



SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

Training Department

A large rectangular area with a light blue background and a repeating pattern of dark blue diamond shapes, resembling a fishnet. The text "Guide for Fishing Gear Survey" is overlaid on this pattern in a large, bold, black serif font.

**Guide for
Fishing Gear Survey**

TD/TRB/87

GUIDE FOR FISHING GEAR SURVEY

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INTRODUCTION

Sea is the biggest food suppliers of the world where most of marine organism usually are used for human's food. Biodiversity of marine organism is fairly large in types of species and the numbers, their habitat and behavior are comparatively different. Obviously, a great demand for food of human is still inadequate, so it was directed towards ever-increasing exploitation of marine living organisms. New fishing gears have always been devised from the old ones to have higher catch efficiency. Under this situation, fishing ground becomes limited even in the high seas because of the fishing vessels equipped with modern equipment which is larger in size as well as the increasing of mechanized vessels.

Today, we know that all food resources, including those in the sea, are not inexhaustible natural wealth. The concept of resources conservation, nowadays, has affected our approach to fisheries. The prior aim is not longer simply to catch a lot of fish rather than to maintain good catch without depleting the stock. In other words, it has become necessary to introduce appropriate management of fisheries at all levels.

In order to respond to fisheries management requirement, it is therefore necessary to grasp the complexities of the current situation in the fisheries. The first step is to examine the "tools of the trade"-Fishing gears and their practices. We should know how they are built and used, their relative effectiveness, target species, fishing season, and etc. It would allow us to compare merit and demerit from the conservationist point of view, and would provide basic for rational fisheries management policy for future.

The authors have inspiration by few lecture notes for fishing technology course entitled, "*Necessary Check Items for Surveying Fishing Gear*" published by *Dr. Masatune Nomura* in few decades ago. Nowadays, marine fishing situation has been changed a lot from the past and there is a need to add some items into the fishing gear survey guide. In this connection, authors develop the Guide based on existing lecture notes and add information of present marine fisheries criteria both for academic and management knowledge.

The Guide contains 2 main chapters: Chapter 1) Survey preparation; and Chapter 2) Field survey procedure. The Chapter 1 Survey preparation includes: management of pre-survey including the survey objective, survey output, staff preparation, budget management for fishing gear survey, tool and equipment of survey, and so on. The Chapter 2 Field survey procedures are emphasized the context of the guide, field survey management, lists of fishing gears and fishing methods. List of fishing vessel information, fishing ground and fishing season information, catches and behavior of target catch, socioeconomic target on financial information are also described and listed. Form of Fishing gear survey,

fishing season and fishing ground is also composed with the Guide. Appendix is compiled basic knowledge for fishing gear surveyors. It contains of fishing gear material netting pattern, fishing boat, and its measurement standard.

The Guide for Fishing Gear Survey is a fishing technology manual developed for fishing gear technologists who have responsible to manage and undertake field survey of fishing technology. People who interested in fishing technology could use the part of appendix; Knowledge of Fishing Gear Material for Fishing Gear Surveyor, to be reference and manual of fishing technology.

The authors wish to express sincere appreciation to *Dr. Chumnarn Pongsri*, the Secretary General of SEAFDEC, who kindly advise the concrete comments. We are grateful to *Dr. Nomura Masatsune* – JICA expert on trawl fisheries and former SEAFDEC fishing instructor, *Mr. Aussanee Munprasit* and *Mr. Bundit Chokesanguan* – former Assistant Chiefs of the SEAFDEC Training Department, *Mr. Prasert Mastawee* – former Fishing Gear Instructor, and all SEAFDEC fishing instructors at present and in the past, who taught and trained us to collect data, and fishers who allowed us to investigate their fishing gear and provide fishing information. We also express appreciation to Japanese Government kindly provides the financial support the training for fishing gear technologist team since establishment of SEAFDEC in year 1968.

PRE-SURVEY

Pre-survey activities are very important phase that project manager or team leader or administrative officer must clarify on the target group of fishing gears and output of the survey. As well as budget management have to clarify before start conducting field survey. It is in order to manage expenses and budget with the most efficiency.

Pre-survey activities is included the preparation of background information, mapping for the location of survey, and appropriate period of survey. Number of surveyor is one of the important items for planning and budget estimation. Appropriate number of surveyors and communication with local staffs are necessary to consider as well.



Figure 1: Meeting with stakeholder (Right: Local Authority, Left: Fishers)
Photo: Isara Chanrachkij

1. Survey Planning and Management

Project manager of Fishing gear survey or administrative officer or team leader should clarified before step forward into part of survey

1.1 Targeted fishing gear for the survey

- 1.1.1 Targeted by type of fishing gear
- 1.1.2 Targeted by location of survey
- 1.1.3 Targeted by species of catches; example tuna, anchovy, shrimp, crab, and etc.
- 1.1.4 Targeted by effective area of fishing gear; example pelagic, bottom, river mouth, lake, and etc.

1.2 Formatted output or product of fishing gear survey

- 1.2.1 Monograph fishing gear (fishing plan for construction purpose)
- 1.2.2 Encyclopedia for fishing gear and fishing practice or fishing gear hand book
- 1.2.3 Poster or brochure or pamphlet

1.3 Fishing gear survey methodology

- 1.3.1 Survey is conducted by survey team which be assigned to take responsible on the production. By this case, survey manager of team leader must be fishing gear technologist.
- 1.3.2 Survey is conducted under Honorarium system. The survey activities and production activities is definitely separated in different team. However team of production needs to understand the fishing gear in order to recognize the some mistaking details of fishing gear samples.

1.4 Preparation of Background information for the fishing gear survey

- 1.4.1 Review fishing gear by references, i.e., fishing gear text or documents
- 1.4.2 Gathering national fisheries statistic or fisheries status to complete with the product and confirmed existed fishing gears in the period of survey.
- 1.4.3 Contact consultants or national coordinators, who have specialize on fishing gear or local fishing gear technologists. In order to confirm the existed fishing gears in the period of survey, consultants or national/local coordinators shall

advice or recommend the interesting fishing gear and place to find targeted fishing gears.

1.4.4 Establish the cooperation with local administrative fisheries officers in order to collect the information of exactly place of fishing gear operation and the survey shall be gotten more convenient.

1.4.5 Contact universities or institutes where are able to support fishing gear information. Staffs of universities or institutes in related subjects should be invited to be consultants of survey program.

1.5 Clarify the details of targeted fishing gear for survey planning

1.5.1 Number of type of fishing gear intended to collect on the survey.

1.5.2 Number of sample of each fishing gear intended to collect.

1.5.3 Both 1 and 2 is directly related to number of day for survey and the budget management.

a. Many types of fishing gear or many samples of each fishing gear shall get complete on the fishing gear information collection.

b. Many types of fishing gear or many samples of each fishing gear shall be spent more time and more expenses

1.6 Mapping whole area of fishing gear survey

1.6.1 Target area of survey should be clarified and considered for management details after gather all necessary basic information.

1.6.2 Designing and planning of the transportation should be clarified and budgeted. Method of transportation should be clarified before step forward into the survey place.

1.6.3 Accommodation should be prepared and booking arrangement should be done before the survey trip started.

1.6.4 Details of 1, 2 and 3 are directly related to number of day for survey and the budget management.

1.7 Specify number of fishing gear technologist involved in survey trip

1.7.1 Recommend partner system and separate duty as one measuring and other taking note.

1.7.2 Most of members in the team survey must clearly understand their role and duty.

1.7.3 Numbers of surveyor shall be directly related to number of day for survey and the budget management.

1.8 Planning number of survey trip and duration of survey

- 1.8.1 Recommend to separate fishing gear survey into 2 to 3 trips if fishing gears have many types.
- 1.8.2 Recommend to separate fishing gear survey into 2 to 3 trips if area of fishing season is very wide.
- 1.8.3 Off fishing season is recommended for fishing gear used by fishing boat. On fishing season is recommended for stationary fishing gear.
- 1.8.4 Off raining season is recommended.

1.9 Budgetary management for fishing gear survey

- 1.9.1 In case of survey is conducted by team of survey manager
 - a. Transportation expenses (Fuel-lubrication-emergency expenses)
 - b. Accommodation expenses
 - c. Allowance for surveyors
 - d. Survey material included stationary and measurement tools
 - e. Cooperation expenses with local fisheries officers
 - f. Souvenirs cost for local fisheries officers and fishermen
 - g. Other/emergency expense
- 1.9.2 If honorarium system is employed, Budget shall be prepared for fishing gear technologists who take responsible to the project. Details should agree under the agreement between surveyors and publication owner.
- 1.9.3 Expenses, borne after finish survey activities, are mostly about the production
 - a. Stationary, Computer software and etc, for producing draft of outcome. It included coordinating and communication expenses between producers and surveyors occur during draft producing.
 - b. Publication expense (depended on quality and quantity of publication)
 - c. Publication distributing expenses

2. Preparation of tools for fishing gear survey

2.1 Stationary tools

- 2.1.1. Plain paper, size A 4 is prepare for sketching fishing gear and record other details of fishing operation
- 2.1.2. Format of each fishing gear type printed into the A-4 paper for filling information of each fishing gear
- 2.1.3. Clipboard, At least one for each surveyor

- 2.1.4. Folded back clip for A-4 plain paper
- 2.1.5. Staples for collect all details of each fishing gear
- 2.1.6. Ring file for collect sketched paper and record other details of fishing operation.
- 2.1.7. Pencil with sharpener and rubber
- 2.1.8. Ball pen and eraser
- 2.1.9. Permanent marker pen
- 2.1.10. Whiteboard and white board marker for writing down the name and of fishing gear before taking photograph
- 2.1.11. Field notebook
- 2.1.12. Computer notebook with plenty of CD for transferring fishing gear data and image recorded by digital camera
- 2.1.13. Map of whole survey area and small scale map of each local area. Map of highway or route in rural area is recommended to store as well as skill driver
- 2.1.14. Knives of scissors for cutting sample of material
- 2.1.15. Plastic box in case of survey is conducted during raining season
- 2.1.16. Sample /catalogue of some fishing gear material e.g., Sample of rope, Sample of net, sample of hook



Figure 2: Stationary tools
Illustrator: Narong Raungsivakul

2.2 Recorder equipments

- 2.2.1 Still camera with flash and films
- 2.2.2 Digital camera with plenty of flash memory. Recommended to use camera with dry battery A-type (AA or AAA)
- 2.2.3 Handy VDO camera
- 2.2.4 Cassette tape recorder
- 2.2.5 Various type of batteries for all camera used during the survey



Figure 3: Recorder
Illustrator: Narong Raungsivakul

2.3 Measuring equipments

- 2.3.1 Measurement tape 3/5 meter length
- 2.3.2 Measurement tape 10 meter length
- 2.3.3 Ruler or protector ruler (to compare with size of fishing gear material)
- 2.3.4 Vernier caliper (Plastic type is accepted)
- 2.3.5 Micrometer



Figure 4: Measuring equipments
Illustrator: Narong Raungsivakul

FIELD SURVEY

There are some activities conducted during the field survey. The survey is not only collecting the details of fishing gears and methods but also contacting with the counterpart such as local fisheries officer, local fisher, fishing vessel owner, etc. Guides of the field survey consisted of 2 main items are;

- 1) Field survey management and
- 2) Lists of fishing gears and fishing methods.

1. Field Survey Management

After clarify most of survey sites, team leader should contact chiefs of local fisheries officer at every survey sites, requests for the cooperation before the trip is started.

- 1.1 Contact local fisheries officers and request them to guide on fishing gear information particularly on the existing and fishing site. Contact should be done by formal protocol (document) or informal protocol (Telephone, etc.) Contact should be clarified on the objective of the field survey and lists or number of expected fishing gear plan for conducting survey in the area. Fishing gear team should prepare some souvenirs e.g. T-shirt, caps, etc., for present to local fisheries officer and fisher.
- 1.2 With limited survey time, Team leader should clarify the assignment of all each members of team survey in order to gain the higher accuracy of data on fishing gear in details.
- 1.3 During conducting the fishing gear survey, fisher or fishing gear owner should be requested to go with the team survey in order to explain the details of fishing gear and their fishing operations.
- 1.4 Time consumption for survey of each fishing gear should be estimated and restricted.
- 1.5 Daily fishing activities; type of the fishing gears; name of fishers; and fisheries officers must be interviewed and recorded for further reference. Surveyor should rearrange all daily information of

activities and the time requirement for transportation during the survey. These details are useful for review data, follow up the fishing gear status, and convenient for back to office reporting.

- 1.6 Survey information has to be cleared and reformed day by day. All surveyors should evaluate their details which have recorded everyday in order to prevent the missing of fishing gear and fishing operation data.
- 1.7 Accommodations should be prepared and reserved before arriving of the survey sites. Due to survey activities always takes time accommodation have to prepare before step into the survey site.
- 1.8 Surveyor has to consider that the cooperation with the fishers and fisheries officers is the key to obtain accurate fishing data. Any recommendation of fishers and fisheries officers should be taken into consideration.
- 1.9 Surveyor should avoid conducting the fishing gear survey in the area or fishing port where the conflicts are occurred. The conflict between different type of fishing gear, among fishers, and between fishers with government that could make incorrect fishing gear data collection and wasting the time for conduct of the survey.
- 1.10 Surveyor must have basic knowledge on various fishing gears and practices in order to certify information collected from the survey in case that of non-accurate details of fishing gear and practices are provided by fishers or fisheries officers)

2. Survey methodology

- 2.1 Before the survey, review of secondary data is necessary for the targeted existing stationary fishing gears. Standard design of data recording for non-textile fishing or stationary gear must be studied and drawn before interviewing the fishers. To confirm and fulfill data of fishing gear's scale and size, the major output from the interview include the design of fishing gears.
- 2.2 Primary data collection methodology should be used through in-depth interview with fishing gear's owner and fishers. The face-to-face interview with structure and unstructured questionnaire focuses on the details of the fishing gears and practices. Since the targeted fishing gears had already been recognized, some details related to the fishing practices, fishing seasons, fishing grounds, and cost of the gear/accessories should also be gathered during the interviewing.
- 2.3 Direct observation without participation methodology is an approach to examine the construction and design of the fishing gears deploying on the fishing ground/port/site. The materials

used for constructing the fishing gear and other assembling techniques will also be recorded through the direct observation at the fishing villages and fishing gear store



Figure 5: Fishing gear and Method of Southeast Asia
Photo: Sayan Promjinda



Figure 6: In-depth interview
Photo: Isara chanrachkij

List of Fishing Gear Material, Construction, and Design

Referred to various kinds of fishing gear, fishing gear surveyors should have basic knowledge of fishing gear material, i.e. Textile fish gear and Non-textile fishing gear, as well as fishing gear construction.

1. Textile fishing gear

In general, fishing gear is constructed using textile materials: i.e. fishing net, fishing rope. The textile is made of both synthetic and natural fiber. Common fishing gear includes gillnet, trawl net, purse seine, lift net, cast net, and longline. The textile fishing gear can be categorized into (i) netting fishing gear, and (ii) line fishing gear.

1.1. Netting fishing gear

1.1.1. Overview information

Before technical information is started the overview information of fishing gear need to be recorded.

1. Type of fisheries
2. Place of observation
3. Date of observation
4. Name of fishing gear: local name of the gear in English and local language; name of areas where the gear is using.
5. Target catches by local name, common name, and scientific name.
6. Historical information of the gear using in the area (When and how was the fishing gear introduced? Information on the development or modification of fishing gear and its practice, if any)

7. Present fishing condition of the fishery (increasing, decreasing, or stable trend of the catch)
8. Amount and value of catch in general and operation expense per average season and per fishing trip
9. Economic important of surveyed fishery in the area. Describe in the comparison with the other type of fisheries or other type of industries in the survey area.
10. Number of fishing unit in the area

1.1.2. Fishing gear technical information

1. Outline of fishing gear construction:

Details of net fishing gear

- 1.1 Composition of fishing gear
- 1.2 Name of each part of fishing gear
- 1.3 Draft illustration of each part of fishing gear

2. Net

Details of the following items should be recorded

- 2.1 Material of net

- a. Local, commercial, and scientific name of the material
- b. Material maker or factory name
- c. Twist type of twine for webbing net
- d. Number of thread and ply in one strand of the webbing net
- e. Thickness of twine (in Denier, Tex or diameter in millimeter)
- f. Weight of net in unit
- g. Preservation or antiseptic dye technique
- h. Price of the netting material per unit with the total weight

- 2.2 Stretch mesh size (mm)

- 2.3 Knotless or knotted net

- 2.4 Type of knot e.g., simple sheet bend, double sheet bent, or reef knot

- 2.5 Preservation method (e.g. dye by tar, etc.)

- 2.6 Total number of meshes in horizontal part of the net panel



Figure 7: Nylon fishing net
Photo: SEAFDEC



Figure 8: Polyethylene fishing net
Photo: Isara Chanrachkij



Figure 9: Fishing rope
Photo: SEAFDEC

- 2.7 Total number of meshes in vertical part of the net panel
- 2.8 Hanging ratio (or percentage)
- 2.9 Total number of meshes at upper edge, lower edge and side edge of the net panel
- 2.10 Length and width of stretch-mesh individual net panel composed to complete fishing gear
- 2.11 Length and width of stretch-mesh in complete fishing gear
- 2.12 Net selvage information
- 2.13 Numbers of section net sheet composed to a complete net panel
- 2.14 Numbers of net panel used during fishing operation
- 2.15 net panel or between the different mesh size of each panel, or between net mesh and rope
- 2.16 Form of net panel in geometric pattern and net cutting pattern
- 2.17 Selvage net information
- 2.18 Other remarkable details

Rope/twine

Details of the following items should be recorded by describe or tabulate

- 3.1 Name of rope/twine i.e. local and commercial name
- 3.2 Purpose of rope/Twine
- 3.3 Material of rope/twine
- 3.4 Rope/twine maker or company
- 3.5 Diameter of rope (mm) or thickness of twine (in Denier, Tex)
- 3.6 Total length and weight of rope/twine (m) used
- 3.7 Twist type of rope/twine
- 3.8 Total number of years/strands of the rope/twine
- 3.9 Breaking strength and elongation properties
- 3.10 Color



Figure 10: fishing rope
Source: www.siambrothers.com

- 3.11 Position of the rope constructing in the gear (i.e. head rope, ground rope, or side rope)
- 3.12 Total number of rope used for the head rope, ground rope, and side rope
- 3.13 Preservation or antiseptic dye techniques
 - a. Material of dye liquid
 - b. Local name of liquid
 - c. Name or factory maker
 - d. Dye liquid making method if fishers do it by themselves
 - e. Rope dyeing method
 - f. Cost for dyeing
 - g. Period of material use after dyeing or period of re-dyeing and cost of re-dyeing
 - h. Period of service of dyeing rope compare with non-dyeing rope
- 3.14 Tightening pattern or knot
- 3.15 Pattern of fixing between rope and net panel
- 3.16 Price of rope
- 3.17 Period for past plus possible future service
- 3.18 Other remarkable details

4. Float and Buoy

Details of the following items should be recorded

- 4.1 Purpose of float/buoy
- 4.2 Material of float/buoy
- 4.3 Name of company or factory maker or brand name or self supplied
- 4.4 Types and shapes/design of float/buoy fixed at fishing gear
- 4.5 Specific gravity or buoyancy force of float/buoy
- 4.6 Dimension of float/buoy (length, diameter of outer part, diameter of pore to float/buoy)
- 4.7 Weight in air and weight in water (if possible)
- 4.8 Arrangement of the float line
 - a. Total number of float/buoy fixed at fishing gear
 - b. Number of float by a measurement unit, for example total number of the floats within 1 meter



Figure 11: Float/Buoy
Photo: SEAFDEC



Figure 12: Float
Photo: SEAFDEC

- c. Length of interval between the float
- d. Joint pattern between float and rope/net
- 4.9 Label of trade mark appeared on the float/buoy
- 4.10 Price of float/buoy
- 4.11 Duration of service
- 4.12 Picture of the float (recommended)

5. Sinker

Details of the following items should be recorded



- 5.1 Material of sinker
- 5.2 Name of company or factory maker or brand name or self supplied
- 5.3 Types and shapes/design of sinker fixed at fishing gear
- 5.4 Specific gravity or sinking force
- 5.5 Dimension of sinker (length, diameter of outer part, diameter of pore to sinker)
- 5.6 Weight in air and weight in water (if possible)
- 5.7 Arrangement on lead line
 - a. Total number of sinker fixed at fishing gear
 - b. Numbers of sinker by a measurement unit, example: numbers of sinker in 1 meter
 - c. Length of interval between sinker
 - d. Pattern of joint between sinker and rope, or net
- 5.8 Record all label of trade mark appeared on the sinker
- 5.9 Price of sinker
- 5.10 Duration of service
- 5.11 Picture of the singer (recommended)



Figure 13: Sinker
Photo: SEAFDEC

6. Other fishing accessories

Lists and details of all accessories (e.g. purse line of purse seine, warp of trawl; flag and buoy of gillnet, and etc.). Other fishing gear materials and accessories related with fishing gear and its operation should be recorded considering a technical part of fishing gear information.

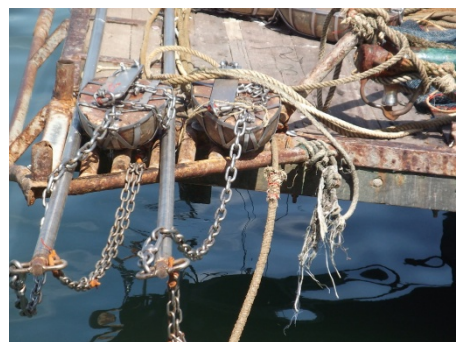


Figure 14: Beam and skies of beam trawl net **Photo:** SEAFDEC

- 6.1 Purpose of equipment
- 6.2 Material of equipment
- 6.3 How to operate/compose/attach with the fishing gear
- 6.4 Number of equipment operate with fishing gear during operation
- 6.5 Dimension
- 6.6 Position of setting/attachment
- 6.7 Drawing picture or taking photograph of the sinker (recommended)



Figure 15: Otter board
Photo: Isara Chanrachkij

1.1.3. Illustration and details

1. Draft complete fishing gear
2. Draft illustration of each part of fishing gear
3. Fastening pattern of float and float line
4. Fastening pattern of sinker and sinker line
5. Method or pattern of net lacing
6. Method or pattern of fastening float and sinker line to net panel
7. Arrangement of net panel to complete fishing gear
8. Hanging ratio
9. Arrangement of float and sinker
10. Amount of material in each section of complete net



Figure 16: Otter board illustration **Photo:** Isara

1.2. Line Fishing Gear

Hooks and lines are gear that the fish is attracted by a natural or artificial bait (lures) placed on a hook fixed to the end of a line or snood where they are caught. Hooks or metallic points (jigs) are also used to catch fish by ripping them when they pass in its range of movement. Hook and line units may be used singly or in large numbers (FAO).

This gear generally consists of line(s) and hook(s), to which edible or artificial baits are attached to attract fish or other aquatic animals. Un-baited hooks or jig may also be used.

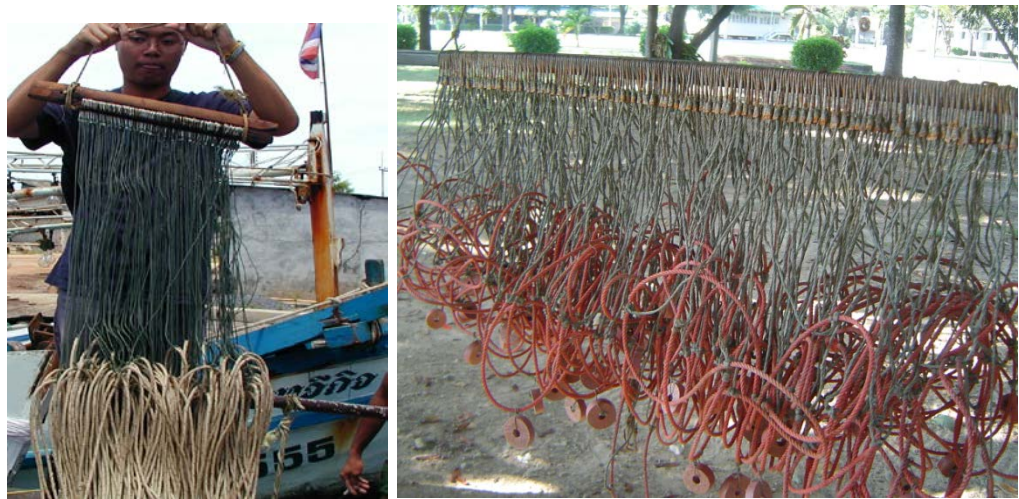


Figure 17: Longline
Photo: Isara Chanrachkij

1.2.1. Overview information

Before technical information is collected, the following general information of fishing gear should to be recorded:

- a. Type of hook fisheries
- b. Place of observation
- c. Date of observation
- d. Name of fishing gear (i.e. local name, area name, and English common name)
- e. Target catches by local name, common name, and scientific name
- f. Historical information of the gear using in the observation area (When and how was the gear introduced? Information on the development or modification of the gear and its practice, if any)

- g. Present fishing condition of the hook fishery (increasing, decreasing, or stable trend of the catch)
- h. Amount and value of catch in general and operation expense per average season and per fishing trip
 - i. Economic important of surveyed fishery in the area. Describe in the comparison with the other type of fisheries or other type of industries in the survey area.
 - j. Number of fishing unit in the area



1.2.2. Outline of construction

Details of hook and line fishing gear

- a. Composition of complete fishing gear
- b. Name of each part of fishing gear
- c. Draft illustration and name each part of fishing gear

1.2.3. Technical Information of Fishing Gear

Main line: Details of main line rope should be recorded by describe or tabulate

- a. Material of the main line rope
- b. Rope company or maker
- c. Diameter of rope
- d. Thickness, or diameter, or weight per unit of length (denier, Tex)
- e. Total number of strand
- f. Twist characteristic of the rope
- g. Length and weight of rope used
- h. Length of rope used to complete the gear
- i. Breaking strength and elongation properties
- j. Color
- k. Preservation or antiseptic dye technique
 - Material of dye liquid
 - Local name of liquid
 - Name or factory maker
 - Dye liquid making method if fishers do it by themselves

Figure 18: Rope for mainline
Source: Tuna Longline Accessories;
 Sanwa Commercial Co., Ltd

- Rope dyeing method
 - Cost for dyeing
 - Period of material use after dyeing or period of re-dyeing and cost of re-dyeing
 - Period of service of dyeing rope compare with non-dyeing rope
- l. Tightening/knot pattern, and pattern of main line rope spicing
 - m. Joining pattern between main lines; main line and branch line or hook; and main line and other fishing gear accessory
 - n. Price of rope
 - o. Total number of manpower and day required for construction
 - p. Period for the past and possible future service
 - q. Other remarkable details

Branch line

Details of the following items should be recorded by describe or tabulate

- a. Material of main line rope
- b. Brand, rope company or maker or factory
- c. Diameter of rope
- d. Thickness, diameter or weight per unit of length (denier, Tex)
- e. Total number of strand
- f. Twisted characteristic
- g. Length and weight of rope used for complete set
- h. Breaking strength and elongation properties
- i. Color
- j. Preservation or antiseptic dye technique
 - Material of dye liquid
 - Local name of liquid
 - Name or factory maker
 - Dye liquid making method if fishers do it by themselves
 - Rope dyeing method
 - Cost for dyeing



Figure 19: Rope for Branch line
Source: Tuna Longline Accessories;
 Sanwa Commercial Co., Ltd



Figure 20: Monofilament hook line
Source: www.alltackle.com

- Period of material use after dyeing or period of re-dyeing and cost of re-dyeing
- Period of service of dyeing rope compare with non-dyeing rope
- k. Pattern of tightening/knot, and main line rope spicing
- l. Pattern of joining branch line to main line, or hook and branch line to other fishing gear accessory
- m. Price of rope/line
- n. Number of manpower and day required for constructing the gear
- o. Estimated age of fishing rope/line and details of fishing gear maintenance
- p. Other remarkable details

Hook

Hook is generally made of iron galvanize. Most of hook is always composed with line or twine in various patterns (e.g. hand line, trolling line, longline, etc.). The following details of hook should be recorded;

- a. Material of hook
- b. Company or factory maker and place of purchasing
- c. Type or shape of hook
- d. Number of hook for complete set of the gear
- e. Dimension of hook
- f. Height of hook
- g. Height of throat
- h. Width of gap
- i. Height of barb
- j. Diameter of shrank
- k. Types and shapes of barb (curve, reverse, offset, etc.)
- l. Type of hook's eye
- m. Color or coating
- n. Price of individual hook and price of complete set
- o. Drawing or picture of the hook (recommended)

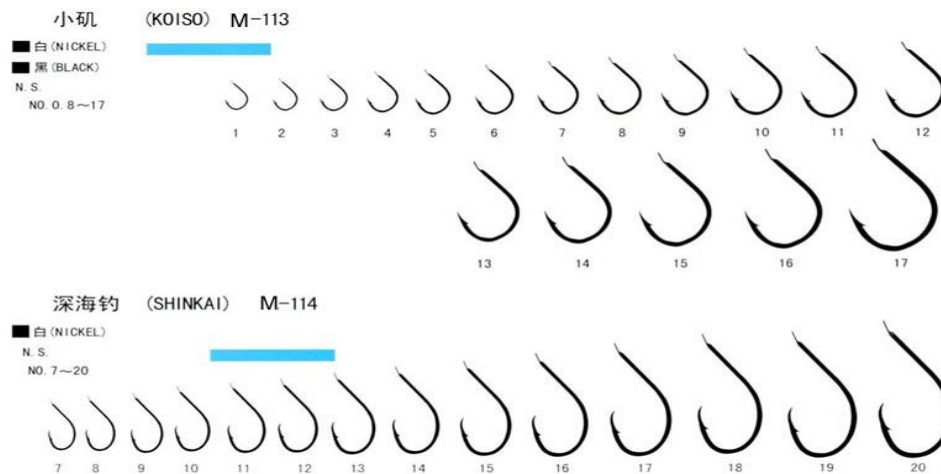


Figure 21: Hooks

Source: <http://www.bomfitfishing.com>

Float and Buoy

The following details of line gear should be recorded

- a. Material of float/buoy
- b. Company or factory maker or self supplied
- c. Types and shapes/design of float/buoy fixed at fishing gear
- d. Specific gravity or buoyancy force of float/buoy
- e. Dimension of float/buoy (length, diameter of outer part, diameter of pore to float/buoy)
- f. Weight in air
- g. Arrangement on float line
 - Total number of float/buoy fixed at fishing gear
 - Number of float by a measurement unit, total number of float within 1 meter
 - Length of interval between floats
 - Joint pattern between float and rope, or net
- h. Record all label of trade mark appeared on the float/buoy
- i. Price of float/buoy
- j. Duration of service
- k. Picture of the float and buoy attached to the gear (recommended)



Figure 22: Fishing float
Source: Tuna Longline Accessories; Sanwa Commercial Co., Ltd.

Sinker:

The following details of sinker should be recorded

- a. Material of sinker
- b. Company or factory maker
- c. Types and shapes/design of sinker fixed at fishing gear
- d. Specific gravity or sinking force
- e. Dimension of sinker (length, diameter of outer part, diameter of pore to sinker)
- f. Weight in air and weight in water (individual)
- g. Arrangement on lead line
 - Total number of sinker fixed with fishing gear
 - Numbers of sinker by a measurement unit, for example, total numbers of sinker within 1 meter
 - Length of interval between sinker
 - Joint pattern between sinker and the gear
- h. Record all label of trade mark appeared on the sinker
- i. Price of sinker

- j. Duration of service
- k. Picture of the sinker (recommended)



Figure 23: Sinker for hook and line
Source: Beijing Hirun Hengda Technic Co., Ltd.



Figure 24: Frozen bait
Source: www.21food.com

Bait

The following details of bait should be recorded

- a. Bait type (live/dead/artificial)
- b. Bait species
- c. Size of bait
- d. Price of bait per unit of weight (per kilogram of per package)
- e. Supplying place/company
- f. Preservation method onboard vessel
- g. Total amount of bait use for one operation/trip
- h. Season of bait availability
- i. Baiting technique

Other fishing gear accessories

Lists and details of every accessory e.g. flag and buoy, radio buoy, light buoy, anchor and etc. Other fishing gear material and accessories related with fishing practices should be considered and collected with a part of fishing gear.

- a. Purpose/function of equipment
- b. How to operate/compose/attach with the fishing gear
- c. Number of equipment operate with fishing gear during operation
- d. Dimension
- e. Position of setting/attachment
- f. Picture of complete set of fishing gear with equipment (recommended)



Figure 25: Fishing gear accessories

Source: 1) Tuna Longline Accessories; Sanwa Commercial Co., Ltd.
2) www.allproducts.com
3) www.topfreebiz.com

1.2.4. Illustration and details

- a. Complete of fishing gear
- b. Fastening pattern of tightening between main line and main line, main line and branch line, mainline and buoy line, hook line and hook, and etc.
- c. Arrangement of main line, branch line and buoy line
- d. Amount of material in each section of complete net

2. Non-Textile fishing gear

Some other fishing gears have composed by non-textile materials. Major materials of these fishing gears include bamboo, wire or plastic wire (e.g. used for fyke net; bamboo stake trap, wooden pot, stow net, etc.). Fishing gear survey for stationary gears that assembled by non-textile material (e.g. bamboo stick, stone, and etc.) is not easily measured due to their large scale and stationed in the sea. Surveyor must prepare to obtain data on the fishing gear type and construction and fishing operations using Rapid Rural Appraisal (RRA) survey method.



Figure 26 (a) : Bamboo stake trap
Photo by Aussanee Munprasit

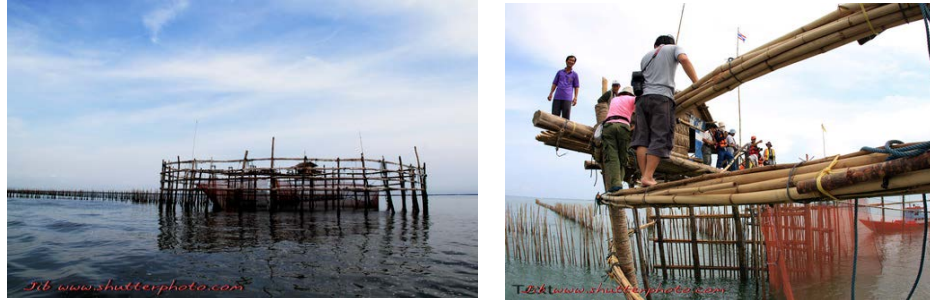


Figure 26 (b): Bamboo stake trap
Source: www.shutterstock.com

2.1 Overview information:

- a. Type of fisheries
- b. Place of observation
- c. Date of observation
- d. Name of fishing gear (i.e. local name, area name, and English common name)
- e. Target catches by local name, common name, and scientific name

- f. Historical information of the gear using in the area (When and how was the fishing gear introduced?)
- g. Present fishing condition of the fishery (increasing, decreasing, or stable trend of the catch)
- h. Amount and value of catch in general and operation expense per average season and per fishing trip
- i. Economic important of surveyed fishery in the area. Describe in the comparison with the other type of fisheries or other type of industries in the survey area.
- j. Number of fishing unit in the area

2.2 Outline of construction: Details of non-textile fishing gear

- a. Composition of complete fishing gear
- b. Name of each part of fishing gear
- c. Draft illustration and name each part of fishing gear

2.3 Fishing gear technical information

- a. Outline of Fishing gear construction:
Details of net fishing gear
 - Composition of fishing gear
 - Name of each part of fishing gear
 - Draft illustration each part of fishing gear
- b. Bamboo:
Bamboo material is commonly used for the fishing gear in coastal zone and river mouth (e.g. bamboo steak trap, giant cast net, lift net and etc.)
 - Types and shapes of bamboo composed to be fishing gear (e.g. bamboo stick or piece of bamboo tree)
 - Dimension of bamboo
 - Bamboo stick/tree: Diameter or circumference of bamboo and length of bamboo stick/tree
 - Interval between each bamboo stick/tree
 - Total number of bamboo stick/tree used for the gear
 - Drawing or picture of the whole gear (recommended)

List of fishing Vessel Information

Details of the following items should be recorded.

1. **Name of vessel**
2. **Type of vessel (Wooden, Steel or Fiber Reinforcement Plastic)**
3. **Name of ship builder/ dockyard**
4. **Date or year of build or launching**
5. **Port registry or/and Fisheries registry**
6. **Type and/or class of vessel**
7. **Registered tonnage**
8. **Size of vessel**
 - a. Length (LOA)
 - b. Gross tonnage
 - c. Width
 - d. Draft at bow and stern with load and without load
9. **Maximum and economic cruising speed**
10. **Engine**
 - a. Type of Engine (Inboard/Outboard)
 - b. Model and brand of company maker
 - c. Engine power in Kilowatt or horse power
 - d. Number of engine revolution per minute and reduction ratio
 - e. Number of screw blades
 - f. Propeller pitch and diameter, fix or variable pitch controller
 - g. Electric or auxiliary engine
 - h. Fuel type and consumption of fuel (per hour)
 - i. Fuel loaded per trip
 - j. Estimated total expenditure per day or trip

11. Fishing accessories, (e.g. fish luring lamp, Fish Aggregating Devices, etc.)



Figure 27: Fishing gear accessories
Photo: Isara Chanrachkij

12. Deck machineries or hauling devices (e.g. trawl winch, Net hauler, Line hauler, power-block, etc.)

a. Net drum

1. Type of machinery
2. Company manufacture included with name and place of manufacture
3. Horse power or pulling power or hauling power
4. Volume of net to store in drum
5. Type of driven (i.e. mechanical driven or hydraulic driven)
6. Winding speed and number of revolution
7. Operation method
8. Number of operated crew



Figure 28: Hauling devices of trawler
Photo: Isara Chanrachkij

b. Net hauler and Power block

1. Type of machinery
2. Company manufacture included with name and place of manufacture
3. Horse power or pulling power or hauling power
4. Size of net suitable for operate with the capacity of net hauler
5. Axle of hauler (i.e. horizontal, vertical and etc.)
6. Type of driven (i.e. mechanical driven or hydraulic driven)
7. Winding speed and number of revolution
8. Operation method; and suitable condition of fishing operation (e.g. sea state, etc.) and fishing depth.
9. Number of operated crew



c. Winch

1. Function
2. Type of machinery
3. Company manufacture included with name and place of manufacture
4. Machine manufacture and its place
5. Horse power or pulling power or hauling power
6. Type of driven (i.e. mechanical driven or hydraulic driven)
7. Axle of drum (i.e. horizontal, vertical)
8. Winding speed and number of revolution
9. Operation method
10. Manual or automatic warp guide
11. Number of operated crew employed



Figure 29: Hauling devices of Purse seiner

Photo: Isara Chanrachkij

13. Fish hold, cold storage, and freezing arrangement

- a. amount of catch that can be stored onboard)

14. Navigation, fishing aid, and fishing finding equipment

- a. Type of instruments
- b. Company manufacture included with name and place of manufacture
- c. Specification of instruments e.g. range, transmitted power
- d. Other remarkable specification



Figure 30: Navigation and fish finding equipment
Photo: Isara Chanrachkij

15. Fishing vessel construction cost, docking cost and maintenance cost

16. Main engine, electric engine and auxiliary engine

- a. Numbers of crew involving with fishing operation. List the duties details of each crew.
- b. Expenses for a day/trip



Figure31: Thai fishing vessels
Photo: Isara Chanrachkij

Fishing Practices

Fishing operations varies depending on season, fishing ground and target species, surveyor should describe process of the fishing operation in details.

1. **Type(s) of fishing gear installed onboard**
2. **Number of the same fishing gears used**
3. **Number of boat and duty of each boat**
4. **Duty and assignment of fishers**
5. **Preparation activities before starting the fishing operation**
6. **Location of fishing practices, for example**
 - a. Artificial reef
 - b. Fish Aggregating Devices
 - c. River mouth
 - d. Rocky or coral area
 - e. Coastal area
 - f. Deep sea or Oceanic and etc.
7. **Depth for setting the fishing gear**
8. **Effective depth of the fishing gear**
9. **Description of fishing practice from gear setting and hauling step by step**
10. **Setting and hauling fishing gear**
 - a. Arrangement of crew during fishing operation
 - b. Method of finding and scouting fish school
 - c. Method of casting net
 - d. Method of hauling net
 - e. Method of hauling catch
 - f. Method of post-harvest catch handling onboard
 - g. Time requirement for casting and hauling net
 - h. Duration of catches generally storing in the fish hold
 - i. Unloading of the catches and their handing at the fishing port

- j. Previous change of the fishing operation up to now

11. Period of fishing operation

- a. Daytime/Night time
- b. Full moon/Dark moon
- c. High tide/Low tide
- d. Flow tide/Stable tide/ebb tide

12. Time interval for fishing practices

13. Mechanism of catch (e.g. enmeshing, entangling, impounding, and etc.)

14. Other techniques (e.g. fish aggregating technique, frightening, or chasing technique)

15. Other remarkable about equipments using for reducing number of manpower onboard or for more convenient of the fishing operation

16. Other remarkable information (e.g. fishing gear setting along the current, fishing or against the current, etc.)

17. Post harvesting

- a. Catch handling techniques/method onboard
- b. Utilization of the catch after landing (e.g. local consumption / fresh market or cannery/frozen processing, etc.)
- c. Method and cost of packing
- d. Market chain
- e. Commission
- f. Place of major consumption
- g. Monthly average price of fish
 - 1. Throughout in fishing season
 - 2. Throughout off-fishing season and
 - 3. Factors of seasonal variation in price
- h. Method of transportation and its arrangement during transporting
- i. Other remarkable information

List of fishing ground and fishing season information

Fishing season: If there is more than one fishing season within the area with or without regard to species, it should be described separately.

1. **Period of the fishing season**
2. **Best period of the season**
3. **Weather condition of the season, and its possible effect to the catches**
4. **Changes in fishing season for a number of years up to present**
5. **Average numbers of fishing operation for a fishing season**
6. **Information should be separately recorded if there are more than one season in the same fishing area**

Fishing ground information: If there are more than one fishing ground in the area with or without regard to season and/or species, describe them accordingly.

7. **Position, location, area, and topography**
8. **Average depth of the fishing ground**
9. **Type of sea-bottom and its inclination**
10. **Water current and wind** (direction, velocity its season and daily variation)
11. **Water temperature, color of water, ebb, and flow**
12. **Changes in the ground for a number of years till now**
13. **Chart of the ground; time required to reach the fishing ground**
14. **Other possible fishing ground in the vicinity**
15. **Number of fishing vessels operating in the same fishing ground** (by the type of fishing gear)
16. **Other remarkable fishing ground information e.g. rocky area, coral area, sandy and etc.**

Target Catches and Their Behavior

In case that there are more than one species of the target catches, information of the target catches and their behavior should be recorded separately as follow:

1. **Quantity of catch by species in a season or in a year**
2. **Range and average of size of fish caught**
3. **Effect of season change on catch**
4. **Annual or monthly statistic of catches for a numbers of year**
5. **Behavior of target fish**

5.1 Changing in swimming layer

- a. Variation by season
- b. Variation by spawning period
- c. Variation by weather condition
- d. Variation by time of day
- e. Variation due to predator and food
- f. Variation by current and tide
- g. Variation depend on body size

5.2 Forming school or dispersion

- a. Variation by season
- b. Variation by spawning period
- c. Variation by weather condition
- d. Variation by time of day
- e. Variation due to predator and food
- f. Variation by current and tide
- g. Variation depend on size

5.3 Migration behavior

- a. Variation by season
- b. Variation by spawning period
- c. Variation by weather condition
- d. Variation by time of day
- e. Variation due to predator and food

- f. Variation by current and tide
- g. Variation depend on size

5.4 Feeding behavior

- a. Variation by season
- b. Variation by spawning period
- c. Variation by weather condition
- d. Variation by time of day
- e. Variation due to predator and food
- f. Variation by current and tide
- g. Variation depend on size

5.5 Body length, weight and body circumference

- a. Season difference
- b. Different by spawning period
- c. Other remarkable factor

Financial Information on Fishing Activities

1. **Type and source of financial**
2. **Type of subsidiary**
3. **Source of subsidiary and external assistance (e.g. from national government, NGOs, and etc.)**
4. **Income**
 - a. Income from fishing
 1. Direct sale
 2. Product after processing sale
 - b. Income from other source
 - c. Total income
5. **Expenses**
 - a. Salary and wage of employee
 - b. Bonus for employee
 - c. Boarding expenses for employee during a fishing season or during whole year
 - d. Other expense for employee
 - e. Repairing, replacement, and supplement of fishing gear and fishing vessel
 - f. Average of depreciation of fishing gear and fishing boat
 - g. Cost of fuel oil and expendable matter
 - h. Tax
 - i. Charge of fisheries included fishing license or other associated matter
 - j. Commission for selling catch
 - k. Other expenses
 - l. Total of annual expense



Form Fishing Gear Survey

General information			
Observer		Date	
Place observed			
Name of fisherman/owner			
Type of fishing gear			
Estimate number of the fishing unit in the area			
Fishing gear			
Size of fishing gear			
Number of fishing gear used for one operation			
Cost of complete set		(Purchase or self-making)	
Material		Wage	
Constructing time		Cost of full operation	
Fishing boat			
Name of fishing boat		Register No.	
Type (Wooden/Steel/FRP)			
Length Width Depth, Gross tonnage			
Engine (inboard/outboard)		hp	Speed
km/h or knot			
Cost of fishing boat		Cost of maintenance	
Fishing operation			
Number of fishing boat		Number of crew	
Number of day/trip			
Fuel/trip		liters	Cost of fuel
			liter/trip
Cost of ice/trip		Cost of food/trip	Other expenses

Table
2

Form 2 Fishing Season, Fishing Ground and Fishing Method

Month	Activity	Fishing Ground	Target species and Catch amount/Day	Operation Period	No. of Operation /day
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Fishing method (Drawing)

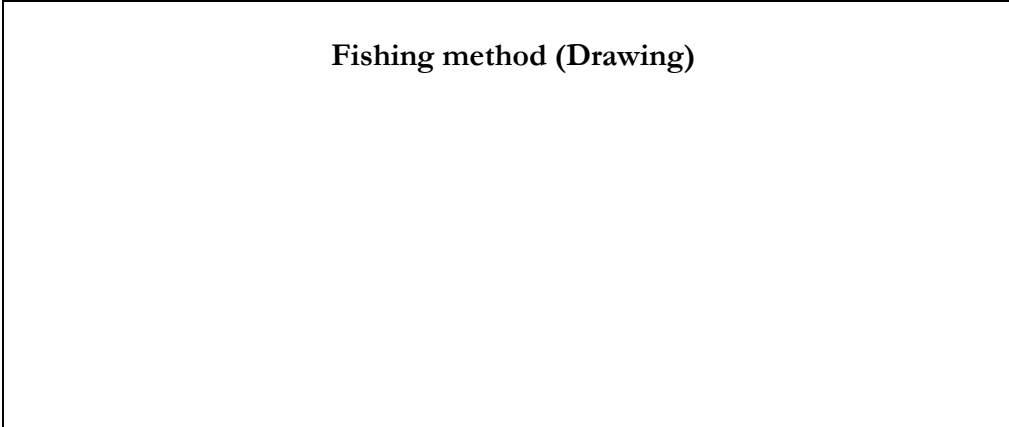


Table
3

Example Survey Form Trawl Net

Survey form of Trawl net					
No.					Date of Survey
Name	Place		Size		
Gross tonnage			S	M	L
LOA (m)					XL
Main Engine (hp)					
Reduction Gear					
Propeller (Inch)					
Otter board size (Length/width in inch)					
Type of Otter board	Trapezoid		Rectangle		
Towing line	Material			Length (m)	
Sweep Line	Material			Length (m)	
Upper net pendant	Material			Length (m)	
Lower net pendant	Material			Length (m)	
Type of trawl net	Shrimp Trawl	Fish Trawl	Hybrid Trawl	Target catch	
Float rope	Material			Length (m)	
Ground rope	Material			Length (m)	
Sinker	Material	Size		Total Weight (kg)	
Float	Material	Size		Total No.	
Body length (m)					
Upper Wing	Material	Mesh size		Length (m)	
Lower wing	Material	Mesh size		Length (m)	
Lenthb of Toe					
Toe net (triangle net)	Material	Mesh size		Length (m)	
Square	Material	Mesh size		Length (m)	Circumfernce (m)
1st sheet Baiting	Material	Mesh size		Length (m)	Circumfernce (m)
Expansion piece	Material	Mesh size		Length (m)	Circumfernce (m)
Codend	Material	Mesh size		Length (m)	Circumfernce (m)
Remark					

Basic Knowledge of Fishing Gear

In general, fishing gear is constructed from textile and/or fishing gear materials. Nowadays, fishing gear textile materials compose of natural fiber and synthetic fiber. Non-textile fiber materials are commonly used for non-textile fishing gear, and for some fishing accessories equipment (e.g. buoy, sinker, etc.). Some fishing gears such as bamboo stake trap, pot, or trap are constructed from non-textile material, using wood, bamboo, and plastic. More detail information on non-textile material appears in this guide under the fishing accessory part.

1. Fishing gear material

1.1. Type of textile fishing

1.1.1. Natural Fibers: vegetable fibers, wool, hemp, coconut plant, etc.

1.1.2. Synthetic Fibers: this is man-made fiber those are synthesized of simple chemical substances. According to these substances and to different fiber structures, several classes of synthetic fibers with different properties may be distinguished. Before the World War II, natural fiber is widely used for the fishing net. Since synthetic fibers were invented, natural fibers have been replaced due to the following factors:

- a. Do not rot by any bacteria or micro-organism.
- b. Comparatively high breaking strength (excluding polyvinylidene chloride).
- c. Comparatively high elongation when stretch.
- d. Less water absorption.
- e. High specific gravity (excluding polyethylene and polypropylene).
- f. High resistance to abrasion.
- g. High resistance to environmental changes (weather, temperature, acid and alkali substances, salts, oil, etc.)

- h. High resistance to UV radiation or sunlight (excluding polyamide) but coloring by special dye could increase UV resistance, and prevent the slipping of knot.

There is only one demerit of the synthetic fiber is comparatively high price comparing to the natural fibers.

The following chemical groups or classes of synthetic fibers are mostly used as fishing gear materials (netting yarns, twines, ropes, etc.):

1. Polyethylene (PE)

Commercial names: Akvaflex (Nor), Cerfil, Cofiplaste (Por), Courlene, Drylene, Norfil, Rigidex (UK), Etylon, Hiralon, Hi-zex (Jap), Flotten, Sainthene (Fra), Hostalen G, Northylene, Trofil, Vestolen A (Ger), Laventen (Swed), Levilene (Ital), Marlin PE (Ice), Velon (USA)

Characteristic	Particular
Specific gravity	0.91-0.98 (Positive buoyancy: Float in the water)
Coal- tar dyeing	Impossible
Dyeing in other colors	Possible in manufacturing process (Product in various colors)
Effect to heat	100-115 °C
Effect to sunlight	Decrease in strength very little
Multifilament yarn	200, 380, 400, 500, 600, 700 and 800 denier/ filament
Monofilament yarn	Not available
Spun yarn	Not available
Usages in filaments	Trawl net and ropes
Usages in spun yarn	Not available
Remarkable	Good elasticity and resistance to abrasion.

Table 1: Characteristic of Polyethylene

Item	Characteristic
In flame:	Shrinks, curls, melts and bums with light flame, drops of melting drip down
After leaving frame:	Continues to bum rapidly. Hot melting substance cannot be stretched.
Residue:	No melting bead, like paraffin, crushable.
Smell of smoke:	Similar to burning paraffin.

Table 2: Simple test for identification of Polyethylene (PE) materials

2. Polypropylene (PP)

Commercial names: Akvaflex (Nor), Courlene PY, Drylene 6, Nufil, Ribofil, Ulstron (UK), Danaflex, Multiflex (Den), Hostalen PP, Trofil P, Vestolen P (Ger), Meraklon (Ital), Prolene (Arg)

Characteristic	Particular
Specific gravity	0.91-0.92 (Positive buoyancy: Float in the water)
Coal- tar dyeing	Impossible
Dyeing in other colors	Possible in manufacturing process (Product in various colors)
Effect to heat	140-160 °C
Effect to sunlight	Decrease in strength very little
Multifilament yarn	170denier/ 240filaments
Monofilament yarn	2000, 2400, 3000, 6000denier/ 1 filament (Manufacture both flat and round type)
Spun yarn	Not available
Usages in filaments	Ropes
Usages in spun yarn	Not available
Remarkable	Good breaking strength and resistance to abrasion.

Table 3: Characteristic of Polypropylene

Item	Characteristic
In flame:	Shrinks, curls, melts and bums with light flame, drops of melting drip down
After leaving flame:	Continues to bum slowly. Hot melting substance may be stretch into fine thread
Residue:	Hard, round, brown to blackish, not crushable
Smell of smoke:	Similar to burning asphalt like wax or paraffin

Table 4: Simple test for identification of Polypropylene materials

3. Polyamide (PA)

Commercial names: Amilan (Jap), Anid, Kapron,(Rus), Anzalon (Neth), Capaolon (USA), Denderon, Perlon, Platil (Ger), Enkalon, Kenlon, Knoxlock (UK), Lilion, Nailon (Ital), Nailonsix (Braz), Nylon (Many country), Roblon (Den), Silon (Czec).

Characteristic	Particular
Specific gravity	1.14 (Negative buoyancy: Sink in the water)
Coal- tar dyeing	Possible
Dyeing in other colors	Possible
Effect to heat	180°C
Effect to sunlight	Loss in strength and change in color (become yellowish)
Multifilament yarn	210 denier /15, 24, 34, 36 filament, 420 denier/48 filament, 840 denier/96, 1260 denier/204, 136 filament, 210 filaments
Monofilament yarn	500 denier/1 filament and size 0.1- 5mm diameter
Spun yarn	1, 3, 5, 20, 22 count's
Usages in filaments	gillnet, purse seine net, trawl net, casting net, some other nets and ropes.
Usages in spun yarn	Seizing and lacing twine and ropes
Remarkable	Large elongation and high elasticity. Excellent breaking strength and good resistance to abrasion.

Table 5: Characteristic of Polyamide

Item	Characteristic
In flame:	Melts and then bums with light flame. White smoke. Drops of yellowish making drip down
After leaving flame:	Stops burning if melting drops fall down. Small bead on the end of the sample. Hot melting bead may be stretched into fine thread
Residue:	Hard, round, yellowish bead, not crushable.
Smell of smoke:	Celery-like; fishy odour, faintly like pyridine.

Table 6: Simple test for identification of Polyamide

4. Polyester (PES)

Commercial names: Dacron (USA), Diolen, Griuten, Trevira (Ger), Tergal (Fra), Terital (Ital), Terlenka (Neth, UK), Terylene (UK), Tetrolon (Jap).

Characteristic	Particular
Specific gravity	1.38 (Negative buoyancy: Sink in the water)
Coal- tar dyeing	Possible
Dyeing in other colors	Possible (Product in black and brown color)
Effect to heat	238-240°C
Effect to sunlight	Decrease in strength very little
Multifilament yarn	210 denier/24 filaments, 250 denier/48 filaments
Monofilament yarn	Not available

Spun yarn	20, 22 count
Usages in filaments	Purse seine net, stick-held dip net, small scale set net, and longline
Usages in spun yarn	Purse seine net, stick-held dip net and rope and others.
Remarkable	Very good breaking strength elongation Good elasticity but poor elongation

Table 7: Characteristic of Polyester materials

Item	Characteristic
In flame:	Melts and burns with light flame. Sooty, blackish smoke. Drops of melting drip down.
After leaving flame:	Stops burning if melting drops fall down. Small black bead on the end of the sample. Hot melting bead may be stretched into fine thread.
Residue:	Hard, blackish bead, not crushable..
Smell of smoke:	Oily, soot odour, faintly sweet, similar to sealing-wax, aromatic.

Table 8: Simple test for identification of Polyester materials

5. Polyvinyl alcohol (PVA)

Commercial names: Cremona, Kanebian, Kuralon, Kuremona, Manryo, Mewlon, Trawlon, Vinylon (Jap)

Characteristic	Particular
Specific gravity	1.26-1.32 (Negative buoyancy: Sink in the water)
Coal- tar dyeing	Possible
Dyeing in other colors	Possible (Product in black, red, pink and brown color)
Effect to heat	220-230°C
Effect to sunlight	Decrease in strength very little
Multifilament yarn	250 denier/36 filaments, 500 denier/127 filaments
Monofilament yarn	500 denier/filament
Spun yarn	1,3,5,20,22 count
Usages in filaments	Purse seine net, stick-held dip net, small-scale set net, and gillnet.
Usages in spun yarn	Purse seine net, bottom trawl net, gillnet, longline and ropes
Remarkable	Good elongation and resistance to abrasion

Table 9: Characteristic of Polyvinyl alcohol

Item	Characteristic
In flame:	Shrinks, curls and burns rapidly with light flame
After leaving flame:	Continues to burn rapidly. Melting substance cannot be stretched.
Residue:	Hard, brown to black, irregular not crushable.
Smell of smoke:	Sharp, sweet like chlorine.

Table 10: Simple test for identification of Polyvinyl alcohol

6. Polyvinylidene chloride (PVC)

Commercial names: Clorene (Fra), Dynel, Velon (USA), Saran (USA and Jap)
Kurahalon, Tiviron (Jap), Wynene (Can).

Characteristic	Particular
Specific gravity	1.7 (Negative buoyancy: Sink in the water)
Coal- tar dyeing	Impossible
Dyeing in other colors	Possible (Product in brown color)
Effect to heat	Not available
Effect to sunlight	Decrease in strength very little
Multifilament yarn	360denier/3 filaments, 720 denier/4, 6 filaments, 1080 denier/6, 9 filaments
Monofilament yarn	500, 1000, 3000 denier/filament
Spun yarn	Not available
Usages in filaments	Large scale set net
Usages in spun yarn	Not available
Remarkable	Good elongation and resistance to abrasion

Table 11: Characteristic of Polyvinylidene chloride

Item	Characteristic
In flame:	Shrinks rapidly and melts. Does not burn. Sooty. Melts into a crumbling, black substance.
After leaving flame:	Hot melting substance cannot be stretched.
Residue:	Hard, blackish, crumbly, irregular, no bead.
Smell of smoke:	Sharp, sweet, sweetish sourish.

Table 12: Simple test for identification of Polyvinylidene chloride

1.2. Designation of Netting Yarns

1.2.1. International Denier system

(Twines made of synthetic continuous multifilament): Td

1 Denier or 1 Td = Fiber weight 1 gram which 9000 meters in length

1.2.2. International system or Resultant tex: R tex

1 Tex = Weight of finished twines 1 gram which 1000 meters in length

1.2.3. English cotton number (Twine made of cotton and synthetic staple): NeC

1 NeC = Weight of cotton 1 pound which 840 yards in length or fiber weight 453.6 gram which 768.1 meters in length.

1.2.4. English Linen number (Twine made of Linen, Ramie, Hemp, Jute): NeL

1 NeL = Weight of Linen 1 pound which 300 yards in length or fiber weight 453.6 gram which 274.3 meters in length.

1.2.5. Metric number (All finished twine): Nm

1 Nm = Fiber weight 1000 gram which 1000 meters length (1 Km/1Kg)

Equivalent and Conversions:

$$1 \text{ TEX} = 0.11 \text{ Denier} = 590.5 \text{ NeC} = (1654 / \text{NeL}) = (100 / \text{NM})$$

2. Twine and ropes

2.1. Basic fiber types

For fishing nets, there is now a wide choice of textile materials available. Synthetic fibers are manufactured in different forms which have an influence on their finished products. Most synthetic fibers are produced in several of the following basic forms:

2.1.1. Continuous filaments (multifilament): fine man-made fibers of indefinite, practically infinite, length.

2.1.2. Staple fibers (short fiber): discontinuous fibers of regular length (cut made-made fibers) or irregular length (natural

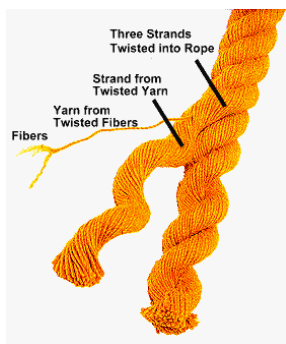


Figure 32: Composition of rope

Source: Narong Raungsivakul

fibers). Those made from man-made fibers may be cut from fine continuous filaments or from the coarser monofilaments.

2.1.3. Monofilament: The monofilament line is extruded and used in this form since twisted the several monofilament lines together will result a loss of strength of individual stand. However, for other fiber types, fabrication of twines or ropes can be achieved by twisting together between 2 to 10 filaments to produce yarn which are twisted together (2, 3 or 4) to produce twine.

2.1.4. Split fibers: this is a yam made of the fibrillating tapes contains split fibers of irregular fineness which are similar to natural hard fibers.

2.2. Definition term of twine and rope

The term "**Twine**" means comparatively fine twist, while for heavy twist of over 3 millimeters in diameter, the term "**Rope**" is used. For heavier rope of over 40 millimeters in diameter, the term "**Cable Laid Rope**" is sometime used. Most of twines and ropes belong to twisted variety. The construction of twined and rope are classified as follow:



2.2.1. Twisted Rope: In general, twisted rope manufacture for fisheries is 2, 3, 4 strands. Direction of twist in twine or rope is generally clockwise, is called **Z-twist** and the anti-clockwise, called **S-Twist**

2.2.2. There are 2 type of braided twine/rope. One is produced by two stands or four stands, is called "Crossing laid" Other is made by knitting together several stands into a tube shape twine, is called "**Tube-shape braided**" The advantage of the Crossing laid type is not twisting or kinking but the resistant of The crossing laid rope is higher than the twisted rope.

Figure 33: Twisted rope

Source: Narong Raungsivakul

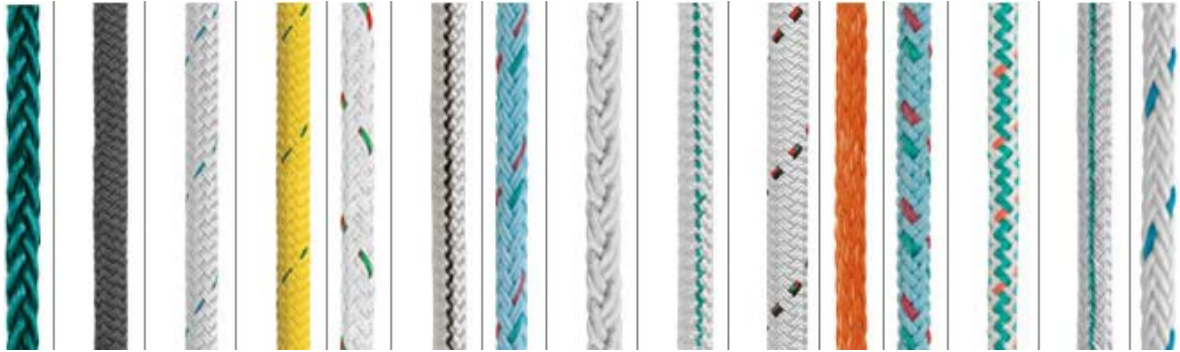


Figure 34: Braided rope

Source: <http://www.samsonrope.com>

2.3. Twine Measurement

There are 2 methods for measuring the twine size (i.e. linear density and diameter)

2.3.1. Linear density

The size of the most fishing twine is commonly shown together with the size of yarn used in making up the twine and the classification of the construction of the twine, for example

380d/5/3

The first part of the specification, 380D (380 denier), signifies the yarn size. The following figures, 5/3, show the construction of twine, that is 5 yarns per strand, 3 strands constructions.

R 345 Tex

The first part of the specification, 23 Tex, signifies the yarn size. The construction of twine is 5 yarn per strand and 3 strands constructions. ($23 \times 5 \times 3 = 345$)

2.3.2. Diameter of twine

The most common estimation method for estimating diameter of twines or rope are showed as follow: roll 20 turns of the twine to be measured around a pencil and measure the total length of the turns

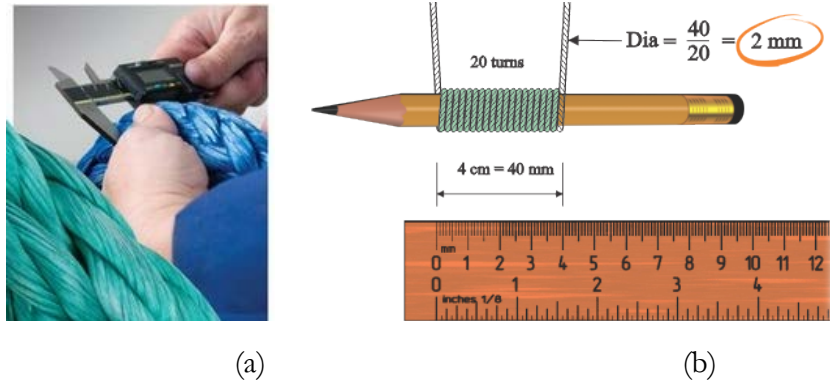


Figure 35: Diameter measurement

Source: (a) <http://www.samsonrope.com> and

(b) Narong Raungsivakul

3. Netting

3.1. Definition of netting

The term of "**netting**" (webbing) refers to textiles which consist of one yam or one or more systems of yams which are crossed or joined so as to form meshes in the final product, or to meshed structures which are formed by other means such as by stamping or cutting sheet materials or by extrusion. Usually, the mesh assumes a diamond shape, seldom square. In knotless netting, the meshes are sometimes more or less honeycomb shaped (hexagonal).



Sheet bend



Reef knot

Figure 36: Knotted types

Source: J. Prado and P.Y. Dremiere

3.2. Types of netting

A mesh is smallest unit of a sheet of webbing from which commercial fishing nets are constructed. It is rhombic opening enclosed by four bars of twines of equal length firmly knotted at the four comers. Each comer is called a "**knot**".

There are many different types of knots used in net construction. The following shows the different types used in netting.

3.2.1. Knotted: Commercial knotted net manufacture by three (3) main knot types, i.e. Sheet bend, Double sheet bend and Reef knotted

3.2.2. Knitted or Knotless: Commercial knotted net manufacture by two (2) types: (a) Minnow, and (b) Rachel net.

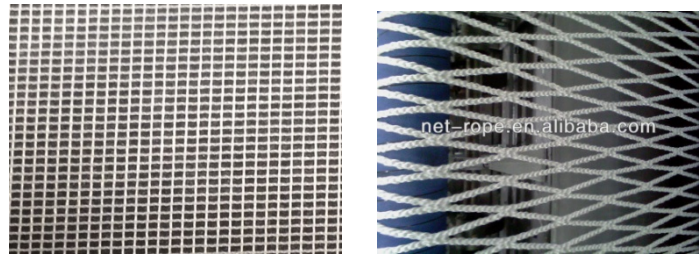


Figure 37: Knotted types: a) Minnow and (b) Rachel net.

Source: (a) www.deltanetandtwine.com

(b) <http://net-rope.en.alibaba.com>

3.3. Netting dimension

There are two types of dimension pertinent to netting: (i) overall proportions of the netting fabric; and (ii) size of the meshes. A number of instructions have been issued for measuring the mesh size due to the fact that most of regulations for the fishery resources conservation are commonly based on the specification of mesh size.

3.3.1. Length and breadth: length of a piece of netting could be indicated either by the number of meshes, or by a total length of stretch meshes (in meter). The breadth (depth) is commonly indicated by the number of meshes in one-row-oriented in the direction at right angles to the direction of the length indication of the net.

3.3.2. Mesh size: The size of the mesh may be indicated as the length or as the opening of the mesh. The mesh length in knotted (or knotless) netting is the distance between the centers of two opposite knots (or opposite joints) in the same mesh when the mesh is fully extended at right angles to (or parallel to) the continuing direction of the twines, whereas the opening of the mesh in knotted (or knotless) netting is the inside distance between two opposite knots (or opposite joints) in the same mesh when the mesh is fully extended at right angles to (or parallel to) the continuing direction of the twines.

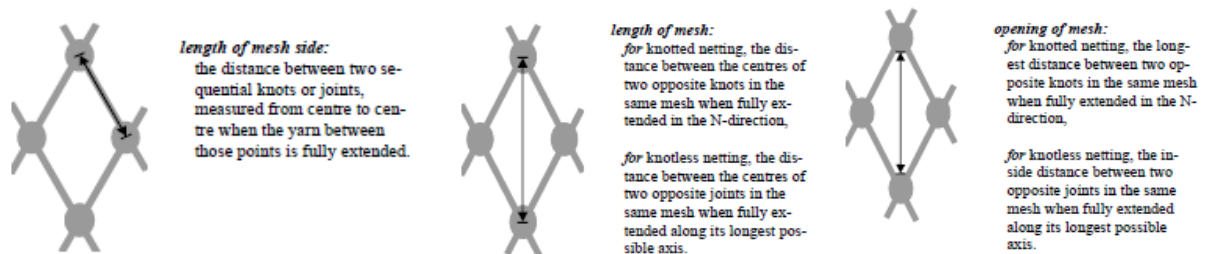
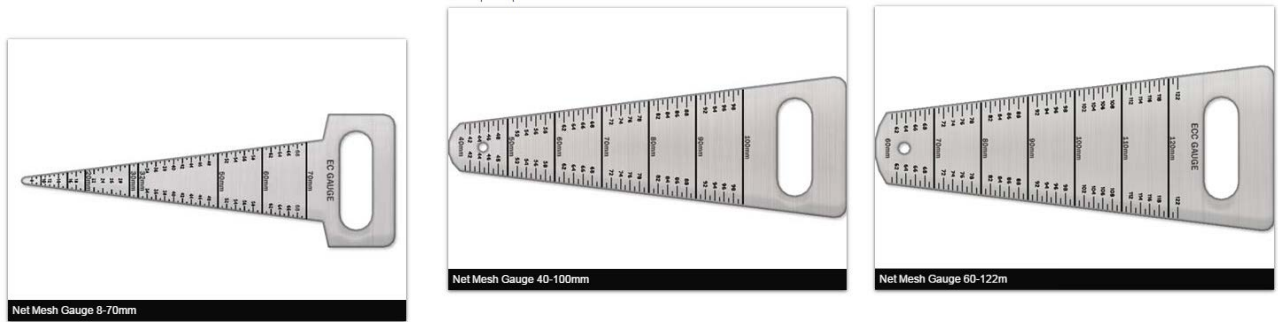


Figure 38: Mesh size measurement **Source:** R. Fonteyne and R.D. Galbraith



Wedge Gauge

Source: www.fishinggauges.com/gauges/net-mesh-gauge.php



Longitudinal Spring Loaded Mesh Gauge

Source: www.nonnodondolo.it/content/misuratore-a-carico-longitudinale



Omega Mesh Gauge

Sources: www.omegameshgaug.com

Figure 39: Types of Mesh Gauge for Scientific Purposes

3.3.3. Net hanging: correct hanging ratio of the netting to the framing or supporting lines is an important factor in all fishing nets. There are currently two methods for expressing the hanging coefficient of the net. However, this causes confusion when constructing nets from its drawing plan. The first method of hanging (or so-called hang-in) is to express the length of line, to which the webbing is hung, in a percentage of the total stretched webbing:

$$(\text{Length of line} \times 100) / \text{Length of stretched netting} = \text{percentage of hanging}$$

The second method is to express the amount of excess or loose netting (total netting minus line length) as a percentage of the total webbing:

$$(\text{Excess netting} \times 100) / \text{Total netting} = \text{percentage of hang-in}$$



Figure 40: Fishing net
Source: www.siambrothers.com

4. Fish Gear Accessories

4.1. Floats and buoys

Floats are used for maintaining the shape of fishing net in the water and to counter act the other force such as weight or those generated subjects due to the fishing gear being move through the water or acted upon by water current. Buoys are attached at the fishing gear to hold the fishing gear at the certain depth and locate the position of fishing gear set.

4.1.1. Materials of float and buoy

Conventional wood, cork, bamboo, glass ball, iron ball and rubber ball were once the most common floats. Recently, the advent of material such as synthetic fiber and polyethylene are increasingly used.

4.1.2. Shape of floats

Float shape varies depending on the type of operation for which they are used. Example, float attached to gillnet must have shape that produce the minimal drag when in a current and convenient for the attaching with the head rope (a) during gill net construction.



Figure 41: (a) Float (b) Buoy
Source: (a) Narong Raungsivakul
(b) Sanwa Commercial Co., Ltd.

Material	Apparent specific gravity (glee)
Cork	0.25
Paulownia	0.294 (0.785)
Bamboo	0.5
Glass ball 15 cm., diameter	0.348
Glass ball 30 cm., diameter	0.244
Synthetic float	0.134
Synthetic rubber	0.160
Cedar	0.32 to 0.38
Cypress	0.48
Fir	0.51
Oak dry	0.65
Oak green	0.95
Pine	0.598 (0.109)
Pine Oregon	0.51
Pine poplar	0.41
Spruce	0.40
Teak	0.82
Walnut	0.61

Note: Figure in parenthesis denote the value after 30 days left in the water

Table 13: Specific gravities of the floating materials

4.2. Sinkers

Sinkers are always fixed on the bottom of a net to maintain proper net shape under water and to give the net proper sinking speed. Sinkers are also fixed at the fishing gear to set them in the certain position. By the different objective, sinkers are various in shape, weight and material.

4.2.1. Materials for sinkers

Sinker is an important fishing gear accessories use for weight the ground rope of some fishing gear e.g. trawl net, purse seine, gill net. Main purpose is to enhance sinking speed and maintain the proper net shape by exerting the sinking force opposite to that of the floats. Lead, stone, porcelain, and concrete are typical material used to make sinkers for ordinary use, while metal anchors or sand bags are sometime employed for sinking large fixed nets. For round hauls and trawl nets a footrope or lead line weight with chain may be used. For drift nets, a footrope made of

wire and textile fiber, i.e. compound rope, is sometime used.

Material	Apparent specific gravity (<i>g_{lee}</i>)
Aluminum	2.5
Brass	8.6
Bronze	7.4 to 8.9
Cast iron	7.2 to 7.8
Copper	8.9
Lead	11.4
Steel	7.8
Tin	7.2
Zinc	6.9
Glass	2.5
Stone	2.6 to 2.7
Brick	1.9
Sand	1.8
Soil	1.5
Porcelain	1.72 to 2.13
Concrete	1.8 to 3.15
Sandstone	2.2
Ebony	1.25
Rubber	1.0 to 1.5
Chalk	2.4

Table 14: Specific gravity of the sinker materials



Figure 42: Sinker of fishing gear
Illustrator: Narong Raungsivakul

4.3. Calculation of buoyancy/sinking force

$$P = A \times (1 - DW/DM)$$

P: Weight (kg.) in water, A: Weight (kg.) in air

DW: Density (g/cc) of water (Fresh water: 1.00, Sea water: 1.026)

DM Density (g/cc) of material

* Remark: Factor followed by a + sign indicates a sinking force

Factor followed by a - sign indicates a buoyant or floating force

Example:

1.5 kg of cork in air = Weight in fresh water: $1.5 \times [1 - (1.000/1.25)] = - 4.5$

Weight in sea water: $1.5 \times [1 - (1.026/1.25)] = - 4.656$

1.5 kg of lead in air = Weight in fresh water: $1.5 \times [1 - (1.000/11.4)] = 1.36$

Weight in sea water: $1.5 \times [1 - (1.026/11.4)] = 1.365$

1. Organic materials

Material	Density
(1) Natural fiber	(1.32 to 1.54)
- Cotton	1.54
- Wool	1.32
- Silk	1.38 to 1.45
- Hemp	1.50
(2). Synthetic fiber	(0.91-1.70)
- Vinylon (cremona)	1.30
- Nylon (Amilan)	1.14
- Vinyliden (Saran)	1.70
- Polyvinyl Chloride (Teviron)	1.39
- Polyester (Tetron)	1.38
- Polyethylene (Hi-zex)	0.96
- Polypropylene (Toplon)	0.91
(3) Synthetic resin	(0.10 to 0.38)
- Vinyl Chloride	0.12 to 0.28
(4) Wood	(0.18 to 0.95)
- Cork	0.18
- Cedar	0.43
- Pine tree	0.95
- Bamboo	0.50
- Paulownia tree	0.29
(5) Artificial rubber	0.13-0.16

Table 15: Specific Gravity of Fishing Gear Materials

2. Metal materials	
Material	Density
(1) Iron	
- Casting iron	7.86
- Steel iron	7.70
(2) Lead	11.34
(3) Copper	8.93
(4) Brass	7.82
(5) Wire rope	4.57
3. Non-metal (Inorganic) materials	
(1) Concrete (cement 1, sand 2, gravel 4)	2.40
(2) Glass	2.70
(3) Stone	2.60 to 2.70
- Granite	2.65
- Marble	2.70
(4) Ceramic	1.72 to 2.13
- Bisque-fired	1.90
- Chinaware	2.13
(5) Soil	1.50 to 2.00
(6) Sand	1.80 to 1.89

Table 15 (Continue): Specific Gravity of Fishing Gear Materials

4.4. Hook

There are many types of hooks for angling. Although previously fishermen used wooden or bamboo hooks for angling, most hooks used nowadays are made of iron or brass. Their shape and size depend on the species of fish to be caught. Anatomy of Hook is composed with 4 main parts, is

4.4.1. Gape: The distance between point and shank

4.4.2. Bite/throat: The distance from the apex of the bend to its intersection with the gape

4.4.3. Point: The sharpened end which penetrates the fish's mouth

4.4.4. Barb: The projection extending backwards from the point that secures your catch from unhooking

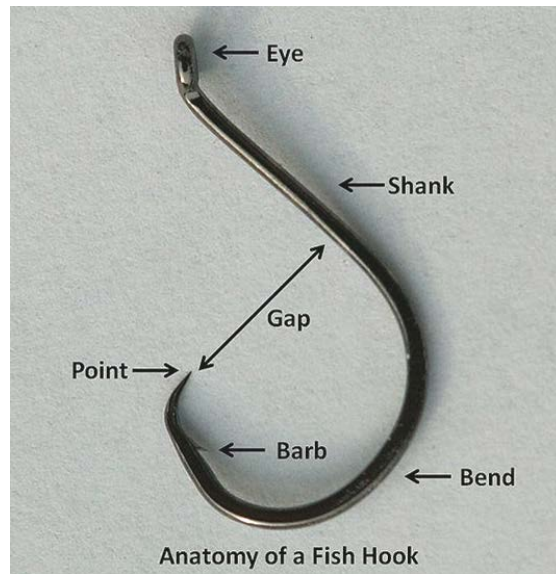


Figure 43: Hook anatomy

Source: http://en.wikipedia.org/wiki/Fish_hook

The two most important dimensions of a hook is;

1. Its gap, the distance between point and shank,
2. Depth of the throat.

Generous dimensions ensure deeper penetration of the point and better holding power of the fish.



Basic KNOWLEDGE FOR RECORDING FISHING BOAT DETAILS

Refer to SEAFDEC publication, **Fishing Technology Outline (TD/TRB45)**, some important details regarding to fishing vessel for surveyor are listed as bellowed;

1. Tonnage system

1.1. Gross tonnage (G.T.)

Size of fishing vessel is usually expressed in term of gross tonnage (G.T.). Method of tonnage measurement differs considerably from country to country. For large size fishing vessels, however, the international method for tonnage measurement is coming into International Convention on Tonnage Measurement of Ships, 1970.

International formula for G.T. measurement of fishing boat over 24 meters length

$$GT = KV$$

When V is the total volume of all enclose space of boat (Cubic meter)

$$K = 0.2 + 0.02 \log_{10} V$$

Current formula for G.T. measurement of small fishing boats. The following formula is used only on Thailand and Vietnam.

$$GT = [(P+B)/2] \times L \times C$$

When P is Periphery measured around the mid ship section of hull. In Vietnam, P is directly measured, while in Thailand, P is derived from the following formula:

$$P = (B+2D) \times C_b$$

Cb: 0.85 for displacement hull, and 0.90 for flat bottom hull construction. C: In Vietnam, 0.060 for wooden boat and 0.064 for steel boat. In Thailand, 0.058 for wooden boat and 0.070 for steel boat

1.2. Net tonnage (N.T.)

The net tonnage is shown the volume of boat which is direct used for the purpose of the operation of the boat, whereas G.T. is shown the total volume of the boat herself. Therefore, N. T. is obtained by subtracting the volume of following spaces from the total volume of boat (Cubic meter): Accommodation, Chart room, Steering gear room, Engine room, etc.

(G.T. - total volume of following spaces from the total volume of boat (Cubic meter): Accommodation, Chart room, Steering gear room, Engine room, Etc.)

1.3. Displacement tonnage (A)

Displacement tonnage implies the weight of boat and varies with the quantities of fuel, water, crew, fish catch, etc., loaded about the boat. Therefore displacement tonnage should be discussed considering the loading condition such as light or full loaded.

1.4. Dead weight tonnage (DW)

Dead weight tonnage is the maximum weight of fuel, water crew, fish catch etc. capable to be loaded on board. In the other words, the dead weight tonnage is the differential between the displacement tonnages at light and fuel load condition.

2. Measurement Unit

2.1. Short ton:

Weight measurement unit as 1 short ton = 2000 pound

2.2. Long ton:

Weight measurement unit as 1 short ton, = 2240 pound

2.3. Ton:

Weight measurement unit is the meaning of metric ton = 1000 kg.

2.4. Ton:

Weight measurement unit is the meaning of metric ton, = 2204 pound by metric ton and 2240 pound by long ton.

3. Principle Dimension of the Ship

3.1. Length (L)

- 3.1.1. Length Overall (LOA): Horizontal distance between forefront of ships bow and rear end of the ship's stern
- 3.1.2. Registered Length: Horizontal distance between forefront of the stem at top of upper deck beam and rear end of stern frame.
- 3.1.3. Length between perpendiculars (LPP): Horizontal distance between fore perpendicular and after perpendicular. There are 2 definitions used in LPP, i.e.
 - F.P. Perpendicular at forefront of the stem at the level of load water line
 - A.P. Perpendicular at rear-end of the stem frame at the level of load water line

3.2. Breath (B)

- 3.1.1. Mould Breath: Horizontal distance between outside of frame on both sides at widest point of the ship
- 3.1.2. Breath extreme: Horizontal distance between outside of shell plating on both sides at the widest point of ship

3.3. Depth (D):

The vertical distance from the base line to freeboard deck at the mid ship section

3.4. Draught (Draught, d) or Moulded Draught:

Vertical distance load water line and base line.

3.1.3. Fore draught: Draught at fore perpendicular

3.1.4. Aft draught: Draught at aft perpendicular

3.5. Freeboard:

Freeboard is vertical distance between freeboard deck and full load water line. Free board could obtain by subtracting draught (d) from depth (D). Big freeboard means big reserve buoyancy which safety for the boat can be increased.

4. Name and parts of the ship and its structure

- 4.1. **Hull:** The body of frame of a ship, apart from the mast, sales and rigging
- 4.2. **Bow:** Round fore-end of the ship
- 4.3. **Stern:** Aft part of the ship
- 4.4. **Starboard:** The right side of the ship when facing to the bow
- 4.5. **Port:** The left side of the ship when facing to the bow
- 4.6. **Deck:** A platform extending from side to side if a ship or part of a ship, covering the space below, and also serving as a floor

- 4.7. **Keel:** The main center line structure member running fore and aft along the bottom of a ship and classified into 2 types, i.e. bar keel and flat keel
- 4.8. **Bilge keel:** Keel attached on a curved part of ship bottom on both side and is also rolling chock. Length of bilge keel is about 2/3 of ship length. It reduces rolling and increase longitudinal strength.
- 4.9. **Stringer:** Longitudinal member making longitudinal strength
- 4.10. **Frame:** Transverse member making transverse strength
- 4.11. **Beam:** Material connecting frame on both side and support deck
- 4.12. **Shell Plating:** Outside plate of ship hull and classified as Sheer strake, Topside plating, Side plating, Bilge strake, Bottom plating and Keel plate

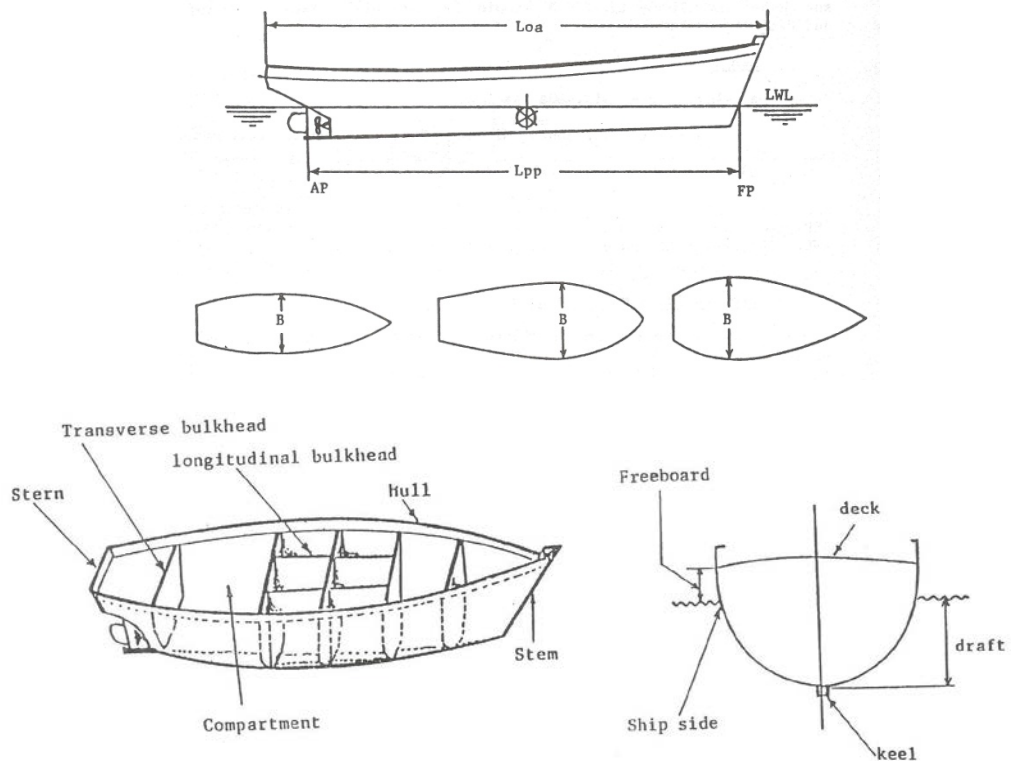


Figure 44: Principle of ship dimension
 Source: Prasert Masthawe, Aussanee Munprasit, et al. 1988

REFERENCES

- J. Prado and P.Y. Dremiere, FAO. 1990 Fisherman's Workbook, Fishing News Books Oxford, United Kingdom.
- Kanagawa International Fisheries Training Center (KITFC). 1978. Outline of Fishing Gear and Method. Japan International Cooperative Agency. Kanagawa Prefecture. Japan.
- Kanagawa International Fisheries Training Center (KITFC). 1992. The Fishing Technology Manual. Japan International Cooperative Agency. Kanagawa Prefecture. Japan.
- Masatune Nomura and Tomeyoshi Yamasaki. 1977. Fishing Techniques (1). Japan International Cooperative Agency. Tokyo, Japan
- Masatune Nomura. 1977. Necessary Check Items for Surveying Fishing Gear, lecture note for fishing technology course. Southeast Asian Fisheries Development Center/Training Department (SEAFDEC/TD), Samutprakarn, Thailand
- Prasert Masthawe, Aussanee Munprasit, et al. 1988. Fishing Technology Outline, SEAFDEC TD/TRB/ 45. SEAFDEC Samutprakarn, Thailand.
- R. Fonteyne and R.D. Galbraith, ICES. 2004. Mesh Size Measurement Revisited. ICES Cooperative Research Report, No. 266. 56 pp
- S.C.C. Catalog Tuna Longline Product. Sanwa Commercial Co. Ltd. Shizuoka Japan.
- SEAFDEC. 2004. Fishing Gear and Methods in Southeast Asia: I Thailand (Revised Edition); TD/RES/9. Southeast Asian Fisheries Development Center/Training Department (SEAFDEC/TD), Samutprakarn, Thailand
- Yozo Tarawa, et al., 1974. Japan Fishing Gear and Method. Oversea Technical Cooperation Agency, Japan.
- Yutaka Mutsunaga. 1987. Fishing Gear Material, SEAFDEC/TD/LN/63. SEAFDEC Samutprakarn, Thailand.
- <http://www.allproducts.com>. Access on 25 February 2013.
- <http://www.alltackle.com>. Access on 25 September 2016.
- http://en.wikipedia.org/wiki/Fish_hook. Access on 25 February 2013.
- <http://www.fishinggauges.com>. Access on 25 February 2013
- <http://www.justofishing.com>. Access on 25 February 2013.
- <http://www.samsonrope.com>. Access on 25 February 2013.
- <http://www.siambrothers.com>. Access on 25 February 2013

<http://www.omegameshgauge.com>. Access on 25 October 2015

<http://www.nonnodondolo.it>. Access on 25 October 2015

<http://www.topfreebiz.com>. Access on 25 October 2015