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SURVEY MANUAL FOR OCEANOGRAPHY AND THE ENVIRONMENT, FISHING  
OPERATIONS AND FISHERY BIOLOGY ON SHIPBOARD TRAINING

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## Introduction

This manual describes the fundamentals of routine work for the surveying of various subjects during SEAFDEC/TD shipboard training. The manual is composed of three parts: 1. Oceanographic and environmental surveying of the fishing ground, 2. Surveying the fishing operations and 3. Surveying fishery biology.

The oceanographic and environmental surveying of the fishing ground include the ship's position, weather, sea water temperature and sea conditions during noon observations; time, position, weather, and sea conditions during fishing operations; and items of topographic observation. Surveying the fishing operations includes date, time, fishing position and time of operation for each fishing method; fishing gears and their measurement; and weighing of the catch. Surveying fishery biology includes the selection of samples and fundamentals of measuring in three major fishing methods; methods of measurement for fish, crab, shrimp and squid. Major references referred to in the manual are listed for the readers information.

This first issue of the survey manual will be revised and updated by the authors as necessary.

## 1. Oceanographic and Environmental Surveying of the Fishing Ground

### 1.1 Noon observation

#### 1.1.1 Ship's position

It is desirable to adopt a fix by land or celestial body and NNSS of Loran. However, when the ship is too far out at sea to observe the land, or the sky is overcast and you can't observe the celestial bodies, you have to adopt dead reckoning position. In these cases you have to mark DRP next to the position mark on the chart.

#### 1.1.2 Weather, wind direction, wind force, atmospheric pressure and temperature

Adopt the same methods and symbols as used in the ship's log book. Units of measurement are, 16 points for the wind direction, Beaufort scale for the wind force, mb for the atmospheric pressure and °C for the temperature.

#### 1.1.3 Sea surface temperature

Take the temperature from a bucketful of seawater or read off the electrical thermometer. It is desirable to always adopt the same means of taking the sea surface temperature.

#### 1.1.4 Sea condition (wave)

Apply Beaufort scale.

### 1.2 Observations during fishing operation

#### 1.2.1 Time and position of starting operation

Same as noon observation.

- 1.2.2 Weather, wind direction, wind force, atmospheric pressure, temperature

Same as noon observation.

- 1.2.3 Sea surface temperature

Same as noon observation.

- 1.2.4 Sea bottom and midwater temperature

Record if the Net Recorder is equipped in the case of trawl operations.

- 1.2.5 Current speed and direction

Record if possible.

- 1.2.6 Color and transparency of the sea water

Record if necessary using Forel scale and transparency board.

### 1.3 Others

- 1.3.1 Tidal current

Measure the drift of the ship, fishing gear, drift wood.

- 1.3.2 Topography of the sea bottom

Record the depth measured by echo sounder or fish finder.

- 1.3.3 Quality of the bottom

Refer to the nautical charts, or observe the material attached to the ground rope of the trawl net.

Environmental Survey Items

Fishing Ground Environment (Oceanography, Meteorology)

		Bottom Trawl	Midwater Trawl	Tuna Longl.	B.V.L.	Purse- seine
Regular Observation (Noon)	Weather	+	+	+	+	+
	Wind Dir. Force	+	+	+	+	+
	Atmospheric Pres.	+	+	+	+	+
	Air Temp.	+	+	+	+	+
	Sea surface Temp.	+	+	+	+	+
	Wave	+	+	+	+	+
Fixed Sta.	S.T.D.	+	+	+	+	+
	Date, Time, Pos.	+	+	+	+	+
	Weather	+	+	+	+	+
	Wind Dir. Force	+	+	+	+	+
	Atmospheric Pres.	+	+	+	+	+
	Air Temp.	+	+	+	+	+
	Sea surface Temp.	+	+	+	+	+
	Water Color	+	+	+	+	+
	Transparency	+	+	+	+	+
Sea Temp. by Depth	+	+	+	+	+	
Observation during Fishing Operation	Date, Time, Pos.	+	+	+	+	+
	Moon age	+	+	+	+	+
	Weather	+	+	+	+	+
	Wind Dir. Force	+	+	+	+	+
	Atmospheric Pres.	+	+	+	+	+
	Air Temp.	+	+	+	+	+
	Sea surface Temp.	+	+	+	+	+
	Bottom Temp.	+				
	Midwater Temp.		+			
	Current Dir. Rate Depth	+	+	+	+	+
	Bottom Quality	+	+			
	Water Color			+		+
	Transparency			+		+
Temp. by Depth			+		+	
Condition of Fish School	Quality					+
	Condition					+
	Size					+

## 2. Surveying the Fishing Operations

### 2.1 Date, moon age, position, time, others

#### 2.1.1 Date

Record the date when the fishing operation is carried out.

#### 2.1.2 Moon age

Refer to the nautical almanac and record to one decimal place.

#### 2.1.3 Fishing position

##### a. Trawl fishing

Shooting position : Record the position when the net touches the bottom. If the net monitor is not equipped, record the position when the intended length of warp is paid out and the brake is fastened.

Hauling position : Record the position when hauling the warp starts.

##### b. Longline fishing

Start shooting : Position when first gear is shot.

Finish shooting : Position when last gear is shot.

c. Purse seine fishing

Operating position: Position when skiff released.

d. Stick held dip net (Boukeami)

Operating position: Position when the ship stops and the luring light is switched on.

e. Gill net fishing

Shooting position : Position when the first radio bouy has gone out.

Hauling position : Position when the last radio bouy is taken in.

2.1.4 Time of the operation

a. Trawl fishing

Finish shooting : Time when the net touches the bottom, or when the trawl winch brake is fastened.

Start hauling : Time when hauling starts.

b. Longline fishing

Shooting time : Time when shooting starts and finishes.

Hauling time : Time when hauling starts and finishes.



c. Purse seine fishing

Start shooting : Time when skiff released.

Finish hauling : Time when the whole net has been taken in after scooping has finished.

d. Stick held dip net (Boukeami)

Start of fishing : Time when the ship stops and the operation luring light is switched on.

Finish of fishing : Time when the last net is hauled in. operation

e. Gill net fishing

Start shooting : Time when the first radio buoy has gone out.

Finish shooting : Time when the last radio buoy has gone out.

Start hauling : Time when the first radio buoy is taken in.

Finish hauling : Time when the last radio buoy is taken in.

2.1.5 Others

a. Trawl fishing

Shooting depth : Depth when the net touches the bottom.

Hauling depth : The depth when hauling starts.

2.2 Fishing gear and measurement

2.2.1 Trawl fishing

Length of warp : Length of warp when shooting finished.

Depth of the net : Depth from the sea surface to net recorder, only in the case of mid-water trawl.

Height of the net mouth : Height measured by net recorder.

Spread of the wing tips: Calculated value by measuring the spread angle of the warps.

Spread of the otter boards : Calculated value by measuring the spread angle of the warps.

Duration of tow : Duration of time from when the ground ropes touch the bottom to when hauling starts.

Condition of schools : White boil  
Breeze, shine, black spot  
Jumper  
Catch on fish finder.

Direction of tidal current at depth of net : Direction of current moving to.

Speed of current in knots : Record to one decimal place.

Depth of the net : Measured by net sonde attached at center point of the sinker line.

#### 2.2.4 Bottom vertical longline

Mean immersion time :  $t_1/2 + t_3 + t_2/2$

$t_1$  = Time spent on shooting  
(Finish shooting) - (Start shooting)

$t_2$  = Time spent on hauling  
(Finish hauling) - (Start hauling)

$t_3$  = Waiting time after shooting  
(Start hauling) - (Finish shooting)

Record the number of hooks which hooked fish.

## 2.3 Weighing of the Catch

### 2.3.1 Trawl fishing

Sort the catch into species as far as possible, except trash fishes, then weigh the whole catch using a balance scale. When the catch is very big and can't be weighed altogether, weigh 3 or 4 containers filled with the same species of fish and calculate average weight, then count number of containers.

### 2.3.2 Tuna longline fishing

Weigh each individual fish.

### 2.3.3 Bottom vertical longline

Weigh each individual fish.

### 3. Surveying Fishery Biology

#### 3.1 Selection of samples

##### 3.1.1 Trawl fishing

Select several target species and pick about 100 samples of each species randomly from the sorted samples (refer 2.3).

If the number of fish from the targeted species is less than 100, use all of them.

Where possible the target species selected should be the same species as in the other surveys.

If rare species are identified, preserve the specimens in a 10% formalin solution and confirm collecting data. The specimens should then be examined in the laboratory. Collecting data should describe the following: 1. Date and time of collection, 2. Location in detail, 3. Fishing method, 4. Depth, 5. Available oceanographic information, 6. Other information considered important.

##### 3.1.2 Tuna longline

All tuna, tuna-like species, marlin and sailfish.

##### 3.1.3 Bottom vertical longline

Selected major species.

### 3.2 Fundamentals of measuring

#### 3.2.1 Trawl fishing

Weigh each of the targeted species with a balance scale, and measure the total length using a punch card. Don't forget to record the body weight and species name or identified abbreviation on the punch card.

#### 3.2.2 Tuna longline

Weigh the body, measure the various designated lengths (refer 3.3), examine the sex, weigh the gonads and check the major stomach contents.

#### 3.2.3 Bottom vertical longline

Weigh the body of each of the selected major species with a balance scale, and measure the total length using a punch card. Don't forget to record the body weight and species name or identified abbreviation on the punch card.

### 3.3 Methods of measurement

Major measurements for fish in general, tuna and tuna-like species, marlin and sailfish, shark, ray, crab, shrimp and squid species are as follows:

3.3.1 Items to be measured

a. Fish in general (Fig. 1)

Total length measurement for types A and B.

\* Total length (TL) : the greatest dimension between the most anteriorly projecting part of the head and the farthest tip of the caudal fin.

Fork length measurement for type C.

\* Fork length (FL) : the distance from the most anteriorly projecting part of the head to the forked point of the caudal fin.

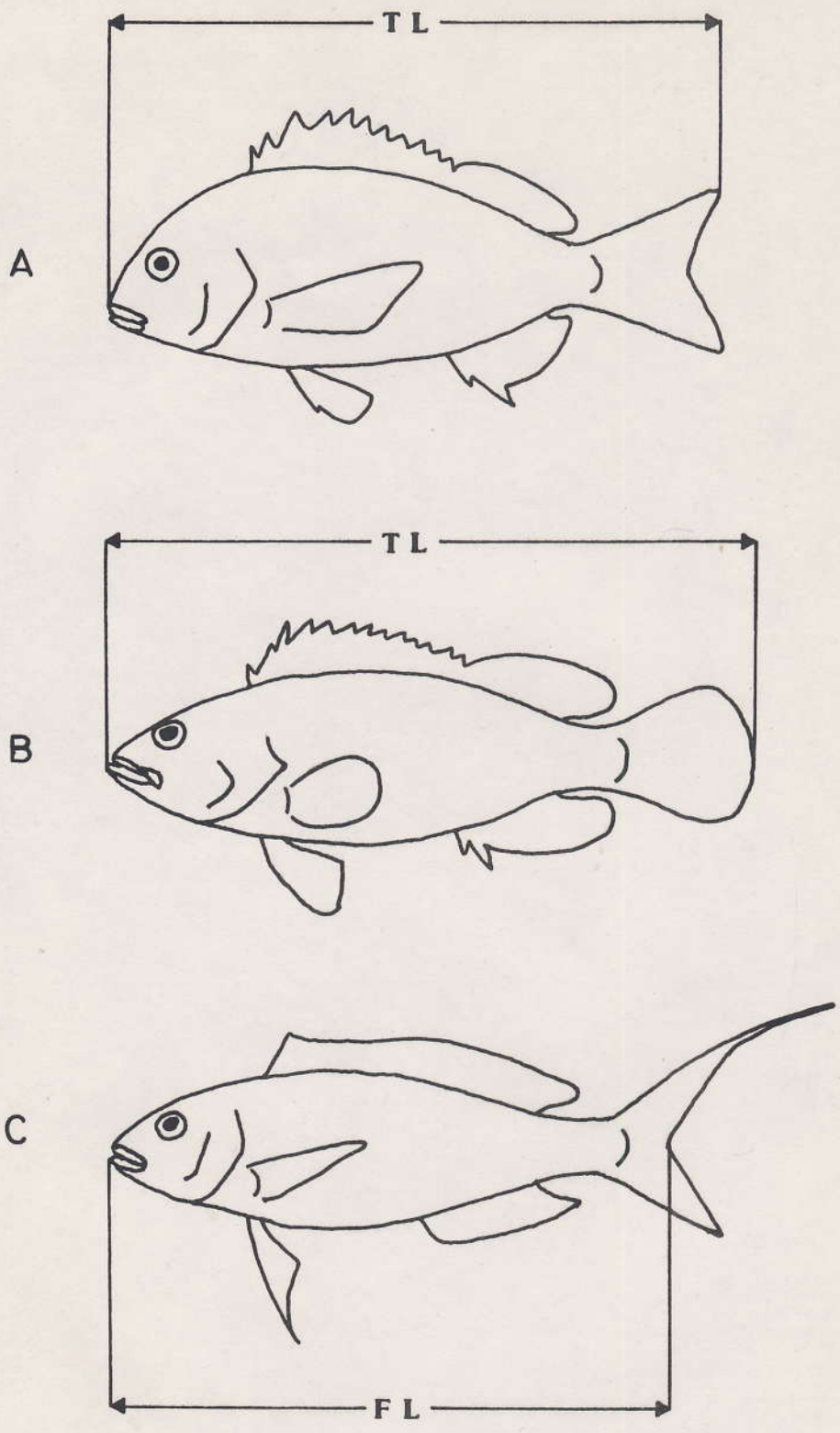


Fig. 1 Total length measurements for types A and B, and fork length for type C.



b. Tuna and tuna-like species (Fig. 2)

- \* Total length (TL) : the greatest dimension between the most anteriorly projecting part of the head and the farthest tip of the caudal fin.
- \* Fork length (FL) : the distance from the most anteriorly projecting part of the head to the forked point of the caudal fin.
- \* Standard length (SL): the distance from the most anteriorly projecting part of the head to the end of the vertebral column.
- \* Head length (HL) : the distance from the most anteriorly projecting part of the head to the most posterior part of the opercle.
- \* Upper jaw-1st dorsal length (UDL) : the distance from the most anterior part of the upper jaw to the anterior base of the 1st dorsal fin.
- \* Body depth (BD) : the greatest dimension, exclusive of the fleshy or scaly structures which pertain to the fin bases.

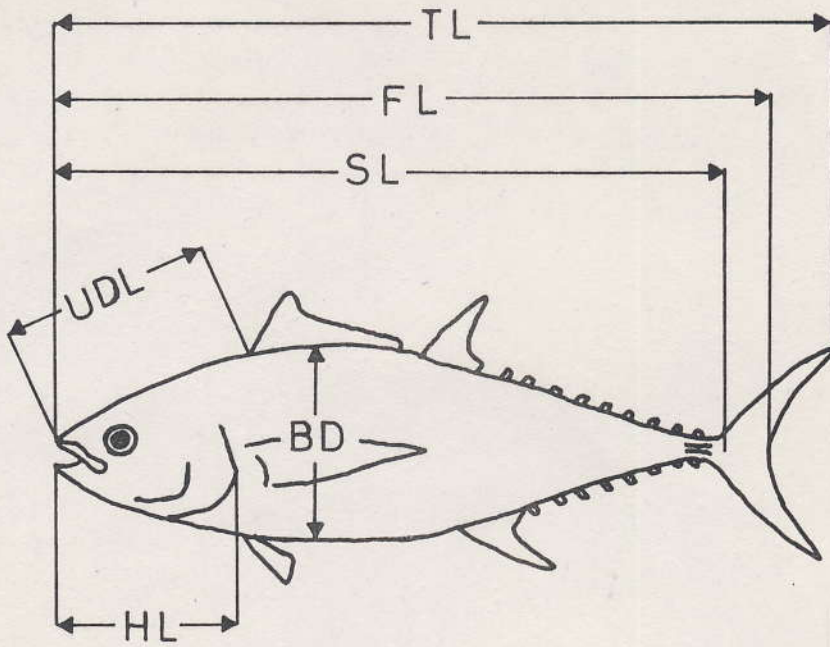


Fig. 2 Measurements for tuna and tuna-like species.

c. Marlin and sailfish (Fig. 3)

- \* Total length (TL) : the greatest dimension between the most anteriorly projecting part of the rostrum and the farthest tip of the caudal fin.
- \* Fork length (FL) : the distance from the most anteriorly projecting part of the rostrum to the forked point of the caudal fin.
- \* Standard length (SL): the distance from the most anteriorly projecting part of the rostrum to the end of the vertebral column.
- \* Body length (BL) : the distance from the most anteriorly projecting part of the mandible to the forked point of the caudal fin.
- \* Eye-fork length (EFL) : the distance from the posterior edge of the eye to the forked point of the caudal fin.
- \* Head length (HL) : the distance from the most anteriorly projecting part of the mandible to the most posterior part of the opercle.
- \* Body depth (BD) : the greatest dimension, exclusive of the fleshy or scaly structures which pertain to the fin bases.

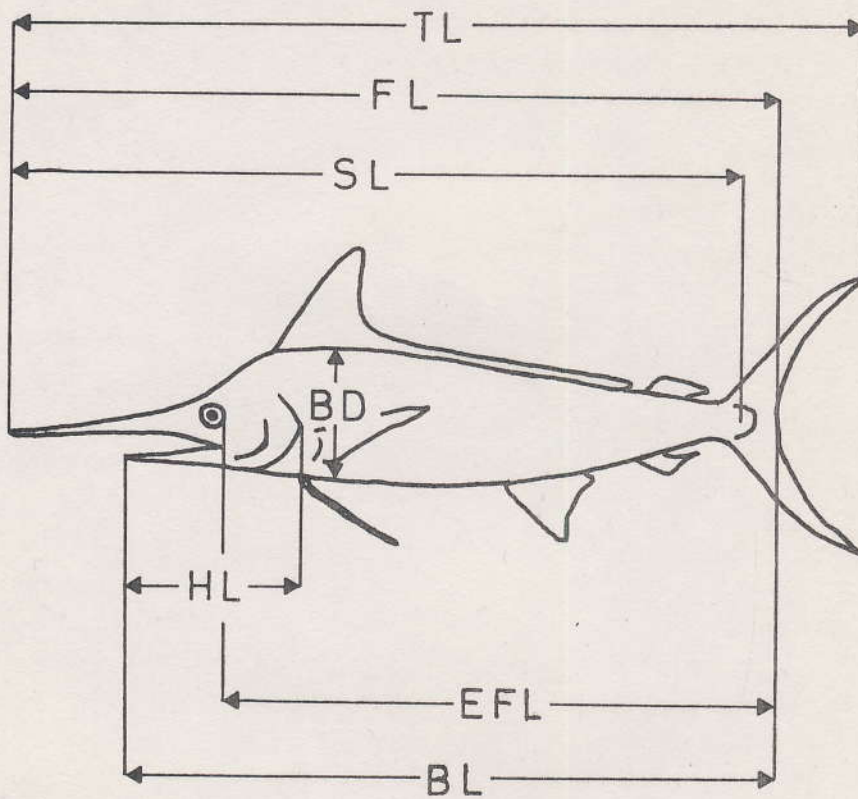


Fig. 3 Measurements for marlin and sailfish.

3.3.2 Items to be measured if possible

a. Fish in general (Fig. 4)

- \* Total length (TL) : the greatest dimension between the most anteriorly projecting part of the head and the farthest tip of the caudal fin.
- \* Fork length (FL) : the distance from the most anteriorly projecting part of the head to the forked point of the caudal fin.
- \* Standard length (SL): the distance from the most anteriorly projecting part of the head to the end of the vertebral column.
- \* Head length (HL) : the distance from the most anteriorly projecting part of the head to the most posterior part of the opercle.
- \* Body depth (BD) : the greatest dimension, exclusive of the fleshy or scaly structures which pertain to the fin bases.

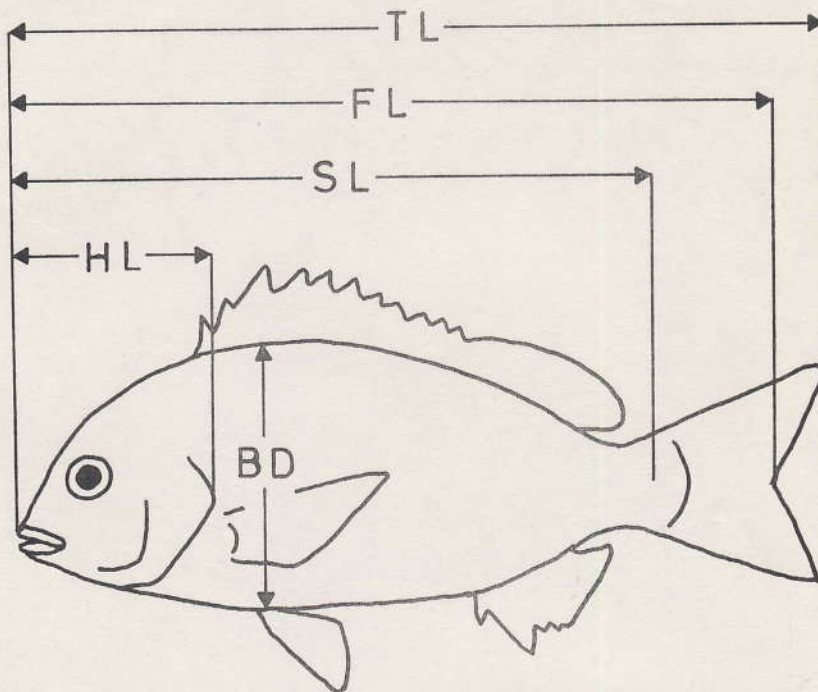


Fig. 4 Measurements for fish in general.

b. Shark (Fig. 5)

- \* Total length (TL) : the greatest dimension from the most anteriorly projecting part of the head to the most posterior part of the upper lobe of the caudal fin.
  
- \* Head length (HL) : the distance from the most anteriorly projecting part of the head to the last gill opening.

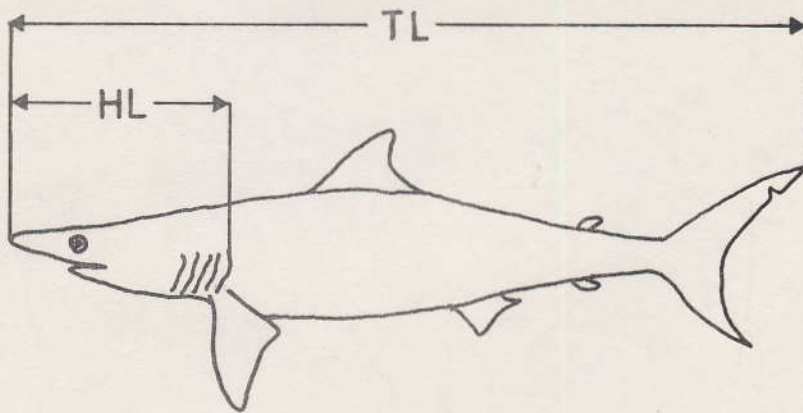


Fig. 5 Measurements for shark.

c. Ray (Fig. 6)

- \* Disk length (DL) : the distance from the most anteriorly projecting part of the disk to the posterior part of the disk.
- \* Disk width (DW) : the dimension of the widest part of the disk.
- \* Tail length (TAL) : the distance from the mid point of the anus to the end of the tail.

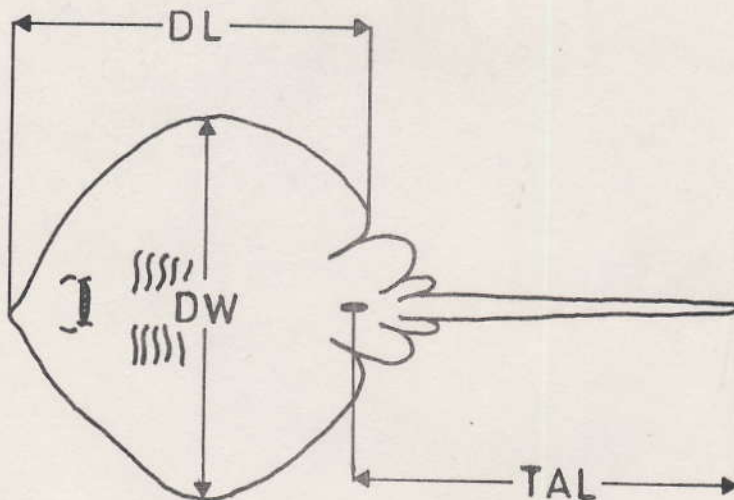


Fig. 6 Measurements for ray.



d. Crab (Fig. 7)

\* Carapace length (CL): the distance from the most anteriorly projecting part to the most posterior part of the carapace.

\* Carapace width (CW) : the dimension of the widest part of the carapace.

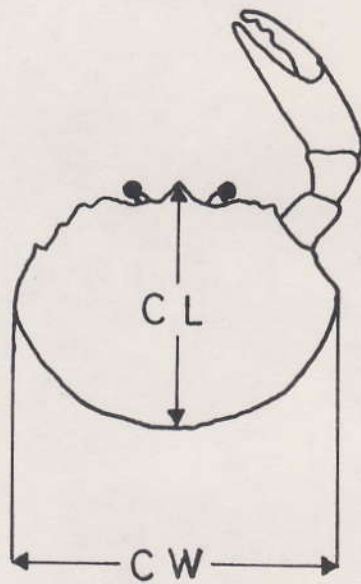


Fig. 7 Measurements for crab.

e. Shrimp (Fig. 8)

- \* Carapace length (CL): the distance from the base of the eye to the posterior part of the cephalothorax.
- \* Carapace width (CW) : the dimension of the widest part of the cephalothorax from the upper view.

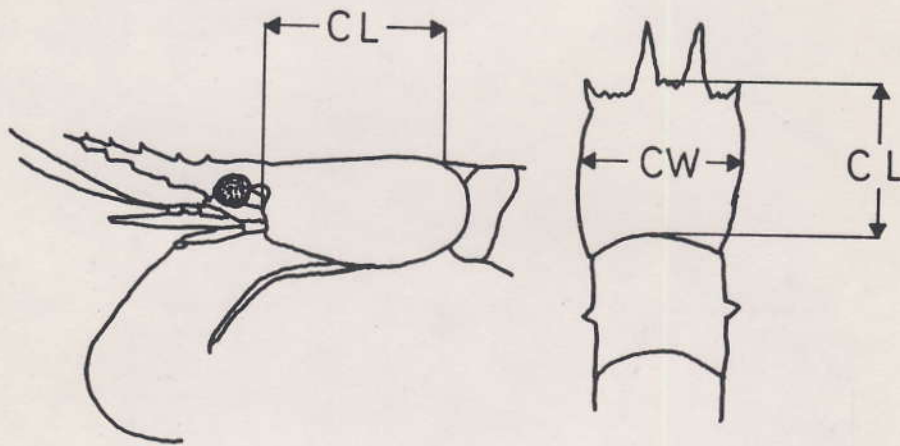


Fig. 8 Measurements for shrimp.

f. Squid (Fig. 9)

\* Mantle length (ML) : the distance from the anterior edge to the posterior edge of the dorsal mantle.

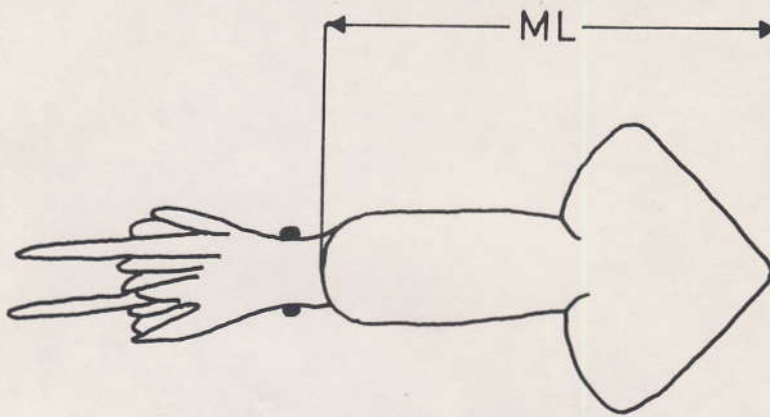


Fig. 9 Measurement for squid.

3.3.3 Detailed measurements

Major references used for this manual are cited below. In addition these references describe detailed measurements or terminology, of each species group, if required.

The species group name in brackets [**bold letters**] shows the availability of detailed measurement description and/or terminology for the species group in the reference.

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**[crab and shrimp]**

NAKAMURA, I. 1985. FAO species catalogue. Vol. 5 Billfishes of the world. FAO, FIR/S125, Vol. 5, 65 pp.

**[marlin and sailfish]**

OKUTANI, T., M. Tagawa and H. Horikawa. 1987. Cephalopods from continental shelf and slope around Japan. Japan Fisheries Resource Conservation Association, Tokyo, 194 pp. (In Japanese and English).

**[squid]**

ROPER, C.F.E., M.J. Sweeney and C.E. Nauen. 1984. FAO species catalogue. Vol. 3 Cephalopods of the world. FAO, FIR/S125, Vol. 3, 277 pp.

**[squid]**

SAKURAI, T. and M. Miyake. 1987. Manual for collecting statistics and sampling on tuna and tuna-like species in the Indian Ocean and Southeast Asian Region. IPTP Manual No. 2, 157 pp.

**[tuna and tuna-like species; marlin and sailfish]**