The Secretariat of the Pacific Community has been active in promoting fisheries development in Pacific Island countries and territories for over 30 years. A particular area of strength has been SPC’s programme of training in fishing and boat-handling techniques for small- and medium-scale fishermen. This programme, initiated in 1978, has been carried out by SPC’s team of Fisheries Development Officers (formerly called Masterfishermen), who, at the request of Pacific Island governments, conduct training courses, visit fishing communities and work with private sector companies to carry out practical fishery demonstration activities. The information contained in this manual has been compiled from the discussions and written records of the SPC Fisheries Development Officers and other fisheries development staff. In fact, part of the reason for compiling the manual was in order to capture, at least partially, the largely unwritten specialist knowledge and practical experience accumulated by SPC’s fishing staff during their commercial activities before working for SPC and during their field activities with SPC.

The main purpose of the manual, however, is to introduce the horizontal longline fishing method to Pacific Island fishermen, as well as to assist those currently involved to improve their fishing success, particularly in commercial or semi-commercial situations. The manual is intended to act as a guide to the principles and techniques of good horizontal tuna longline fishing, for use by fishermen who want to start, refine or broaden their skills. We have tried to give as much detail as possible on the rigging and use of monofilament longline fishing gear, and to provide brief descriptions of rope gear and other possible variations to these gears and the fishing methods. We have included information on fish handling practices which will lead to top prices for fish sold on both local and export markets. Environmental and conservation issues and concerns have also been included to raise awareness and to present ways to minimise impacts on unwanted species or the environment as a result of horizontal tuna longline fishing activities.

A further aim of the manual is to serve as a resource in formal training activities carried out by the SPC fisheries programme as well as national fisheries development agencies and extension officers. The manual is intended for use as a training aid to help introduce and explain fishing topics to small- and medium-scale fishermen and others. To support this aim, we have tried to present as much information as possible in a visual form, for the benefit of the many Pacific fishermen whose first language is not English. For the same reason, the text has been kept as simple and non-technical as possible.

In compiling this manual, we have split the many interwoven aspects of horizontal tuna longline fishing into topics, organised into six main chapters, which deal with tuna longline basics, preparation of the fishing gear and equipment, fishing operations and procedures, handling and preserving the catch, marketing and business operations, and responsible fishing practices. This is followed by several appendices. Appendix A provides useful information and tips on weather conditions and sea state, Appendix B provides important radio frequencies and the phonetic alphabet, and Appendix C provides a glossary of nautical terms. Predictably, it has proven impossible to avoid overlap altogether. However, we hope that the cross-references in the text, together with the detailed topic headings and sub-headings presented in the contents list, will enable readers to follow a given theme in the text, or to find the specific information they seek.

SPC has produced a number of other manuals, handbooks and training materials on fishing and related topics. *Trolling Techniques for the Pacific Islands: A Manual for Fishermen* provides complete information on trolling methods and gear. The two manuals, *Vertical Longlining and Other Methods of Fishing Around Fish Aggregation Devices* and *Deep-bottom Fishing Techniques for the Pacific Islands* explain the techniques involved in these types of fishing. The three volumes of the SPC FAD Handbook are aimed at helping fisheries departments to establish FAD programmes that will provide maximum benefits for the local fishing industry. Various other SPC training and public information materials (including lecture notes, videos, overheads, brochures and posters) on fishing, FADs, environmental concerns, and safety at sea are also available, as are construction diagrams and specifications for the FAO wooden fishing handreels. For more information write to SPC or visit the SPC’s website on http://www.spc.int/coastfish.
CHAPTER 1

BASIC INFORMATION AND TECHNIQUES

A. What is horizontal longlining?
B. The western and central Pacific Ocean tuna longline fishery
C. The catch: target species
D. The catch: byproduct and bycatch species
E. Bait used in longline fishing
F. Handling, preparing and splicing ropes and lines
G. General knots
H. Knots used with monofilament and the use of crimps
I. Working with ropes and lines
J. Longline boats
K. Sea safety appliances and equipment
L. Sea safety and the rules of the road

INTRODUCTION

This chapter provides information on the origin and history of horizontal tuna longlining, the latest science, and the current importance of this fishing method to developing domestic tuna longline fisheries in the Pacific region. The main target, byproduct and bycatch species are examined, looking at the habits that fishermen can use to their advantage in locating them and the baits that can be used. Knots and splices suitable for making up the different components of gear are described, as well as the use of ropes and lines for both fishing activities and general boat handling. It also briefly looks at the different types of tuna longline vessels used in the region, for small-, medium- and large-scale operations. Finally, sea safety and the relevant rules of the road are covered to emphasise the importance of taking precautions and being prepared, as tuna longlining can be a hazardous occupation if not conducted in a safe and professional manner.
CHAPTER 1: Basic information and techniques

A. WHAT IS HORIZONTAL LONGLINING?

Horizontal longline fishing uses a long mainline made of tarred rope or nylon monofilament to which are attached hundreds or thousands of branchlines, each with a single baited hook. The mainline can be from 5 to 100 nm long. The line is suspended in the water by floatlines attached to floats, which may have flagpoles, lights, or radio beacons. Longlines are usually set and hauled once daily and are allowed to drift freely, or soak, for several hours while fishing. Longlines are set, either by hand or mechanically, while the boat steams away from the line and are usually hauled mechanically while the boat steams toward the line. The species targeted are tunas and some billfish.

A bit of history

Horizontal longline fishing for pelagic species evolved in Japan during the nineteenth and early twentieth centuries. Sailboats equipped with hemp longlines would venture as far as 30 nm offshore from Japan in search of tuna and billfish. By 1912 there were over 100 registered sailboat tuna longliners in Japan. The first diesel powered steel longline vessels did not appear until the early 1920s. The longlines were hauled by hand until 1929 when the first mechanical Izui line hauler was developed.

Longline fishing was introduced to the rest of the Pacific Ocean in the 1930s by Japanese fishermen. By 1939 there were about 70 Japanese longline boats of between 60 and 270 gross registered tons (GRT) operating in the western and central Pacific Ocean from bases in Palau, Chuuk, and the Northern Marianas. At about the same time descendants of Japanese immigrants in Hawaii introduced what was called ‘flagline fishing’ to local fishermen. It was called flagline fishing because the mainline was marked by a series of flags on bamboo poles supported by glass floats.

During World War II (1941 to 1945) fishing activities were curtailed in the Pacific Ocean, but after the war they resumed again when restrictions to vessel movements were lifted. By the early 1950s, after abolition of the MacArthur Line (this was the name for the occupation force’s blockade which was set at 24˚N and 165˚E in 1946), there were close to 100 Japanese longliners operating in the western and central Pacific Ocean. Several fish bases were established throughout the Pacific to service the longline and pole and line vessels.

In the 1960s there were over 200 Japanese longliners operating throughout the Pacific: boats of 30 to 100 GRT in the Trust Territories, or Micronesia, boats of 100 to 200 GRT operating further east, and boats up to 400 GRT operating as far east as French Polynesia. Until the late 1960s most of these longliners were targeting albacore for the canneries and the catch was frozen at sea. In the early 1970s the Japanese longline fishery switched to more equatorial tunas and began fishing for sashimi grade bigeye and yellowfin tunas. Korean and Taiwanese boats soon began to replace the Japanese boats in the longline albacore fishery. The combined Korean and Taiwanese fleet numbered in the hundreds of boats and operated in Samoa, Vanuatu and Fiji Islands. In the late 1970s these boats also began switching to the sashimi tuna fishery.
1980 was the peak year for fishing for the Asian fleet operating in the western and central Pacific Ocean — 4647 boats landed 208,696 mt of bigeye, yellowfin, albacore, and skipjack tuna. By 1997 there were more longliners (4886) operating in the western and central Pacific Ocean, but fish landings totalled only 179,535 mt.

In Hawaii the domestic longline fleet stayed relatively small until the late 1980s when it expanded substantially. In 1983 the fleet consisted of around 40, mostly older wooden Japanese-style ‘sampans’ with traditional flagline gear. By 1990 the fleet had grown to 140 mostly steel and fibreglass boats in the 50 to 100 GRT range equipped with modern monofilament longline gear and sophisticated electronics. The fishery also changed. Many boats began fishing for broadbill swordfish. The advent of monofilament longline systems revolutionised the fishery by offering a simpler, more compact, more economical, less labour intensive, but more efficient system of catching pelagic species. The Hawaiian longline fishery was the precursor to the development of domestic longline fisheries in the rest of the Pacific Ocean, including Fiji Islands, Tahiti, Australia and New Zealand.

The 1978 UNCLOS (United Nations Convention on the Law of the Sea) allowed Pacific Island countries and territories (PICTs) to declare 200 nm exclusive economic zones (EEZs), and to take control over the marine resources within their EEZs. Starting in the early 1980s the Japanese, Korean and Taiwanese vessels fishing in the Pacific Ocean were required to secure permits and to pay access fees to fish within the many Pacific Island EEZs. On average, the fees received from foreign vessels amount to around five per cent of the market value of the fish caught. Starting in the late 1980s there has been a trend for PICTs to attempt to replace the foreign fleets with domestic fleets. With domestically based vessels, the financial return to the country can be much higher. Much of the revenue earned from longline fishing is in foreign currency as the main markets for fresh sashimi tuna are in Japan and the USA. Longline fishing can therefore become a very important component of Pacific Island economies.

Some PICTs have developed domestically owned fleets while others have entered into joint ventures with foreign fishing companies. Joint venture operations usually involve two separate companies operating together under a third company. Other PICTs have attempted to start up domestic longline fishing using government owned and operated vessels, while others have a combination of foreign vessels, locally owned domestic vessels, and foreign owned but domestically based joint venture vessels.

Of all the SPC member countries and territories, Fiji Islands, French Polynesia, New Caledonia, Papua New Guinea, Samoa, Tonga and American Samoa have been the most successful in developing domestic longline fishing to date, while others are struggling to enter this fishery.

The Oceanic Fisheries Programme at SPC is the repository for all catch and effort data on the western and central Pacific Ocean tuna fishery. With this data, the Programme makes a regional stock assessment of the resource, and this information forms the basis for management of the tuna resource in the region.
B. THE WESTERN AND CENTRAL PACIFIC OCEAN TUNA LONGLINE FISHERY

The longline fishery typically accounts for around 10 to 12 per cent of the total western and central Pacific Ocean (WCPO) tuna catch, but rivals the much larger purse seine catch in landed value. The longline fishery provides the longest time series of catch estimates for the WCPO, with estimates available since the early 1950s.

The annual total longline tuna catch has been relatively stable during the past 25 years, with total catches generally between 130,000 and 200,000 mt and comprising almost entirely yellowfin, bigeye and albacore tuna. Catches in recent years have been at record levels, but the species composition (35% albacore, 35% yellowfin and 30% bigeye tuna in recent years) has changed significantly from the 1970s (18% albacore, 57% yellowfin and 25% bigeye tuna in 1980), as a result of changes in fleets, operational areas and targeting practices.

The majority of the yellowfin tuna catch tends to be taken in tropical areas, especially in the western parts of the region, with smaller amounts in seasonal subtropical fisheries. The majority of the bigeye tuna catch is taken from tropical areas, but in contrast to yellowfin, mainly in the eastern parts of the WCPO adjacent to the traditional eastern Pacific Ocean bigeye tuna fishing grounds. The albacore tuna catch is taken in subtropical and temperate waters in both hemispheres.

There have been significant changes in fleet operations during the past two decades. For example, a feature of the 1980s was a change in targeting practices (fishing deeper to catch bigeye in cooler waters) in order to capitalise on a higher price for bigeye compared to yellowfin tuna. The entrance into the fishery and subsequent decline of the smaller offshore sashimi longliners of Taiwan and mainland China, based in Micronesia during the past decade, was also noteworthy. There has also been a trend towards flexibility in species targeting in some fleets, notably those with ultra-low temperature freezing capacity. In recent years, large Chinese longliners have been targeting albacore in the high seas areas of the south Pacific, and there has been rapid development of the longline fishery in at least one southeast Asian country (Vietnam).
CHAPTER 1: Basic information and techniques

The tuna longline fishery involves two main types of operation:

- large (typically >250 GRT) distant water fishing nation (DWFN) freezer vessels which undertake long voyages of several months and operate over large areas of the region;
- smaller (typically <100 GRT) offshore vessels, usually domestically based, with ice or chill capacity, and serving fresh or airfreight sashimi markets, which operate mostly in tropical areas.

DWFN fleets

Up to now, most of the WCPO longline catch has been taken by the large vessel DWFN fleets of Japan, Korea and Taiwan, although their proportion of the catch has declined in recent years. Some DWFN vessels operate in tropical waters targeting bigeye and yellowfin tuna for the frozen sashimi market, and others operate in the more temperate waters targeting albacore for canning. Some voluntary reduction by the Japanese distant water fleet has occurred in recent years.

Offshore fleets

In recent years, there has been a gradual increase in the number of PICT domestic vessels, such as those from American Samoa, Samoa, Fiji Islands, French Polynesia, New Caledonia, Solomon Islands and Tonga. These fleets mainly operate in subtropical waters, with albacore the main species taken. These fleets now take over 10 per cent of the total WCPO catch, and close to 50 per cent of the south Pacific albacore catch. The most significant developments over the past five years have been the growth of the Fijian fleet and the establishment of the domestic Samoan and French Polynesian fleets.

Domestic fleet sizes are increasing at the expense of foreign offshore and distant water fleets. There are now over 400 Pacific Island domestic vessels operating in the WCPO region. Activity by the offshore fleets from Japan, mainland China and Taiwan is restricted to tropical waters, targeting bigeye and yellowfin tuna for the fresh sashimi market; these fleets have limited overlap with the DWFN fleets. The substantial offshore effort in the west of the region is primarily by Indonesian and Taiwanese domestic fleets targeting yellowfin and bigeye tuna.
The main target species of pelagic longline fishing are tunas and billfish, while other species including sharks can also be an important component of the catch. Appendix D provides a list of the main species caught on longlines, with the English, French, Japanese and scientific names. The catch can be divided into three distinct categories: target, byproduct and bycatch.

Tunas are by far the most important target species for horizontal longlining. The highest value species are bluefin tuna — which are not often caught in Pacific Island EEZs — followed by bigeye tuna, yellowfin tuna, and albacore tuna, in that order. Some billfish are also targeted, with broadbill swordfish being the most important, followed by striped marlin. Table 1 outlines the main parameters for locating and catching these target species. (Note: these general parameters will vary with hemisphere, locality, season, moon phase, and local conditions.)

<table>
<thead>
<tr>
<th>Species</th>
<th>Capture depth</th>
<th>Temp. range</th>
<th>Best baits</th>
<th>Season</th>
<th>Set/haul times</th>
</tr>
</thead>
<tbody>
<tr>
<td>bigeye tuna</td>
<td>50 – 600 m,</td>
<td>10 – 17°C</td>
<td>saury, bigeye scad, pilchard, squid</td>
<td>winter</td>
<td>0400 – 0800 / 1400 – 1800</td>
</tr>
<tr>
<td></td>
<td>thermocline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellowfin tuna</td>
<td>50 – 250 m,</td>
<td>18 – 28°C</td>
<td>saury, bigeye scad, pilchard, squid</td>
<td>summer</td>
<td>0400 – 0800 / 1400 – 1800</td>
</tr>
<tr>
<td></td>
<td>mixed and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>intermediate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>albacore tuna</td>
<td>50 – 600 m,</td>
<td>10 – 17°C</td>
<td>saury, pilchard, sardine</td>
<td>late summer, autumn, early winter</td>
<td>0400 – 0800 / 1400 – 1800</td>
</tr>
<tr>
<td></td>
<td>thermocline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>broadbill</td>
<td>50 – 150 m,</td>
<td>18 – 22°C</td>
<td>Illex spp. squid, lightsticks</td>
<td>late winter and spring</td>
<td>1800 – 2000 / 0600 – 0800</td>
</tr>
<tr>
<td>swordfish</td>
<td>mixed and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>intermediate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>striped marlin</td>
<td>50 – 250 m,</td>
<td>20 – 23°C</td>
<td>saury, bigeye scad, pilchard, squid</td>
<td>late winter and spring</td>
<td>0400 – 0800 / 1400 – 1800</td>
</tr>
<tr>
<td></td>
<td>mixed and</td>
<td></td>
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<td></td>
<td>intermediate</td>
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</table>

**Bigeye tuna:** are the most valuable species caught in the Pacific and are found throughout the tropical and temperate Pacific Ocean. Fishermen targeting bigeye tuna set their lines deep because bigeye are often associated with the thermocline (Chapter 3 E), which is found between 100 and 350 m, depending on the area and time of year. Scientists have recorded this species going as deep as 660 m in some locations. Bigeye tuna catches are best between the 10˚ and 17˚C isotherms (Chapter 3 B) in the water column, although they can be caught at higher temperatures nearer the surface.

Bigeye tuna can be caught all year round in equatorial waters but are more seasonal in higher latitudes. The best bigeye catches are usually in the winter months. Large bigeye come close to the surface to feed at night in equatorial waters and can be caught a few days before, during, and a few days after a full moon. These full moon sets are shallow, down to about 50 to 100 m using squid for bait, and are made in the evening and hauled the following morning. Otherwise, bigeye sets are generally made in the morning and hauled in the afternoon and evening. The most marketable bigeye tuna are those weighing 40 kg or more. Bigeye tuna are usually marketed as fresh chilled fish for sashimi.

**Yellowfin tuna:** are also found throughout the tropical and temperate Pacific Ocean, but the stock in the WCPO is different than the stock in the eastern Pacific Ocean. Although they can be caught in deeper water, longline caught yellowfin are usually taken in water from near the surface down to 250 m — above the thermocline. This layer of water is called the mixed and intermediate layer (Chapter 3 E). The preferred temperature range for yellowfin tuna is 18˚ to 28˚C, which roughly corresponds to temperatures found in the mixed and intermediate layer.
Fishermen targeting yellowfin often look for temperature fronts or breaks, upwellings, current convergences, eddies, seamounts, and flocks of feeding seabirds (Chapter 3 D). The best season for yellowfin tuna is in the spring and summer months. The most marketable yellowfin tuna are those that weigh 30 kg or more. Yellowfin are usually sold as fresh chilled fish for sashimi or to be used in cooking. Yellowfin is second to bigeye as a sashimi fish in quality and value.

**Albacore tuna:** distribution in the Pacific Ocean is quite different than bigeye or yellowfin distribution. There are separate stocks in the northern Pacific and southern Pacific that inhabit temperate waters. These fish are schooling fish and are caught seasonally, in the summer and autumn months, at the surface by troll boats, and are smaller than longline caught albacore. Larger fish are caught by longline in deep tropical and subtropical waters down to the depth of the thermocline. Depth and temperature ranges for longline caught albacore are similar to those for bigeye tuna.

The season for longline albacore is not as apparent as for other tunas — autumn months in some locations, all year round with peaks in summer and in autumn and winter in other locations, and autumn and winter months in other areas. Longline caught albacore range from 15 to 20 kg and are sold frozen whole to canneries, fresh to export markets, or as frozen quarter-loins. Albacore, although traditionally more important for canning and cooking, is also becoming a popular fish for sashimi. There is currently a seasonal market for imported fresh fish in Japan during the months of July and August, and frozen albacore for sashimi is becoming increasingly popular in US and Japan markets.

**Broadbill swordfish:** are distributed throughout the tropical and temperate Pacific Ocean. They make daily excursions into deep water and return to the top of the mixed layer at night, where they can be caught on longlines baited with large squid and chemical lightsticks or electric lights (for attracting the swordfish to the baited hook). Swordfish are usually associated with seamounts or canyons or can be found near temperature fronts, current convergences, or eddies.

The preferred surface temperature range for swordfish is 18˚ to 22˚C. Moon phases are important in swordfish longlining — fishing is best around the full moon. The best season for swordfish is in late winter and early spring. Swordfish are usually sold as fresh headed and gutted fish. Fish smaller than 23 kg dressed weight are called rats, fish between 23 and 45 kg are called pups, and fish over 45 kg are called markers. Markers are the most sought after fish in US markets. Pacific Island producers often have trouble getting their swordfish into US markets because of mercury content of the flesh, usually associated with larger fish.

**Striped marlin:** are found throughout the tropical and temperate Pacific Ocean. They are usually found in the upper mixed layer or near the surface. In fact, longline caught striped marlin are most often caught on the branchlines nearest the floats, the shallowest branchlines. They are not usually the main target species of longliners, but are caught in association with yellowfin tuna sets. The preferred surface temperature range for striped marlin is 20˚ to 23˚C, although they can also be found in temperatures ranging from 15˚ to 26˚C.

The usual size range of striped marlin is 60 to 120 kg, although specimens up to 190 kg have been caught. The seasons vary according to area. For example, in Hawaii and French Polynesia the best season is late winter and spring, while in New Caledonia the best season is spring and early summer. The flesh of striped marlin is popular as sashimi as it often has a pink colour, unlike the other marlin species, which have white or grey coloured flesh. Pacific caught striped marlin are exported to Japan as fresh fish seasonally.
D. THE CATCH: BYPRODUCT AND BYCATCH SPECIES

**Byproduct:** are species that are caught incidentally (not targeted) during longline fishing, that have a commercial value and are retained for sale. These species include opah, black marlin, Indo-Pacific blue marlin, shortbill spearfish, sailfish, skipjack tuna, mahi mahi, wahoo, pomfret, escolar and barracuda, amongst others. A range of shark species are also taken as byproduct, although they are mainly prized for their fins (finning is probably going to be phased out as more and more countries are adopting a policy where the entire shark must be retained).

Black marlin, Indo-Pacific blue marlin, sailfish, skipjack tuna, mahi mahi and wahoo are distributed throughout the subtropical and tropical Pacific Ocean and are caught near the surface on the shallowest hooks in a set, near the floats. Conditions for catching these species are similar to conditions for catching yellowfin.

Byproduct species such as pomfret, escolar and opah are usually found in deeper waters and are associated with bigeye catches.

The most common species of shark taken by longlining include the blue shark, oceanic whitetip shark, short-finned mako shark, silky shark, thresher shark and tiger shark. These are all pelagic or oceanic sharks. Sharks are mainly caught on the shallower set hooks during normal tuna longlining activity. However, if sharks are specifically targeted, then sets are usually made at night and hauled in the morning.
Bycatch: are the unwanted species that are taken incidentally during longlining, and are discarded as they have no commercial value. These species include snake mackerel, lancetfish, pelagic rays, seabirds and sea turtles, amongst others.

Snake mackerel, lancetfish and pelagic rays can be taken at various depths on a longline, and are not really associated with a particular type of longline set. The fish are generally small in size.

Seabirds, such as albatross, and sea turtles are sometimes caught on longlines. The seabirds attack the baits (Chapter 6 D) on the gear as it is being set, while the sea turtles are taken on the shallow hooks, generally near the floatline. The catch of seabirds and sea turtles by longliners has become an environmental issue in some localities as the animals are protected. This is an area of concern to all longline fishermen, and is discussed more in Chapter 6 B.

Some fleets, especially the Asian freezer boats, discard some of the byproduct species due to the length of their fishing trips and their limited freezer space. This is called high grading. These fish then become bycatch.

Some Pacific longline fishermen are releasing, alive, small target species as their value is low at a small size, and they have a chance to grow and become more valuable to the fishermen. Technically these released fish are also considered bycatch.

Another form of bycatch are fish, both target and byproduct species, that have been damaged by sharks or toothed whales. In some cases, shark damaged fish may be retained for crew consumption or sale if the damage is limited. However, when toothed whales take fish, they only leave the heads, and these are discarded.
E. BAIT USED IN LONGLINE FISHING

Bait used for longline fishing is usually frozen whole finfish such as sardines, saury, or mackerel scad. Frozen whole squid is often used for tuna longlining but is more important as bait for swordfish. Live milkfish is also used for tuna longlining, particularly by Taiwanese boats. Table 2 gives the English, French, Japanese, and scientific names of some of the most common longline baits. Many longline operations have adopted the Japanese names for bait species.

Table 2: English, French, Japanese and scientific names for the main bait species.

<table>
<thead>
<tr>
<th>English</th>
<th>French</th>
<th>Japanese</th>
<th>Scientific</th>
</tr>
</thead>
<tbody>
<tr>
<td>bigeye scad</td>
<td>selar coulisou</td>
<td>me aji</td>
<td><em>Salar spp.</em></td>
</tr>
<tr>
<td>blue pilchard, Aussie pilchard</td>
<td>pilchard d’Australie</td>
<td>iwashi</td>
<td><em>Sardinops neopilchardus</em></td>
</tr>
<tr>
<td>chub mackerel</td>
<td>maquereau espagnol</td>
<td>saba</td>
<td><em>Scomber japonicus</em></td>
</tr>
<tr>
<td>mackerel scad</td>
<td>comète</td>
<td>muro aji</td>
<td><em>Decapterus spp.</em></td>
</tr>
<tr>
<td>milkfish</td>
<td>chanos</td>
<td>sabahii</td>
<td><em>Chanos chanos</em></td>
</tr>
<tr>
<td>sardine, Japanese pilchard</td>
<td>pilchard du Japon</td>
<td>ma iwashi</td>
<td><em>Sardinops melanostictus</em></td>
</tr>
<tr>
<td>saury</td>
<td>balaou du Pacifique</td>
<td>sanma</td>
<td><em>Cololabis sairi</em></td>
</tr>
<tr>
<td>squid</td>
<td>encornet, calmar</td>
<td>ika</td>
<td><em>Illex spp.</em></td>
</tr>
</tbody>
</table>

Commercially available frozen bait usually comes in 5, 10 or 25 kg boxes. Longline operators often import bait by the container. The most popular baits come in boxes of 100 to 120 pieces per 10 kg box. The average bait weighs about 80 to 100 g. If the bait is much bigger than 120 g it is likely that some target fish will be missed. Fishermen have reported getting back just the head of the saury, for example, when fishing for albacore and using baits larger than 120 g. With smaller bait the target fish eats the whole piece and is more likely to be hooked. When fishing for broadbill swordfish, on the other hand, squid as large as 200 to 300 g are used.

Bait rigging

Saury (sanma), one of the most popular baits, especially when albacore is the target species, is usually hooked through the top of the head with the hook going forward. The saury appears to swim naturally when hooked this way. There is a little white dot on the top of the saury head. This is where the hook should penetrate.
Other baits, such as pilchard and sardines, are usually hooked through the back or just behind the head. The best way to hook bait is to hold the fish in one hand and the hook in the other hand. The shank of the hook is pinched between the thumb and second finger while the forefinger rests over the bend of the hook. As the point penetrates the bait, the hook is turned in one rapid motion.

Squid is usually hooked near the tail so that it hangs naturally. With squid it is a good idea to run the hook through twice so that the bait is not lost. Some fishermen prefer to hook squid through the beak with the hook exiting the head between the eyes. This way the hook goes through the cartilage ring that supports the tentacles.

Milkfish can be used as live bait or as fresh or frozen dead bait. When it is used as live bait the milkfish is hooked through the back in a way that will not kill it.

Fishermen have reported that some milkfish survive for more than one set and can be used as live bait twice. Live milkfish are more effective for shallower species such as yellowfin tuna and striped marlin, and are not as effective when fishing for bigeye tuna. Some fishermen use live milkfish on the hooks near the floats and use some other bait such as frozen saury on the deeper set hooks. Larger, dead milkfish over 120 g in weight can be cut diagonally through and used as two baits.

If a longline boat runs low of bait near the end of a trip, the bait supply can be supplemented by cutting up other species. Billfish, including sailfish and shortbill spearfish, make reasonable longline baits. The flesh should be cut in diagonal strips about 20 cm long, 5 cm wide, and 2 to 3 cm thick. A piece of skin should be left on each piece of bait — this is where the hook penetrates. One average sized marlin can yield several hundred pieces of longline bait. Cut bait will keep longer if it is salted.

Some longline fishermen save good bait to reuse a second time. Durable bait, such as sanma or squid, are most suitable for reuse. Good baits that have not started to decompose are removed from hooks during hauling and are stored in a bucket of heavily brined seawater. They are mixed with fresh baits for the following day’s fishing. Reused baits are not hooked in the same place the second time around.
A good fisherman should know a lot about ropes and lines and how to work with them. Most lines on fishing boats are made of synthetic rope — Nylon (polyamide), Kuralon (polyvinyl chloride), Tetron (polyester), or Danline (polypropylene). Polyvinyl chloride and polyester ropes are preferred for longline fishing because they are negatively buoyant, almost as strong as nylon, and do not stretch as much as nylon. Nylon rope is also negatively buoyant but, because it stretches, it is not usually suitable as fishing line. It is, however, preferred for anchor lines and mooring lines. Monofilament (single fibre) nylon is suitable for fishing lines, however. Polyvinyl chloride and polyester ropes used for longline fishing are usually tarred with a mixture of coal tar and kerosene (black line) or synthetic vinyl tar (red line), and they are called tarred line. Tar protects the line from chafing and from the sun and salt.

Typical rope is composed of three twisted strands, and is called three-strand rope. The direction of the lay is usually right-hand or ‘Z’ twist. Rope can be very tightly twisted, or hard lay, or it can be loosely twisted, or soft lay. Generally, most rope on a fishing vessel is in between hard and soft lay and is called medium or standard lay. Medium and soft lay ropes are easier to splice and tie than hard lay ropes.

Braided rope is made from 8 or 12 strands that lay alternately left and right. Braided rope is not usually used on fishing gear. It is often used on winches and on rigging, however, as it does not twist or kink. Some braided rope has a braided core. This type of rope is called Samson braid or double-braided rope.

Any rope is called a rope until it is put to use. Then it is referred to as a line. The main body of a line is called the standing part, a coil formed to make a knot or to round a block is called a bight, and the end of the line used for making a knot is called the bitter end. A knot is a combination of coils used to tie lines together or to tie lines to objects. A bend is a knot used to tie two lines together. A hitch is a knot used to tie a line to some object.

### Measuring out

Some of the gear described in this manual requires ropes and lines to be measured out so that, when finished, the gear will be fishing at a known or predetermined length. The easiest way to measure out the length of a piece of rope or line is for the person doing the job to first measure his arm-span, then count out the correct number of spans that will give the required length of rope. A typical adult male arm-span is around 1.8 m (one fathom).

### Splicing

There are three splices that are important to know for longline fishing: the eye splice, the double splice, and the back splice. There is a fourth splice, the short splice; however, this is not recommended for joining tarred line. Splices are easier to make in tarred rope if a Swedish fid is used; however, a steel spike or a marlinspike will do. A Swedish fid is a hollow fid that is left in the lay of the rope until after the strand is tucked back into the lay. A good pair of wire cutters is also needed. Wire cutters are better than a knife for cutting tarred rope.

Three tucks are all that are necessary when splicing three-strand tarred rope. One tuck is finished when all three strands are tucked under the lay. The ends of the strands do not have to be burnt, whipped, or taped, as the tar holds them together during splicing. After the splice is finished, the ends can be trimmed off even; they will not pull through the tuck as the tar holds them in place.
**Eye splice:** also called a side splice, is used to make a loop, or eye, in the end of a floatline, section of basket gear mainline, or for attaching swivel snaps to floatlines. The strands are tucked back into the standing part of the line from the side, forming a closed bight. A very tight eye splice is used to attach swivel snaps.

Unlay the rope strands and pass the strands through the standing part...

Pass each end over the strand and...

...of the rope so they are at the same level

...under the next until the splice is complete

**Back splice:** is one way to make a stopper knot on three-strand line. A stopper knot is a knot on the bitter end of a line that prevents the line from passing through a block or cleat. A back splice is also useful to keep the bitter end of a line from unravelling. A back splice is made by first tying a crown knot. Then two or three tucks are made back into the lay.

To tie a crown knot, unlay the end of the rope, form a loop...

Repeat the procedure, passing the upper strand over the middle...

Like the eye splice, pass each end over...

...in the lower strand and pass the middle strand over the lower strand and down through the loop

...strand and down, followed by the lower strand over the upper strand and down through its loop and pull tight

...the strand and under the next until the splice is complete

**Double splice:** or fisherman’s splice, is similar to making two eye splices, and is the best splice for joining tarred rope. However, instead of splicing the end of a rope back into itself, two ropes are used, with the bitter end of each one being spliced into the standing part of the other.

Unlay the two rope ends, lay the ropes parallel with the unlaid ends facing the opposite directions and pass the strand ends from one rope through the standing part of the other

Pass each end over the strand and under the next until the splice is complete, exactly as for an eye splice

Repeat with the other set of rope strands, passing the strand ends through the standing part of the other rope
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G. GENERAL KNOTS

The following diagrams illustrate some of the knots that are useful to a longline fisherman.

Overhand knot

The overhand knot is the simplest knot and is useful as a stopper knot, or to quickly keep the ends of three-strand rope from unravelling, or to join two lines as a makeshift repair.

Fisherman’s knot (also called lovers’ knot)

A fisherman’s knot is a good way to join two pieces of three-strand or braided line of the same diameter in a hurry. It is made by tying two overhand knots in the bitter ends of the two lines that lie over the standing parts of each other.

Bowline knot

A bowline is a all-round loop knot that has a lot of applications for fishing as well as for general purposes on a fishing boat. A bowline is useful because it is easy to tie, will not slip, and is easy to untie even after a load has been placed on it. However, it is not good for slippery lines and will not hold in nylon monofilament.

Sheet bend and double sheet bend

A sheet bend is useful for joining two lines of the same or different diameters. It is quick to tie, will not slip, and is usually easy to untie even after a load has been put on it. A variation is the double sheet bend, where the bitter end of one line is wrapped twice around the bight of the other line.
**Slip knot**

A slip knot has many uses but the most important use in longline fishing is to tie monofilament or tarred line onto hooks, snaps and swivels. If the supply of crimps is exhausted during a trip, spare branchlines can still be made using slip knots.

1. Thread the line through the eye of the hook or swivel, then ...
2. …run the line around the end of your finger and hold it in place with your thumb
3. Take four or five loose turns with the bitter end around the finger, working back ...
4. …towards the fingertip, then pass the bitter end back along the finger inside the loose turns
5. Remove your finger, holding the turns ...
6. …in place with the other hand
7. Pull tight

**Figure of eight knot**

A figure of eight knot is good for a stopper knot on three-strand or braided line and is also useful for making a quick loop in the bitter ends of monofilament mainline for snapping the end (first or last) floatline.

**Half hitch and clove hitch**

A half hitch is a simple knot that consists of a single bight with the standing part laying over the bitter end. It is also a basic element of many other knots such as the clove hitch. A clove hitch is two overlaying half hitches. A clove hitch is useful for tying a line to a post or rail. It is also used to secure coils of line, floats, radio buoys, etc. to a rail. A clove hitch should never be used to tie a mooring line to a bollard or a bitt (Chapter 1 I).
Monofilament and some other light lines cannot be spliced, so special knots are used. All knots will weaken a line, sometimes reducing its breaking strain by more than half. The blood knot and the double slip knot are recommended as being the strongest methods for joining monofilament, and the least likely to slip.

**Blood knot**

A blood knot is used for joining two lines of the same diameter. It is a good knot for joining monofilament mainline as it will not slip and it retains about 85 to 90 per cent of the strength of the line.

1. **Overlap the two lines**
2. **Twist both ends together**
3. **Do this 8 or 9 times, then pass each bitter end through the central twist from opposite sides**
4. **Close the knot gently with tension on each side**
5. **Pull tight**

**Double slip knot**

A double slip knot is used to joint monofilament or light lines, generally of less than 3.0 mm in diameter. The knot is strong, and the bitter ends lay parallel to the standing line when the knot is complete.

1. **Use one line to make a loop around the other**
2. **Pass the end of the looped line back through itself**
3. **Make 4 or 5 wraps**
4. **Close the knot but not too tightly, then repeat the process with the other line**
5. **The result is a knot in each line, wrapped around the other line**
6. **Pull tight**
Sleeves (crimps)

Sleeves, also called crimps or swages, are small pieces of metal tubing that are crimped over the doubled end of a piece of monofilament line or wire trace to form a loop or eye. The eye can be used for forming an eye-to-eye connection, or small eyes can be crimped around hooks, swivels, or snaps. Sleeves are used for making branchlines but are not usually used on the mainline of monofilament gear, as this is impractical and can be dangerous. A bench press or bench crimper is generally used to secure the sleeves, although hand crimping pliers can also be used. Other tools needed include monofilament cutters and wire cutters.

Most monofilament branchlines are made with 1.8 to 2.1 mm diameter monofilament. The sleeve used for this monofilament is called a D-sleeve, and when using a bench press, a D-chip or die is used. The die is a hardened steel jaw that squeezes the sleeve. If wire traces are used then a smaller sleeve and chip are used. The sleeve used for 1.6 mm stainless steel trace wire is a No. 3 sleeve. The chip used with 1.6 mm wire is a 2/3-chip. Generally, aluminium sleeves are used with monofilament and nickel-plated brass sleeves are used with stainless steel or galvanised wire.

To make an eye using a sleeve, push more line through the sleeve than is needed. The bitter end is then pushed back through the sleeve in the opposite direction. Monofilament line will pass back through a sleeve easier if it has been cut at an angle rather than straight across. The standing part of the line is then pulled until the eye is the right size, while the sleeve is held with the other hand or gently with the wire cutters. Sleeves can be held in place by slightly squeezing them with the wire cutters. The bitter end of the monofilament or wire should not protrude beyond the sleeve but should be flush. If the bitter end is left sticking out this will cause tangles or injuries to the fishermen’s hands. The sleeve should be placed in the chip of the bench crimper so that it is in an up-and-down position, not sideways. The sleeve should also be placed so that it protrudes slightly from either end of the chip. It is not necessary to use two sleeves for each eye; one will do.

Loop protectors

Loop protectors are usually used in the loops of monofilament branchlines to keep them from chafing. They can be green springs, plastic tubing, or plastic thimbles. Some fishermen have quit using loop protectors — instead, they double loop the monofilament in the ring of the hook or the swivel of the snap before crimping it.
Ropes and lines should be used and stored correctly to maximise their working life and to make them readily accessible. Lines should be clean and dry before they are stowed away and they should be stowed out of direct sunlight.

**Uncoiling new rope**

When new rope is being removed from a coil it should be pulled out from the centre of the coil so that it is spooling in a left-hand direction — the opposite way that it was coiled at the factory. If rope is uncoiled from the outside it will kink, and possibly become tangled if one bight pulls into the others in the coil. If only a portion of a coil of new rope is going to be removed, then the bitter end remaining on the coil should be tied in an overhand knot so that it will not get lost in the coils.

**Flaking and coiling lines**

When lines are not being used they should be flaked or coiled and secured somewhere so that they are ready to use. Large diameter lines and very long lines, such as anchor lines, can be piled up or flaked — sometimes called faked — on deck or in a hold or locker. Flaking is a way of laying a line down so that it does not kink or tangle, and so that it is easy to recover in a hurry. Using two hands, the line should be laid over itself in overlapping right-hand coils or in figure of eight coils. The bitter end should be tied in an overhand knot or to a rail so it is easy to spot.

Smaller lines, such as floatlines, should be coiled. Lines should always be coiled in a right-hand or clockwise direction. Right-hand lay line will kink or hockle if it is coiled backwards, or left-handed. A hockle is formed when a strand twists on itself and comes out of the lay. A hockle will weaken a line and the line will eventually part. As line is being coiled, each coil can be twisted to the right between the thumb and forefinger to remove any kinks. Lines on a fishing boat should never be coiled using the hand and elbow method like Boys Scouts do. This will also cause the line to kink and hockle.

**Mooring lines**

Mooring lines are lines used to tie a vessel to a wharf or dock. There are several ways to tie, or belay, a mooring line to a bitt or bollard. On a double bitt or crucifix bitt, the best way is to first take one turn around the bitt, then take several overlapping figure of eight turns with a locking half hitch on the last one or two turns. Mooring lines are belayed in a similar fashion if the boat is equipped with cleats rather than bitts. This arrangement will hold and it is easy to untie later. The best way to secure a mooring line to a bollard on the wharf is to simply drop an eye over the bollard. The line can be adjusted on the vessel.
Dipping the eye is a good practice as a courtesy when there is another vessel’s line on a bollard. The eye of the mooring line should be passed up through the eye of the other vessel’s line before it is dropped over the bollard. Either line can later be released without disturbing the other. If the line does not have an eye in the bitter end, a bowline is a good knot to use.

If the line needs to be shortened on the bollard, a bollard hitch will do. A bollard hitch is tied by first taking several right-hand turns around the bollard. Then a bight is formed and passed under the standing part of the line and then dropped over the bollard. The hitch can be secured by tying one or two half hitches around the bollard or around the standing part of the line.

**Using a spring line**

A spring line is a special mooring line that usually runs from a forward bitt to a bollard on the wharf. It is usually the first line to be thrown when tying up to a wharf and the last line to be released when leaving a wharf. A spring line is used to spring, or pull, a boat into a wharf or away from a wharf, usually when the wind is trying to do the opposite. To dock a boat, the spring line should be thrown over the bollard first as the boat slowly approaches the wharf. At the skipper’s instruction, it should be made fast on the forward bitt. The rudder will then be turned away from the wharf and the engine will be going slow ahead. As the spring line tightens, the boat will be pulled into the wharf. Someone should standby a spring line at all times during this manoeuvre in case it needs to be let out or shortened.

To pull away from a wharf against the wind using a spring line, the rudder is turned toward the wharf and the engine is at slow ahead. As the spring line tightens, the stern of the boat will swing out away from the wharf. A fender should be used on the bow between the boat and the dock during this manoeuvre. Now the boat can be reversed with the rudder turned away from the wharf and the spring line released. If there is nobody on the dock to remove the line from the bollard, a double line should be used. This is called a slip line. The bight of the slip line should pass over the bollard. One end of the slip line can be released from the bitt and the other end pulled to recover the line.

**Using a capstan**

Capstans are hydraulic or electric spindles that rotate slowly but with lots of power. They are used for heaving anchor hawser or mooring lines. Sometimes they are used for lifting fish out of a fish hold on a boom. Pulling a line with a capstan can be dangerous if not done properly. Three or four turns around the capstan are usually enough. The turns should be made from the inside toward the outside of the capstan. As the capstan turns, the outside turn is pulled off and flaked down on the deck. The capstan should be doing all of the work. The person pulling the line should only be keeping the line taut and removing line from the capstan. Another person should be operating the control valve for the capstan. He should not leave this post while the line is being pulled. If the line jams, he should stop the capstan immediately. Nobody should be standing in the bight of the line.
Longline vessels can be divided into three broad categories: small-scale (under 15 m and less than 20 GRT), medium-scale (15 to 25 m and less than 100 GRT), and large-scale (over 25 m and over 100 GRT). Some vessels have the cabin forward and the working area aft, while others have the opposite layout. Both work successfully, and it is up to the individual to choose the size, design and layout he prefers.

**Small-scale longliners**

Small-scale longline boats include artisanal vessels and *alia* type catamarans that use either hydraulic or hand operated longline reels capable of setting and hauling 300 to 400 hooks per day. Most small-scale longliners use monofilament longline systems (Chapter 2 A). These boats have limited operating range and limited fish holding capacity, but have been quite effective in some localities — for example, Samoa. What they lack in production capabilities is often made up for because they are inexpensive to purchase and operate. The original *alia* catamarans were 8.5 to 9.5 m long and usually went out on day or overnight trips, and made just one or two sets in coastal waters ranging from 10 to 50 nm offshore. The crew on an *alia* catamaran might be two to four fishermen. *Alia* catamarans are only capable of holding about 1 mt of fresh fish, and some do not have icing capabilities but bring the fish back to port to be iced or frozen.

Several designs of larger aluminium catamarans have been developed in Samoa and New Zealand, in the 12 to 13 m range. They can carry around 3 mt of chilled catch, set 500 to 1000 hooks per set, can stay at sea for three to five days, and carry a crew of four or five.

Monohull vessels in the 13 to 15 m range have also been used for tuna longlining. These vessels usually set 400 to 1000 hooks per set, stay at sea for three to six days, carry around 2 to 4 mt of chilled fish, and have a crew complement of three to five.

The size and limited capacity of small-scale vessels greatly restricts their movement, and they cannot follow fish like the medium-scale vessels.
**Medium-scale longliners**

Medium-scale longliners have greater operating ranges and fish holding capacities than small-scale longliners, and thus are able to fish within a country’s entire EEZ and even outside the EEZ on the high seas. Medium-scale longliners can stay out for one to three weeks and have operating ranges of up to 6000 nm. They are capable of setting and hauling between 1200 and 2500 hooks per day and can make about 10 or 12 sets per trip. For these reasons, they are the most popular size of vessel in Pacific Island longline fleets.

Both traditional basket gear (Chapter 2 A) and modern monofilament gear can be found on medium-scale longliners. The average medium-scale longliner is capable of holding from 10 to 20 mt of fresh chilled fish. The crew complement on a medium-scale longliner might range from four to eight fishermen. Medium-scale longliners in the Pacific are often boats that have been in another fishery before being converted to longline fishing. Trawlers, bottom fish boats, trollers, and even squid jiggers have all been successfully converted to longline boats. Many PICT fisheries have chosen second-hand Asian longliners. Longliners can have single or multiple fish holds, fish preservation can be by ice or CSW or RSW (Chapter 4 G), and the hull material can be steel, fibreglass, aluminium, or wood. New medium-scale vessels purpose built for longline fishing come from shipyards in Australia, Fiji Islands, France, New Zealand, Taiwan, People’s Republic of China, United States, and Tahiti.

**Large-scale longliners**

Large-scale longliners include freezer albacore boats and freezer sashimi boats. Their operating range includes all of the world’s oceans. They can stay at sea for several months at a time, conducting from 50 to 100 sets or more per trip and setting from 2500 to 3500 hooks each day. Most freezer longliners use automated basket gear (Chapters 2 B and 3 L) systems. Freezer longliners have crew complements ranging from 20 to 28 fishermen. They are capable of holding up to 100 mt or more of frozen fish.

There are also a few large-scale longliners that target fish for export to overseas markets as fresh chilled fish. These vessels generally have a freezer to freeze and store albacore, which is sold to tuna canneries in the region. For large-scale fresh fish longliners, the fishing gear and technique is similar to medium-scale operations, with a crew of 10 to 12, 1500 to 2500 hooks being deployed per set, and fishing for up to 12 sets before returning to port to unload the catch.

An exception to the above is the large-scale vessels in French Polynesia that target albacore, freezing the processed loins (Chapter 4 E). These vessels chill other tunas towards the end of their 40 to 50 day trips to land fresh for export.
The array of safety appliances and equipment required on a fishing boat depends on a number of factors: the size of the boat, its operating range, the crew complement, and the regulations in force in the country where the boat is operating. The following list of safety gear is the minimum required on a medium-scale longliner that operates within Pacific Island EEZs — out to 200 nm.

**Life raft:** suitable for the number of persons on board — this should be an offshore model, SOLAS (Safety of Life at Sea Convention) compliant or equivalent. It should contain an EPIRB (see below), a SART (search and rescue transponder), distress signals, food, water, a torch or flashlight, a bailer, a knife, a patch kit, an air pump, a sea anchor, a heaving line, a water distillation kit, a medical kit, and a fishing kit. The life raft should be self-launching, with a hydrostatic release mechanism.

**Offshore life jackets:** or Type 1 PFDs (personal flotation device) — one for each person on board. These should have lights, whistles, and reflective tape.

**Life ring:** with lanyard and light. This should be marked with the boat’s name and should be mounted properly, not stored away.

**Distress signals:** 2 rocket flares, 2 smoke signals, 6 hand flares, in a watertight container.

**EPIRB (emergency position indicating radio beacon):** 406 MHz model is preferable to a 121.5/243 MHz model. The EPIRB should have a hydrostatic release mechanism.

**Fire extinguishers:** CO₂ and dry chemical are best on fishing boats, as they are suitable for all types of fires including electrical fires. It is better to have more than the minimum number of extinguishers required, especially on a fibreglass or wood boat.

**Pumps:** bilge pumps and wash down pumps can be used to fight fires but it is good to have a hand operated pump as a backup.

**Medical kit and medical book:** at least one person on board should have some first aid training including CPR (cardio-pulmonary resuscitation), and the boat should have a well equipped first aid kit including sutures.
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**Up-to-date charts:** are required for all areas of operation and ports to be entered.

**Navigation and miscellaneous tools:** wheelhouse compass, clock, barometer, dividers, parallel rule, etc.

**Wheelhouse books:** Light List, Pacific Sailing Directions, International Regulations for Preventing Collisions at Sea, IALA System of Buoyage, Chart Symbols and Abbreviations, Ship’s Medical Book.

**VHF radio and SSB radio** (Chapter 2 H): These should have a power source that is independent of the main power source from the engine room; i.e., an isolated back-up battery bank (battery bank in the wheelhouse, for example). The 2182 mHz channel on the SSB and Channel 16 on the VHF should be monitored 24 hours a day while at sea.

**GPS or global positioning system and GMDSS or Global Maritime Distress and Safety System:** Chapter 2 H covers these systems.

**Other items:** fire hoses and nozzles, metal fire buckets, torches (flashlights) and binoculars.

**Engine room alarms:** including main engine and generator oil pressure and coolant temperature alarms, bilge high water level alarm, and high heat and fire detection alarm. The galley should also have a fire detection alarm.

**Anchor and anchor chain:** or cable and rope suitable for the vessel’s size, and a sea anchor.

**General alarm:** to alert everyone on board in case of an emergency.

The above list of safety gear represents the minimum requirement. It is a good idea to have back-ups and even more equipment and supplies than is required by regulations. Two good examples of this are fire extinguishers, and the food and water supplies provided on life rafts by the manufacturers. The minimum number of fire extinguishers usually required on a fishing vessel would not be adequate on, say, a fibreglass boat with an engine room fire. To be safe it would be better to have more than the required number of extinguishers. The food and water supplied with a life raft are usually only enough for about seven days. Extra emergency food and water should be stored in a place where it is readily accessible. Spare fishing gear should also be packed with the emergency food and fresh water.

Many of the items in the list above have limited shelf lives and have to be renewed or inspected regularly. A life raft that is ten years out of service would probably not inflate upon deployment. The food ration in such a life raft would undoubtedly be spoiled. Fire extinguishers that are empty will not put out fires. An EPIRB with dead batteries will not send a signal. It is essential to service and renew all safety appliances and equipment by the expiration dates. All members of the crew should know the location of all safety appliances and they should know how to use them. Regularly scheduled safety drills should be conducted by the skipper. A pre-departure checklist (sample at Appendix E) is a good way to itemise all of the basic safety equipment and other important things that should be checked before departing on a trip.
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L. SEA SAFETY AND THE RULES OF THE ROAD

Commercial fishing is one of the most dangerous occupations in the world. Every year, hundreds of fishermen lose their lives at sea or are injured while working. Sometimes this is due to events beyond anyone’s control, such as cyclones or other weather conditions. Most loss of life and accidents at sea, however, are due to human error. Fishing boats and lives are lost because vessels run aground, sink, and catch on fire. Accidents often occur because of poor watchkeeping or carelessness, but accidents can also happen because fishermen venture out in vessels that are not seaworthy. Lives are sometimes lost because when disaster strikes the boat and crew are not prepared.

The risks can be minimised if some basic common sense principles are followed. Weather conditions should be checked prior to departure and the weather should be monitored on a daily basis throughout the fishing trip. Weather warnings should be heeded. Diligent watchkeeping is the only way to ensure that a boat steers a true course and does not collide with other vessels or run aground. A boat should not go to sea unless it is fit and seaworthy. This means that the boat is in survey and that all pumps and alarms are working, including high bilge water alarms and engine room fire alarms, and all safety appliances and equipment including life raft, EPIRB, and fire extinguishers are in good order. Filling out a pre-departure checklist (Appendix E) should be a regular routine before every fishing trip, and safety drills should be held before each trip so that all members of the crew know where to find and how to use all safety equipment. All members of the crew should have basic training in sea safety, fire fighting, and first aid.

Most longline boats are set up so that hauling takes place on the starboard side. The reason for this has to do with the rules of the road. Rules of the Road is the common name of the International Regulations for Preventing Collisions at Sea — also called COLREGS. Rule 15 states:

‘When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.’

From dead ahead to two points aft of the starboard beam is the area ahead of a vessel that is underway that is called the Danger Zone. A longline boat that hauls gear from the port side would not necessarily have a good view of the Danger Zone and may be at risk of crossing another vessel’s port bow during hauling and, thus, be at risk of collision.

Watchkeeping

Someone should be on watch at all times while the boat is underway. Some boats do not have autopilots so a helmsman is always on duty to steer when the vessel is moving. This person may be the watchman as well, but in some cases cannot be. A helmsman may or may not be capable of being a lookout, especially when navigating in a harbour or lagoon. It depends on the individual situation.

Rule 5 of the Rules of the Road says that, ‘... every vessel shall at all times maintain a proper lookout by sight and hearing ... so as to make a full appraisal of the situation and the risk of collision.’

In foul weather, when visibility is restricted, when there is a nearby reef or shoal, or when there is nearby vessel traffic, someone should be on watch even if the boat is anchored or drifting. Radar alarms, echo sounder alarms, and GPS alarms should not be depended upon. The watchman should not be reading or listening to loud music while he is responsible for the vessel, nor should he be drinking alcohol or smoking marijuana or using other drugs. All watchmen should know the rules of the road. They should also know the fundamentals of navigation and be able to use a compass, read a chart, and use radar, radio and GPS.
According to *Rules of the Road*, a vessel that is drifting is underway. Rule 3(i) states that, ‘The word ‘underway’ means that a vessel is not at anchor, or made fast to the shore, or aground.’

Watchkeeping should include monitoring the boat’s position, course and speed, as well as all engine room gauges and bilge water levels. The boat’s position and course should be noted on the chart periodically to ensure that it is on course and that no reefs or islands lie in its path. The watchman should be on constant vigil for other vessels by watching the horizon and looking for lights, at night, and by monitoring the radar. The watchman should look in all directions around the boat every 10 to 15 minutes. An overtaking ship may not be able to see a small fishing boat. If land or reefs are near, then the distance to land or the reef and the depth of the water should be watched closely. Both the SSB and VHF radio should be monitored at all times while at sea. The engine room should be checked at least every hour unless there is an engineer on engine room watch.

The watchman should also take a look around the deck at least once during his watch, as long as it is safe to do so. He should check that all navigation lights are operational, that there is no loose cargo or unsecured gear, and that all hatches are secured or dogged tight.

Every longline boat that operates beyond territorial waters — past the 12 nm limit — should have a watch alarm. A watch alarm is an electronic wheelhouse device that is set up to beep at regular 10 or 20 or 30 minute intervals. Each time the beeper goes off, it must be re-set by the watchman. If it is not re-set after one minute, a very loud general alarm will sound. The main function of the watch alarm is to ensure that the watchman stays awake and alert. Watch alarms are usually set and locked by the skipper, and cannot be turned off without a key.

A watch list should be made, showing who is on watch during each block of time. Watches should be rotated on a three hours on, nine hours off basis, or a two on, four off basis, for example. If the watchman is tired and cannot stay awake, he should wake another crew to relieve him.

**Changing the watch**

Changing of the watch is very important. The following procedure should be learned by all members of the crew on fishing boats. Ten minutes or so before your watch is over, wake the next watchman. Return to the wheelhouse and wait for him. This gives him time to adjust — use the toilet and have a cup of tea or coffee. If he does not arrive within five or ten minutes, attempt to wake him again. When he does arrive, talk to him to make sure he is alert. Tell him what course you are on and show him your position on the chart. (It is important that you are in agreement on the vessel’s position. The new watchman should check the previous watchman’s chart work for accuracy.) Make sure he is aware of any possible dangers such as approaching vessels. Tell him when the engine room was last checked and the bilge last pumped and let him know if there are any problems. Stay in the wheelhouse with him for at least five minutes to make sure he is awake and alert. This is particularly important if a long hard day of fishing has just been completed and everyone is exhausted.

If there is any question about the boat’s safety during your watch, wake the skipper immediately. He would much rather be disturbed than be told later — when the boat is broken down — that there was a ‘funny noise’ coming from the engine room during your watch. If you hear anything on the radio that sounds like a distress call, write down the name of the distressed vessel and the position and, again, wake the skipper immediately. If there is a fire or the engine room is flooding or there is some other immediate danger, wake the skipper and sound the general alarm.

Some other things should be checked daily by the skipper or engineer while the boat is underway. These include: the shaft gland or stuffing box, for leaks, the lazarette or rudder room, for leaks on the rudder post and for leaks in the hydraulic lines, and any holds or other compartments for leaks. Engine sump oil levels and service tank fuel oil levels should also be checked daily. Oil pressure alarms and bilge high water alarms are good warning devices but they should not be depended upon.

A skipper can minimise the risk of running aground if he follows the following advice. Check your position regularly, even when it is not your watch. Keep an alarm clock in your bunk and wake up before you arrive at the reef. This is fairly easy to do. Before changing watches, find the nearest reef or land on the chart where your boat could run aground if you went off course during someone else’s watch. Next, calculate the time necessary to arrive at the reef based on boat speed, wind, and current. Then, set your alarm clock to go off ten or fifteen minutes before you would hit the reef. Last, get up when the alarm goes off and check your course and position. Before going back to sleep, re-set the alarm clock for the next hypothetical grounding.
CHAPTER 1: Basic information and techniques

Weather

Weather conditions should be checked prior to departure and daily throughout a fishing trip. Weather reports and warnings are given on Inmarsat-C, SSB radio, or weather fax. Weather fax reports show weather analysis and prognosis or forecast charts for different areas in synoptic times (0000 hours, 0600 hours, 1200 hours and 1800 hours UTC). An analysis chart shows the weather patterns as they are at that point in time, while a prognosis chart shows what is expected to happen in a specified time period. An analysis chart shows weather fronts, troughs, ridges, and wind speed and direction. A front is a place where two different air masses are coming together. A front can develop into a trough or a ridge. A trough is an extended depression where the atmospheric pressure is relatively low along a line. A ridge is just the opposite — a line of high pressure. Troughs usually indicate foul weather while ridges indicate fair weather.

Both analysis and prognosis charts show high and low pressure areas on a large scale — several hundred nautical miles. Pressure systems are depicted by isobars. An isobar is a line connecting places with the same barometric (atmospheric) pressure. Average atmospheric pressure is about 1013 millibars. If the pressure drops below 1000 millibars, foul weather should be expected.

A tropical depression (TD), which can develop into a cyclone, is seen on an analysis chart as concentric isobars (a series of encircling rings) with the lowest pressure in the centre. Lows, or tropical depressions, are labelled as L or TD on a weather chart while tropical cyclones are labelled TC and usually have a name. Highs are the opposite of lows and are seen as concentric isobars with the highest pressure in the centre. Highs are labelled H.

The barometer should be checked daily and the barometric pressure should be noted in the logbook. Preparations should be made for foul weather if the barometer drops steadily or if a cyclone warning is issued. The deck and all hatches should be secured and a plan should be made to run from the cyclone or to seek a safe anchorage.