and automatically moves up and down to catch squid.



### (2) Fish-luring light

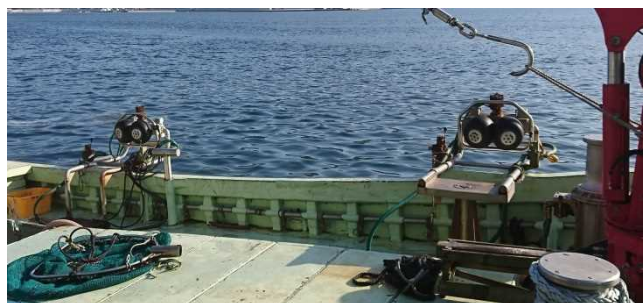
A light that lures squid.



## Fixed-net fishing

### (1) Ball roller (catch roller)

A device that hoists netting by enclosing it within two rotating balls, used when wringing a box net for fixed netting.



(2) Rope-winding roller (standing roller)

A roller that winds a hoisting rope attached to netting which is used when wringing a box net for fixed net fishing.



Basket fishing

(1) Line hoister

A device that winds a main line attached to a basket.



Stick-held net fishing

(1) Multi-level winding winch

A device that simultaneously winds multiple hoisting net (wires) attached to the bottom side of nets.



(2) *Mukaidake* (facing bamboo)

A pipe (bamboo pole) for suspending a net.

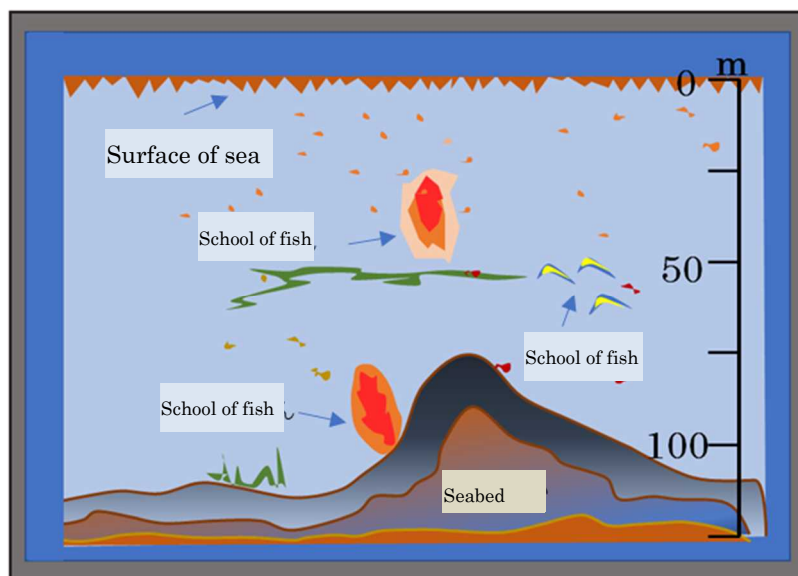


(3) Fish-luring light pole

A pole with a light attached to it used for luring fish.



## 14. Fishfinders



A fish finder is an electronic device that emits an ultrasonic wave which strikes and reflect off of objects and uses this data to display information such as the position and size of schools of fish, the ocean depth, and the state of the ocean floor in an image. The fishfinder image moves toward the side opposite the scale (tick marks for depth), so the side with the scale displays the newest information.

In addition, objects with higher density produce a stronger response when struck by the ultrasonic waves. These strong responses are displayed in red or orange, while weak responses are displayed in blue or green. This makes it possible to judge the amount or size of fish based on the strength (color) of these responses. Within the image, schools of fish are displayed as cloud-like masses floating in the air and single fish are displayed with a boomerang-like shape.

Moreover, the layer-shaped response on the top of the image indicates the surface of the sea. The righthand side of the image has tick marks which indicate ocean depth and can be used to judge the depth of responses.