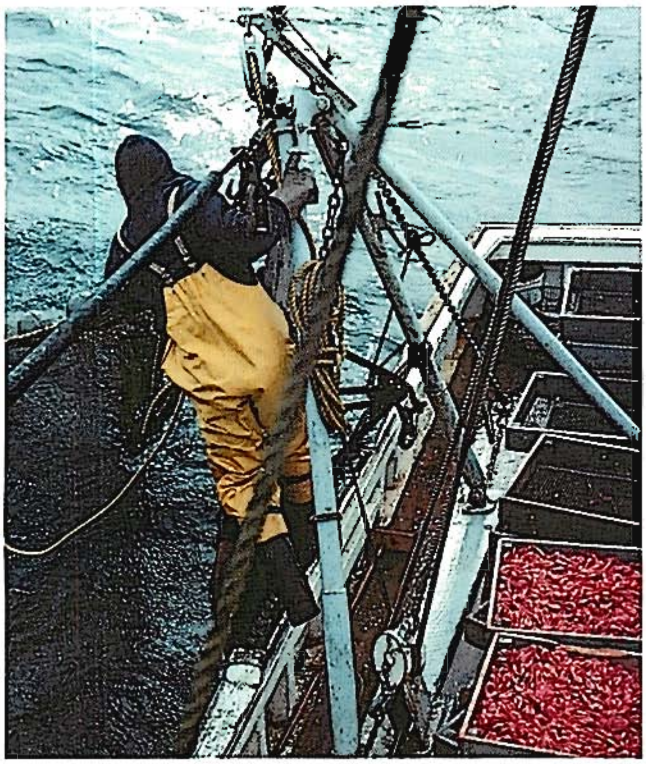
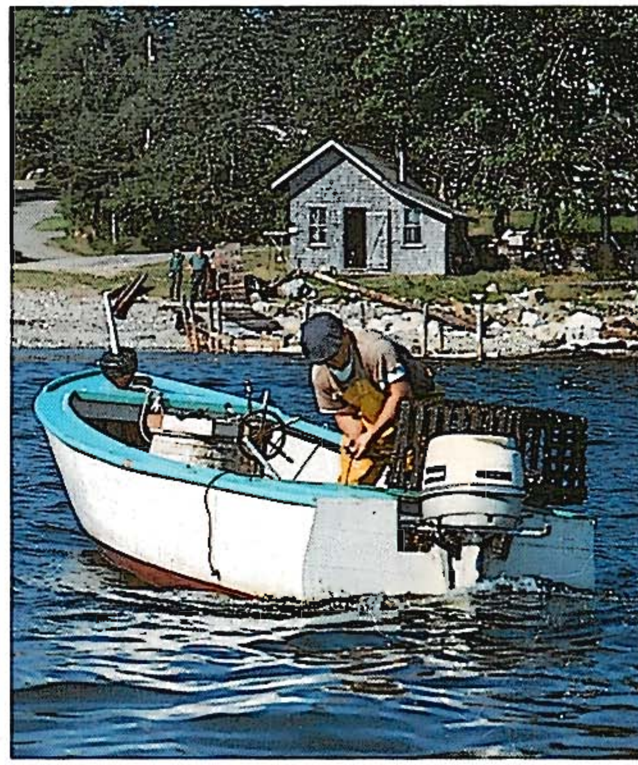
National Council of Fishing Vessel Safety and Insurance

ATLANTIC COAST

FISHING VESSEL SAFETY MANUAL





Produced by: RHODE ISLAND SEA GRANT

In Cooperation with: UNITED STATES COAST GUARD

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PREFACE

The *Atlantic Coast Fishing Vessel Safety Manual* was prepared by the Department of Fisheries, Animal and Veterinary Science at the University of Rhode Island. This version is based on the *North Pacific Fishing Vessel Safety Manual*, written by the North Pacific Fishing Vessel Owners' Association, and the *Gulf Coast Fishing Vessel Safety Manual* prepared by the Marine Advisory Service, Sea Grant College Program at Texas A&M University. This manual was produced and funded in cooperation with the National Marine Fisheries Service Saltonstall-Kennedy Program, Rhode Island Sea Grant and the National Council of Fishing Vessel Safety and Insurance.

The *Atlantic Coast Fishing Vessel Safety Manual* covers fishing vessels and operations from Maine to Virginia. Because of the large area, and the diversity of the fisheries and vessels, a Northeast Region Fishing Vessel Safety Advisory Committee was formed to act as technical consultants. Two members from each state - one from the industry and one from the academic community - reviewed the manuscript, and their suggestions were incorporated into the final version. The U.S. Coast Guard also reviewed the manual, and the Rules of the Road chapter contains sections of the U.S. Coast Guard International and Inland Navigation Rules (COMDTINST M16672.2A), which you are required to carry. (Note: This chapter is not intended to be a substitute for the actual "Navigation Rules International-Inland.")

This edition will present the most current revisions of Coast Guard regulations up to publication date. However, because these regulations are evolving, fishermen should be aware of changes. It is your responsibility to be familiar with, understand and comply with the Fishing Vessel Safety Regulations as outlined in Title 46 CFR Part 28. Requirements for equipment and related matters will vary with your vessel type and size, number of crew members, and location of operation. Any changes made to your vessel, even as you convert from one fishery to another may affect your requirements. Updates to these regulations will be distributed to holders of the manual over the next five years, as required. A pocket page is included in the back of the manual for updates.

Figures included in the manual are not exact representations of actual events, nor are they drawn to scale; they are intended for illustrative purposes. Medical experts have reviewed the recommendations on medical emergencies, and the information represents their consensus.

The *Atlantic Coast Fishing Vessel Safety Manual*, like the other Vessel Safety Manuals, is *not* a set of legal requirements or a rigid set of standards. It should be used as a reference guide for setting up safety procedures. Each vessel owner and captain should adopt his own procedures based on the specific characteristics of the vessel involved, its intended service, fishing grounds, fishing season, and the size and experience of the crew. To avoid confusion, the use of the word *should* in this manual indicates a recommendation; the word *must* signifies law or regulation.

Discuss with the crew each topic in the manual and how it applies to your vessel, and select the recommendations which are useful to you. Keep in mind that stability is complex, and you should contact your naval architect to learn about the your own vessel's capabilities and limitations.

Remember, there is no substitute for the common sense and good seamanship that comes from experience on the fishing grounds. However, all captains and crews are urged to participate in a local or regional safety training program. Training is invaluable for saving lives and property, and often reduces the cost of insurance.

INTRODUCTION BY THE UNITED STATES COAST GUARD

The *Atlantic Coast Fishing Vessel Safety Manual* is a component of an overall safety enhancement program aimed at improving the safety record of commercial fishing vessels. There are a number of other components, including the "Commercial Fishing Vessel Safety Act of 1988", the Coast Guard's voluntary vessel standards and industry-sponsored training courses for fishing vessel crew members.

Regulations implementing the Commercial Fishing Industry Vessel Safety Act will become the basis for fishing vessel design and operational standards. These regulations were being developed at the time this manual went to press. Regulatory standards alone will not make vessels safe. Recognition of the problem, training and education on the use of safety equipment and seamanship are also essential components of the overall safety initiative.

While the regulations are not in place at this time, voluntary standards contained in Coast Guard Navigation and Vessel Inspection Circular 5-86 (NVIC 5-86) provide good interim technical guidance. The NVIC is written for fishing vessel designers, builders and outfitters. It covers topics on stability; fire safety measures; lifesaving equipment and protection of the crew; and hull, machinery and electrical installations. When regulations required by the Commercial Fishing Industry Vessel Safety Act of 1988 are issued, those involved in fishing vessel design, construction and operation must study them to determine the specific requirements applicable to fishing industry vessels. NVIC 5-86 can be obtained at a nominal fee by writing to: Commanding Officer, Marine Safety Center, U.S. Coast Guard, 2100 Second St, SW., Washington, DC 20593-0100.

Whereas the NVIC covers the technical aspects of fishing vessel design, construction and equipment, the *Atlantic Coast Fishing Vessel Safety Manual* is specifically tailored for fishermen and addresses operational concerns. Many of the chapters parallel the vessel standards (NVIC) and are designed as working reference tools for the captains and crews who operate a variety of vessels in different fisheries. Using the best and most current information available, the manual takes vessel operators from general principles to specific situations that affect their vessels. Charts, diagrams, step-by-step illustrations, and photography help present the material clearly.

The final major component of the safety program the Coast Guard hopes to see implemented around the country by industry organizations and associations is voluntary training in safety and seamanship for all fishing vessel crew members. Some programs have already been established and more are needed. The *Atlantic Coast Fishing Vessel Safety Manual* is an excellent reference text and may be used as a curriculum outline for training programs offered in each region and tailored to the local fisheries.

The *Atlantic Coast Fishing Vessel Safety Manual*, coupled with Coast Guard regulations, voluntary vessel standards and private industry training courses, provides the commercial fishing industry with an overall fishing vessel safety enhancement program that will significantly improve its safety record.

THE COMMANDANT OF THE UNITED STATES COAST GUARD
WASHINGTON, D.C. 20593-0001

December 6, 1990

Commercial Fishing is one of the most dangerous professions in the United States. For the commercial fishing industry to meet the American public's expectations in the future, this situation must be changed. The National Council on Fishing Vessel Safety and Insurance and the University of Rhode Island are helping to meet this challenge by preparing the *Atlantic Coast Fishing Vessel Safety Manual* for widespread distribution.

This comprehensive safety manual provides useful, practical information on a wide variety of topics of interest to commercial fishermen. It covers not only those situations routinely encountered at sea, but emergency situations as well.

The Coast Guard enthusiastically supports the publication and distribution of this manual and encourages all commercial fishermen to become familiar with its contents.

Sincerely,

J.W. Kime

J. W. KIME
Admiral, U. S. Coast Guard

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Photo courtesy of Ed Watson

CHAPTER 1

INTRODUCTION

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1.1 Forward

The *Atlantic Coast Fishing Vessel Safety Manual* is a guide for boat operators from Maine to Virginia. This manual addresses one and two-man vessel operations inshore, as well as larger operations offshore.

Most everyone agrees that commercial fishing is an extremely hazardous occupation. Commercial fishing has the worst safety record of all U.S. industries: the death rate in the fishing industry is seven times greater than the national average for all industrial groups.

Vessel losses also reflect the hazards. Recent national casualty statistics show vessel losses for documented fishing vessels of over 5 net tons averaged nearly 250 per year between 1981 and 1984. Loss rates of vessels over 100 gross tons are 5 to 7 times greater than loss rates for U.S. ocean-going cargo ships.

The data shows that foundering, flooding and capsizing account for approximately 43% of all losses. Fires and explosions account for approximately 25% of the vessel losses, over 2/3 of which occurred in the engine room.

Casualty statistics indicate that human error is the major contributing factor in most fishing vessel accidents. The errors occur mainly because of the lack of technical knowledge of vessel operations. Common causes of accidents are: poor watch-keeping practices, navigational errors, violations of the rules of the road, a lack of understanding of vessel stability, and material failure, causing flooding, fire, and explosion. Proper maintenance of the vessel and its equipment may prevent some of these accidents.

There is no way to completely remove human error or the dangers of fishing, but you can reduce the chance of accidents by being more aware of safety. While each member of the crew is responsible for his own safety, the captain is ultimately responsible for the safe operation of the vessel and its equipment, and for the safety of everyone aboard. Since the vessel is only as safe as the owner and operator, the more knowledge they have about the vessel, its equipment, and the fishing operation, the less risk there is to the fishermen. Combined with training, this manual provides knowledge that commercial fishermen can use to be safer at sea.

1.2 Responsibilities

Each crewman must attend constantly to his own safety and perform his work safely, using all safeguards available. Every crewmember must react calmly and effectively in the event of an emergency. There is no substitute for experience, clear thinking, good judgment and quick action.

The captain is ultimately responsible for the safe operation of the vessel and its equipment, and for the safety of everyone aboard.

The vessel owner must provide a seaworthy vessel.

It is the captain's job to devise emergency plans and assign responsibilities. The crew must then learn its responsibilities and practice emergency procedures.

The rule to guide vessel operations is: *personnel safety first, gear second.* Gear is inexpensive compared to injury and death.

1.3 Why Do Accidents Happen?

Most fishing vessel casualties are the result of human error rather than equipment failure. Even when casualties are the result of equipment failure or bad weather, the human factor has often played a part. Maintenance and repair may have been inadequate, for example, or the captain may have exercised poor judgment as to when and where to go fishing.

Faced with economic and competitive pressures, fishermen are prone to take calculated risks. In view of the liabilities that confront the vessel operator today, however, careful risk management is crucial not only for business success, but also for survival.

As one veteran captain says, an emergency at sea is like a snowball: it grows. At first, one or two things go wrong, and you can probably cope with those. Suddenly, however, you've got four or five things to deal with at once, and unless the crew is well prepared and trained, disaster strikes.

> *"A little food for thought for anyone who goes out on the water. We had five minutes from the time we knew we had a fire, until the wheelhouse was engulfed in flames and we were in the raft. The Janileen II was a 73 foot boat.*
>
> *You don't have time to think about what to do then. So be prepared, have a course of action spelled out that the crew is aware of, so then the jobs that need to be done get done, so you still have a crew when you get back to the dock. A little forethought goes a long way."*

We often hear "if only" in the wake of a casualty. While it isn't possible to change what happened, it is possible to prevent *most* accidents if you follow safety rules at all times. Safety is everyone's responsibility. The alternatives to constant attention are needless injury and suffering, loss of property, loss of earnings, and substantially increased operating costs.

Unfortunately, familiarity breeds contempt. Even when someone has the knowledge, their carelessness and inattention can lead to casualties that could have been avoided.

Good seamanship is simply thinking ahead. No one is ever 100 percent ready, but it is the captain's responsibility to ensure that vessel and crew are as prepared as possible for the ever-present possibility of an accident or emergency.

Selection of the crew is very important. Once you have chosen the crew, each member must be given the necessary training and supervision to enable him to do his job safely.

1.4 Atlantic Coast Fisheries

The *Atlantic Coast Fishing Vessel Safety Manual* covers the geographic area from Maine to Virginia, leaving off where the *Gulf Coast Fishing Vessel Safety Manual* picks up (Figure 1-1).

The North Atlantic coast is characterized by a wide continental shelf, which in some places extends for hundreds of miles. Large areas of the shelf rise to form submerged plateaus called *banks*. One of the most productive North Atlantic fishing grounds is Georges Bank.

The most important fisheries in the northern region are those for groundfish. Cod, haddock, redfish, silver hake, pollock and flounders comprise the majority of the catch. Although the major portion of these species are captured by otter trawl; cod, pollock and white hake are fished by gillnet and longline.

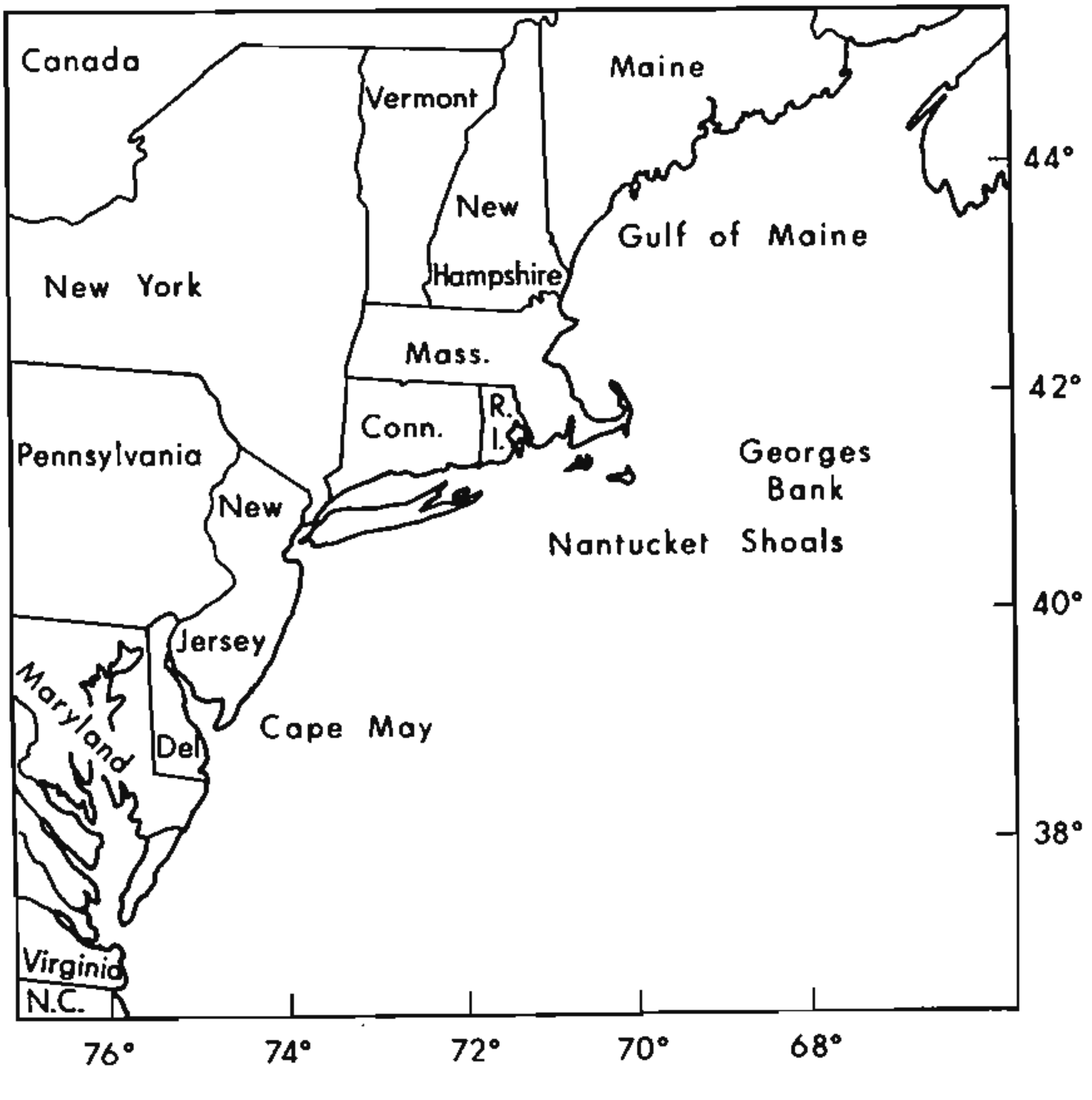

Figure 1-1. Northeast Region - Primary geographical area of operation for those vessels listed in this chapter.

Pelagic species such as menhaden, Atlantic herring and mackerel are caught in several different ways. Mid-water single and pair trawling, weirs, and purse seining are common, depending on the area and the preference of the fishermen.

Shellfish are a major component of the Northeast fisheries including lobster, squid, clams, oysters, and scallops. Lobsters are caught in traps; clams, oysters and scallops by rake or dredge; squid by otter trawl.

The Mid-Atlantic bays and estuaries support a large inshore fishery for blue crabs, oysters, clams and menhaden. Most of the boats in this region are small, one-man operations. The larger boats fish in the ocean, using surf clam and ocean quahog dredges, otter trawl nets, and scallop dredges. It is common for the boats to switch gears seasonally.

1.5 Basic Atlantic Coast Fishing Vessels

Illustrations of fishing vessels in this section were taken from the National Marine Fisheries Service publication "Fishing Vessel Identification Guides."

Eastern Rig Side Trawler

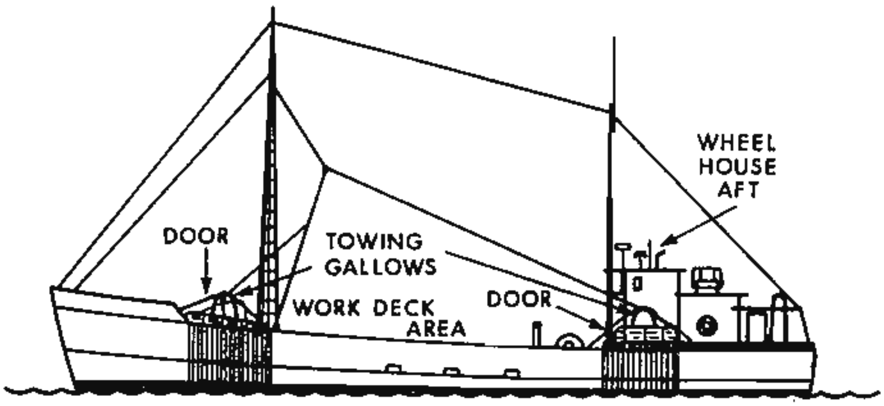

Figure 1-2. The eastern rig side trawler is primarily a New England vessel, fishing inshore to 100 fathoms. The vessels range from 50 to 140 feet LOA (Length Over-All). Before 1975, wood was the most common construction material; since 1975, steel has been most popular. Fishing gear is usually a standard bottom otter trawl with 2 trawl doors. The net is set and hauled in from one side of the vessel using the winches immediately forward of the wheel house.

Western Rig Trawler

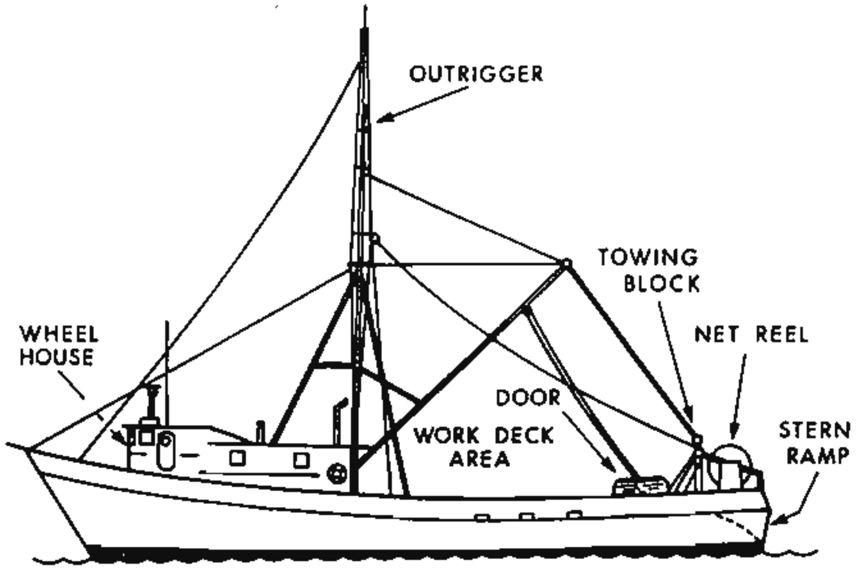

Figure 1-3. The western rig stern trawler, ranging in size from 50-140 feet LOA, is built of either steel, wood or fiberglass. This trawler uses both bottom and mid-water trawls. The nets are stored on the net reels, and set and hauled over the stern ramps. Stern trawlers have the pilot house forward of the trawl/work deck.

Pair Trawlers
(Side Trawlers Or Stern Trawlers Working In Pairs)

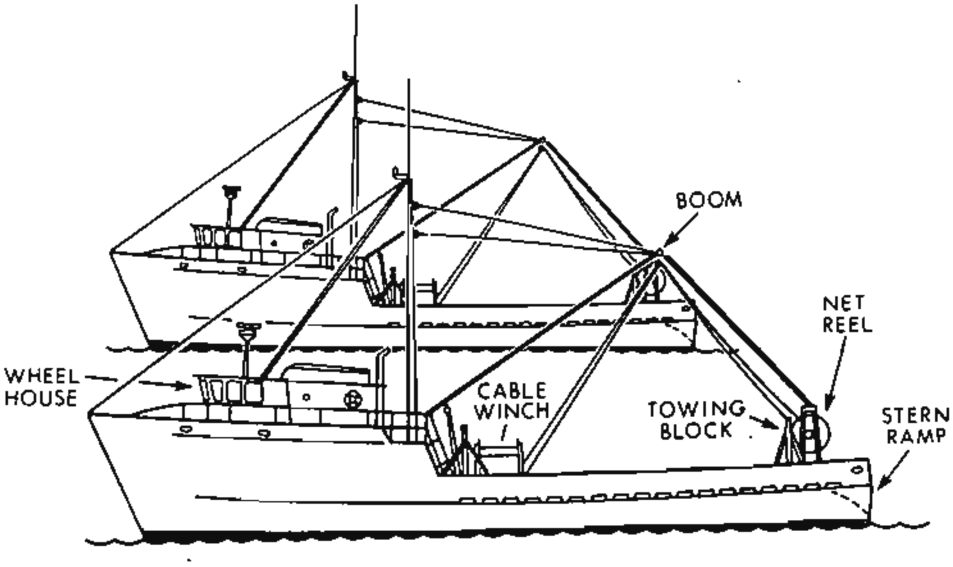

Figure 1-4. These mostly steel-hulled vessels range in size from 70-130 feet. They target mostly mid-water species such as mackerel and herring, but they also conduct some bottom trawling. One vessel sets the gear, and then passes one of the towing warps to the second vessel. After the tow, the first boat takes the towing warp back, and begins haulback.

Inshore Lobster Boat

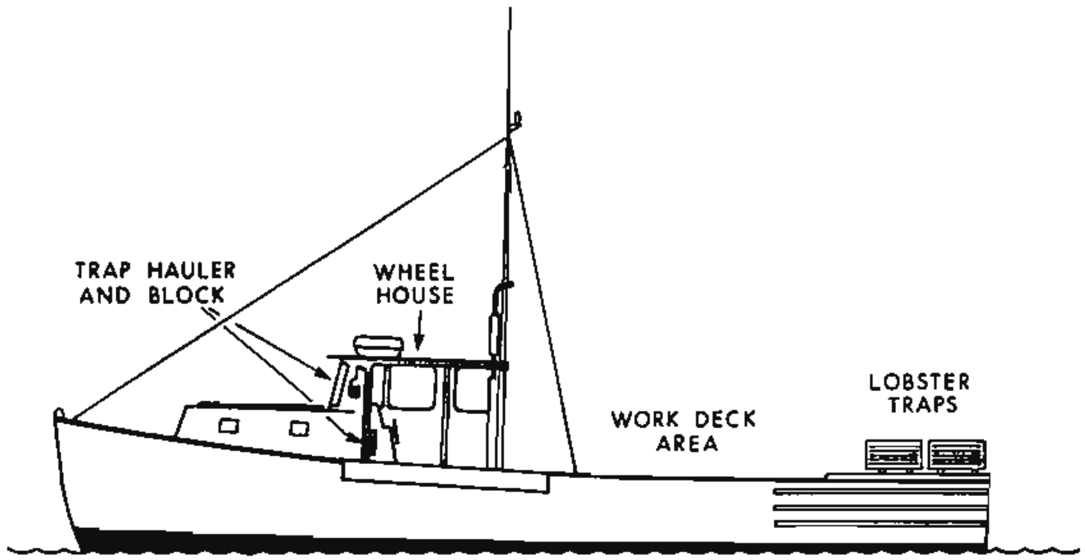

Figure 1-5. The inshore lobster boat ranges in size from 20 to 50 feet LOA and can be constructed of wood, fiberglass or steel. These boats fish in bays, inlets, and near-coastal waters up to 15 miles offshore. They usually fish up to 200 wood and/or wire traps set individually or in trawls. A line hauler on one side of the boat hauls in the traps, and the catch is often stored in a saltwater catch barrel. Bait is stored in large barrels on deck.

Offshore Lobster Boat

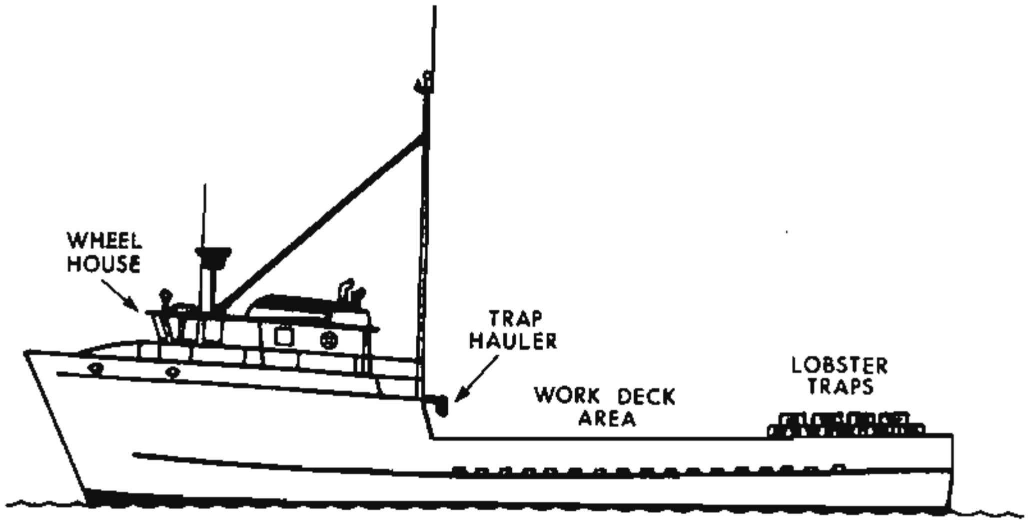

Figure 1-6. The offshore vessels are constructed of steel and range from 80-100 feet LOA. They usually work at the 100 fathom edge of the canyons. They fish trawls of 50-100 wood and/or wire traps that have radar reflectors to mark each end. They can fish up to 500 traps each trip, hauling the trawls with a davit and block that is on one side of the vessel.

Western Rig Lobster Vessel

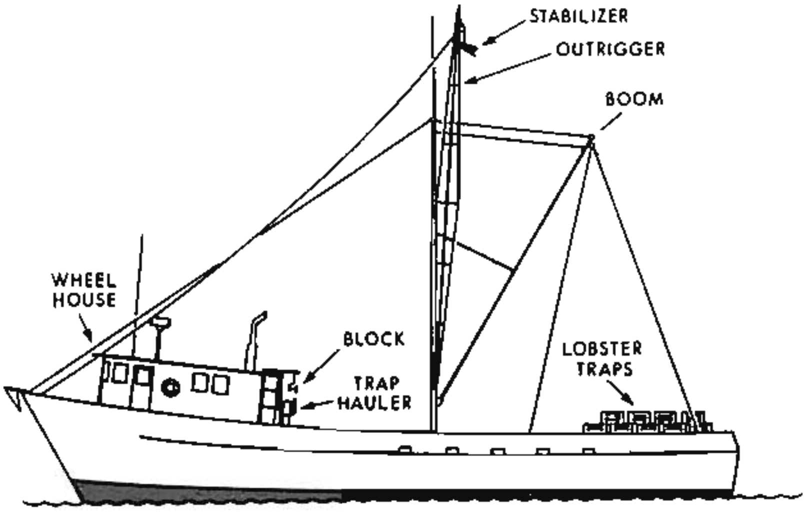

Figure 1-7. Western rig lobster boats are much the same as offshore lobster boat, ranging in size from 60-100 feet LOA, and constructed of steel.

Eastern Rig Clam Vessel

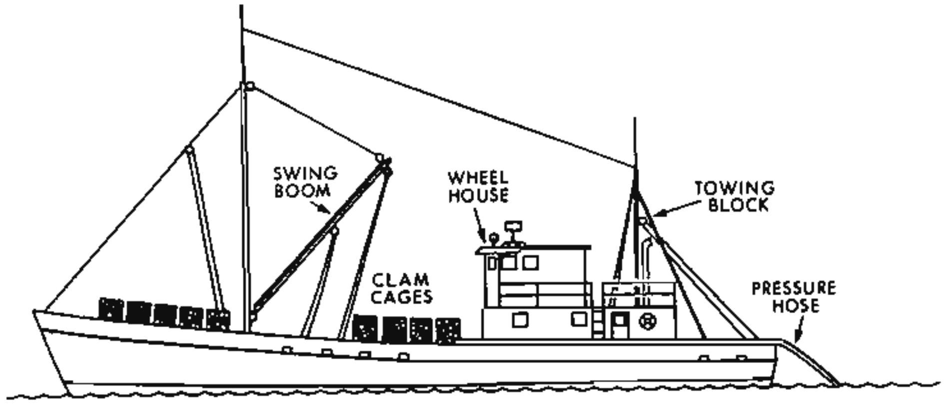

Figure 1-8. The eastern rig clam vessel is constructed of wood and ranges from 60-90 feet LOA. It travels from 3 to 30 miles offshore, targeting the surf clams and ocean quahog. The boat fishes with a hydraulic clam dredge that is operated off a swing boom on one side of the boat.

Western Rig Clam Vessel

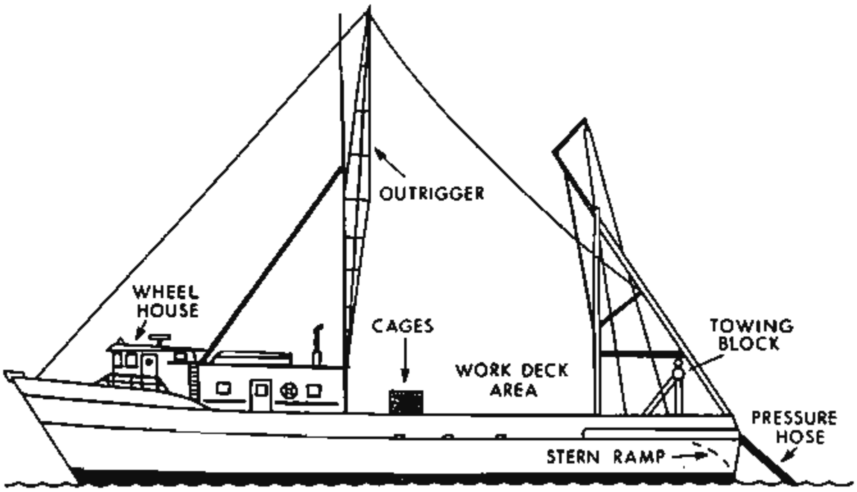

Figure 1-9. The western rig clam vessel ranges in size from 70-120 feet. It is similar to the eastern rig vessel, except that it operates its hydraulic clam dredge from the stern rather than from the side.

Scallop Vessel

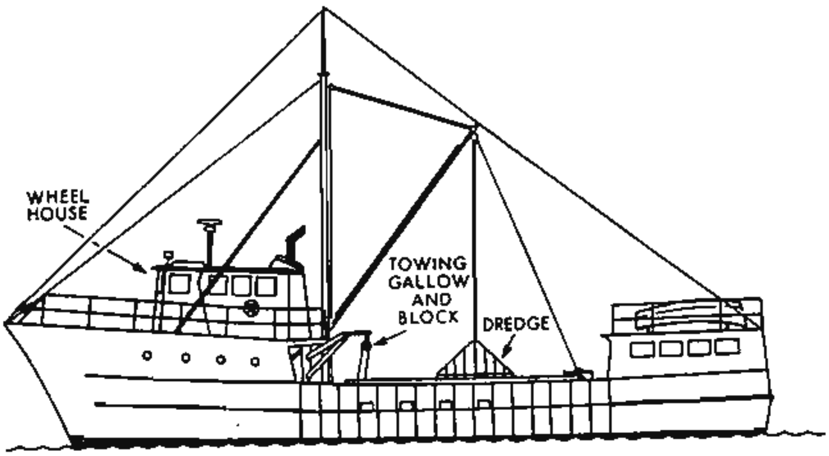

Figure 1-10. This offshore vessel, ranging from 70-100 feet LOA, is usually constructed of steel. The rig consists of 2 large towing gallows, one on either side of the vessel, with 2 large booms suspended from the mast. The booms hoist the scallop rakes that are towed from the gallows. A single cable is used for each dredge. A shucking house is located on the stern.

Gillnet Vessel (Also used for Longlining)

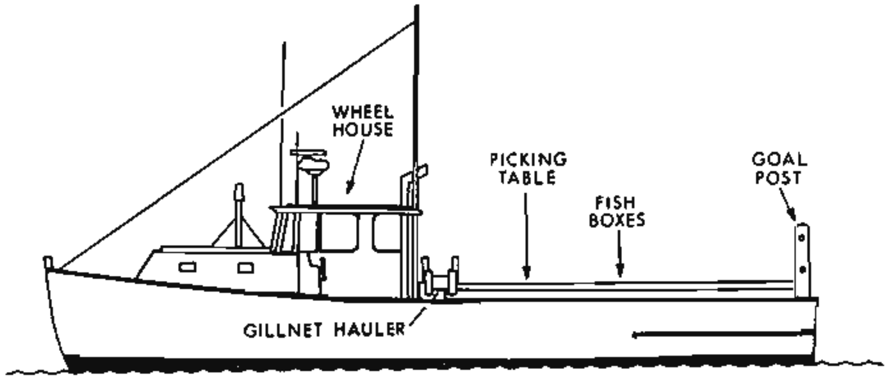

Figure 1-11. This combination vessel ranges from 20 to 50 feet, and is constructed of wood, fiberglass or steel. This boat fishes up to 50 miles offshore. Gear is retrieved using the gillnet hauler.

Stern Trawler/Longliner

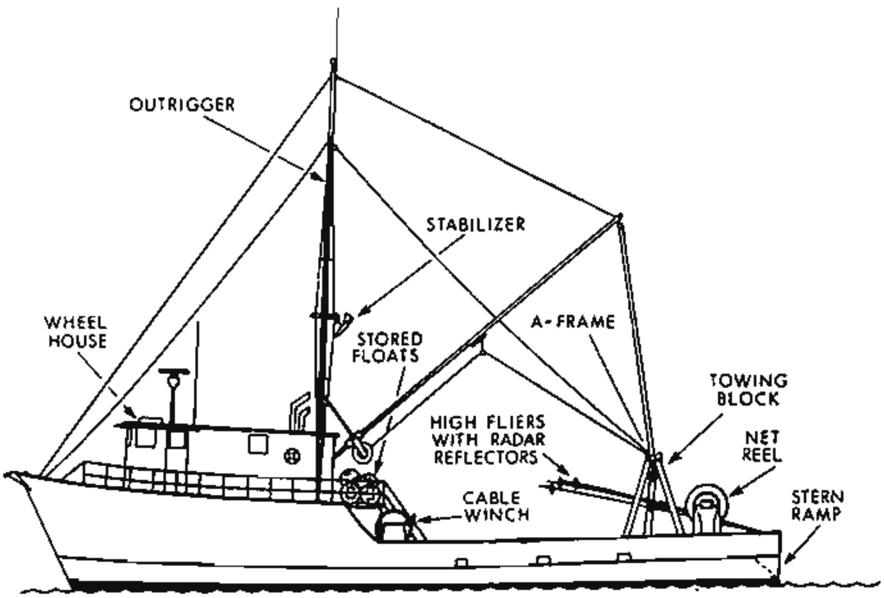

Figure 1-12. This combination vessel is used for trawling and longlining. Its length ranges from 50 to 130 feet, and its construction is of wood, steel or fiberglass. This vessel fishes from inshore to 100 fathoms.

Purse Seiner

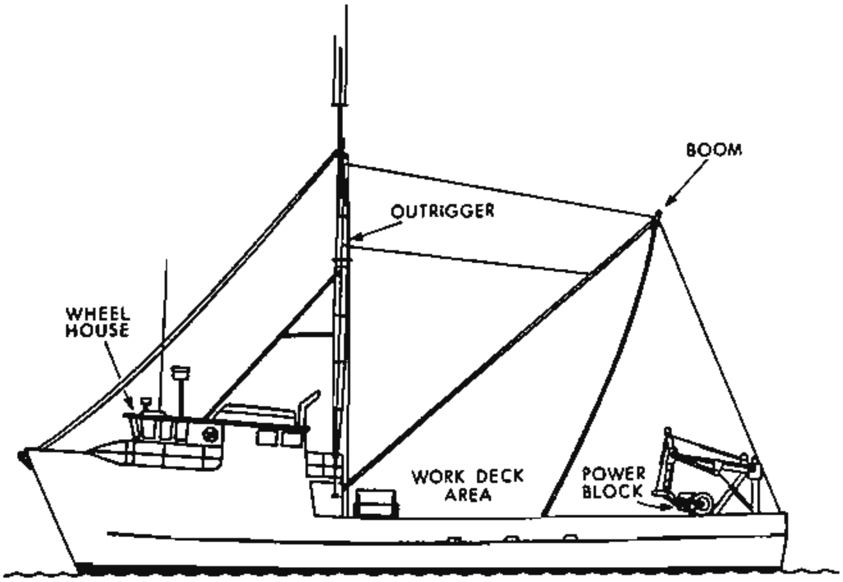

Figure 1-13. The purse seiner ranges from 70 to 200 feet, and is usually steel-hulled, although some wood vessels are still operating. The vessel is identified by the large power block and the main boom that are used to recover the net. Large seiners have a powered skiff which is either towed or carried on deck.

Chesapeake Bay Combination Vessel

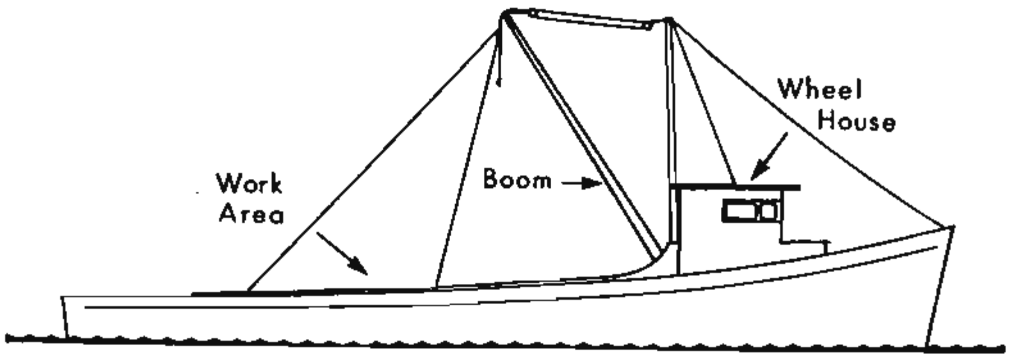

Figure 1-14. The dead rise is a combination vessel used for crab dredging, crab potting, and patent tong oyster fishing. It is primarily constructed of wood; its length ranges up to 50 feet. The vessel is identified by its high stem, large beam, forward style pilothouse and trunk cabin configuration.

1.6 Atlantic Coast Fishing Gear

From a distance away, it is sometimes difficult to recognize fishing vessel type based on its characteristics. It is also difficult to recognize gears in the water and whether navigation around them is recommended, or if it is safe to pass over or through them.

This section offers some general knowledge on basic fishing gear types and probable configurations. Nevertheless, fishing vessels that are involved in fishing are required to display day shapes or lights as described by the Coast Guard Rules of the Road, Rule 26. These are summarized below.

A vessel engaged in fishing, whether underway or at anchor, must show *only* the lights or shapes specified in Rule 26. Remember, however, that the definition of "fishing" does *not* include trolling lines.

Vessels fishing during the day must indicate a day shape. In vessels less than 20 meters (65.6 ft) in length, a basket can be used. Larger than 20 meters, two cones in a vertical line with their points together must be displayed. If its outlying gear extends more than 150 meters (492 ft) horizontally from the vessel, a day shape of a single cone, point up in the direction of the outlying gear must be indicated.

A vessel *engaged in trawling* - dragging a dredge, net or "other apparatus used as a fishing appliance" - must show two all-round lights vertically, green over white, plus sidelights and a sternlight when making way through the water. She must also carry a white masthead light abaft of and higher than the green light, if she is 50 meters (164 ft) or more in length; shorter vessels may, but do not have to, carry this light.

A vessel *engaged in fishing other than trawling* shows red-over-white all-round lights, again with sidelights and sternlight, if making way. If there is outlying gear more than 150 meters (492 ft) horizontally from the vessel, an all-round white light must be shown in that direction. This light must not be less than 2 meters (6.6 ft), nor more than 6 meters (19.7 ft) horizontally away from the all-round red and white lights.

In both cases mentioned, the lower of the two vertical lights must be at a height above the sidelights not less than twice the spacing between the two vertical lights. The required visibility range is the same as for sternlights.

A vessel that is fishing close by other vessels also fishing may exhibit the additional signals described in *Annex II* of the Rules of the Road. These signals are described under each gear description.

A vessel *not* engaged in fishing will show the normal navigation lights for a vessel of her length (Refer to Chapter 9 for a summary of these Rules, or Coast Guard Rules of the Road).

1.6.1 Single Boat Trawling and Dredging

Trawl nets can be either bottom or mid-water, and are towed at some distance behind the vessel (Figure 1-15). Warps from the vessel leads back to doors, or otter boards, which open the net mouth. Legs are attached from the doors to the net. In most cases, a single net is towed from the stern, but some fisheries tow up to 4 nets (2 on each side) from the outriggers.

Trawls can be retrieved either from the side of the vessel (Eastern rig) or the stern (Western rig). You may or may not be able to see the net, depending on how close to the surface it is being fished. Carefully observe day shapes and lights to avoid this gear.

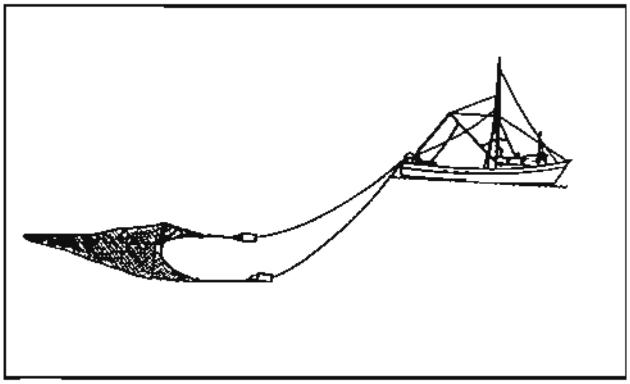

Figure 1-15. A bottom trawl.

One or more dredges can be towed behind a vessel and can be retrieved over the side or stern. Common mechanical dredges consist of a metal triangular or oblong frame to which is attached a bag net made of iron hooks, S-hooks and/or cotton cordings. The dredge may or may not have teeth on the lower edge.

Hydraulic dredges use a jet of water to wash out surf, soft or hard clams. The water is provided by a high powered pump on the fishing vessel. The shellfish are either washed onto, or collected by the tooth bar of the dredge, or washed onto a conveyor which leads to the vessel (Figure 1-16). A suction dredge is used for

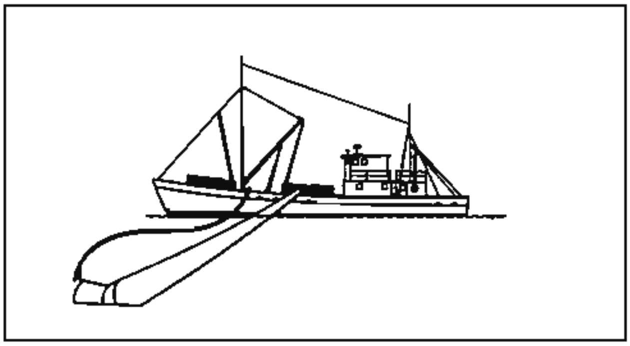

Figure 1-16. A hydraulic dredge vessel with fishing gear deployed.

harvesting oysters. These are removed from the bottom and brought to the surface by action of suction applied to the dredge head which is connected to a power pump on board the dredge vessel.

1.6.2 Pair Trawling (Midwater or Bottom)

Pair trawling in some fisheries (i.e. herring, mackeral) is a commonly used method to enable lower powered vessels to fish large nets. The use of doors is no longer required to maintain the net opening. This is provided by the vessels maintaining a certain distance apart from each other (Figure 1-17).

Midwater trawls or bottom trawls can be fished in this manner. You may not be able to see the net on the surface depending on the depth fished. Use caution in passing between two vessels who may be engaged in a paired operation.

In addition to the required fishing shapes and lights required by Rule 26, the following lights may be displayed. Remember, these are *not* required and may not be visible.

(1). By night, a searchlight directed forward and in the direction of the other vessel of the pair;

(2). When shooting the net, two white lights in a vertical line;

(3). When hauling their nets, one white light over one red light in a vertical line;

(4). When net is hung on an obstruction, two red lights in a vertical line.

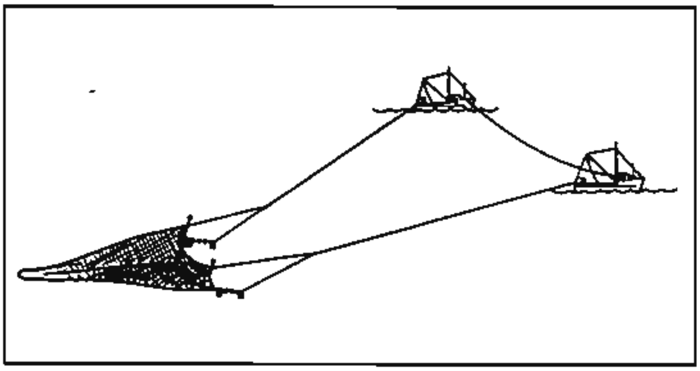

Figure 1-17. Midwater pair trawling.

1.6.3 Gillnets

A gillnet is simply a wall of webbing hung vertically in the water column by a series of floats and weights. Floats should be evenly distributed along the headrope.

Gillnets are usually set across the direction of the migrating fish. They can be placed as bottom nets (Figure 1-18 (a)), or surface fixed nets, or as free drifting nets (Figure 1-18 (b)). Usually one end of a drift net is secured to the fishing vessel, although the vessel may not be visible if the net is long.

If the net is set on the bottom, only the beginning and ending floats may be visible or marked with highflyers; a surface net will have smaller floats evenly spaced throughout the length of the net.

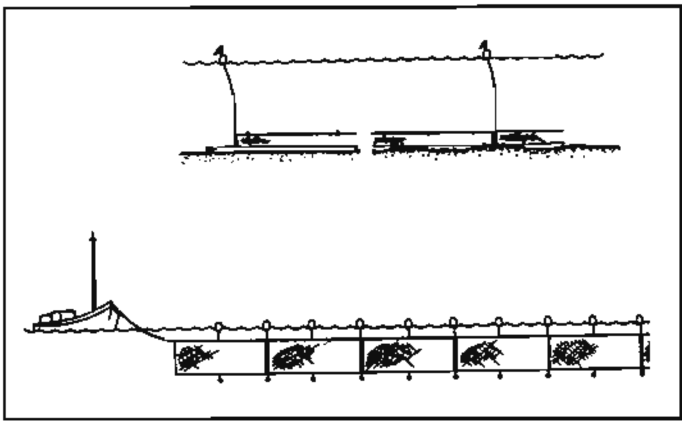

Figure 1-18. (a) Bottom set fixed gillnet; (b) Surface drift gillnet.

1.6.4 Traps

Traps used for capturing fish, lobster, crabs or conchs can be set individually or in trawls (Figure 1-19). A trawl consists of a main line with several traps connected by secondary lines. Depending on its length, both ends will be marked with a buoy and/or highflyer, and intermediate buoys placed throughout.

Rather than retrieve the entire set of traps in a trawl at once and loading them on deck, a vessel usually retrieves and sets one trap at a time by working down the mainline. Therefore, navigation may be hindered while the vessel is fishing.

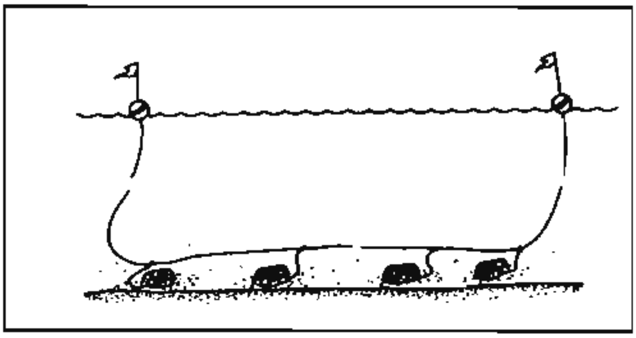

Figure 1-19. A trawl of traps.

1.6.5 Weirs, Pound Nets and Fyke Nets

A variety of entrapment devices are used in coastal marine, bay , lake and river fisheries. Construction material and designs vary according to location and fishery, but the same basic principles apply. Usually, a leader extends outward from the shore, which acts to herd the catch into a trap area. Many times, two wings extend from the mouth of the trap in a V-formation (Figure 1-20 (a)). The trap is usually set on the bottom with the door facing shallow water. It will be buoyed on the top and anchored on the bottom.

Pound nets (usually constructed of webbing) and weirs (usually constructed of wood or chicken wire) may extend a considerable distance from shore. In some areas, these fishing gears are semi-permanent and may be marked with lights and buoys. In some areas, pound net areas may be designated on the chart. Local fishermen are the best source to obtain information on location of these nets.

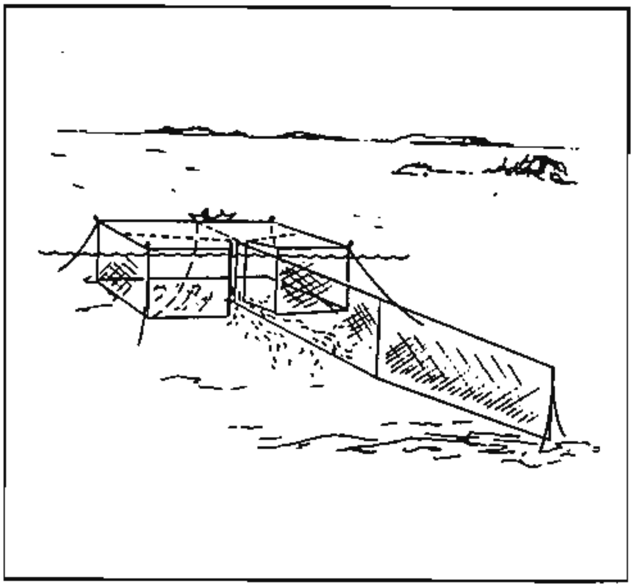

Figure 1-20. Pound net.

1.6.6 Longlines

Longlines consist of a mainline with short secondary lines called branch lines (or snood, leader, dropper-line, dropline, or gangion or gangin). There can be hundreds or even thousands of hooks fixed on these lines. This is a popular method of fishing for swordfish, shark, tuna, snapper and other fish.

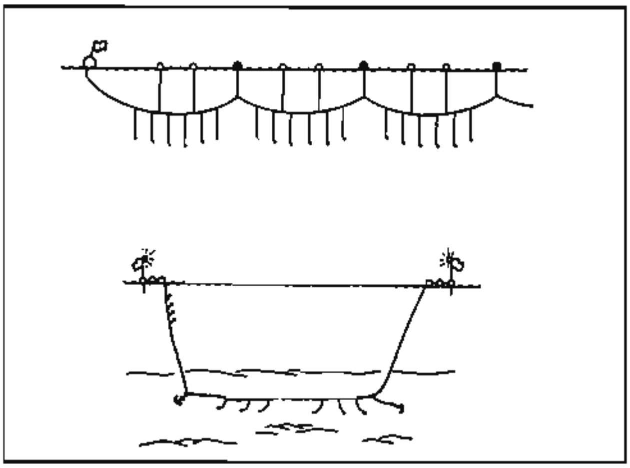

Figure 1-21. (a) Drift longline; (b) Bottom set longline.

Longlines can be bottom set or drift, which are kept on the surface or in midwater. Bottom set lines are usually marked with a high flyer at the start and finish of the line; drift longlines will have buoys placed intermittently to support the line and hooks. Drift longlines are usually attached to the vessel, however, these lines may extend up to 50 miles long and the vessel may not be visible (Figure 1-21).

Use caution when crossing the gear to avoid fouling.

1.6.7 Purse Seines

A purse seine is a system that traps fish by encircling them with a long wall of webbing. The top edge of the net is buoyed with a series of plastic, wood or cork floats; the bottom edge has attached rings strung with rope or wire cable.

The net can either be set with two boats or one although two boat seining is more common along the east coast. To set the seine, the net is divided between the boats, the net is played out from each boat as they surround the target fish school. The ends of the net are towed together to close the circle and the net is pursed. Each boat recovers opposite ends of the net. The fish are trapped in the bunt located at the center of the net (Figure 1-22).

If only one boat is used, one end of the net is secured to an anchored buoy or skiff while the boat plays out the net.

The purse seine floats are visible on the surface and will appear in a circular set. Do not travel into the area of operation.

Additional lights as specified by Annex II *may* be displayed. Vessels engaged in fishing with purse seine gear may exhibit two yellow lights in a vertical line. These lights shall flash alternately every second and with equal light and occultation (dark) duration. These lights may be exhibited only when the vessel is hampered by its fishing gear.

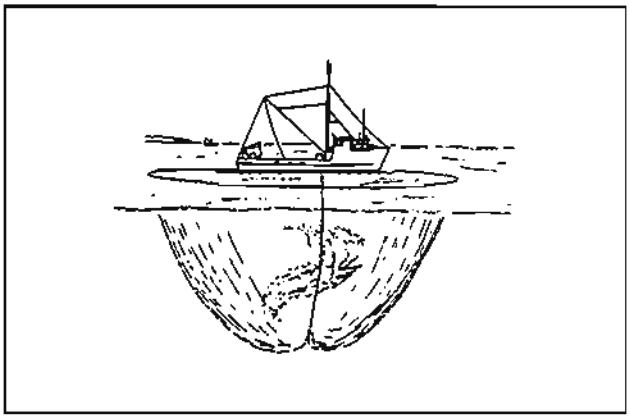

Figure 1-22. Purse seine.

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NOTES

CHAPTER 2

GENERAL SAFETY ORIENTATION TO FISHING AND VESSEL OPERATIONS

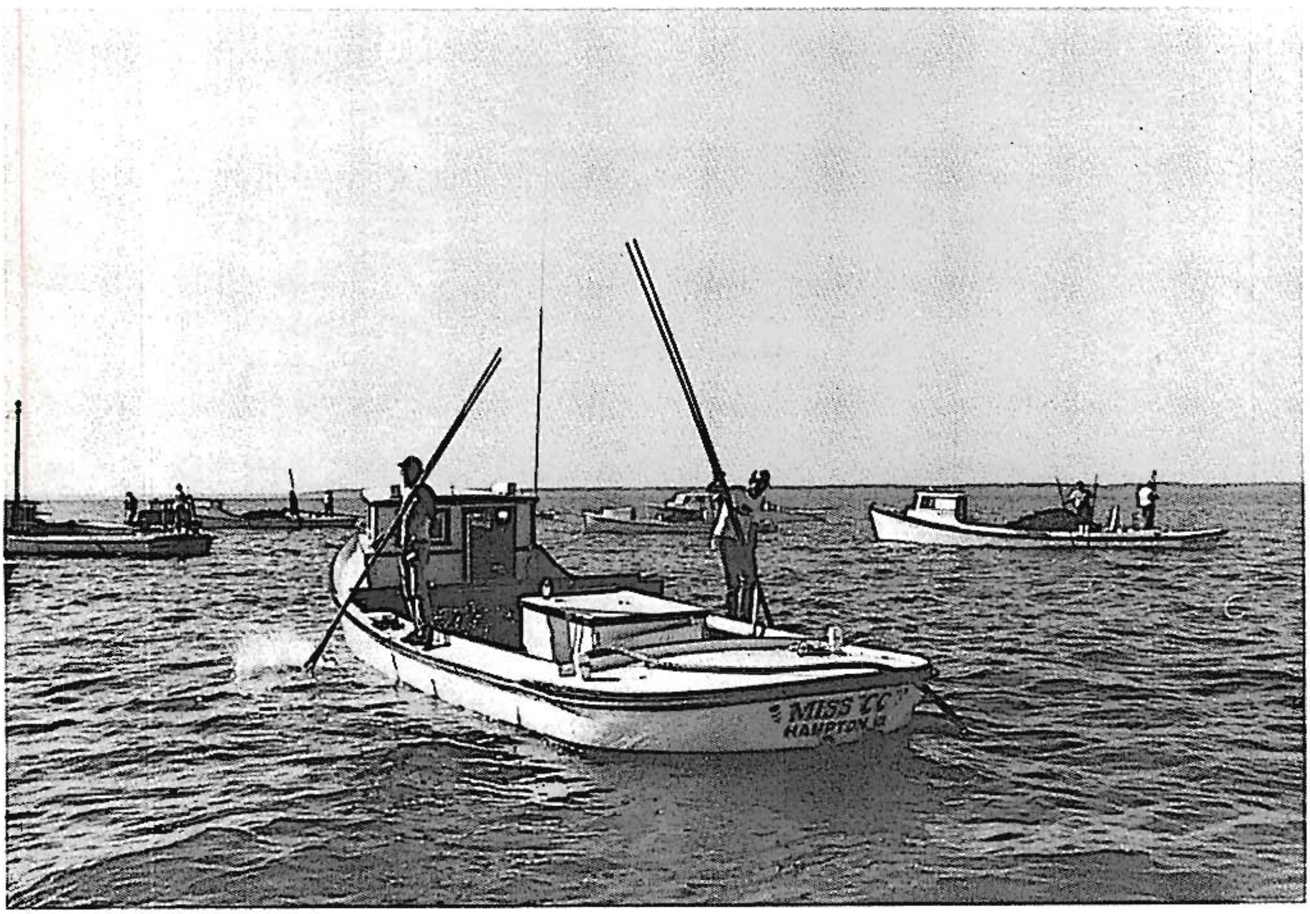


Photo courtesy of VIMS Marine Advisory Program

CHAPTER 2

GENERAL SAFETY ORIENTATION TO FISHING AND VESSEL OPERATIONS

Page

2.1 Introduction

Accidents can happen on any boat, to anyone. Fishing boats are especially dangerous because of the heavy loads and large strains on the vessel's equipment. There are plenty of opportunities for pinching and crushing accidents where line or wire runs over blocks, and around winches and drums. Crew turnover, and the resultant lack of training, experience, and vessel familiarity is another major factor contributing to accidents.

Your safety orientation should begin before you go to sea. You should have a tour of the boat and an explanation of the use of safety equipment aboard. The captain should demonstrate the equipment whenever possible. He should also tell you about the common safety hazards aboard his vessel.

A new crewman should read all the rules and regulations that are important to his safety while he is aboard that vessel. He may be asked to sign a statement saying that he has read and understands them. The statement will be dated and kept on file. He should follow the vessel's safety rules at all times, and promptly report injuries, accidents or defects to the captain. Seasoned crewmen should guard against the carelessness that often accompanies familiarity with the operations on board.

All crew members should know basic emergency procedures and first aid in case something happens to the captain or other crew members. Each new crewman should be briefed on emergency equipment and communication procedures.

The purpose of this chapter is to provide a general orientation to safety on board fishing vessels. Because every boat is different, we will provide general information and highlight some topics that ought to be discussed with the captain or operator of the vessel. You should ask as many questions as possible about basic safety and vessel operations before you leave the dock. The more each crewman knows about safety and seamanship, the better the odds that the vessel will be a success story rather than a casualty statistic.

2.2 Pre-Trip Preparations

2.2.1 Personal Gear

Your job as a fisherman demands that you be prepared to endure long, hard hours at sea in whatever weather conditions the vessel encounters. The personal gear you need depends upon where and how your vessel operates. If you are going to sea for the first time, ask the captain or an experienced hand for advice while you still have time to go shopping (Figure 2-1).

It is very important to dress properly in all seasons, however, it is crucial to dress properly in the extremes of summer and winter.

Be especially careful of the sun in the summer. Wear a hat, sunglasses, and sunscreen, even if you are well-tanned. It is easier to prevent sunburn than to treat it. Remember that it is very painful to work with even a minor sunburn, and that you won't feel the effect of a sunburn until several hours later.

Proper clothing is also important in the winter. You need to protect yourself from spray on the outside and perspiration on the inside. As long as you are dry, you are warm. Avoid blue jeans. Although everyone wears them, they are the worst pants to wear outdoors in cold weather. Cotton allows heat to escape three times faster than wool, nylon, polyester or acrylic. The advantages and disadvantages of these fabrics are as follows:

65% Dacron/35% Cotton clothing is a good choice for fishing. It is durable, inexpensive, and it dries quickly. Most work clothes are made of this fabric. Dacron/cotton over polypropylene makes a good winter outfit.

Wool has been popular for years. It is durable and moderately priced; and it feels dry and provides insulation even when it is wet. However, it is bulkier than synthetic clothing, and it dries very slowly.

Polypropylene, or "polypro," provides almost twice the thermal insulation of wool. Commonly used in long underwear, it dries quickly and doesn't feel damp when it is wet. You can also buy thermolactyl underwear, however, it is much more expensive than polypropylene.

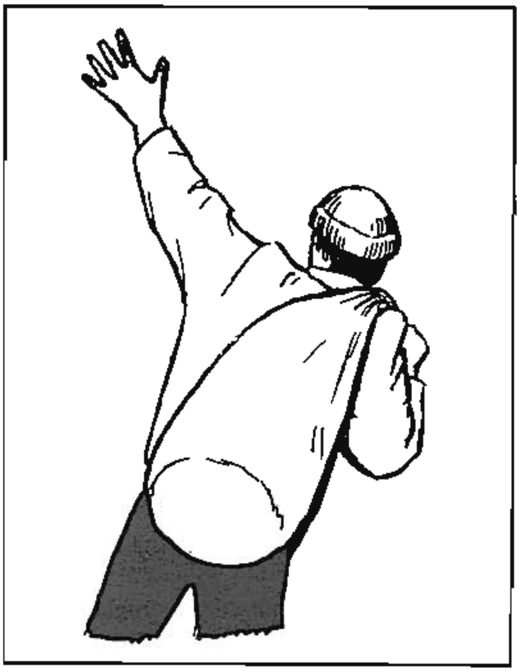


Figure 2-1. Prepare yourself before you go to sea.

Polyester pile garments are good insulation as outer layers in spring and fall, and middle layers in winter. Like polypropylene, the pile stays relatively dry and insulates even when it is damp.

Down is one of the best natural insulation materials available, but not on a boat. Once it gets wet, it is completely useless. It is not recommended for use on fishing vessels.

It is best to wear several layers of clothes made of breathable fabrics. The colder it is outside, the more layers you should wear. The outer layer should be windproof and water-repellent - foul weather gear is best. Good foul weather gear even repels water at the seams. It should have a hood and closures at the ankles, wrist and neck to keep out spray and water on deck. You may want to use tape or heavy rubber bands to help secure the ankle and wrist closures. Wristlets or "wristers" provide added protection for your wrists and forearms.

Be sure your foul weather gear is a *bright, visible* color, and consider applying squares of reflective tape to the shoulders and hood. Your gear may be the only thing visible if you fall overboard.

Because blood circulates close to your scalp, you lose up to 60% of your body heat through your head. If your hands or feet get cold, putting on a wool watch cap can warm them right up.

If you have long hair, you should keep your hair tied up and/or wear a hat whenever you operate winches or other moving machinery. Hard hats should be used when there are heavy objects around that could cause head injury.

You will need heavy rubber boots that keep your feet cool and dry, provide good traction, and protect you from puncturing, tearing and crushing injuries. The boots should be large enough to provide air circulation around your feet, and you should wear socks made of wool and polypropylene to keep your feet dry. Dry boots are essential for preventing infection and "saltwater rash" (trenchfoot). White boots are best in the Chesapeake Bay area and further south, because they reflect the sun that otherwise can heat up boots.

Gloves are another important item to have on board. Heavy leather gloves (lined for severe cold weather) are especially useful for wire rope work. You may also want to have waterproof rubber gloves. You may find that it is difficult to handle lines while you are wearing gloves. Take care not to catch the gloves in any equipment.

Always have several sharp folding knives with 3" to 4" blades close at hand.

Be sure to have a good pair of sunglasses. The sun's glare on the water in both summer and winter can damage your eyes. Although the glare causes a superficial burn, it is very painful, and it requires medical care.

You will be responsible for your own bedding, pillows, towels and toiletries - soap, shampoo, razors, toothbrush and toothpaste, etc. Also bring your own leisure time materials - books, cards, games, TV, stereo, writing paper, envelopes and stamps.

You should prepare a personal survival kit that includes a survival suit and other items as discussed in Chapter 3. Your survival is ultimately dependent on *you* being prepared for emergencies.

2.2.2 Alcohol and Drugs

The rule is simple: there is no room on board your vessel for drugs and alcohol. It is irresponsible for a captain to allow the use of drugs on his vessel. There are enough things on a boat that reduce your alertness - fatigue, stress, rough weather. Alcohol and drugs further reduce your alertness and jeopardize your safety.

Not only is it unsafe to use drugs and alcohol, but it is also illegal. A Federal Zero Tolerance policy took effect in December, 1988, stating that boats will be issued a summons when the personal use of a controlled substance is detected. However, if the master or person in charge of a vessel is found in possession of a controlled substance, or when those on board appear to be impaired, or the person in charge refuses to sign the summons form, the vessel may be seized if records show that the vessel had received a prior summons, or the master or person in charge failed to respond to a summons or pay penalties (Nov 3, 1989). The Coast Guard and Customs Service encourage vessel owners to clearly state their intolerance of drug possession aboard their boat by posting a placard and advising crew members (Figure 2-2).

2.3 Safety on Board

2.3.1 Vessel Orientation

New crewmen are usually hired and assigned to a vessel knowing very little about the captain, the crew's duties, safety procedures or benefits. The crewman is just told to board the boat at a specific place. Unfortunately there are no industry-wide standards for orientation of new personnel.

You should be given a thorough orientation - particularly in the areas of safety and specific duties and responsibilities, including the following:

* Where and how to join the vessel.
* How long the fishing trip will last and the kind of working conditions you can expect.
* Sleeping and eating arrangements.
* What to bring, including clothing, and equipment.
* The chain of command, and tips on how to get along with other crew members.

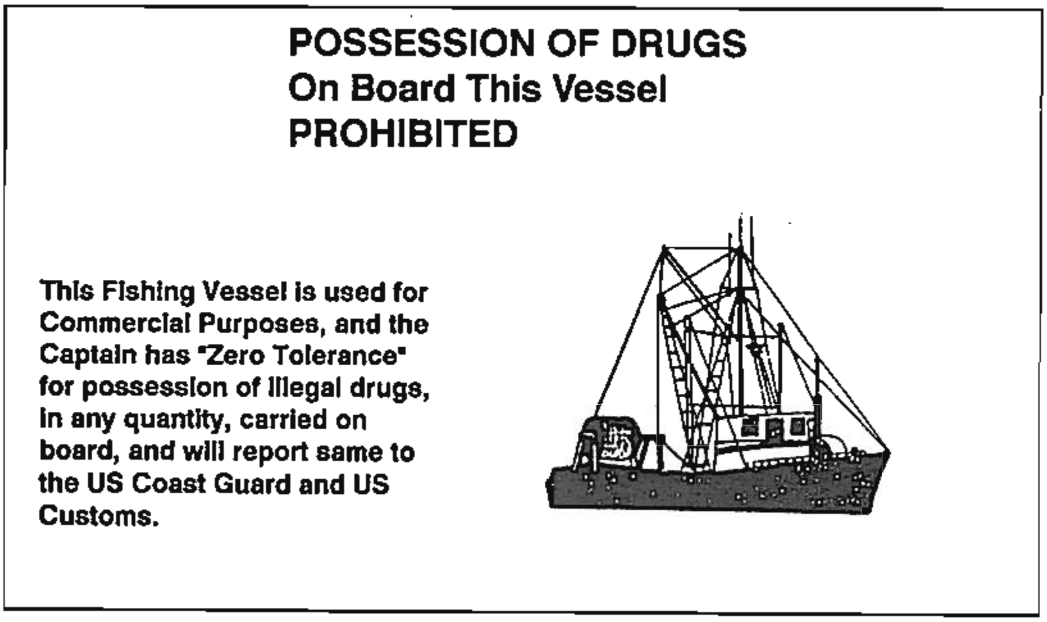


Figure 2-2. Clearly state your intolerance of drug possession aboard your vessel.

* Safety precautions to follow.
* Specific duties and responsibilities.
* When and how you will be paid and what your crew share will be (a placard). If your vessel measures 20 or more gross tons and is on a voyage from a U.S. port, a written agreement between the master or person in charge and each seaman employed aboard the vessel is *required*. The vessel owner is expected to sign it. It shall include the terms of employment, and specify the wage or share for that period of employment.
* Where your mail should be forwarded. How your family and friends can contact you in an emergency.
* Emergency procedures and communications.
* Location of safety equipment.
* Safety hazards aboard that specific vessel.

Be sure to tell your family and friends the name of your vessel, where you are going, and how long you expect to be at sea.

2.3.2 Boarding and Leaving the Vessel

Although it may seem obvious, be careful getting on and off the boat, and passing between boats (Figure 2-3).

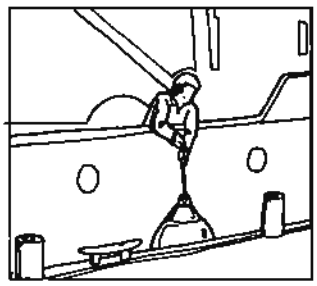


Figure 2-3. Don't put your hands or feet in danger when you're fending off. Since you can't stop the boat anyway, use a fender.

Never jump from a moving vessel if there is a ladder or plank available. You could risk being crushed between two boats or between the boat and the dock.

Whenever possible, rig a secure gangplank or ladder that is hooked over the vessel's bulwark. Keep the plank dry and clear to prevent slipping and tripping. Place the plank outside of the swinging radius of cranes, booms or blocks; and keep a lifebuoy and heaving line nearby.

When the shipboard end of a ladder rests on the bulwark, fixed steps should lead from the top of the bulwark to the deck. Rig a handhold if none is nearby.

Don't attempt to board with your hands full. Pass the load across the rail, or hoist it with the boom. Always grab a secure handhold when boarding the vessel.

To minimize man-overboard hazards, crewmen are advised against attempting to board or exit a small boat while the fishing vessel is underway, especially if it is engaged in an operation such as trawling that renders it hard to maneuver. In menhadden vessels, purse boats are often launched or hoisted in davits (with bare steerage way on) to help keep her stern to sea to minimize roll. Additionally, to minimize capsizing hazards, the fishing vessel should have all way off when the crew is attempting to launch or retrieve a small boat.

If you are taking a mooring line to the dock, wait until the boat lies close enough to the dock for you to step off safely. Take a turn around a cleat before you try to snub the boat, and hold the line as far back from the cleat as is practicable, to avoid pinching injuries (Figure 2-4). Always stand out of the direct line of pull on the line. If you can't hold a line in check, let it go; don't let the line pull your hand into a cleat or bitt.

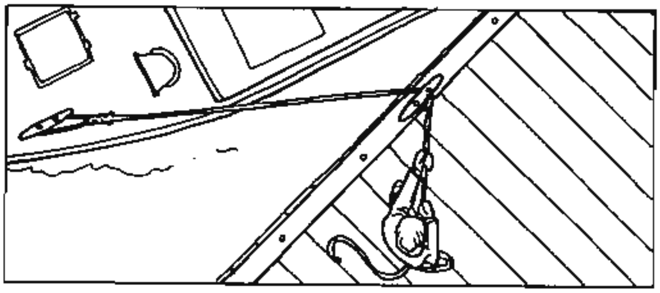


Figure 2-4. When you snub a line, hold it as far back from the cleat as is practicable to avoid pinching injuries.

2.3.3 Moving Around the Vessel

During your first days at sea, you will tire easily, because your muscles are unconsciously working against the movement of the vessel. Since falling is a constant hazard at sea, be careful until you get your sea legs. You will need a surprising amount of strength just to stand up on a rolling deck.

Though it is unsafe, fishermen often urinate over the rail. If you are going out alone at night or in heavy weather, tell someone else that you are going. Take a flashlight, if necessary, and wear a PFD ("personal flotation device") - an approved float coat or a life jacket.

Slick Surfaces

Slipping, falling and tripping injuries are common on fishing vessels. Watch where you walk, and keep decks, floors, grates and stairs clean and dry (Figure 2-5). Report leaks and spills right away, make repairs and clean up the mess. Diesel fuel, oil, and hydraulic fluid are fire hazards and slippery.

Hot Surfaces

Learn the location of and avoid exhaust pipes and other hot surfaces. Since you may not be able to insulate or shield them entirely, be careful when you are working around them. If insulation or a safety guard must be removed for repairs, it should be replaced as soon as possible, and definitely before the machinery is turned on. Report missing machinery guards to the captain.

2.3.4 Ladders and Stairs

Always face ladders and stairs in a seaway, and hold the handrails. Don't carry loads; pass or hoist them up. Be aware of any missing or worn non-skid treads and report them to the captain.

Avoid using portable ladders at sea, if at all possible.

If you must use them, be sure they stand on a firm base, and that they are securely lashed at the top and bottom. Never take a chance on a ladder that shows obvious defects or that is not securely lashed (Figure 2-6).

Rope ladders should have two cross-battens to prevent twisting, and they should not be made of wire rope. Do not use the ladder if any rungs are missing, if the rope is in poor condition, or if the ladder isn't long enough to reach the water or dock.

Rope ladders should be fully extended and should not be secured to the bulwark by the rungs. Only one person at a time should be allowed on a rope ladder, and he should hold the side ropes and not the rungs.

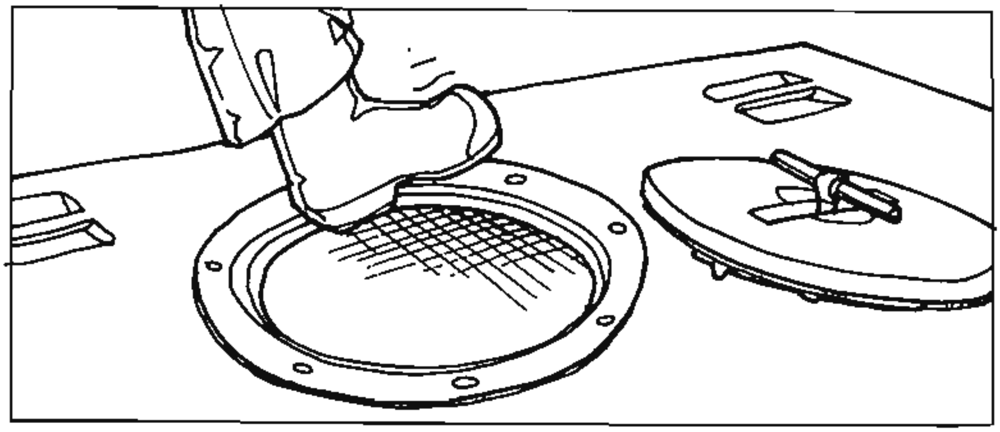


Figure 2-5. There are plenty of falling hazards on a fishing vessel. Don't be the one to find them.

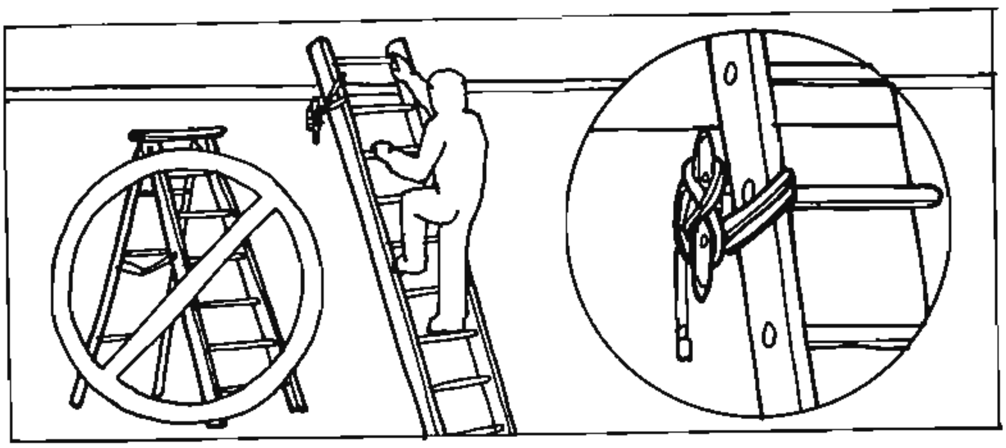


Figure 2-6. Avoid using portable ladders. If you must use them, lash them securely.

2.3.5 Working Aloft

Don't go aloft without a good reason. Tell the captain and the man on watch, in case he has to alter course or speed to protect you. Always use a bosun's chair or safety line. Tie loose tools to you with a lanyard to keep them from falling and injuring someone on deck (Figure 2-7).

De-energize all electric circuits that may pose a hazard before going aloft.

Avoid working beside a radio antennae or radar scanner because of the danger of radiation. Remove fuses or break the circuits, and post a "Man Aloft" sign on the equipment.

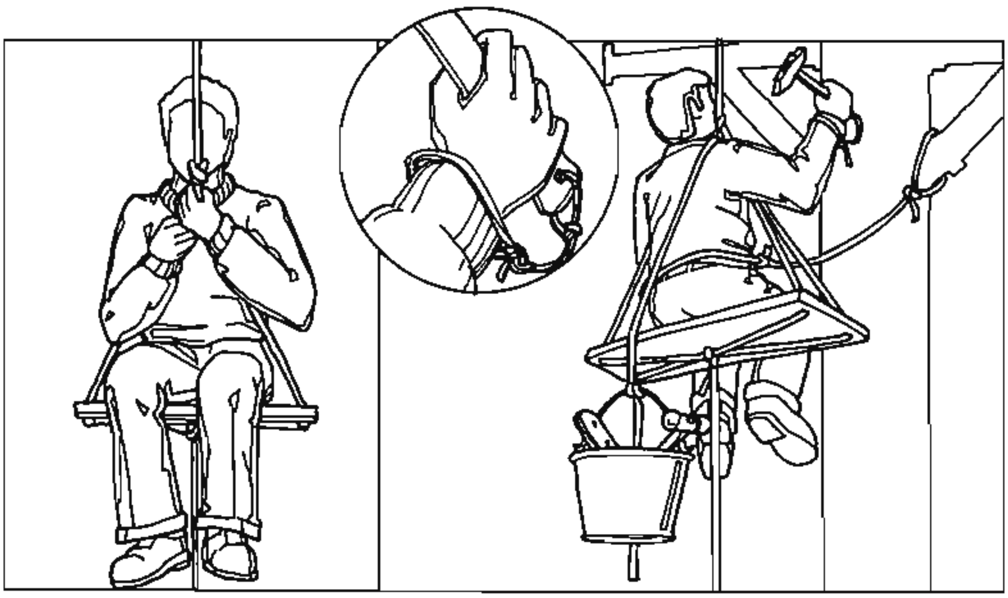


Figure 2-7. Use a bosun's chair and safety line when working aloft, and tie off tools and parts to keep them from injuring anyone below.

2.3.6 General Safety Tips

Follow the Chain of Command

If you're a new or inexperienced hand, the captain will tell you your duties. It is important that you follow the captain's instructions, and that you not try to do a job you are unqualified or unauthorized to do.

If circumstances require you to act other than instructed, you should do so only after consulting the captain.

However, you may not have time for clarification, and then you must use your best judgment and talk to the captain as soon as is possible. For instance, if you were told to hold a certain course, and you see that you are headed for a rock, then you would want to steer around the rock, and talk to the captain immediately.

Keep Awake

Be alert to sea conditions and to what is happening on the boat. It is easy to be lax or inattentive when you are doing a familiar job; and it is that inattention that can lead to accidents.

Take special care in heavy seas. Keep an eye out for your crewmates as well as yourself; and warn them of threatening waves, approaching vessels and other dangers.

Fatigue and stress are the enemies of safety. Unfortunately, commercial fishing does not operate on a schedule, and you may be called upon to work long, difficult hours.

Fatigue affects your strength, your coordination and your judgment, and makes you much more accident-prone.

Get as much rest as you can, watch your diet, and try to stay warm and dry. The more comfortable you are, the less fatigue and stress you will feel.

Know your limits, and be extra careful when you are fatigued. If you feel that you are too tired to do your job safely, tell the captain. If necessary, request a general crew meeting to discuss rest periods.

Your Health

You should be in good health before going to sea. Your captain should know about any medical problems, such as diabetes, severe allergies to insect bites, etc. If you are on medication, you are responsible for having the medication and a copy of the prescription with you. You should also have an updated tetanus shot before going to sea.

Take care of yourself: stay clean, warm and dry. Let the captain know if you are sick or hurt. Be sure to keep your hands clean; treat cuts quickly and use a hand cream or salve.

Treat all injuries immediately, and report them to the captain. You must notify the person in charge regarding any illness, disability or injury suffered when in service of the vessel no later than 7 days after it took place.

Protective Clothing

Make sure your work clothes fit as close to the body as possible. Avoid wearing loose-fitting clothing or aprons with loose strings while operating winches and other moving machinery.

Wear the proper protective clothing for what you are doing: personal flotation devices (PFD's), gloves, helmets, workshoes, boots, goggles, foul weather gear, etc.

Do not wear rings or jewelry.

Make sure your footwear is in good condition and appropriate for the work you are doing. Wear steel-toed safety shoes when handling heavy objects.

Gloves should be appropriate. For example, wear gloves that protect against cuts when you are gutting or trimming fish. The gloves should fit snugly at the wrists, and still allow free movement of your fingers. Do not wear gloves if they can get caught in moving gear or cable.

Wear goggles when you are chipping paint or rust, working on electric storage batteries, sanding, grinding, spray painting, etc.

Noise and vibration can cause fatigue, stress, and hearing loss. Unfortunately, it is impossible to completely avoid noise on a fishing boat. However, you can reduce the noise by wearing ear protectors, and by closing the doors between the engine room and the living quarters (Figure 2-8).

Figure 2-8. Wear ear protection in the engine room.

In darkness, or whenever visibility is poor, wear high visibility protective clothing.

Whenever you work around marine sanitation tanks, wear rubber boots, overalls, rubber gloves and a hair covering. No one working on such tanks should be allowed free movement around the vessel until his protective clothing has been removed and placed in plastic bags. Either wash the clothing immediately, or throw it away.

Decaying matter produces methane and hydrogen sulfide, two extremely hazardous gases. Methane is also highly explosive.

Before entering large holding or treatment tanks, or even spaces containing these tanks, make sure the space has been thoroughly ventilated and that the tanks are safe. Use explosion-proof lights, and do not permit smoking.

Lighting

Make sure all work spaces, passageways, and doors are well-lighted; however, the lighting should not interfere with the lookout or navigation lights. You may need portable lighting where fixed lights are inadequate.

Use guards to protect electric lightbulbs and minimize fire hazards. Use only approved lights and electrical appliances, and don't overload electrical outlets.

Learn how to use the vessel's emergency lighting system, and know the location of portable watertight lights. Keep a flashlight in your bunk in case the lights go down and you have to get out in the dark.

Lifting

Learn how to lift. Bend your knees and use your legs, not your back (Figure 2-9). If something is too heavy for you to pick up by yourself, use mechanical devices or ask for help. Back injuries are all too common; they can cause other disabilities, and they can end your career as a fisherman.

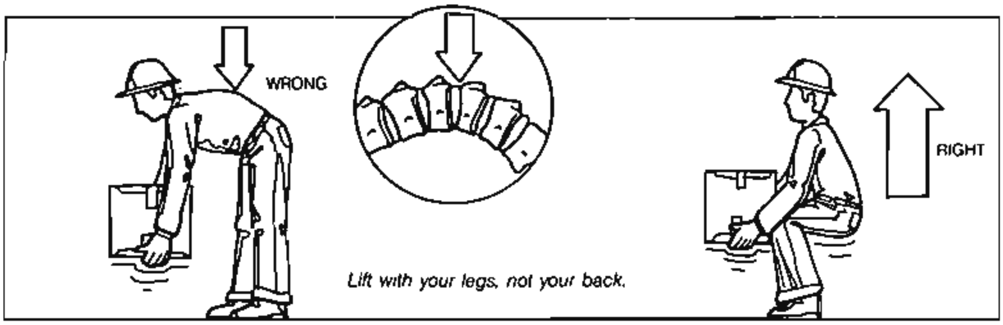


Figure 2-9. Back injuries can be prevented by using proper lifting techniques.

Hand Tools

Use the right hand tools for the job; keep them clean and stow them when you are done using them. Keep cutting tools sharp and make use of all hilt or finger guards to keep your hand from sliding into the blade. Open-bladed knives, gaffs, hooks and other sharp or pointed objects should be sheathed or safely stowed when not in use.

Don't use obviously defective or incorrect tools for the job; and do not use any tools on moving machinery. Remove all gear and tools before restarting a machine that has been serviced.

If you are working aloft or next to a deck opening, do not leave tools or parts lying loose. Place them in a bag and lash them to prevent injuries to people below. Use a line to lower tools from above.

First Aid Equipment

Make sure you know the location of the first-aid equipment, and know how to use it. At sea, fishermen must depend upon one another for emergency medical treatment until professional help is available. You have a duty to your crewmates to learn as much first-aid as possible. Read the chapter on Medical Emergencies in this manual, study more in-depth medical manuals, and take first-aid and cardio-pulmonary resuscitation (CPR) classes.

General Housekeeping

Keep all working and living areas neat and orderly. Dispose of wastes properly. Remove any debris that can clog scuppers, drains, and freeing ports.

Clean up slippery decks, mop up spills as soon as possible, and flush fish slime and seaweed from the deck frequently.

Make sure all tools and equipment, including fishing and trawling gear, are properly stowed and secured. Coil and stow lines and ropes. Keep clothing, foul weather gear, and boots in their place.

Store sharp objects- knives, gaffs, pike poles, etc. in a safe place.

Secure loose gear on deck. Coil and hang water hoses on brackets. Store ladders properly.

Pile hatch covers neatly out of passageways when the hatches are open. Do not leave hatches partly covered or concealed with a tarpaulin. Re-cover hatches if loading is completed or interrupted for a substantial length of time.

Gear Housekeeping

Keep fishing and working gear clean and orderly.

Do not store gear in passageways.

Do not leave blocks or other heavy objects loose or swinging; lower them to the deck or secure them in place. They are a potential source of serious injury, and swinging will wear out the eyes in connecting shackles.

Keep clean rags in a box or locker; dispose of dirty rags in metal containers with lids.

Use proper cleaning solvents, not gasoline.

Wheelhouse and Crew Quarters

Keep quarters neat and orderly.

Stow personal gear properly.

Remove wet gear before entering living areas, and allow wet clothing to dry in a well-ventilated area.

Install fire extinguishers in appropriate places, and never use them as coat racks.

Galley

Keep it clean and orderly. Give others the same courtesy you want to receive. Keep galley floors clean and dry.

Wash pots, pans, dishes and silverware and stow them as soon as you are done eating. Rig slicing and food-processing machines with guards or fences, and stow them after use.

If you are expecting rough weather, remove pots and pans from the stove. If you must cook, keep them only partially filled, turn the handles inward and use pot hold-downs. Be sure the stove is fitted with a perimeter rail.

Keep food storage areas neat and orderly.

Do not hang towels or wash cloths unattended above the stove to dry.

Keep a fire extinguisher handy, and keep the range, exhaust hood, filters and ductwork clean and free of grease and soot.

Microwave ovens speed up food preparation and defrosting of frozen foods. They also eliminate a perpetual safety hazard-pots boiling over on the stove top. However, you should be aware that fires can occur in microwaves.

Know the fuel line shut-off locations.

Sanitation

Keep toilet, washing and shower facilities, lockers and other personal spaces clean and sanitary, and protect them against insects, rats, mice and vermin.

Galley and food storage areas are particularly prone to infestation. Do not leave these areas exposed. Wash dishes and utensils promptly with a suitable disinfectant.

Marine Sanitation Devices

These devices use chemicals and produce gases as a byproduct, some of which present hazards. The manuals for all chemical marine toilets list the type of chemical by brand name and state the amount to use. The vast majority use chlorine bleach, in one form or another. Be sure to read the label, and be careful what chemicals you use to clean it. For example, bleach mixed with certain cleansers (such as ammonia) may form a deadly chlorine gas.

Do not experiment with your chemical tank. Follow exactly the method of treating the blackwater that is described in the manufacturers manual.

Lines in the Water

A line tangled in the propeller can be a very expensive and dangerous mistake, and the lost time will come out of your share. Keep your eye out for lines or wires trailing overboard.

Smoking

Do not smoke in bed or in confined areas. Dispose of cigarettes in metal ashtrays or sand buckets, not cardboard boxes.

Passageways

Keep them clear and free of obstructions and slipping hazards at all times.

2.4 The Vessel

All vessels should be equipped with features to ensure the safety of the crew. Crewmen should be aware of these features and knowledgable about their use. All crewmen should be familiar with the requirements of the Fishing Vessel Safety Regulations.

2.4.1 Communications

Clear communications between the bridge and deck should be maintained by means of properly located functioning intercoms. Deckmen must be warned of breaking waves or heavy rollers. Helmsmen should be advised of navigation hazards observed by the crew, such as lines in the water. The captain may sense a problem and want someone in the engine room in a hurry. In all such cases, good communications are a must.

2.4.2 Bulwarks and Railings

All exposed working decks should be surrounded by bulwarks, rails, chains or wire rope that adequately protect the crew. The recommended height is 39.5 inches, with the lowest course 9 inches above the deck.

For heavy sea conditions, the vessel should have appropriately placed bulwark rails or handgrabs, storm rails on the outside of superstructures and deckhouses, and guard rails, gangways, lifelines or underdeck passages between quarters, machinery spaces and other living and working areas (Figure 2-10).

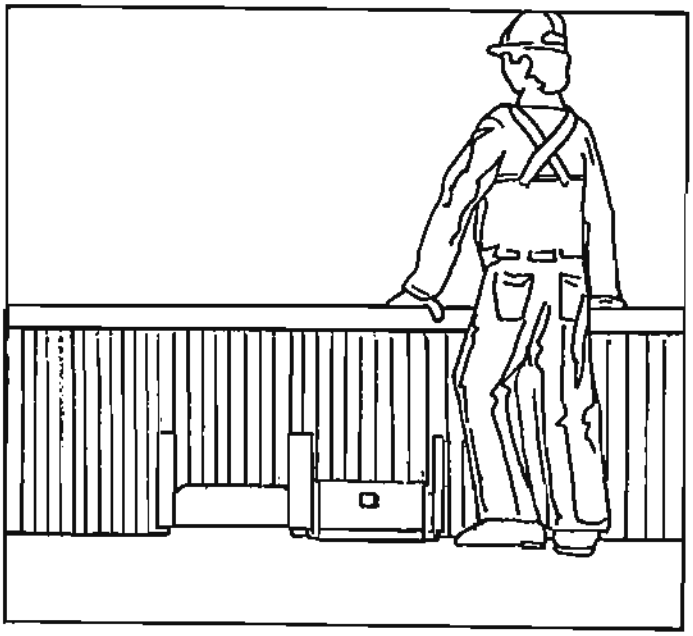


Figure 2-10. Bulwarks should adequately protect the crew.

Periodically inspect handrails, handgrabs and lifelines to be sure they are secure. You can't have too many hand holds.

Stern trawlers should have a means of protection fitted across the stern ramp when net handling operations are not underway. On vessels without a means of protective closure, use a doubled chain.

2.4.3 Covers and Openings

Exposed weather deck hatches should have locking closures. All closures should be capable of being opened from both sides, and all gaskets should be secure and maintained in good condition. Hatchways, manholes and other openings should only be open when required by specific operations, and they should be reclosed and secured as soon as the job is done. When they are open, hinged covers over hatchways, manholes, and other openings should be latched to guard against accidental closing.

Wherever practicable, ropes or railings should be provided around uncovered deck openings. Skylights and hatches should have guards. Escape openings should have hand grabs above them to help crewmen exit in an emergency.

2.4.4 Noise and Fumes

Keep passageway doors closed to keep fumes, odors, and noise from moving between working and living areas. Maximum noise levels should not exceed 75dB. Ways to reduce noise levels:

* Mount vibrating machinery, especially generators, on resilient pads.
* Fit noise barriers or sound-absorbing material around engine rooms and other noisy spaces.
* Mount exhaust, ventilation and other service lines with flexible fittings.
* Ensure that all fit-ups are tight.
* Install seals around doors and openings that separate spaces.
* Install silencers or attenuators on air intakes and exhausts.
* Install sound-absorption material in living spaces.
* Isolate noisy spaces from manned spaces.
* Install seals where wires or pipes penetrate the deck over the engine room.

2.4.5 Deck Coatings

Apply deck tiles, non-skid paints or gratings on walking and working decks, around hatches, doors and passageways, around deck and anchor winches and around the liferaft. It is difficult to launch rafts from slippery housetops on vessels at severe angles of heel (Figure 12-11).

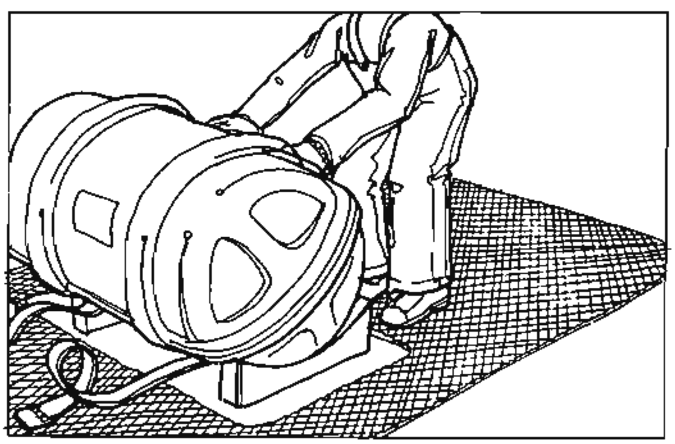


Figure 2-11. Use of non-skid around the liferaft cradle may be crucial in launching the raft from a severely heeled vessel.

2.4.6 Means of Escape

Normally manned spaces such as accommodations, galleys, machinery spaces and working areas must have two means of escape as remote from each other as possible to minimize the possibility that both exits could be blocked at the same time in an emergency.

You should be able to open all escape hatches from the inside; they should not be fitted with locks or closures that prevent quick opening. They should never be obstructed with gear or deck loads, and crewmen should practice exiting in order to be prepared for an emergency. Lubricate hatch mechanisms regularly.

2.4.7 Stairways and Ladders

Stairways and ladders must be adequately constructed and secured to permit safe passage both in port and at sea. Treads should be flat and covered with non-skid, or made of non-slip material. Stairways and ladders in high traffic areas should be permanently attached. Emergency escape ladders may be portable if they are stowed adjacent to the exit and capable of being secured in place by hand.

Install fixed ladders at least 6 inches from the bulkhead to permit a secure foothold. Where ladders are constructed with stringers, the rungs should pass through the stringers, rather than being nailed on the outside.

Avoid using portable ladders at sea. If you must use them, mount them on a firm, flat base and lash them securely in place. Do not use ladders bearing obvious defects such as missing rungs. Repair any bent round metal ladder rungs as soon as possible.

Install handholds wherever they are needed. When the vessel is underway, crewmen should use ladders on the centerline of the pilot house rather than the side ladders; the vessel could lurch, sending the man to the deck. Keep the area around the ladder base free of obstacles.

Gangways

Gangways, where used, should be at least 22 inches wide, and strong enough for the job. They should be equipped with ropes or railings to a height of 36 inches. The footstops and midrails, or ropes, should not be more than 18 inches apart.

2.4.8 Gas Cylinders and Installations

Only use appliances fueled with heavy gases like propane in well-ventilated areas. Avoid a dangerous accumulation of gas in interior spaces by installing a gas detector in your bilge to warn you of a gas leak.

Since propane gas is heavier than air, always install the propane cylinders in a rack or locker on or above the weather deck, protecting the cylinders against wide changes in temperature, direct sun, and continuous dampness. That way, escaping gas will drain overboard. The locker or housing must be vented to the open air near the top and bottom for positive circulation of vapors. Also, protect all valves, pressure regulators, pipes and fittings against damage; and install cut-off valves at each appliance.

Clearly mark any cylinders containing compressed, liquefied or dissolved gases. Also, make sure that you are using the proper fittings for the proper application. Joints must be leakproof, and valves should always be closed when the cylinders are not in use.

If you must carry cylinders containing flammable or dangerous compressed gases below deck, stow those containing one type of gas separately from those containing another. Do not store combustibe materials, tools or objects not belonging to the gas distribution system in compartments containing such cylinders.

Do not use oils or grease on oxygen cylinders or fittings. Also, never use compressed oxygen in place of compressed air for starting engines or machinery.

2.4.9 Volatile Liquids

Do not store unnecessary volatile liquids on your vessel. Leave paint, lube oil, hydraulic fluids, and solvents ashore, if possible. If you do store volatile liquids aboard, designate one locker or storage area for them, remove all other flammables, vent the space to the air, and install a fire extinguisher nearby (Figure 2-12).

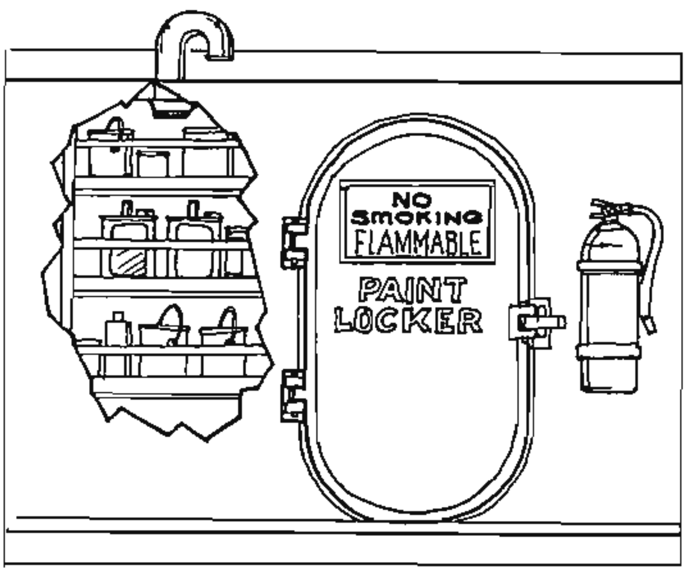


Figure 2-12. Storage areas for volatile liquids should be marked and vented, with a fire extinguisher mounted nearby.

Store volatile liquids in containers designed for the purpose, never in breakable glass containers. Inspect metal containers regularly for signs of corrosion, damage or leaks. Do not stow volatile liquids in the engine room, galley or living quarters. Do not store volatile or contaminating substances near the food supply, since you might taste them in your food.

2.4.10 Hot Surfaces

All hot surfaces should be insulated with non-combustible materials to prevent burns.

Construct and secure electric heaters to reduce the risk of fire. Cover heating elements, to prevent curtains and clothing from catching fire.

Do not use portable appliances such as kerosene heaters, since the open flame is too dangerous to have on a boat. Secure all heating stoves on the sides and the bottom. Insulate exhausts and uptakes, and clean them often to minimize the accumulation of soot. Even in the closed position, dampers should permit sufficient draft to minimize the buildup of combustion gases in the uptake. Ventilate spaces equipped with heating stoves enough to provide adequate air for combustion.

There must be sufficient ventilation to remove fumes and leaking gas where open flame ranges and water heaters are installed. All piping between the gas tank and the appliance should be steel or another metal. Also, make sure the automatic shut-off valves will work in case of flame failure or loss of pressure in the main gas pipe.

Do not hang clothing to dry unattended over a heater or stove.

Never use gasoline appliances.

2.4.11 Gasoline Engines

Gasoline propulsion engines require special precautions. Vent engine compartments properly before starting the engine. Correct fuel leaks immediately, close doors and windows during fueling to prevent the entry of fumes, and extinguish stoves, cigarettes and open flames during fueling. Gasoline engines must be equipped with backfire flame arrestors. Do not allow portable gasoline engines or containers inside the vessel unless in an emergency such as pumping the bilge. If you must have gasoline engines on board, store them on deck with a vented covering that will allow fuel fumes and spill to disperse into the air.

2.4.12 Watertight Integrity

By definition, a vessel must be watertight. Because a fishing vessel is fitted with numerous openings above and below decks, its watertight integrity is constantly dependent upon the vigilance and competence of its crew.

All openings must be closed and secured unless they are actually in use, and especially during threatening weather and sea conditions. The only way to ensure that the vessel is safe when danger or emergency strikes, is to pay constant attention to watertight integrity even in calm conditions.

Construction standards require that the number of openings through which water can enter the vessel be kept to a minimum, and that they be located as high and as close to the centerline as possible. All external openings should be capable of being made watertight by covers, coamings, or doors.

Report any defects in watertight or weathertight closures immediately.

2.4.13 Watertight Closures

Openings in the side of the vessel below the working deck should be minimum in number and located above the deepest waterline wherever possible. Closures on side openings must be watertight and as strong as the surrounding structure. Post notices at all such closures stating that they must be closed whenever they are not in use.

Regularly inspect and grease all closures and dogs to ensure that they are ready for use. Also maintain the gaskets in good condition (Figure 2-13).

The crewman who opens a watertight closure is responsible for ensuring that it is reclosed at the earliest possible opportunity.

The list of watertight and weathertight closures includes closures in watertight bulkheads; doors; covers over hatches, holds, manholes, lazarettes,

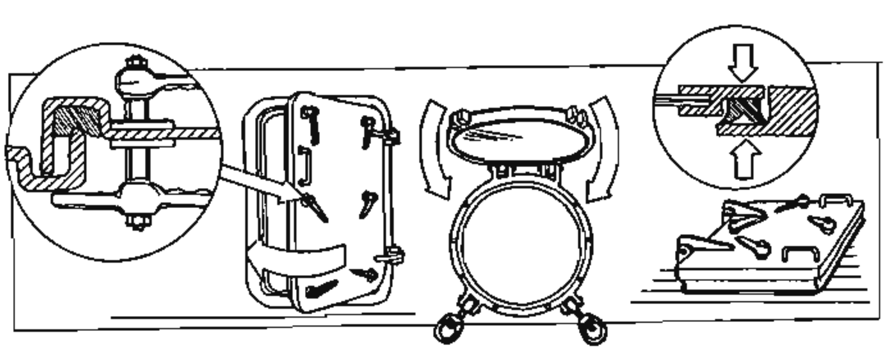


Figure 2-13. Be sure you know the location of watertight closures, and how to secure them.

ventilators or exhausts; and portholes, deadlights and pilothouse windows.

In addition, the vessel has numerous inlets and discharges that pass through the hull. Each should be fitted with a stop valve that is marked or tagged to show its function and means of closure. Check or non-return valves may also be fitted in discharge lines below the waterline. All valves and pumps should be clearly marked as to function. Operation of valves is the job of the captain and rigman, although each crewman should be familiar with the location and operation of inlet and discharge valves in case of an emergency.

If you feel that circumstances require that you operate valves on your own authority, report it to the captain at once.

Hatches and Hatch Covers

Make sure all flush hatch covers in the deck are watertight and easily handled by one person. They should be as strong as the surrounding deck structure. Raised hatch covers and doors should also be watertight. Hatch covers should be kept closed and secured at sea whenever loading operations are not underway. Mark the open and closed position of all dogs or fastening devices.

Exterior Doors

Openings between the main deck and the superstructures should have weathertight closures that can be secured from either side. They should normally be closed and secured, unless there is a specific reason for leaving them open.

Never permit deck loads or gear to interfere with the ability to close exterior doors. Always secure doors before the onset of heavy weather.

Wheelhouse

The wheelhouse should be weathertight. Windows should have deadlights or suitable storm shutters made of tempered or safety glass, lexan, or some other high-strength plastic. Wheelhouse doors should be capable of being secured weathertight, from either side, by one person.

Portlights

Portlights or portholes on or below the working deck should have watertight deadlights hinged on the inside. Keep them closed and secured unless there is a specific reason for leaving them open. Always keep them closed at sea.

Ventilators

Ventilators should have weathertight closures for storm conditions, and they should be as strong as the surrounding structure. The air supplying the engine should come from a high, protected area of the vessel that is close to the centerline. That way there is less of a chance of downflooding due to heeling or wave action.

Vents

Vents for tanks and living spaces should be close to the centerline, and they should have some type of closure for heavy weather, such as ball check valves, hinged closures, wooden plugs, or canvas hoods. Fuel oil tanks must have a way of equalizing air pressure when the vessel is secured for storm conditions.

Inlets and Discharges

Equip pipe discharges with automatic non-return valves and a readily accessible, positive means of closure at each point where the hull is pierced. All hull penetrations in unmanned spaces should have valves that can be operated from the deck. Place a tag on all valves stating their function and rig an indicator that shows whether they are open or closed. The whole crew should know how and when to close such valves.

Regularly inspect valves and pipes for corrosion and leaks. A rust streak on the hull underneath the through hull is the first sign of a leak.

Inlets and discharges in manned machinery spaces should be easily accessible, and they should have open and shut indicators. These spaces must also have alarms to indicate leaking water.

2.4.14 Watertight Bulkheads

Watertight bulkheads vitally affect the seaworthiness of the vessel. The whole crew should know the location and function of the watertight bulkheads in the event of hull puncture or failure. The vessel should have a watertight collision bulkhead forward that can not be fitted with any doors, manholes, or ventilation ducts. Pipes piercing the collision bulkhead must be fitted with screw-down valves that can be operated from the deck. The main machinery space should also be bounded by watertight bulkheads extending up to the working deck.

There should be a minimal number of openings in watertight bulkheads, and all their closures should be in good working order. Each crewman should know when and how to close them properly. Post notices on both sides of watertight closures stating when and how they must be secured.

Watertight closures below the main deck should always be closed and secured, unless there is some specific and temporary reason for doing otherwise.

Forepeak

Do not carry oil in the forepeak or forward of the collision bulkhead.

2.4.15 Lazarette

The lazarette is a special safety hazard, and has produced numerous fishing vessel casualties. Therefore, one crewman should be specifically responsible for its maintenance.

Inspect the lazarette frequently, especially before loading cargo on top of the hatch. Install water and smoke alarms, and test them during each inspection. Also check the steering gear and packing glands.

Have a good light in the lazarette, and make sure that all materials are firmly secured. Install screens on all the inlets and clean them frequently, and immediately remove any loose debris that could clog the pump or drain inlets. Operate lazarette drains from the deck if gear makes entry impossible.

Keep the gasket around the hatch cover absolutely watertight.

2.4.16 Freeing Ports or Scuppers

Freeing ports allow water to escape from the deck. Know where they are located, and keep them clean. Do not lock freeing port covers in the closed position when you are at sea; keep them in the open position in case you encounter icing. Regularly maintain and grease freeing port covers (Figure 2-14).

2.4.17 Bilges

The bilge and ballast pumping system must be able to drain any watertight compartment in all conditions. Install at least two power-driven bilge pumps, each with a separate power supply. One of the powered bilge pumps should have suction capability for the compartment where it is located. A portable bilge pump can be used in the space forward of the collision bulkhead, provided it is capable of draining the compartment.

The bilge and ballast system must prevent seawater or ballast water from passing between holds and machinery spaces, and from moving from one watertight compartment to another.

Keep bilge pumps in good working order, and bilge water kept to a minimum. Test bilge pumps and piping systems at least semi-annually, if they have not been in regular use.

Turn all bilge seacocks to the "off" position as soon as the bilges are pumped. Do not leave seacocks in the open position while the vessel is unattended, or while the crew is sleeping. Clearly label and color-code seacocks according to their use.

Lead all bilge suction lines from the engine room, shaft alley, and lazarette to a central manifold, and equip them with accessible check valves to protect against accidental back flow. The bilge and wash down systems should be separate. Never leave deck hoses hanging overboard where they could siphon water back into the vessel. Inspect suction screens frequently and clear them of any obstructions.

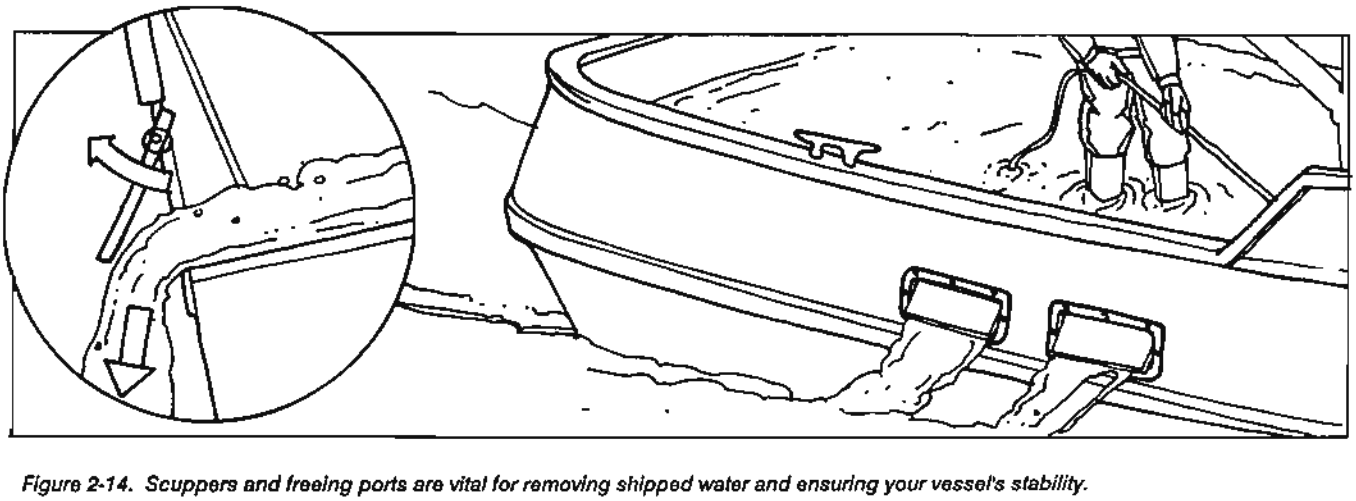


Figure 2-14. Scuppers and freeing ports are vital for removing shipped water and ensuring your vessel's stability.

Install a bilge alarm system with water-level sensor units in the engine room, shaft alley and lazarette. It will activate an alarm if the water rises beyond a preset level. Check the alarms before each trip to make sure they are in working order (Figure 2-15).

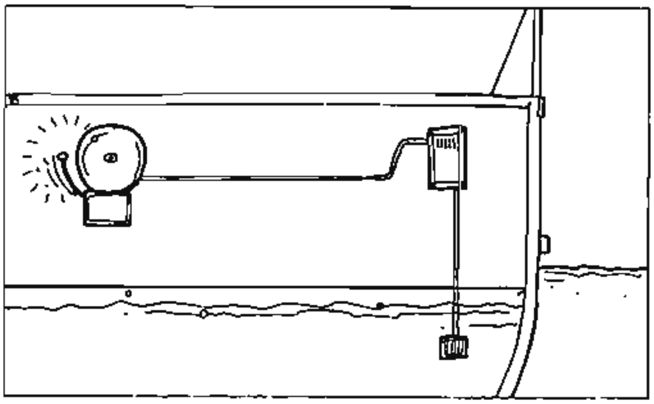


Figure 2-15. Bilge spaces should be fitted with alarms that warn if water rises above pre-set levels.

If a bilge line pierces a collision bulkhead, it should be fitted with a screw-down valve at the bulkhead. It should have either a remote control closure from the weather deck, or it should be installed on the after side of the bulkhead, where you can reach it under all conditions.

Only the captain and engineer should operate the bilge pumps, and no one else. However, each crewmember should know how to operate them in case he is alone or there is an emergency.

Keep bilges free of oil. If there is a spill, pump the bilge into the holding tank. Fishing vessels are subject to Coast Guard pollution prevention regulations (see Pollution Requirements in Appendix).

2.4.18. Confined Spaces

Spaces that have limited access and poor ventilation can develop toxic or asphyxiation hazards. Such spaces may include cargo holds, tanks, machinery spaces, fish holds and lazarettes. They should be clearly marked and assumed to be dangerous until proven otherwise. For example, asphyxiation (death by suffocation) in fish holds has killed at least 40 fishermen in the past 15 years.

Spaces that contain refrigerants or chemicals may be especially dangerous because of toxicity. Similarly, if a CO_2 or Halon fire control system is discharged in the engine room, oxygen will be displaced and you must get out immediately.

If you are going to paint in a confined space, fix a means of ventilation and wear goggles and a filter type respiratory mask.

If you have any reason to suspect a toxic or asphyxiation hazard, report it to the captain and stay away from the area.

All confined spaces should be assumed to be dangerous unless proven otherwise. Death and injury can be prevented by making everyone aware of the danger posed by confined spaces, and by taking precautions as outlined below:

* *Test* the space if you have appropriate instruments. Test for oxygen sufficiency as well as toxic or flammable vapors.
* *Ventilate* before you enter and while you remain in the space.
* If there is a hazard, continue *retesting* and *ventilating* until the space is safe.
* If no means of ventilation is available, wear a *self-contained breathing apparatus* (SCBA) in the space.
* Have a rescue plan ready in case someone collapses in the space. Don't follow a collapsed victim into a confined space without an SCBA or safety line, or there may be two victims.

Although adequate ventilation will usually make a space safe to enter, it is always advisable to test the atmosphere in the space before entering unless you have an SCBA.

Equipment

Vessel owners may wish to consider outfitting their vessel with some of the equipment listed below. Depending on the vessel type and size, number of crew members and location of operation, some of this equipment may be required by the Fishing Vessel Safety Regulations.

* Portable blowers (preferably explosion-proof).
* Self-contained breathing apparatus (SCBA).
* Oxygen sufficiency meter.
* Combustible gas indicator.
* A meter or colorimeter detector tube kit for each toxic gas that can be expected to be found on board.

Lack of Oxygen

Normal fresh air contains about 20.9% oxygen by volume. Oxygen is consumed by internal combustion engines, by persons breathing in the space, and by chemical reactions such as the formation of rust or the action of bacteria as they decompose organic material like fish products. Oxygen can also be displaced by other gases that may be either heavier or lighter than air. These gases can be particularly dangerous because they can exist in invisible pockets within a space.

There are many devices available on the market which allow you to measure the amount of oxygen in a space. Any space containing less than 19.5% oxygen should not be entered without a SBCA. Oxygen content of less than 20.9% indicates the existence of another gas which is displacing the oxygen. It is advisable to continue ventilating any confined space until the oxygen content is approximately 20.9%.

Nitrogen dioxide

Nitrogen dioxide is a brown non-flammable gas with a pungent odor. It is present in the exhaust of internal combustion engines. It causes severe irritation to the skin and eyes. It reacts with moisture to form nitric acid; it is extremely toxic and acts principally on the respiratory tract.

Sulfur dioxide

Sulfur dioxide is a colorless non-flammable gas with a strong, suffocating odor. Small amounts of this gas are present in the exhaust of internal combustion engines. The use of excess sodium bisulfite to prevent blackspot on shrimp has been linked to the formation of this gas. Sulfur dioxide reacts with moisture to form sulfuric acid. Exposure causes irritation of the eyes and lungs with severe choking.

Hydrogen sulfide

Hydrogen sulfide is a very toxic, colorless, flammable gas with a characteristic rotten-egg odor. Concentrations as low as .1% (1000ppm) can be lethal. In large concentrations, the gas quickly desensitizes the nostrils and cannot be smelled. It is found in many mineral waters and is also formed by the rotting of fish products and other organic materials. It acts as a poison by inhibiting the ability of the body's cells to absorb oxygen. Exposure to this gas in high concentrations can cause immediate coma, convulsions, and death from respiratory failure. Symptoms of sublevel dosages include headache, dizziness, excitement, nausea and diarrhea.

Sodium bisulfite

Shrimp are often treated with sodium bisulfite, commonly called dip, prior to storage on board the vessel in order to prevent the formation of blackspot.

Dip should always be made up and used on deck, never in the hold. Even more dangerous is the practice of sprinkling dry powder on shrimp stored in the hold. This not only leaves most of the product unprotected, but also can result in the production of toxic gases, thereby endangering the crew.

Always use bisulfite as a dip at the recommended levels of 1.25% solution for ice boats and 0.75% solution for freezer boats which incorporate the chemical into the brine.

Carbon monoxide

Carbon monoxide is a colorless, odorless and tasteless flammable gas that is formed from the incomplete combustion of carbon. Gasoline or diesel engines are common sources of this gas. It binds with hemoglobin in the blood and interferes with the ability of the blood to carry oxygen to the body's cells. Symptoms of exposure include headaches, dizziness, drowsiness, nausea, vomiting, collapse, coma and death.

Ammonia

Ammonia is a pungent colorless gas which is very soluble in water. It is sometimes formed during the decay of fish products. Ammonia is used in some refrigeration systems. It is irritating to the eyes, nose and moist skin. Other symptoms of exposure include headaches, burning in the throat, loss of ability to smell, nausea, vomiting, swelling in the throat, respiratory arrest and death.

The gases listed below have no toxic properties but they act by displacing oxygen.

Carbon dioxide

Carbon dioxide is a colorless, odorless gas which is produced by normal breathing and the decay or combustion of organic matter. It is a major problem in the fishing industry because it begins to form shortly after the fish die. Dry ice is frozen carbon dioxide and can also be a source of this gas in fish holds. It acts as a simple asphyxiant; that is, it displaces oxygen, causing death by oxygen deficiency. Since carbon dioxide is heavier than air, it will form in pockets at the bottom of the tank or fish hold.

Methane

Methane is a colorless, odorless flammable gas. Methane acts as a simple asphyxiant in addition to being highly flammable. Methane is lighter than air and will rise to the top of a compartment.

Methane (also called swamp gas), and in some cases, hydrogen sulfide, are formed by the decomposition of fish products or other organic materials. Hydrogen is formed in lead-acid batteries as they are charged.

Among the dangers posed by these gases is the formation of explosive mixtures in air. The introduction of a flame or spark into a confined space filled with combustible gases can be disastrous.

There are combustible gas meters available to measure spaces for the existence of explosive mixtures. These meters usually have direct readouts expressed in terms of percent of the *lower explosive limit* (LEL).

The lower explosive limit is that percent by volume of a particular gas that will form an explosive mixture when mixed with air. Any space which contains greater than 10% of the LEL should not be entered without further ventilation and testing.

Freon

Freon is widely used as a refrigerant and aerosal propellant. It can also act as a simple asphyxiant. When exposed to extremely high heat, it decomposes into highly poisonous phosgene gas and related compounds. Freon is heavier than air and will sink to the bottom of a compartment.

Tips for Working in Confined Spaces

* Don't enter a confined space without telling the captain. Use the buddy system if you suspect a hazard, and have a safety line and self-contained breathing apparatus (SCBA) at the ready (Figure 2-16).
* Fish holds should be cleaned as soon as possible after off-loading. Attempt to use clean seawater. Do not use water known to contain a large percentage of sewage or waste.
* Equipment that could create heat or sparks and pose an explosive hazard in a confined space should be shut off at the electrical power supply whenever an explos-

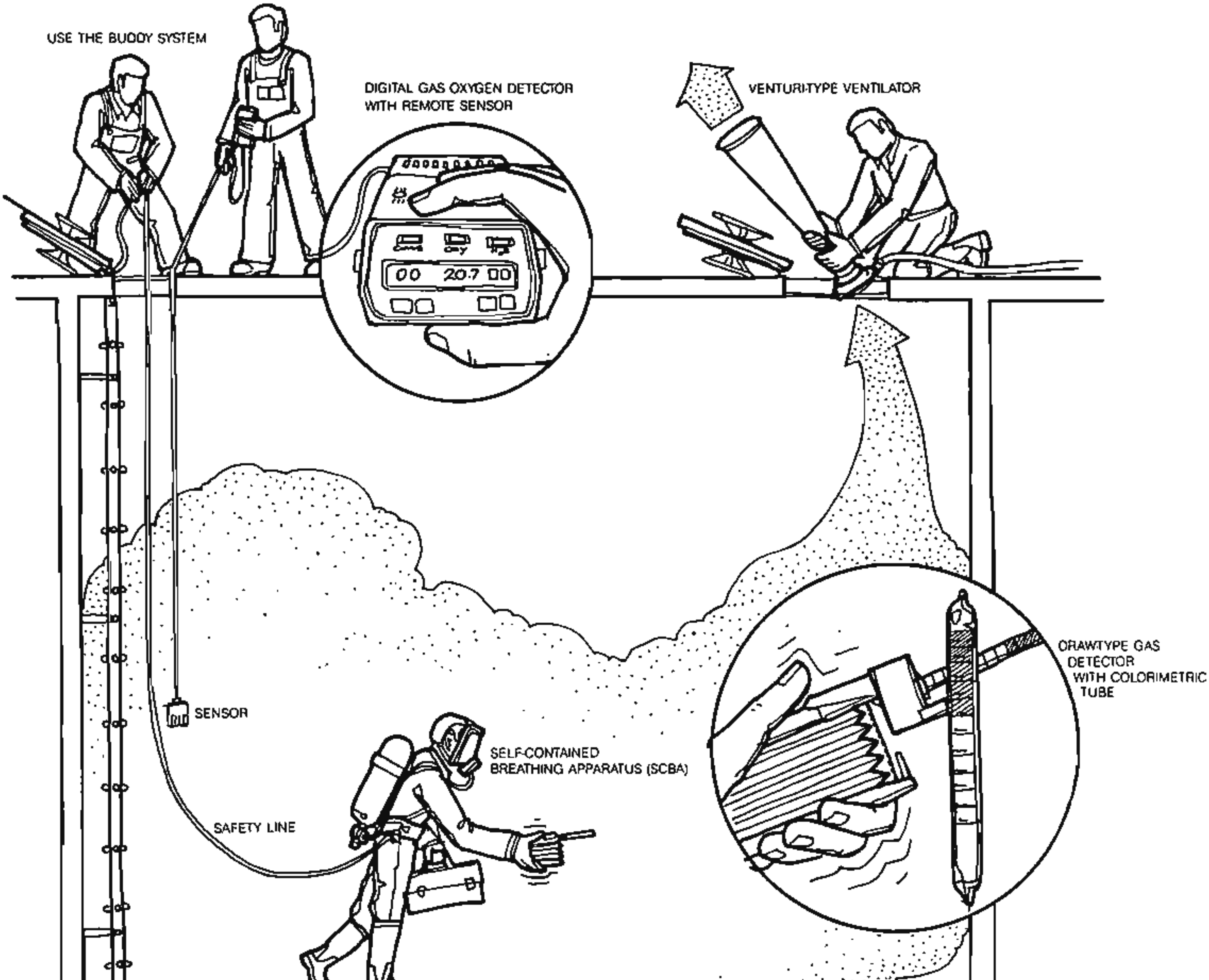


Figure 2-16. Investigating a confined-space hazard. The space must be tested by means of a remote sensor or by a crewman equipped with an SCBA. Ventilators must be explosion-proof or intrinsically safe. The type pictured above is operated by means of compressed air and poses no explosive hazard.

ive hazard exists. A tag should be placed on the power supply warning personnel not to re-energize the equipment.

* Internal combustion engines should only be used in a confined space when there is adequate ventilation. Exhaust from these engines should always be vented out of the vessel.
* Exhaust piping should be inspected regularly for leaks.
* Ventilate spaces using blowers or other methods of forced ventilation. Blowers should be explosion-proof. The length of time needed to exchange the air in a space depends upon a number of factors including the size of the space and capacity of the blower.
* Test the space for oxygen content and the presence of combustible or toxic gases if you have the equipment. Continue testing as long as personnel must remain in the space. Disturbing a pool of sludge or chipping rust can reintroduce hazardous gases or displace oxygen.
* Continue to apply forced ventilation while personnel are in the confined space.
* If you must enter a space that has not been ventilated and tested, wear an SCBA and safety line. Make sure someone else is standing by outside the space in case you must be rescued.
* Crewmen working or painting in confined spaces that have been tested and ventilated should still consider wearing respirators.

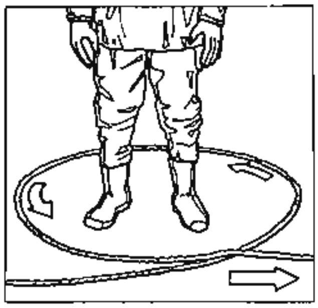


Figure 2-17. Stay out of the bight.

Never stand in the direct line of pull when a rope or wire is under tension, in case it breaks and snaps back (Figure 2-18). Generally, rope or wire snaps back with a corkscrew motion, so the danger zone extends to either side of the direct line of pull.

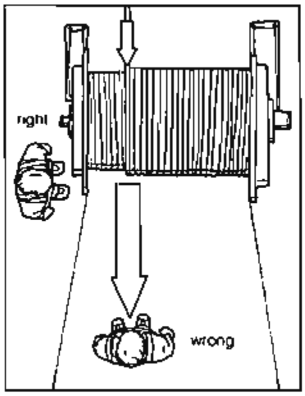


Figure 2-18. Stay out of the line of pull.

2.5 Safety in Fishing Operations

2.5.1 General Deck Skills

Trawling, dredging, and any other mobile gear fishing is extremely dangerous because of the heavy gear that is handled under a variety of sea conditions. It takes years of fishing to become a skilled deckman. However, even an experienced deckman must follow basic safety measures. What follows is merely an introductory list:

Learn the signals used aboard your vessel for communicating between the deck and bridge. Stay in your area. Stand clear of outrunning gear.

Never start a job until the captain gives the signal.

Do not stand on nets or gear when part of it remains in the water, and never stand in the bight of a line (Figure 2-17). Be careful when you clear fouled gear, and don't use your hands to clear a line from a fouling point, since there may be a sudden strain put on the line.

Lines under tension may be subjected to sudden shocks or strains that cause them to bounce violently up and down. Never straddle or step over a line or wire under tension. Similarly, never try to pass underneath a loaded wire.

It is advisable to wear gloves when you handle wire rope, and watch out for "fishhooks" or "thorns" (broken wires that stand up from the rope).

Stay out from underneath loads suspended in the air and keep in mind that suspended cod ends or other loads become battering rams in rolling seas. Don't stand between a load in the air and a rail, stanchion or any solid object against which you could be crushed. If you're the man at the controls, never pass a load over another crewman.

Always try to anticipate what could go wrong with loaded gear and keep a hiding place in mind. Ask yourself, "if that block fails, where is the wire going to go?" Similarly, keep safe handholds in mind so you can grab for them automatically if you must clutch for support. Never use running gear as a handhold.

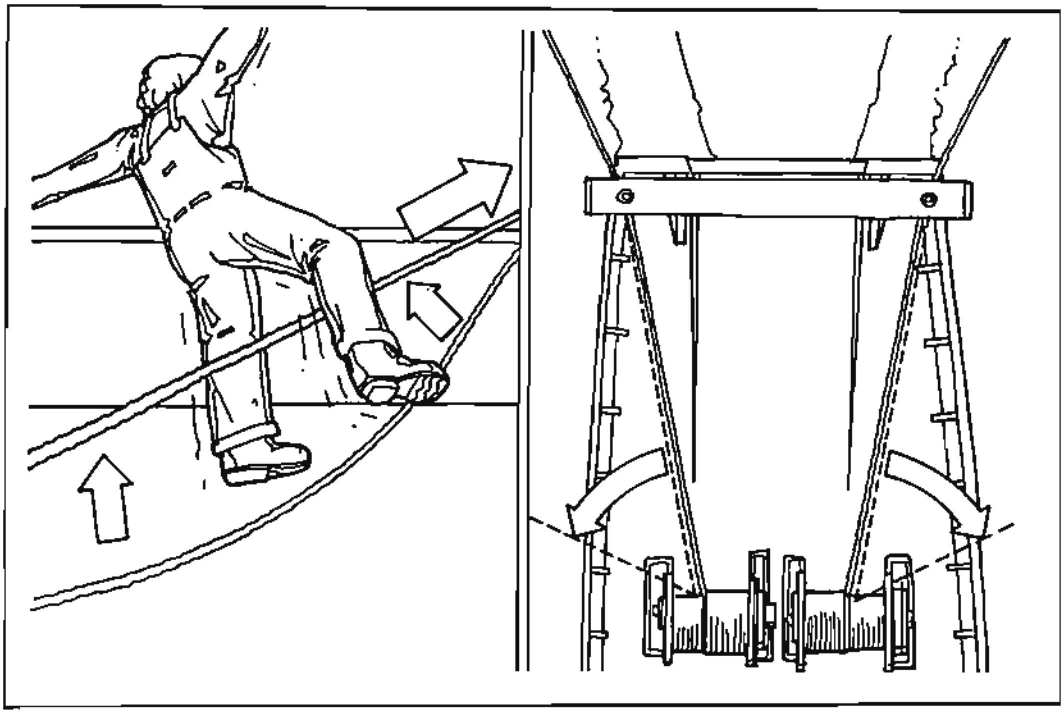


Figure 2-19. Beware of danger zones and watch out for unexpected strains when the gear is out. If a trawl block gives way, for example, the wire may sweep sideways.

In addition to paying constant attention to running gear and suspended loads, each deck man must keep a "weather eye" and be ready to drop the gear and grab a safe handhold when the vessel rolls suddenly, or when a wave comes over the rail.

Be alert to unexpected strains when the gear is fouled on the bottom, and remember that gear can foul at any time before it is all aboard.

If the gear suddenly comes free, lines can snap or sweep sideways, or bounce violently up and down (Figure 2-19).

Be careful of fish or other objects that may come up in a net. Wounds from fish spines should be treated immediately to prevent blood poisoning (See section 12.13.3).

Working with heavy equipment such as trawl doors or large nets requires skill and attention. Don't attempt to work doors and nets before you have been given specific instructions.

If your clothing gets caught in the gear, cut it free immediately. If you have to cut a line, be sure to cut the outboard end (Figure 2-20).

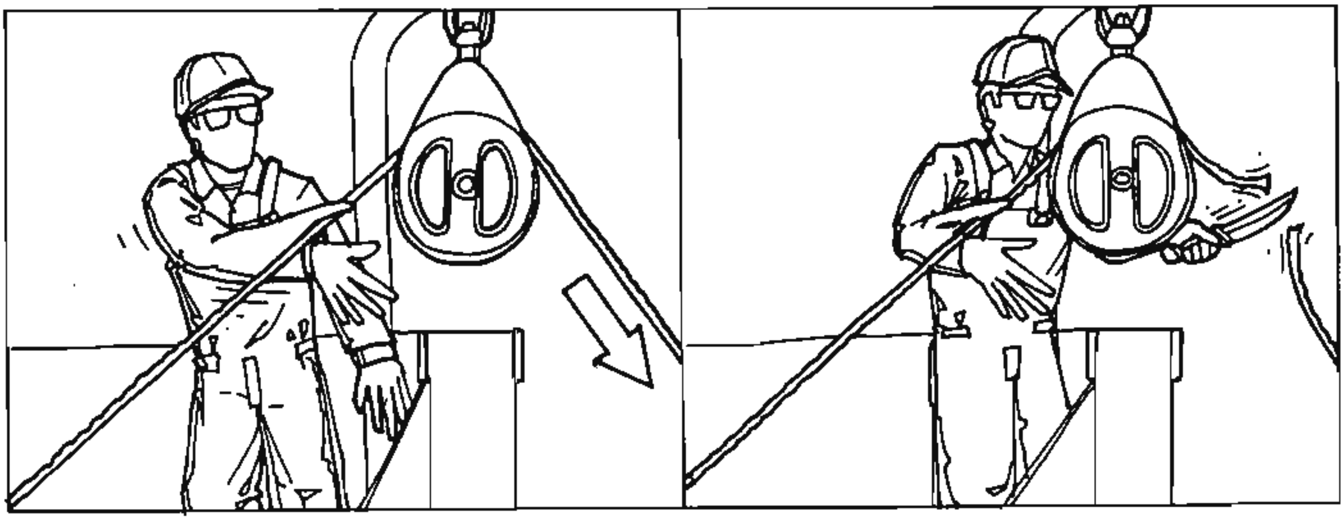


Figure 2-20. Cut the outboard end of the line if you're caught. Otherwise you'll be pulled into the block.

Beware of the danger of working in the vicinity of a trawler's stern ramp, and use a personal flotation device (PFD) and safety line if you have to go down the ramp or out onto the cod end.

2.5.2 Lifting Operations

Whenever weights are to be lifted by means of cranes, booms, tackles, topping lifts or other appliances, consult the manufacturer's tables to determine the strength of the wire used in the standing and running rigging, and never exceed these loads. Inspect all rigging frequently, replacing worn parts and performing preventative maintenance as specified by the manufacturer.

A lifting appliance is only as safe as its weakest part.

The rating (e.g. 12 tons) on a telescoping crane assumes that the arm is fully retracted and that the crane is angled at 70 degrees or higher off the deck (nearly vertical). The rating does not mean that the crane is capable of lifting that much weight with the arm extended and the crane at a low angle.

In any weight handling operation, speed should be subordinated to safety and smoothness of operation.

Jerky movements put enormous strain on the standing and running rigging and can cause seriuos accidents. The greatest force must be applied at the time of starting a load, in order to overcome inertia. The force must be applied gradually to avoid exceeding the safe working load. Speed may be increased once the load is moving.

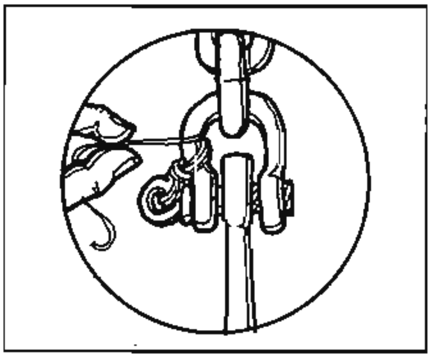
The operator should be an experienced hand. He bears the responsibility for the safety of the rest of the crew: he can kill. If he can't see the working area fully, he should be directed by *one* competent observer using hand signals, not by the entire crew.

Shackles

Shackles are used to connect objects; one wire eye to another, a sling to a load, a hook to a block or a hook to a wire rope eye. A rough formula for determining the strength of old (unmarked) shackles: safe working load = 3 x diameter squared (for a one-inch shackle, 3 x 1 squared or 3 tons). Newly manufactured shackles are marked with the safe working loads they are capable of withstanding. Do not use bolts in place of shackle pins since bolts have a wide range of breaking strengths.

All permanently attached shackles should be the locking type or should be "seized" or secured against accidental opening (Figure 2-21).

Figure 2-21. Seizing a shackle.



Hooks

Hooks are used to attach the load. Because of its open construction, the hook is usually the weakest part of the lifting rig. Safety hooks should be used whenever possible. For unmarked hooks, safe working load = 2/3 D squared, where D is the diameter at the back of the hook below the eye. Like shackles, new hooks are stamped with their safe working loads. For heavy loads, substitute shackles, which are five times as strong as hooks of the same wire diameter. Safety hooks should be "moused", or secured, if there is danger of a sling popping out.

Swivels

Swivels should be inserted in the rig wherever a twist is possible. Swivels are somewhat stronger than shackles of the same size.

Blocks

Blocks are frames of wood or steel fitted with one or more sheaves (pulleys). They are designed as single, double or triple depending on the number of sheaves. The size of a block is determined by the circumference of the rope to be used with it. For fiber rope, the size of the block, measured as the length of the cheek in inches, should be three times the circumference of the rope. The diameter of the sheave should be twice the circumference of the rope. For example, for a 3-inch rope, use a 9-inch block with a 6-inch sheave.

Blocks for wire rope are not as well standardized. Follow the manufacturer's specifications as to sheave diameter and the speed at which the wire may be safely passed through the block. Otherwise, the life of the wire will be considerably shortened by bending and straightening. As a rule of thumb for wire rope, use a sheave diameter at least 15 times the diameter of the rope.

Tackles

Tackles are arrangements of ropes (falls) and blocks for the purpose of multiplying force. To *reeve* is to pass the ropes (falls) around the sheaves of the blocks. The *standing part* is the end made fast to a block. The *hauling part* is the end to which force is applied. To *overhaul* is to seperate the blocks. To *round in* is to bring the blocks together. The blocks are *chock-a-block* or *two-blocked* when they are tight together.

Chain Hoists

Chain hoists are ordinarily constructed with the lower hook as the weakest part, so the hook will start to spread before the hoist is overloaded. Any evidence of spreading or wear on the hook is cause for replacement. Any distortion of the links in the chain means the lift has been overloaded and is probably unsafe for further use. Under ordinary circumstances, the pull exerted on a chain hoist by one or two men will not overload it.

2.5.3 General Lifting Precautions

* Fiber lines should be checked for signs of excessive wear, fraying, rot and dryness.
* Components must be of sufficient size to accomplish the task and should be inspected regularly.
* Wire rope should be examined for fish hooks, badly worn areas, and kinks. Badly worn wire ropes should be replaced.
* Wooden blocks should be inspected for cracked or rotten cheeks or sides, worn pins or cracked or badly worn metal parts.
* Shackles, swivels, metal blocks and hooks should be inspected for cracks, distortion, excessive wear or metal fatigue.
* If one part of a lifting appliance gives way, the force may weaken or destroy other parts.
* Heavy weights should never be allowed to drop no matter what the distance. They should be lowered to rest and secured to prevent rolling or sliding. Never keep a load in the air any longer than necessary.
* All motions with heavy weights should be slow to avoid creating momentum.
* Avoid sudden shocks or strains and beware of side pulls. Side play puts great stress on a boom or crane.
* Avoid dangerous positions: standing under a load, standing in a bight, or standing in the line of pull of a taut rope or cable that might give way (Figure 2-22).
* Special precautions are necessary in wet, slippery conditions.
* Specifications provided by the manufacturer apply to new equipment. Actual safe working loads of worn equipment may be far less.
* Stay out from under booms and cranes while lifting operations are in progress. Keep the deck clear of obstructions and lines. A clean, orderly deck provides the safest working conditions.

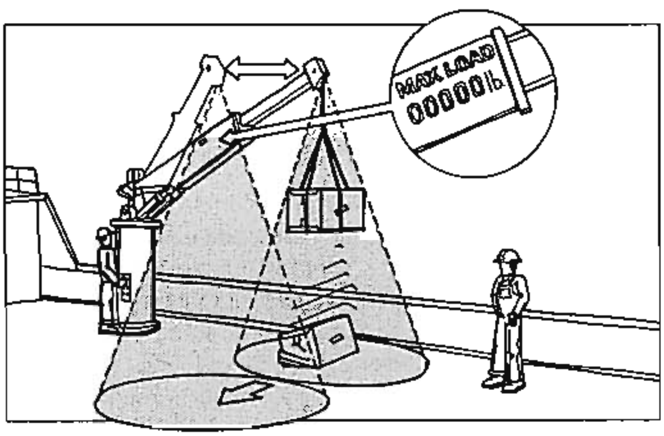


Figure 2-22. Staying out from under the load means staying out of the possible radius of swing.

* Stop, look and listen. While a load is being moved, keep every part of the rig under observation. Listen for changes in sound. A wire or rope normally hums under strain. If it starts to squeak or squeal, watch out. A faulty block may give warning by squeaking or groaning.
* If you're the operator, don't pass a loaded boom over a crewman.
* No unnecessary personnel should be in the area.
* Avoid swinging the load. If you're lifting something off a dock, drag it until the load is directly under the head of the crane or boom.
* Attach steady lines to heavy or unwieldy loads, and know where you can throw a quick hitch in case of trouble.
* Don't stand between the load and fixed objects. Always face the load and keep hands and feet in the clear. A heavy trawl bag in a rolling sea becomes a wrecking ball.
* Never slue a boom when the load is topped up high because of the stress imposed on the gooseneck. Keep crane booms sucked in as tight as possible.
* Check guys and rigging for wear including broken wires and wear in the eyes and thimbles.
* On booms, check the boom lift, the boom guys and the gooseneck. Inspect blocks and lift ropes. Inspect the lift itself for wear, chafe and other signs of deterioration. Boom guys must be in good shape to prevent boom "runaways" and the potential for serious accidents. Inspect goosenecks for wear. On vessels such as trawlers that use the equipment continually, such inspections should be carried out monthly.
* If you are operating a winch or hoist, be sure everyone is clear of the danger zone before applying a load, and never leave the equipment unattended when it is running or when there is a load in the air.
* Make sure snatch blocks are closed and properly latched when used.

• Be sure the area around the controls is unimpeded, and that your view is as unobstructed as possible. Before each operation, test the control handles to make sure they return *automatically* to the neutral or stopped position.
• When using a "cathead" to lift anchors or rigging, never use frayed whip lines which can overlap and continue wrapping. If this occurs, shut off the winch to take the strain off the whip and untangle the line off the cathead,
• Never use two catheads for one line because you have no control for slippage when slacking the line.
• Those on the working deck in the area where loads are lifted over shoulder height, should wear hard hats.

Hand Signals

Where verbal communications are impossible or are likely to be interferred with by other noises, the crew should utilize a standard set of hand signals (Figure 2-23). Where the winch operator doesn't have a clear view of the load, one competent crewman should give signals, not the whole crew,

2.5.4 Trawling

Trawl Wire

Do not guide trawl wire or other types of running wires with your hands, feet or hips. The force you can apply won't affect wire under thousands of pounds of load, and you could be seriously hurt. If your boat is equipped with a cable guide, use it, and make sure of your footing (Figure 2-24). If you fall into running wire, you could be carried into the winch. Be aware of bridles, shackles and fittings that can catch the guide and create sudden movement.

As far as is practicable, do not lead wire or line close to, or over the heads of, crewmen in their normal work stations.

Never work on operating machinery. It must be stopped and rendered incapable of accidental restarting. When repairs are underway, tag the controls to alert other crewmen that the equipment is not to be restarted until the work is complete.

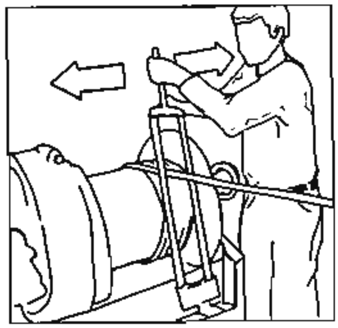


Figure 2-24. Cable guides keep hands and feet away from moving winch cable.

Trawl Doors

Since trawl doors are bulky and heavy, handle them carefully, especially in rough weather. Store the doors in their own storage racks, and make sure they are secured with safety chains (Figure 2-25). Take care to avoid crushing injuries when working with trawl doors at the stanchions. Remember that a trawl door storage rack can either protect or crush you.

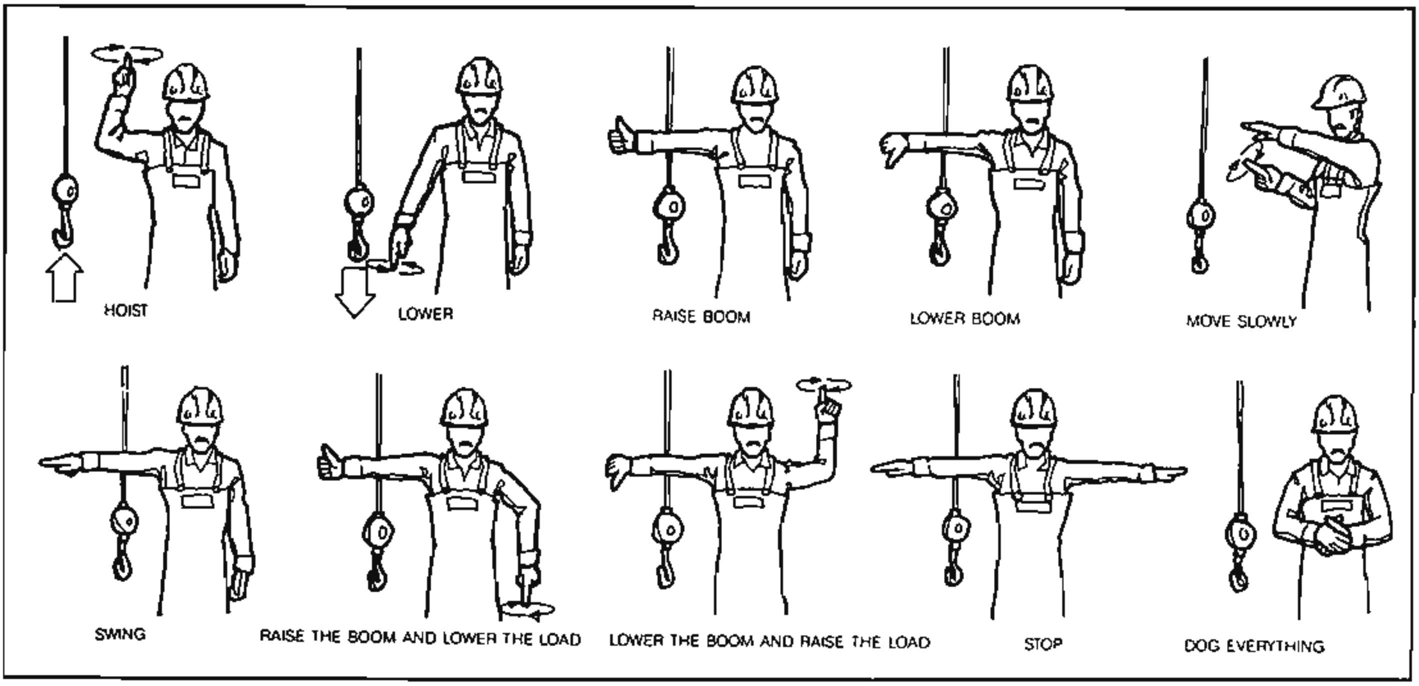


Figure 2-23. Hand signals for use in directing winch or crane operators.

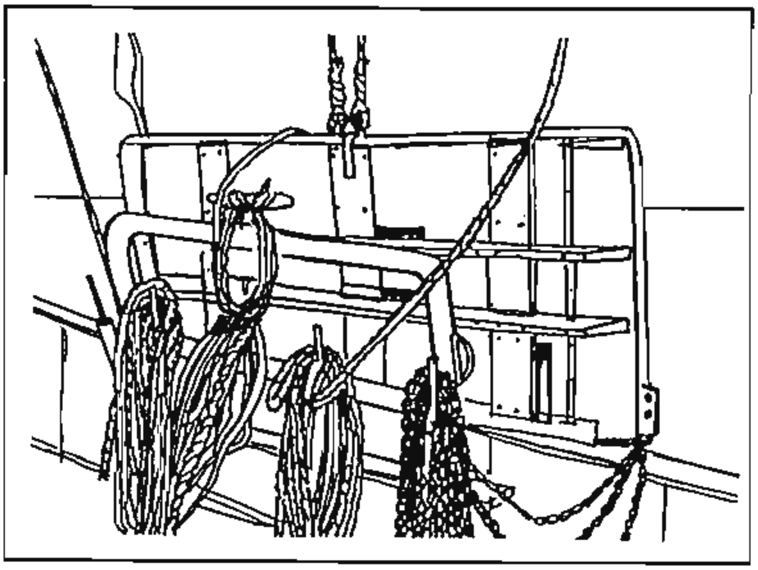


Figure 2-25. Secure trawl doors on racks to ensure they do not break loose in heavy seas and cause serious injury.

Set trawl blocks at the correct height above the deck, otherwise the doors can swing inboard and endanger the crew under heavy sea conditions (Figure 2-26).

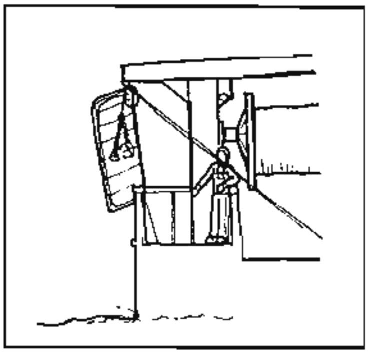


Figure 2-26. Beware of hazards posed by trawl doors.

The man at the rack and the man at the controls must coordinate their actions while hauling back and detaching the trawl doors.

Wait until the doors are completely hauled back before moving to the trawl racks, because shock loads on the trawl gear can cause the doors to bounce inside of the rail. Do not stand under a door. As soon as a door has been hooked to or unhooked from the trawl gear, move out of the radius of it's swing.

Rig doors with safety chains to prevent them from swinging inboard, and in case an eye wears out and a trawl block fails. Never leave the doors hanging only by the trawl warps when the vessel is underway, but support the secured doors by keeping tension on the main trawl cables.

Repair the doors only when they are securely stowed in their racks.

2.5.5 Dredge Gear

Like trawling, dredging operations involve heavy gear which has to be hauled up, brought aboard, emptied and set out again. A large scallop dredge weighs over a ton. Because dredge boats sometimes fish in rough weather, the dredge swings and slides easily.

Crushed body parts and back strain are common on dredge vessels, due to the weight of the dredge and the rocks that come up in it. The dredge stops, camel, hatch, and rail are areas where the dredge is particularly prone to catching a man.

Be especially mindful when a boat is working its gear, and always keep clear of the dredge boarding area.

When the scalloper is steaming, use the safety straps to secure the dredge. In rough weather, shackle down the dredge to prevent it from knocking into someone if it starts to slide.

Stand clear as soon as the winch is engaged to haul back, because of the danger of being pulled into the winch by a loose thread of clothing. When the dredge reaches the gallows bollard, the hook-up man will place the cargo hook in the bull ring, making sure there are no turns in the tackle wires.

On an eastern rig scalloper, the man should be ahead of the forward gallows. Be careful, because just as the dredge comes over the caprail, the hook can fall out and either fall on deck or overboard.

The way you empty the scallop dredge depends on the type of dredge. Maine style dredges are emptied from the bottom of the bag by opening the clubs with a hasp-type latch. The whole dredge assembly is hoisted overhead, and the catch is emptied directly into the dumping box, whose bottom is at waist level.

On a New Bedford style scalloper, the dredge is hoisted aboard with the bail standing straight up in the air, resting against the rail. The dredge is broken down by hand, leaving the crewman in a position to pull the drag on top of him if he isn't careful. He should, therefore, have his head up to watch the cargo hook and make sure it stays in the bull ring.

As the gear is broken down, it is critical for you to stay on your own side of the deck. There is a tendency to move around to a better pulling position, obstructing your view of the other crewmen. Putting the dredge down in a "blind" area could crush a crewman's leg.

Although the procedures for re-setting the dredge vary, there are always dangers. Someone usually has to step inside the bail of the dredge to place the cargo hook in the ring on the dumping chain. It is best to be on top of the dredge, in case it starts to slide. That way you slide with it, and it doesn't slide into you. Never straddle the chains or wires, because they can snap taut unexpectedly.

Rocks on a rolling deck are dangerous to both man and vessel; use slings and hoists to remove them. Do not jeopardize your extremities to save a scallop.

2.5.6 Lobstering

Lobstering is physically demanding. Crewmen are often required to be on deck for twenty hours at a time, with only short breaks while the boat is steaming to the next string of gear. Offshore traps weigh 100 pounds or more when water-soaked; and you will need strength and skill to maneuver them across the deck, and stack them in rough weather.

The new crewman on an offshore boat is usually given the job of banding lobsters. Don't underestimate the power of a lobster or crab claw; even a small one can cut your finger - a large lobster can crush it.

When hauling gear, pay constant attention to the hydraulic hauler. If the line pops out of the sheaves, and isn't put back in immediately, line will begin paying back out through the snatch block. This is *very* dangerous. Also be careful when you place the line into the hauler - if your fingers get caught, they may be crushed or severed.

Traps should be stacked and tied down in rough weather.

Setting gear is the most dangerous operation in lobstering. Offshore boats have fifty to sixty traps on deck with hundreds of fathoms of line flaked across the deck and down below. Usually only one man works back aft during this operation, but there should be someone standing by to assist or notify the helmsman if anything goes wrong.

As in any deck work, stay out of the bight of the line, keep out of the way of gear sliding off the deck, and *pay attention*. If only takes a few seconds for that neat stack of gear to turn into a giant nest of traps, lines, and high flyers racing across the deck. If this happens, get out of the way until things have quieted down.

When you handle some types of lobster bait, especially redfish, and you have punctures or scratches on your hand, you are vulnerable to bait poisoning (also called blood poisoning). Symptoms include a very painful spot on your hand and a red streak running up your arm. See section 12.13.3 for more information.

2.5.7 Fouled Gear

Maneuvering on a hang

First, get the men off the deck, and use pilothouse controls if you have them. Have the crew inside, dressed in their oilskins and ready to go.

Step 1 - With the boat out of gear, use the winches to see if you can lift the gear.

Step 2 - If the gear remains fast, steer a course opposite to your course when your gear became entangled, paying out all cable but the last full drum wrap (never go below the last wrap, because cable anchors alone are never strong enough to hold the gear.) With only one wrap, the cable will bite into the drum, rather than cutting into itself.

Start pulling at half-speed for at least 15 minutes.

Step 3 - If the gear remains fast, slowly increase the throttle to full speed.

Step 4 - If the gear remains fast, retrieve the cable until the vessel is over the gear. Return to the original course, taking care to make the turn in the direction that untwists the gear (the first turn has caused a half-twist). Also take care not to foul the propeller.

Attempt Step 1 again.

Step 5 - If the gear is still fast, start a sawing action by taking tension on one drum, while the other is slack and vice versa. You've got to "saw off" the tangled cable. Don't waste all day. Saw the tangled cable, lick your wounds, set another net, and keep on fishing.

Be sure to take a reading on the hang so you don't hit it again.

Two Boats With Crossed Gear

Keep calm. Two hot-headed captains will make matters worse.

Normally, the vessel whose gear is on top tries to free itself first. If you cannot determine whose gear is on top, which often happens in the fog, then the vessel with the more powerful winches will attempt to untangle both sets of gear.

If you have to cut the cable, do it as close as possible to the trawl door of the other vessel.

Crossed Doors

Simple half-cross - one door is over another but you're not sure which. Retrieve the cable until (water depth allowing) the gear is off the bottom. Use approximately 15 fathoms of main cable between the trawl blocks and the doors.

Try alternating lifting each door about five fathoms, and return it to the same mark. Simply lifting each door may free you, but don't lift to the block or you'll tighten the twist.

Outboard Maneuver

If the doors remain crossed, lift one side while slacking the other until you can count the number and direction of turns of the slack cable ahead of the other trawl door.

Keeping in mind the direction of the turns, lower both doors to 20 to 25 fathoms on an equal setting. Engage the propeller and put the rudder hard over in the direction that will undo the cable turns, and make sufficient turns (plus an extra half-turn) around the gear to free the tangle. The extra half-turn compensates for gear rotation that will occur as you make the turns.

If that doesn't work, secure the door (on the cable with the twists around it) to the stanchion with a chain heavy enough to support it. Rig a stopper on the cable. Uncouple the main towing shackle very carefully, remove the shackle from the splice, and pull the splice through the twists. Use the main winch if necessary.

Crew injury is most likely when you slack the cable to pull the eye through - the captain always did this on the old boats.

Note: inhauls or gilson winches are ideal for keeping a strain on the twisted cable. Use inhauls rigged through a block and padeye from the gantry. Don't use the crane, because a surge will bend the boom.

Inboard Maneuver

On ramp trawlers with clear ramps and two inhauls, pass the inhaul through the ramp and shackle it into the towing shackle on the raised door (the door on the stanchion). Once secured, slack the main warp slowly until the inhaul takes the strain. Slowly pull the door(s) up onto the main deck, secure sweeplines or bridles with stopper chains, and remove the twists.

If your ramp won't pass a door, you will have to use the outboard maneuver. If the ramp will pass the door, the inboard method is safest.

After untangling crossed cables, inspect them carefully for damage. They may have to be re-spliced.

2.5.8 Other Hazards

Explosive Ordnance

For trawlers and other vessels with bottom-tending gear, there is always the possibility of snagging or netting a piece of explosive ordnance (weapons or ammunition). Both explosive and non-explosive ordnance can be found in most fishing grounds along the U.S. Coast, as a result of the military training, sea dumps, and combat operations. If they are handled and disposed of properly, explosives should be of little or no danger to fishermen.

As virtually any type of ordnance may be recovered, it is not practical to identify all types in this manual (Figure 2-27). Items that have been submerged for an appreciable length of time may be heavily encrusted with sea growth and difficult to identify in any case. When in doubt, it must be assumed that the item is explosive ordnance until identified otherwise by qualified personnel.

Torpedo warheads are probably the most dangerous items likely to be encountered because the warhead may be separated from the torpedo body. Should suspected ordnance be recovered, the U.S. Naval Explosive Ordnance Disposal Technology Center recommends the following procedures:

* If the ordnance is covered in nets or dredges, cease all operations immediately. Do not allow the item to remain alongside the vessel where wave action may cause it to contact the hull. If the item is on board and suspended, and can continue to be safely suspended, stabilize the net with guy lines to prevent movement and keep the crew well forward and away from the stern.
* If the item is not on board and can be safely lowered back into the water, do so. If you are in shallow water (less than 130 feet), lower the item to the bottom, attach buoys to the net recovery lines and stand by in the immediate area while you await assistance. In deep water, stream the object aft as far as possible and maintain steerageway as necessary to remain in the area while awaiting assistance. Keep the crew well forward and away from the stern. In all cases, avoid unnecessary movement or jarring of the item. Do not handle suspected ordnance.
* Contact the nearest Coast Guard facility by radio, stating your vessel's position and circumstances, and describe the item as completely as possible. The Coast Guard will notify the nearest military Explosive Ordnance Disposal (EOD) team, which will respond with assistance and attempt a rendezvous at sea. If weather or other circumstances dictate that the vessel must make port with the ordnance on board, anchor or tie up in as remote an area as possible outside the port to avoid endangering other lives and property. Await further instructions from the Coast Guard.

Submarine Cables

The International Convention of 1884 for the protection of submarine cables and the United States Submarine Cable Act 47 USC, Sections 21-33, provide that any person who damages or breaks a submarine cable, either deliberately or through culpable (blameworthy) negligence, is liable to a penalty of imprisonment, or fine, or both. The law also provides that anyone hooking a cable must sacrifice his gear rather than

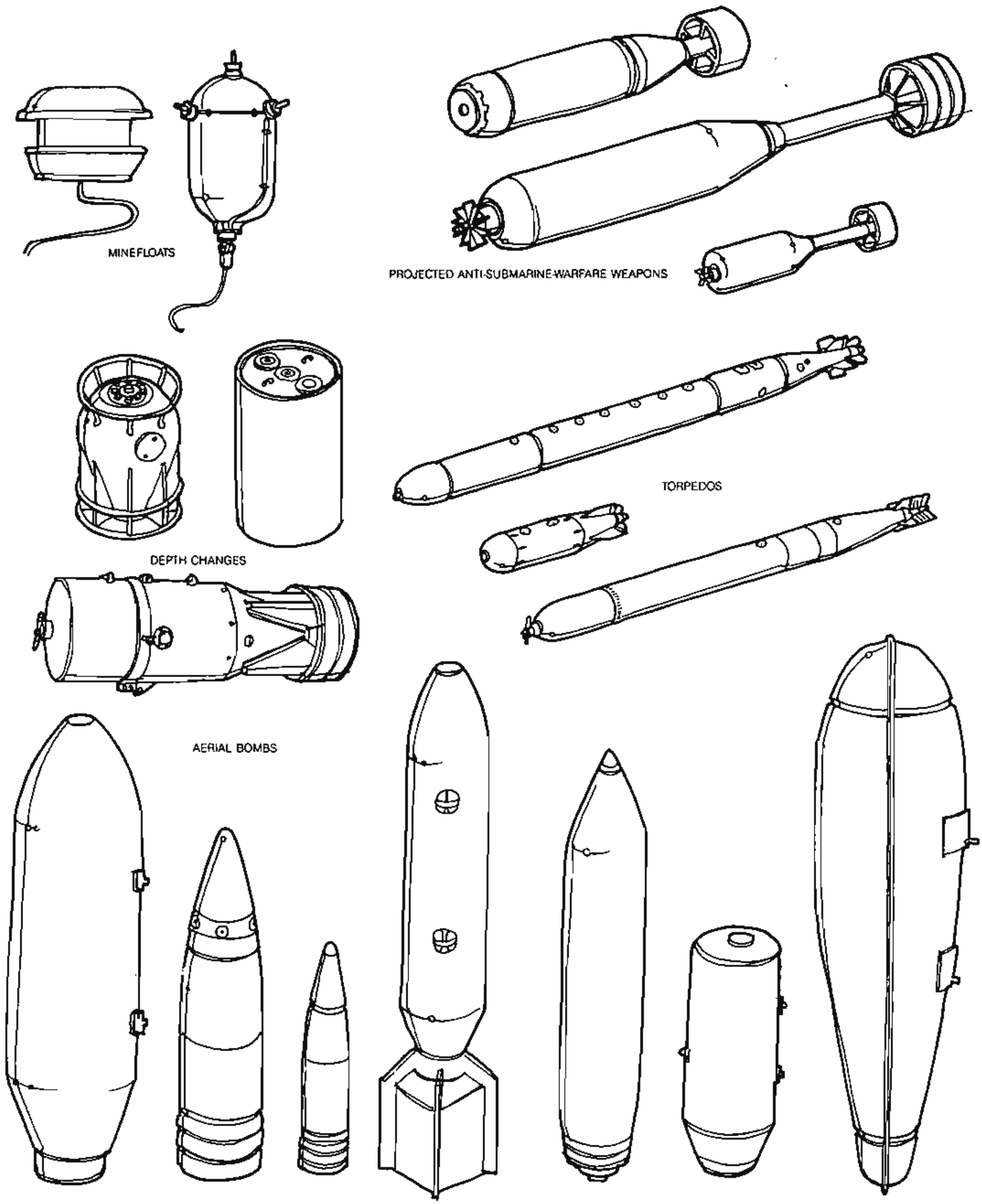


Figure 2-27. Examples of explosive ordnance that may be encountered by fishing vessels with bottom-tending gear.

cut the cable. Cable owners are required to pay compensation for any gear lost under these circumstances, providing such loss can be proved and that all reasonable precautions were taken to prevent fouling the cable. Claims for lost gear are required to be made to the appropriate authority within 24 hours of arrival at the next port of call.

All claims shall be submitted to the Deputy Director -Overseas Facilities Maintenance and Marine Operations, Room S-230, 340 Mt. Kemble Ave, Morristown, New Jersey 07960. A claim for fishing gear loss shall be considered in accordance with the provisions of the International Convention for the Protection of Submarine Cables.

In addition to the danger of snagging cables in fishing gear, most modern submarine cables carry high voltages of approximately 11,000 volts, which could be lethal if attempts are made to cut them.

In the event that a cable is hooked, immediately notify A.T & T. Co. by telephone, collect, giving location and details (201) 234-6771. If the gear cannot be freed without risk of damage to the cable, then the gear shall be abandoned.

Location of cables are charted and are available for free. For free charts call: 1 - (800) - 235-CHARTS.

Other

Other unusual items are occassionally captured in fishing gear. These range from wreckage of boats or planes to human bodies and parts. These should be immediately reported to the nearest Coast Guard Station. The location should be noted and, if possible, the items should be stored or preserved.

2.6 Atlantic Coast Fishing Vessel Safety Tips

Here is a summary of safety guidelines for fishermen:

* No alcoholic beverages or illegal drugs. If you are taking prescribed medication, inform the captain and show him the prescription.
* Never smoke in your bunk, in any confined areas, or while fueling at oil docks.
* Take your time as you move around the vessel. Always use handrails.
* Never run up or down steps, and never run on deck. Avoid "horseplay," wrestling, running or jumping aboard the vessel.
* Always wear life vests or life jackets in rough seas.
* Learn how to lift, load and unload cargo. Bend your knees, not your back.
* Never stand under stressed rigging. Do not walk on or straddle rope. Never stand in the loop of a line.
* When tying up, always place your hands over the line, not beneath the line. Keep fingers from in-between lines and solid objects. Pick up mooring lines from the side of the boat. Make sure there is slack in the anchor line before making a wrap on an anchor cleat.
* Always face a ladder when climbing up or down. Keep stairs and ladders clear of tripping hazards.
* Know the location of all fire extinguishers, and how to operate them. Advise the captain when extinguishers have been used or discharged.
* Never walk barefoot on the boat; always wear appropriate boots or deck shoes.
* Become familiar with emergency procedures and all alarms and whistles.
* Do not lean over the edge of the vessel to grab a line. Use a boat hook.
* Always be aware of slick decks, open hatches, loose or swinging rigging, and loose lines or gear on deck.
* Keep all watertight doors and hatches closed and secured when underway and in open waters. Replace and re-secure all manhole covers, hatch covers and deck plates prior to getting underway.
* Do not obstruct passageways with gear or cargo.
* Learn the location of the vessel's first-aid kit and use it when needed. Report all injuries, scratches, cuts, burns, sprains, etc., to the captain at once, no matter how minor.
* Do not remove guardrails or other safety guards from around winch, power take-off and chain or belt-driven equipment.
* Do not jump from vessel to dock before vessel has come to a complete stop.
* Use hand tools properly. Keep tools clean. Check their condition before use, and do not carry sharp tools in your pockets. Use the right tool for the job. Ground all portable electric tools.
* Do not discharge oil or oily waste into water. Violators are subject to stiff penalties.
* When repairing, checking, oiling, cleaning or adjusting equipment, be sure equipment is turned off and that the switch will not be turned on by other crew members.
* Avoid loose clothing and loose-fitting rain gear near winches and chain-belt or gear-driven equipment.
* In the galley be a good housekeeper. Be careful with knives, keep pot handles turned away from the front of the stove. Keep cabinet doors and drawers closed, and clean up all spills immediately.
* Wear safety glasses when chipping, grinding or doing other work that produces flying particles.
* When pulling in the net, look out for stingrays, sharks, jellyfish and other marine organisms that may cause injury. Report any injuries at once.

* When fishing at night, be sure to have proper light. When fishing during the day, display proper day shapes. Be careful of platforms and other fishing vessels in the area. Use radar if it is available, and have the wheel manned at all times.
* Do not use hands or feet to guide towing wire or cable on winch drums.
* On vessels with sliding pelican hooks, do not stand underneath the hooks.
* Wear safety hard hats when working around or under power blocks, especially while lifting.
* Do not swim off the boat.
* Notify the captain immediately if you see defective or damaged equipment, or any hazard to the crew. Keep safety in mind at all times. Know the proper way to perform your job.
* Keep the holds clear of trash and greasy rags, and wipe up oil and fuel spills.
* Always notify a fellow crew member before you go into the hold. Do not go into the fish hold until poisonous gases are properly ventilated. When you use chemicals, follow the manufacturer's recommendations. Do not stand on a bitt to throw a line on or off a cleat, dolphin, bitt or piling.

2.7 Fishing Vessel Safety Act

The Commercial Fishing Vessel Safety Act of 1988 has put into effect a number of regulations that affect all U.S. uninspected commercial fishing vessels, fish processing vessels and fish tender vessels. The complete list of regulations is available in the Appendix. Some regulations are already in effect and are included in the appropriate chapter in this manual. The remaining rules will become law in late 1990 or early 1991. The major elements of the new regulations relate to:

* General provisions, including casualty and injury reporting requirements.
* Lifesaving equipment such as EPIRBs and flotation devices for all vessels.
* Documented vessels operating beyond the socalled boundary line or with more than 16 individuals on board. These regs include safety training, as well as ground tackle, firefighting, navigation and first-aid equipment.
* Vessels built or converted after the effective date of the regulations and that operate with a crew of 16 or more, the provisions cover mechanical, electrical, plumbing, and fuel systems, in addition to fire fighting gear, survival craft and other safety features.
* Stability, including basic engineering tests and specific standards that ensure a vessel's ability to survive critical conditions such as icing or severe rolling.
* Fish-processing vessels, including the inspection, surveying and classification of such vessels.

What's In Effect Right Now (09/90)

Though referred to in the Fishing Vessel Safety Act of 1988, EPIRB's have been legislated by another independent law. As of May 17, 1990, all commercial fishing vessels that operate on the high seas must have the appropriate EPIRB. Vessels with no permanent berth spaces or galley are suspended from this requirement. Exact EPIRB requirements for these vessels are not yet defined. All other fishing vessels that operate beyond three nautical miles from shore must have a Category I-406 MHz unit unless a Class A unit had been installed aboard the vessel prior to October 1988, even if the vessel only briefly transits these waters. Anyone traveling on the high seas will need a FCC approved 406 EPIRB by August 1, 1991. Failure to have the proper safety equipment might cost a violator $5000 in fines.

The Fishing Vessel Safety Act has several provisions that are in effect right now:

* The US Coast Guard has the authority to terminate a voyage of a fishing vessel if it feels that the vessel is being operated in an unsafe manner. This might include failing to have specified safety or survival equipment on board, qualified operators or unseaworthy conditions of the hull or machinery.
* If your vessel measures 20 or more gross tons and is on a voyage from a U.S. port, a written agreement between the person in charge and each seaman employed aboard the vessel is required. The vessel owner is expected to sign it. It shall include the term of employment, and specify the wage or share for that period.
* A seaman on a fishing vessel shall notify the person in charge regarding any illness, disability or injury suffered when in service to the vessel no later than seven days after it took place. A placard should be displayed aboard all vessels alerting all crewmembers to this responsibility.

2.8 References

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NOTES

CHAPTER 3

SAFETY EQUIPMENT AND SURVIVAL PROCEDURES

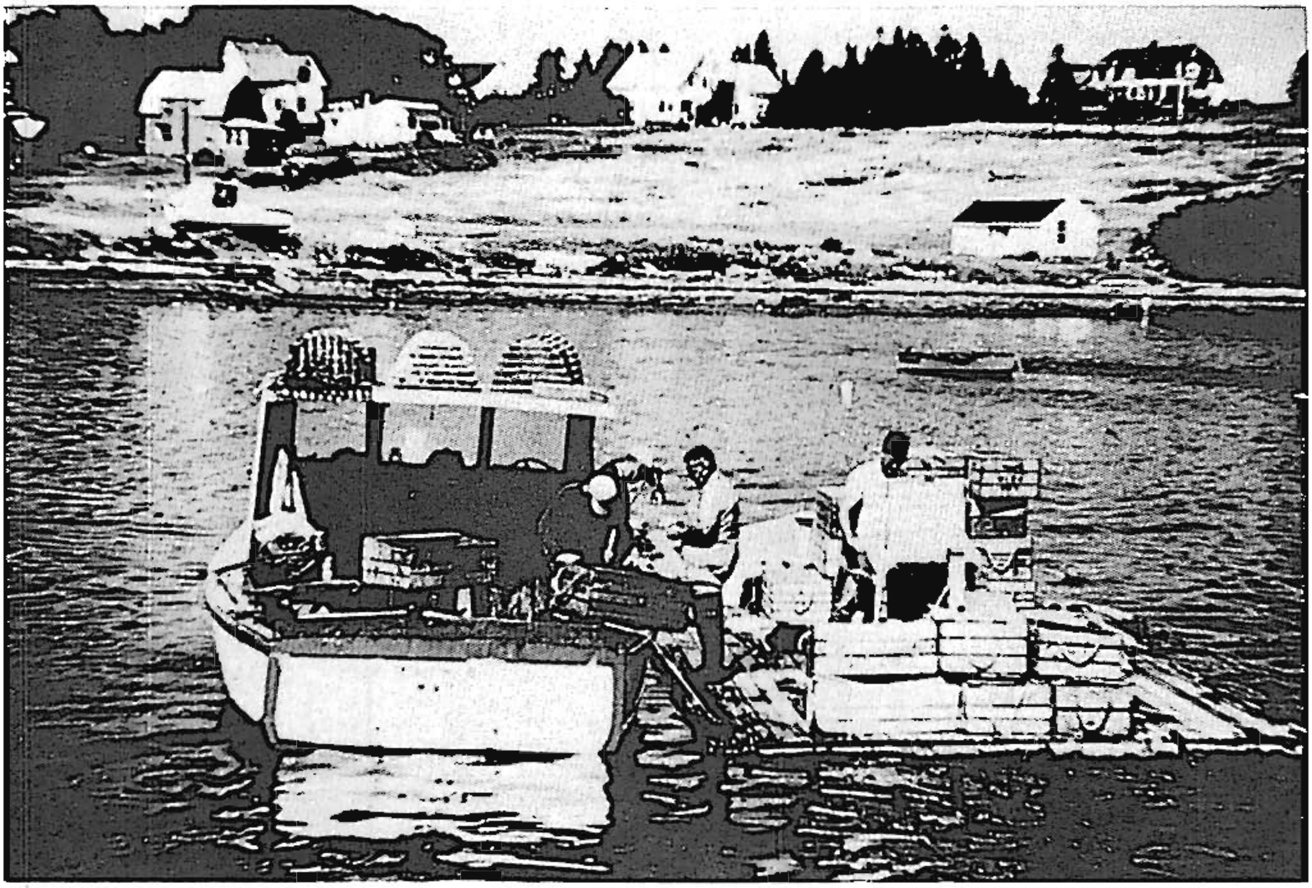


Photo courtesy of Phil Averill

CHAPTER 3

SAFETY EQUIPMENT AND SURVIVAL PROCEDURES

3.1 Introduction

This chapter covers safety equipment, safety procedures such as man-overboard and abandon ship, and survival aboard a life raft.

The survival gear you will need to carry aboard your fishing vessel will depend upon the size of your boat, its mode and area of operation, and the size of your crew. The U.S. Coast Guard has established guidelines for different sizes and types of vessels (See Appendix). Make sure your vessel has the necessary equipment. However, remember that the Coast Guard establishes *minimum* safety guidelines; it never hurts to prepare yourself above and beyond these requirements.

Survival gear includes both personal equipment, such as PFDs (personal flotation devices) and immersion suits, and general equipment, such as the vessel's liferaft. There must be adequate survival gear for every member of the crew; and it must be properly maintained, and stowed where it is easily accessible.

Stow PFD's and immersion suits where the crew can reach them easily in an emergency, preferably near exits.

Your vessel must have contingency plans for coping with emergencies, and each crew member must know his specific responsibilities in each situation.

Failing to plan for an emergency is the same as planning to fail in an emergency.

Included in this chapter are some suggestions for setting up a station bill to assign specific duties to each crewmember in each type of emergency.

It is essential that each fisherman familiarize himself as much as possible with the survival gear that is carried aboard *his own* vessel, and with all emergency alarms and procedures used aboard *that* vessel. The survival of each man depends upon his and his crewmate's foreknowledge and preparedness, physical condition, and ability to remain calm and act quickly and effectively. Panic only ensures catastrophe. Says one fishing vessel captain, who managed to save himself and his crew when their ship went down, "Now when I hire a man, I ask myself, "is this someone I want to have around in a liferaft".

3.2 Preparation

Even for the most modern and self-sufficient fishing vessel, the possibility of a disabling mishap at sea is a fact of nautical life. There are risks in going to sea, and your safety depends on your ability to plan for and manage problems which can be not only costly, but fatal.

"There are a lot of things I wish could have been done differently that may not have resulted in the loss of our boat, but most importantly there was no loss of life.

[That is largely due to a] Fishing Vessel Safety Program, which both my mate and I attended. Because of it, we implemented a station bill which gave specific duties to each crew member in any number of distress situations. During the emergency, in less than five minutes, everything that was supposed to get done was."

There are two parts to being prepared for an emergency: training and practice, and the proper equipment. The importance of training cannot be stressed enough. Although experience is one of the most effective ways of learning skills, some skills are better learned in a controlled situation. There is no room for mistakes in a real emergency.

There are many marine safety training programs offered throughout the region. They range from one-day workshops to month-long intensive courses. In 1989, educators in the Northeast Atlantic and Mid-Atlantic regions developed a network to coordinate their safety programs, and to make them widely available to fishermen. You may not want to lose a day of fishing to attend a training workshop, but it will pay off in the long run.

Once you and your crew have acquired the basic skills, it is important to practice them. The new Fishing Vessel Safety regulations will require that the individual in charge of the vessel to ensure that drills are conducted and instruction given at least once each month. Conduct abandon ship, man-overboard and fire drills whenever a substantial crew change occurs. Explain the emergency procedures to new crewmen, and drill them when they come aboard.

Drills do not need to be elaborate. Putting on an immersion suit on the back deck several times a season is an excellent way to reduce the time it takes to find and don the equipment in an emergency. Discharging a fire extinguisher that is due for servicing, or watching the repacker inflate a liferaft that is about to be serviced, gives the crew vital experience with procedures that may save their lives. Even if the equipment can not actually be used, discussing the procedures educates the new hand, and refreshes the experienced crewman.

Simple discussions are invaluable. One captain whose boat went down credits the survival of the entire crew to their dinner conversation about abandoning ship. In contrast, a fisherman who was carried overboard by the gear says that he nearly lost his life because his crew had never talked about how to retrieve a man from the water.

After attending a survival course, a captain with 40 years sea time expressed amazement at how much he had learned. He had never before put on an immersion suit; and after recognizing that it can be tricky the first time, he vowed his crew would get regular practice.

Practicing with the survival gear has an added benefit: it helps ensure that the gear is working properly. It is far better to discover during a drill rather than during an emergency that the zipper on your immersion suit is broken. If a drill reveals that the vessel's fire extinguishers or liferaft are overdue for servicing, it could save the life of everyone aboard.

Abandonment drills should give the crew a sense of how long it takes to conduct an inventory and gather vital equipment and supplies.

Fire drills should be realistic, and deal with an assumed outbreak of fire in a specific part of the vessel. Give the appropriate signal, lay out and test hoses, unship the fire extinguishers, and occasionally discharge one of the extinguishers. Practice isolating the space by closing ports, doors, ventilating shafts and other openings, and practice using breathing apparatus or other specialized fire-fighting equipment that you have on board.

3.2.1 Training checklist

Training sessions can be creative and truly beneficial to your crew members. Try conducting them at night and setting time limits for certain activities. Training sessions should cover the following:

* Each crew member's duties as listed on the station bill.
* The vessel's alarms or emergency signals/what to do when they sound.
* When and how to launch a liferaft/precautions to be taken before, during and after launching.
* Donning an immersion suit or PFD/entry into the water (Should take less than 60 sec).
* Boarding a liferaft or life float/righting an inverted raft.
* Knowledge of the equipment carried in the liferaft and how to use it.
* Understanding how to survive in a liferaft.
* The use of the EPIRB and other signaling devices.
* The dangers of hypothermia, and how to minimize its effects.
* The use of fire extinguishers.
* The use of fire hoses with different nozzles if applicable.

3.2.2 Station Bills

Military and merchant vessels prepare station bills that assign specific duties, that must be performed in an emergency, to specific crewmen. Fishing vessels must have similar documents that are prepared prior to leaving port. The station bill should cover the duties listed below:

* Making the distress call
* Closing watertight doors, hatches, valves, etc.
* Equipping the liferaft
* Launching the liferaft
* General preparation of other survival equipment
* Manning of fire parties assigned to deal with fires
* Special duties required for the operation of fire-fighting equipment.

The station bill should describe the alarms or signals that summon the crew to their survival and fire stations. A sample station bill appears below.

Sample Station Bill

General Instructions

1. All crew members shall familiarize themselves with their assigned location in the event of an emergency immediately upon boarding the vessel.

2. All crew members shall be thoroughly familiar with the duties that are assigned to perform in the event of an emergency.

3. Each person shall participate in emergency drills and shall be properly dressed, including a properly donned personal flotation device or immersion suit.

4. ____________________ shall be responsible for the maintenance and readiness of all lifesaving appliances and equipment.

5. All vessels should be equipped with a general alarm system. The general alarm system is an electrical system with an actuating switch or push-button in the wheelhouse with gongs, bells, horns or other sound devices installed in the crew's quarters, crew's dining area, crew's work areas and in the engine room. Due to high noise level, the engine room is also equipped with a red strobe light, which flashes in coordination with the general alarm signals.

The system provides communication between the captain and crew in emergencies (Signals to be arranged).

Fire And Emergency

1. Any person discovering a fire shall notify the wheelhouse by sounding the alarm, and then take initial action as appropriate.

2. Upon hearing the fire and emergency signal all watertight doors, fire doors, scuppers and designated discharges shall be closed and all fans, blowers and ventilating systems shall be stopped. All safety equipment will be prepared for immediate service.

3. Upon seeing a "MAN OVERBOARD," immediately throw a ring buoy (with a light attached, if at night) and notify the wheelhouse by reporting "MAN OVERBOARD PORT (STARBOARD) SIDE." In all cases, keep the man in sight.

4. During the abandon ship, dress for survival: put on plenty of warm clothing and an immersion suit, and if at all possible, don't get wet.

Since crew turnover may be high in certain fisheries, it is a good idea to assign duties to individual bunk numbers instead of to names. Post these duties at each bunk outlining emergency procedures for fire, man overboard, and abandon ship. If you have a stable crew, you can assign more precise duties.

> Sample
>
> **BUNK #1**
> **Emergency Procedures**
>
> **Abandon Ship**
> - Get survival suit and kit.
> - Report to winch head, starboard side.
> - Individual tasks will be assigned by captain at this time.*
>
> * These tasks could include making the distress call and manning the radio, inflating the raft, closing watertight hatches and bulkheads, etc.

3.3 Safety Equipment

3.3.1 EPIRBs - Emergency Position Indicating Radio Beacons

EPIRBs are vital in distress situations, especially where communications have not been, or cannot be, established. The EPIRB is a small VHF transmitter that sends out distinctive signals on certain frequencies. The EPIRB should be able to transmit on at least two frequencies. These transmissions can be picked up by rescue aircraft, satellites, ships, and coastal stations. Ships at sea and coastal radio stations keep a round-the-clock watch on 2182 KHz; civilian aircraft monitor both 121.5 and 243 MHz; rescue aircraft can monitor all three frequencies (Figure 3-1).

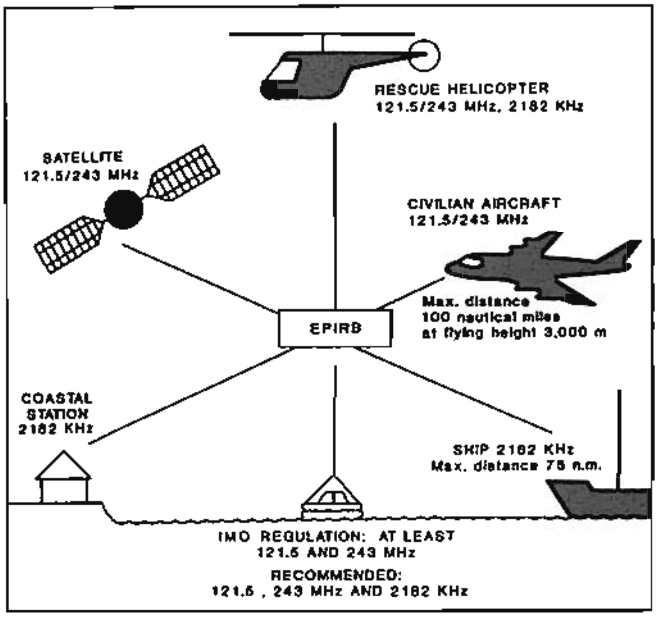


Figure 3-1. Monitoring an EPIRB signal.

EPIRBs are required on all fishing, fish processing and fish tender vessels operating more than 3 miles from shore (on the high seas). The U.S. Coast Guard has established rules describing which type operates on which frequency (Refer to Appendix).

EPIRBs fall into two general classifications corresponding to where they operate: inshore and offshore. Offshore EPIRBs are divided into Class A, Class B and Category 1 types (Figure 3-2). Class A units are being replaced by Category 1 EPIRBs in meeting Coast Guard requirements. Class A's will be completely phased out by Aug. 1991. Table 3-1 illustrates some common features of the two EPIRBs.

Category 1 EPIRBs transmit at 406 MHz and 121.5 MHz. The higher transmitting frequency produces a stronger signal. Each EPIRB will be registered with information on the owner, vessel, etc., which will help in search and rescue operations.

Category 1 (and Class A) EPIRBs activate automatically after they are thrown into the water. If a vessel sinks, these units should float free of their holding brackets and automatically turn on if they are properly

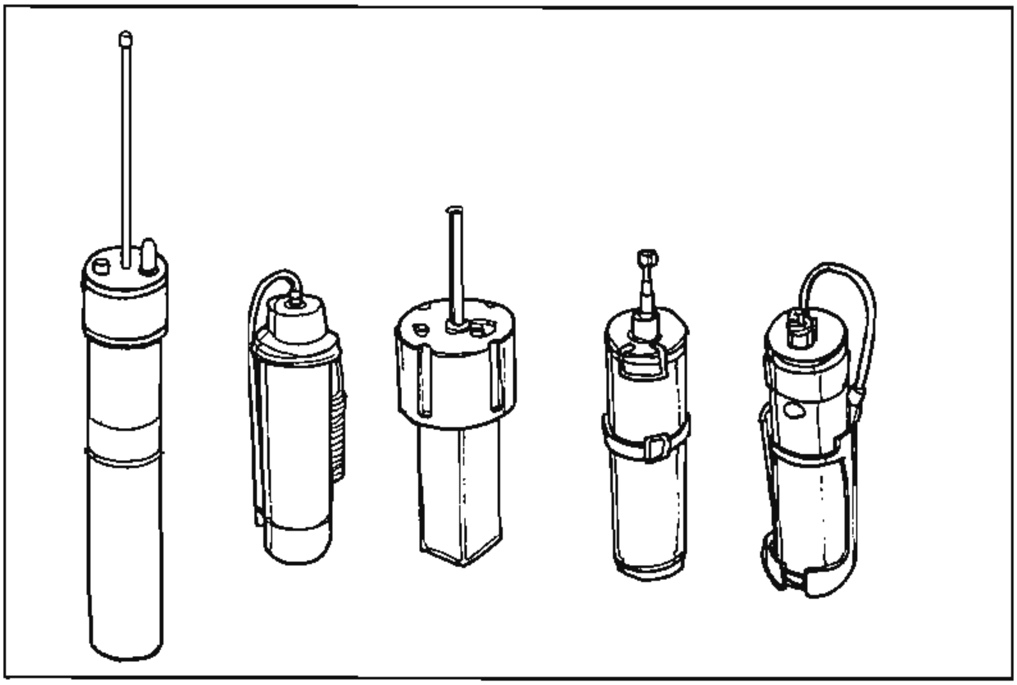


Figure 3-2. EPIRB's come in a variety of shapes and sizes. They may be either Category 1 automatic), Class B (manual), or Class C (for less than 20 miles offshore). New regulations on EPIRB's have been developed. Check in Appendix for updates on these requirements.

placed on the vessel. Note that there are also Category 1 EPIRBs that must be manually activated. Class B can *only* be manually activated. Class B's are not substitutes for a Category 1 requirement.

Inshore EPIRBs are Class C type. When turned on, they transmit alarm and homing signals on the shorter range VHF channels 15 and 16. Transmission alternates between a short warning signal on the emergency channel, and a longer homing signal on the alternate channel. The range for these EPIRBs is about 20 miles. Vessels in the area will be able to hear the periodic alert on channel 16, but will not be able to home in on the signal. Therefore, if a vessel hears the distress signal, they should contact the Coast Guard.

No piece of survival gear is foolproof, and EPIRBs are no exception. Activating an EPIRB may not result in an immediate rescue. Your survival and rescue depend on good judgment and using good quality, well-maintained equipment.

The lanyard attached to the EPIRB should be securely fastened to the raft or to an individual in the water. Most EPIRBs operate best when floating with the antenna vertical.

In rough conditions, operate the EPIRB inside the liferaft, even though this may reduce the range of the signal. A reduced signal is better than a lost EPIRB. Hold it upright, clear of the raft and do not touch the antenna.

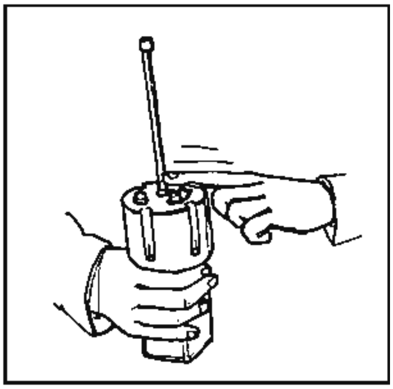
Caution: EPIRBs with water-activated switches must be kept in the water.

Have your EPIRB serviced according to the manufacturer's recommendations. Have it tested periodically to ensure that it is functioning properly. Follow the procedures below to avoid accidentally mobilizing rescue units.

To test a Class "A" (automatic), Class "B" (manual), or Category 1 EPIRB you will need the EPIRB, an FM receiver, a bucket of enough salt water to activate the water-activated switch (if necessary), and a watch.

Check the time. The full-power test can be made only during the International Distress Frequency test period (the first five minutes of any hour) (Figure 3-3).

Figure 3-3. Testing your EPIRB improperly could mobilize rescue units, as well as subject you to a fine.



Category 1 406 MHz EPIRB	Class A 121.5 MHz EPIRB
Global detection- regional satellite earth station not needed.	Regional earth stration needed-not available in many ocean areas. Potential for detection by overflying aircraft.
Reliable beacon with low false alarms and high probability of detection.	Beacons often incompatible with satellites-were designed for detection by aircraft. High number of false alarms is typical.
Beacon signal coding and exclusive international use of the 406 MHz frequency band for distress beacons assures a signal received is from an EPIRB- no problem with false alerts from non-beacon sources.	High false alert rate due to alerts generated by other transmitters within the 121.5 MHz band.
1.5 nautical mile accuracy and a second signal provided to use for homing.	10-20 nautical miles accuracy. Search and rescue forces can home on the primary signal.
Beacon is registered with nationality, owner, phone number, vessel type, etc.	No way to know whether signal is from an EPIRB, similiar aviation beacon or non-beacon source. No coded information with signal.
Good ambiguity resolution, ie. can promptly launch rescue unit to a known position with an alert from a single satellite pass.	Hard to know which of the two separate positions calculated with first satellite pass is the beacon location. Usually must wait for a second satellite pass to resolve.
Several thousand in use in the United States and overseas.	Will be replaced by Category 1 406 EPIRBs.

Table 3-1. Comparison of Category 1and Class A EPIRB's.

* Operate the battery test switch. Turn on the FM radio and tune it to 99.5 MHz.
* Before placing an EPIRB with a water-activated switch in the water, examine the sealing gasket. If the gasket is missing, torn or loose, do not conduct the immersion test because you might ruin the EPIRB.
* When the time is right, activate the EPIRB. Watch the indicator lamp and listen to the radio. Note: You can not hear the EPIRB signal unless the radio is tuned to 99.5 MHz.
* If the EPIRB is operating properly, the indicator lamp will light and you will hear the EPIRB on the radio. Turn it off as soon as you hear the signal. This full-power test must not last longer than one second, or three audio sweeps.
* If you do not hear the signal on the radio, the EPIRB needs to be serviced.

An alternative to testing the unit yourself is to have it professionally tested and serviced.

It is recommended that ALL EPIRBs be Coast Guard-approved.

3.3.2 Visual Distress Signals

A visual distress signal is anything that makes you bigger, brighter or different. By yourself, you are a small target; anything you do to make yourself more visible will help your rescuers find you.

Visual distress signals include pyrotechnics, as well as flashlights, portable strobe lights, mirrors and distress flags (Figure 3-4). There are advantages and disadvantages to each signal, and, of course, you must use them properly for them to be of any help.

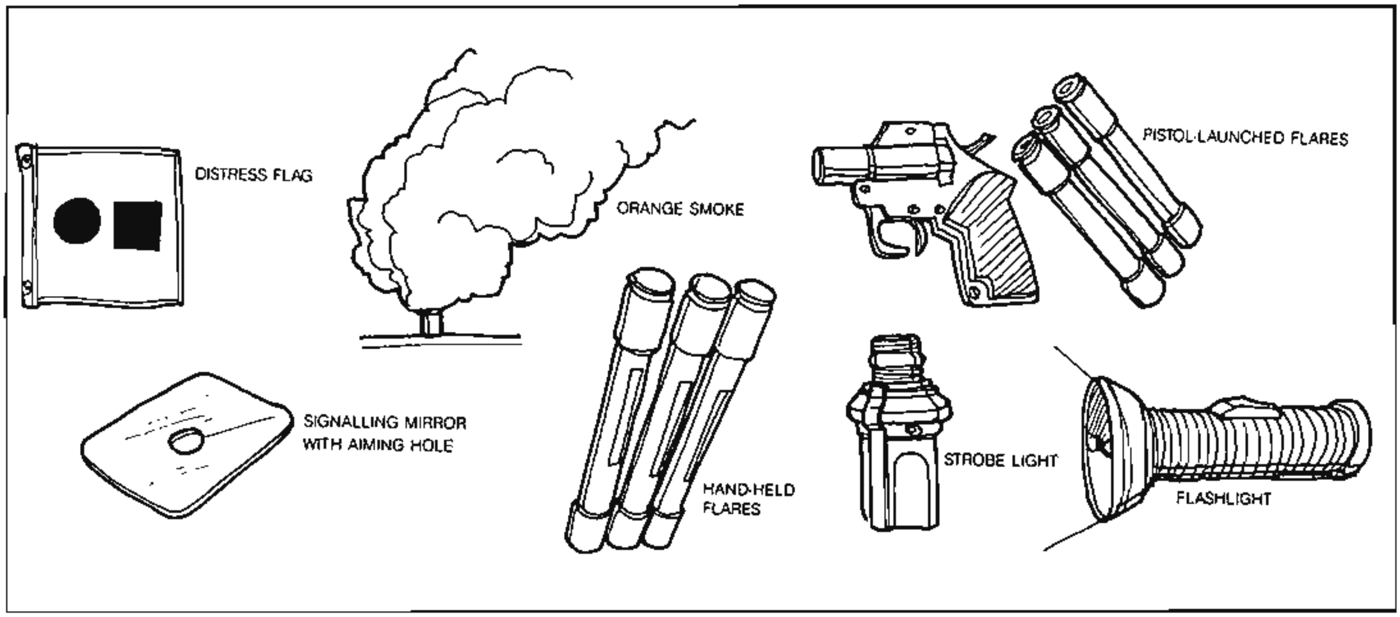


Figure 3-4. Visual distress signals.

Mirrors

Mirrors are the brightest and most effective signaling devices you can use during the day. Rescue crews often see the reflections from a signal mirror before they see anything else.

To use the mirror, first reflect the sunlight from the mirror onto a nearby surface (raft, hand, etc.) (Figure 3-5). Slowly bring the mirror up to eye level and look through the sighting hole. You will see a bright light spot which is your aim indicator. Hold the mirror close to your eye and slowly turn and manipulate it so that the bright light spot is on the target (the aircraft, the approaching ship).

Even if no aircraft or ships are in sight, continue sweeping the horizon. Mirror flashes can be seen for many miles, even in hazy weather.

Pyrotechnics

All signaling devices have both advantages and disadvantages. The most popular, because of cost, are the smaller pyrotechnic devices.

Only use pyrotechnic devices when someone is nearby to see them - use them if you can see or hear a boat or plane.

A pistol-fired meteor will reach a few hundred feet in altitude and burn for 4-6 seconds. Rocket-propelled flares can be seen for greater distances (up to 40 miles), depending on atmospheric conditions (Table 3-2).

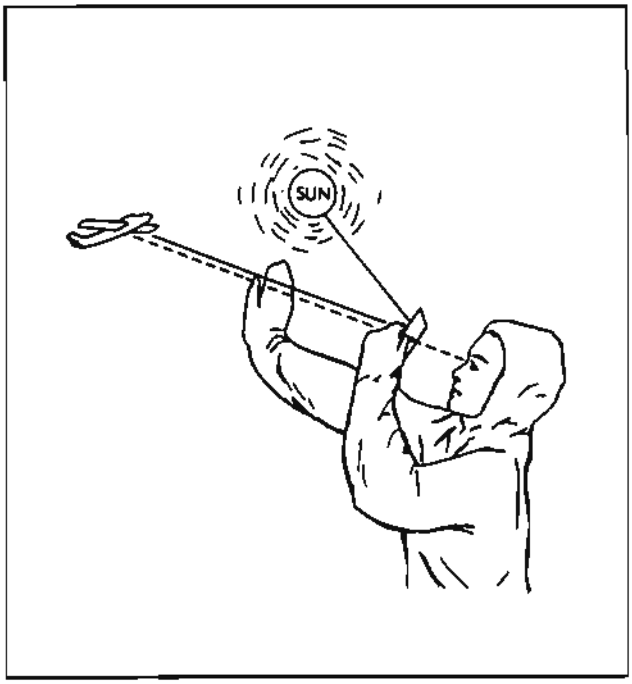


Figure 3-5. Using a rescue mirror.

The official daylight signal is the Buoyant Orange Smoke Signal. It is best on clear days with light winds; however, it tends to lose effectiveness in high winds, because the smoke disperses quickly.

Tests have shown that in normal daylight conditions a hand flare or rocket parachute signal can be seen for a greater distance than an orange smoke signal. The ideal combination is smoke and flare.

Number Marked as Device	Device Description
	DAY USE ONLY
160.022	Floating Orange Smoke Distress Signals (5 minutes)
160.037	Hand Held Orange Smoke Distress Signals
160.057	Floating Orange Smoke Distress Signals (15 minutes)
160.072	Orange Distress Signal Flag for Boats
	NIGHT USE ONLY
161.013	Electric Distress Light for Boats
	DAY AND NIGHT USE
160.021	Hand Held Flare Distress Signal (These signals must have a date of October 1, 1980 or later to be acceptable.
160.024	Parachute Red Flare Distress Signals (37mm) (These signals require use in combination with a suitable launching device.
160.036	Hand Held Rocket-Propelled Parachute Red Flare Distress Signals.
160.066	Distress Signal for Boats, Red Aerial Polytechnic Flare (These devices may be either meteor or parachute assisted type.) Some of these signals may require use in combination with a suitable launching device.

Table 3-2. Description of pyrotechnic devices.

Pistol-launched and hand-held parachute flares and meteors have many of the same characteristics of a firearm, and you must handle them with the same caution and respect. Never aim pyrotechnics directly at a searching aircraft or surface vessel.

Red hand-held flares can be used by day, but are most effective at night or in restricted visibility such as fog or haze.

Pistol-launched or self-contained, rocket-propelled, red meteors can be used by day, but are most effective at night. Because of their rapid descent, their burning time is shorter and they may not be as readily observed as slower descending signals.

Red parachute flares, either pistol-launched or hand-held, are good distress signals for both day and night because of their altitude, slow descent and brilliant intensity. Their slow descent, however, makes them drift with the wind, which can lead a rescuer away from the disabled vessel.

Whatever signals you use, always read and follow the attached instructions. Pyrotechnics make excellent distress signals; however, they can be used only once, and they can cause injury or property damage if they are not handled properly. Another disadvantage is that flares and smoke signals can expel ash and slag as they burn. Even though these particles cool quickly, they can cause painful burns or ignite materials that burn easily. The flare itself is very hot, and it can start a fire if it is dropped. You must hold these devices in such a way that neither you nor the raft is damaged.

Always take the wind into account when you use pyrotechnic distress signals. In calm winds keep your arm at approximately 60 degrees above the horizon with the wind at your back when firing the device. As the wind increases, increase the angle of your arm up to (but not more than) about 80 to 85 degrees. Never fire a pyrotechnic device straight up or into the wind, since it may land on your boat or another boat.

Store pyrotechnics in a cool, dry, readily accessible place. Everyone on board should know where they are stored. You should assign one crewman to bring them in an emergency. You may want to store a pair of gloves along with them.

Each crewman should carry pyrotechnic signals in his PFD and immersion suit. You can never have too many. Never use automobile flares as a substitute.

Visual distress signals are included in the equipment package aboard properly packed liferafts. Have your raft repacked by an authorized service facility to ensure that the pyrotechnic devices work when you need them.

Expiration dates are important. Expired signals do not count as part of your minimum requirements. Only have them aboard as back-ups, or for practice. Dispose of expired pyrotechnics properly with your local fire department, police or bomb squad. Do not place them in the trash.

Sometimes the obvious solution is the most overlooked. If you find yourself in the water, try to make yourself bigger. Tie together floats, debris, PFDs, anything that you can quickly salvage from the vessel. Searchers always investigate debris. If you have dye, put it in the water to attract attention. Use any kind of light as a signal - strobes are best. Attach them to your PFD or immersion suit. Use whistles and air horns, if you have them, to attract the attention of a boat in the vicinity. Never underestimate how small you are in a big sea. Make every attempt to draw attention to yourself.

3.3.3 Personal Flotation Devices (PFDs)

PFDs are designed to keep you floating face up. They should do two things for you: keep your mouth and nose above the surface, and make you clearly visible to rescuers. Without flotation in extremely cold water, your ability to tread water or swim is measured in minutes. If you are unconscious or injured, survival time is even less.

Although most *standard* PFDs are uncomfortable to wear during routine fishing operations, there are a number of vest, jacket and coverall types that can be worn without hindrance or discomfort. We highly recommend that you include them as part of your daily clothing, especially in the cold-water latitudes.

PFDs are classified as Type I or offshore life jackets; Type II or near-shore buoyant vest; Type III or flotation aid; Type IV or throwable device; and Type V or special devices (Figure 3-6 and Table 3-3 and 3-4).

The Coast Guard establishes minimum standards for all vessels. These are outlined in Table 3-3. You must be familiar with these requirements.

Your PFD should fit you snugly. Do not rely on the printed designations on the jacket. For example, a Type I vest, designed for "adults over 90 pounds," might be adequate for a 210-pound person, but bulky and unusable for a 110-pound person. Try it on.

Buoyancy is the force that keeps you afloat. The more the buoyancy, the better. The Coast Guard sets minimum buoyancy levels for each PFD type. The type I, at 22 pounds, is the most buoyant Coast Guard-approved PFD. Anything less than 22 pounds is inadequate in open, rough water. Type IIs and IIIs (USCG minimum 15 1/2 pounds) do not provide enough buoyancy to float most people face up; they tend to roll forward and face down. Type III PFDs include float coats and vests; they provide floatation, and a small amount of hypothermia protection.

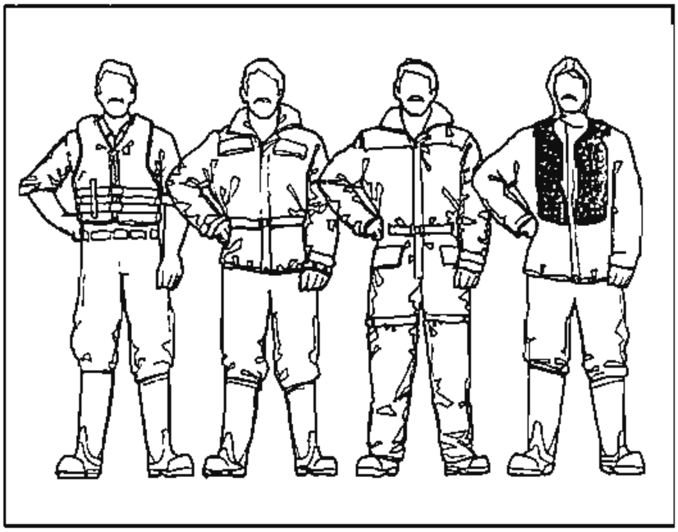


Figure 3-6. Four types of floatation: traditional PFD (Type I)(left); float coat (Type III) (left center); worksuit (Type V) (right center); jacket with inflatable air bladder (right).

PFDs are effective only if they are worn; however, few people feel comfortable wearing them as normal boating attire. Type IIIs are attractive and comfortable, but because of the floatation material, they tend to be bulky. Type V special and hybrids are less bulky, because much of the conventional floatation material is replaced with inflatable chambers. Hybrids have a minimum buoyancy of 7.5 pounds uninflated and 22 pounds inflated. They are *not* approved for children.

Special Type Vs, such as ski jackets and work suits, are designed for specific uses. Many of them are not Coast Guard approved.

For your PFD to work properly, follow these suggestions to ensure that it fits, floats, and stays in good condition.

Area	Vessel Length	Devices Required
Ocean, beyond Boundary Line and North of 32° N or South of 32°S, or Great Lakes	All........................	Immersion suit or exposure suite, each with PFD light and and retroreflective material
Ocean, inside Boundary Line:	Less than 40 feet..........	Type I, Type II, Type III, Type V commercial hybrid immersion suit, or exposure suit, each with PFD light and retroreflective material.
or Ocean, between 32° N and 32°S	40 feet and longer.........	Type I, Type V commercial hybrid, immersion suit, or exposure suit, each with PFD light and retroreflective material.
Lakes, bays sounds, or rivers	Less than 40 feet..........	Type I, Type II, Type III, Type V commercial hybrid, Immersion suit, or exposure suit, each with retroreflective material.[1]
Ditto	40 feet and longer	Type I, Type V commercial hybrid, Immersion suit, or exposure suit, each with retroreflective material.

[1] Certain Type V Personal Flotation Devices are approved for substitution for Type I, II, or III Personal Flotation Devices when used in accordance with the conditions stated in the Coast Guard approval label.

Table 3-3. Coast Guard requirements for personal flotation devices and immersion suits.

TYPE PFD	FLOATABILITY	MINIMUM BUOYANCY	ADVANTAGES	DISADVANTAGES	ENVIRONMENT
TYPE 1 OFFSHORE LIFE JACKET	will float majority of people face-up even if unconscious.	22 pounds (Adult)	Excellent performance. Suitable for rough water.	Very bulky and cumbersome.	Offshore, open water, coastal cruising.
TYPE II NEARSHORE BUOYANT VEST	Some wearers may not float face up if unconscious.	15.5 pounds (Adult)	Good flotation and low cost	Uncomfortable Not suitable for rough water or cold water.	Inland water or where rescue will be quick.
TYPE III FLOTATION AID	May take active participation to float wearer in upright position.	15.5 pounds (Adult)	Comfortable and stylish. Allows wearer to swim. Useful in water-skiing, small boat sailing, etc.	Not suitable for rough or cold water.	Inland water or where rescue will be quick.
TYPE IV THROWABLE DEVICE	A broad category for devices designed to be thrown.	16.5 pounds for ring buoy. 18 pounds for cushions.	Throwable.	Cannot be worn. Not for unconscious persons or non-swimmers.	In areas where there are other boats and rescue will be quick.
TYPE V HYBRID (Required to be worn)	When inflated provides either Type I, II, or III flotation performance. When deflated, may not float some people.	7.5 pounds deflated. Minimum of 22 pounds when fully inflated (Adult)	Very Comfortable and stylish. May provide better flotation than Type II or III.	Higher cost. Requires attentive maintenance.	Depends on equivalent flotation performance (i.e. Type I, Type II, or Type III).
TYPE V Special	A Type V PFD is approved for restricted uses or activities such as board-sailing, commercial white water rafting, etc. The label on the PFD indicates whether a particular design can be used in a special application, what restrictions or limitations apply, and its equivalent performance Type				

Table 3-4 Characteristics of CG approved PFD's.

* Try on your PFD and adjust it until it fits comfortably in and out of the water.
* Mark your PFD with your name if you are the only wearer. *Always mark it with the name of your boat.*
* Do not alter it. If it doesn't fit properly, get one that does. An altered PFD is no longer Coast Guard approved.
* Dry a wet PFD thoroughly before storage. Store it in a well-ventilated area.
* Do not dry your PFD in front of a radiator or other source of direct heat.
* Make sure there are at least 31 square inches of retro-reflective tape on the PFD to increase your visibility.
* Accessories such as strobes and whistles can be attached to your PFD in a location that will not interfere with your work on deck.

Inspect your PFD periodically to make sure that it is free of rips, tears and holes; that all seams and joints are securely sewn; and that the fabric, straps and hardware are still strong. If it contains a CO_2 cartridge, make sure you have extras available.

Buoyant inserts must not show signs of water-logging, shrinkage, mildew odor, oil absorption, or increased hardness or stiffness. In the case of kapok, the plastic insert coverings must not be torn, split or punctured. To test for punctures, apply gentle pressure to the insert to see if air escapes. If you have any of the above mentioned problems, replace your PFDs immediately.

To test the buoyancy of your PFD, do the following:

* Put the device on and get in water deep enough that you can stand with your head above the surface.
* Tilt your head back to see if the PFD will float you on your back or slightly back of vertical.
* Your mouth should be above water as you breathe in and out.

Figure 3-7. Donning an immersion suit. A sharp jerk on the carrying sack ejects the suit (far left). Remove your boots but leave plenty of clothes on (near left). Don the hood before you zip (center). To avoid problems in zipping the suit, arch your back to remove wrinkles in the fabric (near right). Secure the face closure before entering the water (right). To increase ease of donning the suit, put plastic bags over your shoes.

3.3.4 Immersion Suits

Coast Guard-approved immersion suits are required for each member of the crew on vessels operating on all U.S. coastal waters above 32° N Lat (Figure 3-7). Even in more southern waters, consider having immersion suits if your vessel will operate far offshore in winter, where prompt rescue may not be available.

An inflatable life raft along with an immersion suit represent your best hope of survival in cold water.

There are many different varieties of immersion suits on the market. When you shop for an immersion suit, it is important that you select one that meets the legal requirements that apply to your vessel, and that fits your personal needs. Some suits are just big overalls; others have boots, detachable gloves, leg zippers, and other features.

The suits that do not have detachable gloves or zippered hand openings do not allow for much hand movement. If you buy a suit with built-in boots, minimize the time you spend walking, since the foot pads wear easily.

An immersion suit should be equipped with a whistle; an attached strobe light is required on ocean going vessels of any size. It should have an inflatable pillow to keep your head and neck out of the water for better thermal protection, and to help eliminate the strain of holding your head up. As with PFDs, the suit must have 31 square inches of retro-reflective material on the shoulders, back, and hood to make you more visible. Your suit should include a lifting ring and a buddy cord.

Make sure the suit fits you properly; there have been cases of people drowning in suits that were too large for them. The suit should form a tight seal around your face.

Your immersion suit will come in a storage bag. The bag itself is tested to provide protection to the suit, and it is clearly marked with instructions for use. Your suit is a sturdy piece of equipment, but treat it with care.

Mark the suit with your name and the vessel's name in large letters with a waterproof marker or stencil. Avoid using paint, since it may become brittle. Marking the suit may help prevent theft, and if the suit is found floating in the water, the markings will help rescuers identify what vessel the suit came from.

Ideally, you should inspect the suit for defects as you are buying it; but if that is not possible, check it as soon as you get it. Immersion suits have saved hundreds of lives, but like any piece of equipment they need periodic inspection and maintenance. Try it on to make sure that it fits, and check it for defects: rips, tears, improper seals, and defective zippers. Be sure that your zipper has a lanyard or tail long enough to enable you to grasp it easily with your gloves on. Inflate the buoyancy ring, tug gently on the hose to make sure it won't come off in your hand, and make sure the zipper is well lubricated with a non-petroleum based product.

* Check all zippers for smooth operation. *Any* corroded, broken or malfunctioning zippers should be replaced. The manufacturer or someone qualified to repair "dry" diving suits should make the repair.
* Lubricate the watertight zipper on the front of the suit with canning paraffin, beeswax, or the wax provided by the manufacturer. Silicone and graphite lubricants, available from dive shops, also work well. DO NOT use vaseline or other petroleum based greases, since they destroy the material to which the zippers are attached.
* Check the stitching and gluing on all of the seams on the suit as well as the seams on the storage bag.
* Inflate the external flotation bladder to ensure that it will hold air. Pay particular attention to the joints and connection-point of the inflation tube. Contact the manufacturer for instructions if repair is required. Deflate before storage.

Test your suit in the water when you have the chance. This is a good way to not only check its condition, but also become more familiar with it. When your suit has been used in salt water or in a swimming pool, make sure to rinse it inside and out with fresh water to rid it of salt and harmful chemicals. If the suit has been in contact with petroleum by-products, such as oil and fuel from harbors, wash it in a mild detergent and rinse it thoroughly.

To dry the suit, turn it inside out, and hang it in a well-ventilated place - but out of the sun, since the sun degrades the material in immersion suits. When the inside is thoroughly dry, including the very end of the fingers and feet, turn the suit right-side out to finish drying the outside.

Pack your suit according to the following diagrams. Always re-lubricate the zippers, and leave them open (down). If the zipper breaks or snags, you want to be able to at least get into your suit. Roll your suit up and fold the arms over it (Figure 3-8).

Immersion suits should be stored in a very accessible, dry place. Aboard fishing vessels, there is a debate whether that means in each crewman's bunk, or in the wheelhouse. If you put it in your bunk, you know where it is, but you may not be able to reach it in an emergency. Wheelhouse storage would normally be best, but there may not be adequate space. It is a decision you must make based on the configuration of your boat.

Whatever you decide, know the location of all survival gear, especially the immersion suits. Make sure you can reach your suit in a hurry.

If you cannot repair minor leaks or tears using the kit packed with the suit, try using some of the compounds sold at dive shops. If that doesn't work, have the manufacturer repair it. If that doesn't work, replace the suit.

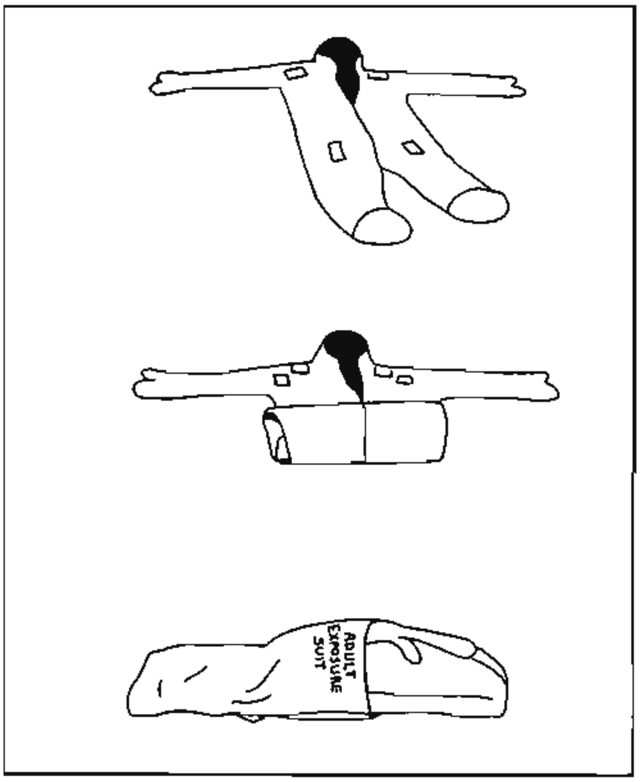


Figure 3-8. Storage of your immersion suit: (a). Lay suit flat with zipper open. (b). Roll suit up from bottom to top, trying to prevent any folds. (c). Last step before inserting into bag should be to fold arms over rolled up suit.

Two manufacturers voluntarily recalled early suits because of problems with the inflation tube for the external flotation bladder. These are still in use on some uninspected vessels. If your suit was manufactured in 1981 or before, and does not have a clasp around the tube at each joint, contact the manufacturer. You may have one of the problem suits. The manufacturers are still making free repairs to those early suits.

Have your suit checked and maintained at least once a year, preferably more often. Write the inspection date on the outside of the storage bag. And remember, if you have to use your suit: don't put it on too early, but don't wait until it's too late.

Immersion suits do not guarantee your survival, but have been shown to greatly enhance your chances. Even if you do not survive, it is important to your family if your body can be recovered. Many insurance companies require proof of death in order to finalize payments.

3.3.5 Personal Survival Kits

The development of immersion suits means that even if you are lost at sea without a liferaft, you have a margin of hope. Immersion suits have enabled survivors in Alaskan waters to endure for more than 24 hours. You can boost your chances even more by creating a personal survival kit in a small, watertight bag that is stowed with your immersion suit. Attach a 3-foot lanyard to the bag so you can tie it off once you're in the water (Figure 3-9).

Suggested contents:

* Wool watch cap/reflective space blanket.
* Personal EPIRB, strobe light, flares, dye, mirror, whistle.
* Flashlight and batteries.
* Fresh water (as much as you can carry with you).
* Extra pair of prescription glasses.
* Seasickness pills.

Figure 3-9. A personal survival kit enclosed in a watertight bag and stowed with your immersion suit boosts your chances of surviving.

3.3.6 Liferafts

U.S. Coast Guard approved liferafts are required on cargo, tank, and passenger vessels. There will be some requirements established for fishing vessels in the near future. The U.S. Coast Guard has only approved some of the liferafts on the market that meet this requirement.

Coast Guard approval guarantees that the liferaft is made of high quality materials, and that it has passed a series of rigorous tests. It assures that the liferaft will perform properly, if it is serviced regularly. Be careful of the non-approved rafts, since they may not have passed the rigorous Coast Guard tests.

Many liferafts carry a "SOLAS" (the International Convention for the Safety of Life at Sea) approval. However, "SOLAS" approved equipment *can not* be substituted for Coast Guard approved equipment.

There are many features available on rafts. You should be aware of the benefits and disadvantages of each. All rafts intended for cold water use should have double canopies and inflatable floors, to ensure adequate insulation from the cold.

A rule proposed by the Coast Guard would require that approved rafts be equipped with water ballast systems on the undersides to improve stability in high winds and seas, reducing the probability that the raft will capsize. The Coast Guard does not favor any particular design, but they have shown that rafts with large water volumes in ballast appendages perform best.

It is important to consider the survival gear that you may need aboard your raft. Approved rafts come with either an *ocean service* or *limited service* equipment pack. The equipment pack is clearly marked on the raft container.

Rafts with either pack include such things as canopy lights, paddles and distress signals. Ocean service packs include emergency drinking water and food, a first aid kit, fishing tackle and other items. Ocean service rafts should be used on all vessels operating more than 20 miles offshore or in remote areas. The Coast Guard also recommends that all rafts be equipped with an EPIRB.

The following items are recommended for all liferafts:

* Boarding ladder or ramp.
* Heaving line.
* Survival instructions
* Safety knife.
* Interior and exterior canopy lights.
* Paddles.
* Painter.
* Manual inflation pump.
* Sea anchor.
* Bailer.
* Flashlight
* Repair kit.
* Distress signal.
* Sponge.
* EPIRB.
* Sea Dye.
* Radar reflector.

These additional items are recommended for ocean service rafts:

* First aid kit.
* Signaling mirror.
* Emergency drinking water.
* Provisions.

Installing your Liferaft

Install your liferaft atop the wheelhouse or in some location where it is accessible to the crew and capable of floating free if the boat sinks before you are able to launch it. Keep it clear of deckhouse overhangs and rigging. Consider installing non-skid strips and/or hand-holds around the raft, since you will need solid footing in order to pull the inflation cord.

You should not install the raft where it is exposed to boarding seas that could damage it. Nor should you install it next to exhaust stacks, since heat and gases will damage the rubber gaskets on the canister. Damaged gaskets may allow salt water to enter the canister and damage the raft.

Install it on a cradle or bed shaped to fit the bottom of the canister. Then secure the raft canister to its cradle with a hydrostatic release that will free it automatically if the vessel sinks suddenly (Figures 3-10 and 3-11). Have the hydrostatic release inspected and tested every time the raft is serviced.

Secure the painter to the vessel with the weak link supplied with the raft. Display the operating instructions on or near the canister.

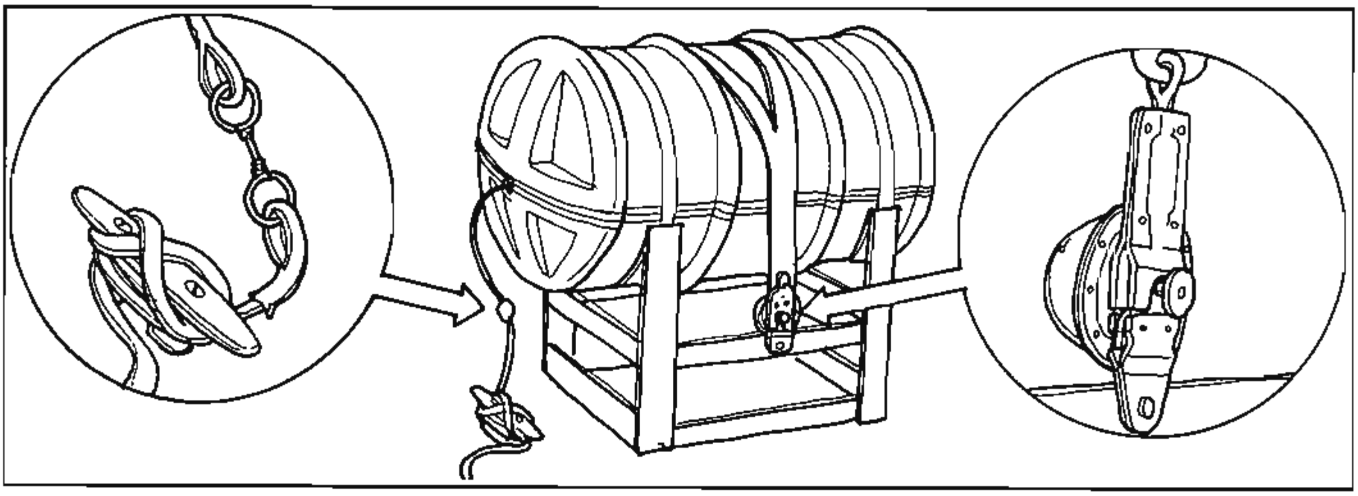


Figure 3-10. The raft should be stowed in a cradle or bed in a location where it is capable of floating free if the vessel sinks suddenly. The raft should be secured by means of a hydrostatic release (right). The painter should always be firmly secured to the vessel, with a weak link (left) incorporated into the line.

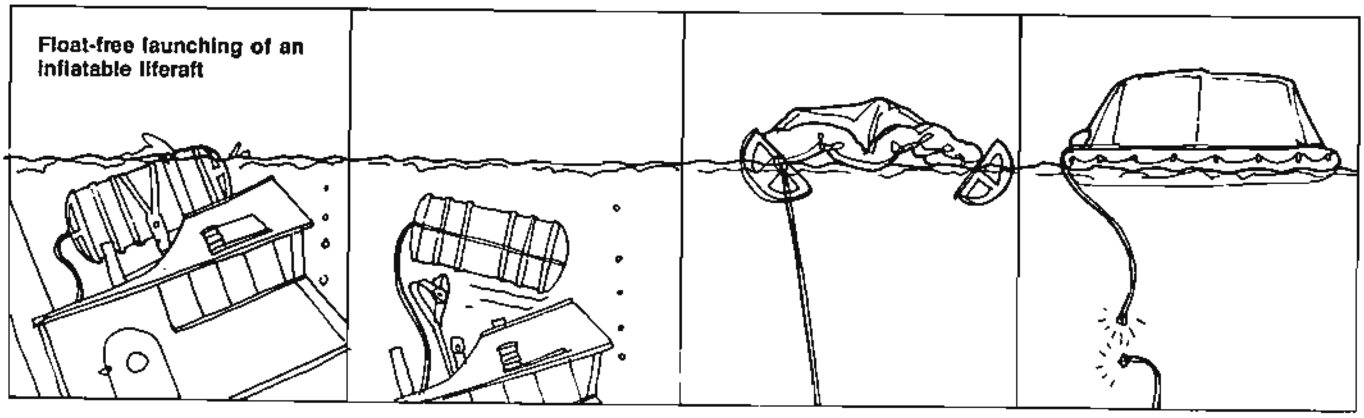


Figure 3-11.

At a depth of approximately 3 meters, the hydrostatic release is activated and the liferaft starts to float to surface.

As the vessel sinks, the painter pays out to full length and activates the CO_2 cylinder to inflate the liferaft. If the water depth is less than the length of the painter, however, you will have to pull out the painter manually to its full length to activate the mechanism. Swim to the raft, place your feet on the cannister and pull until the raft inflates.

If the vessel continues to sink, the painter or a weak link parts and the liferaft floats free.

Servicing Liferafts

Liferaft manufacturers and the Coast Guard recommends that you service your raft at least once a year at a facility *authorized by the manufacturer.*

Servicing ensures that the CO_2 cylinder remains fully charged and operational, and that the raft is able to pass a working pressure leakage test. Servicing also includes the renewal and replacement of such things as light cells, pyrotechnic signals, water, provisions, etc.

Even the best liferaft is useless if it does not inflate or fails when it does inflate.

The names of authorized service facilities are readily available from the manufacturer. An authorized facility will have a recent letter of authorization on the manufacturer's letterhead, signed by a company official. In addition, if the manufacturer makes Coast Guard-approved rafts, the facility will have a copy of a letter from the Coast Guard stating that it is approved for servicing.

Lifefloats and Inflatable Platforms

A typical lifefloat is available in 6- to 25-person capacity, is made of a urethane inner core with a fiberglass shell, is equipped with polypropylene life-lines and requires very little maintenance. However, they should be periodically examined for signs of deterioration. Prepare and maintain a well-stocked survival kit for this raft, including all the survival equipment needed with inflatable rafts, as well as paddles, a radar reflector, a strobe light and sea dyes.

Lifefloats do not provide the all-weather, canopy-cover protection of inflatable liferafts. You are not able to get out of the water, however, they are less expensive to buy and to maintain. They are "visually ready to go," and they do not depend on an inflating mechanism in order to deploy. Unfortunately, they do not offer any protection from hypothermia; wearing an immersion suit will increase your chance of survival (Figure 3-12).

Inflatable platforms are non-canopied, soft flotation devices, operated with a CO_2 inflation system. Grab lines are located around the edges, however, it is possible to climb aboard to reduce body heat loss. These are not Coast Guard approved at this time.

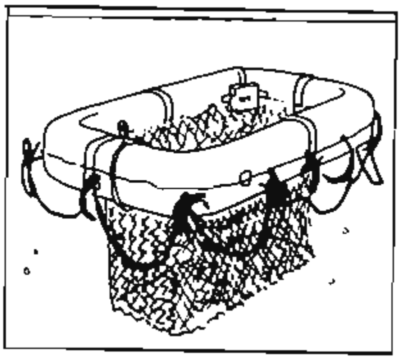


Figure 3-12. Lifefloat (a) and inflatable platform (b).

3.4 Man-Overboard

Just a few minutes of exposure to cold water can be disabling to a crewman who lacks flotation and thermal protection. 99 percent of the people who go overboard, are not prepared to be there. Therefore, speed *is* the key to saving the crewman who does fall overboard. The skipper and crew must react quickly, and the person in the water must minimize heat loss.

The amount and type of clothing greatly affects your survival time. Figure 3-13 graphically illustrates survival time versus water temperature. With ordinary clothing at water temperature of 10° C, you may only have 2 hours, while with an immersion suit, this is expanded to over 6 hours.

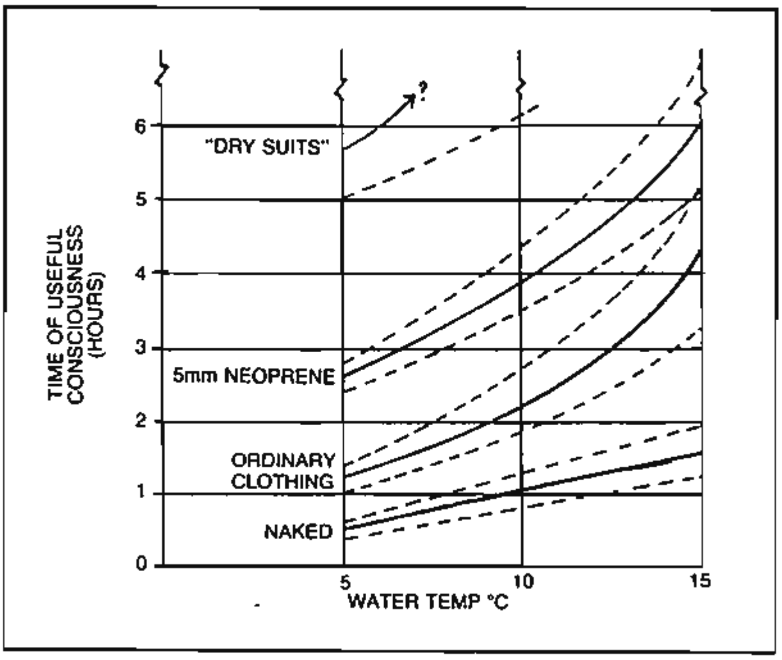


Figure 3-13. "COLD WATER SURVIVAL". The above graph demonstrates the time of useful consciousness in hours for various water temperatures. For example, a person in ordinary clothing only has approximately 2 hours of consciousness in water of 10 degrees,

Golden Rule Number 1: don't be the man overboard. If you do fall overboard, don't swim after the boat. You can't catch it, and swimming causes faster heat loss in cold water. Assume the heat escape lessening posture, or HELP position (Figure 3-14). Stay calm. Attract as much attention as possible and concentrate on staying afloat.

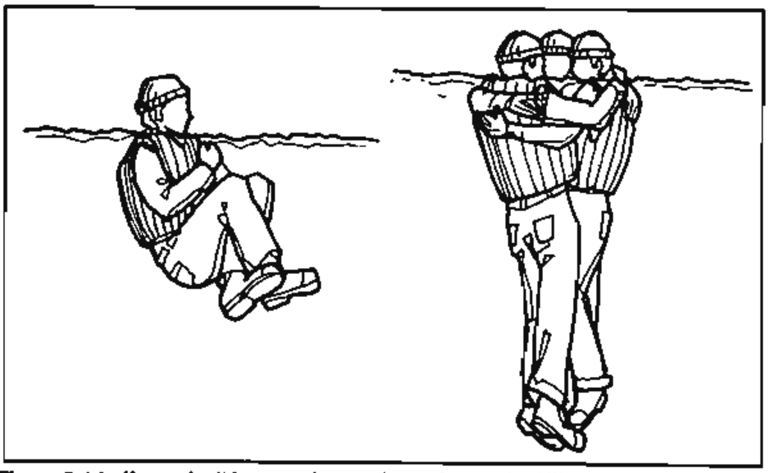


Figure 3-14. If you don't have an immersion suit, use the HELP position (left). If there are other survivors nearby, form a group (right).

You are much better off if you happened to be wearing a PFD or some other form of flotation when you fell over. You want to keep your head and neck out of cold water above all, and any form of flotation keeps you higher in the water. That means Golden Rule Number 2 is: wear flotation, whether it's a PFD, a work suit, a float coat, a pair of inflatable suspenders or foul weather gear equipped with an inflation bladder.

If there is anything else floating nearby, try to crawl up on it to get as much of your body as possible out of the water. You want to prevent heat loss, and you lose heat many times faster in water than in air.

Once someone is seen falling overboard, the crew must act immediately. Notify the skipper right away and simultaneously, throw the victim several ring buoys, if they are available. If there is no ring buoy close at hand, throw anything that will provide flotation for the victim to help him get high in the water.

Golden Rule Number 3: make sure your boat has adequate ring buoys located where they are needed. All fishing vessels must have at least one throwable device (ring buoy) on deck for a man-overboard situation. Owners are advised to place ring buoys at the working deck level as well as on the sides of the wheelhouse. Depending on the size of the vessel, two or more ring buoys should be located inside the bulwarks on either side of the working deck. At least one ring buoy on either side should be outfitted with at least 60 feet of heaving line and rescue light (Figure 3-15).

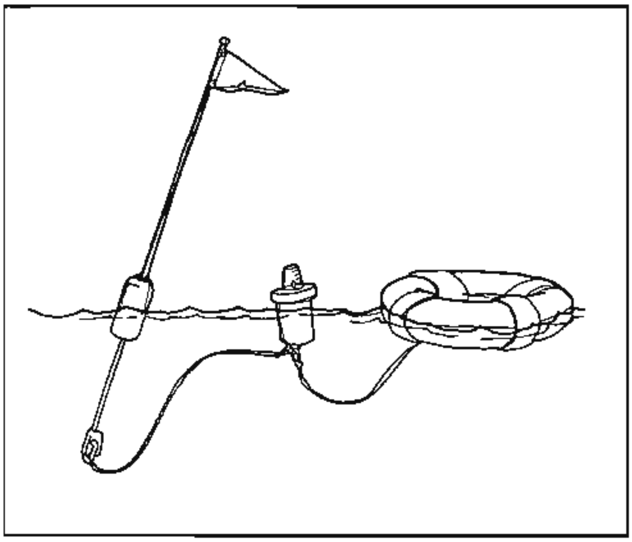


Figure 3-15. Ring buoy equipped with strobe light and man overboard pole.

Also throw a highflyer with a radar reflector, a strobe light, or a smoke flare, if possible, to help you relocate the victim. Some boats rig their ring buoys with strobe lights and man-overboard poles. The strobe light is hung upside down, but is designed to float upright; the light activates itself automatically when it is turned right-side up. The man-overboard pole consists of a fiberglass wand with a weight at one end and a flag at the other. The buoy, light and pole are connected by light line, and all three are tossed in the water together in the event of a man-overboard accident.

Because the victim will be incapacitated very quickly in cold water, whether or not he is injured, a rescuer equipped with an immersion suit and lifeline should be ready to go into the water to help him.

3.4.1 Man Overboard Precautions

Learn what and where to grab. Falling into the sea is dangerous. You may not be seen going overboard. You may be sucked under the vessel and through the propeller or get caught in semi-submerged nets and drown. Falling against machinery or through deck openings can be just as dangerous. The falling hazard is made worse by rolling and pitching decks, by running gear, by wet, slippery conditions, and by fatigue.

When the weather is rough, use extra precautions. Carelessness produces many avoidable man-overboard and falling accidents. Never grab a piece of running rigging. Whenever you are around running gear, know where there is a safe handhold; you may need to grab it if you start to fall.

Do not work alone on deck in heavy seas unless you have told other crewmembers and someone is watching you. If you must go on deck, wear a PFD and safety line. If you have to get something that falls overboard, do not lean over the rail. Use a boat hook. Do not use a draw bucket when the vessel is underway. Do not sit or climb on the rail. Do not climb into the rigging unless you are sent for a reason; observe safety procedures.

If you are standing a wheel watch, make sure you warn the deck crew of heavy oncoming seas, or of changes in course and speed.

If someone else falls overboard, sound the alarm, throw him a line or buoy, and keep your eye on him until you get further instructions.

When a fishing vessel has its gear out, it can't simply turn around to pick up an overboard crewman. There is a time lag before the rescue can begin. Crewmen are urged to wear worksuits, float coats or PFDs with inherent buoyancy, or properly maintained inflatables. Vessel operators should also consider requiring crews to wear hard hats.

We recommend that you rig a self-rescue device - a ladder or length of knotted rope - at the quarters of your vessel. There have been casualties and near casualties when crewmen were in contact with the vessel, but unable to reboard by themselves.

3.4.2 Man-Overboard Recovery Methods

There are a number of man-overboard recovery methods, and they are described in detail in Chapter 5. The most commonly used are:

1) *One-turn* or *Anderson:* fastest but requires the most skillful shiphandling;
2) *Williamson turn* for night or low visibility: turns you around and sends you down your previous track.
3) *Race track:* for the quickest recovery when you are proceeding at high speed in clear weather.
4) *Y-backing:* for ships with large turning circles and lots of backing power, proceeding at slow speeds.

Large ships often use a small boat to recover a man from the water. Smaller vessels will use the boat-recovery method as well when the sea is very rough, or when there is little chance of getting the man close along-side. Swimmers with PFDs or immersion suits and tending lines should be ready to go into the water.

No matter which recovery method is used, the same basic principles and methods apply. Swing the stern away from the person with full rudder. If possible, stop the shaft before the person reaches the screw. Always assign someone to do the job of keeping the man in the water in sight.

3.4.3 Recovering the Victim

The person must be recovered as soon as possible. Cold water kills in a matter of minutes. For small vessels in good weather, this means using the Anderson or race track methods. At night or in low visibility, the Williamson Turn, though not the fastest recovery method, must be used to bring the boat back along its former track. For any method, the desired final position is beam-to-the-wind, slightly to windward of the person, with all way off. In this position, a lee is provided for the man in the water, and since the vessel will make more leeway than the man in the water, it will drift toward him.

Hoisting a man out of the water can be difficult, especially on a vessel with high freeboard, and in a seaway. An effective method is to use a bowline or a ring buoy (Figure 3-16).

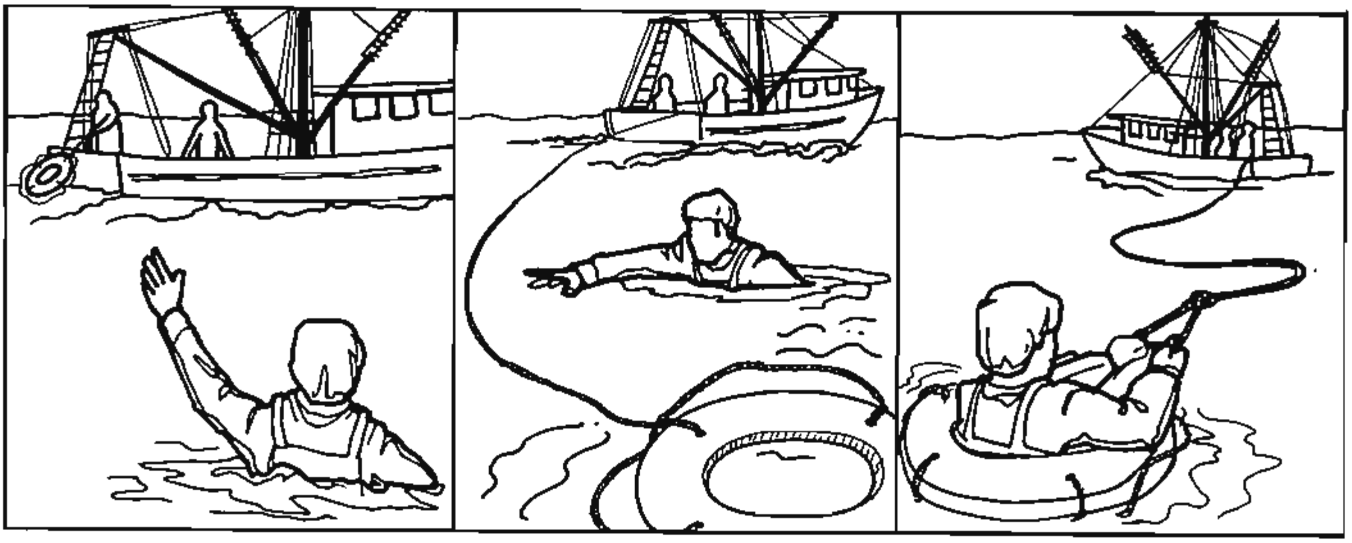


Figure 3-16. A life ring buoy should be thrown to man overboard quickly.

3.5 Abandoning Ship

3.5.1 Seven Steps to Survival

Abandoning ship is never routine, and the suggestions offered in this chapter cannot possibly address all the circumstances that may arise in an emergency. They are intended to make you aware of generally accepted procedures that should increase your chances of survival.

The Coast Guard has determined that there are seven steps to survival that you should observe:

1) Recognition. You must confront the fact that a life-threatening emergency exists. Don't wait until it's too late to make a distress call and initiate survival procedures.

2) Inventory. What have you got that will help you cope with the emergency? You must make your inventory quickly and assemble the gear you need.

3) Shelter. Your boat is your best shelter as long as it remains afloat, and it is a mistake to leave the boat too soon. If you must abandon ship, immersion suits and the liferaft become your best means of shelter at sea, and you must find other means of shelter if you reach the shore.

4) Signals. Your hope for survival probably depends on alerting someone who can help you. Your radio is your best signaling device, and you should establish radio contact as soon as you recognize that an emergency exists. When you no longer have radio contact, you must depend on EPIRBs, flares, strobes, flashlights, mirrors, dyes, etc.
5) Water. You need fresh water to stay alive and to maintain the physical strength needed to cope with survival. There should be fresh water in the survival pack on your raft, but take as much extra water as you can. Begin drinking rationed quantities of fresh water immediately to maintain your strength. *Never* drink salt water, urine, or alcohol.
6) Food. You need high energy food and you should add to the rations in your raft's survival pack if you can. Remember, however, that water is more important than food. Don't eat if you don't have water, because the food will make you thirsty, and it will drain your body of water.
7) Play. Survival gear won't keep you alive if you don't have the will to survive, and play helps maintain your will. Play can be a joke or a game, anything that keeps your mind focused on life instead of death.

3.5.2 The Decision to Abandon Ship

Only the captain should give the command to abandon ship; and only when the ship is in such distress that the lives of the people on board are endangered. Abandoning ship signifies the end of attempts to save the vessel. It means that the raft has become the best shelter.

You must sound the alarm and alert the crew in plenty of time to enable them to get to their emergency stations and prepare the survival gear. It is much better to have to re-stow the survival gear after a close call than to wish you had assembled it sooner. When the alarm sounds, each crewman must report to his station immediately and begin his assigned survival duties.

The first rule is to establish radio contact with a shore station or another vessel as soon as you recognize that an emergency exists. Don't let pride or panic cause you to delay making a distress call (Figure 3-17). The man on watch should always know the vessel's position; keep a DR (dead reckoning), and log your position and/or loran numbers at least every two hours and at every course change (for information on how to keep a DR, see Section 6.3.5 in Chapter 6).

If your emergency does not allow for a well-organized abandonment, use whatever time is available to send a distress message, muster all persons on board, and prepare the liferaft. In general, the smaller the vessel, the less time you will have between a disaster and the need to abandon ship.

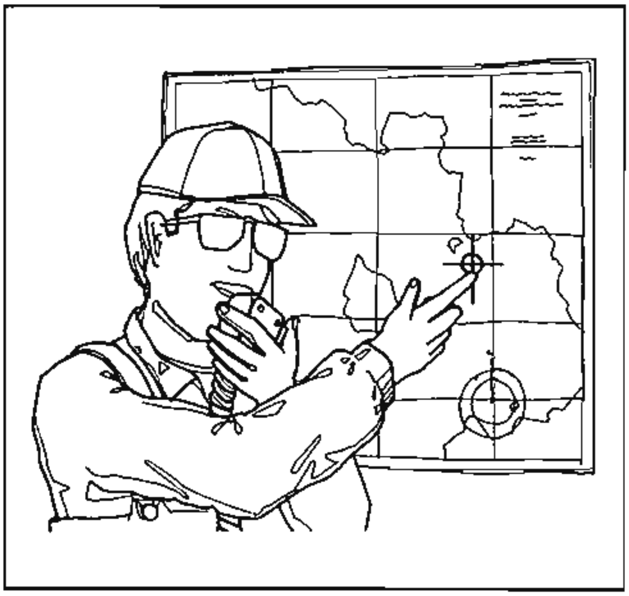


Figure 3-17 Establish radio contact as soon as you recognize that an emergency exists. Update the log frequently to ensure that the man on watch can quickly report the vessels position.

While it is a fatal mistake to wait too long to give the order for abandonment, it is just as dangerous to abandon ship too soon. As long as the vessel continues to float, it is your best means of survival. Searching aircraft and ships are more likely to see a vessel than a liferaft. However, to stay with the vessel, you must have a relatively safe place for the crew, and you must have a quick escape route to the liferaft.

3.5.3 Dress for Survival

If you are faced with an abandonment emergency, put on plenty of layers of warm clothing, including a watch cap, even if you will be using an immersion suit. Wool or polypropylene clothing is best (Figure 3-16). If you don't have an immersion suit, use something waterproof for the outer layer.

Cold, not lack of food and water, is the greatest killer.

If you have to enter the water without an immersion suit, the initial *cold shock* may be disabling or even fatal. Extra clothing and a waterproof outer layer will markedly reduce this shock effect.

Extra clothing will prolong your survival time by reducing your loss of body heat. The clothes will also help keep you afloat, because when you enter the water, air gets trapped between the extra layers of clothing. If you are lucky enough to board the liferaft without getting wet, the extra clothing will reduce the effects of cold (for discussion of cold-related threats, including *hypothermia*, see section 12.9).

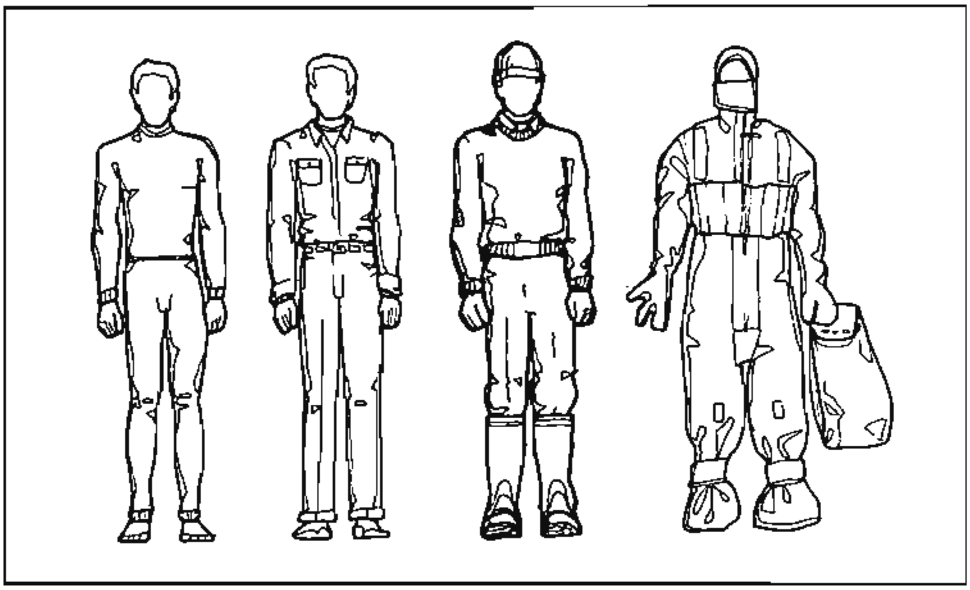


Figure 3-18. Put on layers of polypropylene or wool clothing to keep you warm and dry.

Be Sure you Have Flotation

Without a PFD or immersion suit even good swimmers will have difficulty staying afloat in cold water because of the disabling effects of cold, shock and cramps. Swimming makes you lose body heat and kills you faster in cold water.

A PFD or immersion suit will keep you afloat without effort, no matter how injured you are, or how much clothing you have on. Flotation also helps keep your head out of the water, which is vital in miminizing heat loss.

Know how to use your flotation before you need it (see sections 3.3.3 and 3.3.4 for discussion of PFDs and immersion suits).

3.5.4 Launching the Raft

Make sure your raft is installed with a hydrostatic release and clear of the rigging (see Installing your Liferaft, section 3.3.6). That way, if your vessel sinks suddenly, your raft will automatically inflate, and float to the surface (Figure 3-11).

However, if you have time before you have to abandon ship, you can launch your liferaft manually. Securely attach the raft's painter to your vessel before you launch the raft, otherwise you may lose the raft.

You may want to launch the raft from somewhere other than where it is stowed. If you do, be sure to untie the painter first, to prevent inflating the raft accidentally, since pulling the painter out of the canister to its full length is the way to inflate the raft. Resecure the painter to the vessel structure immediately using the weak link.

If you must cut the painter for any reason, there is a safety knife stowed near the raft entrance.

Before launching the raft, make sure the water in the immediate area is clear of people and obstructions. Two crewmen should grasp the canister at the ends and toss it into the water *on the lee side* of the vessel. The raft canister will have bands around it from the manufacturer. You do not need to cut these bands before you launch the raft. Pull the painter until the raft inflates (Figure 3-19). There may be as much as 100 feet of painter in the canister which must be fully withdrawn before the raft will inflate.

Wait for the raft to fully inflate before boarding. If you board too soon you may interfere with the raft's inflation.

Your raft will probably over-inflate and you will hear the sound of air escaping through pressure-relief valves. This does not mean that the raft is defective - the sound should stop in a few moments.

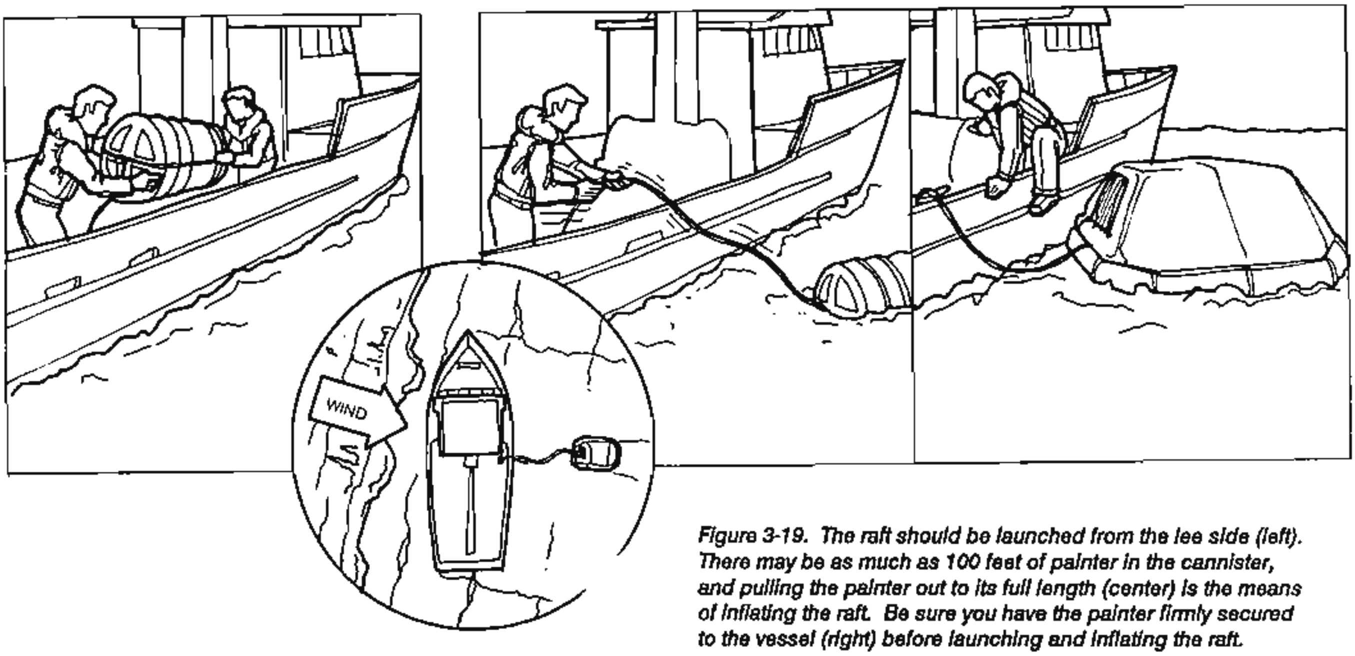


Figure 3-19. The raft should be launched from the lee side (left). There may be as much as 100 feet of painter in the cannister, and pulling the painter out to its full length (center) is the means of inflating the raft. Be sure you have the painter firmly secured to the vessel (right) before launching and inflating the raft.

Additional Supplies

Coast Guard-approved ocean service rafts contain a considerable amount of equipment. Your repacker should provide you with a list of everything aboard, and you should be aware of the raft's contents (see section 3.3.6 on Servicing Liferafts for the descriptions of survival packs).

However, you may want some more equipment. If you have time, gather as much other equipment as you can. Use your time wisely, and remember the seven steps.

We suggest you stow the following gear ready for abandonment:

* Blankets and extra clothing.
* Foul weather gear and waterproof material like space blankets, tarpaulins, or plastic sheeting.
* An EPIRB.
* Flares, strobes and other signaling devices.
* Additional flashlights, batteries and bulbs.
* Extra water. Fill water-tight containers three-quarters full; they will float and can be towed behind the raft.
* High-energy foods - energy bars, candy bars, cookies, fresh or dried fruits in watertight packages. Canned foods are heavy, and offer little energy value.
* Vitamin supplements.
* Notebook and pencil for keeping a log.
* Charts marked with the vessel's estimated position/ current charts.
* Light rope for towing purposes
* Light buckets or bailers
* Sea dye
* Radar reflector
* Portable radio
* Copy of this manual

3.5.5 Boarding the Raft

Boarding from the Vessel

If possible, board the liferaft without entering the water to avoid the effects of cold. You may be able to jump from the rail directly into the canopy entrance, or lower yourself to the raft with a ladder, net or line. If the distance isn't too high, and there is no one else already inside the raft, you can jump directly onto the canopy (Figure 3-20).

Think before you jump. Your odds of surviving are going to be even worse if you hurt yourself. Do not bring any sharp object with you that could puncture the raft.

Jumping into the Water

If you must enter the water, choose a safe place to leave the vessel, keeping in mind the following points:

* If at all possible, enter where you can use the painter line to guide you to the raft. If you are not in contact with the painter line, you may be swept beyond the raft.

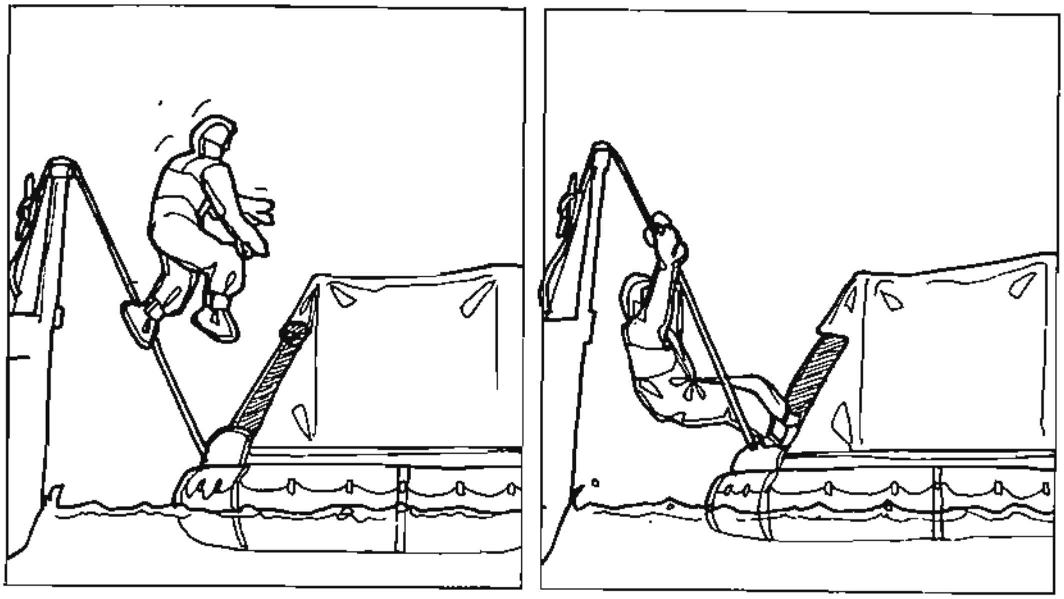


Figure 3-20. If at all possible, board the raft without getting wet. You can jump directly into the canopy opening (left), or lower yourself with a ladder, net or line (right).

* Beware of hazards below you. Don't jump onto people, objects or burning oil. Jump from the lowest suitable point to minimize impact with the water. Consider using a ladder, net or line to lower yourself to a safe point of entry.

If you are Wearing a PFD:

* Be sure it is securely fastened. Cross your arms over your chest to help hold it down.
* Block off your nose and mouth with one hand.
* Protect your head.
* Keep you feet together in case you land on something.
* Check the area below before you jump.
* Jump feet first (Figure 3-21).

If you are Wearing an Immersion Suit:

* Be sure it is fully zipped and that all closures are snug. You want it to keep water out.
* Leave the external flotation bladder *deflated* until you are in the water.
* Hold the top of your suit with one arm for two reasons: to protect your head, and to prevent escaping air from popping the hood of the suit up over your head.
* Check the area below.
* Jump feet first, with feet together (Figure 3-22).

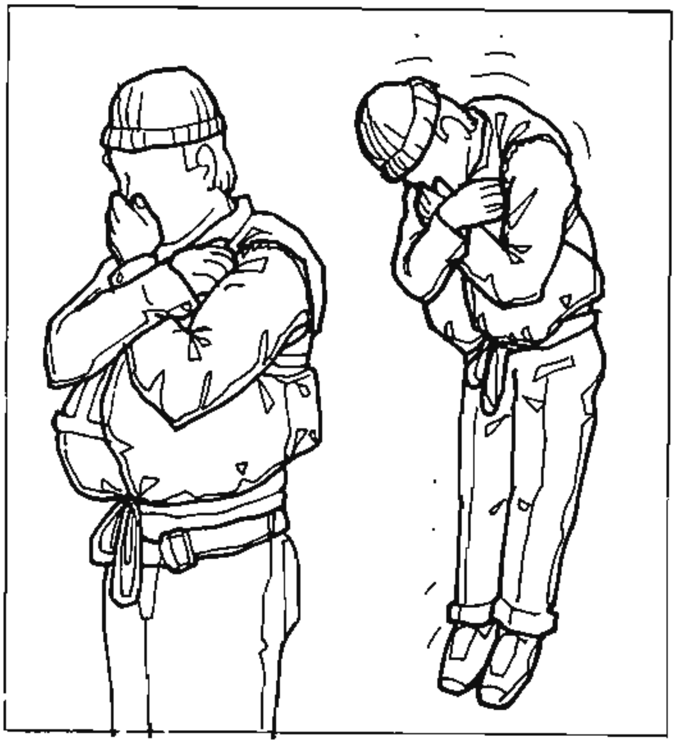


Figure 3-21. If you must enter the water wearing a PFD, cross your arms securely over your chest and block off your nose and mouth (left). Always enter the water feet first, with your feet together (right).

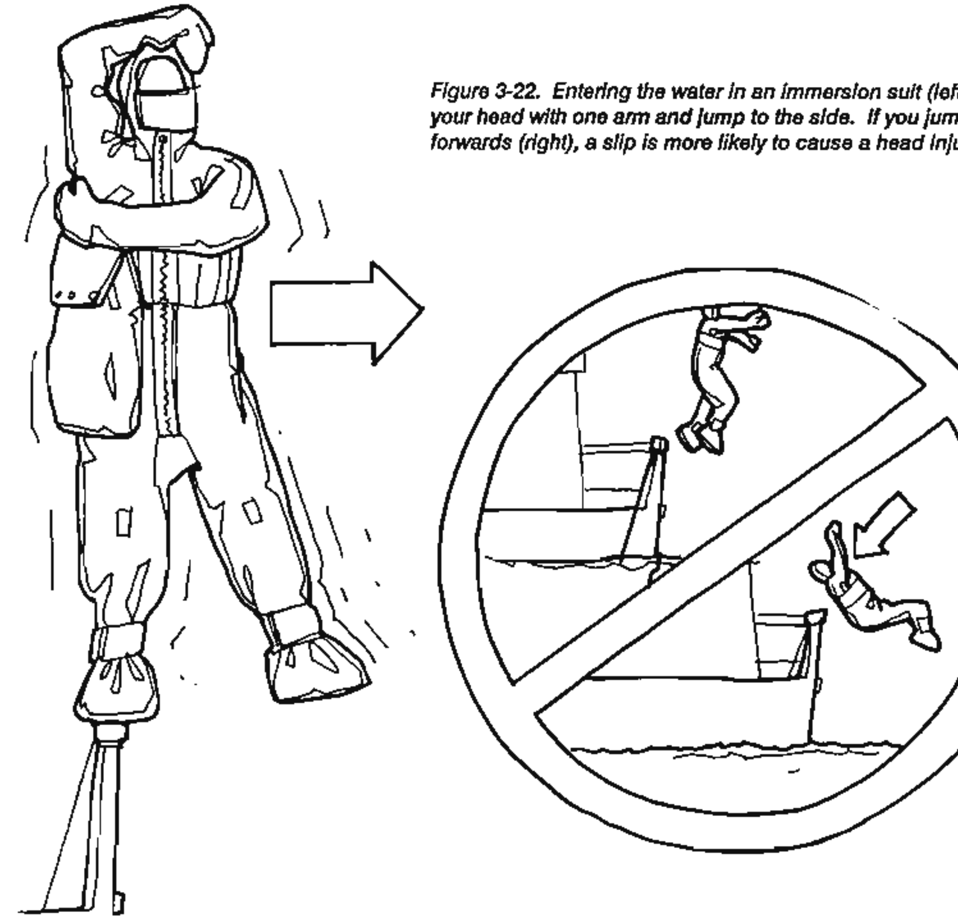


Figure 3-22. Entering the water in an immersion suit (left). Protect your head with one arm and jump to the side. If you jump facing forwards (right), a slip is more likely to cause a head injury.

Stay with your Boat

If your boat is still afloat, remain secured to it unless fire or some other danger forces you to cut the painter. There are two good reasons for remaining attached to your boat:

* It may not sink, and as long as it remains afloat it is a potential form of shelter. If it sinks in shallow water, it may serve as an anchor for the liferaft.
* Staying close to your boat keeps you closest to your distress position and makes you easier to spot, both visually and on radar.

If you decide to cut the painter, use the safety knife stowed near the entrance. Its curved blade is designed to avoid accidental damage to the raft.

If there is more than one raft in the water, tie them together with a doubled rescue line. Again, there is safety in numbers. You will have more survival gear between the two, and it is easier to spot two rafts than one. If there are heavy seas, leave adequate slack between the rafts. When rafts are tied by a short line in big seas, they tend to snatch, which may allow wind to get underneath and cause a capsize.

Action in the Water

Avoid staying in the water one second longer than necessary. You will lose body heat to the surrounding water very quickly. This leads to hypothermia (cold exposure), unconsciousness and death. Wearing extra clothing will help delay the start of hypothermia.

If you cannot get into a liferaft, do not swim aimlessly; swimming increases heat loss. Remain as still as possible using flotation to keep you high in the water. Since heat loss occurs much faster in water than in air, keep as much of your body out of the water as possible. You may be able to get on top of floating debris (a lifebuoy, a board, even a dead body) to help keep you out of the water.

Now is the time to inflate the external bladder on your immersion suit with the mouth tube. If you don't have an immersion suit and you are alone, use the HELP (Figure 3-14) technique. If there are other survivors, form a huddle. A group is more easily located, more likely to maintain morale, and a good way to decrease heat loss.

If your immersion suit or PFD has a whistle attached, use it to attract attention. You may not be visible, but using the whistle will enable you to let others know where you are. If you have taken the time to prepare a personal survival kit, you may have other signaling devices that will boost your chances of rescue. Use them wisely, and get into the liferaft as soon as possible.

When you are in the water, whether or not you are in a liferaft, try to stay near the boat. It may not sink, and you may be able to reboard. If it stays afloat, searchers will be able to spot it more easily than they can spot you. Staying close to the boat also keeps you closest to the position reported in your distress call.

Boarding the Raft from the Water

Boarding a liferaft from the water without help is difficult. Pull your head and upper body in first using the boarding ladder and lifelines at the raft entrance. It may help to bob down and use the buoyancy of your PFD or immersion suit to help lift you out of the water. Once your upper body is on the buoyancy tube, there should be internal lifelines to help you pull yourself all the way in. Try to pull yourself in with the boarding ladder and lifelines rather than the canopy, since you run the chance of tearing the canopy.

Getting an Injured Man Into the Raft

If one of your crewmates is injured and unable to help himself aboard the raft, pull him in carefully to avoid aggravating his injuries. Have him face the raft until you get his upper body aboard. Pulling him in with his back to the raft could harm him if he has a back injury. Once his hips are resting on the buoyancy tube, gently turn him until he is on his back, and pull him into the raft (Figures 3-23). Keep him lying on his back until you have determined the extent of his injuries (see Chapter 12 - Medical Emergencies - for tips on assessing and treating injuries).

3.5.6 Righting a Capsized Raft

One person can easily right a capsized craft if it is done before the canopy fills with water. Swim to the side marked *Right Here*. If there is no marking, go to the side with the CO_2 cylinder. Maneuver the cylinder side of the raft so that it is downwind, then reach up and grab the righting strap. Start pulling yourself up onto the raft. It may help to kick your feet out as if you were swimming.

If that doesn't work, try putting your feet or knees into the external lifelines to help you pull yourself up on the raft. Some rafts may right while you are climbing onto them. If not, stand on the very edge, where the CO_2 cylinder is located. Lean back with all your weight and pull on the righting strap.

If the canopy is clear of the water, the raft will begin to follow you. If the raft is large, it will land on top of you, unless you spring backwards just as the raft begins to right (Figure 3-24).

If the raft does land on top of you, don't panic. The bottom of the raft is soft and flexible and your head will form an air pocket. Stay face up, catch a breath of air and pull yourself out from underneath. If you try to swim out face down, your PFD or immersion suit could get hung-up and make it difficult for you to get free.

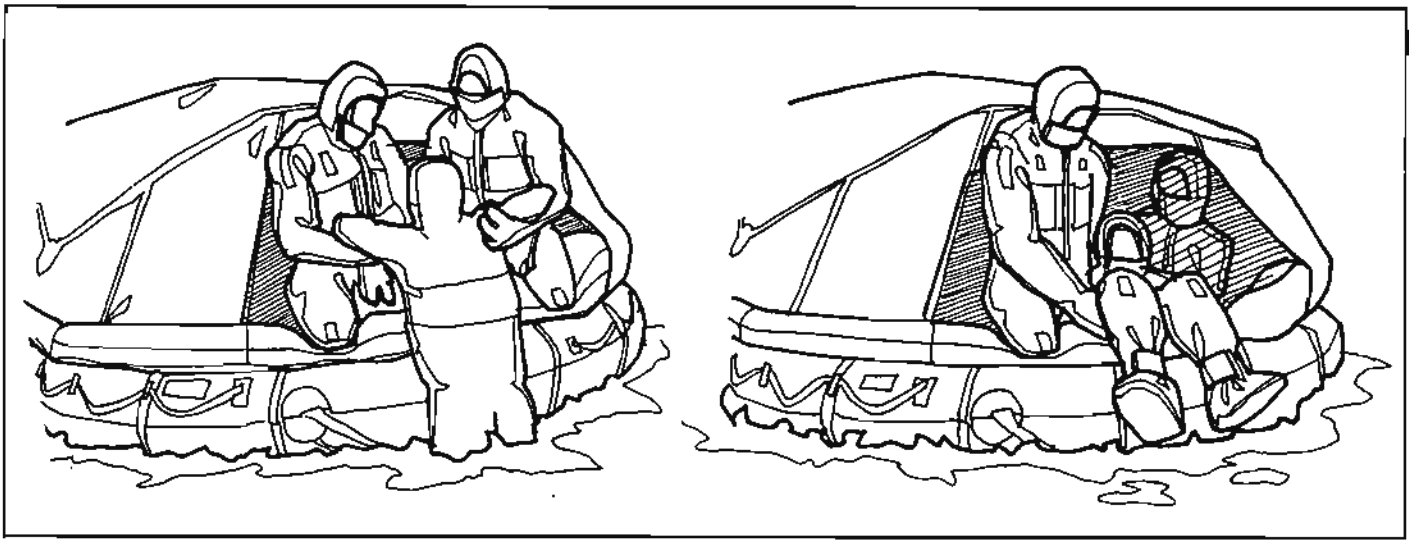


Figure 3-23. Lift an injured survivor with his face toward the raft until his torso rests on the inflation tube (left). When his hips are on the tube (right), gently turn him on his back and pull him into the raft.

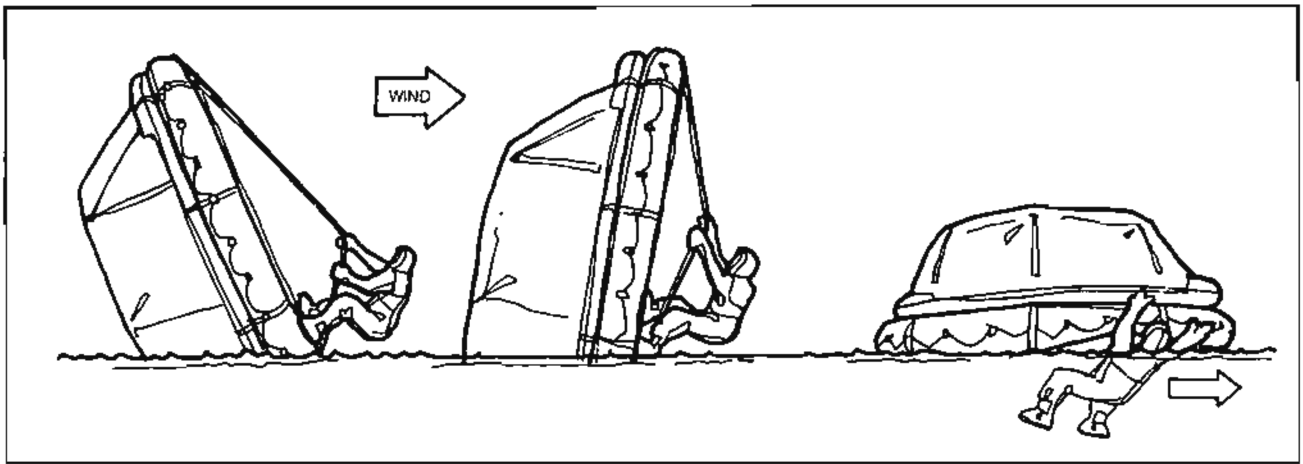


Figure 3-24. To right a capsized raft, grab the righting strap and pull. When it starts to right, you have to spring backward to avoid having the raft land on top of you (right).

Righting a capsized raft with water trapped in the canopy

If the inverted canopy fills with water, the raft will be more difficult to right. Put as many people as you can on the righting strap, and try to pull it over. If you can't right it, you may have to cut a hole in a non-vulnerable part of the canopy, taking care not to deflate the canopy or the raft.

3.6 Surviving Aboard the Liferaft

3.6.1 Initial Situation in the Liferaft

Immediately after abandoning ship and gaining the shelter of a liferaft, survivors are likely to be cold, wet, exhausted, and suffering from varying degrees of shock. Mental and/or physical let-down leading to collapse is likely at this stage. If you are going to survive, you must maintain your self-control and your will to live.

At this point, you will be faced with multiple problems, and you must decide the order in which you deal with them. *Inventory* and *shelter* are high priorities. You must be sure that all survivors have found the liferaft, and make it a real shelter by insulating it against the cold. You must treat serious injuries and try to prevent seasickness. You should examine the equipment and supplies on the liferaft, and read the instructions for their use. If there are several people on board, assign each person a task to accomplish the tasks simultaneously. You must establish priorities, keeping in mind the seven steps (Section 3.5.1).

Look for other survivors. The survival pack aboard the raft should include a flashlight that will help you search at night. The light is also a handy signaling device. Look for lights or reflective tape on other life-saving equipment. Listen for whistles. If it is necessary to swim to a survivor, use a safety line because the raft will drift faster than you can swim.

If you have cut the raft free of the vessel, check to be sure that your *sea anchor* or *drogue* has been deployed. Liferafts can drift rapidly. The sea anchor reduces the rate of drift and assists the search by reducing your distance from your distress position. The sea anchor is deployed automatically on many rafts, and there is usually a spare packed aboard (see the section on sea anchors and drogues later in this chapter.)

Close the liferaft entrance when everyone is inside to keep out the cold and wet and keep in the warmth generated by the occupants. Leave only a small opening for ventilation. Post a look-out.

Rafts are made so that you have the choice of pumping the floor up with air or not. This is because in tropical climates, the water under the raft will help cool the inside. In northern latitudes, regardless of the time of the year, you should pump up the floor with the hand pump inside the raft. Some rafts have seating positions that also must be pumped up by hand (Figure 3-25).

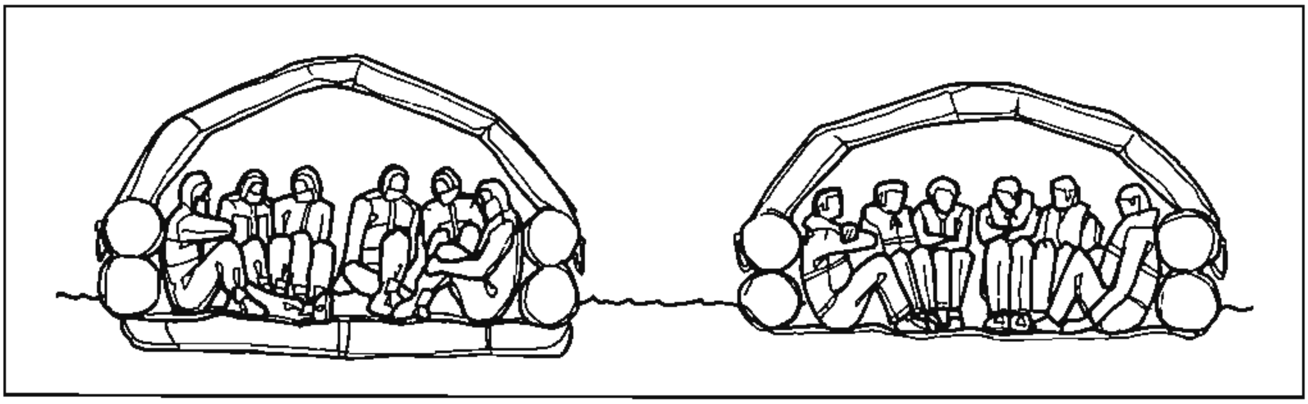


Figure 3-25. In cold climates, pump up the floor as soon as possible (left). In hot climates (right), the floor may be left uninflated to help keep you cool.

Inspect the liferaft for damage. If there are leaks, use the repair clamps (Figure 3-26).

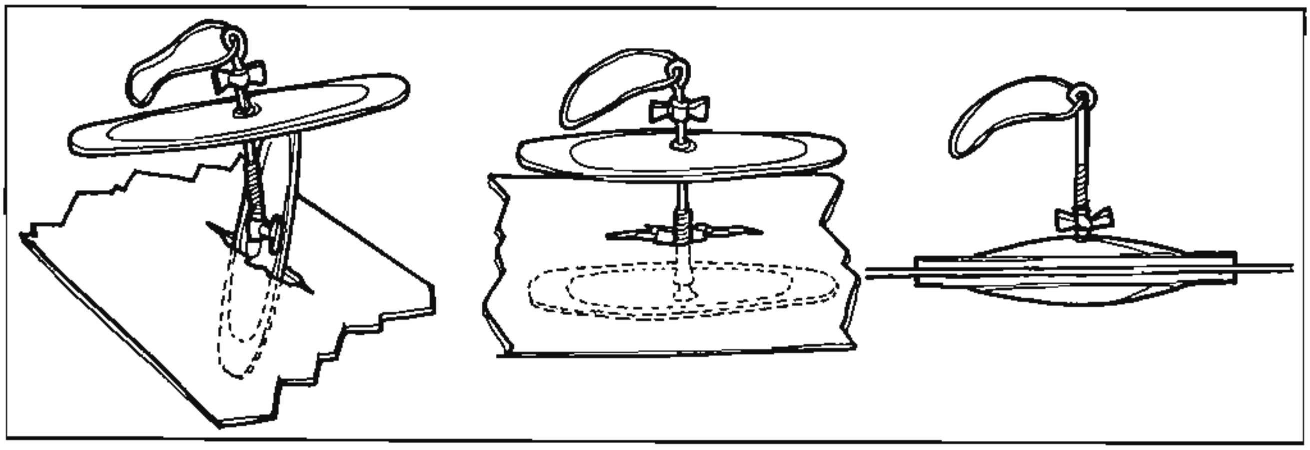


Figure 3-26. Inspect the raft and use the repair clamps to fix leaks.

Take seasickness tablets as soon as possible. Even *hardened sailors* are probably going to get seasick on a raft, and seasickness results in loss of body fluid and incapacitation.

If you have an EPIRB, make sure it is working (see section 3.3.1). Leave it on. Don't switch it on and off or work the switch unnecessarily. If you have a hand-held VHF radio, transmit distress messages to help rescuers home in on the signal. Any portable two-way radio available should be taken aboard the raft.

Use distress flares and rockets sparingly, and only where there is a likelihood of their being seen (see section 3.3.2). If they are sighted by a searching aircraft, it may be some time before your rescue is at hand, but your location will be known.

Treat all Injuries

You must assess and treat serious injuries according to the procedures outlined in the Medical Emergencies chapter, with one exception. You cannot perform the chest compressions required for cardiopulmonary resuscitation (CPR) because of the soft floor of the raft. A suggested method of performing chest compressions is to place the victim on his back, *on top of* another crewman. The man on the bottom wraps his arms around the victim's chest, locks his hands and performs the chest compressions as if he is giving a bear hug.

Where crewmen are recovered from the water apparently drowned, start mouth-to-mouth rescue breathing immediately, and continued until help arrives, or you are too exhausted to continue. In cold water (below 70 degrees F.), near-drowning victims have been revived after being submerged for as long as an hour because of a body response known as the *mammalian diving reflex.* It is the same response that enables whales and seals to remain underwater for long periods. *Don't give up on a near-drowning victim.*

Preserving Body Heat

Remember that cold is the greatest killer. Every attempt should be made to pump or bail out the liferaft, and to dry out the interior by using the sponges provided in the survival pack, extra clothing, etc. If your clothing is wet, remove it, wring it out as much as possible, and put it back on.

In general, clothing should be shared among survivors, but take special care of the sick and injured. Make waterproof or windproof clothing available to those on lookout duty in the open.

Once the liferaft has been dried out as much as possible, make every effort to raise the body temperature of the survivors. This is vital in cold weather or when survivors have had prolonged immersion in the water. Keeping dry also helps guard against *immersion foot* (see section 12.11).

Close the canopy entrances, inflate the floor and have the survivors huddle together for warmth. The body heat of the occupants will raise and maintain the temperature inside the raft. Tests in sub-zero temperatures have shown that the temperature inside the liferaft can be raised to 60 degrees F inside an hour.

3.6.2 Leadership and Morale

Good leadership and high morale are crucial for survival. Good leadership creates high morale, and the leader must take on the responsibility of keeping the other survivors as organized, calm and comfortable as possible.

The vessel captain will normally be the leader aboard the liferaft, unless he is injured or missing. In some survival circumstances, however, unlikely leaders emerge. The leader should be the person who is in the best shape, physically and emotionally; he will establish priorities and maintain morale, whether or not he is the captain.

If you are in charge, it is important for you to communicate with the other survivors. You must reassure them *and* assess who is best able to carry out vital tasks. Do everything you can to reduce fear and panic. Use the materials in the liferaft to show the survivors that there is shelter, means of signaling, water and food.

Try to establish a sense of companionship and a firm but positive level of discipline. If you must deal with someone who has lost his emotional control, don't let him disrupt the rest of the crew. If may help to give him an aimless task. One survival instructor suggests rigging a fishing line with a weight, but no hook (which might tear the raft), throwing the weighted end over the side, and instructing the man to catch a fish.

While the leader has the greatest responsibility, each survivor must strive to maintain a positive attitude and carry out the tasks which he is assigned. The survival of the group depends on each man's contribution, and it is here that preparation and training pay off. A man who has foreknowledge of survival procedures, and can focus his mind on constructive tasks, is much more likely to make a positive contribution than one who has his panic for company.

In striving to maintain morale, don't forget that one of the seven steps is *play*.

Establish the Routine

The discipline of a routine not only helps ensure that vital tasks get done, but helps focus attention on the positive work of survival. The following suggestions should help you establish a routine:

* Assign one-hour watches in pairs, with one man on duty outside and one man on duty inside.

Outside

a) Look for ships, survivors, aircraft and useful wreckage.
b) Flash the signaling mirror all around the horizon when there is sunshine. Someone else can see your mirror before you can see them.
c) Look for land. At night, listen for surf.

Inside

a) Maintain the liferaft (bailing, drying, ventilation, etc)
b) Attend to injury victims.
c) Maintain equipment.
d) Keep rations.

Keep the minds of the survivors occupied during waking hours, but don't overdo it. Avoid unnecessary work.

Water

Your body is about 70 percent water. Maintaining your body's *water balance* is a prime requirement for survival. Remember that water is a higher priority than food. You can probably live for weeks without food, but your survival will be measured in days if you have no water. Because the digestion of food drains needed water from your body, don't eat if you don't have water. Every bit of water you conserve, even perspiration, increases your survival time.

While conserving water is vital, so is maintaining enough physical strength to cope with the ordeals of survival. Survival experts recommend that you begin drinking rationed quantities of water soon after boarding the liferaft, the amount depending upon how much you have been able to bring aboard. They suggest drinking one-half of the daily ration at a time, rather than sipping very small quantities.

Thirst may be reduced by chewing on gum, or practically anything else. However, this relief does not reduce the body's need for water.

Drinking seawater will exaggerate thirst, promote water loss through the kidneys and intestines, and shorten your survival time. Under conditions of lack of water, urine is too toxic to drink and will also cut down your survival time. Alcohol will promote heat loss through the skin and water loss through the kidneys. Drinking alcohol under the conditions of lack of water is suicidal.

General

Lash down all gear so that in case the raft capsizes or is swamped, nothing is lost.

If you don't have a metal radar reflector, metal paddles can be used to reflect radar signals. A raft is never a good radar target. Recovering survivors in a raft usually depends on visual sighting.

Never waste your distress signals, flash light batteries, etc. Distress signals should only be used with the permission of the leader and only when there is a reasonable chance that they will be seen. Use the whistle and shout in thick weather.

3.6.3 Using a Sea Anchor or Drogue

Your liferaft should have a *sea anchor* or *drogue*, which is used to reduce the rate of drift away from the distress position, and thereby reduce the likely search area.

The drogue is normally attached to a strong point on the raft and lightly lashed so that it is released automatically when the raft is launched (Figure 3-27). A spare drogue is usually stowed with the other equipment. Since you will use the drogue continuously, have it and its line inspected frequently.

By varying the point of attachment, the drogue can be used to alter the position of the raft openings relative to the seas. The drogue can thus help you gain more shelter or better ventilation.

If both drogues in the liferaft have been lost, make every attempt to jury-rig another one, using whatever is available on the raft: paddles tied to lifejackets; discarded clothing; or a pair of trousers with legs tied, and the waist held open. You may be able to use a section of the raft canister if you still have it. Or, you can make a temporary drogue using two buckets and a heaving line. With the bight of the heaving line inboard, make each end fast to the handle of the bucket (and around the bucket for safety), and pay out one bucket on each bow.

Until recently, liferaft drogues have not been rigged with tripping lines, although such lines are now being installed on Coast Guard-approved rafts. If there is no trip line and you need to increase your rate of drift (to clear obstacles or reach a landfall, for example), you will need to haul the liferaft to the drogue, and remove the drogue from the water.

3.7 Personnel Trapped in a Capsized Vessel

The following procedures are recommended for personnel trapped in a capsized vessel.

* Seek out an air pocket. People have lived for hours in this manner. Don't panic. If you remain calm, you've got a chance. If you panic, you're dead.
* Before attempting escape, make an inventory of what survival aids you can take along. Signals are especially important. If possible, take a PFD or immersion suit: you'll need flotation and shelter once you have surfaced outside the boat.

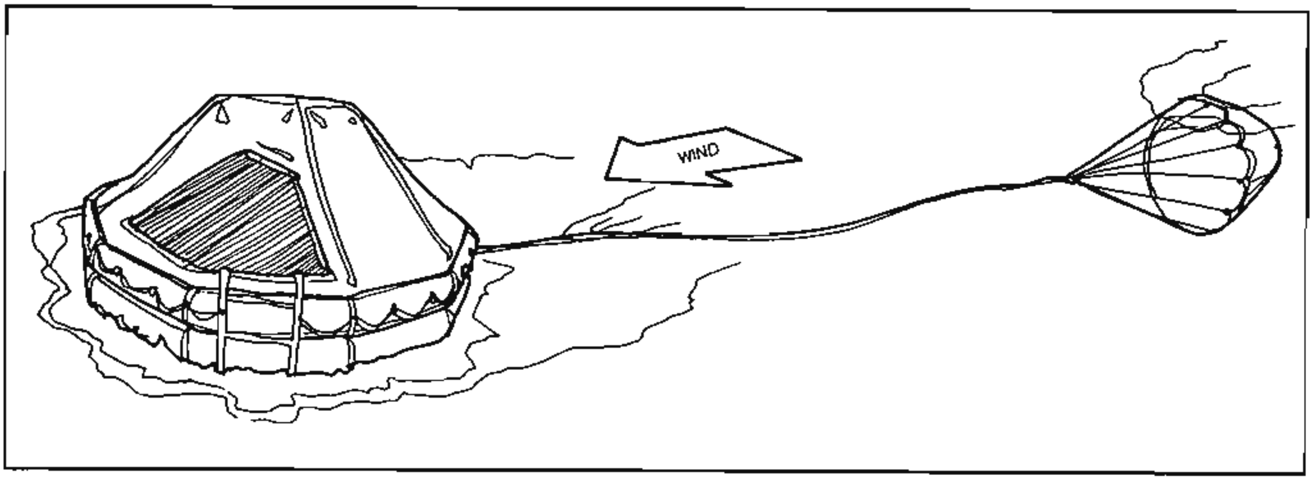


Figure 3-27. The drogue or sea anchor should be deployed automatically when the raft inflates. It is essential for reducing the rate of drift.

* Remember that cold water will significantly decrease the length of time you can hold your breath. It may also give you a sensation of tightness in the chest. If you are unsure of how long you can stay down, practice inside the compartment before making an escape attempt. Practice may avoid panic.
* If you are unable to dive deep enough wearing a PFD or immersion suit, remove it and try again. Pull yourself hand-over-hand if you're unable to swim or dive deep enough to reach an opening.
* Remember that the boat is upside down and *all* exits and passageways will appear different.
* If more than one person is trapped, the first person to exit should try to rig a guide line for others. When he is free, he should try to communicate with them through the hull.
* If you can't escape, don't give up hope. Stay with the air pocket. When you hear rescuers, try to communicate by shouting or pounding on the hull. Try to conserve your remaining air by staying calm and minimizing physical activity. Conserve your body warmth by getting as far out of the water as possible.

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CHAPTER 4

FIRE PREVENTION AND FIRE FIGHTING

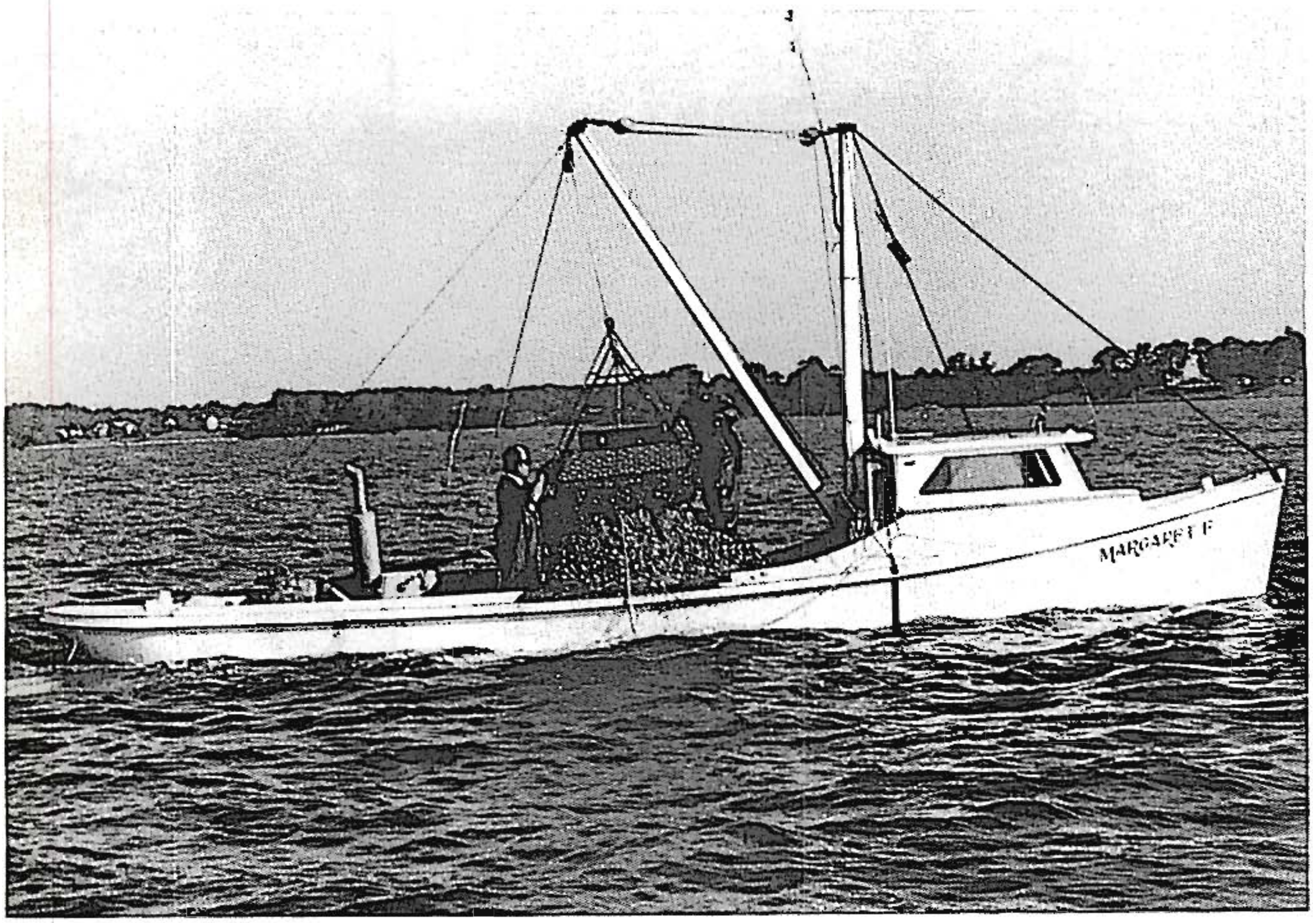


Photo courtesy of VIMS Sea Grant Advisory Program

CHAPTER 4

FIRE PREVENTION AND FIRE FIGHTING

4.1 Introduction

Fire is even more dreaded at sea than it is ashore. Fishermen faced with fire at sea can neither call for professional help nor run away from the danger. You must decide if you should remain on board and fight the fire yourself or abandon ship.

It is every fisherman's responsibility to be well prepared for the prevention and control of fire. You should understand the causes of fire and make every effort to prevent it. You should have a good working knowledge of the equipment and techniques that will best contain and extinguish fire. The Fishing Vessel Safety regulations will set minimum equipment and training requirements for your vessel size and type. You must be familiar with these regulations.

This chapter covers the following: tips for fire prevention; an explanation of the factors that enable fire to sustain itself; a discussion of different types of portable and fixed fire extinguishers; how to use water to fight fires; and basic fire fighting tactics.

No matter how well you understand the material presented in this chapter, without hands-on experience with the type of fire fighting equipment carried aboard your vessel, you won't really be prepared. One of the most valuable lessons that should be learned in any training program is when to make the decision to abandon ship. Even the most experienced fire fighter with the best equipment should be ready to use this option. Your boat may be lost, but you and your crew will live to tell the story.

"A little food for thought for anyone who goes out on the water. We had five minutes from the time we knew we had a fire, until the wheelhouse was engulfed in flames and we were in the raft. She was a 73 foot boat."

4.2 Preparation and Prevention

Coast Guard statistics reveal that most fires aboard fishing vessels occur in unattended machinery spaces. However, fires also happen in accommodation spaces and galleys. Typical causes include broken fuel or hydraulic oil lines that spray fuel on hot engine parts, faulty electrical systems, uninsulated exhausts in contact with flammable materials, rags or other combustibles in the vicinity of hot engines, and spontaneous combustion of oil-soaked rags.

Fire prevention begins with the design and construction of the vessel. Each vessel should be built with an eye toward maximizing structural fire protection and restricting the use of combustible materials. Bulkheads, decks and other structures should be noncombustible. Fire resistant or retardant materials should be used for deck coverings, interior surface finishes, curtains and carpets. Avoid having combustible furniture on board your vessel. Polyurethane foam or other insulations must be applied properly and covered with a fire-resistant coating.

Adequate ways to ventilate your vessel should be built into the design. Fuel, lube and hydraulic oil lines must be installed in a safe manner. Exhaust systems must be properly insulated, and engine rooms, cargo spaces and fuel tanks must be adequately vented. You should observe minimum stairway and passageway sizes, and there should be at least two means of escape from each compartment (Figure 4-1). Electrical and machinery installations must be done by trained personnel.

Your vessel should have fire and smoke detection and alarm systems in unattended machinery spaces, galleys, accommodations and other high risk

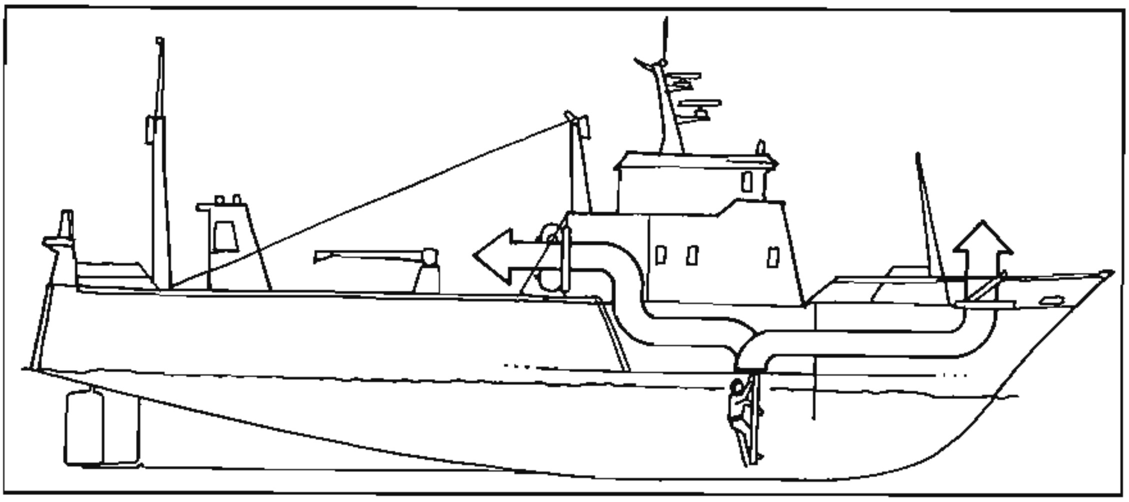


Figure 4-1. Each crewman should practice exiting via escape routes he may be forced to use in an emergency. If a fire breaks out, he may have to exit in the dark or in blinding smoke.

spaces. Fixed fire extinguishing systems are recommended and may be required on larger vessels.

The International Maritime Organization, the U.S. Coast Guard and vessel classification societies set standards for fire prevention, firefighting equipment, and vessel design. You should follow these standards when you have your vessel built, or when you equip it for fishing. No matter how well a vessel is designed, constructed and equipped, however, it is up to the crew to keep the vessel safe from fire.

4.3 Awareness

Constant awareness of the danger of fire is the responsibility of each and every crewman. In other words, carelessness is a chief cause of vessel fires.

Each crewman should be alerted to common fire hazards and taught how to eliminate them. Each crewman should be advised of his duties in the event of fire, and should be aware of all means of escape from interior spaces in case a fire occurs.

4.4 Causes of Fire

4.4.1 Spontaneous Ignition

Spontaneous ignition (commonly called "spontaneous combustion") is often overlooked as a cause of fire aboard ship, yet it can occur within many common materials.

For example, a rag soaked with oil or paint and thrown into the corner of a workshop, storage area or engine room is an excellent candidate for spontaneous ignition.

The area is warm and there is no ventilation. The oil on the rag begins to "oxidize" to react chemically with the oxygen in the warm air around it - which in turn produces heat. The heat causes the oil to oxidize faster and produce still more heat. Since the heat is not drawn away by ventilation, it builds up around the rag.

Finally, the rag gets hot enough to burst into flames (Figure 4-2). It then can ignite any nearby combustible substances - perhaps other rags or stored materials - and a major fire becomes very possible. All of this can and does occur without any outside source of heat.

4.4.2 Faulty Electric Circuits and Equipment

For properly insulated and wired equipment, electricity is a safe and convenient source of power. When electrical equipment wears out, is misused or is poorly wired, electrical energy can turn to heat, and fire may be the result.

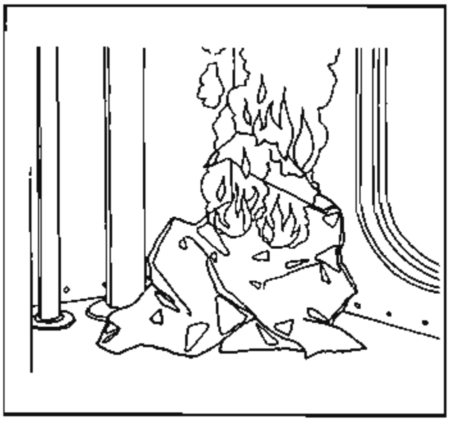


Figure 4-2. Oil-soaked rags in a warm, unventilated corner are all it takes to cause a fire.

Especially in the harsh environment at sea, electrical equipment must be installed, maintained, tested and repaired by trained personnel.

Standard home or industrial electrical equipment has no place on the ocean. The salt air causes corrosion, and a steel hull can cause erratic operation or shortcircuiting (Figure 4-3). The result may be overheating or arcing in equipment or wiring and the ignition of flammable materials nearby.

Approved marine electrical equipment is specially made for shipboard use. Given the right maintenance, it will withstand the hard life at sea. Thus, only approved equipment and replacement parts should be used aboard your vessel, and only in the manner for which they have been approved.

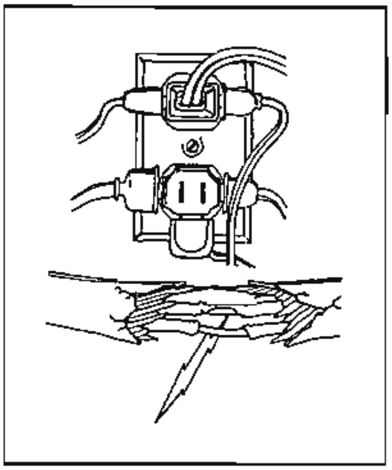


Figure 4-3. Damaged insulation, overloaded receptacles are common causes of fire.

The insulation on electrical wiring, like that used for appliances, electric hand tools and drop lights, does not last forever. With age and use, it can become brittle and crack. Or, it may be rubbed-through or broken by abuse or vibration. No matter how it happens, the result of damaged insulation is dangerous bare wire. A single exposed wire can arc to any metal object. Two exposed wires can touch and cause a short circuit. Either circumstance can produce enough heat to ignite the insulation on the wiring or set fire to some other nearby material.

Further, if there is no fuse or circuit breaker in the problem circuit, or if it is oversized, the circuit won't be broken. Instead, an increased current will flow and the entire circuit will overheat. In time, the insulation will begin to burn and ignite combustible material nearby.

You can avoid this type of fire by making frequent inspections and replacing wires that are obviously defective, and by using only fuses and circuit breakers of the proper size for their circuits.

Crewmen should avoid "juryrigging" electric outlets or circuits to serve additional appliances, and should avoid overloading electric receptacles.

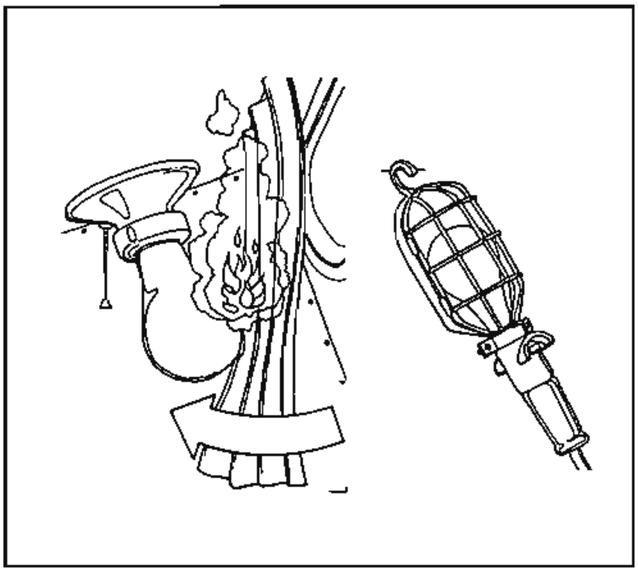


Figure 4-4. Exposed light bulbs can cause fires; Bulbs should have guards.

4.4.3 Exposed Light Bulbs

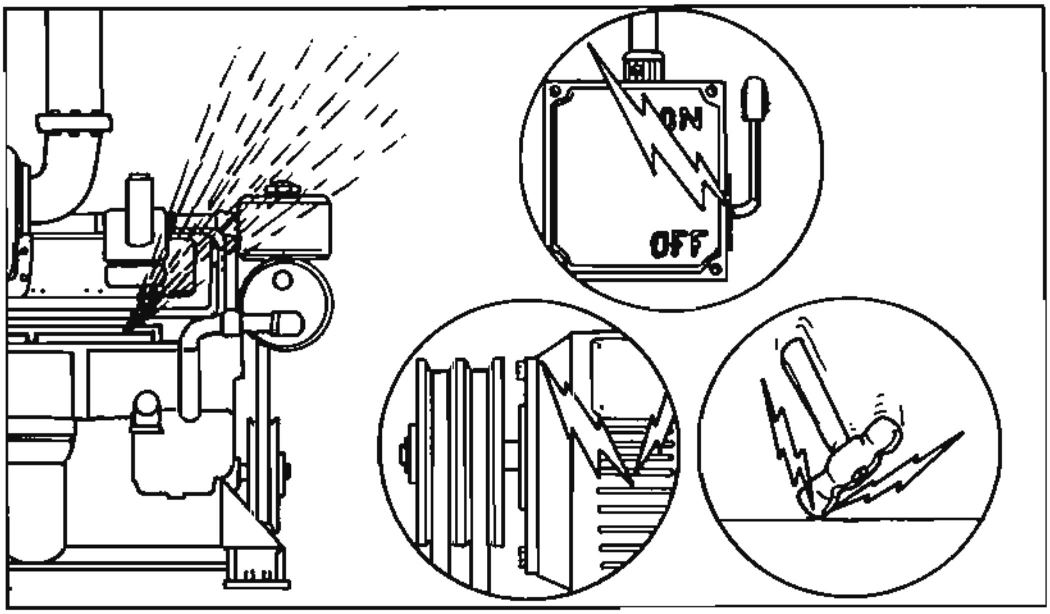
An exposed light bulb can ignite combustible material by direct contact. Numerous vessel fires have started when a crewmember left a lamp lit in unoccupied quarters. As the ship rolled, curtains or other combustible material came in direct contact with the hot bulb and ignited. Crewmen should use no unauthorized lighting on extension cords, and should utilize guards provided with drop lights (Figure 4-4).

Engine room lights should be covered by vapor globes and screens. Lights and electrical fixtures in areas that contain flammable or combustible vapors should be fitted with UL-approved explosion proof devices.

4.4.4 Engine Rooms

Engine rooms are full of fire hazards. Water dripping from ruptured sea water lines can cause severe shortcircuiting and arcing in electric motors, switchboards and other exposed electrical equipment. This in turn can ignite insulation and nearby combustible materials. Diesel fuel and hydraulic oil are highly flammable when vaporized. Ruptured fuel and lubrication lines above and near electrical equipment, or near hot engine exhausts have been the cause of many vessel fires (Figure 4-5). Uninsulated engine exhausts have also started fires where they penetrate wooden decks or come in contact with other combustible materials.

Figure 4-5. Atomized fuel can be ignited by a faulty switch, an arcing motor, even the spark from a heavy tool dropping.



Prevent kinks in fuel and lubricating lines. Hard piping runs should be used wherever possible in place of a hose that will fail under high heat or impact. Nonmetallic hose can not be used in lengths any longer than 30 inch segments. All connections should be tight. Pipes should be arranged so they don't rub against structural members. Drip trays should be emptied frequently, and oil accumulation in the bilges should be kept to a minimum. A safety fuel shut-off should be installed outside the engine compartment to allow the operator to stop the flow of fuel without entering a fire area. No plastic or glass sight gauges should be used on fuel and hydraulic reservoirs.

Where hose must be used to accommodate vibration, it should be frequently inspected and replaced if cracked, brittle or otherwise damaged.

4.4.5 Foam Insulation

Many vessels use rigid polyurethane or other organic foam insulations because of their excellent insulating properties (Figure 4-6). Such foams should be covered with a suitable flame barrier, preferably metal lining, and should never be exposed to fire sources.

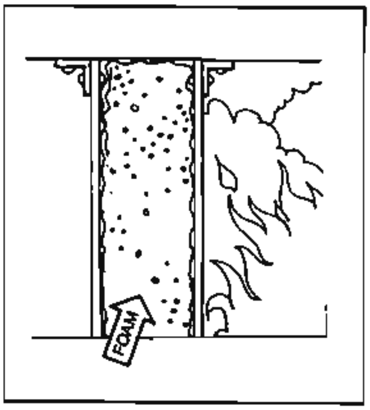


Figure 4-6. Foam insulation should be covered by a flame barrier.

Should fire occur in areas filled with foam, after the fire is extinguished, the foam must be completely removed to insure that the fire is not smoldering in concealed spaces. Any foamed or foam-filled area that has been exposed to fire or high heat should be considered a significant fire risk until the area has been completely cooled, disassembled and/or examined.

All foams can burn, and they give off toxic gases and black smoke.

No welding and cutting operations should be permitted on surfaces covered with rigid polyurethane foam, and electrical circuitry used in and around foam should be enclosed in approved conduit.

Many types of plastic, insulation and other recently developed materials release phosgene gas and other poisonous (toxic) gases or fumes when burning.

4.4.6 Electric Motors

Faulty electric motors are prime causes of fire. Problems may result when a motor is overloaded, isn't properly maintained or is used beyond its safe working life. Motors require regular inspection, testing, lubrication, cleaning and ultimately replacement. Sparks and arcing may result if a winding becomes short-circuited or grounded, or if the brushes do not operate smoothly. If a spark or an arc is strong enough, it can ignite nearby material. Lack of lubrication may cause the motor bearings to overheat, with the same results.

4.4.7 Charging Storage Batteries

When storage batteries are being charged, they emit hydrogen, a highly flammable gas. A mixture of air and hydrogen between 4.1% to 74.2% by volume can be explosive. Hydrogen is lighter than air and will rise as it is produced. If ventilation is not provided at the highest point in the battery charging space, the hydrogen will collect at the overhead (Figure 4-7). Then, any source of ignition can cause an explosion and fire.

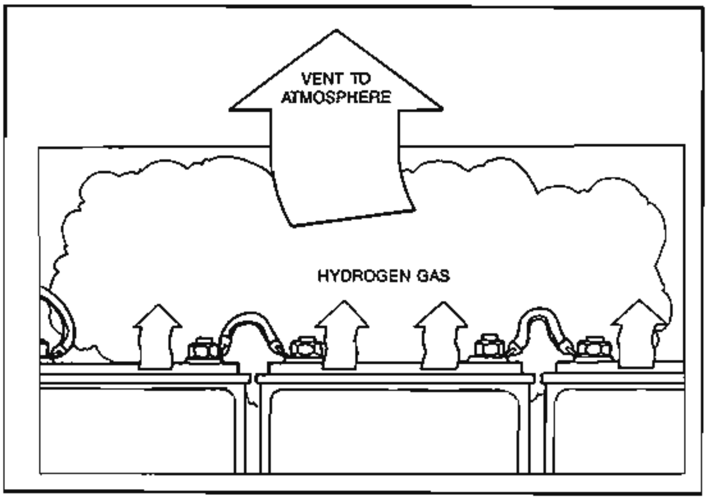


Figure 4-7. Hydrogen gas will be emitted from your battery as it charges. Make sure ventilation is adequate to prevent the gas from accumulating.

4.4.8 Galley Operations

A ship's galley is a busy, potentially dangerous place. The intense activity, the many people, the long hours of operation and the basic hazards - open flames, fuel lines, rubbish and grease or soot build-up and general poor housekeeping - all add to the danger of fire.

For cooking, the most common energy source aboard fishing vessels is propane. Liquified petroleum gas (LPG), which is a combination of propane, butane, and other gases, is used on some smaller vessels. All stoves and exhaust ductwork should be well secured and insulated. Propane and butane are heavier than air and will collect in bilges if allowed to do so. Entry and introduction of ignition source to such areas should be avoided. A sudden increase in rate of use of LPG or other cooking or heating gas may indicate a leak. If reasonably possible, another heat source rather than a propane or LPG should be chosen. Compressed natural gas (CNG) is primarily methane gas and may be a feasible alternative to propane in the future. Electric ranges are subject to the same hazards as other electrical equipment such as short circuits, brittle and cracked insulation on wiring, overloaded circuits and improper repairs.

When liquid fuels are used for cooking, extreme care should be taken to avoid damage to fuel lines. You should be constantly alert to leaks in fuel lines and fittings. In the event of a leak, the fuel supply should be immediately shut off at the source, and repairs made by competent personnel before the equipment is used again. Everyone who uses the galley should know where the fuel line shut-off valves are, and the valves must be easy to get at.

The galley provides plenty of opportunities for fires caused by carelessness. Thus, good housekeeping is a must. Used boxes, bags, paper and even leftover food should be placed in covered non-combustible refuse cans where they cannot catch fire because of a carelessly thrown cigarette butt, or from being too close to a hot stove.

Grease or soot build-up in and around the range, hoods, filters and ductwork can fuel a galley fire (Figure 4-8). If the ductwork becomes involved and there is a heavy buildup of grease or soot, the fire can spread to other areas and decks. Thus, cleanliness is a must, and it doesn't mean just cleaning the stove top. Fixed automatic extinguishing systems for ductwork are extremely valuable for putting out grease fires. (For deep-fat fryers use only extinguishers containing sodium bicarbonate dry chemical.)

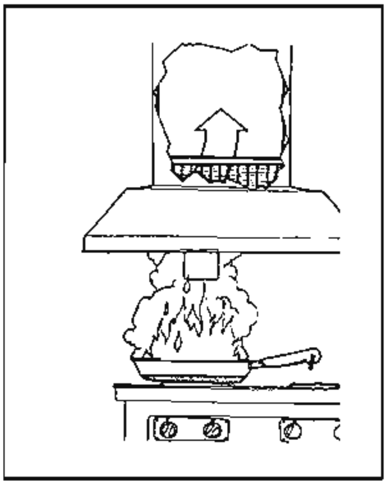


Figure 4-8. Grease or oil on a hot stove can easily ignite and spread to other combustibles. Don't leave the galley unattended when the stove is in use.

4.4.9 Smoking

Careless smoking is a key fire hazard. Cigarettes and matches must be properly disposed of in noncombustible receptacles. Ashtrays should be emptied into metal containers with lids, not cardboard boxes used as trash containers. In hazardous areas, no-smoking warnings should be posted and observed (Figure 4-9). Smoking in bed should be prohibited.

Figure 4-9. Observe No Smoking warnings.

4.4.10 Space Heaters

Open flame heating appliances should not be used. Electric heaters or radiators must be secured against the motion of the vessel. Heating elements must be protected so they cannot come into contact with clothing, curtains or other flammable material. Clothing should not be left to dry unattended near a heating system, engine exhaust system or stove.

4.4.11 Stowage

Space for stowage is always scarce aboard fishing vessels, and scarcity produces another Golden Rule: a place for everything and everything in its place.

Proper stowage is a key fire prevention measure, but only if the stowage area and method are safe to start with. Combustible materials must be stowed away from sources of flame, arcing or heat, and in well-ventilated areas. Combustible wastes should be discarded promptly.

On-board stowage of paints, solvents and other highly flammable substances should be kept to a minimum. Those carried aboard should be inspected frequently for corrosion or damage to the containers that could produce leakage. Spaces used for stowage of highly flammable liquids should have direct access only from open decks. Such spaces should be posted with "No Smoking" and "No Open Lights" warnings, and no unnecessary wiring or electrical equipment should be introduced.

Cylinders used to contain gas or other hazardous substances (whether full or empty) should be stowed on open decks. Valves, pressure regulators and pipes leading from the cylinders should be protected from damage.

Pressure cylinders should be stored in an upright position and be lashed or chained in place. Loose gear can rupture fuel lines, damage machinery and smash electrical equipment, causing short-circuiting. In addition, it is difficult and dangerous to try to regain control of heavy equipment that has come loose in heavy seas (Figure 4-10).

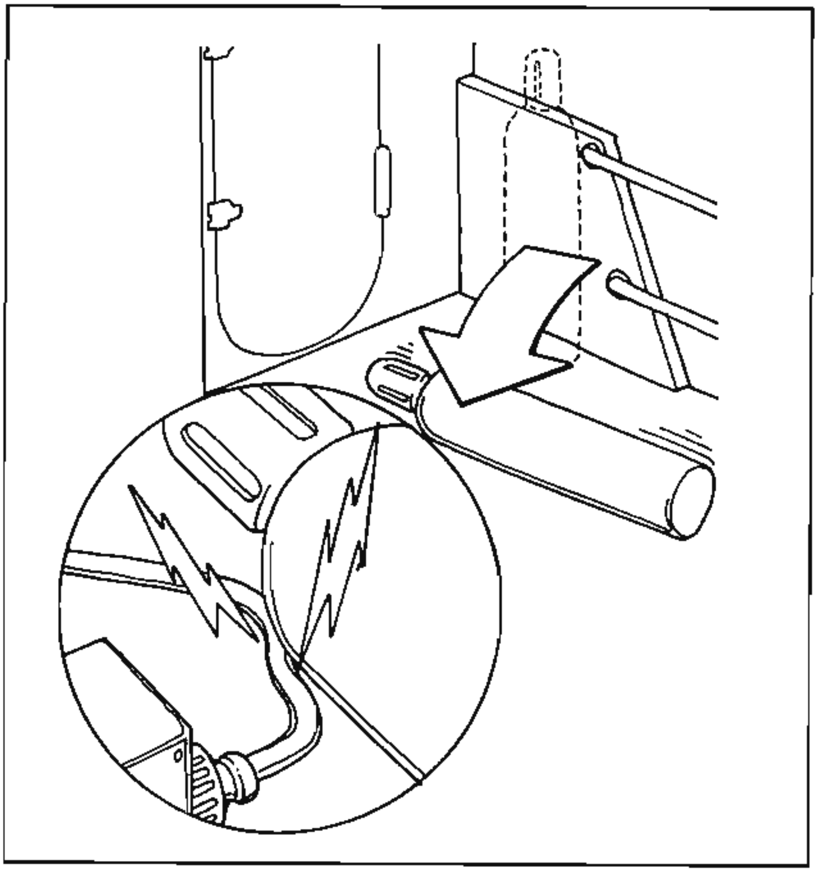


Figure 4-10. Heavy objects should be tightly secured. Fires may occur when stowed gear becomes loose and falls or slides across deck in rough weather.

4.4.12 Unsafe Burning and Welding Practices

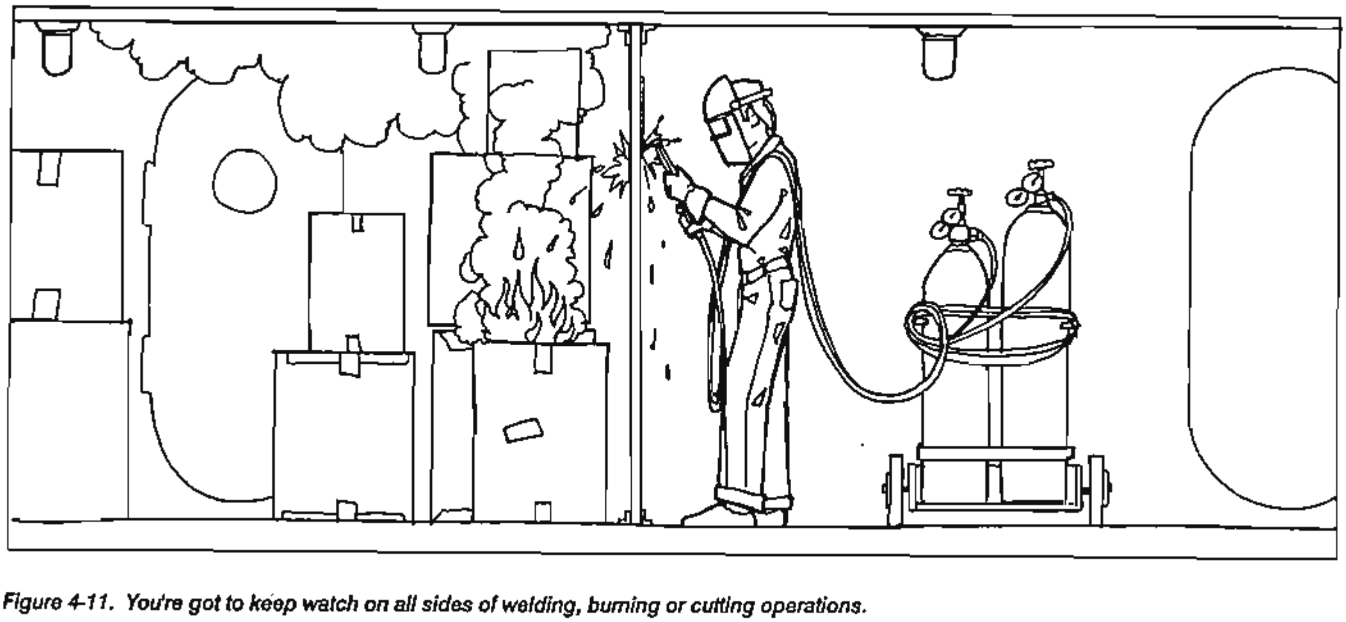


Figure 4-11. You're got to keep watch on all sides of welding, burning or cutting operations.

The high temperatures, molten metal and sparks produced in welding and burning can be a serious fire hazard. During these operations, vessel fires may be caused by:

1) Failure to keep watch in the work area, below the work area and on the other side of a bulkhead that is being welded or burned.

2) Failure to move combustible materials (or to protect them if they cannot be moved).

3) Burning near heavy concentrations of dust or of combustible vapors such as those given off by fuel oil, lubricating oil and other flammable liquids.

4) Failure to remove flammable vapors, liquids or solids from a container, pipe or similar workplace, or from a confined space such as a fuel tank, void, coffer dam or hold.

5) Failure to have the proper type of fire extinguisher at the scene.

6) Failure to secure oxygen and gas cylinders in an upright position.

7) Failure to protect gas and oxygen hoses from mechanical damage, or damage from flying sparks, slag and hot metal.

8) Failure to provide a gas shutoff valve outside a confined space.

9) Failure to remove hoses from confined spaces when the torches have been disconnected.

10) Failure to provide fire guards by boat crew as well as by contractor.

11) Failure to check for flammable insulation on other side of bulkhead (Figure 4-11).

4.5 Fire Prevention

4.5.1 Good Housekeeping

From the fire prevention standpoint, good housekeeping means the elimination of sources of fuel for fire, that is, the elimination of fire "breeding grounds." Various housekeeping problem areas are listed below. All of these can be eliminated with a little effort.

1) Cleaning rags and flammable wastes should be stored in covered metal containers.

2) Oil rags should be placed in covered metal cans and thrown away as soon as possible (Figure 4-12).

3) Discarded packing materials should be disposed of immediately.

4) Flammables should not be stored in crew quarters.

5) Oil soaked clothing or other flammables should never be stored in crew lockers.

6) Paints, varnish, etc., should be stored in the paint locker when not in use, even if you'll need them again the next day. Containers should be inspected frequently for damage and leakage.

7) Leaks in fuel oil or lube oil piping and spilled oil or grease should be cleaned up immediately. Oil in bilges or on floor plates should be kept to a minimum.

8) Kerosene and solvents should be stored in proper containers and in approved spaces. The containers should be inspected frequently for damage and leakage.

9) Oil-soaked clothing should not be worn by crew members.

10) Grease filters and hoods over galley ranges should be cleaned regularly.

Figure 4-12. Store oil rags in a separate container.

4.5.2 The Fire Triangle

A fire must have heat, fuel and oxygen in order to burn. Remove any leg of this "triangle" and fire cannot occur.

The fuel for a fire can be in the form of flammable solids, liquids or gases. Liquid fuels burn more intensely than solid fuels because they are more easily vaporized. The vapor from a liquid fuel is also heavier than air. It is extremely dangerous because it will seek low places, dissipate slowly and travel to distant sources of ignition. Flammable gases are already in the vapor state required for combustion or explosion. All they require for ignition is intermixing with oxygen and a source of heat.

Air contains the oxygen necessary for burning, and ignition heat is present in many forms aboard vessels, including flame, spark, friction and spontaneous or internal combustion (Figure 4-13).

There is a fourth ingredient necessary for fire, however, and that is the chain reaction, or, in other words, the chemical reaction between the fuel, oxygen, and heat.

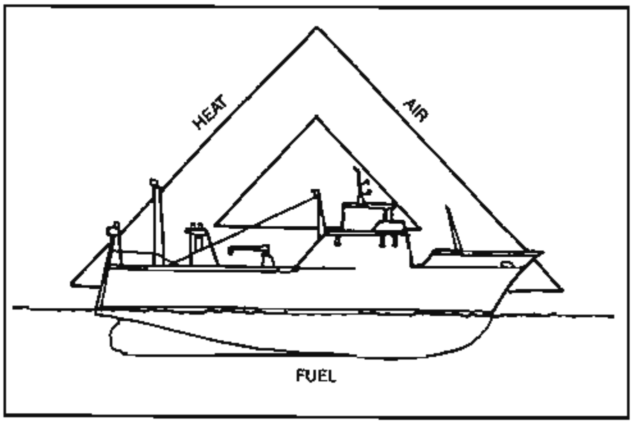


Figure 4-13. A boat is full of fuel sources for fire.

A fire can be put out by destroying one of the components in this reaction (Figure 4-14).

If the fuel, oxygen or heat is removed, the fire will die out. If the chain reaction is broken, the reduction in vapor and heat will put out the fire, although cooling with water may be needed where smoldering or reflash is a possibility.

Removing the Fuel

Theoretically, you could put out a fire by physically dragging the fuel away from the source of the heat, like someone pulling a log out of a campfire. While this may be rarely practical, it is often possible to move nearby sources of fuel so the fire cannot expand beyond what is already being consumed.

In fire fueled by liquids or gases, it may be possible to extinguish the fire by cutting off the fuel supply. When a fire is being fed by a leaky hydraulic or diesel line, for example, it can be put out by closing the proper valve. If a pump is supplying liquid fuel to a fire in the engine room, the pump can be shut down. Either way, the source of the fuel is removed and the fire is extinguished.

Fire in a defective fuel burner can be brought under control and put out by closing the supply valve. Fire involving acetylene or propane can often be put out by shutting the valve on the cylinder.

Removing the Oxygen

A fire can be put out by removing its oxygen, or by lowering the oxygen level in the air to less than 16%. For example, extinguishing agents such as carbon dioxide or foam smother a fire by depriving it of oxygen.

In open areas, smothering a fire is difficult (but not impossible) because the smothering agents are quickly scattered. Carbon dioxide is rapidly blown away from an open deck, for example, especially if the vessel is underway. On the other hand, fire in a galley trash can may be snuffed out simply by placing a cover tightly over the can, thus blocking the flow of air to the fire. As the fire consumes the oxygen in the can, it becomes starved for oxygen and puts itself out.

To put out a fire in an enclosed compartment, engine room or cargo hold, the space can be starved of oxygen by completely closing all air-tight hatches, doors, etc. The fire will consume all the available oxygen as long as *no* air can continue to enter. If your boat is equipped with a fixed carbon dioxide system, the area can be flooded with CO_2.

When the carbon dioxide enters the space and mixes with the air, the percentage of oxygen in the air is reduced below 16% and the fire goes out. For the methods to work, however, the space must be completely sealed to keep fresh air out (Figure 4-15). Your vessel design should allow for airtight enclosures.

Removing the Heat

The most common method of putting out fires is to remove the heat by attacking the fire base with water. An excellent heat absorber, water destroys the ability of a fire to sustain itself by cooling the fuel and

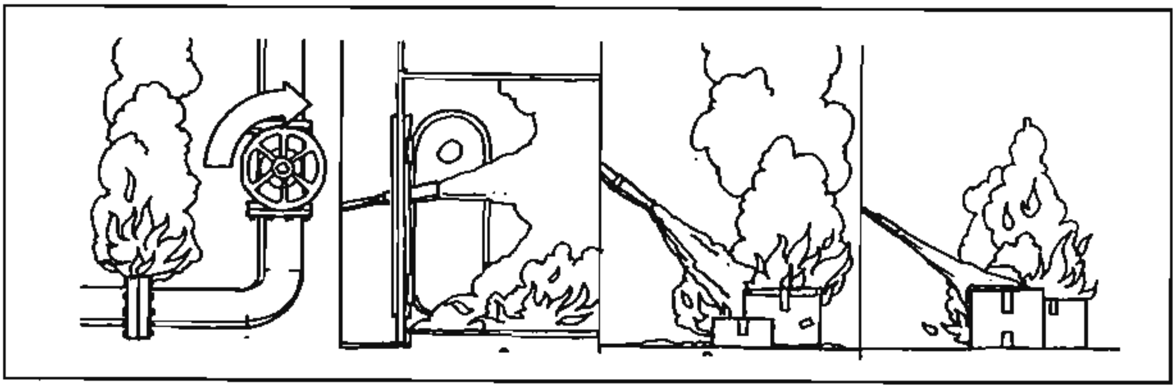


Figure 4-14. Four ways to put out a fire. Remove the fuel (1); remove the air with a smothering agent like CO_2 or foam (2); remove the heat with water (3); or break the chain reaction with dry chemical or Halon (4).

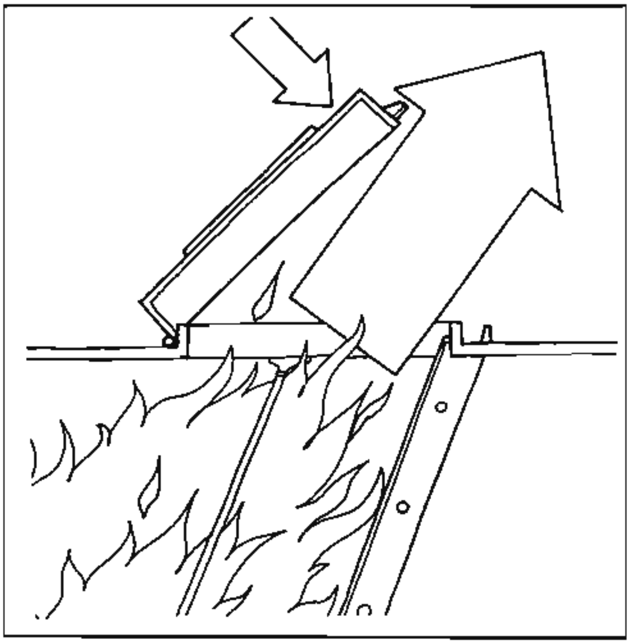


Figure 4-15. Fire should usually be contained and isolated by closing doors, hatches, ventilators and exhausts.

by absorbing the fuel and by absorbing radiant heat from flame. The chain reaction is indirectly attacked both on the fuel surface and at the flames. The production of vapor and radiant heat is reduced, and continuously applied water will control and put out the fire.

Stability hazard: the use of large quantities of water to fight fire may jeopardize the stability of the vessel. "Dewatering techniques," discussed later, must be commenced immediately when large quantities of water are used.

When the fire is attacked with hoseline, water must first be sprayed onto the main body of the fire to achieve the quickest possible heat reduction, and water spray can be a highly effective cooling agent. To put out the fire completely, water must then be applied to the seat or base of the fire.

Breaking the Chain Reaction

Breaking the chain reaction permits a fire to be put out rapidly. The extinguishing agents most often used to attack the chain reaction and stop combustion are dry chemicals and Halon. These agents attack the molecular structure of compounds formed during the chain reaction and reduce the flame-producing capability of the fire. Keep in mind that these agents do not cool a smoldering fire or a liquid whose container has been heated above the liquid's ignition temperature. In these cases, the extinguishing agent must be maintained on the fire until the fuel has cooled down or the fire will re-ignite. Otherwise, a cooling medium such as water must be used on the smoldering embers or the sides of the container.

Warning: the use of water on electrical fires is not recommended. On electrical fires, water creates a shock hazard. On oil fires, a solid stream will splash the oil, possibly spreading the fire. Water fog may be used on oil fires.

4.5.3 Spread of Fire

If a fire is attacked quickly and effectively, it can usually be contained and extinguished. If it is allowed to burn freely, however, it will generate great amounts of heat that can spread throughout the vessel and ignite new fires wherever fuel and oxygen are present.

Additionally, the heat flame, smoke and gases associated with fire pose many health hazards. Crewmen fighting a fire should use all available protective clothing and respiratory equipment, and should stay low and retreat to fresh air before they are overcome.

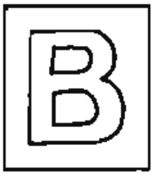
Unless you have the proper fire-fighting equipment and training, you would be best advised to close off the fire and try to deplete the oxygen inside, allowing the fire to put itself out. Then make preparations for abandoning ship (see Chapter 3).

4.6 Classification of Fire

To put out a fire successfully, you need to use the most suitable type of extinguishing agent - one that will do the job in the least amount of time, cause the least amount of damage and result in the least danger to crew members. The job of picking the proper agent has been made easier by the classification of fires into four types, or classes, lettered A through D. Within each class are all fires involving materials with similar burning properties and requiring similar extinguishing agents. However, most fuels are found in combinations, and electrical fires always involve some solid fuel. Thus, for fire fighting purposes, there are actually seven possible fire classes. Knowledge of these classes is essential to fire fighting, as well as knowing the burning characteristics of materials found aboard vessels.

Class A Fires

Fires of common combustible solids such as wood, paper and plastic are best put out by water, a cooling agent. Foam and certain dry chemicals, which act mainly as smothering or chain-breaking agents, may also be used.

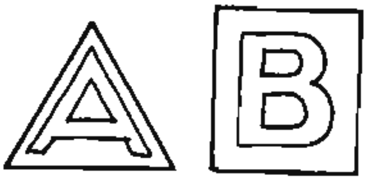


Class B Fires

For oil, grease and gas fires, and other substances that give off large amounts of flammable vapors, a smothering agent is best for the job. Dry chemical, foam and carbon dioxide (CO_2) may be used. Water, although appropriate, in most cases, with inexperienced personnel, will only make the fire worse. If the fire is being supplied with fuel by an open valve or a broken pipe, a valve on the supply side must be shut down to stop the fuel supply. This may put the fire out itself, or at least make it easier to put out and allow the use of much less extinguishing agent.

In a gas fire, it is imperative to shut down the control valve before you extinguish the fire. Attempting to put the fire out without shutting down the valve permits flammable gas to continue escaping and creates an explosive hazard that is more dangerous than the fire itself.

It may be necessary to put out a gas fire before shutting down the fuel supply in order to save a life or to reach the control valve, but these are the only exceptions.



Combination Class A and B Fires

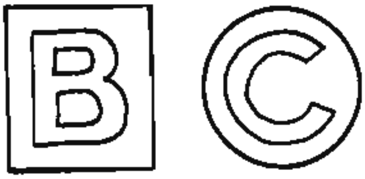
Water fog and foam may be used to smother fires involving both solid fuels and flammable liquids or gases. Water fog will only be effective with the proper gear and training. These agents also have some cooling effect on the fire. In closed spaces, carbon dioxide may also be used to put out such fires.

Class C Fires

For fires involving energized electrical equipment, conductors or appliances, non-conducting extinguishing agents (CO_2, Halon and dry chemical) must be used, although dry chemical will ruin electronic equipment. An external generator and main engine shut-down switch should be available to shut off electrical sources. Always try to de-energize the circuit to remove the chance of shock and the source of ignition.

Combination Class A and C Fires

Because energized electrical equipment is involved in these fires, nonconducting extinguishing agents must be used. Carbon dioxide, Halon and dry chemicals are the best. Carbon dioxide reduces the oxygen supply, while the others break the chain reaction. Always try to de-energize the circuit.



Combination Class B and C Fires

Here again, a nonconducting agent is required. Fires involving flammable liquids or gases and electrical equipment may be extinguished with Halon or dry chemical acting as a chain reaction breaker. In closed spaces, they may be extinguished with CO_2. Larger CO_2 cylinders should be grounded (in contact with some part of the vessel) during use. As the gas is discharged it builds a large static charge that can discharge and cause reignition.

Class D Fires

These fires may involve combustible metals such as potassium, sodium and their alloys, and magnesium, zinc, zirconium, titanium and powdered aluminum. They burn on the metal surface at a very high temperature, often with a brilliant flame.

Water should not be used on Class D fires. It may add to the intensity or cause the molten metal to splatter. This, in turn, can extend the fire and inflict serious burns on those nearby.

Fires in combustible metals can be smothered and controlled with special agents known as dry powders. Dry powders are not the same as dry chemicals, although many people use the terms interchangeably. The agents are used on entirely different types of fires: dry powders are used only to put out combustible metal fires; dry chemicals may be used on other fires, but not on Class D fires.

Class D fires are not likely on today's fishing vessels; however, knowledge of Class D fires is included as general background information.

4.7 Extinguishing Agents

The main reason for the fire classification system is to aid crew members in picking the right extinguishing agent. However, it is not enough to know that water is best for putting out Class A fires because it cools, or that dry chemical works well in knocking down the flames of a burning liquid. The extinguishing agent must be applied properly, and sound fire fighting techniques must be used. The use of protective clothing during the fire fighting process is mandatory.

4.7.1 Hand Portable Fire Extinguishers

Portable extinguishers can be carried to the fire area for a fast attack, but they contain a limited supply of extinguishing agent. The agent is quickly used up, and continuous application can exhaust the extinguisher in as little as 8 seconds. For this reason, it is important to back up the lead extinguisher with additional extinguishers or a hoseline (Figure 4-16). Then, if the first extinguisher fails or does not have enough agent to put the fire out completely, the additional extinguishers or the hoseline can be used to finish the job.

A crewman who is using an extinguisher cannot advance a hoseline at the same time. On average, the extinguishers carried on present day fishing vessels are too small to fight any volume of fire.

The first step in fighting a fire is to sound the alarm and alert the captain and crew so the fire can be fought as a team (Figure 4-17). Vessels have been lost because someone tried to fight a fire by himself without sounding the alarm. By the time the rest of the crew knew what was happening the fire was out of control.

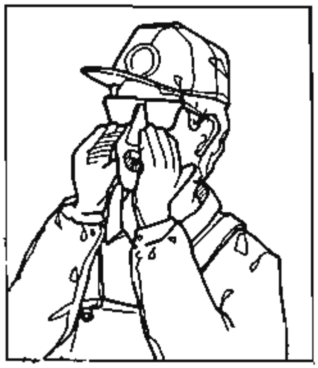


Figure 4-17. Let your crew know that there is a problem early.

There is a right way to use a portable fire extinguisher, and there are wrong ways. Untrained crewmen often, waste extinguishing agent through improper application. At the same time, untrained personnel tend to overestimate their ability to put out fires. Training, including practice with the types of extinguishers carried on board, is the best insurance against inefficient use of this equipment. Extinguishers that are due to be emptied and recharged are put to excellent use in training sessions.

CO_2 extinguishers must be securely stored so they can't fall over or be struck by gear. They can become deadly rockets if the valve assembly breaks off. Dry chemical extinguishers should be up-ended and shaken periodically (every month) in order to prevent the compacting of the agent.

4.7.2 Classes of Fire Extinguishers

Every portable and semi-portable extinguisher is classified in two ways, with one or more letters and a numeral. The letter or letters indicate the classes of

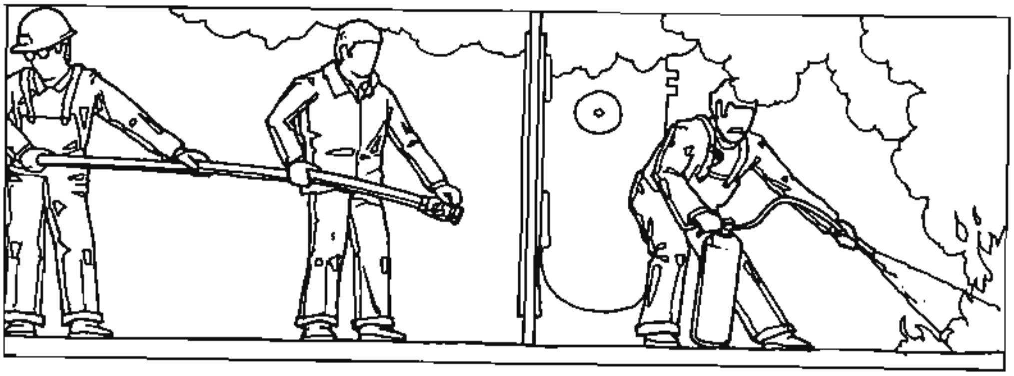


Figure 4-16. Always back-up the lead man.

fires on which it may be used. These letters correspond to the four classes of fires. For example, Class A extinguishers may be used only on class A fires-those involving common combustible materials. Class AB extinguishers may be used on fires involving wood, diesel oil or both.

The numeral indicates the relative size or efficiency of the extinguisher. For example, a 4-A extinguisher will extinguish twice as much Class A fire as a 2-A model.

The National Fire Protection Association (NFPA) uses ratings established by Underwriters Laboratories (UL) and expressed in Arabic numerals to rate the efficiency of fire extinguishers, with the numerals growing larger as efficiency increases. An NFPA/UL rating of 20-B would be four times as efficient as a 5-B extinguisher for Class B fires.

The Coast Guard has its own classification system which uses Roman numerals to indicate the sizes of portable and semiportable extinguishers. The numeral I indicates the smallest size and V the largest. Thus, a B III Coast Guard rating indicates a medium-size extinguisher good for fires involving flammable liquids and gases.

4.7.3 Water

As an extinguishing agent, water's chief effectiveness is in its ability to cool burning material. Water initially absorbs heat as it is heated towards its boiling point. As water reaches its boiling point, a big increase in heat input is necessary to cause the water to flash to steam (Figure 4-18).

The ability to absorb huge amounts of heat and the ready availability of water at sea make it an ideal extinguishing agent for use aboard ship.

There are some additional side benefits that water has as an extinguishing agent. When water flashes to steam it expands approximately 1,700 times its original liquid volume. The expanding steam acts to reduce the oxygen content in the flame area. This steam smothering effect is temporary since the velocity of the gases in the flame area tend to pull the steam upward with the escaping gases.

Water also has the ability of being able to soak and quench Class A material, and when it is applied as a solid stream, water has the ability to penetrate and break-up solid Class A substances.

Water can be used as a protection against the heat of the flame. By spraying the water in a fine mist in a circular pattern in front of the fire fighters, a heat shield can be formed. This can only be accomplished with a proper fire nozzle affixed to a hose line supplied with the proper pressure. The mist of water will fall back on the fire fighters and cool them off, while it absorbs much of the heat coming from the fire. A deck hose should not be used to fight fires because not enough water pressure can be generated.

Water is normally considered as being rated for Class A and B fires. For Class A fire fighting, water is used as a solid stream to penetrate and break up the material as well as to cool and soak. For Class B fires, water is used as a fog or high-volume spray and the action is one of cooling the fire below its flash point. A straight stream applied to a flame liquid fire will make the fire flare up. Make certain that all areas and parts of the vessel can be reached by hose lines.

4.7.4 Dewatering

Free water can impair the stability of a vessel. Every effort should be made to limit the accumulation of water in large compartments and cargo holds (refer to Chapter 11). The efforts should begin with the use of water in methods which produce maximum cooling with minimum quantities of water; For example, preference should be given to water spray over solid streams. As soon as water is used for extinguishment, dewatering procedures should commence.

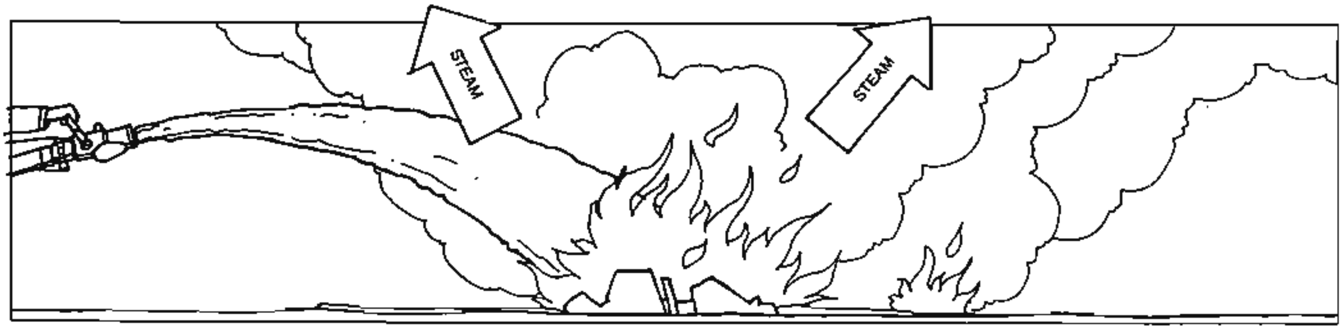


Figure 4-18. Water cools a fire and removes the oxygen as it flashes to steam.

4.7.5 Foam Extinguishers

Foam produces a blanket of bubbles that smothers a fire. The bubbles are formed by mixing water and foam concentrate. The various foam solutions are lighter than flammable oils and form a blanket on the surface that interrupts the supply of oxygen to the fire, while it prevents flammable vapors from escaping. The water in foam also has a cooling effect. The operator of any extinguisher should be cautioned:

a) to avoid plunging the nozzle or agent into the burning product;
b) to stay low to avoid heat and toxic gases;

Because they contain water, foams should not be used on live electrical equipment.

The most common foam extinguishers carry NFPA ratings of 2A:4B. They can thus be used on both Class A and Class B fires with ranges of 30-40 feet and discharge durations of slightly less than a minute.

Operation

There are two types of foam extinguishers. The older extinguishers are charged by filling them with two solutions that are kept separate until it is to be used. Foam extinguishers are carried to the fire right side up, then inverted to mix the solution and form liquid foam plus CO_2 gas. The CO_2 acts as the propellant and fills the foam bubbles, and the liquid foam expands to about 8 times its original volume.

The newer extinguishers combine the ingredients under pressure, and foam is formed when air is drawn through a venturi in the tip of the hose. The newer models require no special preparation prior to firing.

To avoid scattering the foam or the liquid, foam should be applied gently on burning liquids by "bouncing" it off a nearby surface and allowing it to run down onto the liquid until the entire surface is covered (Figure 4-19). If the fire involves ordinary combustibles, apply the foam as a blanket.

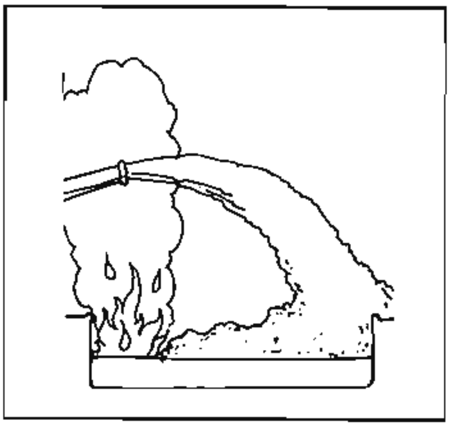


Figure 4-19. Smothering with foam.

4.7.6 Carbon Dioxide (CO_2) Extinguishers

Carbon dioxide extinguishers are used mainly on Class B and C fires. Among portables, the most common sizes contain from 5-20 Lbs. of CO_2. The CO_2 is mostly in a liquid state, at a pressure of 850 psi. The 5-lb. size has a rating of 5-B:C. Its range varies between 3-8 feet, and its duration extends from 8 to 30 seconds.

Operation of CO_2 Extinguishers

The extinguisher is carried to the fire in an upright position. Its short range means that the operator must get fairly close to the fire. The extinguisher is placed on the deck, and the locking pin is removed. The discharge is controlled either by opening a valve or by squeezing two handles together (Figure 4-20).

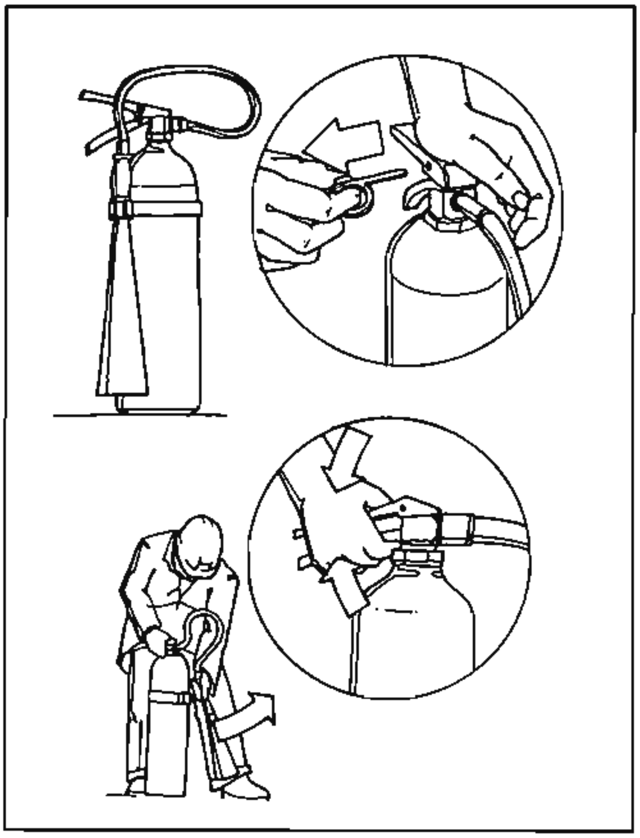


Figure 4-20. The use of the CO_2 extinguisher.

The operator must grasp the handle and not the discharge horn. The CO_2 expands and cools very quickly as it leaves the extinguisher; the horn gets cold enough to frost over and cause severe frostbite (Figure 4-21).

Remember that CO_2 displaces oxygen. When a CO_2 extinguisher is used in a confined space, the operator must guard against suffocation by wearing breathing apparatus, or by immediate evacuation. In opened areas, the wind can make this agent ineffective.

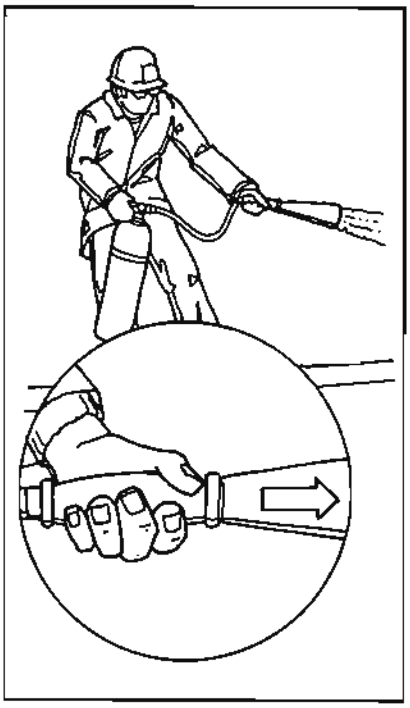


Figure 4-21. Don't grab the horn when using the CO_2 fire extinguisher. Use the handle.

CO_2 and Class B Fires

The horn should be aimed first at the base of the fire nearest the operator. The discharge should be moved slowly back and forth across the fire, being careful not to disturb the liquid. At the same time, the operator should move forward as quickly as his safety permits (Figure 4-22).

The result should be a "sweeping" of the flames off the burning surface, with some carbon dioxide "snow" left behind.

You've got to sweep all of the flame away or the fire will simply re-ignite itself as soon as your extinguishing agent runs out. Always beware of the possibility of reflash and the need to maintain an escape route. The fire is your enemy. Never turn your back on it. When your extinguisher runs out or you are forced to retreat, back away quickly and carefully, always keeping your eyes on the fire.

Warning: a liquid fire can flank an operator who moves in too fast, or reflash around an operator who is too close.

Whenever possible, a fire on a weather deck should be attacked from the windward side. This will allow the wind to blow the heat away from the operator and to carry the CO_2 to the fire. Generally, CO_2 extinguishers do not perform well in the wind. The blanket of CO_2 gas does not remain on the fire long enough to permit the fuel to cool down.

Fighting a fire successfully with portable extinguishers depends largely on how fast you can get to the scene, and how aggressively you attack it. At the same time, you've got to keep in mind the need for teamwork and adequate backup. It doesn't do any good to rush into a fire by yourself and expend your extinguisher if the fire is simply going to re-ignite itself the instant you're done.

CO_2 and Class C Fires

The discharge should be aimed at the source of a fire that involves electrical equipment (Figure 4-23).

There are no fire extinguishers rated only for Class C fires; all are also rated for Class A or B.

Maintenance of the CO_2 Extinguisher

CO_2 extinguishers need not be protected against freezing. However, they should be stowed at temperatures below 130°F to keep internal pressure at a safe level. Regularly, CO_2 extinguishers should be checked for damage and to ensure that they are not empty. At annual inspections, these extinguishers should be weighed. Any extinguisher that has lost more than 10% of its CO_2 weight, (as indicated on the stamp on the cylinder) should be recharged at a service center. A CO_2 extinguisher should also be recharged after each use, even if it has been only partly discharged.

Remember, an extinguisher that needs recharging provides an excellent opportunity for a hands-on fire drill.

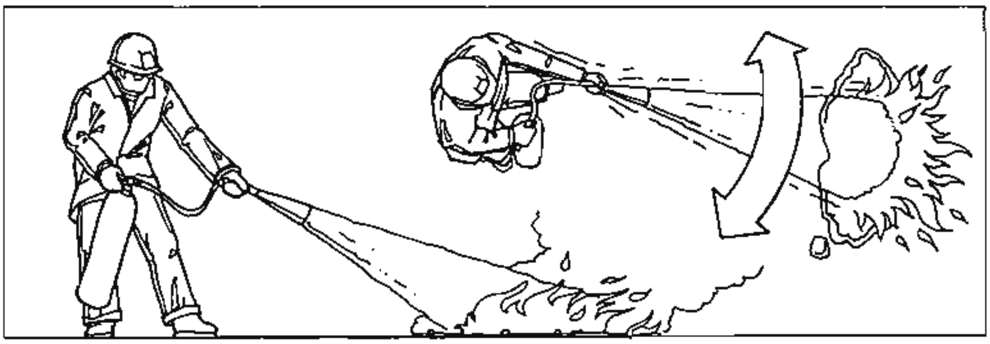


Figure 4-22. Aim at the base of the fire and sweep the flames away.

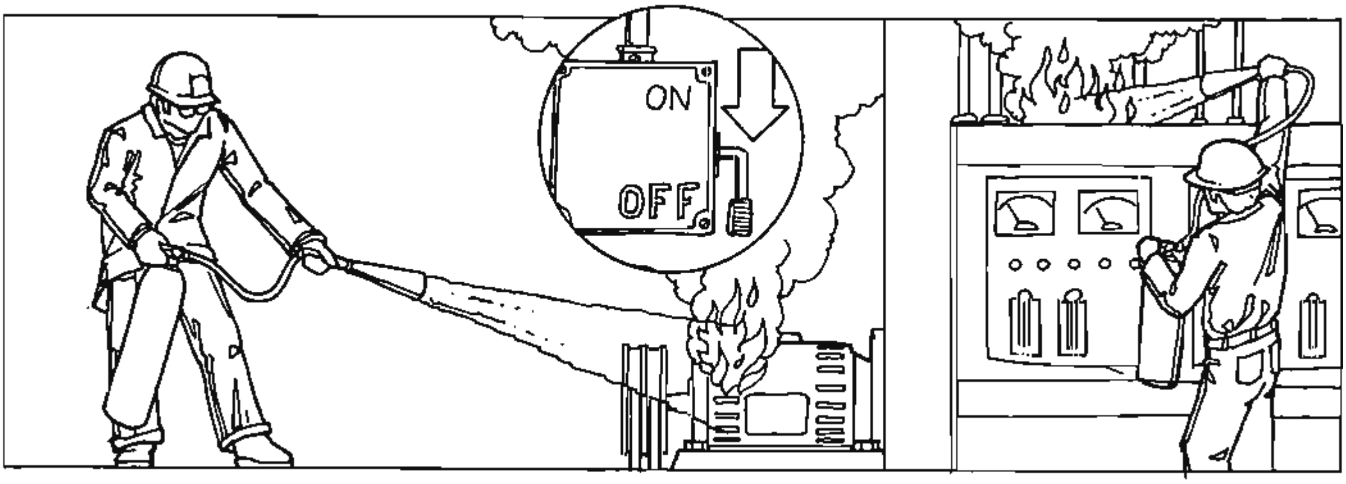


Figure 4-23. De-energize the equipment and aim at the source of an electrical fire.

4.7.7 Dry Chemical Extinguishers

Dry chemical extinguishers are available in several sizes and may contain any of five extinguishing agents. All have at least a BC rating. There are two basic styles of extinguishers: a cartridge operated and stored pressure.

Cartridge-Operated Dry Chemical Extinguishers

Portable cartridge-operated dry chemical extinguishers range in size from 2-30 lbs.; semi-portable models contain up to 50 lbs. of extinguishing agent. A small cylinder of inert gas is used as the propellant. Cartridge-operated dry chemical extinguishers have a range of 10-30 feet. Units under 10 lbs. have a discharge duration of 8-10 seconds, while the larger extinguishers provide up to 30 seconds of discharge.

Operation

The extinguisher is carried and used at an angle slightly forward of the vertical. The ring pin is removed, and the puncturing lever is depressed with a blow from the palm of the hand (Figure 4-24).

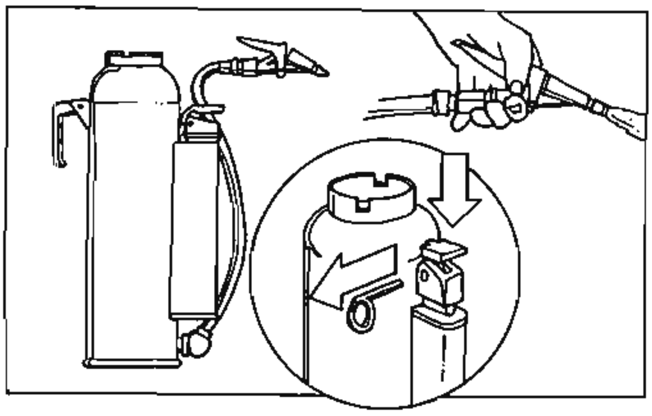


Figure 4-24. Use of a cartridge-operated dry chemical extinguisher.

Be sure the screw-cap at the top of the extinguisher is pointed away from you when you activate the extinguisher in case it has been improperly secured. It could blow up in your face.

Depressing the puncturing lever releases the propellant gas, which forces the extinguishing agent up to the nozzle. The flow of dry chemical is controlled with the squeeze-grip On/off nozzle at the end of the hose (Figure 4-24). Test the discharge momentarily before you approach, the fire extinguishers don't always work. Stay low and direct the discharge at the seat of the fire, starting at the near edge. The stream should be moved from side to side with rapid motion, to sweep the fire off the fuel. On a weather deck, the fire should be approached from the windward side if at all possible.

Don't shoot the initial discharge directly onto the fire from close range (3-8 feet) because the force of the stream may scatter burning material or splash a burning liquid. The agent may be applied in short bursts by opening and closing the nozzle with the squeeze grips. If the propellant gas cylinder is punctured but the extinguisher is not put into use or is only partially discharged, the remaining gas may leak away in a few hours. Thus, the extinguisher must be recharged after each use or activation.

Dry chemical extinguishers put out Class B fires by breaking the chain reaction, with little or no cooling. Thus, a re-flash is possible if the surrounding surfaces are hot. More dry chemical or another appropriate extinguishing extinguishing agent must be ready as a backup, until all sources of ignition are removed.

Dry chemical may be used along with water. Some dry chemical extinguishers are filled with an extinguishing agent that can be used with foam.

Stored-Pressure Dry Chemical Extinguishers

Stored-pressure dry chemical extinguishers come in the same sizes as cartridge operated types. They have the same ranges and durations of discharge and are used in the same way. The only differences are that the propellant gas is mixed in with the dry chemical in the stored-pressure type, and the extinguisher is controlled with a squeeze-grip trigger on the top of the container. A pressure gauge indicates the condition of the charge (Figure 4-25).

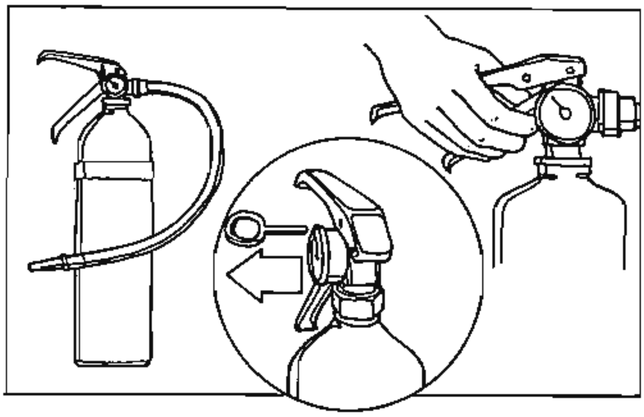


Figure 4-25. Use of a stored-pressure dry chemical extinguisher.

Class A Extinguishment Using ABC Dry Chemical

Only one dry chemical extinguishing agent, monoammonium phosphate, is approved for use on Class A fires. This agent puts fires out by chain breaking, as do the other dry chemical agents. In addition, it clings to the surfaces of burning materials to form a coating that deprives the fire of air. As with the other agents, this dry chemical should be directed at the seat of the fire and swept from side to side to knock down the flames (Figure 4-26). However, once the fire has been knocked down, you should move close to the burning debris. Then all fuel surfaces should be thoroughly coated with the chemical agent using short, intermittent bursts.

Class B Extinguishment Using BC or ABC Dry Chemical

A flammable liquid fire should be attacked as in Figure 4-26). The agent should first be directed at the edge nearest the operator. The nozzle should be moved from side to side with a wrist action to cover the width of the fire. The operator should maintain the maximum continuous discharge rate, remembering that the extinguisher has a range of 10-30 feet.

The operator must be very cautious and move toward the fire very slowly. Remember, a liquid fire can flank an operator who moves in too fast, or reflash around an operator who is too close.

When all the flames are out, the operator should back away from the fire very slowly, remaining alert for possible reflash. A hot spot that is missed can reflash and recreate the original fire. When you fight this type of fire, always have backup units on hand and ready to assist.

If you must use dry chemical to approach a pressure gas fire in order to close off the fuel flow, the heat shield afforded by the dry chemical should be maintained in front of your face. Water fog may also be used to provide an effective heat shield. When you are ready to put the fire out, the dry chemical stream must be directed into the gas stream nearly parallel to the gas flow, at about 10 degrees to the right or left of entry. If dry chemical is directed into the stream at too great an angle, the dry chemical will not penetrate the full stream and won't put out the fire. On the other hand, if the chemical stream does not have a slight right or left angle, the dry chemical will be deflected by the gas pipe.

Once the gas is shut off or the fire is out, the operator should slowly back away, always keeping an eye on the fire.

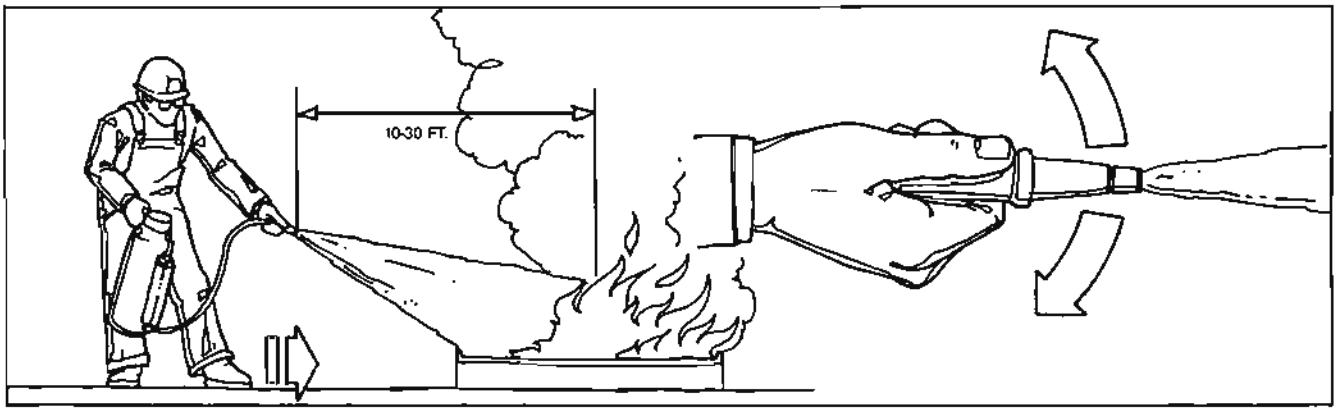


Figure 4-26. Aim at the seat of the fire, sweep from side to side and advance carefully. Dry chemical extinguishers have a range of 10-30 feet.

Class C Extinguishment Using BC or ABC Dry Chemical

When electrical equipment is involved in a fire, the stream of dry chemical should be aimed at the source of the flames. If the fire involves an electrical panel, for example, you may have to direct the extinguisher behind the panel to reach the source. In small spaces, the cloud produced by the dry chemical will limit visibility and may cause choking. The chance of electric shock is also increased when you can't see.

If at all possible, electrical equipment that may be involved in a fire should be de-energized at the source before any attempt is made to put the fire out.

Dry chemical extinguishing agents leave a coating or residue that must be cleaned off of electrical equipment before it can be used. Monoammonium phosphate (ABC) dry chemical leaves a sticky coating that is very hard to remove. This coating also enters and sticks to circuit breakers and switching components, making them almost useless. For that reason, ABC dry chemical should not be used on electrical fires if there is any other alternative.

Dry chemical agents that contain sodium can contaminate or corrode brass and copper electrical fittings.

Electrical fires are best put out with carbon dioxide and Halon, which are "clean" extinguishing agents.

Maintenance of Dry Chemical Extinguishers

Dry chemical agents and their propellants are unaffected by temperature extremes and may be stored anywhere aboard the vessel. They do not break down or evaporate, so periodic recharging is not needed. However, the cartridges in cartridge-operated extinguishers should be inspected and weighed every six months. Cartridges that are punctured or weigh 1/4 oz. less than the indicated weight should be replaced. At the same time, hoses and nozzles should be checked to ensure that they are not clogged.

Stored-pressure extinguishers made after June 1, 1965, have pressure gauges that show whether the internal pressure is within the operating range. These should be checked visually at frequent intervals. Stored pressure extinguishers should be inverted and shaken frequently. Otherwise, the extinguishing agent may cake at the bottom of the extinguisher, especially after heavy pounding at sea.

It you can't feel the extinguishing agent move when you invert the cylinder and shake it, the extinguisher may be useless.

4.7.8 Halon Extinguishers

Halon is considered to be one of the most effective fire extinguishing agents available. It is generally considered safe, compact, affordable, non-conductive and effective. However, the biggest problem with Halon is that it is extremely dangerous to the earth's ozone layer - so dangerous, in fact, that Halon production will cease by the year 2000.

Halon extinguishers come in two types and several sizes, and all are used in the same way (Figure 4-27). Halon extinguishers may contain from 2 1/2-20 lbs. of agent and carry NFPA/UL ratings of 3-B:C and larger. Their range is from 3-15 feet and they discharge their contents in 8-15 seconds. Halon leaves no residue and is virtually noncorrosive. However, it can be toxic. When exposed to heat and pressure, some types of Halon can produce phosgene gas, which is deadly, and its vapors should not be inhaled.

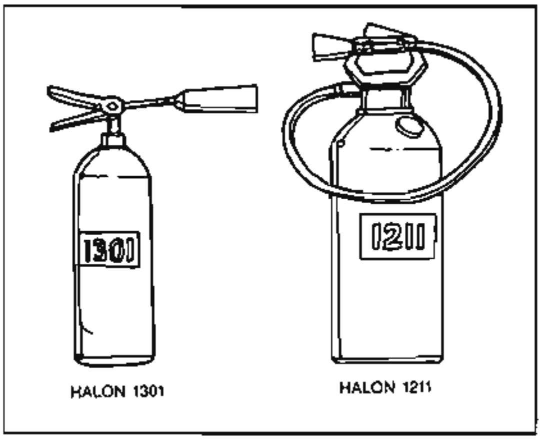


Figure 4-27. Halon extinguishers.

The extinguishing agent is pressurized in a lightweight steel or aluminum alloy shell. The cap contains the discharge control valve and discharge nozzle or discharge hose.

Operation

The extinguisher is carried to the fire and the locking pin is removed. The discharge is controlled by squeezing the control-valve carrying handle. The Halon should be directed at the seat of a Class B fire and applied with a slow, side-to-side motion (Figure 4-28). It should be directed at the source of an electrical fire.

4.8 Inspecting and Testing Portable Extinguishers

All extinguishers should be serviced yearly by qualified personnel. Fire extinguishers should be inspected monthly for the following:

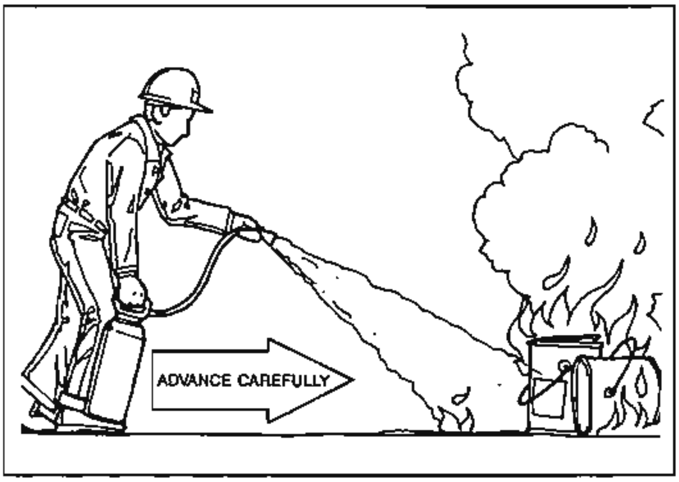


Figure 4-28. Halon should be directed at the seat of a Class B fire.

1) Proper location, highly visible and unobstructed.
2) Absence of corrosion or dents or mechanical damage.
3) A full charge.
4) A clear nozzle.
5) Good condition of the hose.
6) Good condition of horn, if CO_2 .
7) Cleanliness, free of grease or paint over-spray.
8) Name plates and instructions legible.
9) Tagged, showing inspection dates and inspector.
10) All dry powder types of extinguishers must be upended and shaken to loosen the powder.
11) CO_2 's should be weighed.

4.9 Fixed Fire Extinguishing Systems

Engine rooms and other high-risk spaces should be equipped with carbon dioxide or Halon 1301 fixed fire extinguishing systems. For such systems to be both safe and effective, however, certain precautions must be followed:
1) Locate the activation device outside the protected space.
2) Evacuate the space before activating the system. Coast Guard regulations require that CO_2 systems include a minimum 20-second delay between activation of the system and the release of the gas to enable crewmen to escape.
3) Close the space tightly. It is essential to curtail the flow of oxygen to the space and to contain the extinguishing agent by closing doors, ventilators and exhausts. If there are no closures on ventilators or exhausts, you may have to seal them with blankets, pillows, mattresses or other materials.
4) Shut off main and auxiliary machinery and allow them to wind down before the system is triggered, or the gas may be expelled through the exhaust system and rendered ineffective. If the system is triggered automatically by a heat or smoke sensor, be sure that sensors are adjusted so that the vessel's fire alarm sounds before the fixed fire-extinguishing system is activated. Otherwise, the gas may be expelled before you are aware of the fire and have had a chance to isolate the space and shut off the machinery. Many fishermen prefer a manual triggering system to preclude this possibility.
5) Don't reopen sealed compartments prematurely. The fire must be permitted to cool sufficiently to prevent re-flash, or you may find yourself with a new fire and no more extinguishing agent. Monitor the temperatures of adjacent bulkheads for at least a half-hour before reopening or restarting machinery. If bulkhead temperatures haven't dropped substantially, don't reopen. If necessary, request a tow and leave the compartment sealed until you have reached port and help has arrived.
6) Before entering a space that has been flooded with CO_2 be sure it has been ventilated sufficiently to prevent asphyxiation.
7) Fixed CO_2 and Halon 1301 extinguishing systems should be tested annually by a qualified service facility. CO_2 cylinders should be recharged if weight loss exceeds 10 percent of the weight of the charge. Halon cylinders should be recharged if weight loss exceeds 5 percent or pressure drop exceeds 10 percent. In addition, alarms, release mechanisms and automatic shutdowns should be tested, and all flexible connections should be pressure tested.

CO_2 displaces oxygen and would rapidly suffocate anyone remaining in the space after release. At high temperatures, Halon breaks down into toxins that are extremely hazardous.

4.10 Fire Fighting

4.10.1 Sound the Alarm

A delay in sounding the alarm usually allows a small fire to become a large one.

The crew member who discovers a fire or the indication of fire must sound the alarm immediately. When you sound the alarm, be sure to give the exact location of the fire, including the compartment and deck level. This is important for several reasons. It confirms the location for the vessel's fire party and gives them information regarding the type of fire to expect. The exact location may indicate the need to shut down certain fuel, electric and ventilation systems, and it indicates what doors and hatches must be closed to isolate the fire.

A distress call to the Coast Guard or standby vessels should be made immediately. All extra crew should prepare equipment to abandon ship.

4.10.2 Hidden Fires

Before a compartment or bulkhead door is opened to check for fire, the door should be examined.

If flames can be seen, the location of the fire is obvious. However, if only smoke is evident, the fire may be hidden behind a bulkhead or a compartment door. If so, certain precautions must be taken. Discolored or blistered paint indicates fire directly behind the door (Figure 4-29). Smoke puffing from cracks at door seals or where wiring passes through the bulkhead is also an indication of fire (Figure 4-30). The bulkhead or door should be touched with the back of a bare hand. If it is hotter than normal, it is probably hiding a fire.

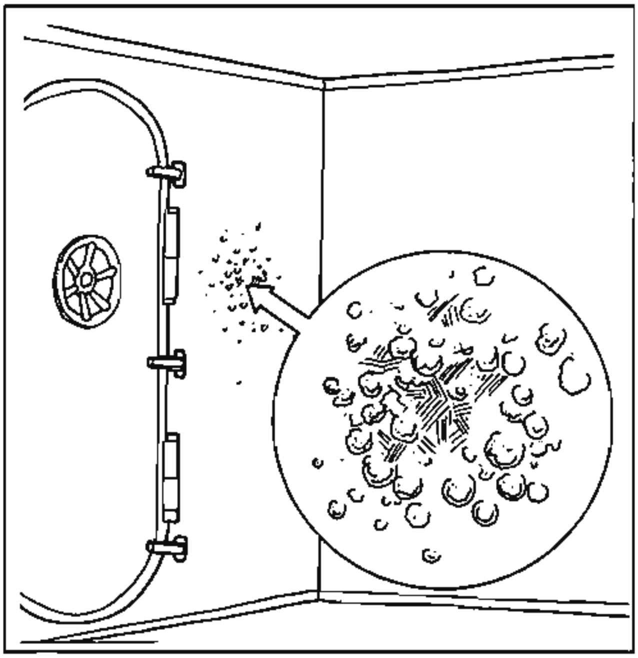


Figure 4-29. Adjacent surfaces may have to be cooled with water spray to prevent the transfer of heat by conduction.

Do not open a door hiding a fire until help, a charged hoseline, and trained personnel are at hand (Figure 4-31).

A fire burning in a closed compartment consumes the oxygen within that space. Opening the door will feed additional oxygen to the fire, and usually means that the fire will grow in size with explosive force.

Flames and superheated gases are then forced out through the door, and anyone standing in the path could be severely burned. Therefore, before opening it, cool the door with water and have everyone stand clear. Remember that opening a door to a fire-involved space will release heated gases into the area in which the hose teams are located. The vessel may be positioned so that the apparent air movement is from behind the attacking fire-fighters. These gases are dangerous and they will kill! Removal is essential to fire fighter survival.

4.10.3 Size-Up

Size-up is the evaluation of the fire situation. The on scene leader should determine:

1) The class of fire: what combustible materials are burning?

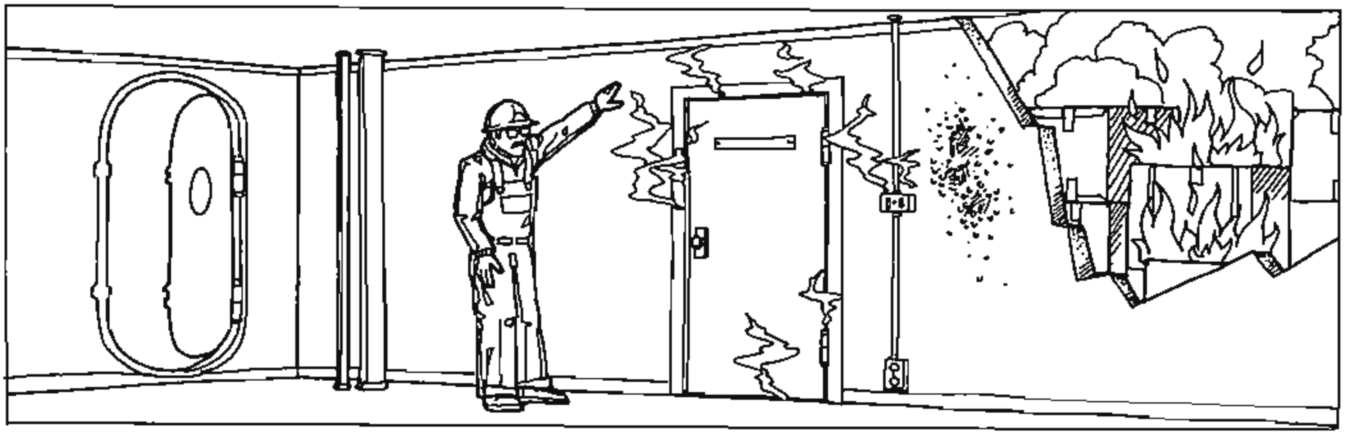


Figure 4-30. Before a compartment bulkhead door is opened to check for fire, the door should be examined.

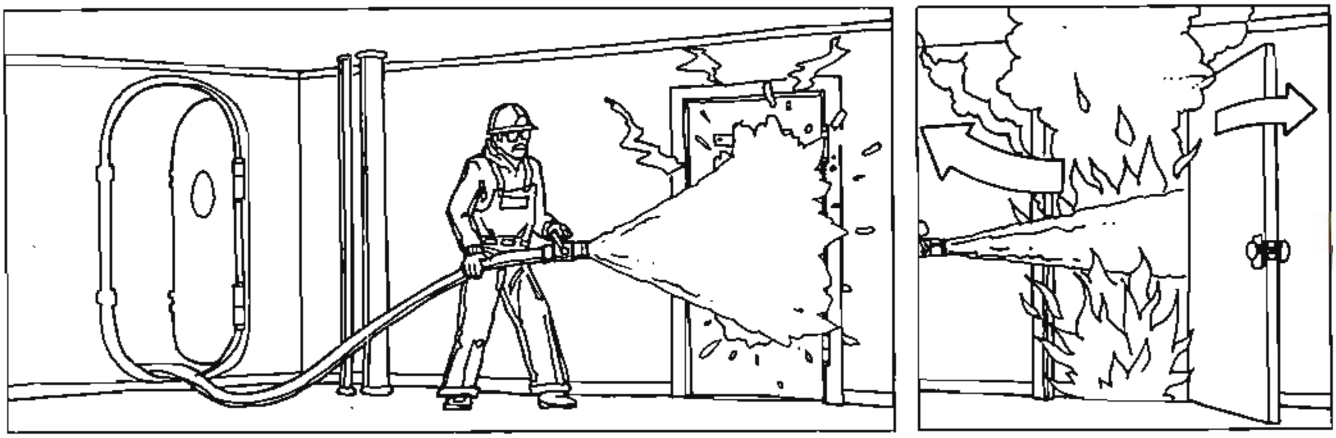


Figure 4-31. Do not open a door hiding a fire until help and a charged hoseline are at hand.

2) The appropriate extinguishing agent.
3) The appropriate method of attack.
4) How to keep the fire from spreading.
5) The required manpower and fire fighting assignments.

A small fire might be extinguished by the first few crew members to arrive. Larger fires require a coordinated attack and efficient use of manpower and equipment. During size-up, or as soon thereafter as possible, communications and a staging area should be set up.

Station Bills

Each vessel should have a Fire Duty Station Bill posted in a visible location. By pre-assigning responsibilities to each crewman and alerting each one about what will be expected of him, the Station Bill speeds the size-up and planning processes.

Communications

Communications with the captain should be established by intercom or messenger. Communications with fire fighting teams must be established and maintained.

Staging Area

The staging area should be established in a smoke-free area, as near as possible to the fire. An open-deck location, windward of the fire, is ideal. However, if the fire is below deck deep within the vessel, the staging area should be located below deck. A location near an intercom, if feasible, would be helpful in maintaining communications. However, the staging area should not be located where it will be endangered by fire.

All supplies needed to support the fire fighting effort should be brought to the staging area.

4.10.4 Attacking the Fire

The attack should be started as soon as possible, to gain immediate control of the fire and to prevent or minimize its spread. The attack will either be direct or indirect, depending on the fire situation, and the equipment available and training level of the crewmen. Direct and indirect attacks differ widely in how they achieve extinguishment; both are efficient when properly employed.

4.10.5 Direct Attack

In a direct attack, fire fighters advance to the immediate fire area and apply the extinguishing agent directly into the seat of the fire. However, if heat and smoke make it impossible to locate or reach the seat of the fire, an indirect attack should be considered.

4.10.6 Indirect Attack

An indirect attack is employed when it is impossible for fire fighters to reach the seat of the fire or they are not properly prepared as trained fire fighters. Generally this is the case when the fire is in the lower portions of the vessel. The success of an indirect attack depends on the complete containment of the fire.

One technique involves making a small opening low into the fire space, inserting a fire hose nozzle and injecting a water spray. Heat converts the water spray to steam, which acts as a smothering agent. For this method to work the space must be completely sealed and the fire hot enough to convert the water to steam (Figure 4-32).

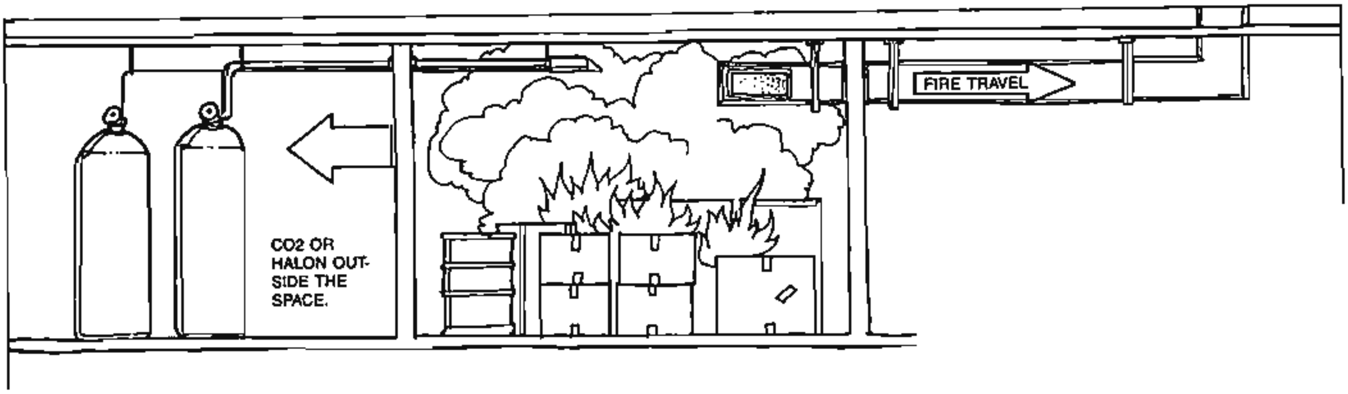


Figure 4-32. In an indirect attack, all possible avenues of fire travel must be cut off by closing doors and hatches, and shutting down ventilation systems and exhausts.

Another indirect method is to flood the space with carbon dioxide or Halon 1301. Here, too, the space must be completely sealed (Figure 4-33).

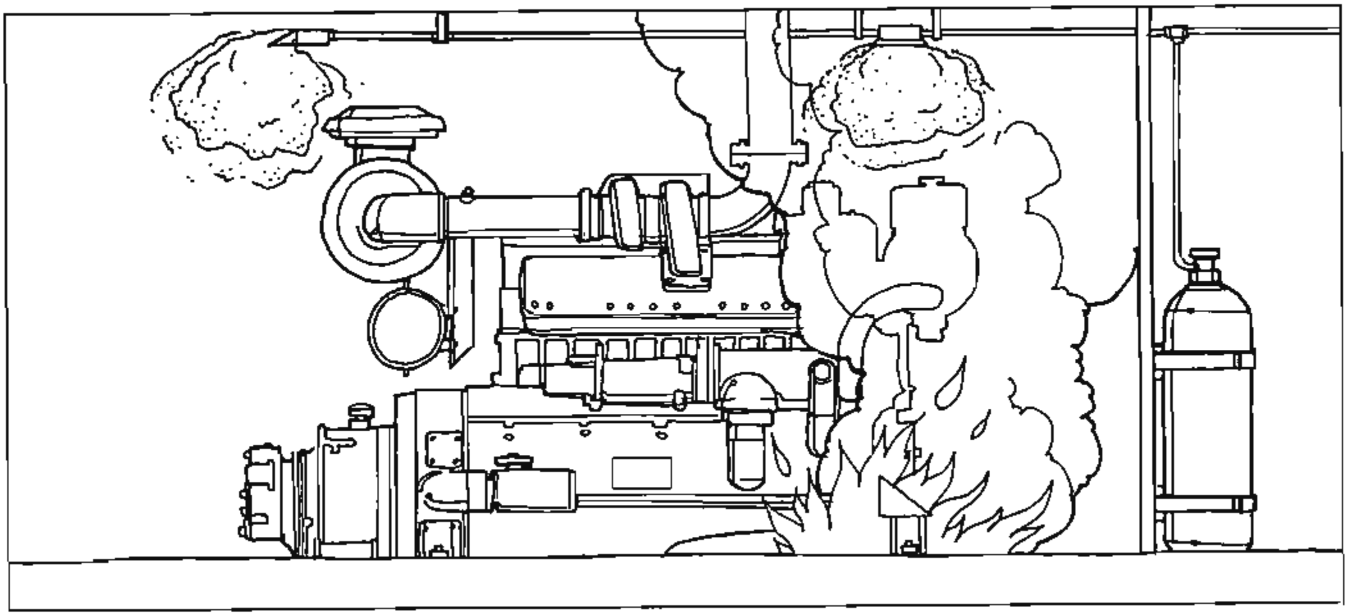


Figure 4-33. Flooding the space with CO_2 or Halon.

4.10.7 Ventilation

Ventilation is the action taken to release combustion products trapped within the vessel and vent them outside the ship. Most fire fatalities result from asphyxiation by combustion gases or lack of oxygen rather than burning. However, ventilation is *only* used when a direct attack is made on a fire. During an indirect attack the fire area must be kept as airtight as possible to keep oxygen out.

4.10.8 Preventing Fire Spread

If a fire can be prevented from spreading beyond the space in which it originated, it can usually be controlled and extinguished without extensive damage. To do this, the fire must be virtually surrounded on six sides: fire fighters with hose lines or portable extinguishers must be positioned to cover the flanks and the spaces above and below the fire. The possibility of the fire traveling through the venting system must also be considered. Many times in a fire at sea, the life rafts, life rings and life jackets (PFDs) are burned up before it occurs to anyone that the burning vessel might have to be abandoned. Provisions should be made to safeguard and prepare life saving equipment during fire drills and actual fires.

4.10.9 Overhaul

Overhaul is begun after the main body of the fire is out. It is actually a combination of two procedures: examination and cleanup. The purpose of the examination is to find and extinguish hidden fire and hot embers, and to determine if the fire has spread to other parts of the vessel. At the same time debris should be cleaned up and free water removed. Any unsafe condition should be corrected. For example, hanging lagging should be removed, hanging wires should be secured, and all debris should be removed to make the fire area as safe as possible.

4.10.10 When the Fire is Out

Before a fire can be considered out, the on-scene leader must ensure that certain essential steps have been taken. These include:

1) A thorough examination of the fire area to ensure that all potential paths of fire spread have been examined.
2) All smoke and combustion gases have been removed through ventilation.
3) A reflash watch has been established. Crew members must be assigned to do nothing but check for re-ignition, and to sound the alarm if it occurs.
4) An examination has been made to see if the vessel has been damaged by the fire. High temperatures can cause decks, bulkheads and other structural members to warp or become structurally unsound.
5) Any necessary dewatering procedures have been started.
6) A muster has been conducted to account for all personnel.

4.11 Coast Guard Required Fire Extinguishing Equipment

The Commercial Fishing Industry Vessel Safety Act of 1988 provides general guidelines for fire protection and fire fighting equipment, for fishing vessels, including fire alarms and portable and semi-portable fire extinguishing equipment for combustible liquid fuel fires (refer to Appendix).

Each fire extinguisher is classified, by letter and Roman numeral, to show the type of fire it is expected to put out, and the size of the extinguisher. The "letter" shows the type of fire, the "Roman numeral" shows the size. The amounts of agent shown are the minimum agent weights for each size category.

Fire extinguishers approved for uninspected fishing vessels are hand portable, B-I or B-II, and semi-portable B-III, B-IV and B-V classifications (Tables 4-1, 4-2, 4-3).

UL listed extinguishers with a manufacturing date of 1972 or later (the year of manufacture can be found on the label, valve or cylinder), may be substituted for Coast Guard-approved extinguishers using the table. Select the extinguisher you are going to replace and be sure the UL extinguisher has the same amount of agent. All Type B extinguishers must have a UL 5-B:C or higher rating, such as UL 10-B:C classifications.

Coast Guard Classification		Dry Chemical	CO_2	Halon 1211/1301	Foam
Type/Size		Lbs.	Lbs.	Lbs.	Gallons
A	II	-	-	-	2 1/2
B	I	2	4	2 1/2	1 1/4
B	II	10	15	10	2 1/2
B	III	20	35	-	12
B	IV	30	50		20
B	V	50	100	-	40
C	I	2	4	2 1/2	-
C	II	10	15	10	-

Table 4-1. Coast Guard classification scheme and the amount of fire extinguishing agent contained in each.

Gross Tonnage	Minimum number of B-II portable Fire Extinguishers
0 - 50	1
50 - 100	2
100 - 500	3
500 - 1000	6
1000 - UP	8

Note: In addition to the hand-portable fire extinguishers, one B-II hand portable fire extinguisher shall be carried on board for each 1000 brake horsepower (BHP) of main engines or fraction thereof. However, not more than six such B-II extinguishers need to be carried.

Vessels over 300 gross tons must carry either one B-III semi-portable fire extinguisher or have approved fixed fire extinguishing system installed in the machinery space.

Table 4-2. Minimum requirements for motor vessels more than 65 feet.

Vessel Length	BI		BII
Under 16'	1		
16' - Under 26'	1		
26' - Under 40'	2	or	1
40' - Under 65'	3	or	
	1	and	1

Table 4-3. Minimum requirements for vessels 65 feet or less (motorboats).

Note: Vessels may carry one less B-I if an approved fixed fire extinguishing system is installed in the machinery space.

An "outboard" powered open construction vessel is a vessel less than 26 feet in length in which:

1. There are no closed compartments under thwarts and seats in which portable fuel tanks may be stored.
2. There are double bottoms that are not sealed to the hull or which are not completely fitted with floatation material.
3. There are no enclosed living spaces.
4. There are no permanently installed fuel tanks.
5. Exceptions which do not require that a fire extinguisher be carried are:

1. Bait wells
2. Glove compartments
3. Buoyant flotation material
4. Open slatting flotation
5. Ice chests.

Space	Classification	Quantity and location
Safety areas Communicating corridors	A-II......	1 in each main corridor not more than 150 feet apart. (May be located in stairways)
Pilothouse	C-I.......	2 in vicinity of exit
Service spaces Galleys	B-II or C-II	1 for each 2,500 square feet or fraction thereof suitable for hazards involved
Paint lockers	B-II......	1 outside space in vicinity of exit
Accessible baggage and storerooms	A-II......	1 for each 2,500 square feet or fraction thereof located in the vicinity of exits, either inside or outside the spaces
Workshops and similar spaces	A-II......	1 outside the space in vicinity of exit
Machinery spaces		
Internal combustion propelling machinery space	B-II......	1 for each 1,000 brake horsepower, but not less than 2 nor more than 6
Electric propulsion motors or generators of open type	C-II......	1 for each propulsion motor or generator unit
Auxiliary spaces		
Internal combustion	B-II......	1 outside the space in vicinity of exit
Electric emergency motors or generators	C-II......	1 outside the space in vicinity of exit

Table 4-4. Recommended fire fighting equipment (Class A-B-C Extinguishers are recommended for all-purpose use, other than Class D (metal) fires).

4.11.1 Fire Extinguishers

Fire extinguishers must be clearly marked with a permanent name plate showing CG and/or UL approval or listing for marine use.

Fire extinguishers must be held in place with a marine or non-corrosive motor vehicle-type mounting.

Fire extinguishers must be in good condition, meaning that they are within weight and/or pressure limits and free of leaks and damage.

It is the responsibility of the owner/operator to show the Coast Guard that all fire extinguishers on board are in good condition and meet the minimum requirements.

4.11.2 Fireman's Outfit

Fishing vessels having provisions for a fire fighting party should have a sufficient number of fireman's outfits on board the vessel. A fireman's outfit should contain the following equipment: self-contained breathing apparatus with lifeline attached, flashlight, rigid helmet, boots and gloves, protective clothing, and fire axe. It is important when a fireman's outfit is provided that personnel be properly trained in its use.

On vessels that do not carry approved fireman's outfits, it is important that the crewmen protect themselves as best they can from the effects of smoke and flame. Wear heavy, layered clothing over the entire body, preferably wool rather than cotton or polyester. Just as layers of clothing protect you from the cold, trapped air within layers of clothing provides cooling when the body is exposed to high heat.

Always wear gloves, the more heavily insulated the better, and a hard hat or wool watch cap, not a baseball cap. Foul weather rain gear is not an approved form of protective clothing for fighting fires. In contact with flame or burning material, the rubberized cloth can melt and cause painful burns. If nothing better is available, however, thick foul weather gear may provide some protection during periods of short exposure to high heat.

Each vessel should have at least one fire axe.

4.12 References

National Fire Protection Association. *Pleasure and Commercial Motor Craft.* Pamphlet No. 302. Batterymarch Park. Quincy, MA 02269. No publication date.

US Department of Commerce. Maritime Training Advisory Board. Maritime Administration. *Marine Fire Prevention, Fire Fighting and Fire Safety.* No publication date.

CHAPTER 5

SEAMANSHIP

Photo courtesy of Ed Watson

CHAPTER 5

SEAMANSHIP

Page

5.1 Introduction

Unfortunately, most fishing vessel accidents are caused by human error. The secret of safety at sea is *KEEPING OUT* of trouble, rather than *GETTING OUT*, once you are in trouble. Everyone on board should have a working knowledge of basic seamanship and navigation. There is no substitute for hands-on experience in your vessel in a variety of sea states and conditions.

This chapter describes basic watchkeeping and seamanship skills; however, local conditions may require you to have more in-depth skills.

5.2 Watchkeeping

Most accidents are caused by human error, and mistakes are the result of a number of factors: lack of training; poor attitude; lack of attention ("familiarity breeds contempt"); and negligence.

As a fishing vessel crewmember, you have no more critical duty than standing a steaming watch. The person on watch is responsible for the lives of everyone on board and for the safety of the vessel. Staying awake and being alert to what's going on both aboard and around the vessel are the most basic requirements.

In addition to always knowing where the vessel is and where it is going, the person on watch must know how to deal with other traffic in the area. Therefore, a working knowledge of the rules of the road is vital.

Most important, if in doubt, call the captain. When you stand watch, you are his eyes and ears. It's your job to keep him informed.

The following is a checklist of things that every watchstander should know:

Vessel Details

* Length, beam and draft.
* The vessel's turning diameter, stopping distance and other handling characteristics. Remember, the heavier the load, the longer it takes to stop.
* How to turn the vessel in the shortest time.
* How to turn the vessel in the least space.
* How the vessel handles in reverse.
* Location and function of gauges (oil temperature and pressure, engine water temperature, etc.), and correct action to take if they indicate a problem.
* Operation of internal vessel intercoms.
* How to operate the autopilot; how to convert from automatic to manual steering.
* How to recognize an unseaworthy condition. Examples: lack of watertight integrity; slack fluids in tanks.

Navigation

* An understanding of the rules of the road.
* Location of the magnetic compass deviation card, and how to apply error.
* An understanding of night eye reaction.
* How to take visual and electronic fixes, and to maintain a dead reckoning (DR) plot.
* How to operate the radar, loran, fathometer and other navigation equipment.
* How to determine when the risk of collision exists.
* An ability to read and interpret the information on a chart.
* Knowledge of ship-borne weather instruments and how to use them.
* Knowledge of the characteristics of various weather systems.

Fishing Operations

* What to do if the fishing gear becomes fast on the bottom or another obstruction.
* How to avoid running over fishing gear.
* How to communicate with the deck crew. You must warn them of heavy oncoming seas or other hazards.

Emergency Procedures

* How to sound the general alarm and what to do in emergencies such as fire, rescue and assistance, man-overboard, collision, and grounding.
* Location and number of personal flotation devices and immersion suits.
* Location and capacity of life rafts.
* How to release and inflate liferafts.
* Location and use of flares, distress signals and EPIRBs.
* Location and identity of all alarms (smoke, fire, bilge, etc.).
* Radio procedures; how to broadcast a distress message.

As you Prepare to Take Over the Watch Ensure that you:

* Are well rested.
* Have established your night vision if it is a night watch (be sure to protect your vision from sources of bright light).
* Know the position of the vessel on the chart and how and when the position was obtained.
* Know the vessel's course and speed.
* Know the identity of any navigation marks either in sight or expected.
* Know the depth of the water.

* Know what navigation equipment is in use, its capabilities and limitations.
* Know what weather is expected.
* Know the prevailing and predicted tides and currents.
* Know the direction and speed of the true and relative wind.
* Know of any navigational hazards to be expected.
* Are informed of any special orders that apply to your watch.
* Know the compass error, if any.
* Know the location and movement of traffic in the area.
* Have the correct navigation lights burning if it is dark or you are in conditions of reduced visibility.

Visual Checks

After making sure the vessel is where it should be, is headed in the right direction and is safely navigating through traffic, you must ensure the smooth and safe operation of the boat. Regularly check the engine controls and gauges. At each watch change, monitor the engine room and other compartments to ensure that they are not flooding with water, smoke, oil, etc. Scan the decks regularly for loose gear. Keep circulating tanks either pressed up and full, or completely empty.

Periodic Checks During Each Watch

* Make sure the helmsman or autopilot is on course.
* Establish the standard compass error at least once per watch.
* Compare magnetic and gyro compasses.
* Test the steering system in the manual position.
* Make sure navigation and signal lights, and other navigation equipment are functioning properly.

Restricted Visibility

When visibility is restricted, the first responsibility of the person on watch is to comply with the rules of the road. Where necessary, you must slow to a safe speed and sound fog signals. A good rule of thumb for a safe speed in limited visibility is that you can stop the vessel in half the distance of the visibility. If the vessel is not underway, ready the engines for immediate use. The person on watch should also:

* Inform the captain.
* Post lookouts. The lookouts should have no other duties that interfere with their observations.
* Change to manual steering if the vessel is in congested waters.
* Turn on navigation lights.
* Operate and use radar.

Taking Chances

Don't. Your responsibilities as a watchstander are too great to permit any risk-taking or inattention to detail. The only way to ensure the safety of the vessel and its crew is to follow proper watchstanding procedures in every instance. Remember, if you have any doubt whatsoever about conditions on or around the vessel, call the captain at once.

Choosing the Watch, Combating Fatigue

The captain must assess the crew and assign watches only to crewmen who are in good physical and mental shape. The crewman who has been up the longest or out the latest should get the last watch. It is advisable to use "snooze" or wake-up alarms whenever fatigue poses a potential hazard.

Common Causes of Groundings

* Too much reliance on radar and Loran without cross-checking other means of navigation.
* Improper application of compass error.
* Failure to use visual navigation aids.
* Failure to read the Notice to Mariners concerning temporary or missing aids to navigation.
* Failure to use the fathometer.
* Failure to account for set and drift.
* Mistakes in identifying lights or other fixed aids to navigation.
* Failure to maintain a good DR track.
* Failure to take enough fixes.
* Improper reliance on floating aids to navigation.

Common Causes of Collisions

* Lack of familiarity with the rules of the road.
* Failure to establish soon enough that the risk of collision exists.
* Failure to turn on running lights.
* Failure to check for steady bearing in a closing situation.
* Poor judgment in evaluating effects of wind and current.
* Failure to understand the vessel's turning characteristics.
* Failure to keep a sharp lookout.
* Using both radars on long range.
* Using both radars on short range.
* Failure to switch from automatic to manual steering in congested waters.

Common Causes of Floodings, Founderings, and Capsizings

* Lack of understanding of the factors that govern stability.
* Failure to refer to the vessel's stability book or follow its recommendations.
* Overloading.
* Improper tanking.
* Failure to maintain watertight integrity.
* Poor judgment about when and where to go fishing.

When to Call the Captain

* At the onset of restricted visibility.
* When you encounter heavy traffic.
* If you are experiencing difficulty in maintaining course.
* When you fail to sight land or an aid to navigation as expected.
* When you have an unanticipated change in soundings.
* When you unexpectedly sight land or a navigation mark.
* If there is failure of engines, steering gear or essential navigation gear.
* If there is any question about the vessel's seaworthiness or ability to handle prevailing weather and sea conditions.
* If your relief is unfit.
* Whenever you are in doubt about the vessel's safety or how to proceed.

Circumstances such as those listed above may force you to take immediate action to preserve the safety of the vessel. If you must act on your own authority, alert the captain at the earliest possible opportunity.

Your Relief

Always make sure that your relief is awake, alert and well informed before you leave him on watch. If he looks unfit for watchstanding, don't turn over the helm to him. Do not leave the wheelhouse until you are relieved by a competent replacement.

At Anchor

Maintain a continuous anchor watch whenever the captain deems it necessary. After setting the anchor, the captain should plot the vessel's position on an appropriate chart as soon as possible. As crew, you should:

* Maintain an efficient lookout. Make frequent checks of your position to determine if the anchor is dragging. If possible, use lights or landmarks to establish a range. Visual or electronic bearings and soundings are other means of checking your position. Setting the radar range ring on the shoreline and using fathometer alarms are good backup methods of monitoring your position. However, remember that nothing replaces vigilance and the human eye.
* Inspect the vessel periodically.
* Observe weather, tidal and sea conditions.
* Make sure that engines and other machinery are always ready.
* If visibility is obscured, notify the captain and sound the appropriate fog signal.
* Make sure that proper navigation lights are burning.
* Check the anchor cable for vibration, a good sign that the anchor is dragging.
* Notify the captain and take necessary measures if the vessel begins to drag.

Night Vision

Learning to "see" navigation hazards at night takes practice. Your eyes respond more slowly in the dark, and they will perceive a moving object more easily than one standing still. It is sometimes easier to see something out of the corners of your eyes rather than looking straight ahead.

Any exposure to white light at night will greatly reduce night vision. A carelessly used flashlight, an open hatch, or even the flare of a match may reduce your ability to see. High intensity sodium lights on an approaching vessel will destroy your night vision and obscure its running lights.

Night Vision Rules

* Give your eyes at least 15 minutes to adjust to the dark before reporting for watch. Wear red goggles in lighted areas.
* At night use only dim red lights in the wheelhouse.
* Scan the horizon slowly and regularly.
* Use clean binoculars.
* Keep in good physical condition: fatigue, alcohol, drugs and tobacco lessen dark adaptation.
* Extinguish high intensity lights at least two miles away from an approaching vessel. Call other vessels on Channel 16 if they fail to extinguish all but their running lights in an approaching situation.

The effect of bright sunlight on the eyes lasts long after the sun goes down. Persons exposed to strong sunlight during the day see only half as well at night. Protect your eyes with dark glasses on bright days.

* At night, look to one side, above or below object being observed.

5.2.1 Suggested Watchkeeping Standards *

*(from the North Pacific Fishing Vessel Owner's Association)

All personnel involved in the operation of the vessel are required to be familiar with and maintain these standards while underway:

I. The captain is ultimately and totally responsible for the selection, training and competency of the crew and enforcement of these standards. Any accidents aboard or involving the vessel are his responsibility.

II. Specific watch instructions from the captain, including calls and procedures, are inviolate and not subject to any discretion or interpretations by the watchstander.

III. The captain should, at a general meeting or prior to sailing, instruct the crew as to the watch standards expected aboard the vessel. Any questions can be raised at that time. Replacements should receive a similar briefing in the presence of the rest of the crew.

IV. The watch should not be criticized for alerting the captain to apparent or suspected changes in conditions or equipment malfunctions.

V. If practical, there should be two men on watch in the wheelhouse at all times on inside waters or within captain-specified distances of an expected landfall or shoal condition, or at any time deemed necessary by the captain for the safety of the vessel and its crew.

VI. On a two-man watch, one should be designated by the captain as Watch Chief in charge of the watch. Prudence dictates that the most experienced hands will be paired with less experienced personnel and such watches should be used to train less experienced crewmembers in navigation and seamanship. This includes the use of compass, radios, radar, Loran, fathometer and other navigational aids, both as primary instruments and as cross checks. Rules of the road should be periodically reviewed.

VII. Normally, if a voyage begins with an unrested crew, discretion will dictate that the captain stand the first watch.

VIII. Normally, the watch should be called 15 minutes beforehand. The watch on duty should ensure that the charts and publications required for the relief are available and in good order. Running lights should be checked by the watch at dusk and prior to each relief during the hours of darkness. High intensity lights are not to be used down below or near other traffic.

IX. The watch on duty is not relieved until the relief arrives in the wheelhouse, an orientation takes place and is noted in the log. The orientation should include position information, the condition of the vessel, running lights, and the current course. The course will be logged and repeated verbally by the relief.

X. No recreational reading material, TV or radio sets should be allowed in the wheelhouse.

XI. The use of alcohol, drugs, or any substance that alters judgment prior to or during a watch may be grounds for relief and immediate dismissal. The U.S. Coast Guard has set legal intoxication limits based on blood alcohol levels. Individual company policy would determine relief and dismissal policy.

XII. A ship's log should be kept in the wheelhouse.

a. No erasures should be made.

b. Corrections should be made after lining out the error.

c. Any observations should be noted in the log.

d. Watch changes and orientations, including the course at the time of relief, should be noted.

e. All personal injuries must be reported to the skipper immediately and logged.

f. All accidents, incidents or breakdowns should be entered immediately.

XIII. The captain should make periodic spot checks of the watch on duty and record in the log. Any discrepancy will be noted in the log.

Note: The above are suggested standards and subject to modifications or expansion at the decision of the captain. While the captain bears the ultimate burden of responsibility for the well being of the vessel and crew, always bear in mind that the safety of the vessel and your crewmates is entrusted to the watch.

5.3 Shiphandling

Too much headway is the cause of nearly all shiphandling accidents. If you're in doubt about whether you have too much headway while making an approach, stop and begin from a stopped position.

Reverse is your only brake. Test reverse before you need it, especially if you have been at sea for a long time and haven't used it. Don't wait until you are bearing down on a pier or another boat to discover reverse isn't working.

Experiment with stopping distances and turning circles in calm conditions. Remember, the more way you have on, or the heavier your load, the longer it will take to back down to a stop. Your turning circle will be greater at speed than from a standing start because of side slip. From a standing start, putting the wheel hard over at full throttle produces the minimum turning circle.

The average vessel will pivot about a point approximately one-third of the length of the vessel measured aft from the bow (Figure 5-1). Use spring lines to come alongside or get away in tight quarters. For example, to clear the stern in a starboard-to-mooring, use the after bow spring and go ahead slow with hard right rudder.

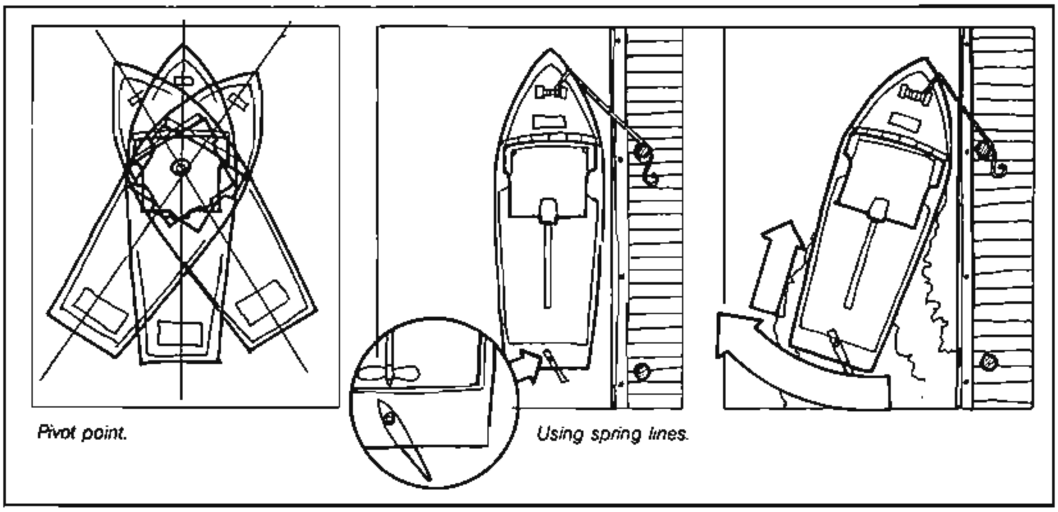


Figure 5-1. (a) Pivot point; (b) Using spring lines.

Carefully monitor the effects of wind and current when maneuvering in tight quarters.

Reversing a single screw vessel creates *transverse* or *side thrust* that may hamper control. The helmsman must understand the effects of transverse thrust in maneuvering a vessel alongside a wharf or pier. Side force walks the stern in the direction of propeller rotation. It is greatest when the ship is dead in the water and decreases rapidly as speed increases (Figure 5-2).

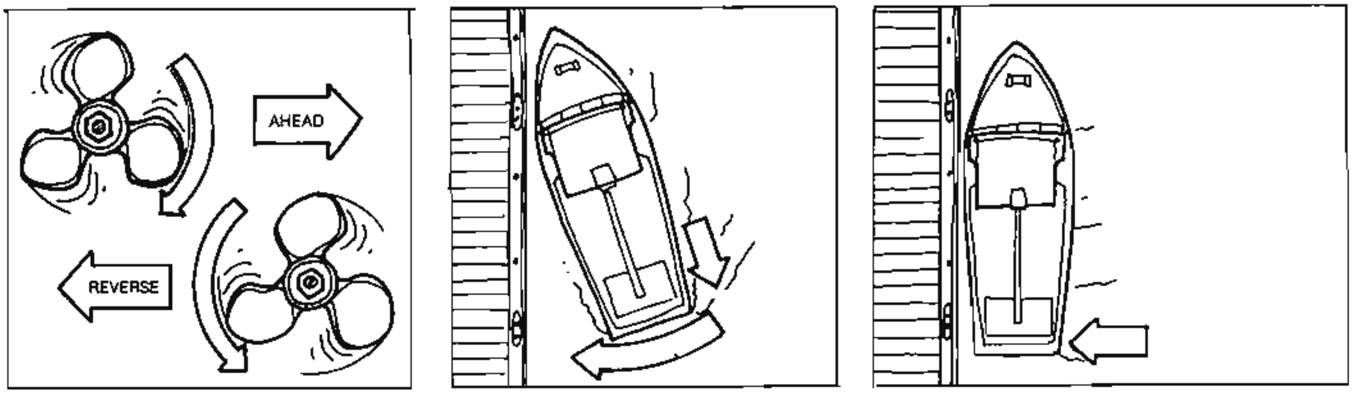


Figure 5-2. Side force walks the stern in the direction of propeller rotation. Reversing a right-hand screw makes portside docking easier.

A right-hand screw walks the stern to port in reverse, so it's easier to come alongside a pier port-side-to than starboard-to. You can nose up to a port-side pier and use reverse to bring the stern in. To come alongside starboard-to, you have to come in straighter because reverse will walk you away. Make a starboard-to landing at slower speed since you can't use as much reverse.

With sternway, stopping the engines and putting the rudder half over will produce a faster turn than putting the rudder hard over.

Whenever the vessel is being brought alongside a wharf or pier, crewmen should be stationed fore and aft with mooring lines.

In windy conditions or strong tides, you may want to have an anchor ready when going alongside or maneuvering in tight quarters.

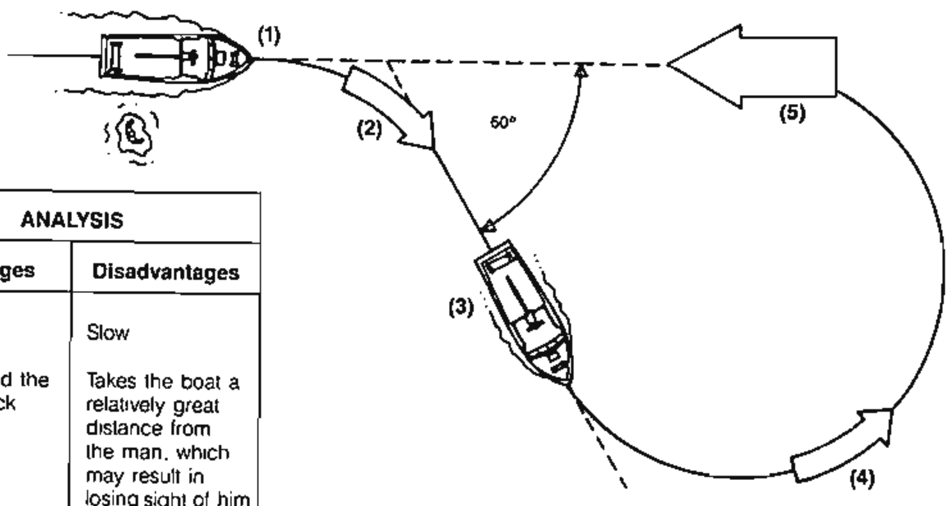
5.4 Recovering Objects from the Water

The following are step-by-step explanations of the four most common recovery methods.

5.4.1 Williamson Turn

(Refer to Figure 5-3).

1) Put the rudder over full in the same direction as the man (this swings the stern away from him). For example, if a person fell over the starboard side, put the rudder over full to starboard. Stop the engine.
2) When clear of the man, go ahead with the engine. Continue using full rudder.
3) When the heading is 60 degrees beyond the original course, shift the rudder to full over in the opposite direction without having steadied on a course. 60 degrees is proper for many vessels, but you will need to find the exact amount through trial and error.
4) Come to the reciprocal of the original course, using full rudder. For example, if your original course was 090 degrees, you should be steady on 270 degrees after turning.
5) Use the engines and rudder to get into proper final position: vessel upwind of the man and dead in the water with the man along-side, well forward of the propellers.



PRIMARY USE	ANALYSIS	
	Advantages	Disadvantages
Used in reduced visibility because it makes good the original track. Used when it is believed that a man fell overboard some time previously but he is not in sight.	Simplicity Makes good the original track	Slow Takes the boat a relatively great distance from the man, which may result in losing sight of him

Figure 5-3. The Williamson method.

5.4.2 Anderson or One-Turn

(refer to Figure 5-4)

1) Put the rudder over full in the same direction as the man (this swings the stern away from him). For example, if a person fell over the starboard side, put the rudder over full starboard. Stop the engine.
2) When clear of the man, go ahead full. Continue using full rudder.
3) When about two-thirds of the way around, back the engine two-thirds or full. Stop the engines when the man is within about 15 degrees of the bow, then ease the rudder and back the engines as required to attain the proper final position (same as that for the Williamson method).
4) Many variations of this method are used. They differ primarily in the use of one or both engines on twin screw vessels, and the moment at which they are stopped and backed to return to the man and tighten the turn. The variation you use should reflect individual vessel characteristics, sea conditions, and personal preferences.

PRIMARY USE	ANALYSIS	
	Advantages	Disadvantages
Used by vessels which have considerable power available and a tight turning circle.	Fastest recovery method.	Requires very skillful shiphandling because of the lack of a straight approach to the man

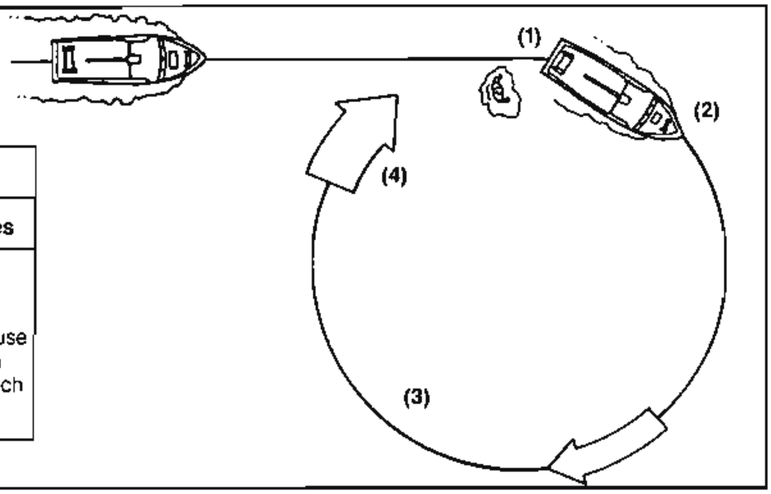


Figure 5-4. The Anderson or One-turn.

5.4.3 Y-Backing

(Refer to Figure 5-5)

1) Put the rudder over full in the same direction as the man (this swings the stern away from him). For example, if a person fell over the starboard side, put the rudder over full to starboard. Stop the engine.
2) When clear of the man, back the engine with full power, using opposite rudder to attain the proper final position (same as for other recovery methods).

PRIMARY USE	ANALYSIS	
	Advantages	Disadvantages
Used by vessels with low height of eye. The vessel remains comparatively close to the man, making it easier to keep him in sight.	The vessel remains comparatively close to the man.	Backing into the wind and sea may result in poor control of the vessel.

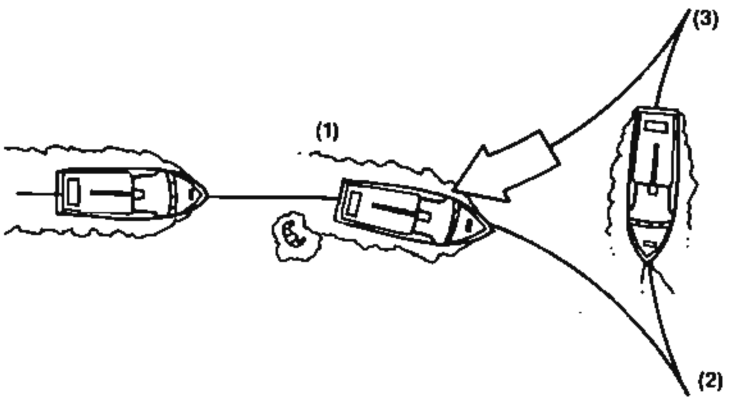
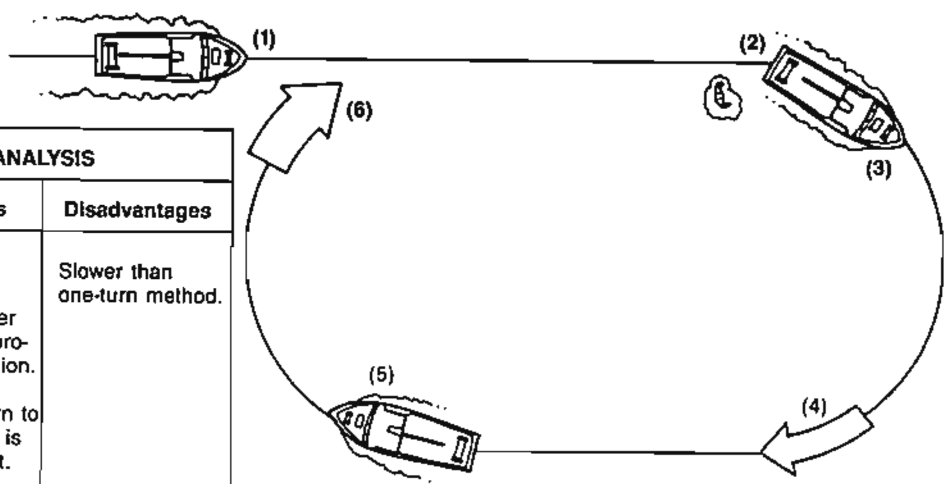


Figure 5-5. Y-backing.

5.4.4 Racetrack Turn

(Refer to Figure 5-6).

1) A variation of the one-turn method which provides a desirable straight final approach to the man.
2) Put the rudder over full in the same direction as the man (this swings the stern away from him). For example, if a person fell over the starboard side, put the rudder over full to starboard. Stop the engine.
3) When clear of the man, go ahead full and continue using full rudder until you come to the reciprocal of the original course. For example, if you original course was 090 degrees, steady up on 270 degrees after turning.
4) Hold the reciprocal course long enough so you can make a straight final approach to the man on the original course.
5) Use full rudder to turn to the man.
6) Use the engine and rudder to get in the proper final position (the same as for other recovery methods).



PRIMARY USE	ANALYSIS	
	Advantages	Disadvantages
Used in good visibility when a straight final approach leg is desired.	Straight final approach leg makes it easier to attain the proper final position. Ship will return to the man if he is lost from sight. Reasonably fast. Effective when wind was from beam on original course.)	Slower than one-turn method.

Figure 5-6. The Racetrack turn.

5.5 Shallow Water

Speed increases draft by forcing water away from the bow and creating a trough aft. At high speed in shallow water, the propeller drives water away from itself and creates a partial water vacuum, which sets up vibration throughout the vessel and increases draft. Vibration warns of the danger of grounding. Reduce speed to dead slow in shallow water, don't try to power through a potential grounding.

5.6 Navigating Inlets

Tidal inlets are one of the worst places to be in violent weather. Shoal water builds up treacherous surf that often cannot be seen from seaward.

When offshore swells run into shallower water along the beach, they build up steep waves because of resistance from the bottom. Natural inlets on sandy beaches, unprotected by breakwaters, usually build up a bar across the mouth. When the swells reach the bar their form changes rapidly, they become short, steep-sided waves that tend to break where the water is shallowest.

When approaching from offshore, the sea may be relatively smooth while the inlet from seaward may not look as bad as it actually is. Breakers may run clear across the mouth, even in a buoyed channel.

Shoals shift so fast with moving sand, that buoys do not always indicate the best water. Local captains often leave the buoyed channel and are guided by the appearance of the sea, picking the best depth by the smoothest surface and the absence of breakers. A stranger is disadvantaged here because he may not care to risk leaving the buoyed channel. He should thus have a local pilot if possible, or he might lay off or anchor until he can follow a local boat in.

If you must get through without local help, these suggestions may make things more comfortable: Don't run directly in, but wait outside the bar until you have had a chance to watch the action of waves as they pile up at the most critical spot in the channel, which will be the shallowest. Usually they will come along in groups of three, sometimes more. The last sea will be bigger than the rest and by watching closely you can pick it out of the successive groups.

When you are ready to enter, stand off until a big one has broken or spent its force on the bar, and then run through behind it. Watch the water both ahead *and behind* your boat; control your speed and match it to that of the waves. An ebbing current builds up a worse sea on the bars than the flood does because the rush of water out works against and under the in coming swells. If the sea looks too bad on the ebb, it is better to keep off a few hours until the flood has had a chance to begin.

Departing through inlets is less hazardous than entering, as the boat is on the safe side of the dangerous area and usually has the option of staying there. If you do decide to go out, you can spot dangerous areas more easily, and a boat heading into surf is more easily controlled than one running with the swells. On the other hand, the skipper of a boat outside an inlet may have to enter, and can only attempt it in the safest possible manner.

5.7 Radiotelephone Operating Procedures

Choose the Correct Channel or Frequency

Each of the marine frequencies and channels is authorized for a specific type of communication. Therefore, you must choose the correct channel for each type of communication. The authorized use for each channel is given in Table 5-1.

Channel	Purpose and Comments
16 156.80MHz	DISTRESS AND SAFETY: Ship to Shore and Intership Guarded. 24 hours by the Coast Guard. No routine messages allowed other than to establish use of a working channel. CALLING: Ship to Shore and Intership. Use Channel 16 to establish contact, then switch to the appropriate working channel.
06 156.30 MHz	INTERSHIP SAFETY: No routine messages allowed. This channel is limited to: talking with the Coast Guard and others at the scene of an emergency, and to get information on the movement of vessels.
22 157.10 MHz (21 in Canada) 161.65 MHz	COAST GUARD COMMUNICATION Channel. Not guarded by the C.G., but after vessel makes contact with the C.G. for non-distress calls on Channel 16, the C.G. will tell you to switch to and use only 22 for communicating. C.G. Weather Advisories and Notices to Mariners are also broadcast on Channel 22. C.G. announces times of these broadcasts on Channel 16.
09	Ship to Shore and Intership: only channel common to both Commercial and Pleasure craft. Also for use to limited shore stations, marinas, yacht clubs, etc. (Your electronics dealer should know local frequencies.)
12,14	Ship to Shore and Intership: Port operations, harbormasters, etc. (Your electronics dealer should have local frequencies.)
13	Intership, Commercial. For ocean vessels, dredges, tugs, etc. Bridge and lock information. Monitored 24 hours by Commercial craft.
68,69,71,72,78A	Ship to Shore and Internship, Pleasure craft only. Shore stations are marinas, etc. For pleasure craft this is the best channel for general communication.
70	NOT authorized for non-commercial or commercial ship-to-ship calls. Authorized ONLY for distress, safety or general purpose calls-using digital selective calling (DSC). Ships must have special equipment for DSC.
24,25,26,27,28, 84,85,86 and 87	Marine Telephone Operators
15	NOAA Weather Reports - primarily weather channels. WX-1, WX-2, WX-3 (receive only)

Table 5-1. VHF channel numbers and their designated use.

FCC Requirements

A vessel equipped with any radio transmitting device (VHF-FM or SSB radio, radar or EPIRB), must have a current ship station license issued by the FCC.

At all times when the radiotelephone is turned on and you are not actually communicating, you must maintain a listening watch on the distress and calling frequency - either 156.8 MHz (Channel 16) or 2182 KHz. You must log all distress calls and auto-alarm signals you hear in a radio log book.

Radio checks may not be conducted with the Coast Guard. Conduct radio checks with another vessel or station on a working frequency. Do not use Channel 16 or 2182 KHz.

5.7.1 Distress Communications

In the event of an emergency, it is extremely important to establish radio communications immediately with the Coast Guard or another vessel, using VHF-FM or single sideband (SSB) equipment. Do not wait until the situation is out of control. At that point, there may be no power to the radio, or it may be too late for rescue units to respond.

Note: all vessels are required to monitor the calling and distress frequencies, Channels 16 (VHF) and 2182 (SSB), for good reason. You may be the vessel in the best position to assist another vessel in distress, or to relay important information to rescue units. In addition, marine weather warnings and notices to mariners are announced on Channel 16, then transmitted on Channel 22.

Radio Telephone (voice) Distress Messages

The use of proper format is essential in the transmission of distress messages. The urgency of the situation requires that distress messages be as brief and clear as possible, while still containing all necessary information. All crewmen must understand distress message format and transmission procedures.

If you need information or assistance from the Coast Guard, call on either 2182 KHZ (SSB) or Channel 16 (VHF). You will then be advised to shift to a working frequency to transmit your message, allowing the distress frequency to remain clear.

Radio Telephone Alarm

Transmit the radio telephone alarm signal (if available) for approximately one minute prior to the distress call. The signal consists of two audio tones of different pitch that are transmitted alternately. Use it to attract the attention of persons on watch, and only use it to announce that a distress call is about to follow.

Making the Distress Call

If you are in distress (threatened by grave and imminent danger), transmit the International Distress Call on either 2182 KHZ or 156.8 MHZ (channel 16 VHF-FM). Speak slowly and clearly and give the following information. Use the following format:

* MAYDAY, MAYDAY, MAYDAY, THIS IS (your vessel name and call sign) repeated three times.
* Describe the nature of the emergency.
* Give your position in latitude and longitude, loran coordinates, or reference to a known geographical position and depth of water. Says a Coast Guard veteran, "Give us everything you've got" that pertains to your location.

Once you have established two-way communications with another station, you may pass on additional information.

* Description of vessel - length, colors, construction, type.
* Number of people aboard.
* Radio frequencies on board.
* Lifesaving and survival equipment on board.
* On-scene weather.
* What assistance is requested from the Coast Guard.
* If you have an EPIRB, that it will be activated if no reply is heard.
* Present seaworthiness of your vessel.
* Homeport, owner's name and telephone number.
* Official number of vessel.
* Cargo aboard.

If it is a Medical Emergency, Give

* Name and call sign of your vessel.
* Your position.
* Victim's name and age.
* Nature and complete description of the problem. Relay the victim's vital signs, if you are able (see Chapter 12, Medical Emergencies). Include a past history of similar problems if it is available.
* Medicine administered or available.
* Name and phone number of victim's physician.

For more information on reporting medical emergencies, see the chapter on Coast Guard Standards & Procedures. In cases where evacuation is either not necessary or not possible, medical advice may be passed via the Coast Guard.

Phonetic Spelling Alphabet

The spelling alphabet is to be used to identify letters when spelling out words, names, abbreviations and call signs in voice communications (Table 5-2).

The spelling alphabet is to be used to identify letters when spelling out words, names, abbreviations and call signs in voice communications.

Letter to be Identified	Identifying Word	* Spoken as:	Letter to be Identified	Identifying Word	* Spoken as:
A	Alfa	**AL** FAH	N	November	NO **VEM** BER
B	Bravo	**BRAH** VOH	O	Oscar	**OSS** CAH
C	Charlie	**CHAR** LEE (or **SHAR** Lee)	P	Papa	PAH **PAH**
D	Delta	**DELL** TAH	Q	Quebec	KEH **BECK**
E	Echo	**ECK** OH	R	Romeo	**ROW** ME OH
F	Foxtrot	**FOKS** TROT	S	Sierra	SEE **AIR** RAH
G	Golf	GOLF	T	Tango	**TANG** GO
H	Hotel	HOH **TELL**	U	Uniform	**YOU** NEE FORM (or **OO** NEE FORM)
I	India	**IN** DEE AH	V	Victor	**VIK** TAH
J	Juliett	**JEW** LEE **ETT**	W	Whiskey	**WISS** KEY
K	Kilo	**KEY** LOH	X	X-ray	**ECKS** RAY
L	Lima	**LEE** MAH	Y	Yankee	**YANG** KEY
M	Mike	MIKE	Z	Zulu	**ZOO** LOO

* The syllables to be emphasized are in bold face type.

Table 5-2. Phonetic Spelling Alphabet.

5.8 Radar for Collision Avoidance

The increasing efficiency of electronic navigation aids is both a blessing and a curse. They have made the work of navigation far easier, but people tend to rely on them too completely - even to the exclusion of using old-fashioned but useful devices such as binoculars. You must understand the fundamentals of navigation and use your eyes and your head to constantly check electronic information.

Never rely on any one source of navigation information to the exclusion of other sources. Be sure all of your sources agree with each other. If one source doesn't check out, follow up on it, and recheck it. Never blindly trust any source of navigational information; always apply the "seaman's eye" and common sense.

Since radar and other electronic devices become primary navigation aids in low visibility, practice using them in good weather.

Radar

Radar must be used on the proper range scales whenever visibility is low, or in congested waters.

Details about radar operation for navigation is discussed in section 6.4.2. However, it is important to note that a basic trick of watchstanding often ignored is the use of the radar cursor to giver early warning of collision. When a target appears on the scope, rotate the cursor to put the line directly on top of the blip. If the target stays on this line as it gets closer, you're on a collision course (Figure 5.7). This is known as constant bearing/decreasing range.

If you already have the cursor on one target and another appears, you can note the bearing on the ring around the radar screen, or, if the target is in sight, you can take a visual sight and observe whether the angle between your vessel and the target changes or remains constant. If the angle remains constant as range decreases, you are on a collision course. For example, if you see lights in line with the bow chock and they stay right there as they get brighter, you know you've got a problem.

The best way to use radar as an anti-collision tool in crowded waters is to use a *Maneuvering Board* rather than to try and solve relative motion problems in your head. Any text on radar navigation will explain how to use one.

Large vessels with sophisticated radar systems may be equipped with Video Plotters. These devices provide an electronic record of target motion similar to what has traditionally been accomplished by means of a Maneuvering Board.

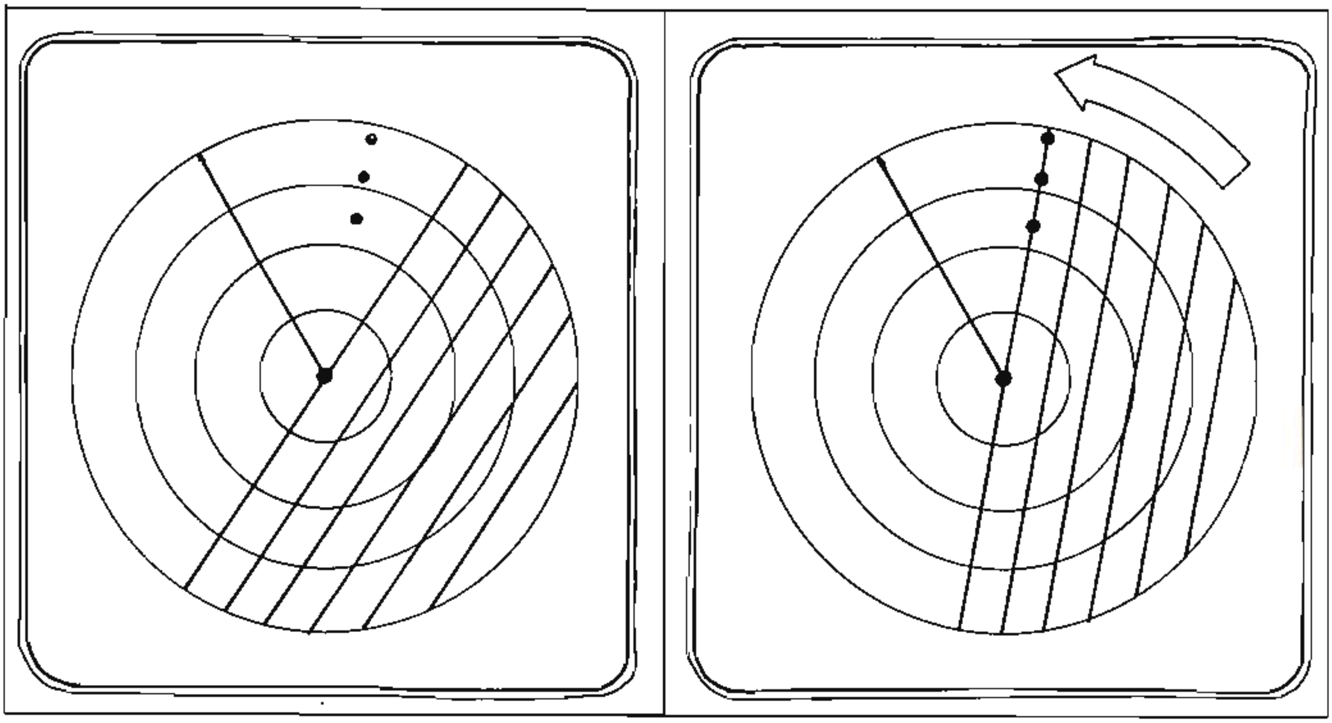


Figure 5-7. A basic trick of watchstanding often ignored is the use of the radar cursor to give early warning of collision. When a target appears on the scope, rotate the cursor to put the line directly on top of the blip. If the target stays on this line as it gets closer, you're on a collision course. This is known as constant bearing/decreasing range.

5.9 Avoiding Collisions at Sea

* Often in meeting or crossing a big ship, the burden for avoiding a collision falls upon you, because the ship cannot maneuver fast enough to keep clear.
* Large diesel or steam engines cannot be thrown into reverse quickly when a ship is running full ahead. It takes big ships a long time to stop even after the engines are reversed, and they cover a lot of water in the process.
* Once the ship's engines are *full astern* there is nothing else the captain can do. Reversing may cause him to lose control of the ship. In most cases, the reversing action will cause the bow to swing to starboard.
* A ship that is slowing down does not steer very well. A ship with its engine and propeller stopped steers very poorly. If the captain feels a turn will save the situation, he may not slow down and risk losing control of the ship.
* Big ships don't slow down when it gets dark. Keep your eye out for big ships after dark, and be sure your navigation lights are working properly and are bright enough to be seen.
* If you meet a big ship, night or day, make a *large, early* course change. Then the pilot will have no doubt about which way you are heading (Figure 5-8).

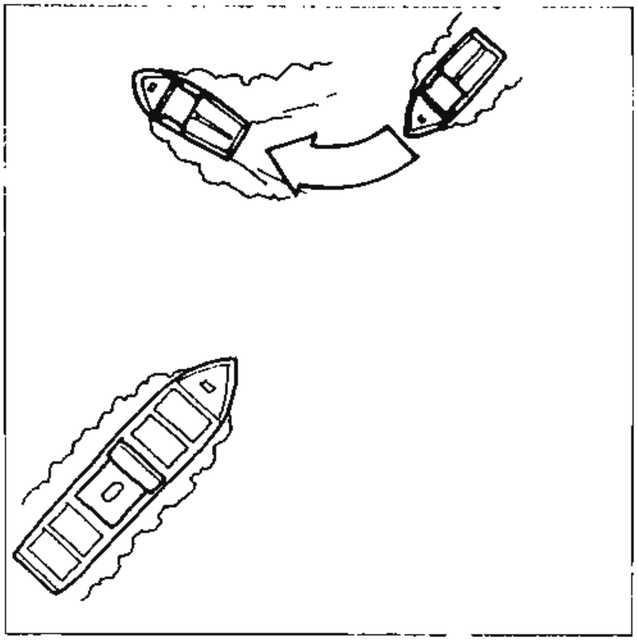


Figure 5-8. Make a large course change when you meet a big ship.

* If you are being overtaken by a big ship at night, use a search light or flare-up light to warn him of your position, but *never* shine the light toward the ship's bridge or you may hamper the pilot's night vision (Figure 5-9).

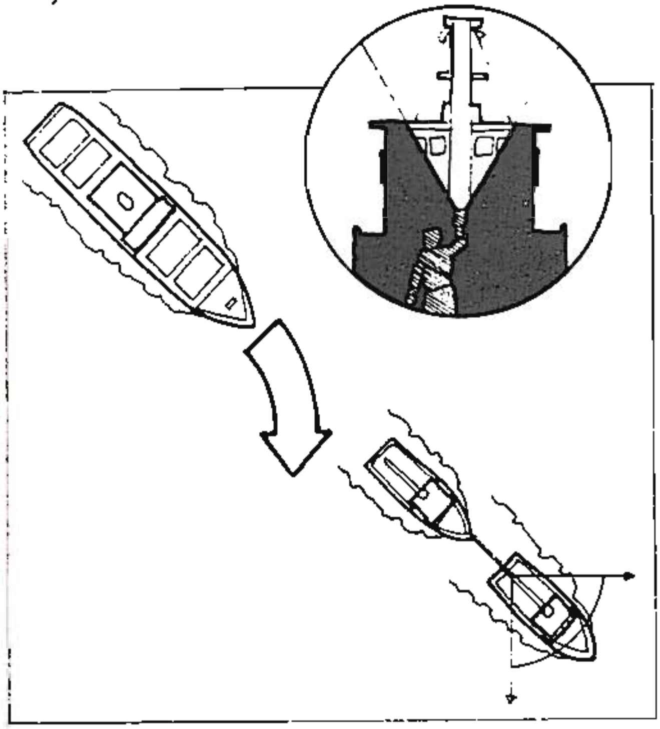


Figure 5-9. If you're being overtaken by a big ship, use a flare-up light to illuminate your own vessel. Never shine the flare-up light at the bridge of the big ship.

* Big ships will typically wait until small craft are fairly close aboard before changing course because they want to avoid having to make multiple course changes should the small craft change their headings. Most ship pilots will attempt to set a course and hold it in waters congested with small craft.
* If a big ship running at full speed has begun a sharp turn to avoid you and it appears the turn is insufficient to eliminate the collision, *you* have to get out of the way. The ship cannot increase its rate of swing.
* Large ships travel quickly. For vessels that travel at 20 knots or more at sea, *dead slow* may mean 9 knots.
* Big ships travel quickly, even in poor visibility or congested waters, for reasons that may range from maintaining maneuverability to staying on schedule.
* Keep in mind that even big ships can have steering and engine failures.
* Visibility from many ships is poor, especially when booms and masts stick up like a forest in front of the wheelhouse windows (Figure 5-10).
* If you hear a big ship's whistle in fog, a veteran pilot recommends that you contact the other vessel and alert them to your presence. A possible action that may be decided upon is to stop your vessel and let the ship maneuver around you by means of its radar. The ship's pilot will be better able to take avoiding action if he doesn't have to guess which way you're going.
* In other conditions, although big ships use dual radars, pilots recommend that you take avoiding action rather than rely on a big ship to pick up your boat by radar after dark, in either fair weather or foul.

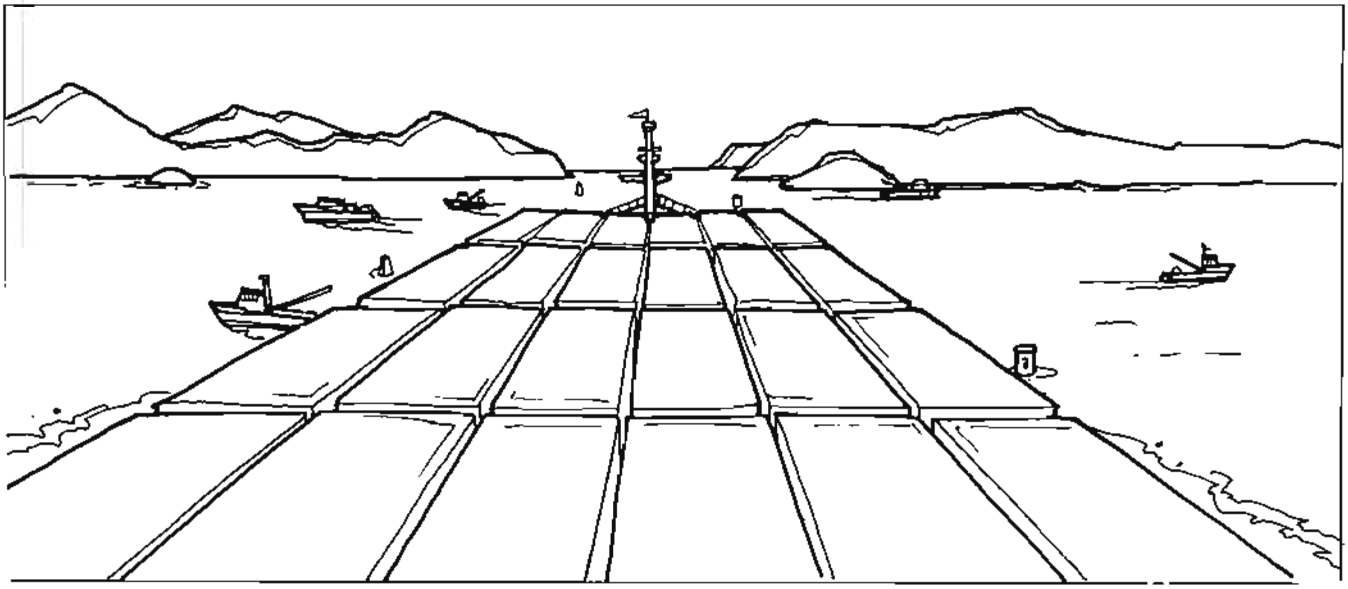


Figure 5-10. View from the bridge. When a small vessel passes in front of a big ship, the ship's pilot loses visual contact long before the point of impact.

* When a small vessel crosses ahead of a big ship, the pilot of the ship loses visual contact long before the point of impact. Once he loses sight, the pilot dares not turn the ship because he doesn't know what the smaller vessel is doing.
* Following currents can make steering a big ship very difficult, especially if you force it to slow down. Lateral currents can cause a ship to bear down on you even if it appears to be heading in a direction that should carry it safely past. Give big ships extra room in strong currents.
* The large *sail* area of a big ship may cause it to make considerable leeway in strong winds. Give it plenty of maneuvering room to fight the wind.
* A big ship probably cannot hear your whistle signal.
* Always maintain proper running lights during hours of darkness or low visibility and display
* After starting a turn at full speed, a big ship will move ahead a considerable distance (in the direction of its original course) before coming to a new heading 90 degrees from the original. You must be beware of this *advance* that occurs when a big ship is turning in your vicinity. A turning ship also experiences *transfer* (movement in the direction of the new heading) as it makes a turn. Figure 5- 11 shows that transfer is half the distance of advance. The transfer factor may place vessels to the side of a big ship in danger if it is a forced to turn to avoid collision.

5.10 Heavy Weather

If you have no alternative but to ride out a storm at sea, you must storm-proof your vessel: button up, secure loose gear, and ready safety and emergency gear.

Secure deck cargo at the first sign of heavy weather

There can be no hard and fast rules for heavy-weather tactics. Too many variables exist in the weather; sea state; type, design and condition of vessel; crew competence; loading; geographical position; etc. But failing to recognize an approaching storm and/or not preparing for a storm may be fatal mistakes.

5.10.1 Heavy Weather Handling

A boat will pound heavily going to weather with a head sea. This pounding can damage the bottom plating, frames, engine hold downs, portholes, bridge windows, deckhouse plating, ladders, etc. You can also damage the engine's gearbox and shaft if the propeller races when the stern lifts out of the water.

Reduce speed as soon as you notice heavy seas coming from up ahead, since even minimal pounding can damage the vessel. Adjust the throttle until the bow rises with the oncoming waves rather than driving into them. Taking the seas on the port or starboard bow also lessens some of the pitch (Figure 5-12).

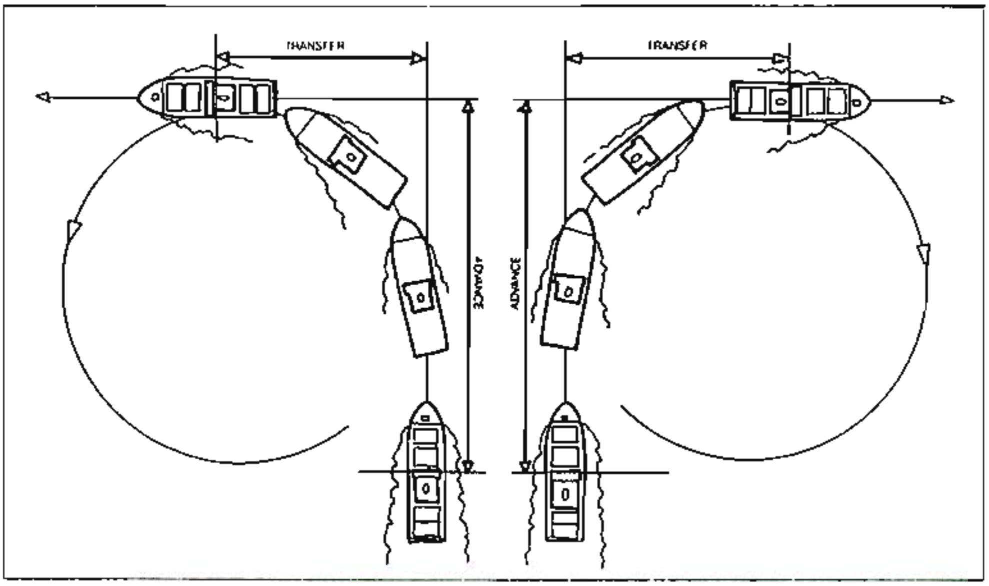


Figure 5-11. Advance and transfer.

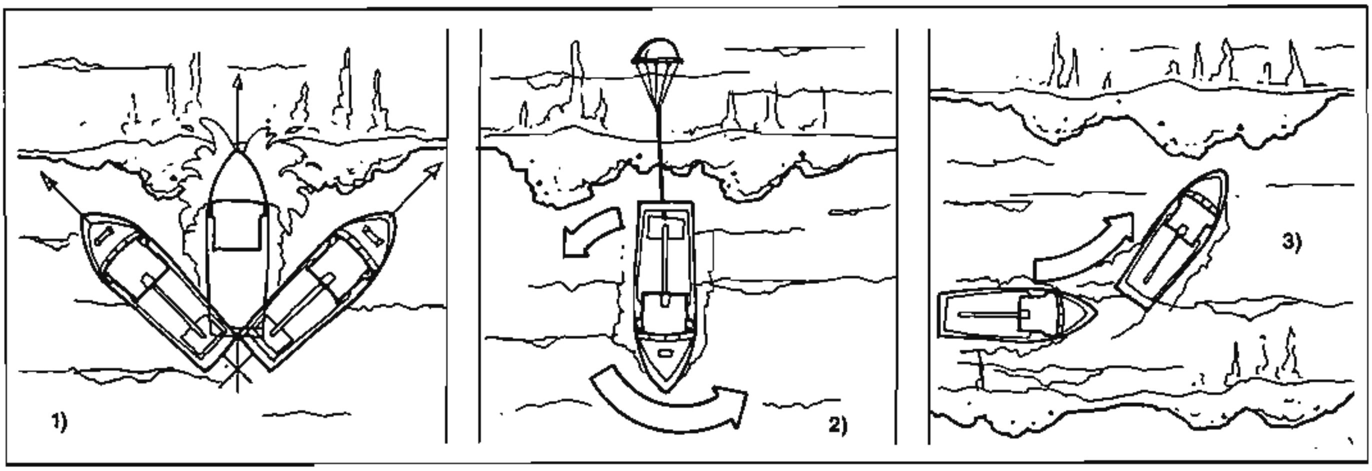


Figure 5-12. Heavy weather handling.

At the right speed, going to weather is safer than having the weather abeam or astern. If there is sufficient room, speed can be reduced until only steerageway is maintained, and the vessel is "hove-to" or jogging with the seas at an angle to the bow.

Running before big seas is dangerous because the hull is lifted by the stern and you can lose steerageway and power, and broach in the trough. When conditions warrant, reduce speed and let the swells roll by, or even use a drogue or sea anchor (Figure 5-12 (2)).

Avoid the trough except in an emergency. When you are moving broadside to the waves, turn the wheel momentarily to take larger crests on the windward bow, then return to course when conditions permit (Figure 5-12 (3)).

5.10.2 Boarding and Quartering Seas

When the sea is on the bow, the vessel rolls and pitches simultaneously, and the resistance of the vessel's headway reduces the angle of roll. When the vessel runs with the sea, however, the roll increases because there is less resistance forward, and because the wave runs past the vessel more slowly and stays in contact longer. The result is pronounced roll and pitch and the possibility of taking heavy seas over the stern. Because the sea is traversing the vessel from astern, the rudder is less effective, and the vessel may be slewed across the waves and broach. The added weight of water from boarding seas can subject the vessel to the danger of capsizing.

As a counter measure, the captain must quickly alter course and speed to avoid synchronization of wave and vessel speed and direction. He may have to come head-to-sea. Putting the sea to one quarter or the other can improve control and "riding" conditions in a following sea.

5.10.3 Turning in Heavy Weather

Always turn before it is necessary; for example, before the vessel finds itself in jeopardy off a lee shore. Turn in a *smooth*, a period when the waves are momentarily flatter than the prevailing sea condition. Start the maneuver as soon as the last wave crest has passed the vessel (Figure 5-13 (1)). Reduce engine speed to allow the sea to pass quickly. Turn the wheel hard over and turn the vessel in the trough between the crests. Try to turn fast enough to be head-to the next wave. Apply power to complete the turn quickly but don't gather too much headway (Figure 5-13 (2)). Reduce speed as soon as the vessel is nearly head-to weather (Figure 5-13 (3)).

Don't turn when there is water on deck. Turn well before your vessel suffers damage or loss of stability. A stern trawler with a ramp may have to turn to weather before other vessel types because the sea will run up the ramp and break on deck. High bulwarks ordinarily make it comfortable to work, but allow water to escape less quickly than do low bulwarks. Always keep freeing ports clear.

5.10.4 Seaworthy Versus Seakindly

The degree to which the vessel will roll on the waves depends on its center of gravity. A low center of gravity means a stiff vessel, resistant to waves, with a very quick roll. Such a vessel is very stable and seaworthy, but it is not seakindly. A high center of gravity means a tender vessel with a slow roll. Such a vessel is comfortable but not stable. If your vessel is tender and you have water on the deck, a shifting load, or free surface in the tanks, you will have trouble. While a stiff boat is seaworthy, a very quick roll places heavy strains on lashings, hold-downs, and stays. Avoid either extreme.

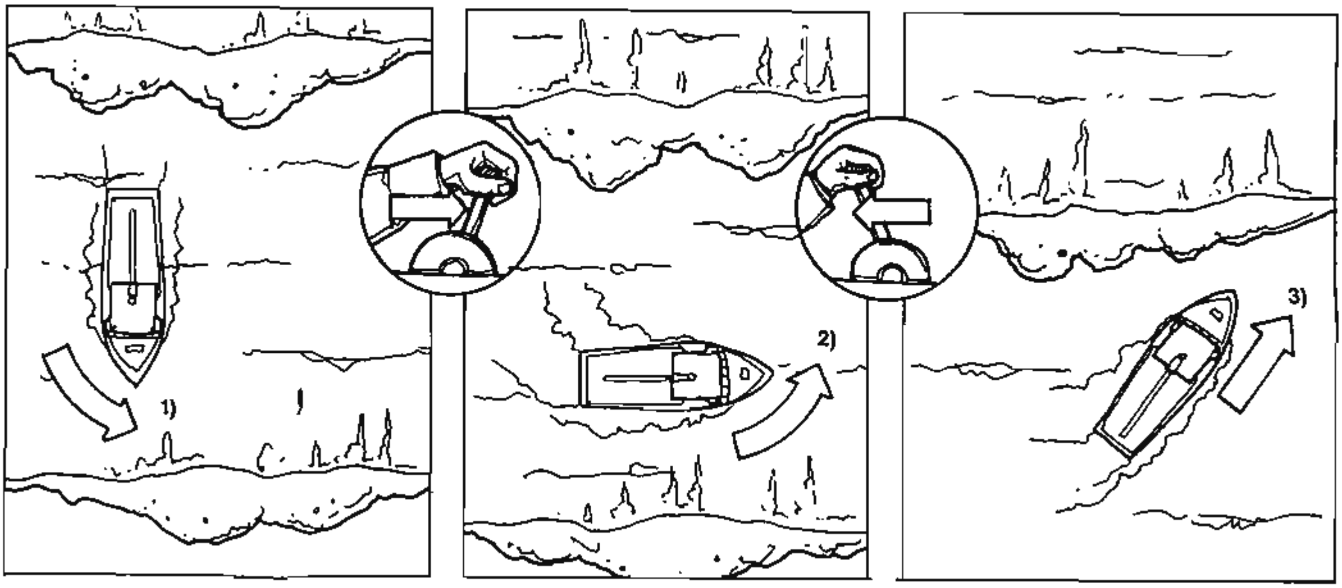


Figure 5-13. Turning in a smooth.

Captains must study stability plans and understand the vessel's behavior in bad weather.

5.10.5 Heaving-To

It is up to the captain to decide the point at which it becomes safer to jog or heave-to rather than continue trying to maneuver. Once this point is reached, he must choose the tactic that results in the most comfortable ride and is easiest to maintain. Again, there are no hard and fast rules that apply to all fishing vessels in all conditions. The following are a few tips:

* Power vessels in heavy weather will normally be most comfortable when drifting with no way on. However, because of propeller drag and wind sheer, they will normally assume a stern to or nearly stern-to the-weather position, which increases the possibility of taking a breaking wave aboard (Figure 5-14 (1).

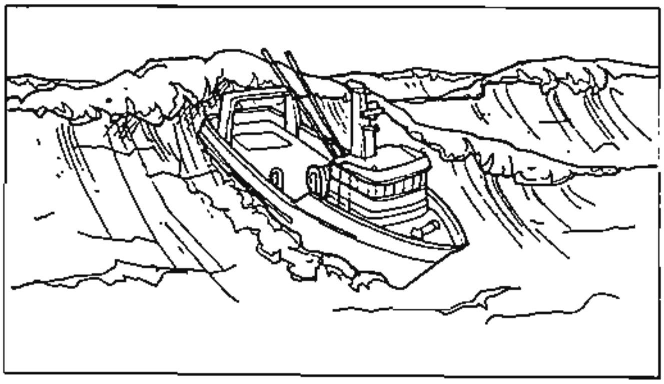


Figure 5-14. (1) A stern-to position increases the possibility of taking a wave over the stern.

* Using a drag or some other method to keep the bow to the weather while the vessel continues to drift would probably be a better means of heaving to, especially for vessels with impaired watertight integrity or stability. Windage and propeller drag usually make it impossible to maintain a bow-on position while drifting, especially for a house-forward vessel. Many captains prefer to jog bow or shoulder-to the weather with only enough way on to maintain steerage (Figure 5-14 (2)).

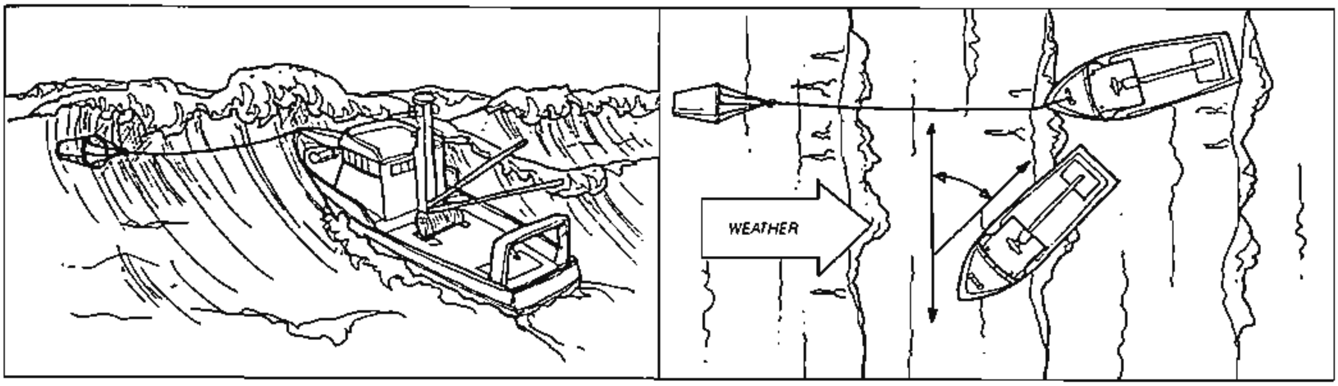


Figure 5-14. (2) A sea anchor may help maintain a bow-on position.

* If your vessel rolls dangerously as it drifts, you may try running quickly enough just to keep steerageway (Figure 5-14 (3)).

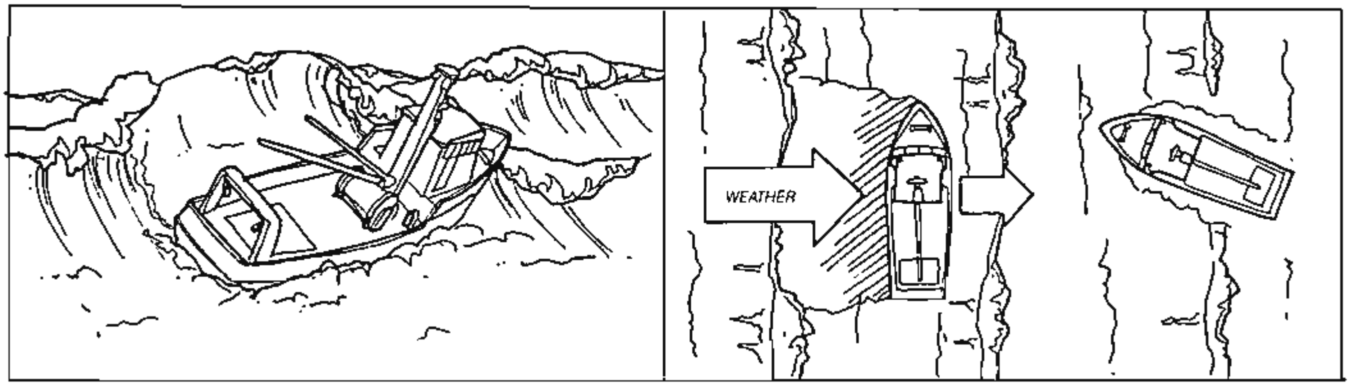
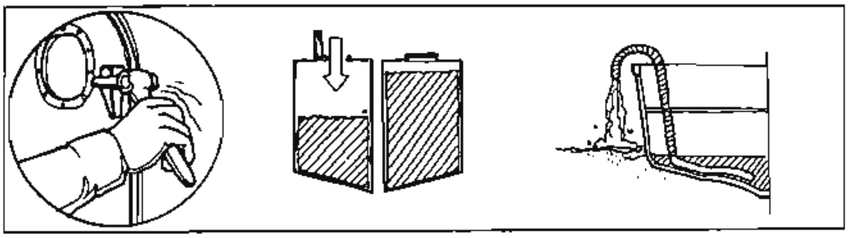


Figure 5-14. (3) Run your vessel quickly enough so that you can maintain control.

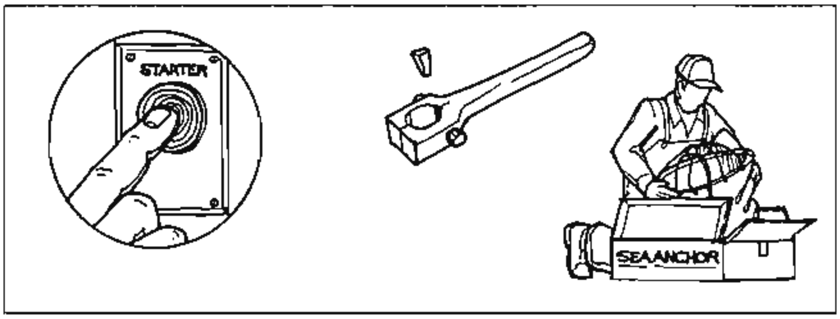
Before using any heavy weather tactic or storm avoidance maneuver, the captain must know the characteristics of his vessel. He should know its level of stability in loaded and light conditions, its level of watertightness, the likelihood of cargo shifting, the condition of its tanks (full or empty tanks are best, half-full tanks are worst because of free surface), the length of seas most likely to cause synchronous rolling, the vulnerability of the hull and equipment to racking and bending, etc. Some of this information is available in the stability reports prepared by naval architects or surveyors. Some can only be acquired through experience at sea. Some general information is included in Figure 5-15 (a)-(e).

Figure 5-15. Heavy Weather Rules

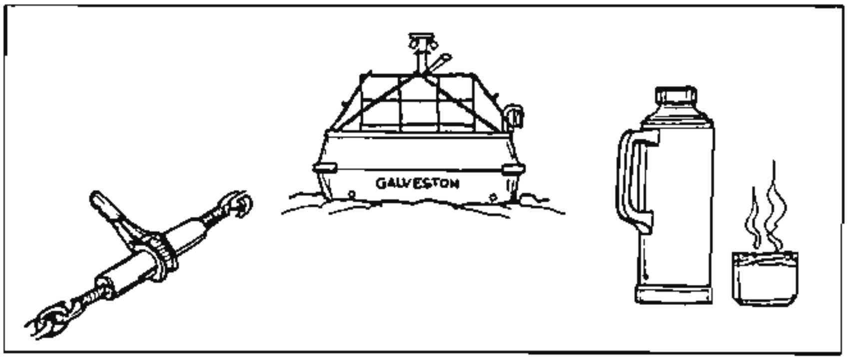
Ensure watertight integrity: *Dog all hatches. Inspect bilges and bilge pump screens, and remove anything that could clog them. Make all effort to reduce free surface in tanks and bilges: keep tanks containing liquids either full and pressed up or entirely empty. Secure port/starboard tank cross-connection valves.*



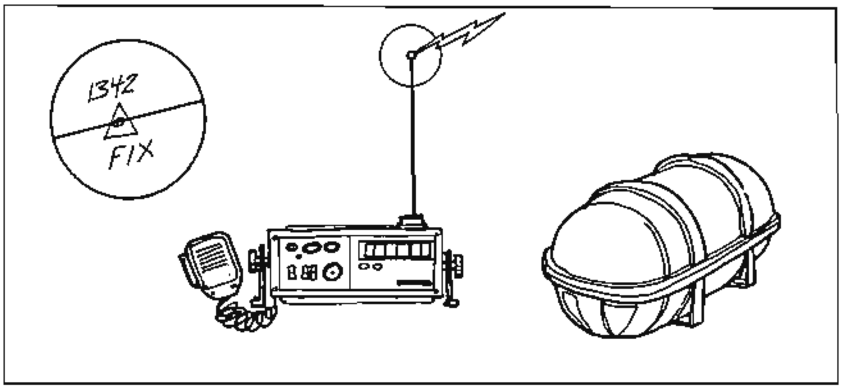
Ensure power and control: *Start engine and generator. Inspect rudder control linkage. Ready emergency tiller and sea anchor*



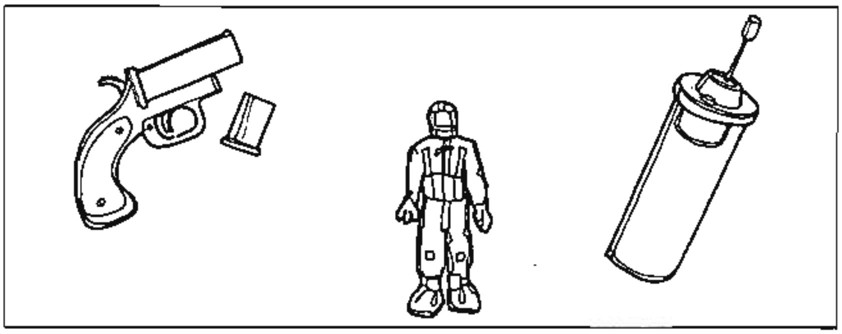
Clean up and tighten down: *Remove freeing port covers and pound boards that might hinder the escape of shipped water. Secure all deck cargo and use extra chain or lashing on crab pots and other heavy objects. Secure the bow anchor. Have meals and snacks prepared in advance*



Navigation: *Take a fix to update your DR track. Record barometer reading, wind direction and speed, and set and drift. Prepare a storm and sea forecast: what do you expect the sequence of events of the storm to be? Plot the storm track. Check operation of all navigation equipment. Have emergency lighting readied. Ready PFDs, immersion suits and safety harnesses. Get a radio check, and report your position.*



Emergency equipment: *Ready signal and distress flares. Have emergency repair gear readied. Have an emergency station bill posted and assign action stations. Ready survival gear for possible abandonment. Require personnel who must work topside to wear PFDs and safety lines. Ready the EPIRB*



5.11 Mooring

Mooring Lines

The *bow line* runs through the bullnose or bow chock. The *stern line* runs through after chocks. *Breast lines* may be run perpendicular from the bow, waist or quarter to keep the vessel from moving away from the pier. *Spring lines* may be run from the bow or quarter to eliminate forward or aft movement of the vessel (Figure 5-16(1)).

When you are tying to a pier or wharf, pay attention to the tide. At high tide, leave enough slack to ensure that as the water level falls, lines will not part, carry away bollards or list the vessel at a dangerous angle. If a rising tide could pull the mooring line over the top of a cleat or piling, pass the line under the *bull rail* then over the cleat or piling. Check mooring lines after each turn of the tide.

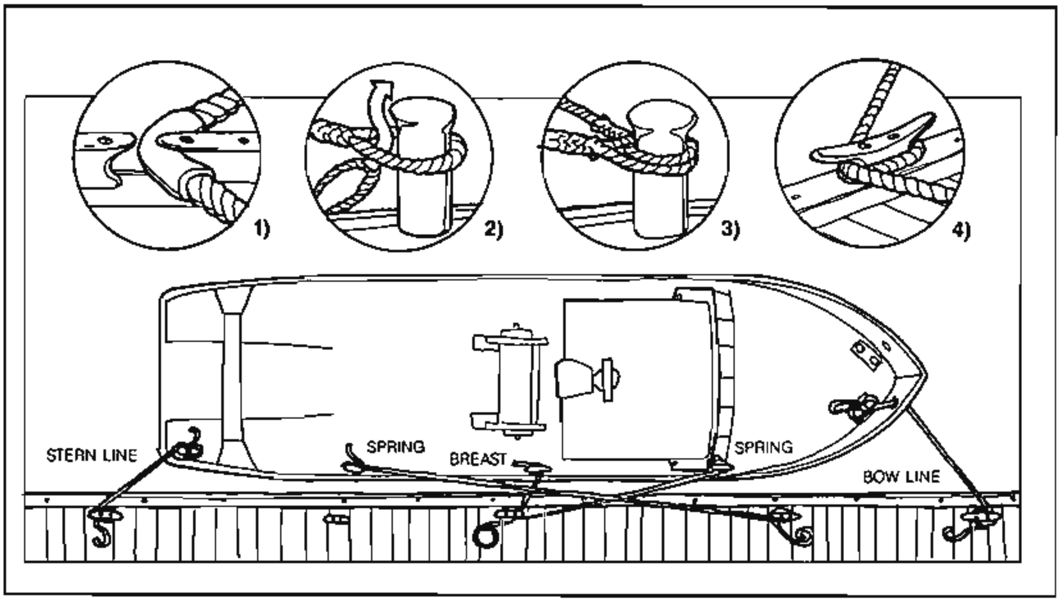


Figure 5-16. Mooring. (1) Use of chafing gear; (2) & (3) Dipping the eye; (4) Snubbing a line on a cleat.

Use only spliced eyes in the ends of mooring lines, no knots. Send the eye to the dock, and have the man on board tend the line.

Before you leave the vessel at its mooring, check the condition of dock cleats, piles and rails to be sure they will hold. If you're the inboard boat in a raft, run extra lines.

Avoid extreme bends in mooring lines where they pass through hawse holes or fairleads (use a minimum bending radius of 3 times the diameter of the line to avoid wear or failure.) Use rubber hose or some other material as chafing gear around the bends (Figure 5-16 (1)).

Dipping the Eye

If two bights or eye splices are to be placed over the same bollard, lead the second up and through the eye of the first so that either can be removed independently (Figure 5-16 (2) & (3)).

Making a Hitch on a Cleat

Start with at least one full turn around the base before you begin taking turns over the horns. Use only figure-eight turns, no knots or hitches that may jam under tension. Synthetic lines are slippery, with little friction; use extra turns. Watch your hands to avoid pinching or crushing injuries.

Snubbing a Line on a Cleat

Never try to hold a vessel without first taking turns on a cleat. Stand well back from the cleat, out of the bight and at 90 degrees (Figure 5-16 (4)).

5.12 Ground Tackle and Anchoring

Ground tackle is one of the most vital parts of a vessel's equipment. Good ground tackle has saved many lives. Correspondingly, improper maintenance and use of ground tackle has caused many casualties. Every fisherman must understand the use and upkeep of his vessel's ground tackle.

5.12.1 Elements of Anchoring

Rode

The rode includes all gear between the vessel and the anchor, including line or chain, and connecting swivels or shackles (Figure 5-17). The rode may be all chain, or a combination of chain and wire or chain and line. A combination is best, since it will allow the rode to stretch under load. First attach 10-12 feet of chain between the anchor and the line or wire. The chain not only adds extra holding weight, but it also keeps the pull horizontal, ensuring that the flukes will dig into the bottom properly. Chain also withstands the wear of lying on the bottom better than wire or line.

Use chafing gear where and when it is needed, and mark the rode by length to help you determine how much rode has been paid out.

The rode should have a breaking strength of five times the anchor hold if made of line or wire, and two times the design load if made of chain.

Bow Rollers, Hawse Pipes, Hawse Holes

Many fishing vessels have *bow rollers* that permit the rode to be paid out or heaved in, and that serve to secure the anchor when the vessel is underway. The

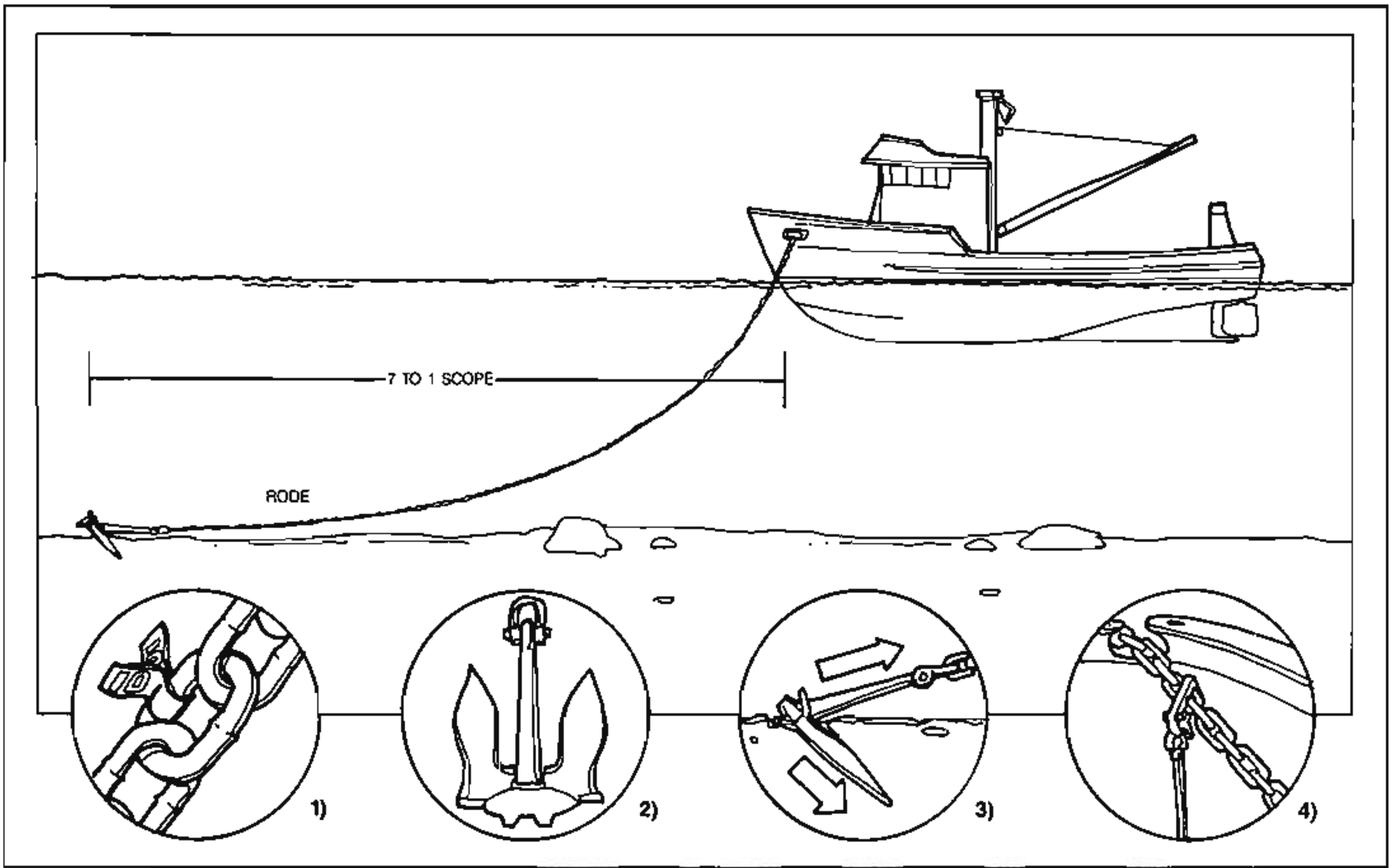


Figure 5-17. Ground tackle. The rode refers to all gear between the bow hawse and the anchor. (1) Marking the rode; (2) A typical fishing vessel anchor; (3) With proper scope, every pull on the rode sets the anchor deeper; (4) Dogging the anchor chain.

term *hawse* refers to pipes or holes that pass through the bulwarks to lead the anchor line or chain. The hawse pipes or holes may be used for storing certain types of anchors so that they can be quickly deployed. Stow the anchor securely in its bow roller or hawse pipe to prevent its breaking loose and causing damage in a seaway.

Riding Chocks, Stoppers, Dogs

These are devices that take the strain off the winch or windlass when the vessel is riding at anchor. Always stopper or dog the anchor rode to keep the vessel from riding on the winch or windlass brake.

Wildcat

On vessels equipped with a windlass, this is a sprocket wheel that engages the anchor chain as it is being hauled in. Always dog the wildcat when the vessel is riding on the chain.

Capstan or Gypsy Head

These are vertical or horizontal drums fitted to a windlass for handling the line portion of the anchor rode or other forward mooring lines. When you are working a line on a capstan or gypsy head, stand as far back as possible and watch your hands. If possible, stand at right angles to the direction of pull.

Chain Pipe, Chain Locker

On vessels equipped with windlasses, after passing over the wildcat or gypsy, the chain or line drops down the chainpipe into the chain locker below. The bitter end of the line or chain must be securely fastened in the chain locker to prevent losing the ground tackle overboard.

On vessels equipped with winches and wire rodes leave one full layer of turns on the drum to "lock" the wire in place.

Scope

This is the length of the rode (measured from the hawse or bow roller) compared to the depth. A scope of 7 to 1 is the general rule for anchoring (7 feet of rode for every foot of depth), although this rule may not be practical in deep water. Adequate scope is essential to enable the flukes of the anchor to dig into the bottom. With adequate scope, every pull of the vessel sets the anchor deeper. With too little scope, the pull of the vessel lifts the shank, and the flukes come free. With too much scope, the vessel may swing excessively and foul other lines or endanger other vessels.

Shots

These are lengths of chain connected to form the anchor cable. The standard shot is about 15 fathoms, or 90 feet long.

Anchor Elements

* *Flukes or palms*, the flat members that grab the bottom.
* *Shank*, the metal bar that joins the *crowns* to the ring or hole that accepts the rode.
* *Stock*, a crosspiece that helps position the flukes so they dig into the bottom.

5.12.2 Anchoring Procedure

Since you may need anchors unexpectedly, keep them ready for immediate use.

Do not leave the anchor windlass in gear when you are underway. Use the hand brake and dogs or stoppers in case you lose power and have to set the anchor manually.

Always let the anchor go when your vessel is moving slowly, to avoid paying the chain down on top of the anchor and fouling the flukes. Under normal conditions, let the anchor go when the boat has slight sternway (Figure 5-18).

Always send two men forward to work the anchor gear: one to work the gear, and the other to stand by in case the first man gets hung-up.

You must be able to swing 360 degrees with no obstructions on the surface or underwater at low tide. The radius of your swing circle equals the length of the rode plus the length of the vessel.

Do not anchor over underwater cables or pipes, or where your vessel will interfere with other vessel operations.

When you are letting go, maintain control over the anchor and rode by keeping a turn on the winch or windlass. If you are handling the chain over a wildcat, use the palm of your hands. Never put your fingers into the links. Stand as far back from the wildcat as possible, and stay out of the bight.

If you must let go at high speed, let the rode run until the vessel loses way sufficiently to make it safe to check it. There is no harm in letting out a considerable length of rode, and then hauling in to the proper scope.

Scope

Remember, proper scope is the key to safe anchoring. The common rule is to use a scope of seven times the depth at high tide, although this may not be practical in deep water. If you need great holding power, it is safer to set two anchors than to use excessive scope.

When you have let out the proper scope, set the anchor by backing down against it.

Anchor Watch

Always maintain an anchor watch to ensure that the vessel doesn't drag or break free unnoticed. Take visual bearings and ranges to use as reference points.

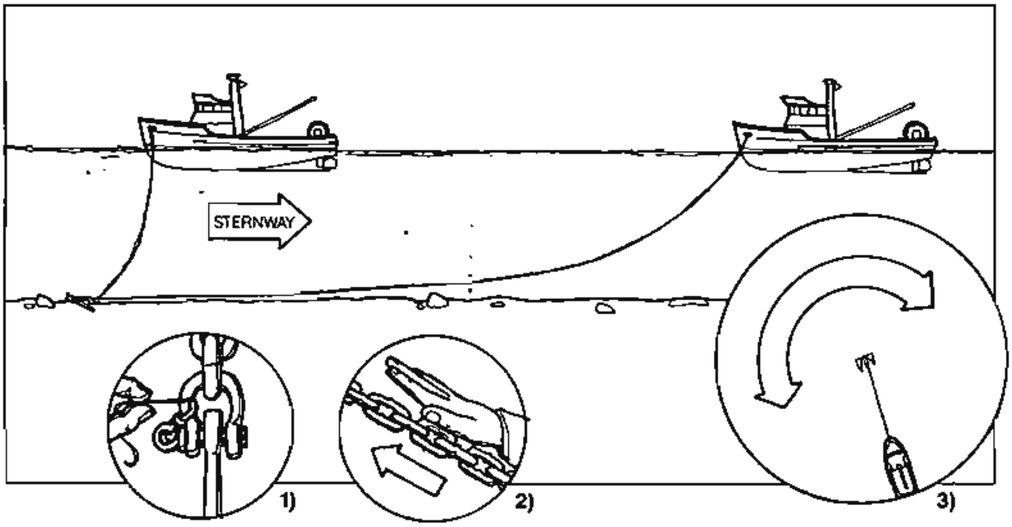


Figure 5-18. Anchoring. The anchor is normally set with slight sternway, then snubbed when the proper scope has been paid out. (1) Mousing an anchor shackle; (2) Using the palm, not the fingers, to handle the chain; (3) The radius of the swing equals the length of the rode plus the length of the boat.

You might also want to set the radar range ring on the shoreline, and use the fathometer depth alarm as warning mechanisms. Just remember that nothing replaces the human eye.

There is a tendency to feel safer the longer you have been at anchor, but beware. When the vessel swings on the tide, the flukes can pull free. Therefore, check the set of the anchor frequently.

Anchoring in a Tideway

A vessel at single anchor in strong tideway may sheer considerably and be brought up against the chain with violent shocks. Put the rudder hard over and keep it there, and the vessel will be held across the current.

Anchoring in Heavy Weather

If a storm approaches, the best course of action is to seek the open sea. If you must ride out a storm in an anchorage, use extra scope. You might set a second anchor to form a mooring, or drop a second anchor underfoot to prevent the vessel from surging back and forth across the wind.

Always make sure that the inboard end of the anchor rode is made fast before letting go.

Maintenance

Ideally, inspect the anchor gear annually. Pay special attention to detachable chain links, shackles and swivels, and replace them as needed. Lay out the anchor rode on deck and examined it for damage throughout its entire length. Remove any scale and corrosion. To distribute wear, rotate chain shots. On all-chain rodes, shift a worn or defective shot to the bitter end until it can be replaced.

Anchors also require maintenance. Lubricate the hinges to keep the flukes from seizing up, particularly if you rarely use the anchor.

Seize screw-type shackles that are used to connect segments of the anchor rode to prevent them from coming loose when the anchor is on the bottom.

5.13 Marlinespike Seamanship

This section is an introduction to the safe use of fiber line and wire rope. For more detailed information, consult one of the many comprehensive manuals available on the subject of marlinespike seamanship.

Rope and Cordage

Rope refers to both fiber and wire rope, although fishermen usually refer to fiber rope as *rope* or *wire*. More specifically, a line is a fiber rope with a specific use, like a mooring line or heaving line.

All cordage is made by spinning natural or synthetic fibers into yarns. The yarns are then twisted (laid) together to form strands, and the strands are twisted, braided or plaited together to form ropes. To carry the process further, ropes may be twisted together to form cable, or *cable lay*.

In twisted rope, the direction of the strands determines the *lay*. The angle of the lay and the degree of twist determine the character of the rope, which may be hard or soft, left or right. Right hand lay should be coiled in a right or clockwise direction.

5.13.1 Fiber Rope Do's and Don'ts

Overloading

Know the safe working load ranges of your ropes and lines and don't exceed them. The ranges are established by taking 15 to 25 percent of new rope tensile (or breaking) strength for braided rope, and 10 to 20 percent for twisted rope. They apply to rope in good condition, with proper splices, under normal service conditions. As a general rule, use at least a 5-to-1 safety ratio. In other words, select lines five times as strong as you need.

Because of wide variations in rope condition and use, and in the degree of risk associated with various uses, working load recommendations provide only general guidelines and do not alleviate the need for constant attention to safety.

Use the lower limit of the working load range where there is risk to life or limb, or for exceptional conditions such as shock loads or sustained loads. If your rope is old or worn, make additional allowances for safety.

Breaking a line isn't just a matter of ruining a piece of material. A broken line can injure or even kill. Never continue to increase the tension when a load is two-blocked or fully tightened.

Abrasion

The outer and inner fibers of rope contribute equally to its strength, and abrasion produces substantial weakening. At rub points, wrap and tie chafing gear around the rope.

Shocks and Jerks

Sudden strains can part ropes that would be capable of supporting the same loads under steady conditions. Start and stop loads gently.

Kinks

Never load a kinked rope or pull it through a block. This will result in serious damage to the rope fibers. If this does happen (and it often does), the rope can't be trusted and should be replaced.

Bends and Angles

Chafe and wear account for most rope failure. A rope is substantially weakened if it is bent at too sharp an angle. Use recommended sheave diameters (at least 6 times rope diameter for fiber cordage) and groove sizes (so the rope doesn't rub against the side plates). Make sure leads are fair. If you must lead a rope across part of the vessel's structure, pad it.

Rigging

When you rig for heavy loads, do not attach blocks or leads to untested pad eyes or fittings. They may pull away and cause an injury.

Reverse the Ends

Prolong the safe working life of a rope by cutting off ends to move wear points, and reversing the ends to bring new sections into areas of heavy wear. You can removed localized wear by cutting out the damaged part and splicing the ends back together.

Chemicals

Chemicals severely damage natural fiber ropes. Synthetic ropes are much more resistant, but still do not expose them to oil, gasoline, paint or other chemicals.

Keep It Clean

Dirt abrades rope fibers. Wash ropes in clean water, and always dry natural fiber ropes before storing them, since they will rot if they are stowed wet.

Storage

Stow synthetic ropes out of direct sunlight, out of the elements and away from heat.

Heat and Cold

Excessive heat will melt synthetic ropes and make natural fiber ropes dry and brittle. Ice crystals will cut the fibers.

Blocks and Sheaves

Sheaves should be guarded wherever practical. Regularly maintain, inspect, and lubricate blocks, for your safety, and for the extended life and efficiency of the block. Things to note during inspection:
* Wear on pins or axles, rope grooves, side plates, bushings, bearings and fittings.
* Deformation in side plates, pins and axles, fitting attachment points, etc.
* Mis-alignment or wobble in sheaves.
* Security of nuts, bolts and other locking devices, especially after tear-down and reassembly.

5.13.2 Synthetic Cordage

Synthetic ropes have replaced natural fiber ropes on most fishing boats for several reasons. They are stronger and more durable than natural-fiber ropes, they are generally not affected by rot or chemicals, and they can be stored wet or dry. However, they do break down in sunlight.

Unreel coils of synthetic rope the way you would unreel wire rope (see section 5.13.5).

If oil or grease makes a synthetic line slippery, scrub it with a grease-cutting cleaner.

Nylon

Nylon rope has great strength and elasticity that enables it to withstand shock loads that would break other fibers. Nylon is also highly resistant to weather and abrasion, although it deteriorates in direct sunlight.

Nylon is capable of withstanding repeated stretching with no ill effect. Twisted or cable laid nylon rope safely stretches one-third of its length under normal working loads. A stretch of 40 percent is the critical point, and the rope parts at a 50 percent stretch.

Unlike natural fiber rope, nylon doesn't make noise when it is in danger of breaking.

Nylon's visible warning signs are excess elongation (stretch) and decreased diameter. Nylon line parts with a powerful snapback and recoils in a corkscrew motion that extends the danger zone to either side. Stay well clear of the direct line of the pull when heavy strains are applied. Nylon line can stretch on capstan heads under load, and snap back when eased, pulling your hands into the capstan head.

Take care when you are easing nylon line around bitts or cleats. Since the material has low friction and may slip, use extra turns.

Dacron

Dacron is second to nylon in elasticity and highly abrasion-resistant. After an initial 50 percent loading, dacron will elongate only half as far as nylon under strain. Unfortunately its expense keeps it from wider use in fishing.

Polyester

Polyester rope is slightly less strong and considerably less elastic than nylon rope, although it resists sunlight better. It is a good choice for use in tackles and other applications where low stretch is required.

Polypropylene

Polypropylene rope is the lightest of the synthetics, with good strength and storage characteristics. Due to its low cost and multiple applications, it is widely used in the fishing industry.

Polyethylene

Polyethylene rope floats although it is heavier and slightly less strong than polypropylene. It is stiffer and more slippery than polypropylene, but highly resistant to abrasion and water.

Blends

Manufacturers are developing numerous blends of nylon, dacron, polypropylene, kevlar and mylar fibers to take advantage of various characteristics of synthetic fibers. Their use is increasing, especially for rigging trawl nets.

5.13.3 Rope Construction

Twisted (laid) rope is strong, relatively inexpensive. and spliceable. It is normally manufactured by twisting three strands of fiber in a spiral direction. If the twists are clockwise, it is *right lay* and must be coiled to the right.

Three-or four-strand right or left-lay twisted ropes are called *rotating ropes* because all of the strands are wound in the same direction and the rope tends to turn under load. Under heavy loads, turn is transferred into the strands. When turn in the strands builds up to a point where the strands cannot maintain their equilibrium along a length, they tend to turn back on themselves and the inside yarn of the strand may pop through the cover (called a *hockle*). Three- or four-strand rope also tends to kink or unlay, depending on whether the user is putting in too much rotation (kinking) or taking out rotation (unlaying).

Braided, plaited or eight-strand ropes are called *non-rotating* or balanced because they have an equal number of right-layed and left-layed yarns or strands.

Braided rope was developed to avoid the hockling problem that occurs with laid rope. It is made up of many yarns instead of strands, and it has a very smooth, cylindrical surface.

A three-strand rope is adequate for most uses. Where there is a free end such as an anchor or mooring float, a non-rotating rope is preferable.

Solid braid rope is constructed with 8,12 or 16 strands of fibers tightly braided around a center core of parallel fibers. It is strong, but hard to splice.

Diamond braid rope is constructed with 8,12 or 16 strands of fibers braided over and under each other in a circular direction. The hollow center allows easy splicing. It is generally stronger than solid or maypole braid.

Braid on braid rope is two ropes in one: a jacket braided over a braided core. It is a very strong and flexible rope that doesn't kink, hockle or rotate under load. It is spliceable.

5.13.4 Knots, Bends, Hitches and Splices

Never use a knot where you can use a splice, since a spliced line retains 80 or 90 percent of its strength, where a knot may reduce the line's strength by half. Use splices to make permanent eyes and permanent repairs in ropes, and always use a splice whenever the rope will be used under heavy or sustained loads.

The *standing part* of a rope is the end of the line that is made fast. The *bitter end* is the part of the line that is free (Figure 5-19 (a)). A *knot* forms a loop or a stopper at the end of a rope, like a bowline or a figure-eight (Figure 5-19 (b)). A *bend* joins two rope ends (Figure 5-19 (c)). A *hitch* makes a rope fast to another object or to the standing part of another rope (Figure 5-19 (d)). A *splice* joins two rope ends or forms a loop or eye (Figure 5-19 (e)).

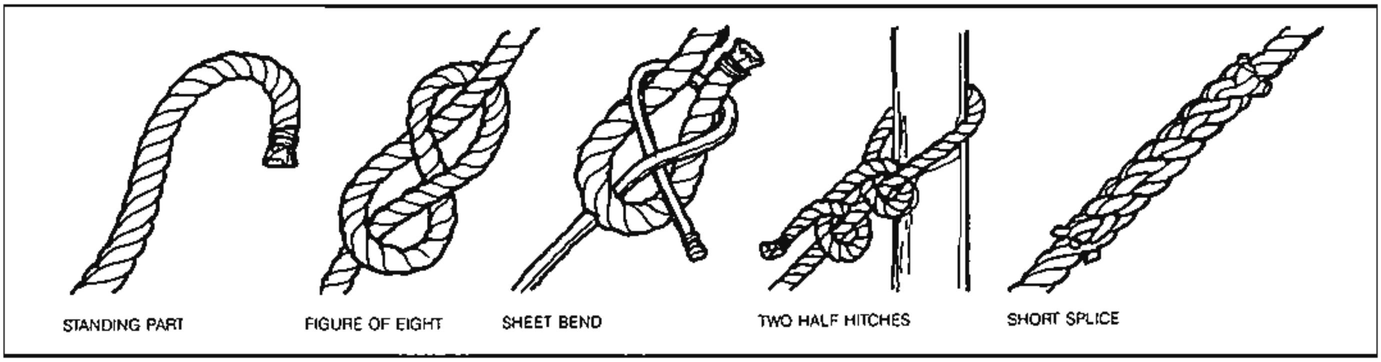
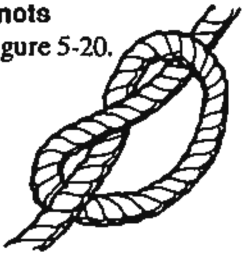


Figure 5-19. Knot terminology. a) Standing part; b) Figure of eight; c) Sheet bend; d) Two half hitches; e) Short splice.

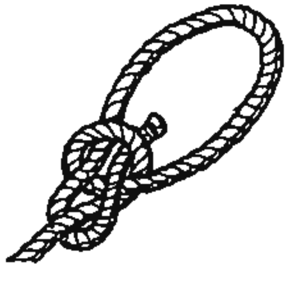
Knots

Figure 5-20.



Overhand knot: *the first move in tying the square knot.*

Square or reef knot: *widely used for lashing when a strong, secure knot is required.*

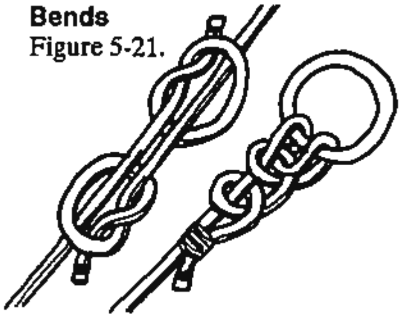


Bowline: *another widely used knot that every fisherman must know. Makes a secure loop or eye and won't jam under a load. A running bowline produces a running eye, while a bowline on a bight produces a doubled eye of greater strength than the single variety.*

Figure-of-eight: *this knot serves as a stopper to prevent a line from unreeving itself from a block. Can be used temporarily to keep an unwhipped line from unlaying itself.*

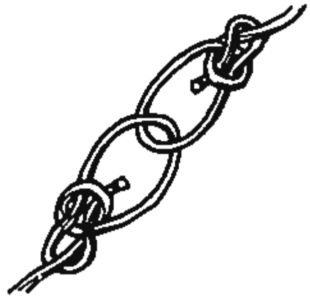
Bends

Figure 5-21.



Fisherman's bend: *There are two bends by this name. One joins two lines that must pass through a narrow opening. The second joins a line to a ring or spar. In the second case, the end should be seized to the standing part or locked with a half-hitch or stopper knot.*

Double carrick bend: *used for joining large lines. The ends should be seized to the standing parts.*

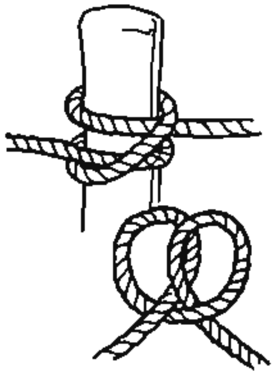


Two bowlines: *used to join hawsers together.*

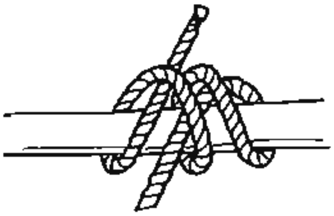
Sheet bend: *(Becket bend) used for joining lines. Use the single sheet bend for lines of similar size. Double it for lines of different sizes.*

Hitches

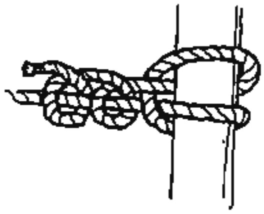
Figure 5-22.



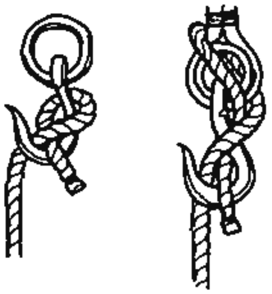
Clove hitch: *extremelv useful hitch that secures the end of a line under tension. Should be checked after strain is removed. Can be preformed and dropped over a bollard. Add a half-hitch to "lock" it against slippage.*



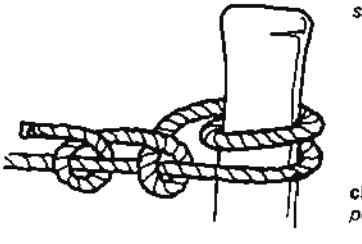
Rolling hitch or stopper hitch: *an improved clove hitch with an extra turn. An excellent hitch that can be tied back upon itself to keep a line from slipping, or tied to a rail or pipe without slipping under the strain. It can be used with chain or wire rope to hold the strain while a nding (fouled) turn is cleared from a winch.*



***Clove hitch with two half hitches:** used for attaching a line to a spar or stanchion.*



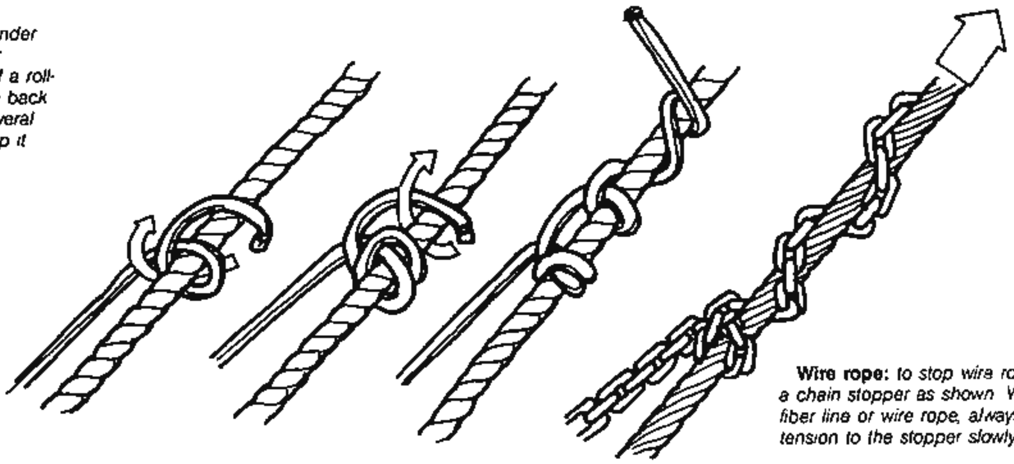
Blackwall hitch: *used to bend a strap to a hook.*



Round turn and two half hitches: *helps prevent a line from slipping along a spar or stanchion*

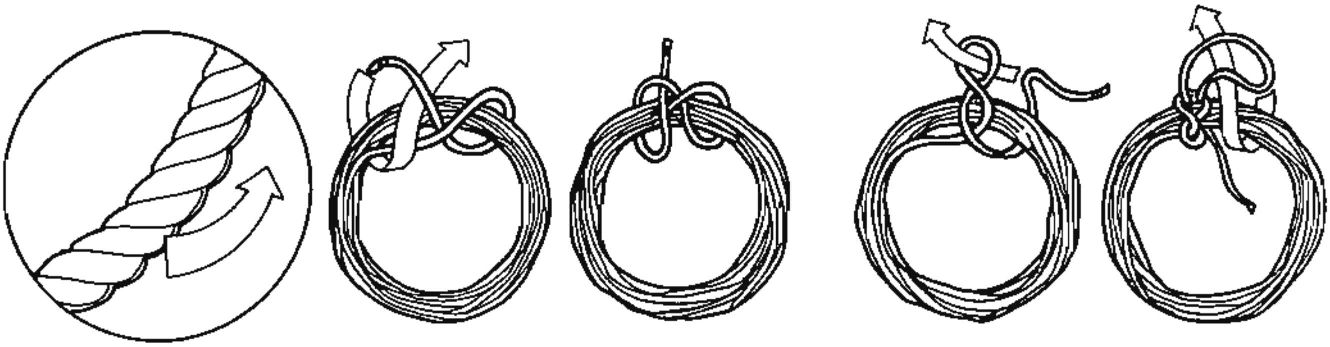
Stoppers
Figure 5-23.

Fiber line: *to hold a line under tension if you must move it or resecure it, make two turns of a rolling hitch against the lay, then back it up with a half hitch and several more turns (as shown) to keep it from jamming.*

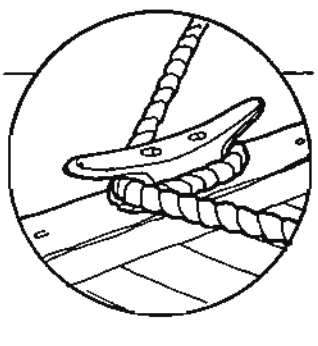


Wire rope: *to stop wire rope, use a chain stopper as shown. With fiber line or wire rope, always apply tension to the stopper slowly.*

Coiling Fiber Line
Figure 5-24.

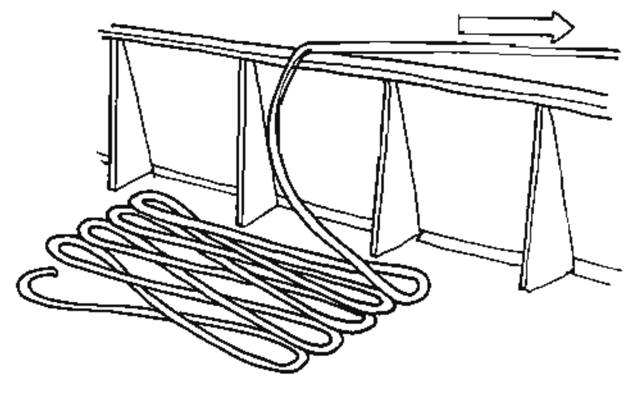


RIGHT-HAND LAY



Coiling lines: *Twisted rope should always be coiled in the direction of the lay. For example, right-hand lay is coiled in a right or clockwise direction. Two methods of finishing coils are shown (above). When a coil is paid out rapidly, it may snarl. To avoid potentially dangerous problems in paying out, it is worth the time to fake down the line by laying it back and forth on deck (right).*

Making fast to a cleat: *A line made fast to a cleat must support the load without jamming. Take at least one full turn around the cleat (left), then criss-cross the lines over the horns in a series of figure eights. Never start with a knot or hitch that will be impossible to ease under tension.*



Seizing and Cutting

Place seizings securely on each side of the point where a cut is to be made to prevent the rope strands from exploding or flying apart. The seizing should be tight enough that no strands are displaced. Twine, wire and tape are all good seizings (Figure 5-25).

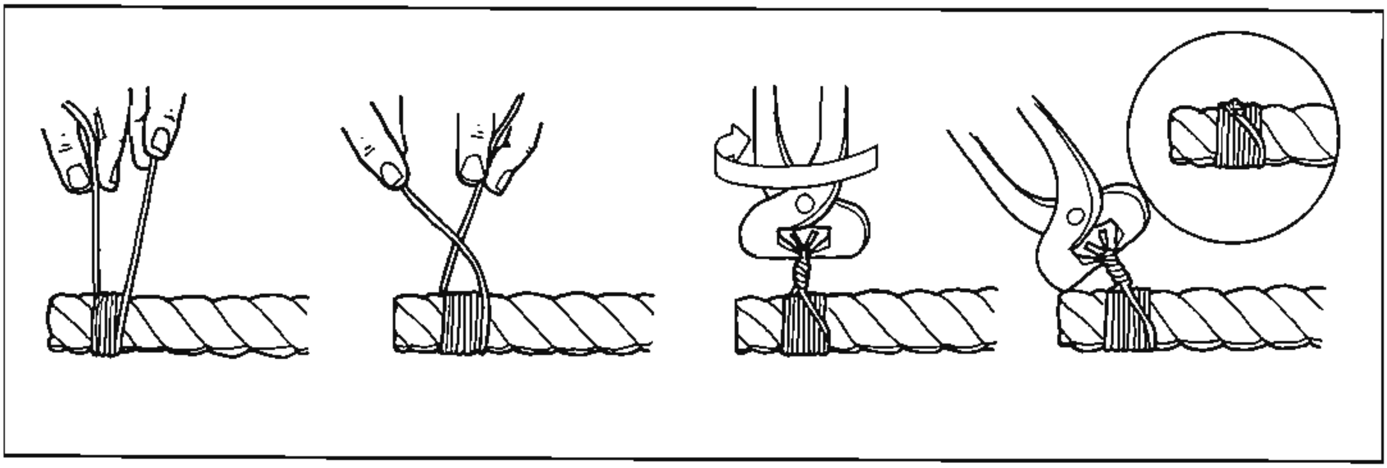


Figure 5-25. Seizings.

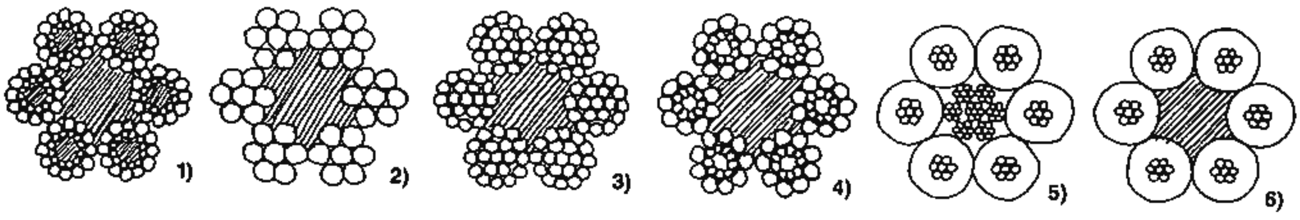
5.13.5 Wire Rope

Construction

Wire rope is made from multi-wire strands laid in a spiral around a core of fiber or steel. It is always made larger, never smaller, than the *nominal* or rated diameter. For example, a 1-inch nominal diameter rope may vary between 1 and 1 3/64-inches (Figure 5-26).

The core is the foundation of a wire rope and dictates its bending and loading characteristics. Wire ropes commonly used in fishing consist of fiber core (FC) or independent wire rope core (IWRC) constructions.

Figure 5-26. Wire ropes used in fishing: purse seine, 6 x 24 on seven polypropylene cores, 2) trawl warp, 6 x 7 on single polypropylene core, 3) trawl warp, 6 x 19 on single polypropylene core, 4) 6 x 19 trawl warp, 5) combination rope, galvanized steel wire strands spun with polypropylene yarn on polypropylene core, 6) steel-cored combination rope.



The design of a rope is also determined by strand construction - the number and arrangement of wires in each strand, and rope construction - the number and arrangement of strands in each rope.

Ropes are classified by the number of strands and the number of wires in each strand: 6 x 7, 6 x 19, 6 x 37, 8 x 19. However, these are *nominal* classifications. For example, the 6 x 19 class includes ropes made with strands containing from 15 to 26 wires. Ropes within the same class may have different working characteristics. When you order wire rope, order a specific construction, or otherwise you may end up with the wrong rope for a particular job.

Wire Rope Lay
(Figure 5-27)

Right lay: clockwise.

Left lay: counterclockwise.

Regular lay: wires in strands are laid in the opposite direction of the lay of the strands, and they are parallel to the rope axis. Ropes with regular lay are easy to handle and have greater resistance to crushing than those with lang lay.

Lang lay: wires are laid in the same direction as the strands of the rope, and at an angle to the rope axis. Longer lengths of the individual wires are exposed, creating greater resistance to wear and improved flexibility. Only use lang lay ropes where both rope ends are "fixed." Do not use lang lay rope with a swivel-type terminal.

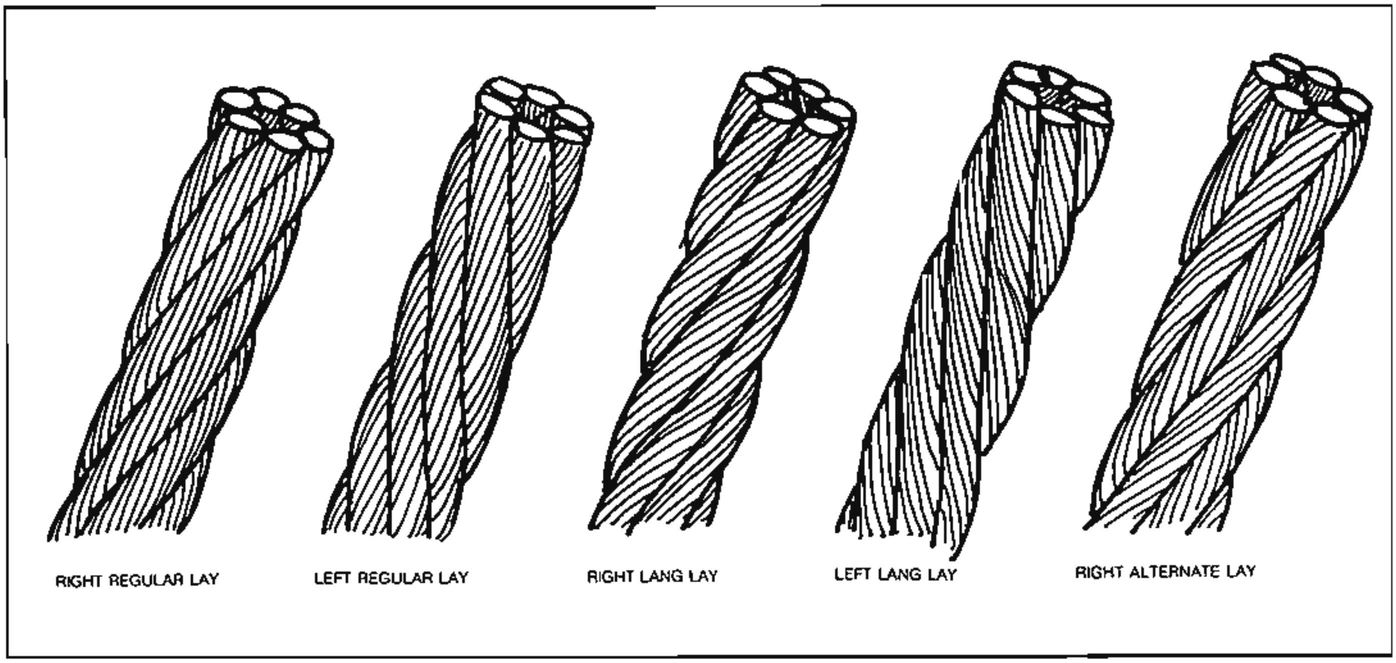


Figure 5-27. Wire rope lay.

5.13.6 Using Wire Rope

Since wire rope is gradually consumed by wear and tear, you must always be aware of the gradual decrease in load-bearing capacity that occurs in a wire rope system. With the tremendous strains that occur during fishing operations, regular and careful inspection of the components in a wire rope system is essential (Figure 5-28).

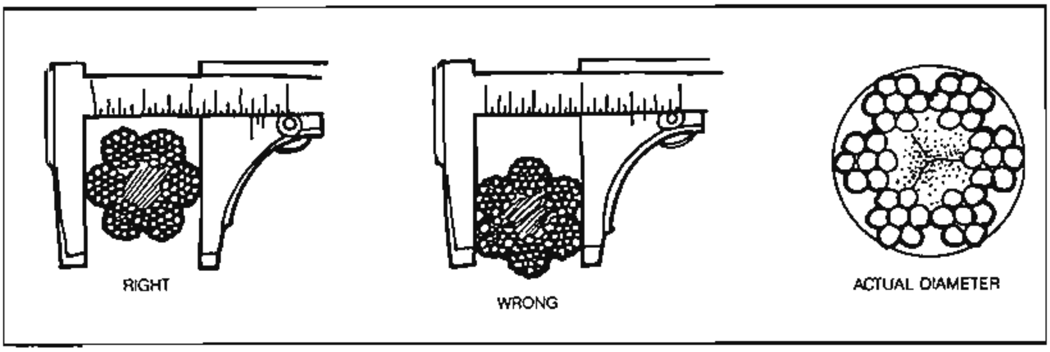


Figure 5-28. The correct diameter of a wire rope is the largest cross-sectional measurement.

Wire rope that has been worn or damaged develops "thorns" or "fishhooks," protruding strands of broken wire that stand up from the lay. Be careful because they can slash your hands. Always wear leather gloves around running wire (Figure 5-29).

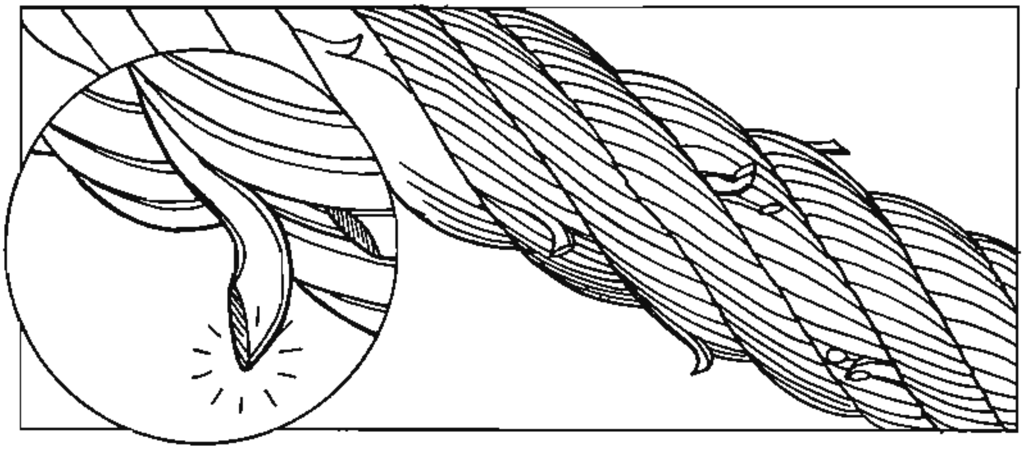


Figure 5-29. Wear gloves to protect your hands against wire ropes 'fishhooks'. Be careful not to hang up gloves in moving cables and gear.

Safe Working Loads

A safe working load depends on the normal strength of the rope and the efficiency of end attachments. There are two ways of attaching a rope: by forming an eye or by placing a fitting on the end (Figure 5-30). Since wire rope may be pushed toward its ultimate breaking strength, keep in mind that two ropes rated as having the same safe working loads may differ substantially in ultimate breaking strength. If wire rope starts vibrating under strain, it may be in danger of parting. Stand clear.

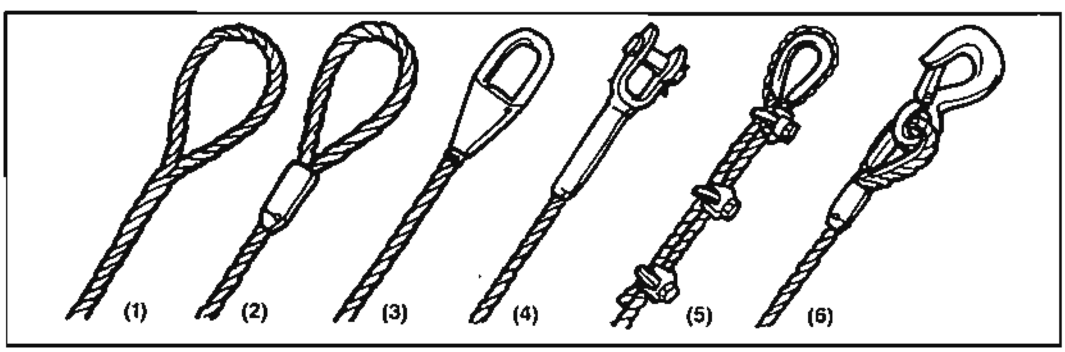


Figure 5-30. End attachments with efficiency as a percent of rope strength. 1) hand splice (80-90%); 2) mechanical splice (90-95%); 3) spelter socket (100%); 4) swaged socket (95-100%); 5) wire rope clips (75-85%); 6) mechanical splice thimble (90-95%).

Bending Stress

Ropes operating over sheaves and drums may be subject to fatigue if the sheave or drum diameters are too small, if loads are excessive, or if the sheaves or drums are worn. Also, you will need larger sheaves the faster you operate the machinery. Avoid reverse or S bends from one sheave to another, since they greatly accelerate rope fatigue.

The diameter of a sheave should *never* be less than 15 times the diameter of the rope, generally larger. It is best to have larger sheaves and slower speeds. All manufacturers prescribe minimum sheave diameters, and the guaranteed breaking strengths and estimated safe working loads assume you will use a minimum or larger sheave diameter, and moderate working speeds. High speeds cause wear two ways: by increased friction over the sheave, and also by the friction of the wires rubbing against one another.

Method of Attaching Wire Rope Clips

1) Turn back around the thimble the length of rope specified (Figure 5-31). Apply the first clip so the U-bolt is no less than the width of the clip saddle back placed over the dead end, and the live end of the rope rests in the saddle. Tighten both nuts evenly and torque.
2) Apply the next clip as near the loop as the thimble will permit. Turn both nuts on firm, but do not tighten.
3) Space additional clips equi-distant from one another. Tighten all nuts evenly on all clips, and torque as specified.
4) Apply the initial load to the rope and retighten all nuts to the recommended torque. Rope will stretch and shrink in diameter when they are under load. Inspect the clips periodically, and retighten them to the recommended torque as necessary.

Note: Always put "U" bolt on bitter end side when using wire rope clips.

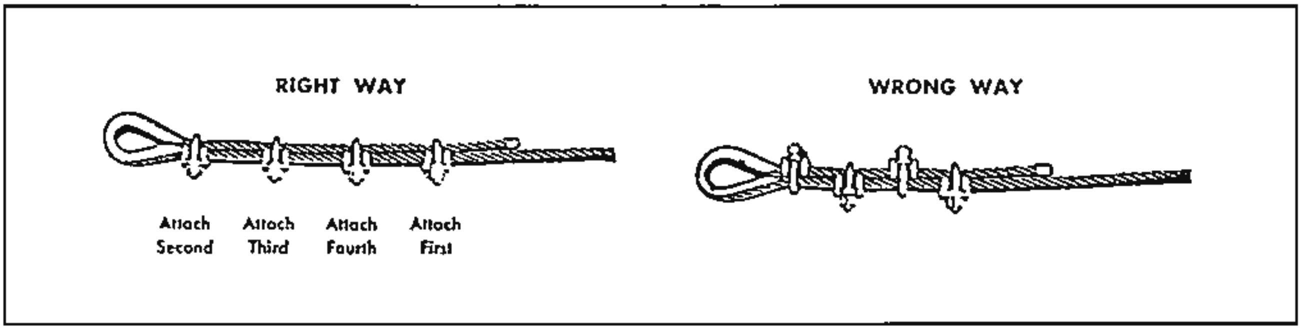


Figure 5-31. Method of attaching wire rope clips.

Measuring Grooves on a Sheave

Under normal operating conditions, as a groove wears it tends to get deeper and narrower until eventually you will need to replace the sheave. Excessive side wear may indicate a mis-alignment in the system. A properly fitted sheave groove should support the rope over 135-150 degrees of the rope's circumference. Field gauges are made to the nominal diameter of the rope PLUS one-half the allowable oversize. In an on-board inspection, when the gauge for worn grooves fits perfectly, the groove is at the minimum acceptable size Figure 5-32). A worn, corrugated sheave groove will quickly damage a new rope.

During an inspection, also check the condition of bearings and shafts. A sheave rotated by hand should run true, without wobble. The groove should be round in relation to the shaft, and each sheave and shaft should be properly aligned.

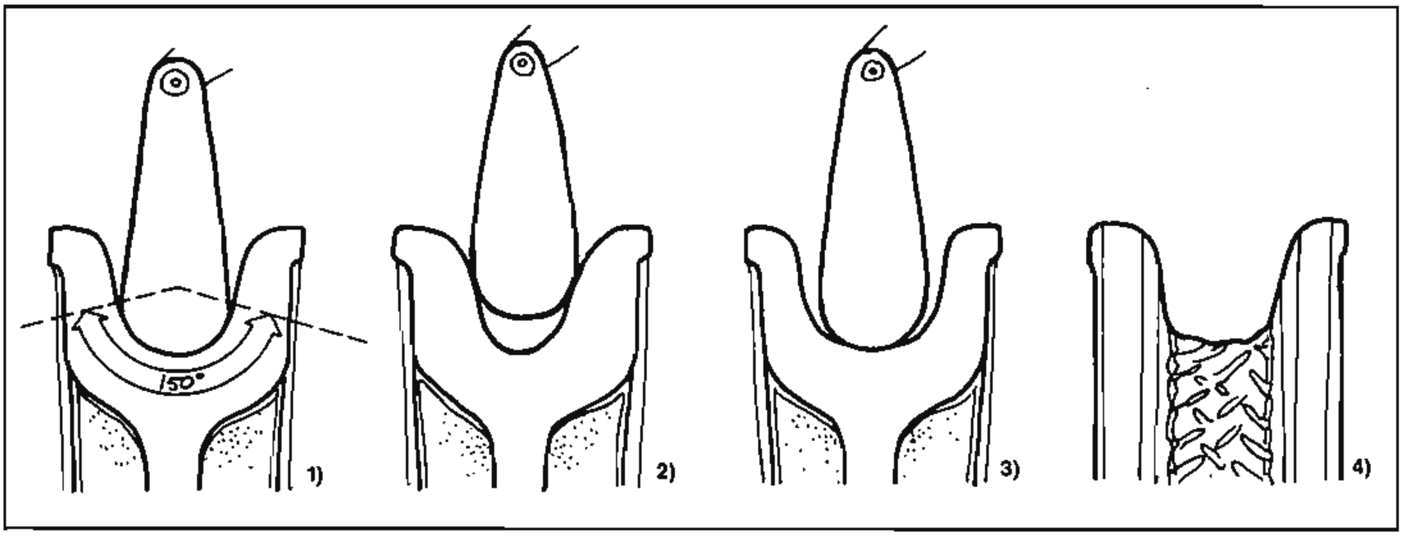


Figure 5-32. Measuring grooves on a sheave: 1) correct; 2) too tight; 3) too loose; 4) corrugated sheave groove.

Winding with the Lay

You must follow the lay when you wind the rope on a drum to ensure that the wraps hug together and form and even layer. Winding against the lay causes the wraps to spread; the rope may cross over itself and become crushed or flattened (Figure 5-33).

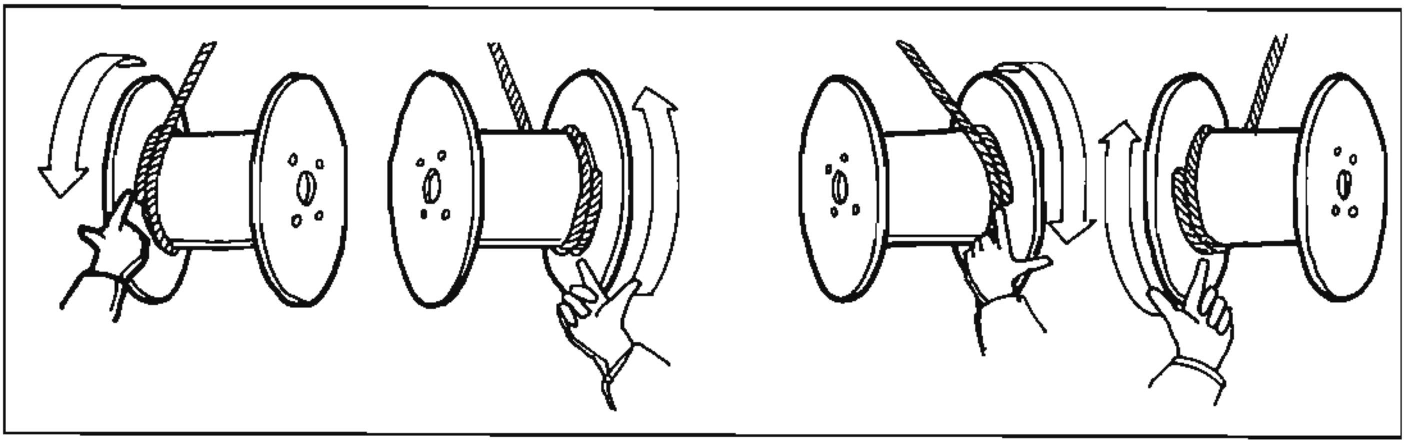
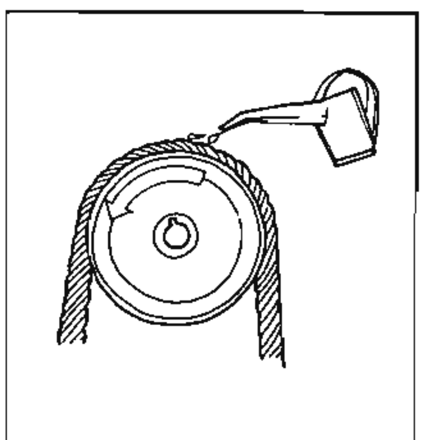


Figure 5-33. Use your hand with thumb and forefinger extended to tell you how to wind wire rope on a smooth drum. For right lay (left), your right hand tells you to overwind left to right and underwind right to left. For left lay (right), your left hand tells you to overwind right to left and underwind left to right.

Extending Rope Life

* Break-in: run new rope with light loads and controlled speeds to allow the wires and strands to adjust to each other.
* If wear occurs near the ends, cut them off to move the wear points.
* Reverse the ends to bring less worn sections into areas where conditions are destructive. Take care to avoid kinking and other damage.
* Clean and lubricate (Figure 5-34). Wire rope is a machine with moving parts, and factory lubricants don't last forever. Clean the surface to allow new lubricant to penetrate to the core. Don't use lubrication-destroying solvents.

Figure 5-34. To lubricate, use a light-bodied, penetrating lubricant applied by dripping, spraying or brushing. Apply it at the top of a bend over a sheave where the strands open up.



Inspection

Regular inspection determines when a rope can no longer be used safely, and helps pinpoint faults in your equipment or operation that are causing costly and potentially dangerous rope wear. Check wire by bending it; if it has no spring-back, replace it.

Your rope ought to be replaced if a significant number of wires breaks, or when obvious signs of damage appear.

Chisel fractures happen when the outside wires have been worn away by abrasion. When they are worn to one-half their original diameters, replace the wire (Figure 5-35).

Peening is distortion caused by pounding rather than abrasion. Excessive peening causes fatigue breaks. You probably have a problem in your system that ought to be repaired.

Square-end breaks may occur even in relatively new ropes if there is excessive vibration or too much bending. Any sudden increase in such breaks means the rope ought to be replaced (Figure 5-35).

Cup and cone fractures are the result of overloads. Such breaks should not occur if your rope is operating under safe loads (Figure 5-35).

Reduction in diameter - if you notice a sharp reduction in diameter, there may be core failure or internal corrosion. Either way, replace the rope.

Increased lay length - view any increase in lay length (the distance a single wire travels in making one complete turn around the rope) with concern. It may indicate core failure, and the rope should be replaced.

Corrosion of outside wires will produce accelerated wear, because the wires will no longer tolerate bending. Internal corrosion means the rope is unsafe and should be replaced. Since trawlers operate in the highly corrosive marine environment, their rope is particularly susceptible to corrosion.

Accidental damage caused by the rope jumping a sheave or being struck by a falling weight calls for close inspection and constant checking. It will be impossible to determine the remaining strength, and you may need to replace it.

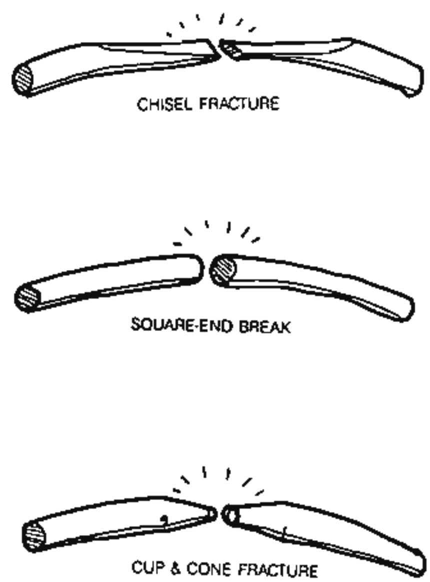


Figure 5-35. Inspection can prevent dangerous accidents.

5.13.7 Rope Handling

Taking a Rope from a Reel

The reel must be mounted on a shaft or turntable where it is capable of rotating, or rolled along the ground as the rope is paid out. Never pull rope over the flange of a stationary reel.

Storage

Ropes should be cleaned, lubricated, wound on a reel and stored indoors and away from corrosive atmospheres.

Rope on Drums

When winding rope from one reel to another or from a reel to a drum, avoid reverse bends that will make the rope "twisty" and hard to handle. Wind from top-to-top or from bottom-to-bottom (Figure 5-36). To avoid slack, always keep the rope taut and even on the drum. The turns in one row should never overlap one another, and the first layer on a smooth drum should be wound tightly and left as "dead wraps" that are never removed. In paying out, avoid overruns: the result is slack rope on the drum and excess abrasion as the slack is taken up. You may even part a slack rope if the drum is started suddenly.

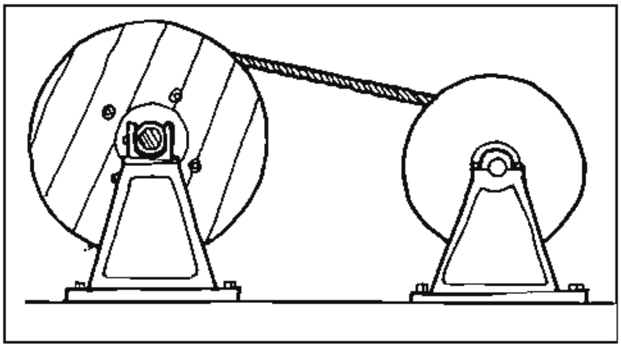


Figure 5-36. Winding rope.

Uncoiling a Rope

Always lift the coil on edge and roll it like a hoop (Figure 5-37). Never pull the rope from a stationary coil or you will produce kinks that will ruin the rope even if it is brand new. Any time a loop forms in a slack rope, carefully remove it by unwinding the free end. You can repair minor damage by tapping the rope with a wooden mallet against a block. A kink pulled through can never be repaired.

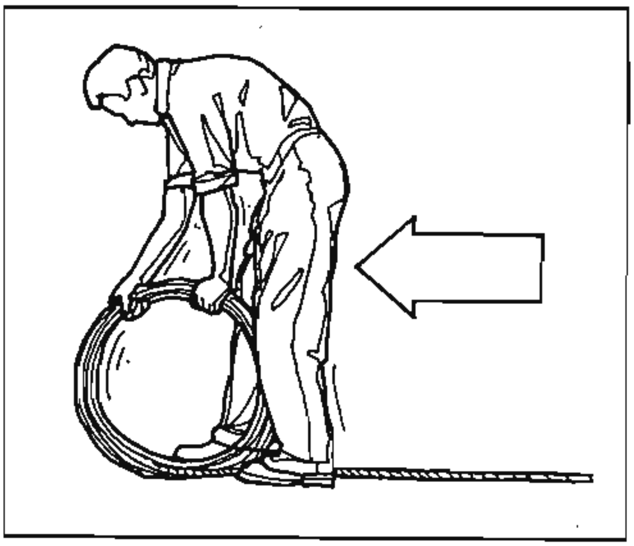


Figure 5-37. Uncoiling a rope.

5.14 Towing

5.14.1 Requesting Assistance from the Coast Guard

If you request a tow from the Coast Guard, you will be asked to describe your situation during the initial radio call (see Chapter 10, Coast Guard Standards and Procedures, for a discussion of the agency's towing policy). When a Coast Guard unit arrives on scene, you will be asked for more information about what kind of bitts or other towing attachments you have aboard, your normal operating speed, your loading condition, etc.

Coast Guard personnel may launch a small boat and come alongside or board your vessel for a first-hand look. You should comply with all the directions issued by the Coast Guard, and maintain radio contact whenever possible. Remember:

* Have all crewmen outfitted in PFDs. The Coast Guard won't proceed otherwise.
* Clear the fo'c's'le and ready a means of securing the tow line.
* If a line-throwing projectile is used, keep all personnel under cover until the projectile clears your boat.
* Be sure you advise the towing vessel of your normal speed. If your vessel running speed is 10 knots, you don't want to be towed at 15 knots.
* Be sure the towing line or towing bridle is securely attached to your vessel and protected against chafing and wear.

5.14.2 Towing Another Fishing Vessel

If you are called upon to assist another fishing vessel, remember that everything must be done slowly and cautiously. The tow will affect your safety and stability in numerous ways, and each situation is different.

In a seaway, remember that the vessels must be kept *in step*. This means that you must adjust your speed and the length of the tow line so that each vessel has the same orientation to the sea state. If you are cresting a wave, for example, the tow should be cresting several waves back. You are trying to avoid one vessel cresting while the other vessel is lying in the trough (Figure 5-38). Being in step is vital for conducting a smooth and stable tow.

You must be careful to use enough tow line. The shorter the tow line, the greater the strain. In contrast, the longer the tow line, the more it sinks and absorbs shock (Figure 5-39). A Coast Guard veteran recommends that the tow line be at least 200 feet long and perhaps as long as 600 feet. He says he never tows anything with less than 100 feet of tow line even in flat calm water, and recommends that if your tow line is less than 200 feet long, you proceed at bare idle speed.

Don't forget that the act of towing affects how each boat reacts to the wind and waves, and problems mount when the weather is bad. Beware of shock loads that may result from running in a seaway, heavy weather, waves, sudden changes of speed and sharp turns.

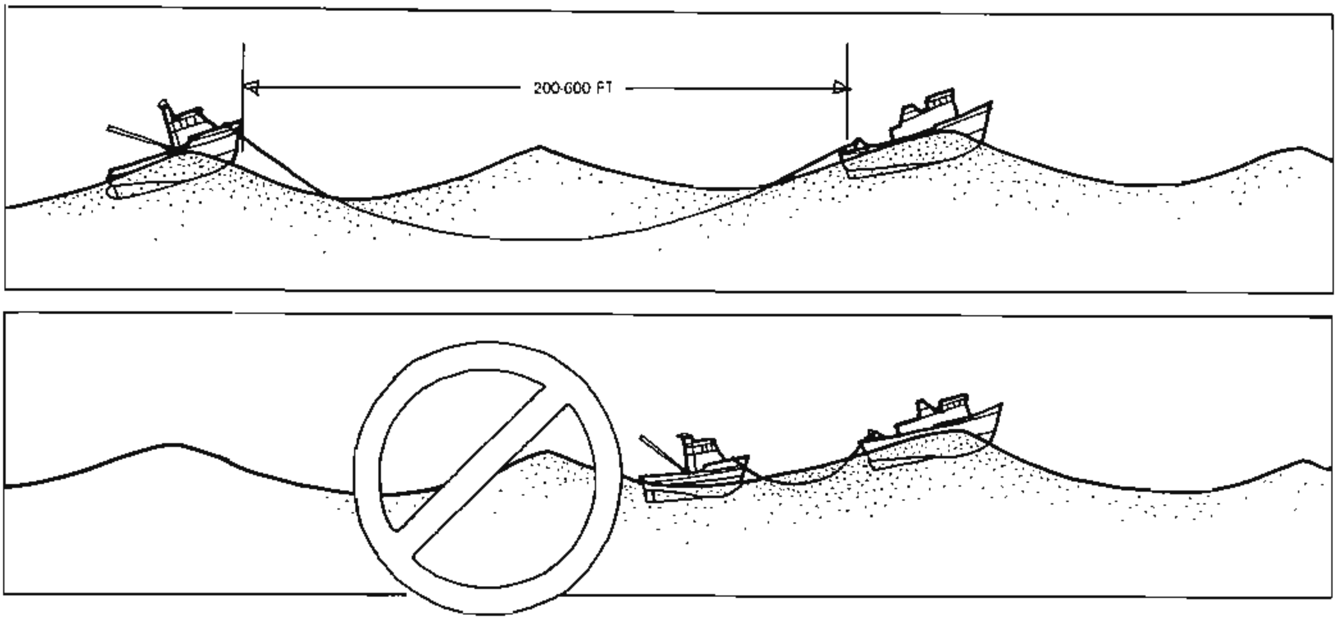


Figure 5-38. If you tow another fishing vessel, use plenty of tow line and keep the vessels in step (above). Towing with a short line and the vessels out of step means heavy surge loads.

Before you take a vessel in tow, be sure that it has been secured by:

* Ensuring watertight integrity;
* Securing heavy objects and movable cargo;
* Eliminating free surface and other threats to stability
* Pumping bilges.

Navigation lights carried aboard each vessel must be in accordance with the rules of the road. If you are called upon to assist a vessel in distress and you do not have a means of displaying lights normally required aboard a vessel engaged in towing, you must take all possible measures to indicate the nature of the relationship between the two vessels, including use of a searchlight to illuminate the tow.

Remember that the act of assisting another vessel does not alleviate the burden of safe and prudent navigation.

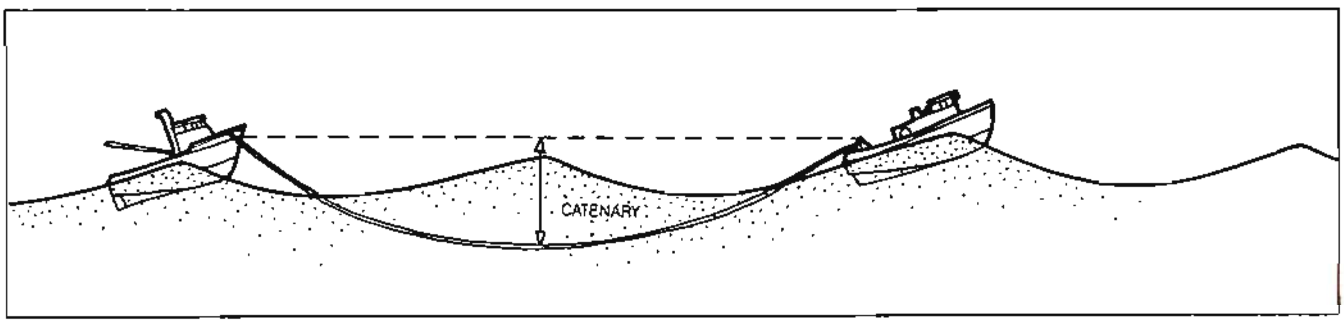


Figure 5-39. The weight of the tow line creates a catenary or dip in the line which reduces surge loads.

5.14.3 Towing Gear

A *towing hawser* may be made of synthetic rope, wire or chain (Figure 5-40). An important asset for offshore towing is weight in the tow line, and heavy chain used in bridles or as an intermediate length in the tow line provides resistance to sudden surges and shock loads. Chain and wire provide resistance to wear on the bottom, while a synthetic rope hawser should not be used in shallow water where it could be subject to wear from dragging on the bottom.

Although it is possible to tow a vessel by a single pennant, it is better, especially offshore, to use *bridles.* Bridles must be of equal length, and the legs should be long enough for the angle at the apex to be less than 45 degrees. Since towing gear failure occurs most frequently at or near bridle connections, bridle legs and connections should be strong enough to absorb surge loads. It is safer to rig a bridle that is too heavy than one that is too light.

Towed vessel hook-up. Rather than secure the bitter end of towing gear directly to deck bitts, it is safer to lead the towing gear through fairleads to the deck bitts and then to secondary fittings. It is common for deck bitts used in towing to fail.

You can connect the bitter ends of the towing gear directly to heavy towing pads or lugs that are reinforced under the deck.

You can minimize *surge loads* by putting a shot of chain between the towing hawser and the apex of the bridle, or by putting a pennant of synthetic line (nylon, dacron or polypropylene) at the bitter end of the towing hawser on the towing vessel.

Chafing gear. Use it at wear points on both vessels.

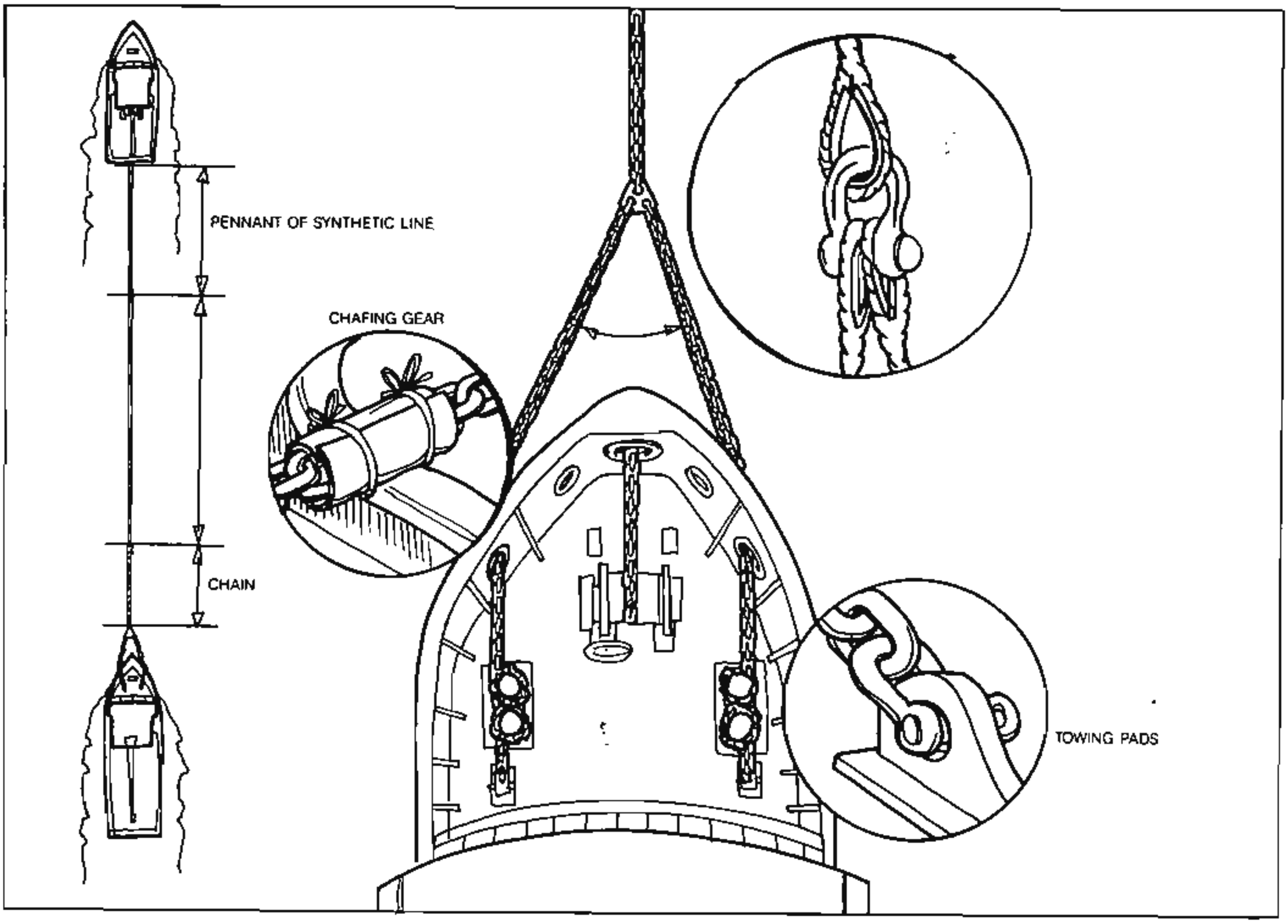


Figure 5-40. Towed vessel hook-up. Surge protection (below left) can be achieved by using a heavy shot of chain between the bridle and the tow line, or a pennant of synthetic line at the bitter end of the towing hawser.

5.14.4 Rescue Tow

A rescue tow can be accomplished by using the towed vessel's anchor chain or cable. In heavy weather, the rescue vessel should approach the bow of the casualty at a large angle across the bow (Figure 5-41, (1). Drop a line and buoy from the stern of the rescue vessel, and allow the casualty to drift down on it (Figure 5-41, (2). This line is used as a messenger to pass the anchor chain or cable to the rescue vessel.

It is possible for a vessel to tow a casualty of perhaps twice her own tonnage, but in heavy weather she may only be capable of maintaining steering way to keep either vessel from broaching. Use plenty of chafing gear under these conditions. Never use your own line to tow another vessel, except in emergency. Be prepared to quickly release the towed vessel, even without their permission. Have an ax, cutting torch, hack saw or knife available for quick release.

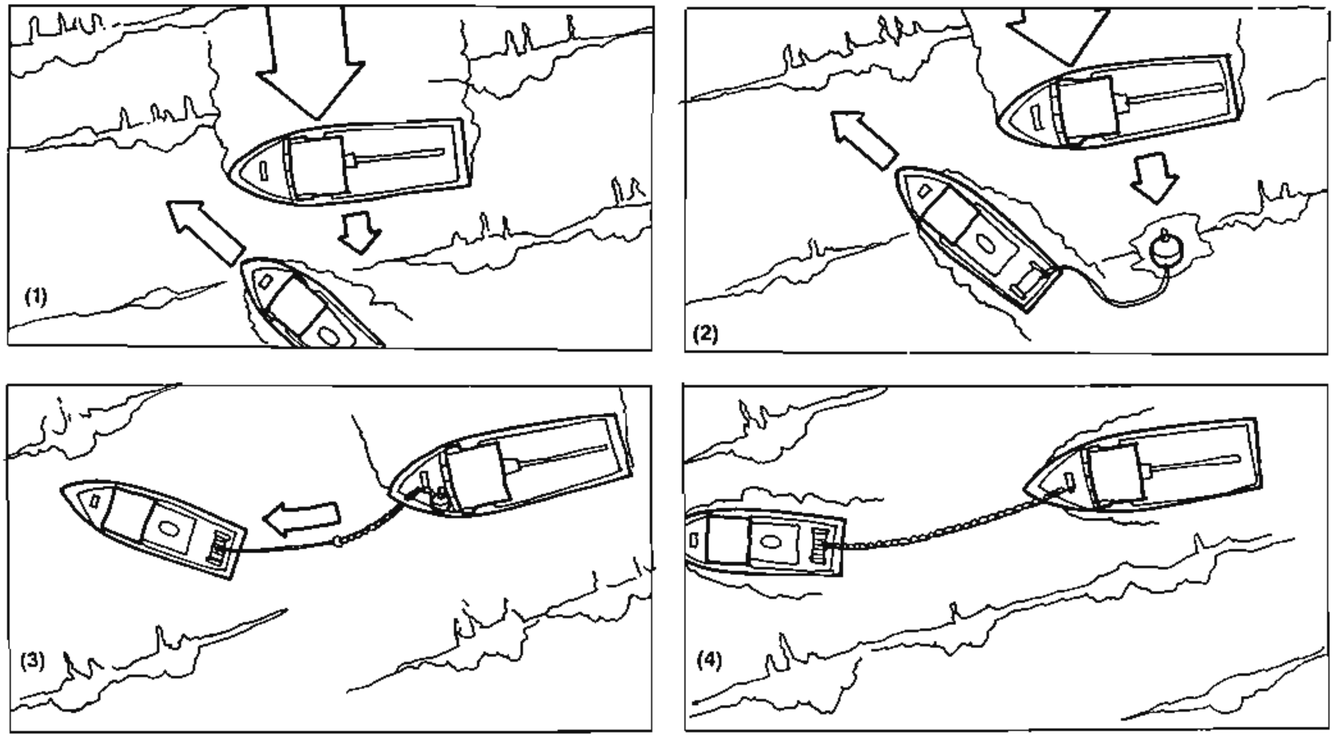


Figure 5-41. Rescue tow using the towed vessel's anchor chain.

5.15 References

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CHAPTER 6

NAVIGATION

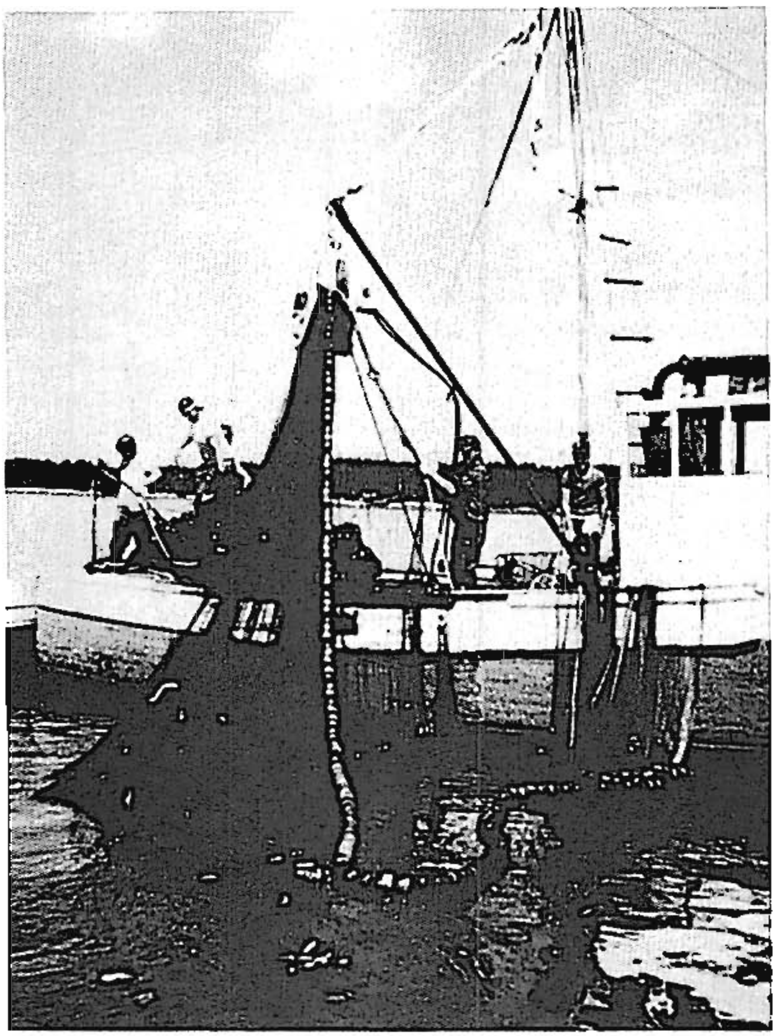


Photo courtesy of Phil Averill

CHAPTER 6

NAVIGATION

Page

6.1 Introduction

All navigation, from the most complex to the most elementary, involves two things: determining the present position of your vessel, and directing that vessel from one known position to another. To do so safely is a science and an art. Navigational accuracy is vitally important to you, since it can save travel time, increase safety, and make more money for your operation.

There is no mystery to navigation. The concepts are relatively simple, but you must pay constant attention to detail. Says one veteran fishing vessel captain, "vigilance is 99 percent of navigation." You must use multiple sources of information, update that information frequently, and regularly double- or even triple-check your work.

Even with the best navigation equipment in the world, if you fail to question electronic data, misinterpret plotting data, or if you are disorganized, you could put your vessel in jeopardy. Always be vigilant, and use the "seaman's eye."

Although electronic equipment has made the navigator's task easier, fishermen today tend to overrely on electronic equipment and they tend to neglect or ignore the basics. Since electronic systems don't always work, and since they are fallible, every fisherman ought to know how to use the old-fashioned basics as well as the new technological gadgets.

This manual presents only the rudiments of navigation; you must consult more in-depth books for a thorough treatment of the subject. This chapter introduces the tools of navigation, charts, how to determine the visible range of objects, the buoyage system, magnetic compass deviation and variation, how to develop speed tables, dead reckoning, tips on piloting, using radar for navigation, and the Loran-C system. This chapter addresses not only the captain and the navigator, but also the crewman who wants to upgrade his skills and master the ability.

6.2 Aids to Navigation

6.2.1 Tools

The Fishing Vessel Safety regulations will require many vessels to carry navigation equipment and materials. Refer to the Appendix for more detail. The basic tools of navigation are:

* *Charts*, updated and properly scaled.
* *Soft lead pencils.*
* *Grease pencils.*
* *Stop watch.*
* *Speed log*, a mechanical device for measuring speed through-the-water.
* *Speed table*, tabulated speed-through-the-water as a function of engine RPMs. Obtained by running measured mile at various RPM settings.
* *Nautical slide rule*, device for determining speed, time or distance when the other two variables are known.
* *Magnetic compasses.*
* *Hand-held bearing compass.*
* *Compass deviation table*, list of compass errors due to deviation for representative headings through 360 degrees. Posted by the steering station.
* *Plotter, protractors, parallel rules*, devices for placing on a chart, or taking from a chart, a course or bearing.
* *Dividers*, devices used to measure distance on a chart.
* *Tide and current tables* for the current year.
* *Notice to Mariners*, the best source of recent chart corrections in your area. Available free from local Coast Guard districts.
* *Light lists*, publications describing aids to navigation maintained by the Coast Guard.
* *Coast pilots*, directions for piloting in inland and coastal waters of the U.S. (similar publications for foreign coasts are called *Sailing Directions*).
* *Gyrocompass.*
* *Radar.*
* *Loran-C receiver.*

6.2.2 Charts

When you buy or use a chart, you should check to ensure that the chart is up-to-date and has been corrected recently. All charts are dated to indicate first printing and new edition dates.

First Edition Date

The first edition date is the original date of issue of a new chart. It is shown at the top-center margin (example: 1st Ed., Sept. 1950).

New Edition Date

The date of re-issue of a chart that has been corrected (making previous editions obsolete). The date of the first edition is still at the top; however, the number and date of the new edition appears at the lower left-hand corner. This date is the same as that of the latest *Notice to Mariners* to which the chart has been corrected (example: 5th Ed., July 19, 1970).

Scale

The ratio of a given distance on the chart to the actual distance which it represents on earth. It may be expressed in various ways. The most common, 1:80,000 or 1/80,000, means that one unit (such as an inch) on the chart represents 80,000 of the same unit on the surface of the earth (Figure 6-1).

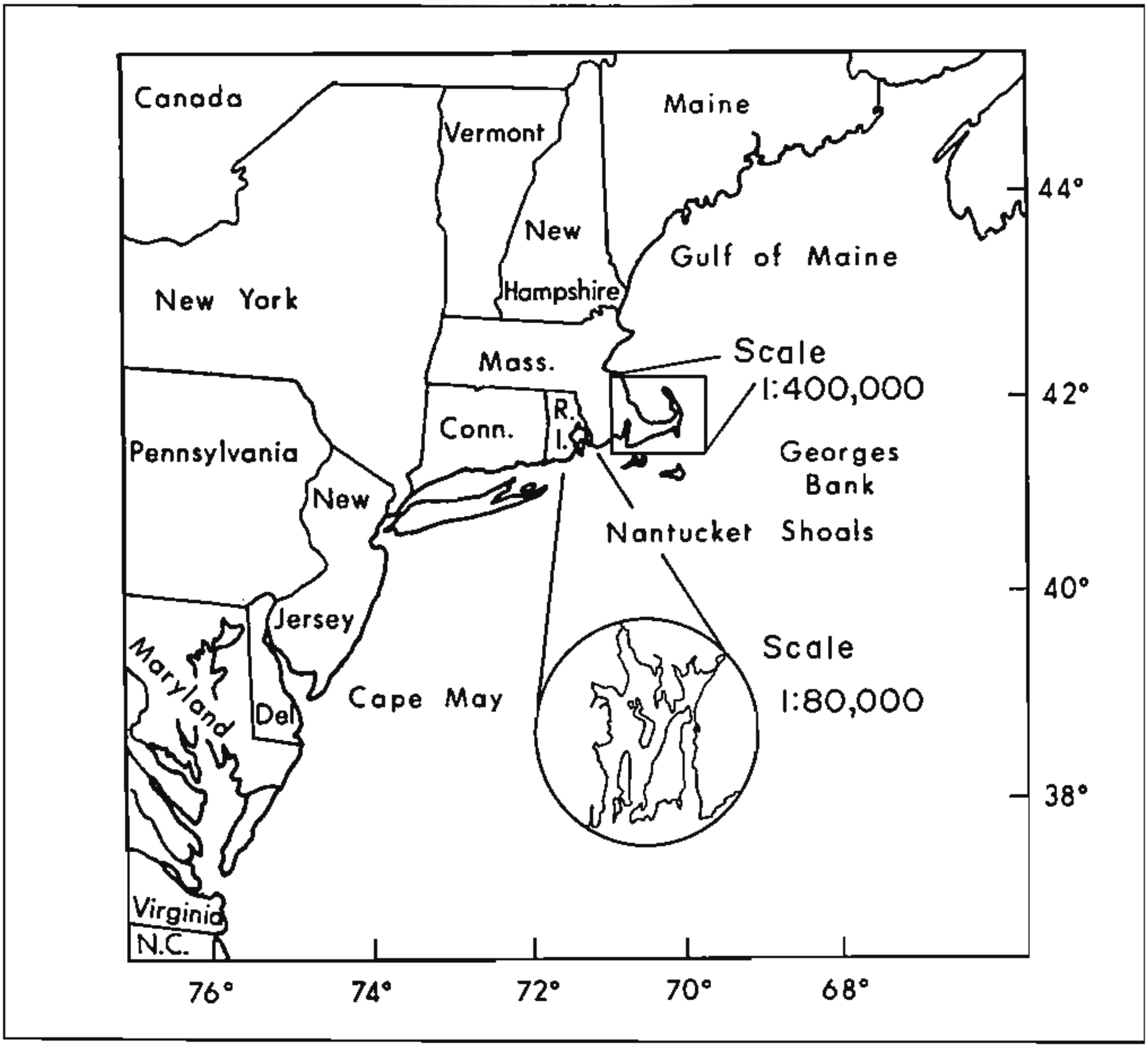


Figure 6-1. The most commonly used method of expressing scale.

Harbor Charts

These charts are intended for navigation and anchorage in harbors and small waterways. The scale is generally larger than 1:50,000.

Coast Charts

These charts are intended for inshore coastwise navigation where the course may be inside outlying reefs and shoals, for entering or leaving bays and harbors of considerable width, and for navigating large inland waterways. The scales range from 1:50,000 to 1:150,000.

General Charts

These charts are intended for coastwise navigation outside of outlying reefs and shoals. The scales range from 1:150,000 to 1:600,000.

Sailing Charts

These are smaller scale charts, used for planning trips, fixing your position at sea, and dead reckoning during a long voyage. The scale is generally smaller than 1:600,000.

Chart No.1

Much of the information contained on charts is shown by symbols. The symbols make no attempt at accuracy in scale or detail, but are shown at the correct location and make it possible to convey large amounts of information. The standard symbols and abbreviations used on charts published in the U.S. are shown on *Chart No.1 - Nautical Chart Symbols and Abbreviations* (Figure 6-2).

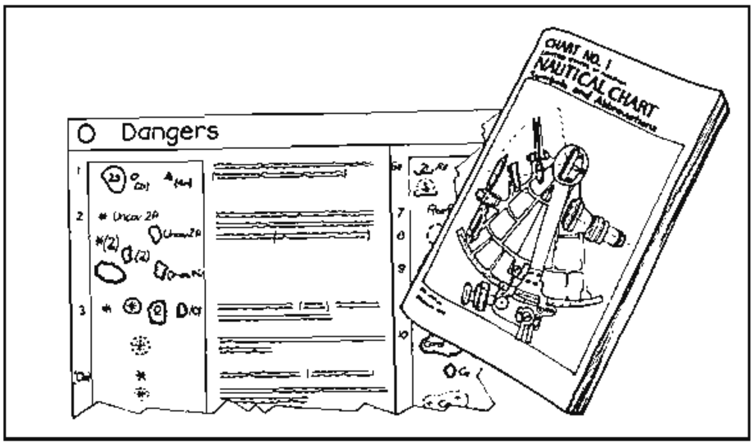


Figure 6-2. Much of the information contained on charts is shown by symbols. The symbols make no attempt at accuracy in scale or detail, but are shown at the correct location and make it possible to depict great amounts of information. The standard symbols and abbreviations used on charts published in the U.S. are shown on Chart No. 1, Nautical Chart Symbols and Abbreviations.

The Compass Rose

The compass rose consists of inner and outer circles, each marked off in degrees. It should be noted that the direction represented by these two circles do not correspond. The outer circle indicates true directions. The inner circle indicates magnetic directions. The difference between true north and magnetic north is call *variation*, and it differs in each part of the world. Variation for the region represented is noted at the center of each compass rose. Variation also changes with time and must therefore be corrected for the year, if you are using old charts.

Distance from Latitude

Latitude and longitude are marked on the margins of each chart. Latitude and longitude are measured in degrees, minutes and seconds (or tenths of a minute). One minute of latitude is equal to one mile on the earth's surface, and the latitude scale on the side of the chart is usually the handiest place to measure distance. One nautical mile equals one minute (1') of latitude (a mile a minute). Since there are 60 minutes in a degree, one degree of latitude equals 60 nautical miles.

When using the latitude scale to measure distance, always choose a portion of the scale that is midway between the latitudes of the two points on the chart you are measuring. This is necessary since the latitude scale on a Mercator projection (the most common type of navigation chart) expands at higher latitudes because of the distortions that occur in projecting the curved surface of the earth onto a flat piece of paper (Figure 6-3). Do not measure distance on the longitude scale.

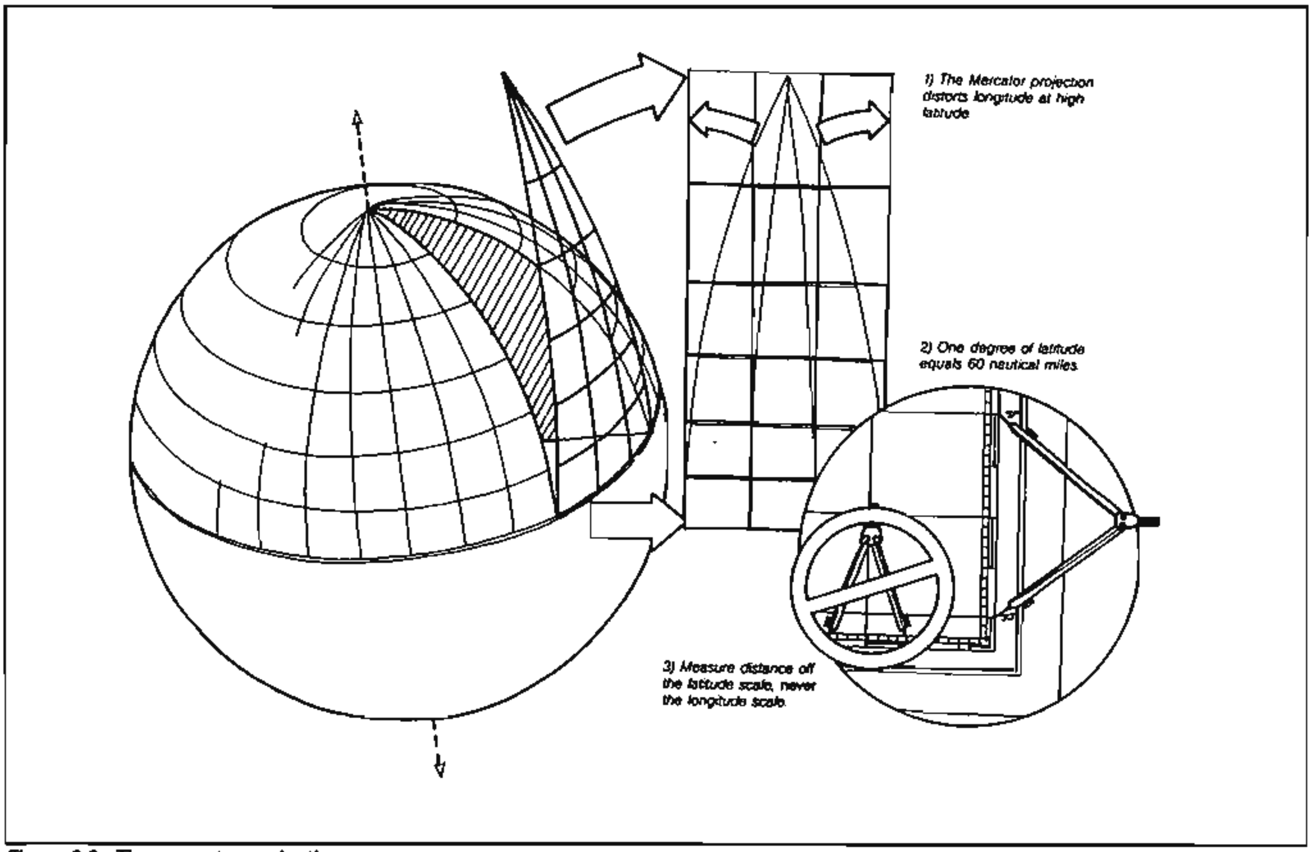


Figure 6-3. The mercator projection.

6.2.3 Buoyage Systems

Two buoyage systems are used on Atlantic coast waters, the Navigable Waters and the Intracoastal. The basic structure for these systems is called the Lateral System of Buoyage, now called the lateral (modified). This system is based upon channels determined as "proceeding from seaward" in which vessels returning from sea are to leave red markers to the starboard side (as the saying goes, **Red Right Returning**).

The term "**Proceeding From Seaward**" means following the Atlantic coast in a southerly direction.

Navigable Waters

Navigable Waters are defined as coastal waters that include bays, sounds, rivers and lakes that are navigable from the sea. The buoyage system used on navigable waters follows the lateral (modified) system of buoyage, as entering from seaward. This system employs a simple arrangement of shapes, colors, numbers/letters and light characteristics to show the side on which to leave the buoy, when proceeding in a given direction. Certain buoys and daymarks have differentiated shapes, and some are painted distinctive colors to indicate, both of which tell you on which side to leave the buoy. Numbers and/or letters further identify the individual buoys. In this system, buoys that mark the sides of channels have numbers which increase when proceeding from seaward.

Shapes

Buoy shapes and their special uses are described later in this chapter.

Colors

Buoys are colored red, green or a combination of red and green. Some buoys are red and white, and some are yellow.

Green buoys mark the port (left) side of the channel when "proceeding from seaward," or the location of wrecks or obstructions that must be passed by keeping the buoy on the port side of the vessel when proceeding from seaward.

Red buoys mark the starboard (right) side of the channels, or location of wrecks or obstructions that must be passed on the starboard side of the vessel when "proceeding from seaward." (Red Right Returning)

Junction buoys are green with a wide red horizontal band, or red with a wide horizontal green band. The topmost color indicates the preferred channel.

Mid-channel or fairway buoys are red and white vertically striped. They are "safe water" aids to navigation, and can be passed close-by on either side.

Yellow is the color used on all special purpose buoys according to the International Association of Lighthouse Authorities (IALA) plan, which is in use in this country. This is discussed in further detail in the section on special purpose buoys.

Numbers

Most buoys, daybeacons and minor lights used on navigable waters have numbers, letters or a combination of both numbers and letters placed conspicuously on the aids. These markings are usually made of reflective material to help identify the aid.

* Odd numbers are used only on solid green aids.
* Even numbers are used only on solid red aids.
* Letters may be required *with* a number, so as not to disturb the sequence of the numbering, but to indicate some other significance such as a particular shoal. Letters customarily mark junction and mid-channel buoys, as well as buoys that are not solid green or solid red.
* Daymarks that are used in place of buoys are numbered and/or lettered in the same manner as buoys.

Light Colors and Characteristics

Lights used on aids to mark the sides of channels along navigable waters are green and red. White lights have been discontinued on the starboard and port hand aids in waters used by international mariners.

* Only *green* lights on solid green buoys mark the port side of the channel when "proceeding from seaward." Lights are Flashing, Quick Flashing, or Occulting. Check the Light List for details.
* *Red* lights are used on solid red buoys marking the starboard side of the channel when "proceeding from seaward." Lights are Flashing, Quick Flashing, or Occulting. Check the Light List for details.
* Preferred channel aids will carry the light corresponding with the topmost color. The light characteristic of these aids is Composite Group Flashing (2+1).
* *White* lights are used on mid-channel or fairway (safe water buoys with the flashing characteristic of Morse Code "A" (MoA).
* Yellow lights are to be used on special purpose buoys.

Intracoastal Waterway (ICW)

The buoyage system used on the Intracoastal Waterway is the same as that for navigable waters with some variations. The ICW follows a comparatively shallow channel in more protected waters that lie parallel with, and extend along, the Atlantic and Gulf coasts from New Jersey to the Mexican border.

This passage, sometimes referred to as the "inside route," is considered to be "proceeding from seaward" as it follows the Atlantic coast in a southerly direction to the tip of Florida. Numbers on the ICW buoys and daymarks follow the basic system, beginning with the number 1 as if approaching from seaward. The numbers increase along the "inside route" up to the number 200, then begin again with the number 1.

The ICW uses the same coloring of buoys and daymarks as the lateral (modified) system with one exception: all buoys and daymarks that identify the ICW route have an *additional yellow symbol*, usually a band or horizontal bar. Basically green buoys and daymarks identify the port side of the channel, and red buoys and daymarks mark the starboard side of the channel, when proceeding from New Jersey to Mexico.

When the ICW coincides with another waterway marked according to the lateral (modified) system of buoyage, special ICW markings are used. They consist of a *yellow square* or a *yellow triangle* painted on a conspicuous part of the dual-purpose aid to navigation. The *shape* of the yellow mark indicated the side of the channel for the ICW. A yellow triangle on an aid means that the aid must be kept on the starboard side; a yellow square indicates that the aid must be kept on the port side, when proceeding from "seaward." When yellow squares or triangles are used on dual purpose aids, the yellow band or bar is omitted. (*Don't be confused* if you see a yellow square on a nun (red) buoy, or a yellow triangle on a can (green) buoy.)

Lights on buoys and fixed structures along the ICW follow the basic system of green lights on green aids, red lights on red aids, and white lights on safe water or mid-channel buoys. The lights carry the same characteristics as lights in the lateral (modified) buoyage system.

Buoys

Buoys are floating objects anchored to the bottom at specific locations so as to function as aids to navigation. They may be unlighted or lighted, with a visual signal of definite color and flashing pattern. There are also *sound* buoys with audible signals of various natures, and buoys which have both light and sound. Buoys are depicted on charts by various symbols and abbreviations that indicate the type, color, and numbering or lettering, and visual and/or sound signals, if any. The actual size of a buoy is not shown on a chart.

Shapes

In order to provide quick identification, certain unlighted buoys are differentiated by shape.

Can buoys are cylindrical. The upper part of the cylindrical shape may consist of two metal plates at right angles to each other; these serve as a *radar reflector* without changing the appearance of the buoy from a distance (Figure 6-4).

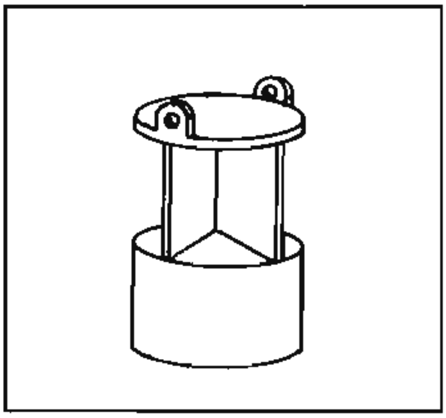


Figure 6-4. A can buoy.

Nun buoys consist of shorter cylinders topped with blunted conical caps or metal plates that give the conical appearance at a distance (Figure 6-5).

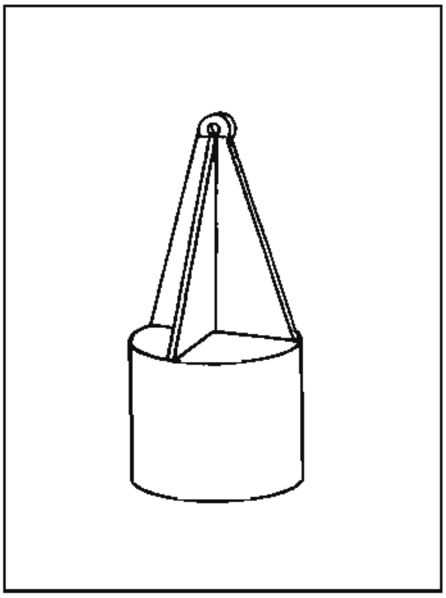


Figure 6-5. A nun buoy.

Safe-water buoys marking mid-channels and fairways are spherical, or they have spherical topmarks.

Other lighted and sound buoys may be pillar or spar-shaped. You can find illustrations in Chart No.1, *Nautical Chart Symbols and Abbreviations.*

Isolated Danger Mark

Isolated danger marks are erected in, moored over, or placed immediately adjacent to an isolated danger which may be passed safely on all sides. The aid is colored black with one broad horizontal red band. It may be any shape except nun or spherical. The mandatory topmark for the isolated danger mark is two vertical black balls. These marks must be lettered; the first character must be the letter "D".

Colors

All buoys are painted with one or two of the basic colors - green, red, white and yellow. Can buoys are green. Nun buoys are red. The distinctive color of a buoy is the primary feature that indicates its navigational significance. Some buoys may be green (or black) with a horizontal red band, or red with a horizontal green (or black) band. Buoys which are vertically striped will be red and white. Yellow is used on buoys to identify all special aids in all systems except the Uniform State Waterway Marking System. It is also used as an identification on the Intracoastal Waterway aids.

Numbers

Buoys are usually numbered in sequence as "proceeding from seaward." Odd numbers (1,3,5, etc.) are placed on green buoys. Even numbers (2,4,6, etc.) are placed on red buoys. Numbers are customarily used on buoys that mark the sides of channels. Letters are used in some instances to designate additional channels or junctions. Numbers and letters are of a contrasting color to the buoy, usually white, and are of a reflective material to be easily identified at night.

Reflectors

Most buoys, lighted or unlighted, have patches of optical reflective material that greatly facilitates their location at night. These reflectors show up brightly in the rays of a searchlight, hand-held electric lantern, or strong flashlight.

Reflective material may be white, green, red or yellow and has the same significance as lights of the same color. The numbers and letters on a buoy are also reflective material - usually white, for easy identification at night.

Many modern buoys, especially larger ones that are located in high fog areas, have radar corner-reflectors built into their superstructure to make them easier to detect.

Lighted Buoys

Some or all of the buoys may be equipped with lights in an area where there is significant night-time traffic on the water (Figure 6-6a). Lighted buoys are painted either green or red when replacing an unlighted can or nun buoy. In these cases, no lateral significance can be placed on the shape of the lighted buoy, since the appearance of all lighted buoys are essentially pillar shaped. Neither can-shaped nor nun-shaped buoys display lights.

Green lights are used *only* on green buoys, and on green and red horizontally banded buoys with the topmost band green.

Red lights are use *only* on red buoys and on red and green horizontally banded buoys with the topmost band red.

At present, white lights may be used on any color buoy where the greater range of visibility of a white light is required, or where a white light is needed to distinguish one buoy from other showing red and green lights. However, when the modifications are complete, white lights will *only* be used on safe-water (mid-channel and fairway) aids.

Light characteristics of each lighted buoy can be found in the applicable Light List. Lights on red and green buoys will always be flashing, occulting, or quick flashing.

Flashing

The light flashes at the rate of 50 or fewer flashes per minute. The normal rate is once every 2 1/2, 4, or 6 seconds. In a flashing light, the light is off longer than it is on. Thus, the periods of darkness are interrupted by short flashes of light.

Occulting

The light is on longer than it is off. This light is steady with interrupted short eclipses of darkness, thus - "on" more than "off."

Quick flashing

When it is desired that a flashing light have a distinct cautionary significance, such as sharp turns or sudden constriction in a channel, or to mark wrecks or hazardous obstructions which can be passed safely *on one side only*, the frequency of flashes will be at a rate of *50-80 or more per minute.*

Lights on green and red horizontally banded buoys will always show a Composite Group Flashing (CGpFl) (2+1).

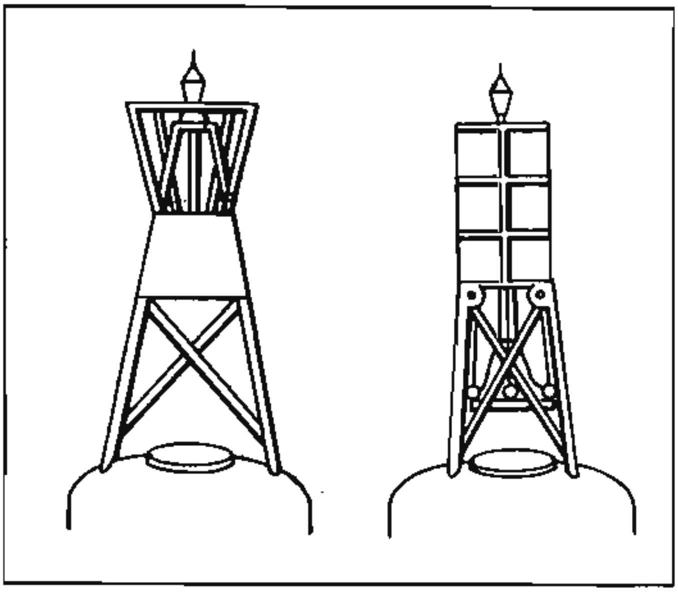


Figure 6-6. Light (a) and sound (b) buoys.

This is a sequence of 2 flashes followed by a single flash. Such buoys are placed to indicate preferred channels.

Lights on red and white vertically-striped buoys consist of a short flash followed by a long flash, the letter "A" of the Morse Code. This series of a short, then a long flash recurs at a rate of about 8 times per minute. These buoys are placed at mid-channels, fairways and in entrances to harbors.

Almost every lighted buoy is equipped with a special device which automatically causes the light to operate during the hours of darkness, and to be extinguished during the daylight hours. These devices are not of equal sensitivity, and therefore, all lights do not come on or go off at the same time.

Sound

Some buoys are equipped with sound signals to increase their effectiveness during periods of restricted visibility (Figure 6-6b). One should be cautioned that buoys with bells and gongs sounded by the motion of the sea, do not emit regular signal characteristics. *Do not* depend upon them when the sea is calm. There may be no signal at all.

Bell buoys have 4 clappers hung loosely about a bell, so that even a slight rolling of the buoy causes the bell to ring.

Gong buoys have multiple gongs, usually 4, of different tones, each with a separate clapper. The gongs are rung in random order by the motion of the buoy in the sea.

Whistle buoys use air, captured and compressed by the rising and falling the the buoy in the sea. Such buoys are used in open and exposed areas where sufficient ground-swell exists to operate the mechanism.

Horns may be used on some buoys. The signal is produced at regular intervals by electrical means.

Special Purpose Buoys

Special aids are used to mark areas that have no lateral significance. These special buoys will be all *yellow*, and if lighted, will show a yellow light. Among them are:

1. Ocean Data Acquisition Systems (ODAS).
2. Traffic separation schemes, where channel marking could be confusing.
3. Dredging buoys, where conventional channel marking would be confusing.
4. Fish net areas.
5. Spoil grounds.
6. Military exercise zones.
7. Anchorage areas (white buoy and light).

Note: The use of yellow for special purpose buoys does not apply to the Uniform State Waterway Marking System (USWMS).

Station Buoys

Sometimes it is necessary to place a buoy in close proximity to a floating aid to mark the station in case the regular aid is accidentally shifted or otherwise incapacitated. Station buoys are colored and numbered or lettered the same as the regular aid to navigation. If the buoy that is being temporarily replaced has a sound signal, the station buoy should carry the same sound signal.

Daybeacons

Daybeacons are unlighted fixed structures in shallow waters (sometimes as much as 20 feet), or onshore. The daybeacon consists of a simple structure of a single pile of wood, concrete, or metal, or a group of piles tied together at the top, called a dolphin. On the structure are one or more signboards called daymarks, to convey navigational information.

Daymarks are signboards that can be identified by shape and color, and have navigational significance. They are covered with reflective material, and also have retro-reflective borders, which make them easy to locate at night with a searchlight.

Shape and Purpose

1. Square daymarks are used the same as can buoys to mark the port (left) side of channels when proceeding from seaward. The color is green the same as can buoys.
2. Triangular daymarks are used the same as nun buoys - to mark the starboard (right) side of channels when proceeding from seaward, and carry the same color (red) as nun buoys.

3. Preferred channel daymarks can be square or triangular to mark junctions in channel, wrecks, or obstructions. The shape of the daymark and the color of the top half indicate the preferred channel.
4. Octagonal-shaped daymarks are used to mark the fairway or middle of the channel. These daymarks will be vertically divided, half red or black and half white.

Numbers and Letters

Daymarks are numbered and/or lettered much the same as buoys. The numbers are white and reflective to be more easily identified with a searchlight at night. They are used to mark the sides of channels, and they are given numbers and letters in accordance with the lateral (modified) system of buoyage.

6.2.4 Major Lights

Lights are the other major aids to navigation besides buoys and daymarks. These powerful lights are in lighthouses, on lightships, and on towers or large navigation buoys. Whether the "light" is classified as *primary* or *secondary* depends upon the importance of its location, intensity, and the prominence of its structure. Those of lesser importance are, of course, considered secondary. Refer to the Light List for the individual characteristics of each station.

Lighthouses

Lighthouses have structures of distinctive design and coloration to make identification easy. Until recent years, they all used to be manned, but they are gradually becoming automated. Besides the "light," many lighthouses are also equipped with fog signals and radiobeacons.

Lightships

Lightships have distinctive shaped hulls, usually painted red with the name of the station in large white letters on each side. At present, the only lightship remaining in active service is the *Nantucket*. Lightships are especially equipped to emit light, sound and radiobeacon signals. Lightships formerly were anchored at specific locations to serve as aids to navigation. Each ship required a crew of 15 to keep it in operation.

Light Towers

Light towers have replaced many of the old lightships, and they are located in deep water offshore to mark shoals and heavily traveled sea lanes. The foundation of each tower is firmly embedded in bedrock, and each tower is equipped with a light, a fog signal and radiobeacon. A tower is usually manned with a crew of 4 or 5.

Large Navigation Buoys (LNB)

Large navigation buoys, the newest of the three offshore light stations, have also been used to replace lightships. LNBs are 40 feet in diameter with 42-foot towers, and they are fully automated. The light is visible for ten miles, and the fog signal is audible to two and a half miles. The radiobeacon transmits a distance of about twenty-five miles.

6.2.5 Compass Courses

There are three types of courses commonly referred to in navigation:

True Course, your direction in relation to true north.
Magnetic Course, the course after correcting the true course for variation.
Compass Course, the course after correcting the magnetic course for deviation.

While many fishing vessels now use automatic steering systems interfaced with gyrocompasses that are oriented toward true north, a properly installed magnetic compass - and the ability to correct for variation and deviation - are essential elements for safe navigation (Figure 6-7).

Variation

Variation is the difference between the true, geographic north pole, and the magnetic north pole, measured in degrees. Your magnetic compass needle will seek to align itself with the magnetic lines of force that encircle the earth, pointing toward the magnetic north pole. Because the magnetic north pole is not located in the same place on earth as the geographic north poles, the compass needle will indicate a bearing that *varies* from true north, thus the word *variation*. It is an error, or variance, from true north that may be either east or west depending upon your location.

Determining variation is a simple matter; just look at the chart. Variation is listed on each compass rose, several of which are located on every chart. You should note that each compass rose on the same chart may have a different value for the variation. You should use the variation from the compass rose closest to your position.

Variation is not a constant quantity; it changes. The annual increase or decrease is also noted on the compass rose, and the value should be applied for each year since the date listed in the compass rose.

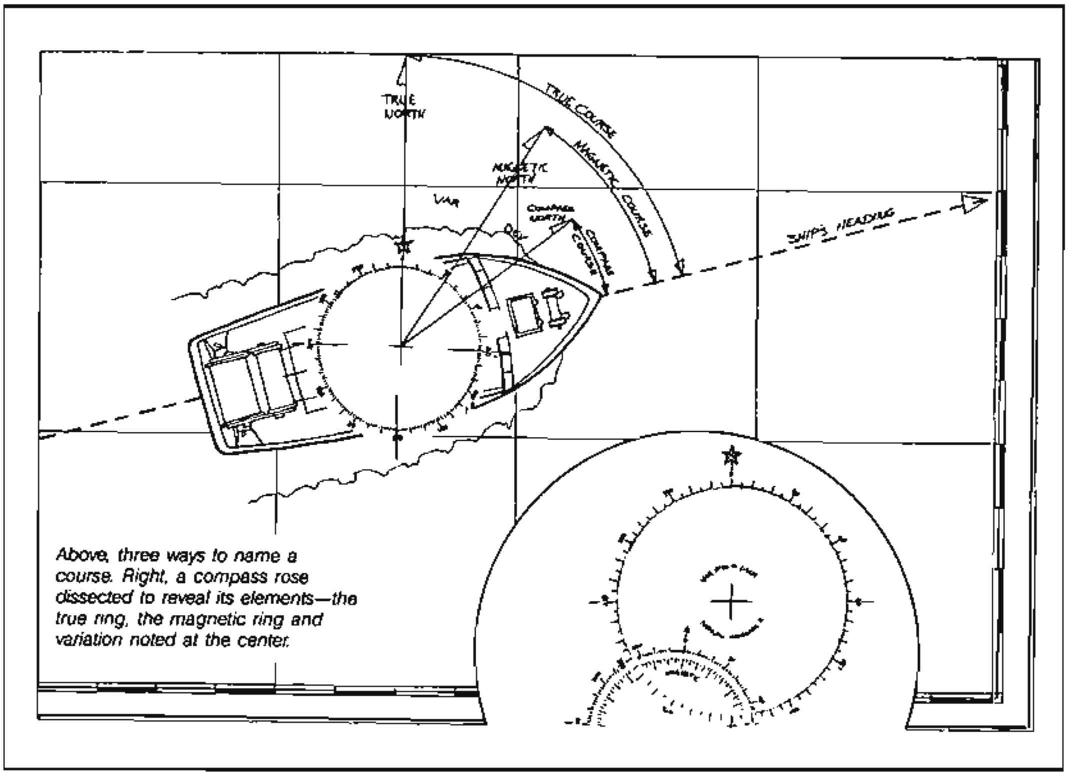


Figure 6-7. Three ways to name a course.

Deviation

Deviation is the difference between magnetic north and compass north. It is caused by your vessel's magnetic effect on the compass. The hull structure, deckloads, machinery, etc., all combine to cause an error in your compass. In other words, the combined magnetic disturbances aboard your vessel pull the compass needle away from the magnetic north pole, and this error is called *deviation* (Figure 6-8). It is an error, or deviation, from magnetic north that may be either east or west of the magnetic north pole.

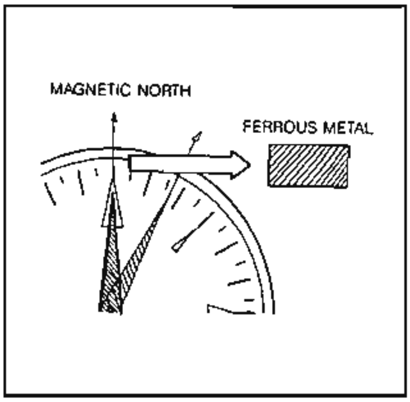


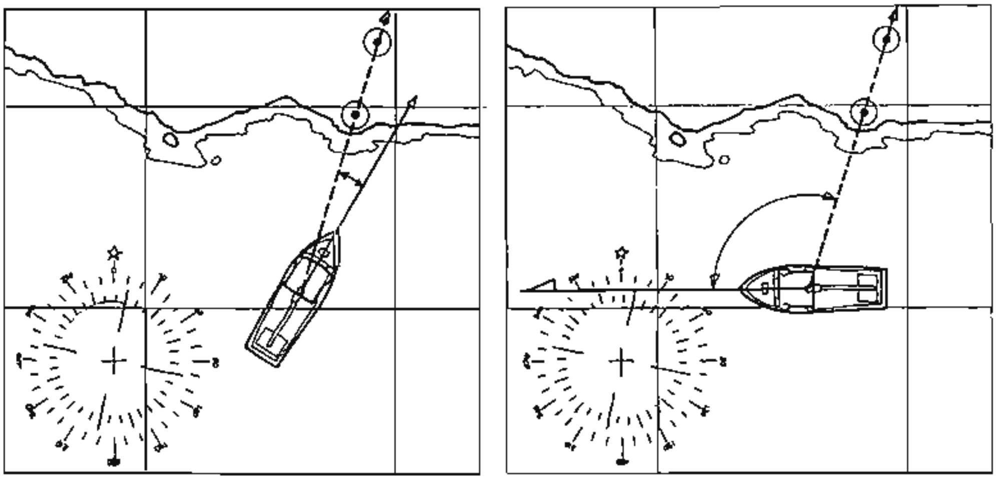
Figure 6-8. Any ferrous metal object pulls your compass needle away from magnetic north.

When you are navigating with a magnetic compass, you must keep in mind that the earth's magnetic field (causing variation) and the vessel's magnetic field (causing deviation) are always at work, always changing and continuously affecting the ability of your compass to indicate the correct direction. You must be capable of correcting a compass course to a true course by applying the variation and deviation errors.

You need to determine the magnetic compass deviation of your vessel, and recheck it from time to time. Post the results on a Deviation Table near the steering station. A compass adjuster always make up a Deviation Table when he corrects the compass on a fishing vessel.

You can also determine deviation using the following method. First, look for two conspicuous objects on shore that appear on the chart (lighthouses, towers, stacks, etc.). Draw a line through these two objects on the chart and read the true bearing. To this bearing apply the variation (adding if west and subtracting if east) and you have the magnetic bearing. Position the vessel on the line and take a compass bearing of the two objects when they form a range. The difference between the magnetic bearing is the deviation for that heading.

In the example, on a heading of 045 the deviation would be 1 W (and would have to be applied to a course steered or a bearing taken). Likewise on a heading of 270 the deviation would be 5 E (Figure 6-9).



VESSEL HEADING 045

True bearing................030

Variation....................2E
Magnetic bearing............028

Compass bearing
Observed.... 029
Deviation.................. 1W

VESSEL HEADING 270

True bearing................030

Variation........... ....2E
Magnetic bearing............028

Compass bearing
Observed..................023
Deviation...................5E

Figure 6-9. Determining deviation.

By taking a series of compass bearings with the boat on different headings, you will be able to make up a deviation table (Table 6-1).

Table 6-1. Sample partial deviation Table.

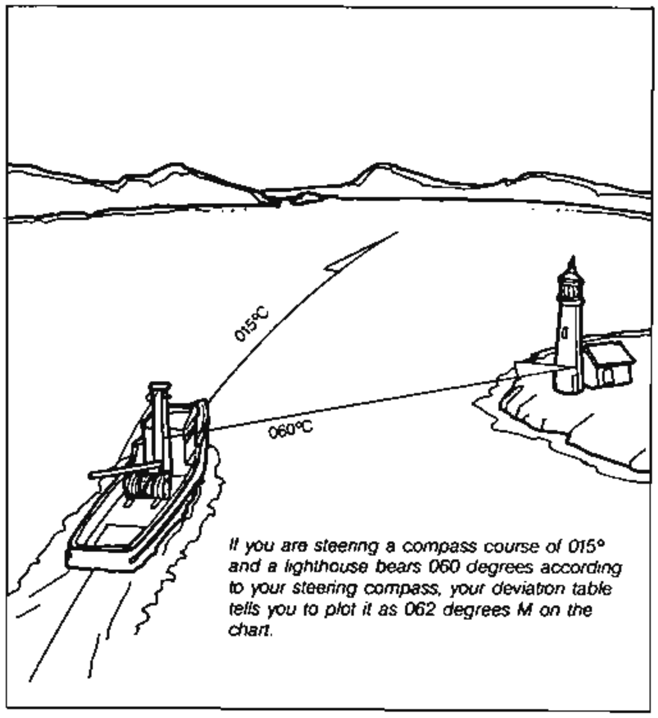
SAMPLE PARTIAL DEVIATION TABLE

(In moving from left to right on the table, ADD EAST and SUBTRACT WEST error)

Compass Heading	Deviation	Magnetic Heading
000	2 E	002
015	2 E	017
030	0	030
045	1 W	044
060	2 W	058

Correcting Compass Courses

With a table like Table 6-1 you can go from magnetic to compass to magnetic depending on need. You can take the magnetic course off the chart (using the compass rose), compare it to the table and find the proper compass course to steer. If the magnetic course is 017 degrees you know to steer a compass course of 015 (Figure 6-10).



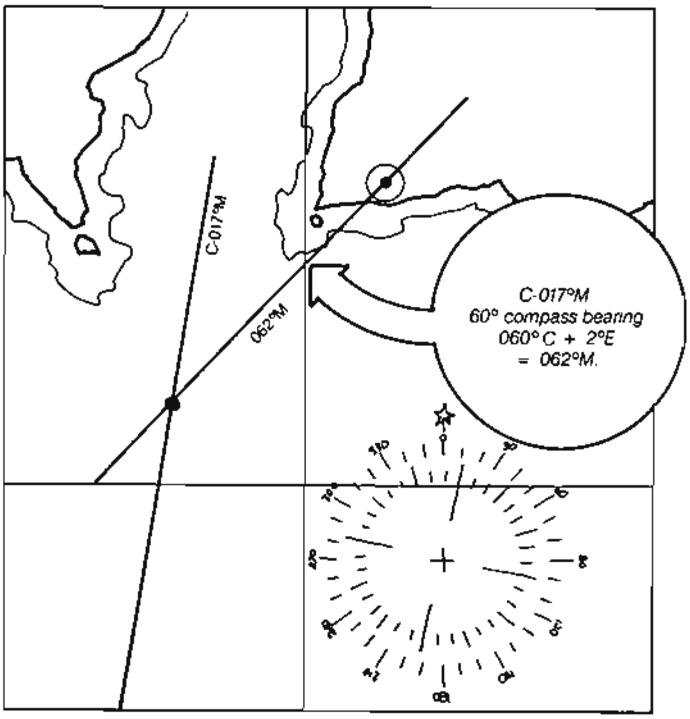


Figure 6-10. Correcting compass courses. Note: When you are correcting a bearing, always apply the deviation that corresponds to the heading of the vessel, not the figure that corresponds to the bearing itself.

Compass Course Correction

This is a good rule to remember to help you apply deviation and variation to magnetic compasses: Can Dead Men Vote Twice (Figures 6-11 and 6-12).

Can	Dead	Men	Vote	Twice
Compass course	Deviation	Magnetic course	Variation	True course

When moving to the right add easterly deviation and variation.
When moving to the right subtract westerly deviation and variation.
When moving to the left subtract easterly deviation and variation.
When moving to the left add westerly deviation and variation.

Can	Dead	Men	Vote	Twice	
	2E		6W	045	This is what is known
		051	6W	045	Solve for men add west when moving left 045 + 6 = 051
049	2E	051			Solve for Dead when moving left subtract east 051 − 2 = 049
049	2E	051	6W	045	

For example, if you want to head 045 degrees true, and you know the deviation is 2 degrees East and the variation is 6 degrees West, then using the rule:

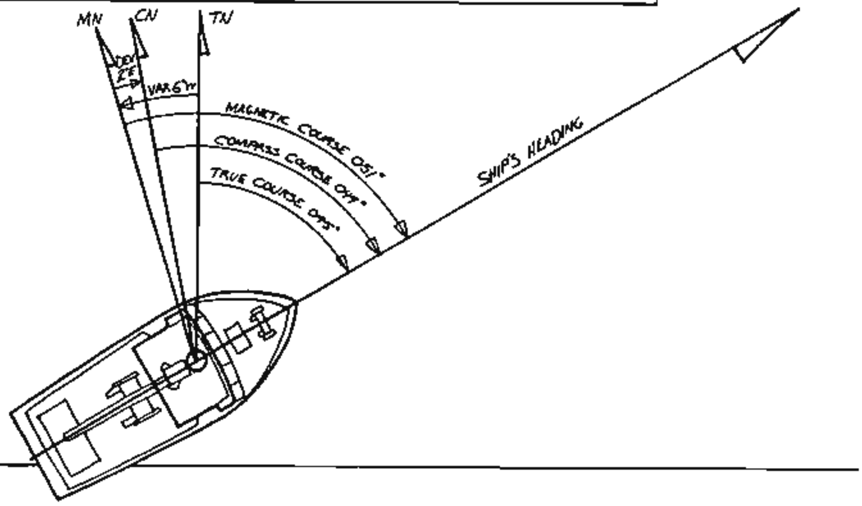


Figure 6-11. Example 1.

Can	Dead	Men	Vote	Twice	
300	7W		16E		This is what is known
300	7W	293			Solve for Magnetic when moving to the right subtract west 300 − 7 = 293.
		293	16E	309	Solve for True when moving to the right and east 293 + 16 = 309.
300	7W	293	16E	309	

Another example; If you're steering a compass course of 300 degrees and the deviation is 7 degrees West and the variation is 16 degrees East what are the magnetic and true courses?

Applying the deviation and variation errors is important because every degree of error in your desired course means that you will miss your desired destination by 100 feet per mile traveled. If you travel 40 miles and steer a course that is 3 degrees off you'll miss your destination by about 2 miles (40 miles x 300 ft. = 12,000 ft. = 2 miles).

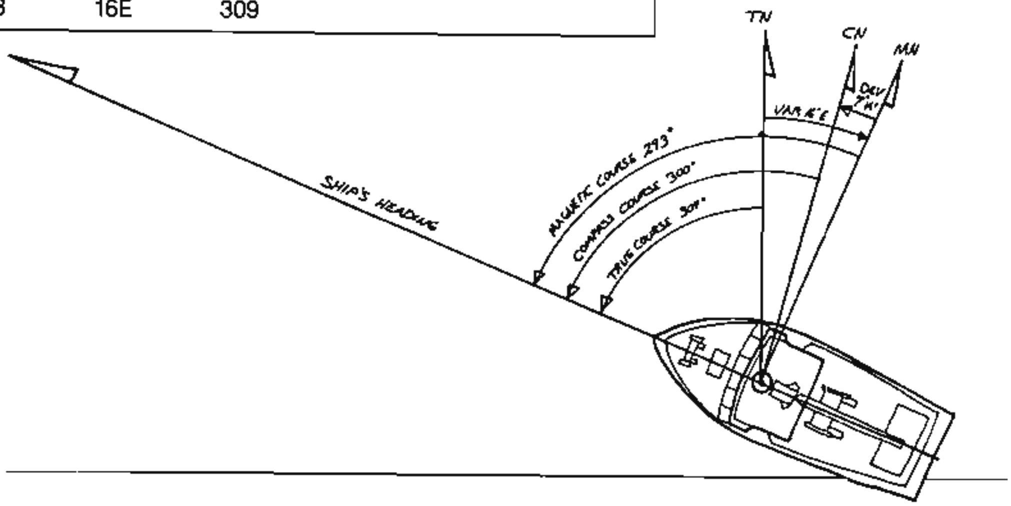


Figure 6-12. Example 2.

6.3 Piloting

6.3.1 The Fix

A *line of position* (a bearing), however obtained, represents a series of possible positions. Your vessel must be somewhere along each line position (LOP), but you don't know where, until you have obtained a *fix*, or the intersection of at least two LOPs. Stated differently, the intersection of at least two, simultaneous, non-parallel lines of position represents the only place your vessel can be.

The important point to keep in mind is that any bearing taken with a steering compass is a compass bearing and cannot be plotted directly on the chart until it has been corrected for deviation (Figure 6-13).

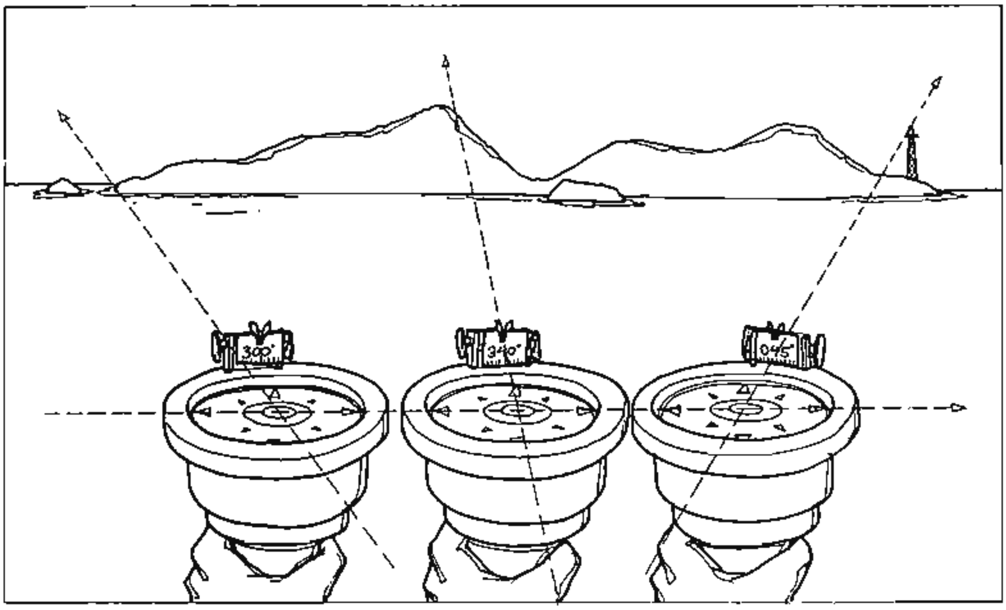


Figure 6-13. Bearings may be taken by sighting over the steering compass or using a hand-held compass.

However, after correcting the compass bearing for deviation, the magnetic bearing can be laid down on the chart because we have a magnetic rose (the inner one) on the chart from which we can get magnetic directions (Figure 6-14).

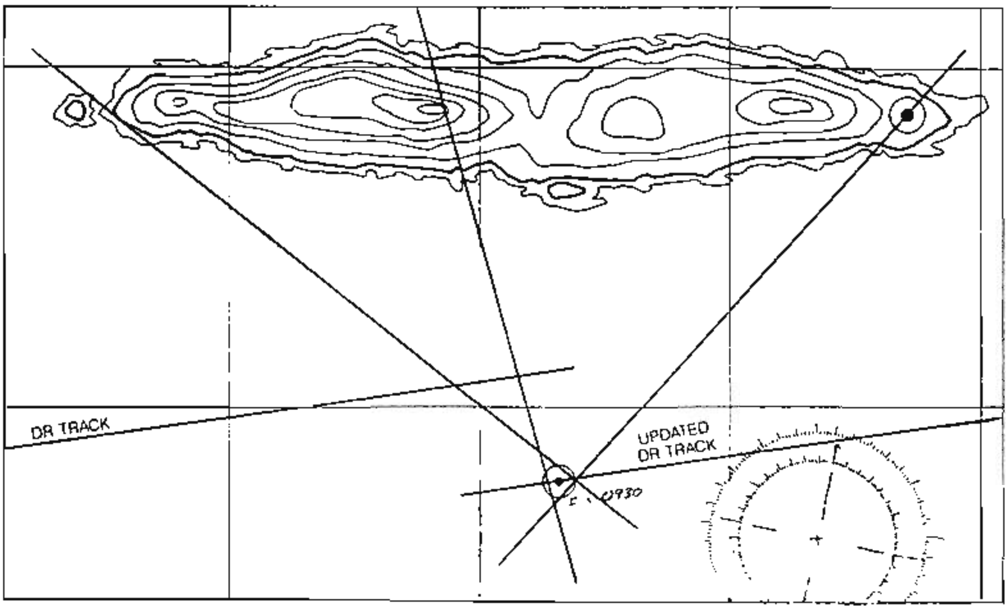


Figure 6-14. The intersection of at least two LOPs creates a fix. A third LOP produces greater accuracy.

Note: When converting from a compass bearing to a magnetic bearing, be sure to apply the deviation for the vessel heading, not for the bearing you have taken.

Practical piloting requires you to have a thorough familiarity with the principles, knowledge of local conditions, constant alertness, and good judgment. A study of avoidable grounding reveals that, in most cases, the the cause of the problem was not a lack of knowledge, but a failure to use or interpret available information. Among the more common errors are:

* Failure to obtain or evaluate soundings.
* Failure to identify aids to navigation.
* Failure to use available navigational aids effectively.
* Failure to correct charts.
* Failure to adjust a magnetic compass or maintain an accurate table of corrections.
* Failure to apply deviation, or error in its application.
* Failure to apply variation, or to allow for a change in variation.
* Failure to keep a dead reckoning plot.
* Failure to plot information received.
* Failure to properly evaluate information received.
* Poor judgment.
* Failure to do own navigation (following another vessel).
* Failure to obtain and use information available on charts and in various publications.
* Failure to "keep ahead of the vessel."

6.3.2 Ranges

You can take one type of bearing by eye without measurement. When two objects appear directly in line, one behind the other, they are said to be "in range," and together they constitute a range. For accurately charted objects, a range may be the most accurate line of position, and one of the easiest to observe. Tanks, steeples, towers, and cupulas often form natural ranges. Ranges are so useful in marking a course that many artificial ranges - two beacons - have been installed in line with channels in many ports. A vessel proceeding along the channel must only keep the beacons in range to remain in the center of the channel (Figure 6-15).

If the farther beacon (customarily the higher one) appears to "open out" (move) to the right of the forward (lower) beacon, one knows that he is to the right of his desired track. Similarly, if it opens out to the left, the vessel is off the track to the left.

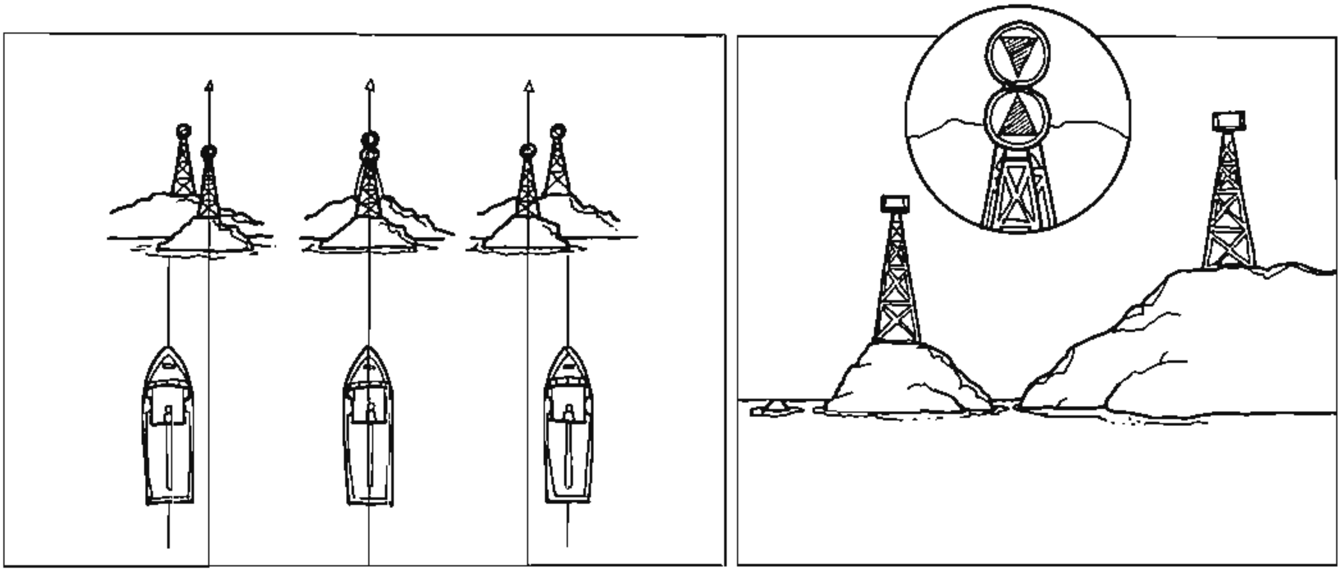


Figure 6-15. A range creates one of the simplest and most accurate bearings. When the range markers line up (right), the vessel is on the desired track.

6.3.3 Bow and Beam Bearings

Bow and beam bearings are another simple, valuable way to get a fix. If an identifiable charted object is observed when it bears 45 degrees on the bow and again when it comes abeam (90 degrees), the distance run between observations is the distance of the object from the vessel when it is abeam (Figure 6-16).

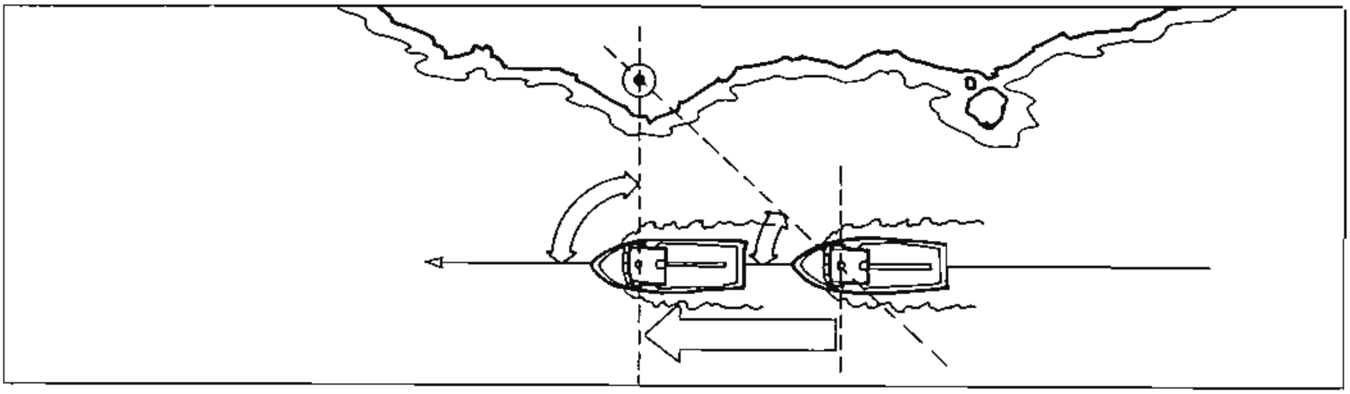


Figure 6-16. Doubling the angle on the bow. The distance run equals the distance from the object when it is abeam.

This method is also known as doubling the angle of the bow. This method will work with observations of 45 degrees and 90 degrees as shown. It will also work with other sets of angles, the second of which is double the first. For instance: 30 degrees and 60 degrees, 40 degrees and 80 degrees, etc.

Remember, you must have an accurate speed table for this method. Also, you must calculate the actual distance-made-over-the-bottom, not the distance through the water, and you must correct for any known current.

Also remember, the deviation that you will apply to a bearing is the one that applies to the vessel's heading at the moment when the bearing was taken.

6.3.4 RPM-Speed Table

In navigating, it is always important to know the speed of your vessel - your speed over the ground, as well as your speed through the water. Chances are, your speedometer is not very accurate, especially at slow speeds, and it cannot measure currents that determine your real speed; speed over the ground.

Most engines have tachometers, and a boat's speed at a given tachometer setting is usually quite predictable. You can develop an *RPM-Speed Table* using the following technique. Use a stopwatch to time yourself while running between buoys. Be sure to run both ways at the same rpm to cancel out the effect of current. Make several runs at different tachometer setting (rpms) and calculate your speeds. (Caution: always calculate the speed each way and average the two speeds - never average the times). An RPM speed table should be established for different loading conditions.

The basic formula for calculating speed, time and distance when two of the three are known is: 60D = ST (or 60 x D = S x T), where D is distance in nautical miles, S is speed in knots, and T is time in minutes.

For a simple way to use this formula, follow Figure 6-17.

$$\frac{60 \times D}{S\ T}$$

Formulas can be rearranged to solve for the variable you want. For example, for S, the formula is:

$$\frac{60 \times D}{T}$$

For distance, the formula would be:

$$\frac{S \times T}{60}$$

For time, the formula would be:

$$\frac{60 \times D}{S}$$

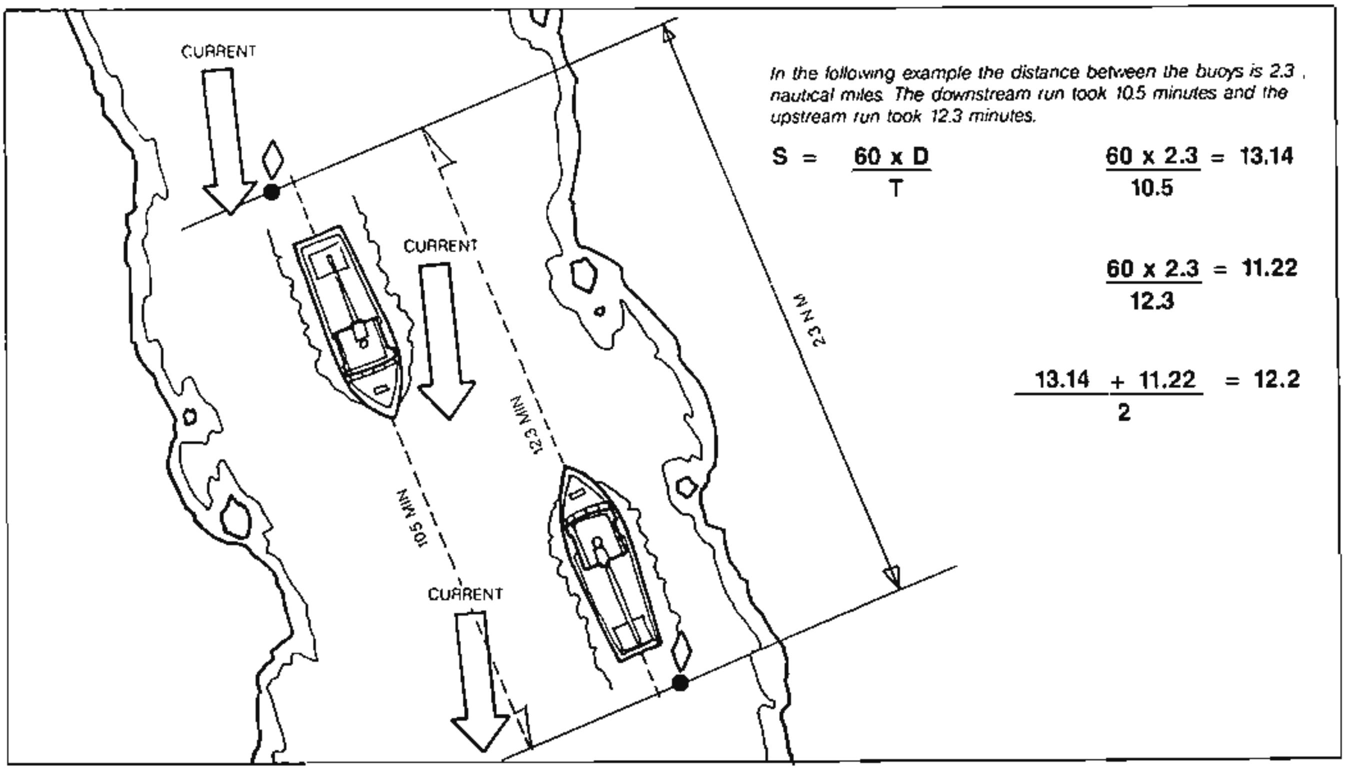


Figure 6-17. 12.2 Knots, the average of the two speeds, is what should be listed on the Speed Table for the RPM used during the two runs.

6.3.5 Dead Reckoning

Dead reckoning (DR) is the act of putting together the elements of navigation as you guide a vessel from place to place. Your DR is the sum of all the information you receive - heading, speed, bearings, soundings - from whatever source. It depends on three things: your point of departure, your course over the ground (including all its twists and turns), and your distance run. Know those three things, and you'll always know the position of your vessel (Figure 6-18).

Dead reckoning is a matter of logging each change in course or speed, and of maintaining a running plot of your progress on a chart. Logging your departure is easy. Simply note the place and time, along with your course, heading, and speed over the water. Start your plot by making a straight line from your point of departure in the direction of your heading, and label it with the direction (degrees magnetic or true) above the line and the speed below the line.

Now your log and your DR plot become records of every change in heading or speed. Note all significant navigation information in the log, and update your plot on a regular basis using LOPs, fixes, soundings, etc. When a good fix shows that you are no longer on your DR track, the difference in your estimated and actual positions becomes a good indicator of either set and drift (direction and speed of the current) or steering error.

Maintain the log and the DR plot well, and you'll always have a pretty good idea of where you are, even if your electronics go down just as the fog sets in. After all, dead reckoning was how men navigated before they had all the technological gadgets. It still works just as well in the hands of a navigator who uses all the sources of information at his disposal, and who keeps a record of what he learns.

A dead reckoning plot also enables you to cross-check electronic data. Label the course above the heading line, and the speed below the line. The half circle represents a *dead reckoning position* based on inputs of speed and heading. The full circle identifies a fix consisting of at least two LOPs.

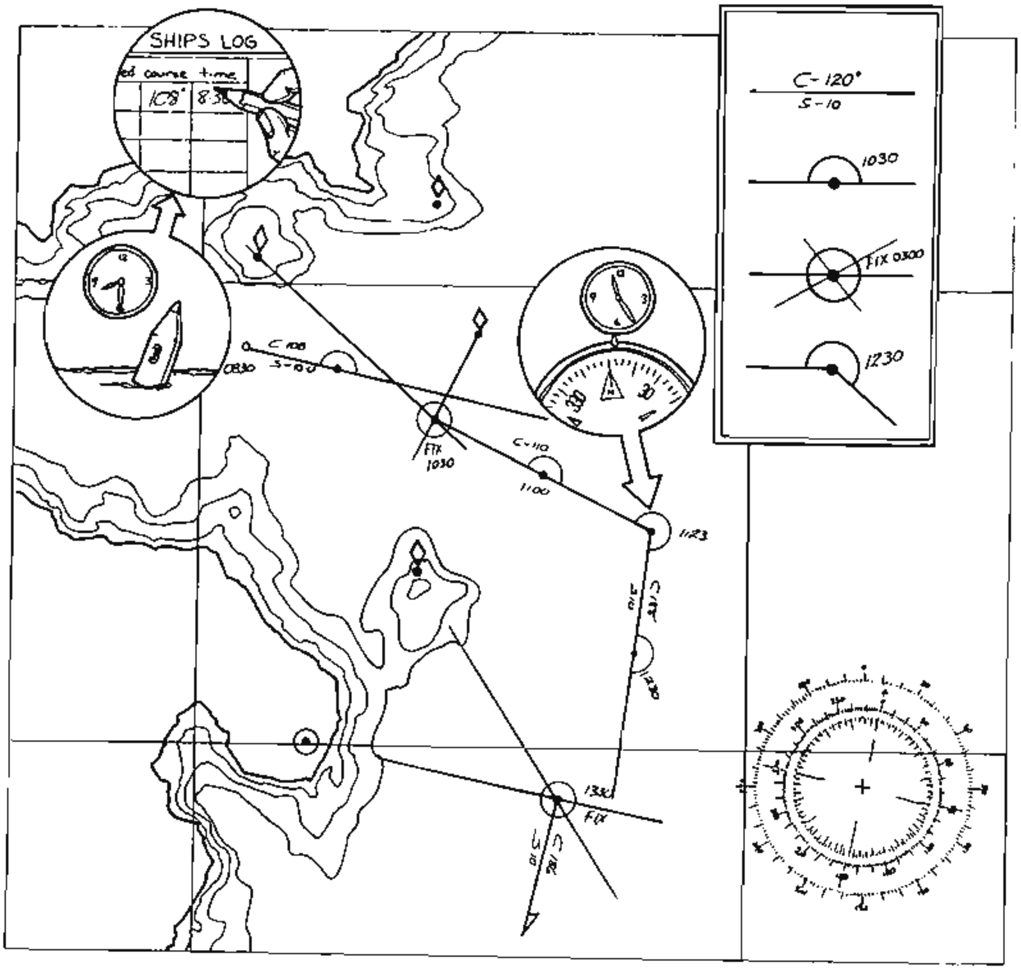


Figure 6-18. A DR is simply a running plot of your progress over the ground.

6.4 Electronic Navigation

6.4.1 Loran

Loran stands for LOng RAnge Navigation. The Loran-A system was developed during World War II, and the superior Loran-C system was put into widespread service during the late 1970s. It is a radio navigation system that uses shorebased transmitters and shipboard receivers; it normally offers continuous, highly accurate positioning in areas covered by Loran signals.

Like all navigation information, Loran is not foolproof, and you must always check your Loran positions against other sources of data.

In areas where signal quality is good, Loran is capable of providing a reliable fix within 0.1 to 0.25 nautical miles. Its *repeatability* (the ability of the system to return to the same spot consistently) is even better. In other words, once you have logged a position based on Loran input, the unit will typically maintain the same degree of error and enable your to return to the logged position over and over again with considerable accuracy. If you have logged the coordinates of a harbor entrance or buoy, for example, a Loran receiver should enable you to return to that spot no matter what the weather or visibility.

While the system is normally quite accurate and unaffected by atmospheric condition, over-reliance on Loran can be extremely dangerous. For example, the signal can become lost or distorted, not allowing the unit to determine its position. In some areas, *signal geometry* (the angle at which the Loran lines of position cross one another) can produce significant positioning errors. Or, you, the operator, may incorrectly interpret information provided by the Loran. In a worst case, loss of power aboard the vessel could make the Loran unit useless.

As the navigator, you must understand the Loran system and its shortcomings, and you must constantly question Loran positions by comparing them to positions obtained from dead reckoning, visual bearings, ranges, soundings, and other types of electronic navigation equipment.

Loran Don'ts
* Rely on Loran as a sole source of position information.
* Rely on lat/long readings near land without cross-checks.
* Use TDs (time difference gradients) near the baseline extension.
* Rely on the Loran when the warning lights are on.

Loran Do's
* Make sure the initial installation is good.
* Be sure background noise on the boat has been suppressed.
* Cross-check Loran information with other sources of data.
* Beware of possible latitude/longitude distortions near land.
* If possible, choose a chain you can use the entire trip.
* Choose secondary stations with good TD gradient.
* Choose TDs with good crossing angles.
* Be aware of your unit's warning indicators.

Loran-C chains

Loran-C transmitters operate in groups referred to as "chains." Each chain has a master station (labeled M) and two to four secondary stations (labeled W,X,Y, or Z). The master station transmits its radio pulse first. Each secondary waits a precise amount of time, then transmits its own. The Loran receiver compares the signals emitted by the master and secondary stations in terms of *time differences* or *TDs* measured in microseconds (millionths of a second).

The distance from each transmitting station to the receiver is directly related to the time the signal takes to arrive. When the receiver measures the difference in signal times between the master station and one of its secondaries, the result is a line of constant time difference (Figure 6-19). At any point along the line, the Loran receiver would measure the same difference between the two stations. Thus, the vessel's position is somewhere on that line.

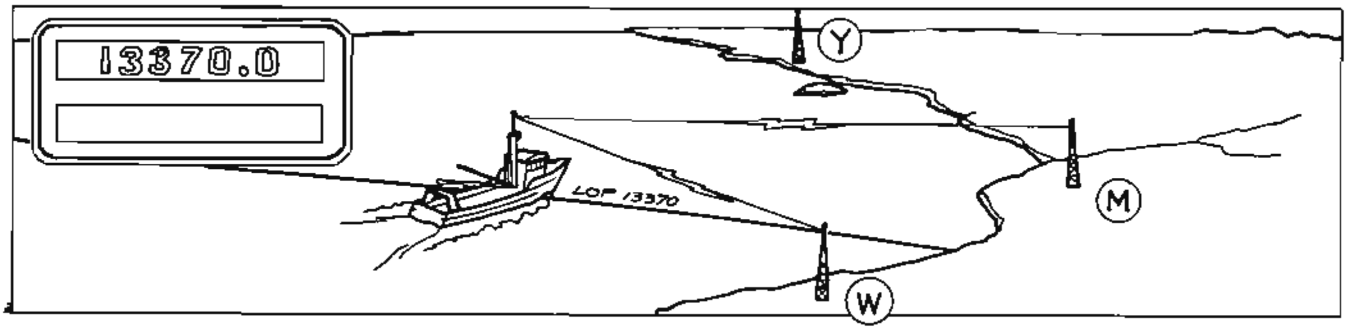


Figure 6-19. A vessel receiving a signal from the master and secondary station will produce a line of constant time difference.

Such lines are called Loran *lines of position* or *LOPs*. As in other forms of navigation, the intersection of two LOPs creates a *fix*, or the vessel's position (Figure 6-20).

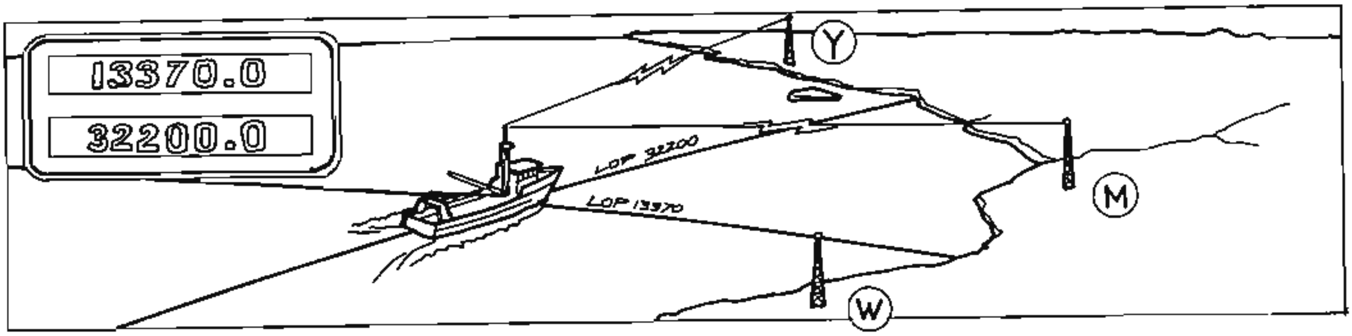


Figure 6-20. A fix is obtained when two LOPs intercept.

Loran TDs are represented by a grid that is printed on special charts (Figure 6-21). If your unit reads only in TDs, you must compare the readout on the Loran to the lines printed on a Loran chart to find your position. Once you have located your position, you can use the chart to convert to latitude and longitude (lat/long).

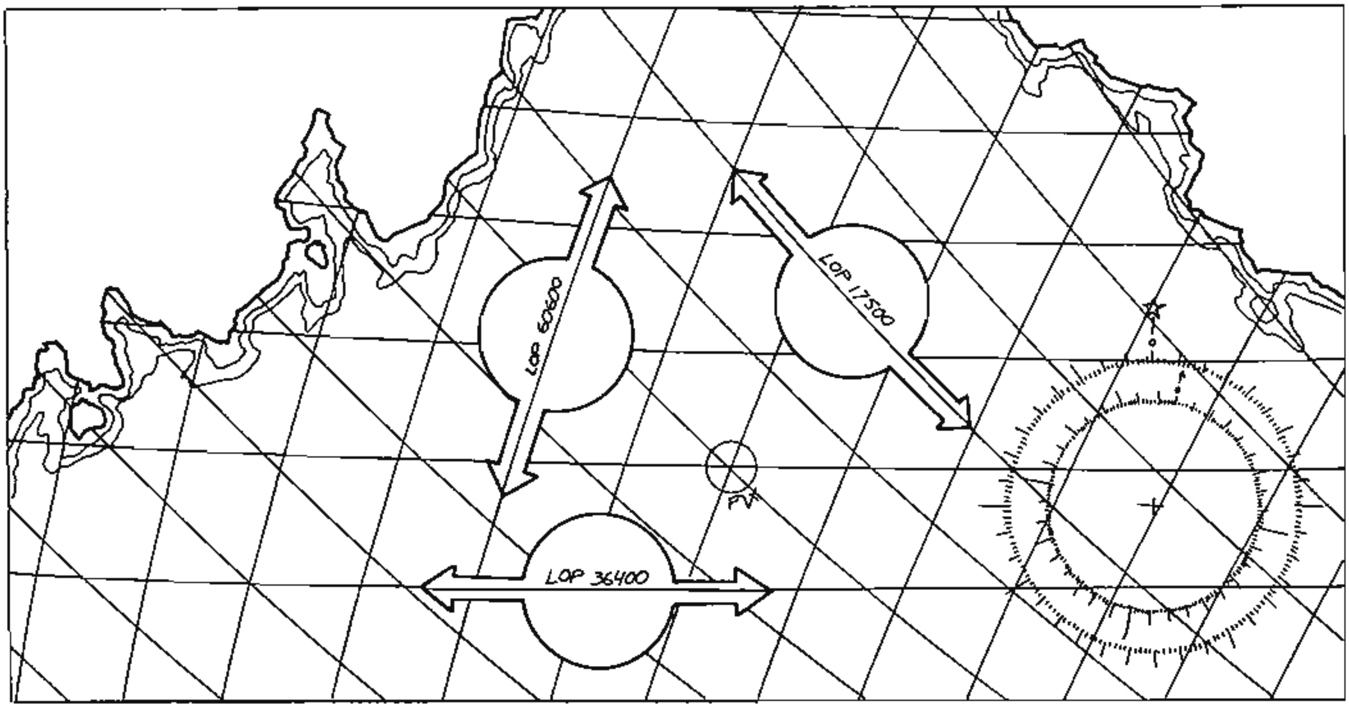


Figure 6-21. Loran TDs are printed on special charts that enable you to convert to lat/long.

Lat/long Conversions

If your Loran unit features a lat/long converter, it is capable of making the conversion from TDs to lat/long for you. This eliminates the need for special charts and reduces the possibility of plotting errors. Beware, however, that signal distortion caused by land masses may hamper your unit's ability to convert to lat/long when you are near land or in a harbor.

Near land, it may be safer to convert the unit to TDs and plot your position on TD charts, which are corrected for signal distortion. Or, your operator's manual should tell you how to enter "offsets" to help your unit compensate for distortion as it converts to lat/long. When you are near land, you must check Loran positions against other sources of information: visual bearings, soundings, radar, etc.

Selecting a Chain

Loran chains are identified by four-digit numbers. In many areas, only one chain is available. In some areas, however, coverage overlaps, and you must select which chain and secondary stations provide the best positioning within a given area. Or, you can contact you local Coast Guard District Office to get information on the preferred chain to use in your area.

In order to be sure that you are getting accurate information from your Loran, you must understand the factors that determine why one chain, or one set of secondaries, is better than another.

The first factor to consider is strength, which depends largely on distance from the transmitting station, unless interference, or an interruption in the signal, means that you cannot receive the correct secondaries in the chain nearest your position. And, whenever possible, you should select a chain that you can use during your entire trip. This enable you to "lock on" the receiver prior to departure, and, assuming your receiver has the capability, to "track" a set of signals for the entire trip.

The first step in operating your unit is to enter the four-digit number that identifies a chain. You should normally choose the closest one, unless you determine that signal quality or geometry makes another station better to use. If you are travelling long distances, you may leave one coverage area and enter another. At that point, you must reprogram the Loran receiver by entering a new chain identification number.

On the Atlantic Coast the 9960 chain is the only chain available. If you should leave the Atlantic Coast you would need to switch to the Loran chain available in the area in which you are entering.

Normally there is a "chain overlap," or dual coverage, between chains. If you are operating exclusively within this area, you could use either chain depending on which provided the best signal quality and the best LOP crossing angles.

TD gradient

Once a chain has been selected, your unit may require that you tell it which secondary stations you want to use. Or, it may be programmed to select a pair of secondary stations automatically. Even if the unit is automatic, however, you may find it necessary to override the unit and manually choose another pair in order to get the best fixes. The most important consideration in choosing secondaries is called *TD Gradient.*

Gradient refers to the spacing between TDs generated by each station.

As you can see in Figure 6-22, the spacing between the Y lines is one nautical mile or about 2,000 yards. In terms of time, the Y lines are 10 microseconds apart, so that each microsecond of time difference equals about 200 yards of distance. You might expect an error in your Loran reading of plus or minus 0.1 microseconds, which would correspond to plus or minus 20 yards in this case.

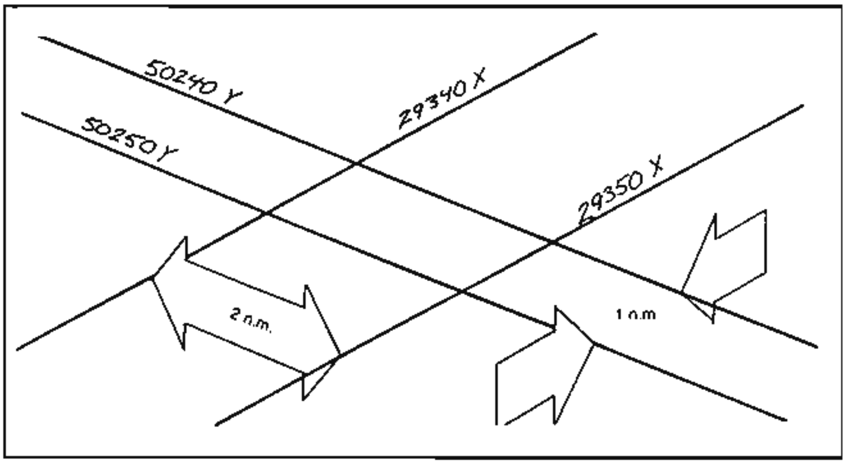


Figure 6-22. TD gradient refers to the spacing between the lines.

Looking at the X lines in this example, you could expect an error of plus or minus 40 yards for each 0.1 microsecond error experienced by the Loran receiver.

In Figure 6-23 however, you see much larger gradients for the W and Z lines, although the same 10 microsecond time difference separates each pair. In this case, a 0.1 microsecond error in time difference as measured by the Loran receiver translates into a positioning error of plus or minus 180 yards in the case of the Z lines, and plus or minus 240 yards in the case of the W lines.

The smaller gradient (the closer lines of equal TD spacing appear on the chart), the better the accuracy. In this case, you should choose the X and Y secondaries, assuming signal reception from those secondary stations is good.

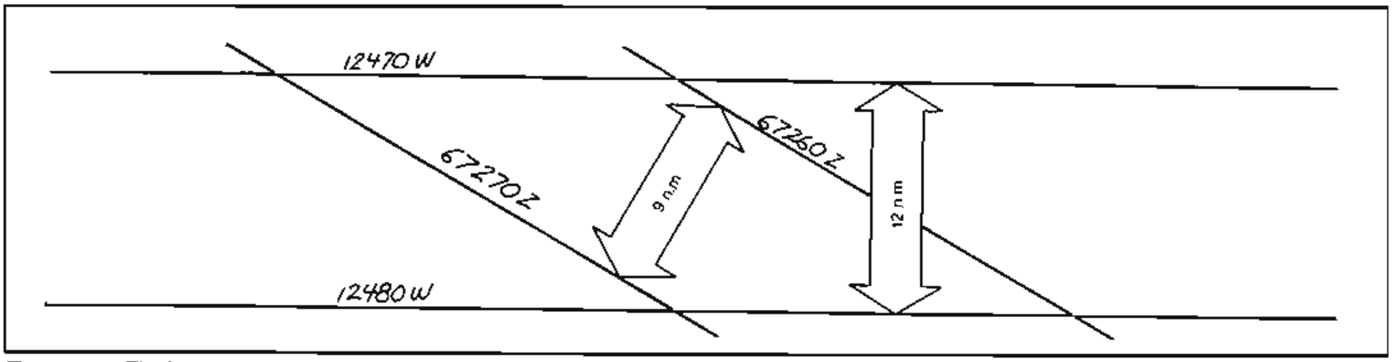


Figure 6-23. The larger the gradient, the less accurate the position.

Crossing Angles

Ideally, Loran LOPs would all cross at right angles (90 degrees). Unfortunately, however, nearly all Loran LOPs are curves that cross at angles other than 90 degrees. Assuming equal gradients, you should always choose the TD pairs that cross closest to 90 degrees (Figure 6-24). In Figure 6-22 the lines cross at about 70 degree, which should provide a high degree of accuracy. In Figure 6-23, however, the lines cross at about 30 degrees and a small error in time difference translates into a significant error in position. Be wary of fixes produced by LOPs that cross at angles less than 30 degree. Consider the crossing angle when you choose a chain.

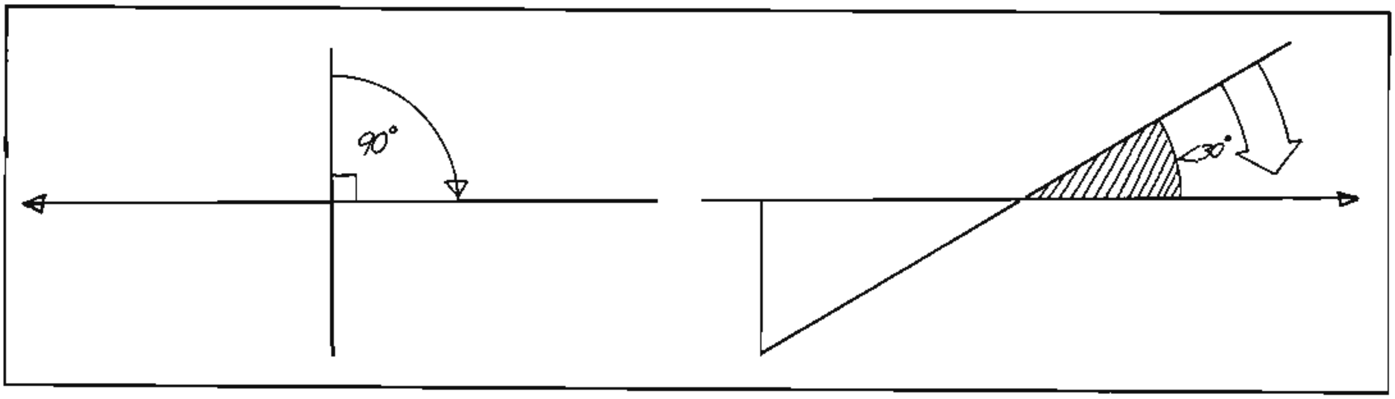


Figure 6-24. Loran lines intersecting at right angles provide the best positions. Don't use lines that cross at less than 30 degrees.

Baseline Extension

As you can see in Figure 6-25, the line that connects the master station with one of its secondaries is called the *baseline*. The *baseline extension* occurs where the line extends beyond either station, and the LOPs become sharply curved in these regions.

Do not use a TD near its baseline extension.

The gradient becomes very large in this area, and there is the definite possibility that the receiver will be confused about which side of the baseline it is on (see Figure 6-26).

Loran charts clearly identify baseline extension areas, and you should choose another secondary (or another chain) if your vessel is about to cross a baseline extension.

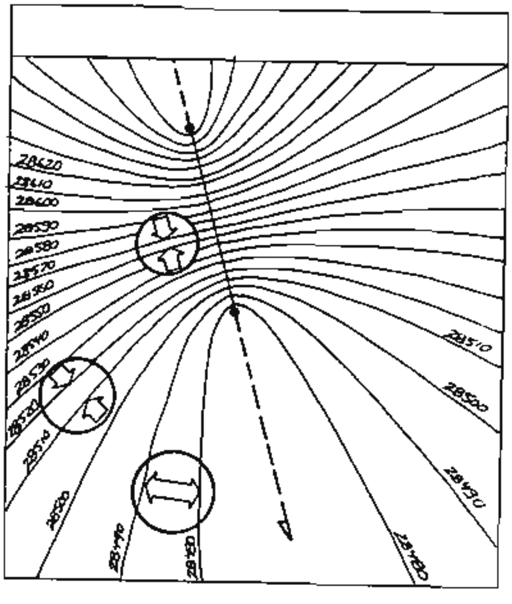


Figure 6-25. Baseline extension.

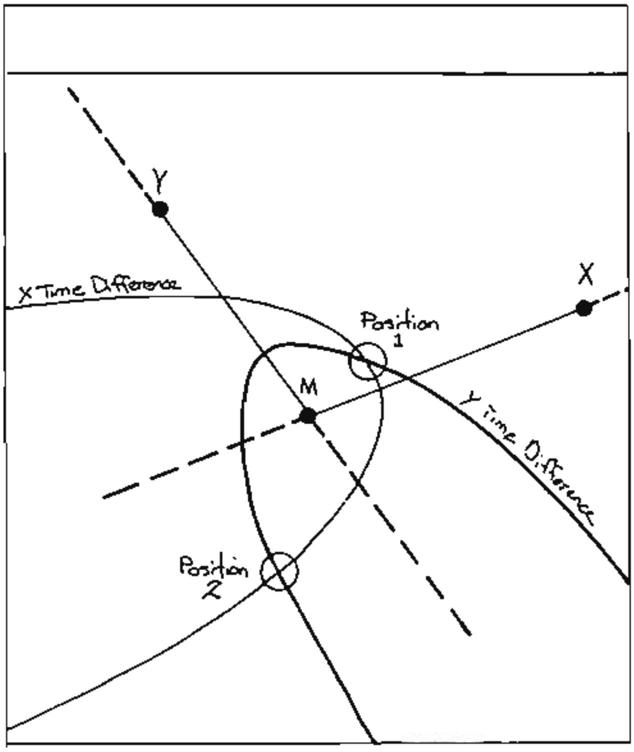


Figure 6-26. Loran ambiguity.

Plotting Loran Fixes

The Loran system is highly accurate, but careless plotting can ruin its ability to fix your position. If your unit converts to lat/long, plotting a fix is the same as in other forms of navigation. To help you plot fixes, each loran chart features a Loran interpolator in one corner. In the following example, assume your Loran receiver has established 11347.5 microseconds one LOP.

Using a pair of dividers (Figure 6-27), measure the distance on the chart between lines 11340 and 11350, a distance of 10 microseconds. Now place the dividers on the interpolator exactly where one point rests on the top line and the other point rests on the bottom line. Without moving the bottom point, move the top point straight down to a position 7.5 divisions from the bottom line (for a 10 microsecond TD spacing, consider that the bottom line represents 0, the top line represents 10 and each dark line in the middle of the interpolator represents 2 divisions. It may help to temporarily pencil in 10, 8, 6, 4, and 2 over the numbers 100, 80, 60, 40, and 20 on the scale at right).

Now go back to the chart. Place the bottom point of the dividers on the 11340 line. With the dividers held perpendicular to that line, the top point indicates 11347.5. Draw a line parallel to the printed lines through this point and you have plotted the 11347.5 LOP. Do the same with a second LOP, and the intersection represents your fix.

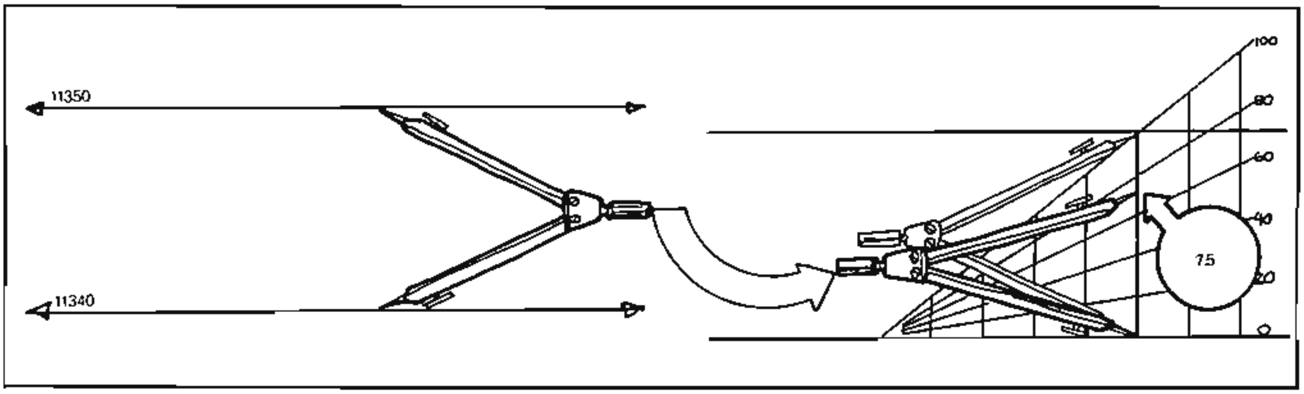


Figure 6-27. Measure the distance with dividers, and transfer to the interpolator.

Additional Operating Notes

Estimates of loran accuracy assume that you have a good quality receiver that has been correctly installed, and that uses a proper antenna. Accuracy also depends on your ability to tune and operate the receiver. If your loran receiver is computerized, it may have numerous functions that enable you to store positions as waypoints, monitor your course and speed over the ground, and to steer predetermined courses. Many receivers are fitted with a "HOLD" switch that enables you to store your present position instantly, while the receiver continues to track internally. This memory function can be vital in returning to pick up a man overboard. You should consult your operator's manual to learn all of the unit's capabilities. It may also include various alarms that indicate problems with the signal.

For example, Loran signals consist of groundwaves normally used for position fixing, and skywaves that bounce off the ionosphere. At extreme distances from transmitters, the unit may lose a fading groundwave signal and pick up the stronger skywave. Skywave navigation is very tricky at best, and you should view these positions with suspicion. If your unit warns that it is receiving a skywave, refer to the operator's manual for a discussion of this type of navigation.

A *blink* warning indicates that there is a malfunction at the transmitting station.

A *cycle slip* warning indicates that the receiver has locked onto the wrong cycle of the Loran-C signal.

A *lost signal* alarm tells you that the signal is too weak for proper receiver function.

Also, interface may cause the last digit of the readout on your receiver to jump or jitter. If this occurs, you must average the reading.

Whenever an alarm light is on, do not rely solely on your Loran data. For more information on Loran, consult the Loran-C User's Handbook issued by the U.S. Coast Guard.

6.4.2 Radar

A vessel is required to use "all available means appropriate" to navigate safely and avoid collision. Vessels equipped with functioning radar are legally required to use it when visibility or traffic warrants.

And, says former Commandant of the Coast Guard, "The mariner who fails to properly utilize radar can expect to be held accountable for this failure in the same manner as for any other neglect or disregard of the requirements of good seamanship."

The use of radar (the name is an acronym for RAdio Detection And Ranging) is widespread among fishing vessels; however, it is not always used correctly. Despite the capabilities of radar, it has not eliminated collisions at sea. For the sake of both law and human life, every fisherman who stands watch on a vessel equipped with radar ought to know how to use it properly.

A radar unit consists of a transmitter which sends short bursts of high-frequency radio energy through a rotating antenna. These radio pulses are transmitted in a highly directional pattern, and they produce *echoes* that are reflected back to the antenna when they strike target objects, such as other vessels or land masses. The returning signal is displayed as a visual symbol or *pip* on a dark screen, to indicate the direction and range of the target.

Relative Motion Display

Most fishing vessel radars provide *relative motion displays* in which your own vessel is always at the center of the display and the motion of a contact is *relative* to your own vessel. This means that in order to determine the direction and speed of the target, you must consider your own motion in relation to that target.

On relative motion display, fixed objects, such as land masses, move at a rate equal to, and in a direction opposite to, the motion of your own vessel.

The relative motion display can either be *heading-up*, in which your own vessel's heading is always at the top of the screen, and contacts are displayed at bearings relative to your own vessel's bow; or *north-up*, in which the picture is gyro-stabilized and north is always at the top of the screen. In this mode, the heading line wanders according to your own vessel's heading, and contacts are displayed in true bearings.

The heading-up display is most suitable in crowded coastal areas or narrow channel. The north-up display is often preferred on the high seas, and simplifies plotting, because target bearings appear in degrees true. The north-up mode requires that the radar unit be connected to a gyrocompass.

In Figure 6-28, your own vessel on a heading of 270 degrees detects a contact bearing 315 degrees true. The contact pip appears at 045 degrees relative on a heading up display.

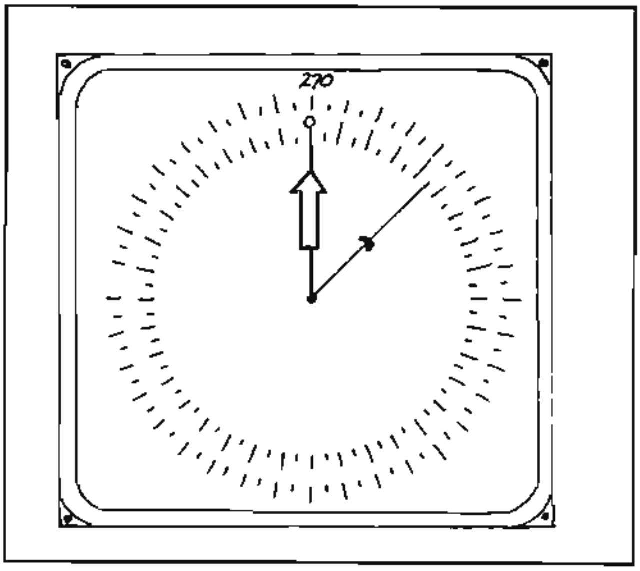


Figure 6-28. Heading up display.

In Figure 6-29, the same contact appears at 315 degrees true on a north-up display. In both cases, the pip bears 045 degrees from the heading flash, but the heading-up display provides a more immediate indication of whether the contact lies to port or to starboard.

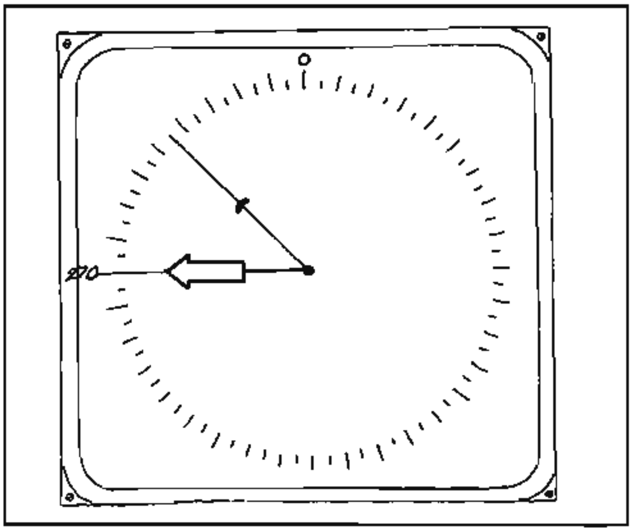


Figure 6-29. North-up display.

Range

The likelihood that a radar unit will detect a target depends as much on the size, shape, material, height and angle of the target as it does on the range of the radar. Ranges beyond 15 miles are of limited use on fishing vessels except for coastwise navigation. The use of a high-range scale makes the picture of the more important close-range area smaller, and makes targets in that area much smaller and less likely to be noticed.

The Radar Horizon Table (Table 6-2) indicates that even if the radar is on the 15-mile scale, a unit with a 35-foot antenna height has a horizon of only 7 nautical miles. To present a good reflection, a target at 15 miles would have to present a reflection surface at least 45 feet above water.

Table 6-2.

RADAR HORIZON TABLE

Height (ft.)	Distance (n.m.)	Height (ft.)	Distance (n.m.)
5	2½	65	10
10	4	70	10
15	4½	75	10½
20	5½	80	11
25	6	85	11
30	6½	90	11½
35	7	95	12
40	7½	100	12
45	8	110	13
50	8½	130	14
55	9	150	15
60	9½		

Use the Radar Horizon Table to calculate the range at which various targets are likely to be seen. For example, with an antenna height of 35 feet, the radar horizon is 7 nautical miles, while a 45-foot-tall lighthouse has a radar horizon of 8 nautical miles (Figure 6-30). Therefore, the lighthouse should appear on the radar, under normal conditions, at 15 nautical miles (7 n.m. + 8 n.m. = 15 n.m.)

Most fishing vessels use a 6- to 12-mile radar range when running, and a closer range during fishing operation, although circumstances may dictate other ranges. For maneuvering close to targets, the range is usually reduced to the smaller range that will show the area of interest.

When the radar is used as a collision avoidance aid, the short range area is of greatest importance. It is very dangerous for the target to disappear from the screen as it approaches the vessel, as is often the case when the radar unit is set on long range.

In the open sea, however, take care not to neglect the longer distance ranges in conditions of reduced visibility, when another vessel could get dangerously close without being noticed if you only use short ranges.

A boat running at 10 knots, detecting another vessel running at 20 knots at a distance of 10 miles in a head-on approach needs at least 20 minutes to evaluate the relative motions of the two vessels, and to take action to avoid a collision.

Rough seas, rain, fog, snow, and certain Navy experiments interfere with radar reception. You can reduce the interference by natural conditions by resetting the controls on the radar set. The unit can be tuned to reduce *sea clutter* (reflection from waves) or *rain clutter* (reflections produced by heavy precipitation); but you must be aware that tuning out clutter may also tune out weak target signals.

Ice accumulation on the antenna can cause a steady deterioration in the signal. Shut down an exposed scanner, and remove the ice gently. Heavy ice buildup may cause the scanner to blow a fuse by increasing the load on the motor.

Bearing Resolution

Bearing resolution is the ability to discriminate between two targets that are located at the same range and close in azimuth (angle from your own vessel) to each other. Usual bearing resolution is on the order of 1 to 2 degrees. The horizontal beam width of the antenna is the primary factor in bearing resolution. Smaller radars now coming onto the market have only a 5-degree rating for bearing resolution.

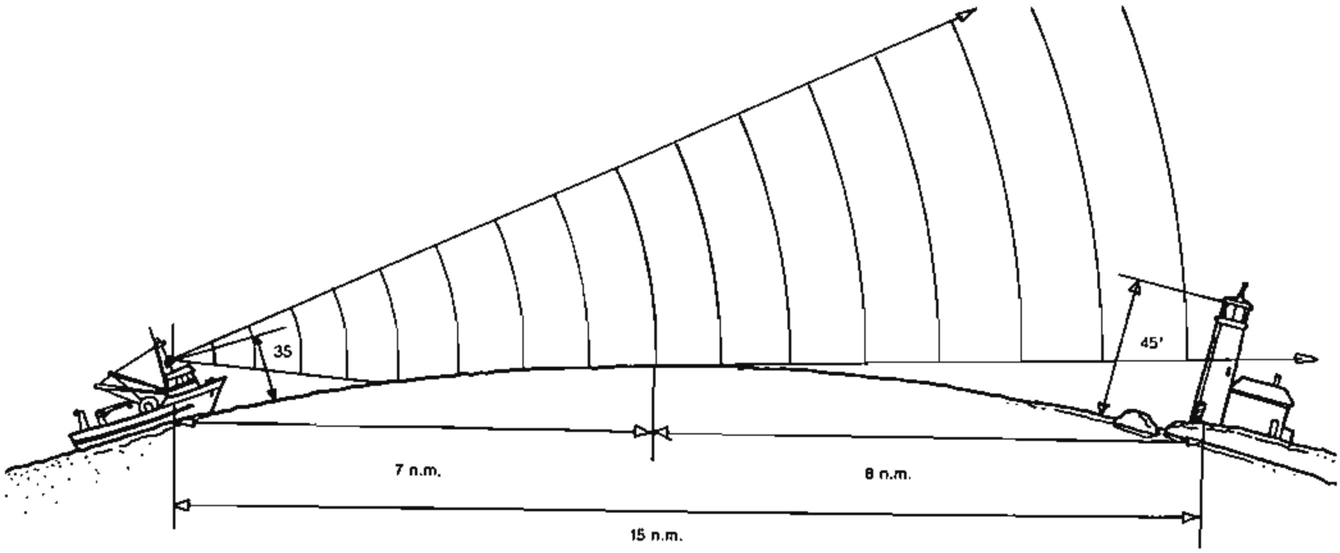


Figure 6-30. With an antenna height of 35 feet, the radar horizon is 7 nautical miles, while a 45 foot lighthouse has a radar horizon of 8 nautical miles.

Bearing Accuracy

Accurate measurement of bearings is vital to using your radar set properly. The accuracy of the bearing depends primarily on the narrowness of the radar beam. Also, when bearings are taken relative to your own vessel's heading, the adjustment of the heading marker at installation is an important factor. To minimize error in measuring the bearing of a target, put the target echo close to the outside edge of the screen by selecting the proper range.

Range Discrimination

Range discrimination is the ability to distinguish between two targets that are in the same direction and close to each other. It is determined by the length of the radar pulse.

Range Measurement

Range measurement is an important function of the radar unit. Generally there are two ways to measure range: fixed range rings, which appear on the screen, and the variable range marker, which can be moved inwards or outwards so that it touches the leading edges of a target and indicates range on a digital readout.

False Echoes

Occasionally, echo signals may appear on the screen at positions where there is no target. They may also disappear, even if there are targets. Multiple reflections occur when a wide and flat target near your own vessel produces multi-reflection of the radar pulse. This results in the appearance of multiple echoes on the screen at equal intervals after the true echo, as shown in Figure 6-31.

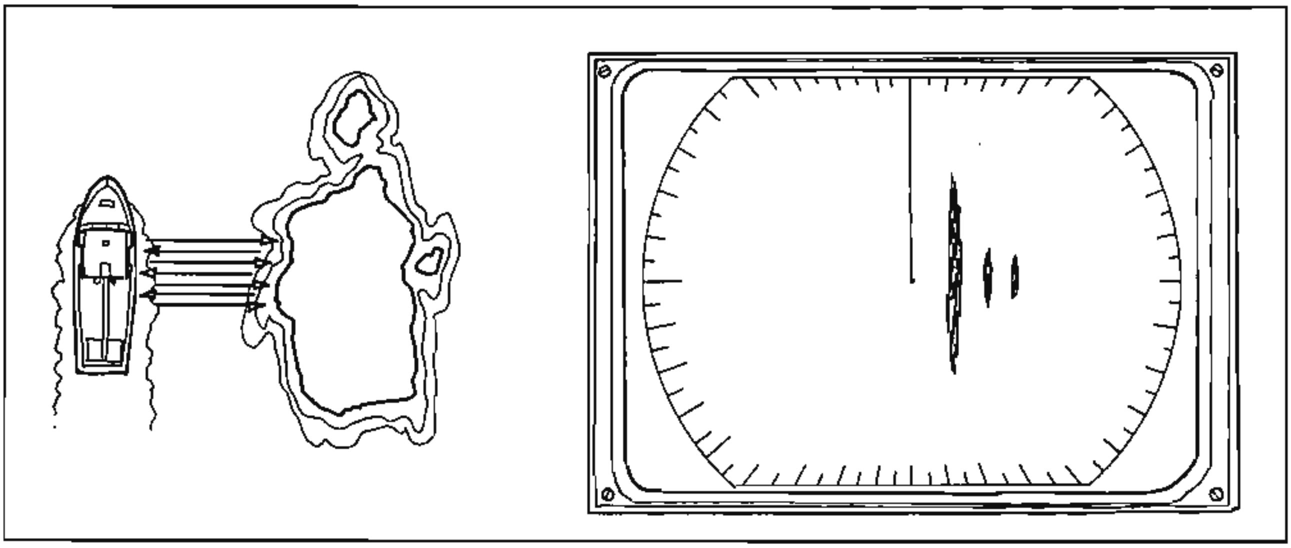


Figure 6-31. Occassionally, echo signals may appear on the screen at positions where there is no target, or disappear even if there are targets. Multiple reflections occur when a wide and flat target near your vessel produces multi-reflection of the radar pulse. This results in the appearance of multiple echoes on the screen at equal intervals after the true echo.

Side Echoes

Side echoes may occur because a radar pulse emitted from the antenna produces a main beam and side beams. A large, strong target may be detected by the side beams as well as by the main beam, and produce side echoes that appear at both sides of the true echo at the same range (Figure 6-32).

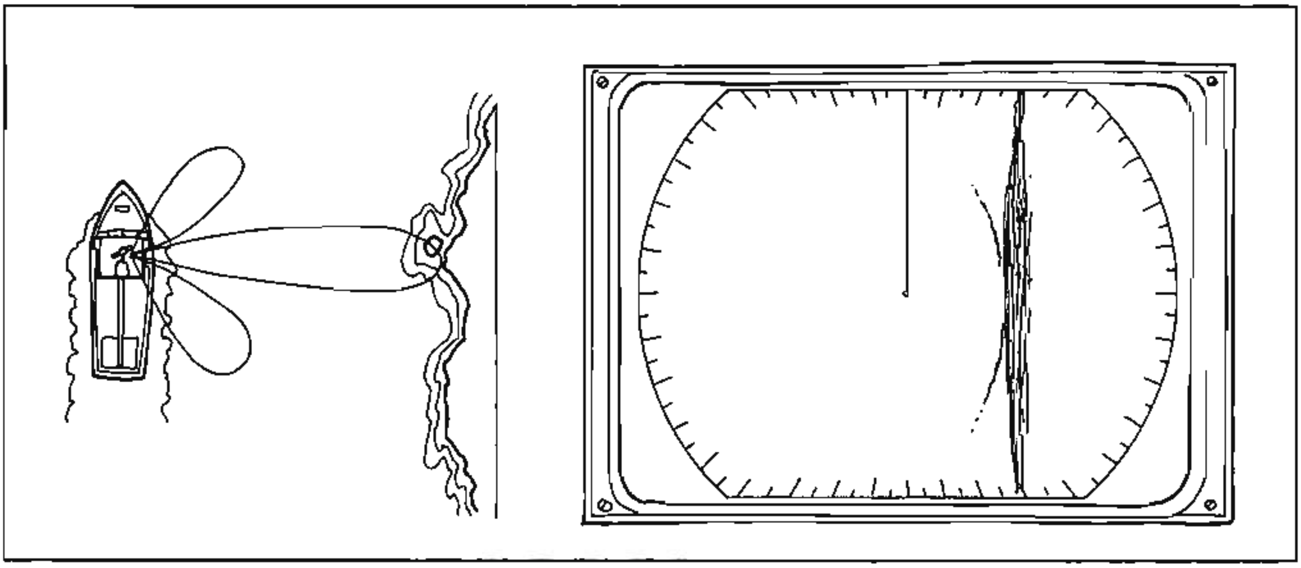


Figure 6-32. Side echoes may occur because a radar pulse emitted from the antenna produces a main beam and side beams. A large strong target may be detected by the side beams as well as the main beam, and produce side echoes that appear at both sides of the true echo at the same range.

Virtual (mirror) Images

A relatively large target, close to your own vessel, may be represented at two positions on the screen. One of them is the true echo directly reflected by the target, and the other is the false echo, which is caused by the mirror effect of a huge object on or close to your own vessel (Figure 6-33). If your own vessel comes to a big metallic bridge, for example, such a false echo may temporarily be seen on the scope.

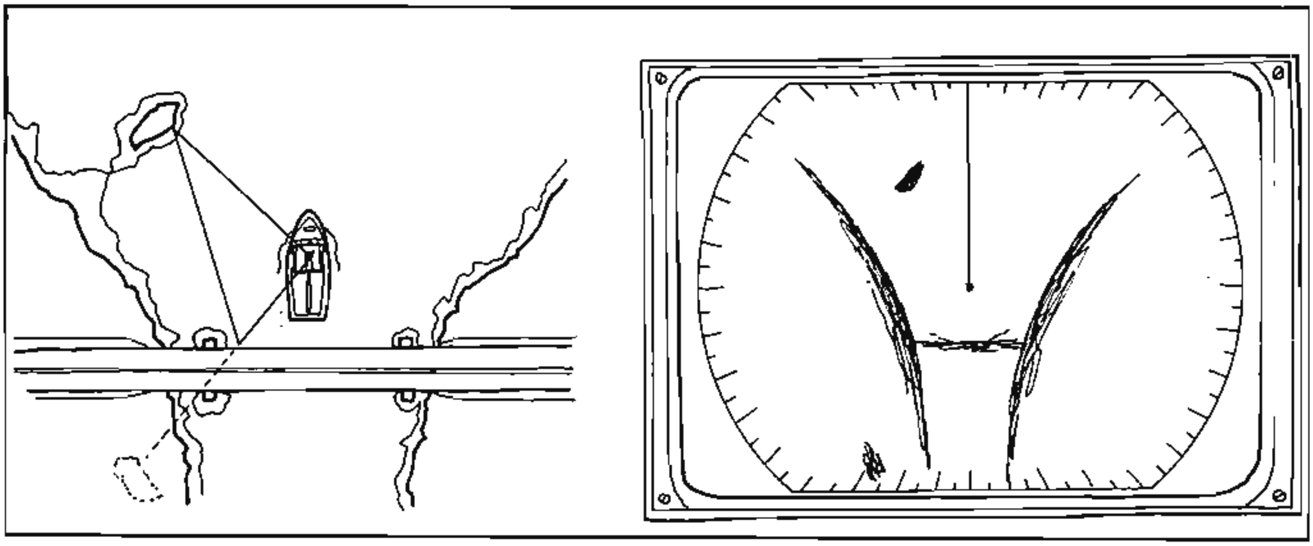


Figure 6-33. A relatively large target, close to your vessel, may be represented at two positions on the screen. One of them is the true echo directly reflected by the target, and the other is the false echo which may be caused by the mirror effect of a huge object on or close to your own vessel. If your vessel comes to a big metallic bridge, for example, such a false echo may temporarily be seen on the scope.

Dead Angle (blind sector)

A funnel, mast or derrick post near the radar antenna may intercept the radar beam (Figure 6-34). In that case, you will not detect any target in that area, called the *dead angle.* A huge object next to your own vessel may cause a similar signal blockage.

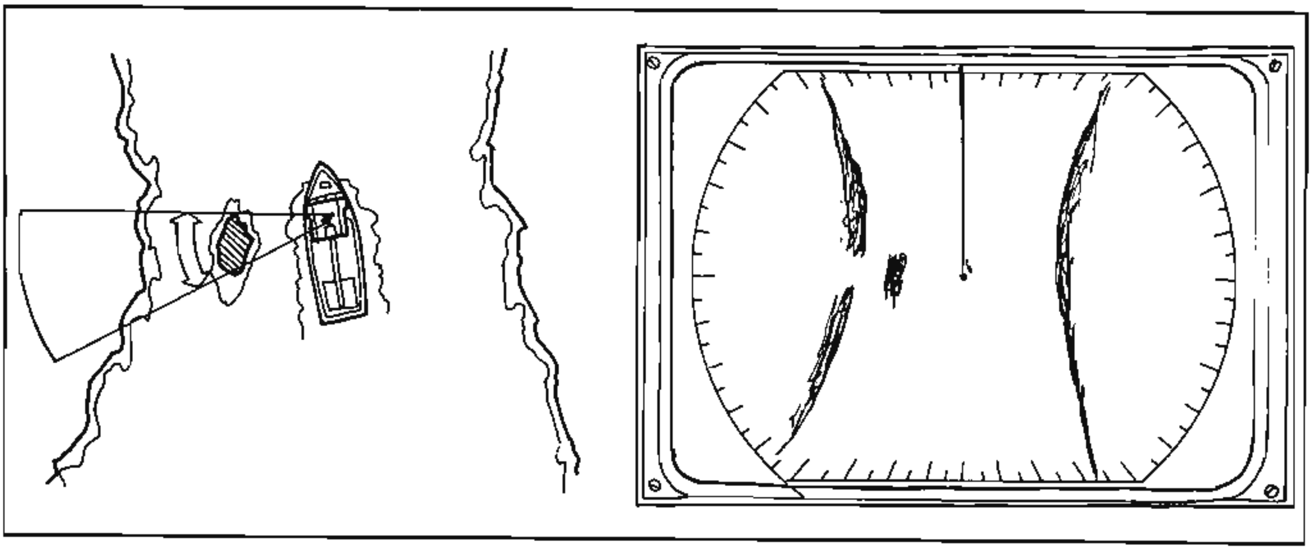


Figure 6-34. A funnel, mast or derrick post near the radar antenna may intercept the radar beam. In that case, no target can be detected in that direction, called the dead angle. A huge object next to your own vessel may cause a similar signal blockage.

Radar Interference

When another vessel is using the same frequency as your radar, the pulses emitted from the other vessel are received by your unit and appear on the screen as curved spokes ("rabbit tracks") (Figure 6-35).

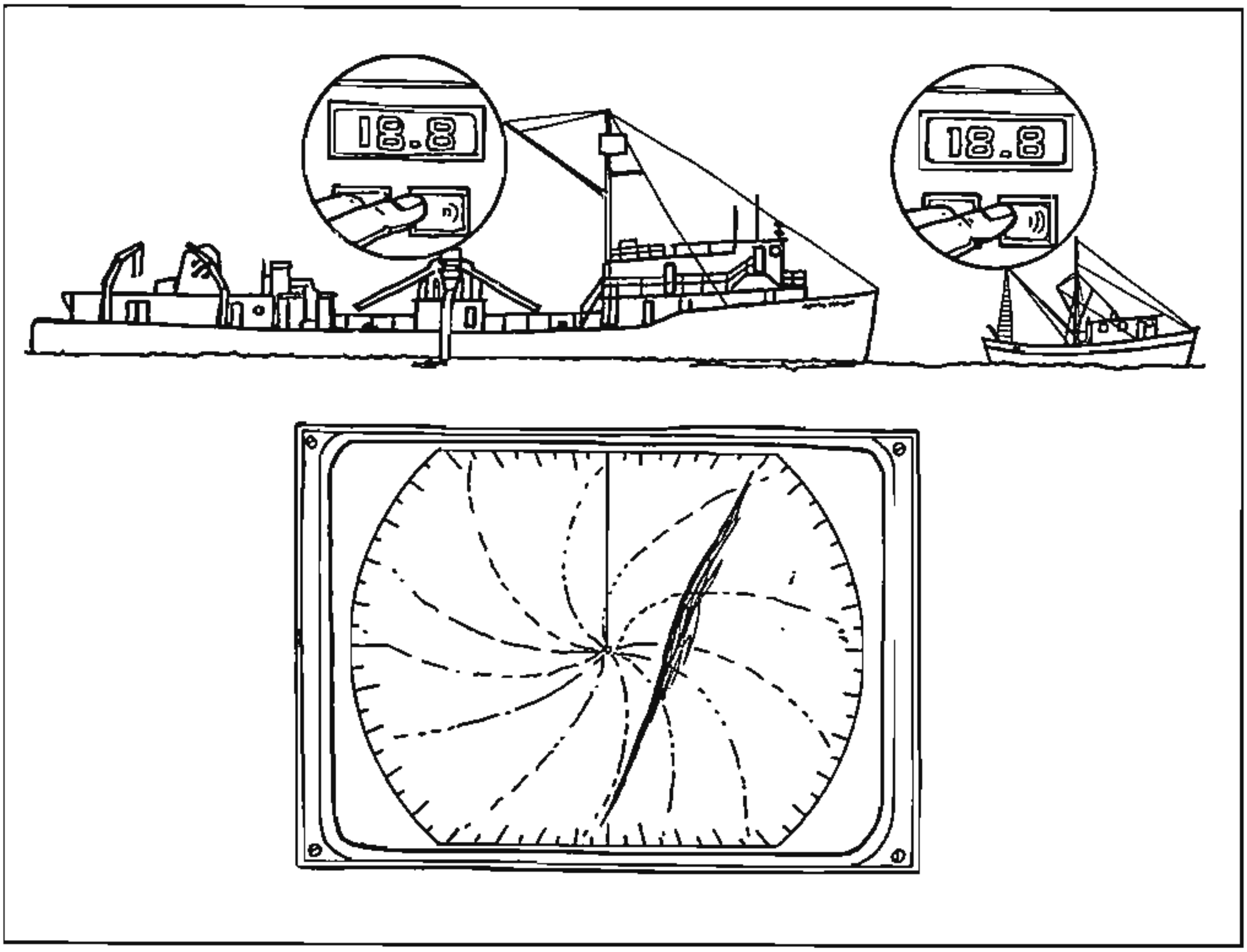


Figure 6-35. When another vessel is using the same frequency as your radar, the pulses emitted from the other vessel are received by your unit and appear on the screen as curved spokes (rabbit tracks).

Constant Bearing/Decreasing Range

(See section 5.8 in Chapter 5 on Radar for Collision Avoidance.)

Identifying Land Masses

Using radar to navigate along the shoreline is complicated by distortion and other factors. It can be quite difficult to identify specific features. Unless the shoreline consists of high, distinct cliffs, for example, it is likely that buildings, towers and inland hills will appear on the radar screen before the shoreline itself.

Position-fixing by means of radar ranges requires the correct identification of specific features. If you mistakenly assume that the radar image is the shoreline when it is actually a hill two miles inland, however, you will be two miles closer to jeopardy than you think you are.

Figure 6-36 illustrates the distortion effects of radar shadow, beam width and pulse length. View A shows the actual shape of the shoreline and the land behind. Note the steel tower on the low sand beach, and the two ships at anchor close to shore. The heavy line in view B represents the reflected image on the radar screen, while the dotted line represents the actual position and shape of all targets. Note the following:

* The low sand beach is not detected by the radar.
* The tower on the low beach is detected, but it looks like a ship in a cove. At closer range, the land would begin to fill in, and you would not see the tower without reducing the receiver gain.
* There is a radar shadow behind both mountains. Distortion caused by radar shadows is responsible for more confusion than any other factor. The small island does not appear, because it lies in the radar shadow.

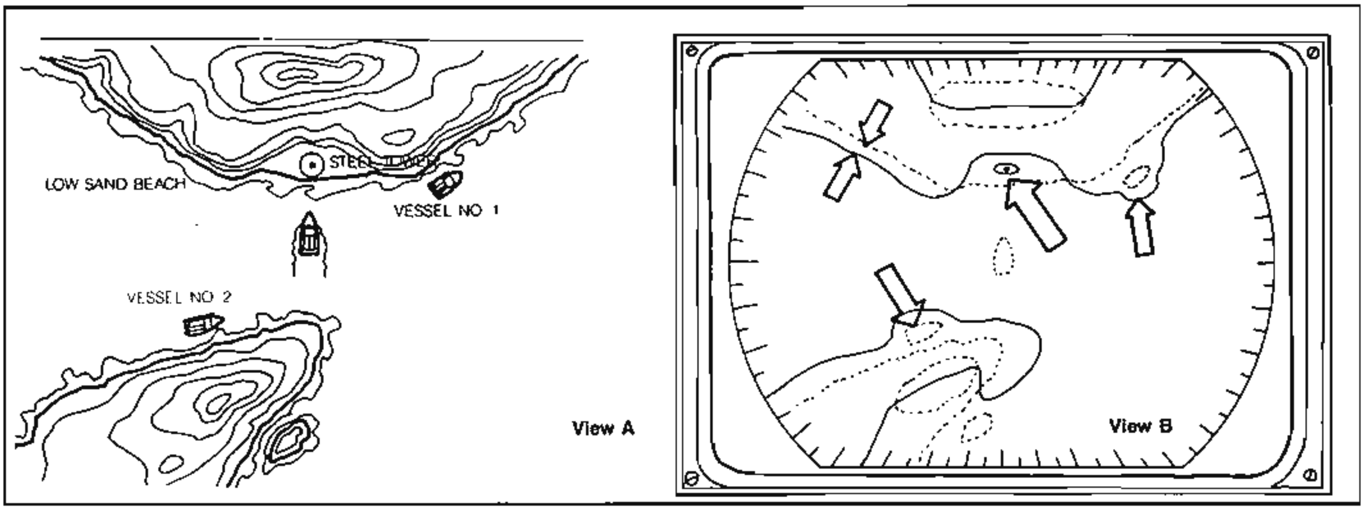


Figure 6-36. Distortion effects. View A shows the actual shoreline shape, View B represents the radar image.

* The beam width distortion causes a spreading of the land bearing. Look at the upper shore of the peninsula. The shoreline distortion is greater to the west, because the angle between the radar beam and the shore is smaller as the beam seeks out the more westerly shore.
* Vessel No.1 appears as a small peninsula. Here the pip has emerged with the land because of beam width distortion.
* Vessel No.2 also merges with the shoreline and forms a bump. The bump is caused by the pulse length and beam width distortions. Reducing receiver gain might cause the ship to separate from the land, provided it is not too close to shore.

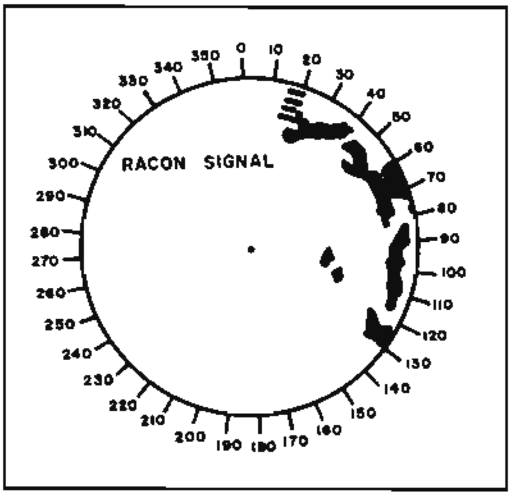


Figure 6-37. Racon signals as observed on a radarscope.

Racons

Racons are radar beacons in the marine radar frequency bands, 2900-3000 mHz and 9300-9500 mHz. When triggered by a vessels radar signal, they provide a bearing by sending a coded reply. This signal received takes the form of a single line or narrow sector extending radially towards the circumference of the radarscope from a point slightly beyond the spot formed by the echo from the lighthouse, buoy, etc. at the Racon site (Figure 6-37). Hours of transmission are continuous and coverage is all around the horizon unless otherwise stated. Their ranges depend on the effective range of the ship's radar and on the power and elevation of the Racon apparatus. Mariners are advised to turn off the interference controls of their radar when wishing to receive a Racon signal, or else the signal may not come through to the vessel.

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NOTES

HAPTER 7

WEATHER

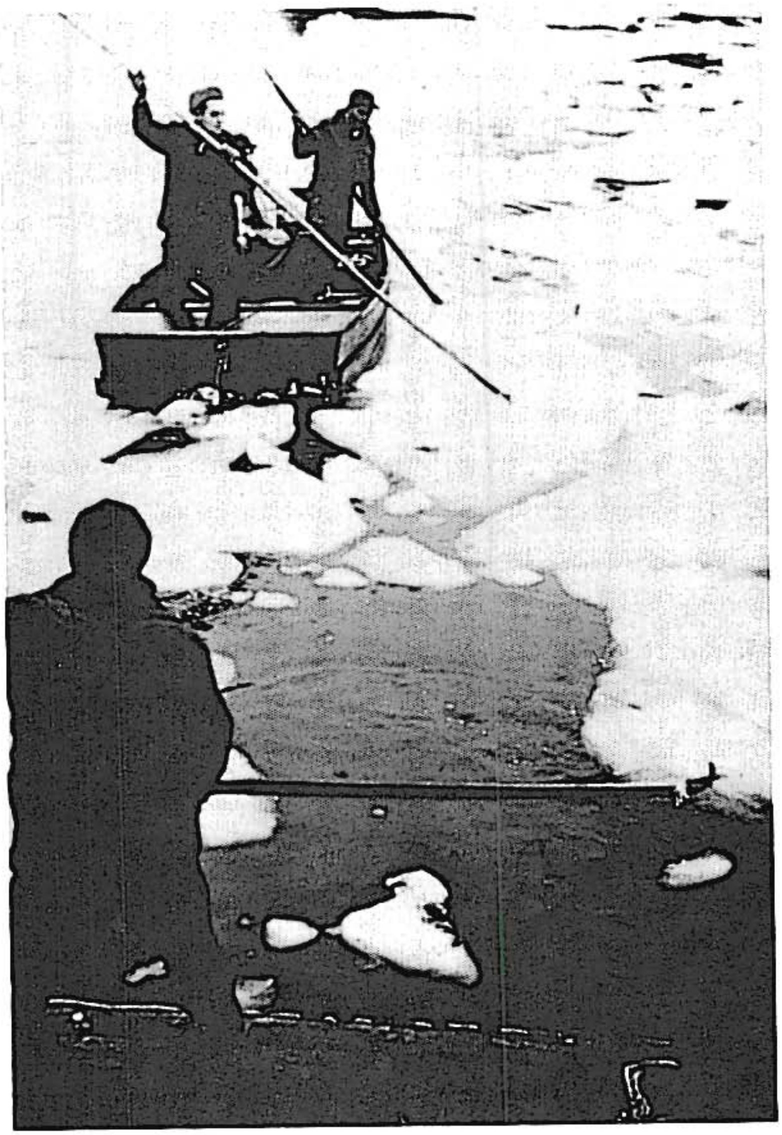


Photo courtesy of Phil Averill

CHAPTER 7

WEATHER

Page

7.1 Introduction

Weather has a great influence on commercial fishing. It often determines if and when you go, and if your trip will be safe. Weather influences the time you need to get to and return from the fishing grounds, and how long you will fish. In many cases, the weather is a major factor determining your trip's failure or success.

Fishermen as a group have a special need to know about weather and sea conditions. As a commercial fisherman, you appreciate how fast weather can change. You have a lifetime of observing the weather and making informal predictions. You must be able to recognize the signs that warn of impending bad weather.

Fishermen sometimes fish far from shore, and because land is out of sight, they can no longer judge the weather by changes over land. Predicting the weather over the open sea involves guesswork, and a wrong guess can easily lead your boat into trouble. Fishing boats still travel much slower than do changing weather patterns.

You need a constant update of weather information and forecasts so that you can relate that information to your own situation, skills, and capabilities. The weather radio gives these constant updates as well as information provided by other fishermen who report their local conditions to land-based weather stations.

Since fishermen are most concerned with wind, fog, ice, waves and swell, this chapter will discuss these conditions as they relate to the Atlantic Coast of the United States.

7.2 Global Circulation Patterns

Weather is the sum of all of the elements of heat, pressure, wind and moisture in the atmosphere. All weather changes are caused by temperature changes in different parts of the atmosphere.

The earth receives heat from the sun during the day and loses heat at night. Over the ocean, a considerable part of the sun's energy is used for the evaporation, rather than the warming, of the sea water. Over land, however, almost all the sun's radiation is used to warm the soil. Therefore, during the daytime the land surface generally warms faster than the sea surface, while during the night the land surface cools faster than the sea surface.

Heat from the sun is not uniform over the earth's surface; the sun is stronger in the equatorial regions than in the polar regions. The atmosphere near the equator becomes warm, expands and rises. In the polar regions the atmosphere cools and contracts, and it moves towards the equatorial regions, counteracting the upward movement of the atmosphere in that region. This atmospheric movement is deflected by the effect of the rotation of the earth. The movement of air becomes even more complicated due to the air passing over the irregular pattern of the earth's land and water with the many differences in heat absorption and reflection.

The atmosphere is constantly moving around the earth. In the United States, which is subject to the prevailing westerlies, differential heating and differences in pressure cause most weather systems to move from west to east, and from north to south.

7.3 Pressure Systems

The unequal heating and the rotation of the earth create prevailing wind patterns that move great air masses around the earth in bands. Spinning off those bands are high whirling masses of air called high-pressure cells (also called highs or anti-cyclones) and low pressure cells (lows, depressions, or cyclones).

In the northern hemisphere, the circulation of air is clockwise around a high. The wind direction is both clockwise and outward from the high's center. Fair weather and light winds are generally characteristic of a high, or anticyclone. Depending on the time of year, location and source region of the high, it can be either cold or hot. An elongated high pressure area is called a ridge.

A high pressure system, called the Bermuda high, prevails from the Atlantic Ocean across the southeast Atlantic Coast into the Gulf of Mexico. It is only disrupted in the winter by intrusions of cold air masses from the north, and in late summer and fall by tropical storms or hurricanes. The air flow around the Bermuda high accounts for the prevailing southwesterly wind direction along the Atlantic Coast during the summer (Figure 7-1).

Landward to the north and west beyond the Appalachians and the Saint Lawrence Valley lies the source of dry, cold arctic and polar air masses, the Polar High. Although the Bermuda and Polar Highs are more or less permanent fixtures, they shift seasonally and affect the weather along the Atlantic Coast.

During the winter, the Bermuda High moves southward, allowing colder air to move downward. In spring and early summer, both the Polar High and the Icelandic Low weaken, and the Bermuda High intensifies and expands over most of the Atlantic Ocean.

Lows develop when air warms and rises, or is lifted by other means, such as rising over a mountain range. The air flow around a low in the northern hemisphere is counterclockwise and inward. Weather near a low, or cyclone, is just the opposite of a high -

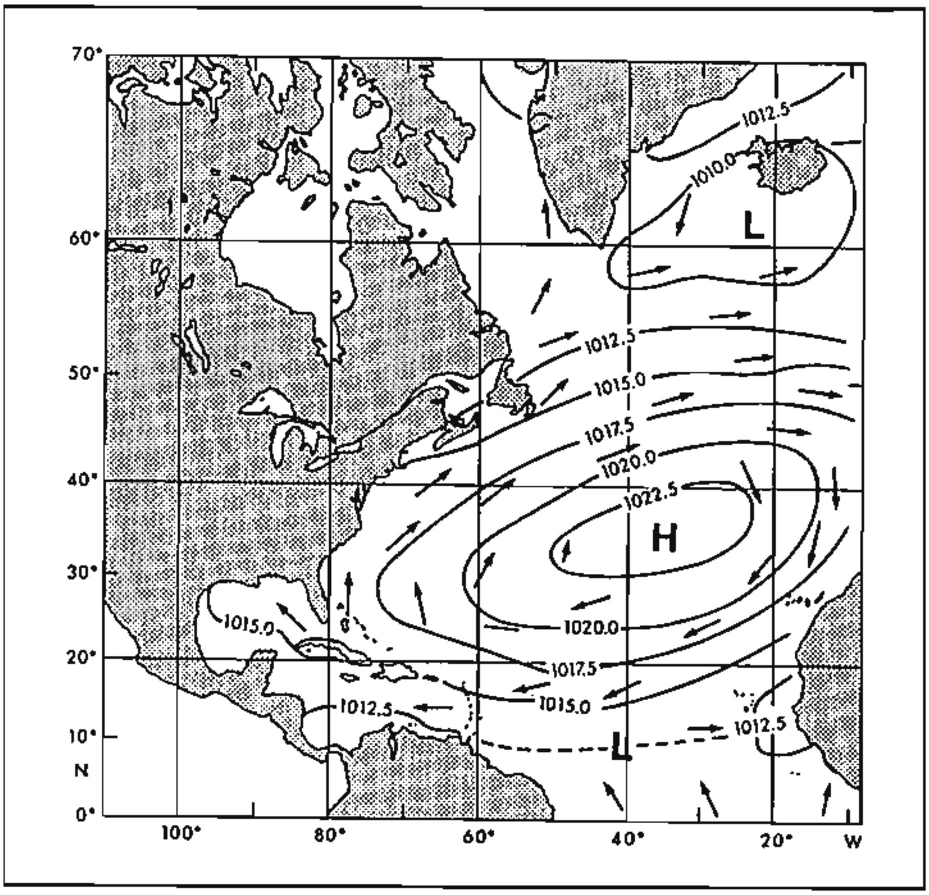


Figure 7-1. The average August pressure (millibars) and wind patterns for the North Atlantic Ocean. Note the locations of the Icelandic low (polar front), and the Bermuda high.

cloudy, rainy, stormy, or if cold enough, snowy and icy. Winds are also stronger around a low. An elongated area of low pressure is known as a trough. There is a semi-permanent low located west of Iceland.

Tropical storms and hurricanes (tropical cyclones) are the most violent low pressure systems, but extra-tropical cyclones can be almost as menacing. Gale-force winds, and in a few cases, hurricane-force winds, have been reported in these rapidly forming and fast-moving lows.

Of the two major pressure systems (highs and lows), the low-pressure system is, by far, the more dangerous to fishermen. Although the winds in the outer periphery of highs may sometimes reach gale force, creating undesirable or dangerous sea conditions, the winds throughout an entire low-pressure system (except in the very center) and their generated waves and swells can be extremely hazardous. Consequently, all mariners should know a little something about the generation, maintenance, and characteristics of lows.

A simple rule of thumb by which to locate a low pressure area is to stand with your back to the wind. Low pressure will be to your left. This is known as Buys-Ballots's Law (See Section 7.10.3).

7.4 Clouds

Clouds give us the simplest indication of weather. Each cloud is formed by water droplets or ice particles. Cloud formation is nearly always related to the upward motion of the air. When air rises, its temperature decreases, and the lower temperatures causes the water vapor to condense, forming small water droplets. Thus condensation is directly related to the water vapor content of the air. There is usually a much higher water vapor content in the lower atmosphere, since it is supplied by the sea surface, lakes and rivers. This is why high altitude clouds are thin and those at a lower level are usually thicker, appearing dense and grey.

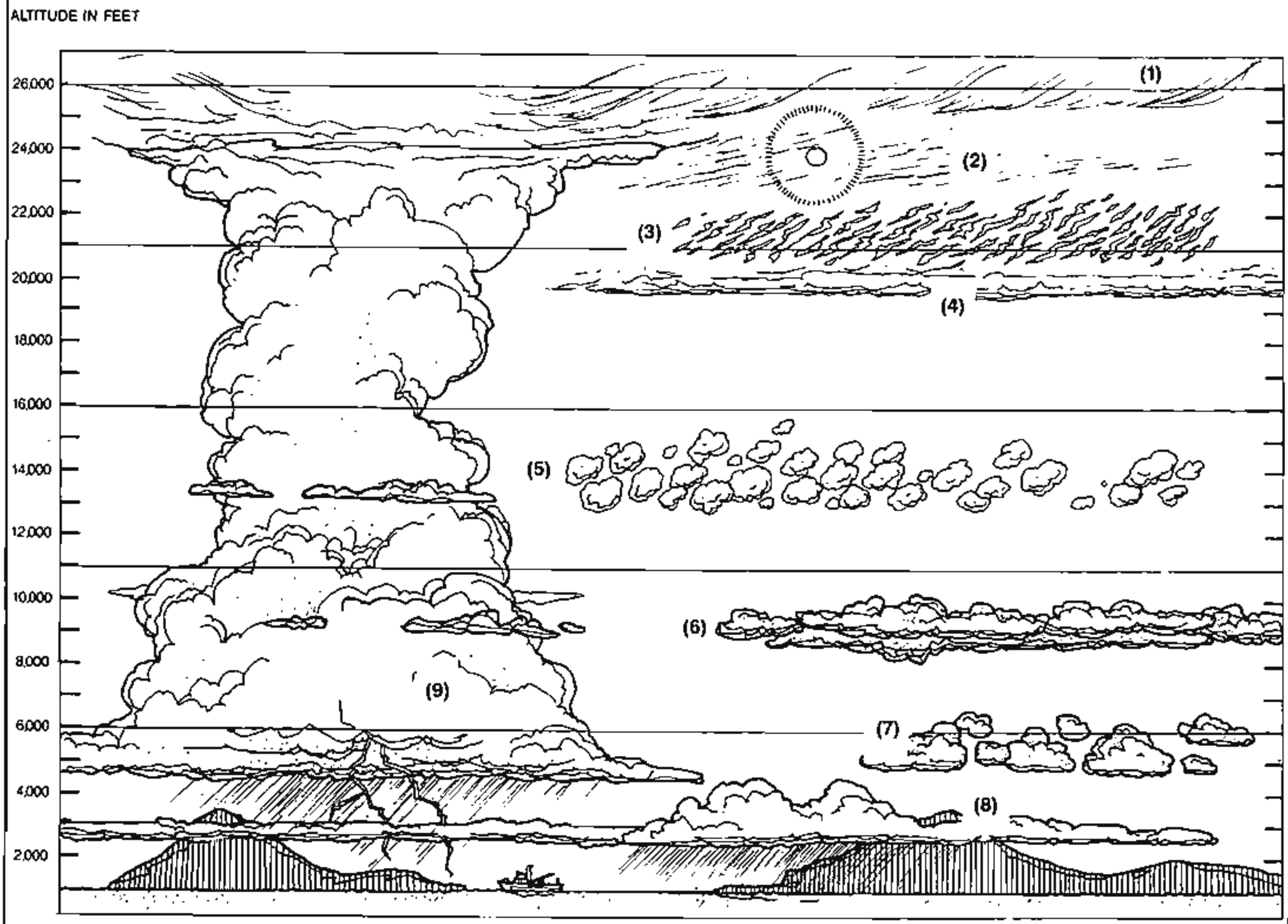
The meteorological classification of clouds is complex; however, they are generally divided into four classes - high, middle and low altitude clouds, and vertically extending clouds. Only low, middle and vertical-development clouds produce weather that affects us directly at the surface. But all the clouds enable us, to some extent, to foretell the approach of, or change in weather.

The thin white clouds which seem motionless are located at a high altitude, about 26,000 feet or more (high altitude cloud). The rather thick, white or grey-white clouds covering the wide expanse of sky are generally located at middle altitude, i.e. higher than 6,000 feet, and may consist partly of ice particles (middle altitude cloud). The thick black clouds are lower and may bring rain; they consist of water droplets and are in continual movement, changing form (low altitude cloud).

On sunny days we often see cotton-like white clouds scattered in a blue sky. These Cumulus clouds, also change form quite rapidly, but they do not generally bring rain.

We may sometimes see very large clouds of the same nature extending to the upper atmosphere, sometimes reaching 32,000 feet or more. These Cumulonimbus clouds frequently bring heavy rain and thunderstorms.

There is strong upward and downward air movement in Cumulonimbus clouds, and their upper strata consists of ice particles. These clouds are carried from one zone to another by the movement of the upper air. They are continually changing form, developing with heavy rain and thunder, and then gradually disappearing. Of all types of clouds, the Cumulonimbus, or thunderstorm, are the most violent and of the most concern to the fisherman (Figure 7-2).



1) Cirrus, "mare's tails."
2) Cirrostratus, white sheet that may cause a halo around the sun.
3) Cirrocumulus, "mackerel sky"
4) Altostratus, gray sheet
5) Altocumulus, white puffs
6) Stratocumulus, dark layered rolls.
7) Cumulus, big tufts of cotton with areas of dark
8) Nimbostratus, rain clouds
9) Cumulonimbus, "thunderheads."

Figure 7-2. The various types of clouds:, where they are located in the atmosphere, and a brief description of each.

7.5 Air Masses

Air masses are huge masses of air with the same temperature and humidity. They are caused when an area of air hundreds of miles wide rests on a sea or a land mass that has a fairly even temperature and humidity. The air takes on the characteristics of the surface below. There are two extreme kinds of air masses: tropical ones, which are warm; and polar ones, which are cold.

On weather maps, air masses are labelled to show where they came from. Air masses from the Poles are labelled P, air masses from the Tropics, T. If they are formed over land, they are labelled c (for continental), if they formed over a sea or ocean, m (for maritime). So an air mass labelled cP came from a polar land mass, like Alaska, for example, while and air mass labelled mT came from a tropical sea, like the Caribbean.

The air masses that most affect the United States and the Atlantic Coast are: continental polar (cP), maritime polar (mP), maritime tropical (mT), and continental arctic (cA) (Figure 7-3).

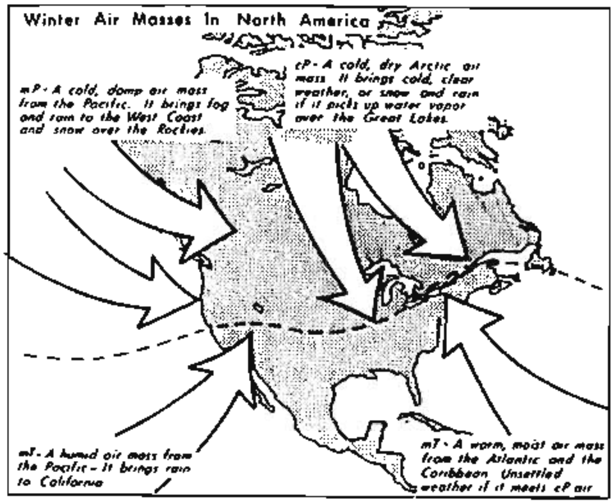


Figure 7-3. The air masses that most affect the continental U.S..

Continental polar (cP) air masses form over Canada during winter and move south and east into the U.S.. These are cold and usually dry air masses (the Alberta Clipper). Continental arctic (cA) air masses originate in the frozen reaches around the arctic icecap or the frigid interior of Siberia in winter. The sheer weight of this extremely cold air moves rapidly south and east into the continental U.S. This is the coldest of all air masses and is usually dry (Artic Express).

Maritime polar (mP) air masses move from the north Pacific Ocean into the northwest U.S., then eastward across the continent. They are originally moist, due to their source region, and not normally as cold as continental polar air masses.

As air masses leave the place where they formed, they become modified, warming up or cooling down, becoming drier or moister, according to the different surfaces they travel over. Meanwhile, fresh supplies of polar and tropical air are being produced at the Poles and in the Tropics.

Very different air masses don't mix together when they meet. There is a polar front in each hemisphere, a boundary between modified polar and tropical air masses. These boundaries are belts of unsettled weather and are referred to as fronts.

7.6 Fronts

The boundary between two air masses of different temperature or moisture content is called a front. There are four kinds of fronts - cold, warm, stationary and occluded. All four are common along the Atlantic Coast.

Cold Fronts

When cold air replaces warmer air, we have a cold front. These generally lie along a northeast-southwest line, moving at speeds of 10 to 20 knots in summer and 20 to 30 knots or faster in winter. Typically, they move from northwest to southeast. You can tell a cold front is on the way when there is a sharpening of winds from the south or southwest, the skies begin to cloud up, and the barometer starts to fall. As the front nears, the clouds appear lower, precipitation (rain or snow) may begin, and winds will increase further, usually from the southwest.

The barometer is still falling. As the front passes, winds shift rapidly to the north or west and become gusty. Precipitation may continue a bit and the barometer will hit its lowest reading. Shortly after the front passes, the barometer begins to rise fairly rapidly, the sky begins to clear, and the temperature drops. Clearing will be slower along the coast and over the water than it will be inland.

Cold fronts form when colder, denser air slides under and replaces warmer, less dense air. As this warmer air is lifted by the colder air, it condenses and forms cumulus and cumulonimbus clouds along the leading edge of the boundary (Figure 7-4). These

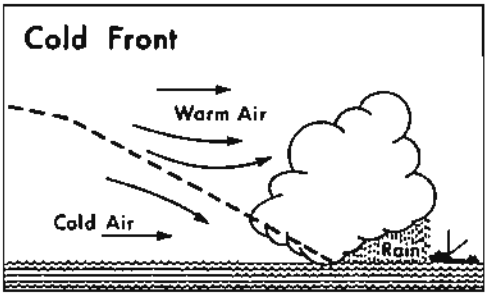


Figure 7-4. Cold front.

cloud formations can produce thunderstorms which can include lightning, hail, heavy rain, strong gusty winds, and even tornadoes or waterspouts (tornadoes over water). Sudden wind shifts, from the south or southeast to north or northwest, signal the cold frontal passage and can easily capsize a small boat, if you are not prepared.

Squall lines are nearly solid lines of thunderstorms. They can develop along a cold front, or even 50 to 100 miles ahead of the front. They form most often in the late winter or spring, but can occur at any time of the year.

The weather in a cold front or squall line, although intense, is seldom long-lasting. After the front has passed, you can usually look forward to clearing skies, lower temperatures, drier weather and higher pressure.

Although weather conditions may improve following the passage of a cold front, sea conditions may not. In fact, seas may actually build and become quite rough and confused. Until winds subside and the air temperature moderates closer to the sea-surface temperature, waters may remain rough for several days.

Warm Fronts

If a warm air mass is replacing a colder air mass, the boundary is called a warm front (Figure 7-5).

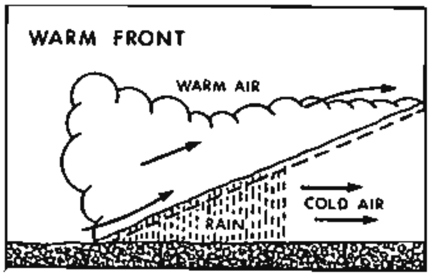


Figure 7-5. Warm front.

These generally lie along a northwest-southeast line and move from south to north at speeds about half that of cold fronts. The effects of a warm front may be felt over 1,000 miles away and more than 48 hours in advance of its passage. High, filmy, cirrus-type clouds precede a warm front. The barometer begins to fall slowly and winds are usually easterly. Whether they are southeast, east or northeast depends on the location of the pressure center. As the front nears, clouds thicken and lower, often bringing precipitation. The barometer keeps falling and precipitation intensifies until the front has passed. Then winds shift to the southwest, and temperatures rise fairly quickly over land. Fog may form at sea if the water temperature is cold enough.

Warm fronts do not have the same violent weather as do cold fronts. However, since cold fronts occasionally follow hard on the heels of warm fronts, the duration of good weather may be short-lived. Relatively calm seas before and after a warm frontal passage also may be temporary, if an approaching cold front looms on the horizon.

Stationary Fronts

Stationary fronts, as their name implies, move very little and are difficult to predict. Sometimes they oscillate back and forth over a ship or station several times. Stationary fronts usually lie in an east-west direction, but sometimes can orient themselves north-south.

The weather associated with a stationary front is similar to that in a warm front - nimbostratus clouds, steady rain or drizzle, fog and low visibility, cool temperatures, and light-to-moderate wind. Weather along a stationary front may persist for days, up to a week in some instances, if no weather systems move in and displace it. Because of the slow movement of these storms, thunderstorms can form along the frontal boundary, producing locally heavy rainfall for an extended period of time.

Occluded Fronts

Occluded fronts form when a cold front overtakes a warm one, lifting the warm air mass off the surface of the earth. Weather associated with this front is a combination of the best and worst features of the two fronts (Figure 7-6).

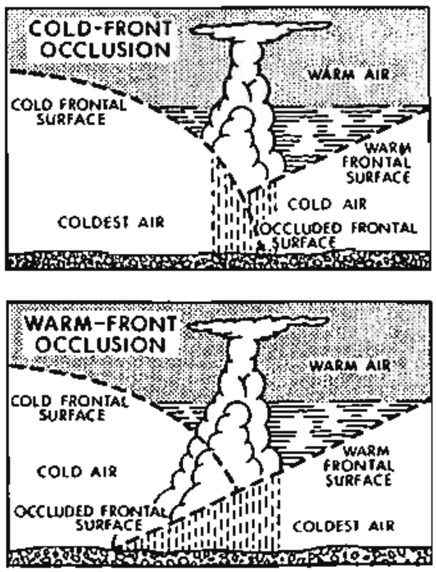


Figure 7-6. In the upper diagram, the cold air behind the cold frontal surface is colder than the cold air ahead of the warm frontal surface; this forces the warm front up. In the lower diagram, the cold air ahead of the warm frontal surface is colder than the cold air behind the cold frontal surface; in this case, it is the cold front that is forced up.

Nor'easters

Many of the storms along the Northern Atlantic Coast are caused by the large temperature difference between the cold arctic air streaming southward off the southern New England coast and the warm waters of the Gulf Stream. The warmer water adds energy to the cold air, causing a circulation to begin which may built to a nor'easter (so called because of the direction from which the strongest winds come). These storms, which are common in New England and off Cape Hatteras, often sit just off the coast for a number of days - three, according to folklore - producing weather that varies in each local area.

7.7 Land and Sea Breezes

Land surfaces warm and cool more rapidly than do water surfaces; therefore, the land is warmer than the sea during the day. Wind blows from the cool water to the warm land, resulting in a sea breeze, so called because it blows from the sea (Figure 7-7).

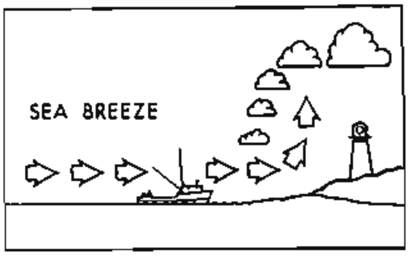


Figure 7-7. Sea breeze.

At night, air over the land cools quickly, falls, and blows out over the warmer water. This creates a land breeze (Figure 7-8).

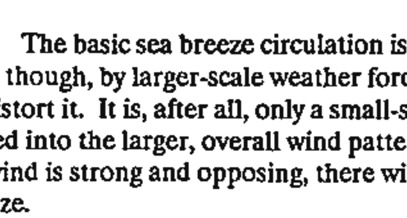


Figure 7-8. Land breeze.

The basic sea breeze circulation is often modified, though, by larger-scale weather forces which tend to distort it. It is, after all, only a small-scale wind inserted into the larger, overall wind pattern. If the overall wind is strong and opposing, there will be no sea breeze.

Clouds, too, play a part in the development of a sea breeze. Extensive cloud cover decreases the temperature difference between land and water, retarding or even preventing a sea breeze from developing.

Valleys or indentations along a shoreline can cause a sea breeze to penetrate further inland than it would otherwise, following the contours of the valley. Along the Connecticut coast, for instance, a sea breeze sometimes reaches as far inland as Hartford. Areas on a bay may have, in effect, two sea breezes - one from the bay and the other from the ocean beyond. This happens often in Buzzards Bay.

Barring other influences, the greater the temperature difference between land and water, the more likelihood there is of a sea breeze. And the prime season for this is spring. Ocean temperatures still retain their winter chill while the land mass is already warming. By midsummer, the frequency and intensity of sea breeze days begins to diminish. Finally, by mid or late fall, as the days shorten and the sun fails to heat the land to its previous high temperatures, sea breezes disappear.

7.8 Thunderstorms

A thunderstorm brings the most violent weather a fisherman or boater can experience - fierce lightning, torrential rains, battering hail, hurricane-force winds, and monster seas. Some people have survived to tell of their experiences; others haven't.

Thunderstorms are common along the Atlantic Coast in every season but winter. Between 20 and 30 occur each year. When winter thunderstorms do occur, they are usually well offshore.

Various weather situations produce these storms. In spring and early summer, when cold Canadian air moves into the region, displacing the relatively warmer moist air, thunderstorms often form in the vicinity of the front separating these widely different air masses. Normally, the storms form a line 100 to 200 miles ahead of the front in the warm air. These are "squall lines" and they deserve a boater's respect. From a boat, the approaching squall line looks like a wall of rolling, black cloud. If there is time, you should head for a safe mooring. Violent thunderstorms, torrential rains, and extremely high, shifting, and gusty winds are on the way. Occasionally these can be as high as 50 to 60 knots over the water.

Passing warm fronts can also trigger thunderstorms, which usually move from the south and southwest. These are rarely severe. Wind gusts on the water's surface tend to be less than 25 knots.

More dangerous are those storms associated with an occluded front (the point where a cold and warm front intersect - see section 7.6). They can bring high winds, hail, and a great deal of lightning for relatively long periods.

Yet another kind of storm, an air mass thunderstorm, is a summer phenomenon that occurs inland on a clear day when air rising off the earth's surface is warm and moist enough to become unstable. Occasionally, these air mass thunderstorms drift over coastal waters, usually from the north. They can contain tremendous wind or none at all, but betting on thunderstorms is risky.

A little-known, but particularly dangerous phenomenon, called a microburst, gust front, or downburst, is possible in a thunderstorm. These sudden downdrafts produce explosive wind shifts, far greater than a simple gust, reaching speeds of 100 mph or more, and have been known to capsize large vessels. They are especially dangerous because they can occur miles from the parent storm cloud, and because there is little advance warning. However, a watchful eye may be able to predict an approaching microburst by the approach of building waves.

Lightning is one of the most dangerous features of a thunderstorm at sea. Although lightning strikes on boats are rare, they do happen, and boaters have been severely burned and even killed. Small wood or fiberglass boats, especially sailboats, are particularly vulnerable, because their masts and radio antennas can act as lightning rods. These boats don't have the automatic grounding protection of large, metal-hulled vessels. A proper grounding system can greatly minimize your chances of being struck by lightning. Follow the methods described in the National Fire Protection Associations Lightning Protection Code of 1977. Sources of more detailed information on grounding procedures and other safety measures are listed in the references.

A thunderstorm's electrical activity can be used to tell something about the storm's distance and intensity. Because light travels about one million times faster than sound, the distance in miles to a thunderstorm can be estimated by counting the number of seconds between lightning and thunder, and dividing by five (sound travels about 0.2 miles or 0.3 kilometers per second).

A simple AM radio can also warn of impending thunderstorms and lightning problems. In addition to producing static in harmony with lightning discharges from an approaching storm, the radio can tell a boatman when the charged water area associated with a thunderstorm surrounds his boat. According to Thorn Bacon in *Weather for Sportsmen* (The Hearst Corporation, N.Y., N.Y., 1974), an AM radio will produce loud hissing or sizzling noises (a bacon frying sound) when a storm's "electrical shadow" overtakes a boat.

You should heed warnings of an approaching storm, and take precautions long before the rain comes.

If you are caught in a thunderstorm, follow the recommendations outlined below, even if your boat is properly grounded:

* Remain in the center of the cabin of a closed boat when possible.
* Don't go in the water or swim until the storm passes.
* Keep away from any metal fittings aboard the boat, particularly those which are connected to the lightning conductive (ground) system.
* Disconnect the major electronic equipment not being used.
* Don't touch the radio equipment or wiring.
* On small boats, lower the radio antenna and keep a low profile below the freeboard.
* Ground small boats with a length of battery cable; clamp it to the wire stays of the mast and allowed it to hang over the side into the water.
* If the boat is near shore, seek refuge under a bridge.
* After any lightning storm passes, check the electrical system and compass. Lightning strikes have been known to alter the magnetic characteristics of a boat.
* If you must ride out a thunderstorm in a boat, try to avoid shallow water; it does not insulate a boat from the earth as well as deep water.
* If you feel your body hair stand on end or your skin tingle, lightning may be about to strike you. Drop to your knees and bend forward, placing your hands on your knees. Do not lie flat.

A person struck by lightning receives a severe shock and may be burned externally as well as internally. However, the body retains no electrical charge and may be handled safely. A person apparently "killed" by lightning can often be revived by prompt, prolonged mouth-to-mouth resuscitation and cardiac massage (See Chapter 12, Medical Emergencies).

7.9 Tropical Storms and Hurricanes

Tropical storms and hurricanes are the "glamorous" low pressure systems (tropical cyclones) that affect the Atlantic Coast. Tropical storms are assigned names when wind speeds reach 34 knots (39 mph). Tropical storms are upgraded to hurricanes when wind speeds reach 64 knots (74 mph).

A hurricane is born at sea. It is formed when moist, warmed air at the water's surface is forced aloft and replaced by cooler, denser surrounding. The air blows spirally inward around the center, or "eye," of the storm. A hurricane can generate winds of over 85 knots and deep-ocean waves 50 feet or more in height. When the storm's forward momentum carries it over land or cooler water, it is no longer fed by warm moist air, and the storm quickly dissipates.

In an average year, more than 100 disturbances with hurricane potential form in the Atlantic, the Gulf of Mexico, and the Caribbean. Fewer than ten reach the tropical strom stage, and only about six mature into hurricanes. On the average, three of these strike the United States. "Hurricane season" extends from June 1 to November 30; however, the greatest likelihood of hurricanes is in August and September.

Fortunately, hurricanes no longer strike without warning. NOAA's earth-orbiting satellites have all the tropical cyclones under constant surveillance long before they develop into hurricanes. When they travel to within several days of landfall, weather advisories begin to carry hurricane watch and warning messages.

A hurricane watch is established when a hurricane threatens a coastal or inland region. It means that hurricane conditions are a possibility. When a hurricane watch is issued, everyone in the area should listen for further advisories and be ready to respond quickly to hurricane warnings.

A hurricane warning is issued when hurricane conditions are expected within 24 hours, and identifies coastal areas where winds of at least 64 knots are expected. *Take immediate precautions.* If the path of the hurricane is unusual or erratic, the warnings may precede the onslaught of the storm by only a few hours.

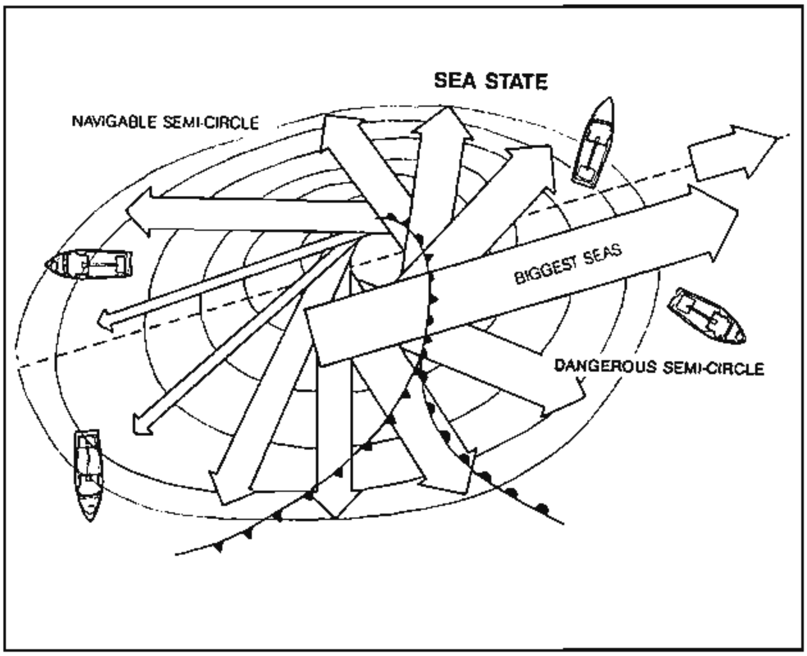


Figure 7-9. Every storm has a dangerous and a navigable semi-circle.

7.10 Maneuvering to Avoid the Storm Center

The safest procedure, with respect to lows, is to avoid them. If action is taken sufficiently early, it is a simple matter to set a course that will take the vessel well outside the track of the storm.

7.10.1 The Dangerous and Navigable Semicircles

If you find yourself caught within the storm area, however, the proper action to take depends in part upon your position relative to the storm center, as well as upon its direction of travel. It is customary to divide the circular area of the storm into two parts. In the northern hemisphere, that part to the right of the storm track (facing in the same direction in which the storm is moving) is called the dangerous semicircle (Figure 7-9).

It is considered dangerous because: (1) the wind speed is intensified by the forward motion of the storm; (2) the direction of the wind and sea push the vessel into the path of the storm; and (3) because the greater wind speed in this semicircle creates higher seas.

The area to the left of storm track is called the navigable semicircle. In this region, the storm-generated wind is in opposition to the storm's forward motion, and blows the vessel away from the storm track (in the forward part of the semicircle).

7.10.2 Which Semicircle are you in?

Plotting the movement of the storm center should indicate which semicircle you are in. However, storm positions issued in weather bulletins are unreliable because of the lag between the time of observation and the broadcast. The use of radar eliminates the time lag, but may not provide a true indication of the storm center. Perhaps the most reliable guide is the wind (Figure 7-10).

7.10.3 Using the Wind to Locate the Storm Center

According to *Buys Ballots Law*, an observer with his back to the wind has the center of the low on his left (in the northern hemisphere) and somewhat in front of him (115 degrees is a good approximation). This value applies when the storm is still several hundred miles away. Closer to the center, 090 degrees is a better figure (Figure 7-11).

While the vessel can still make good headway, a course should be selected to take it as far as possible from the center of the storm. If the vessel can move

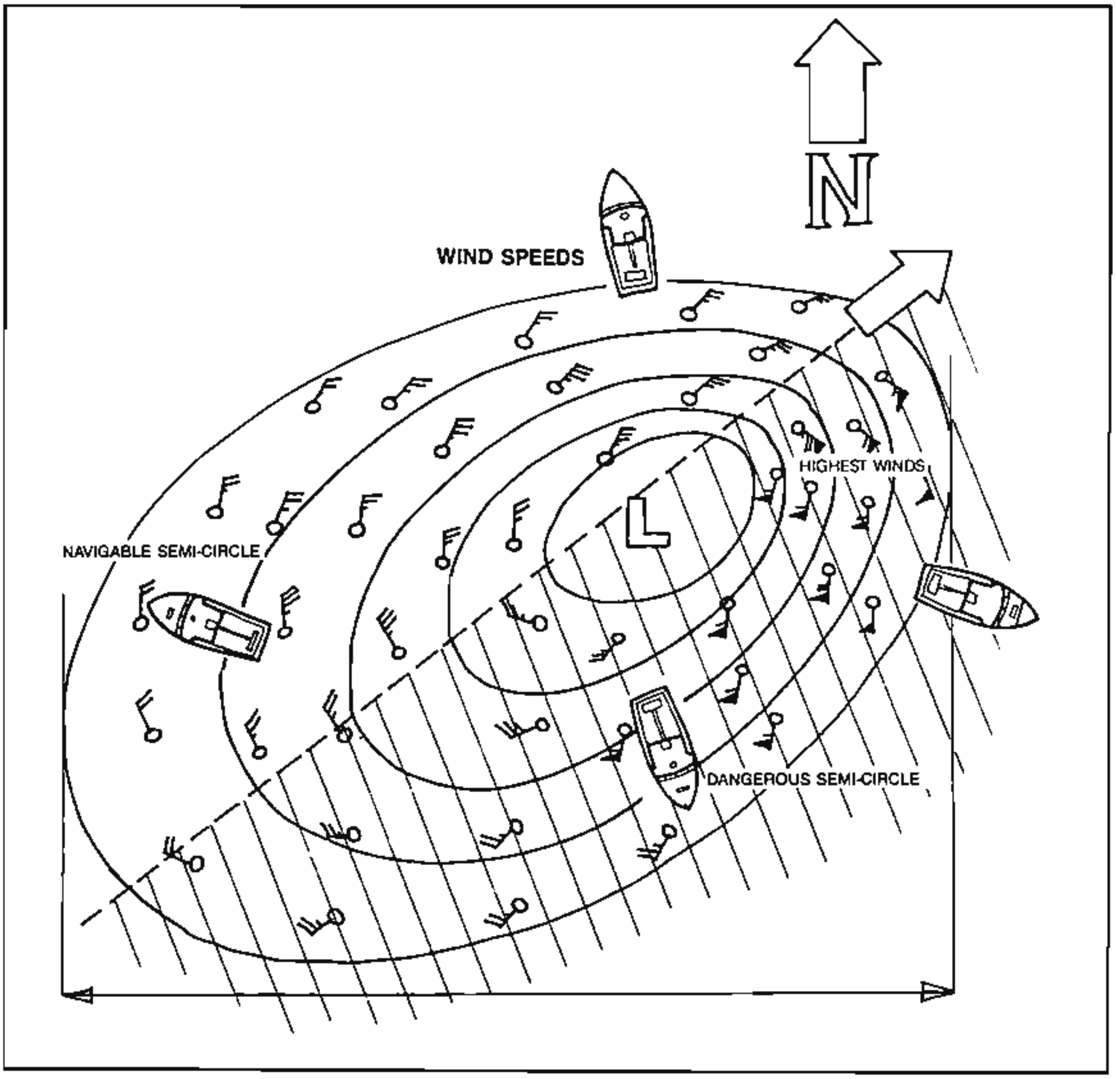


Figure 7-10. Wind speed is the most reliable guide as to what semi-circle of the storm you are in.

faster than the storm, it is a simple matter to outrun the danger as long as sea room permits. When the storm is faster than you are, however, matters are trickier. The problem is to select a course that will put as much distance between you and the storm center as possible. This is best determined by means of a relative motion plot.

7.10.4 Practical Rules for Maneuvering to Avoid the Storm Center

Assuming you are unable to reach port and have sea room in which to maneuver, and that you know where the storm center is, its probable track, and which semicircle you are in - the following rules apply.

The Right or Dangerous Semicircle

Bring the wind on the starboard bow (045 relative), hold course and make as much way as possible at a safe speed.

The Left or Navigable Semicircle

Bring the wind on the starboard quarter (135 relative), hold course and make as much way as possible at a safe speed.

On the Storm Track Ahead of the Center

Avoid the center by the best practicable course, keeping in mind the tendency of lows to curve northeastward.

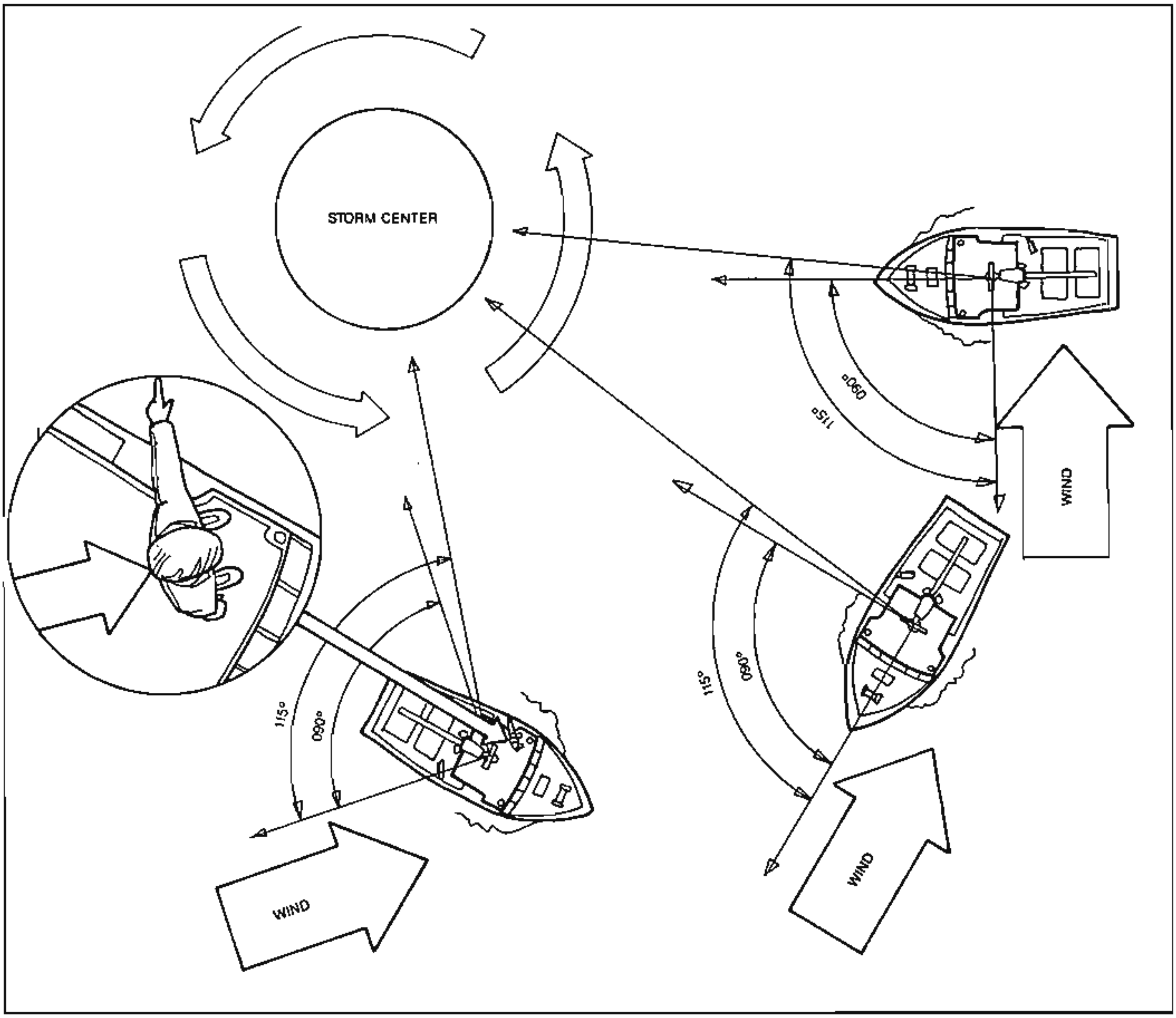


Figure 7-11. Use Buys Ballots Law to help you determine where the storm is in relation to you.

Obviously, none of the standard rules should be followed when doing so heads a vessel on a collision course with a lee shore, other vessels or any other hazard, or results in the vessel rolling dangerously in the seaway. It may also be inadvisable to head toward a strong current or a shoal that could cause steep seas.

Figure 7-12 shows a fully developed low with a partially occluded frontal system. To further illustrate the importance of the "dangerous" and "navigable" semicircles, let's look at the weather that vessel A would experience in the dangerous semicircle, as opposed to the weather that vessel B would experience in the navigable semicircle.

Vessel A is struck by both the warm and the cold fronts, which produce increasing, gusty, rapidly shifting winds, heavy rain, and confused seas. Vessel B avoids both fronts, experiences lower seas (because the wind and the movement of the storm are acting against one another), and avoids most of the rain (Figure 7-12).

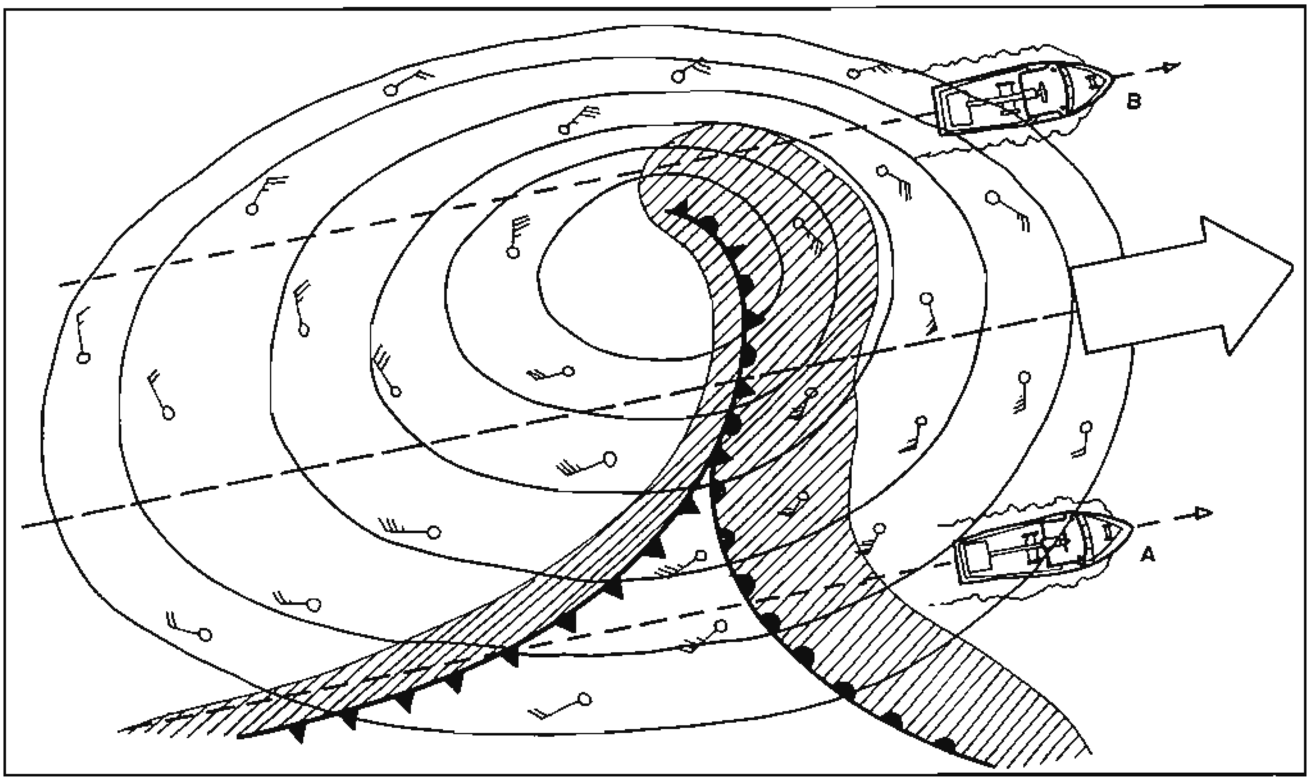


Figure 7-12. Vessel A is struck by both the warm and the cold fronts in the dangerous semicircle, where vessel B avoids both fronts, experiencing lower seas and less rain, in the navigable semicircle.

7.11 Fog

Fog is a surface-based phenomenon that occurs when the air is cooled to the dewpoint temperature (the temperature at which moisture condenses). Many types of fog occur along the Atlantic Coast, but the most prevalent are *sea smoke* and *advection fog.*

Sea smoke is almost exclusively a winter phenomenon, consisting of wispy steam rising off the ocean's surface as cool, dry air passes over the warmer surface water. The air closest to the water warms and absorbs moisture, rising through the chilly air above, which cools it, and the water vapor condenses out as fog. Northerly or northwesterly dry winds in late summer, fall, and early winter cause this kind of fog, and it is most likely to occur in early morning or evening. It reduces visibility, but it is rarely as thick as summer advection fog.

You are likely to run into *advection fog* anywhere along the coast in spring and summer, especially in July. And the further east you go, the more likely you are to encounter fog, since the Labrador current cools that water more. It is caused by conditions just the opposite of those that bring sea smoke: warm, moist air from the southwest passes over the cooler water surface, chilling the air and condensing the water in it (Figure 7-13). This kind of fog, which can persist until the weather pattern changes, can be thick, reducing visibility to near zero.

Fog can trick you in a number of ways. Though it sometimes comes with some warning, it can just as easily shut down all at once, catching you unprepared. Always check offshore conditions before you leave. If fog threatens to overtake you at sea, keep an eye on distant objects as a way of tracking its progress, and know your position at all times.

Finally, fog fools the ears as effectively as the eyes. Since fog muffles sound waves, it is easy to mistake the direction of warning bells or horns when you cannot see them. Have a radar reflector and foghorn on board.

Some sailors use a sling psychrometer to predict fog. This tool measures the difference between temperature and dew point. However, it is useful only after you have left port. For long-range information, listen to VHF reports on visibility upwind.

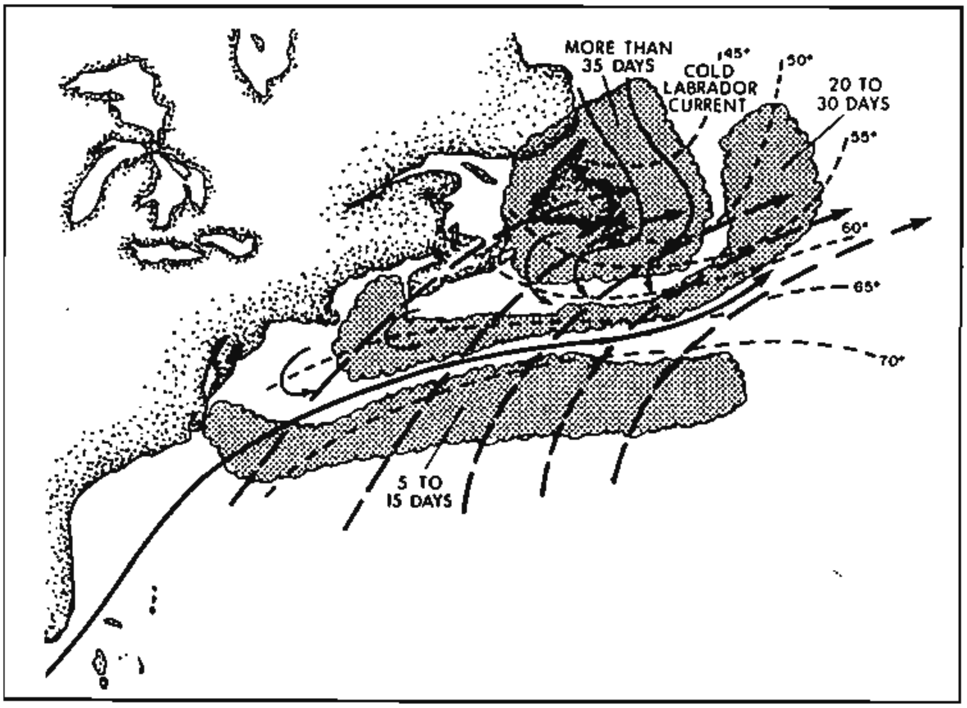


Figure 7-13. Fog over the western North Atlantic during the summer months. The shaded areas are fog; numbers in the middle refer to the average number of days with fog during the period June-August. Dashed lines are sea-surface temperature (isotherms) in degrees Farenheit. Dashed arrows are streamlines of the prevailing surface air currents. Solid arrows represent the cold Labrador Current and the warm Gulf Stream.

7.12 Ice Accretion

Ice forming on boats at sea is a serious hazard, since the added weight of ice reduces freeboard and jeopardizes the stability of the vessel. When ice forms on the mast, rigging, and superstructure, the vessel may become top-heavy and difficult to handle in heavy weather (see Chapter 11 on Stability).

Ice can form on a vessel as the result of freezing rain, arctic frost smoke or freezing spray. Freezing rain can cover a vessel with fresh-water glaze ice, but the accumulated weights are unlikely to endanger the vessel directly. Arctic frost smoke, which occurs when the air is a least 16°F colder than the sea, is often confined to a layer only a few feet thick. Fishermen in northern waters refer to it as white frost when the top layer is below the observer's eye level, and as black frost when it extends above the observer.

A portion of the small water droplets freeze immediately when they come in contact with a part of the vessel. The other portion stays liquid for a short time before it freezes. The result is an accretion of opaque white rime ice with air inside. This rime ice is easier to remove than the clear ice because it is porous.

Freezing spray is the most dangerous form of icing. It occurs when the air temperature is below the freezing temperature of the sea water (about 27°F). The spray freezes on the exposed surfaces of the vessel and produces clear ice or glaze. At lower air temperatures, the ice may be opaque.

Freezing spray is common in air temperatures below 28°F, and in winds of 18 knots or more. The lower the air temperature and the stronger the wind, the more rapid the accumulation of ice. The rate of ice accumulation depends on the amount of spray coming from wind-and vessel-generated waves, the design and loading of the vessel, and on the vessel's speed and heading relative to the wind and waves. Accumulation of ice will, by itself, increase the rate of accumulation, since ice increases the surface area of the rigging, masts, and rails. Figures 7-14 a-d will help you determine the rate of icing in different weather conditions.

A combination of very low air temperatures and strong winds are the worst conditions for ice accretion. Although you may not always be able to avoid these conditions, you may be able to head for warmer air and warmer water. If you seek shelter in the lee of the land, you may have less icing, since the wind speed and spray is less. Experience with your vessel in icing conditions will help you determine where you will fish and under what weather conditions your boat will be able to perform.

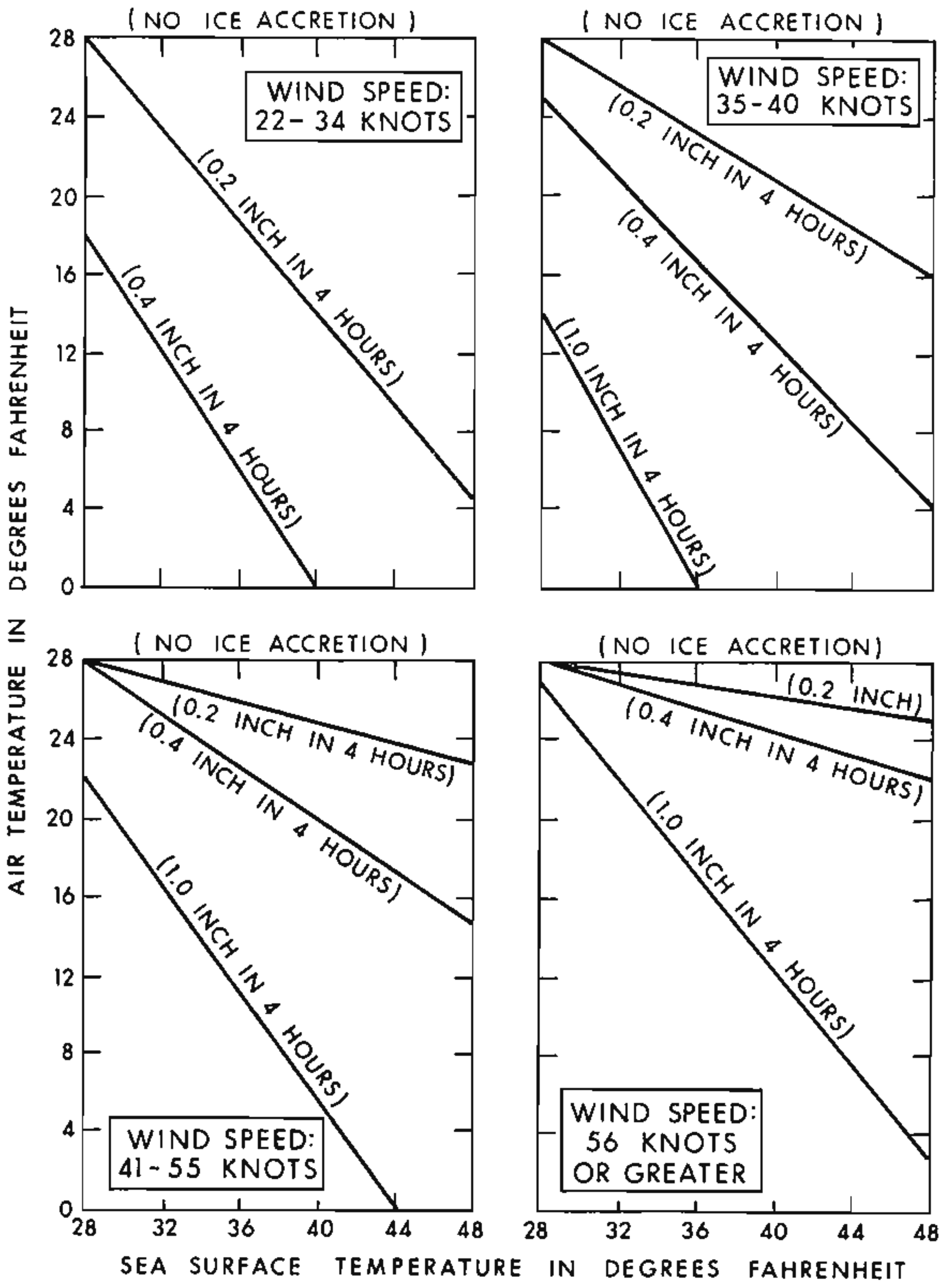


Figure 7-14. Graphs for estimating rate of ice accretion; (a). Wind speed 22-34 knots; (b) Wind speed 35-40 knots; (c). Wind speed 41-55 knots; (d) Wind speed 56 knots or greater.

7.13 Wind and Waves

The longer and harder the winds blow, the higher the waves become. The three most important factors determining wave height are the wind speed at the sea surface, the fetch (the stretch of water over which the wind blows), and the duration (the length of time that the wind has blown).

The Beaufort Scale (Table 7-1) enables you to estimate the wind speed from the appearance of the sea.

BEAUFORT WIND SCALE

Beaufort Number or Force	Wind Speed Knots	mph	km/hr	World Meteorological Organization Description	Effects Observed at Sea
0	under 1	under 1	under 1	Calm	Sea like a mirror
1	1-3	1-3	1-5	Light Air	Ripples with appearance of scales; no foam crests
2	4-6	4-7	6-11	Light Breeze	Small wavelets; crests of glassy appearance, not breaking
3	7-10	8-12	12-19	Gentle Breeze	Large wavelets; crests begin to break, scattered whitecaps
4	11-16	13-18	20-28	Moderate Breeze	Small waves 0.5 - 1.25 meters high, becoming longer; numerous whitecaps
5	17-21	19-24	29-38	Fresh Breeze	Moderate waves of 1.25 - 2.5 meters taking longer form; many whitecaps; some spray
6	22-27	25-31	39-49	Strong Breeze	Larger waves 2.5 - 4 meters forming; whitecaps everywhere; more spray
7	28-33	32-38	50-61	Near Gale	Sea heaps up, waves 4 -6 meters; white foam from breaking waves begins to be blown in streaks
8	34-40	39-46	62-74	Gale	Moderately high (4-6 meters) waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked steaks
9	41-47	47-54	75-88	Strong Gale	High waves (6 meters); sea begins to roll; dense streaks of foam; spray may reduce visibility
10	48-55	55-63	89-102	Storm	Very high waves (6-9 meters) with overhanging crests; sea takes a white appearance as foam is blown in very dense streaks; rolling is heavy and visibility is reduced
11	56-63	64-72	103-117	Violent Storm	Exceptionally high (9-14 meters) waves; sea covered with white foam patches; visibility still more reduced
12 ·	64 and over	73 and over	118 and over	Hurricane	Air filled with foam; waves over 14 meters; sea completely white with driving spray; visibility greatly reduced

Table 7-1.

7.13.1 Wind Chill

The risk of frostbite is not to be taken lightly (see Chapter 12, Medical Emergencies), and temperature is only one point to consider. As the wind speed increases, the chance of freezing exposed flesh greatly increases. Under certain conditions, flesh may freeze within 30 seconds.

The cooling power of wind is called *equivalent chill temperature* or *wind chill*. If you know (or can guess) the temperature and wind speed, you can use Table 7-2 to determine the wind chill. For example, assume an air temperature of 10°F, and a wind speed of 30 mph. Read across the table and find that this combination of temperature and wind have the same effect on exposed flesh as a temperature of -33°F.

Equivalent Temperatures (°F)*

Wind Speed (mph)	CALM	35	30	25	20	15	10	5	0	-5	-10
	10	22	16	10	3	-3	-9	-15	-22	-27	-34
	20	12	4	-3	-10	-17	-24	-31	-39	-46	-53
	30	6	-2	-10	-18	-25	-33	-41	-49	-56	-64
	40	3	-5	-13	-21	-29	-37	-45	-53	-60	-69

*°C = .556 (°F-32)

DANGER ZONE
FLESH MAY FREEZE
WITHIN 1 MINUTE

Table 7-2. Wind Chill.

7.14 Forecasting

Reading the weather is not only basic to good seamanship, but it is invaluable in ensuring that your trip turns out well. Anyone can learn to foresee calms, foul weather, changing wind direction, and wind velocity. In areas where high and low pressure systems follow one another in quick succession, as in New England, it pays to know how to anticipate the patterns before you put to sea. Two days of improving weather conditions after a depression, for instance, may be only a ridge between two lows.

Experience is a good teacher, though sometimes a harsh one. The time to familiarize yourself with the weather in your area is before you meet it. The basics include learning to read your barometer, typical cloud formations, and a newspaper weather map (Table 7-3). The satellite photos your favorite TV forecaster shows on his program can also help you understand how weather patterns form. If you want to go beyond these, the books listed in the references will be helpful.

Once on the water, it is helpful to know how to read the clouds (see Clouds, section 7.4). Keep a weather eye out for those that may foretell a squall or thunderstorm. Note any steady increase in wind or sea, and remember that when wind and tidal currents are opposed, they can build waves steep enough to broach a boat.

There are several useful sources of marine weather information. None is infallible! Use them, but don't rely on them totally. They cover large areas, and weather conditions in your area can change quickly and drastically.

NOAA Weather Radio is a service of the National Ocean and Atmospheric Administration of the U.S. Department of Commerce. It provides continuous broadcasts of the latest weather information direct from the National Weather Service in major cities. Taped weather messages are repeated every four to six minutes and are routinely revised every one to three hours, and more frequently if necessary.

Typical marine radios receive these broadcasts. And although the frequencies are not normally found on the average home radio, a number of radio manufacturers offer special radios that have them. The range of these transmissions can be as far as 40 miles from the antenna site.

	Fair weather	Falling temp.	Rain/Snow	Weather deteriorating	Rising temp.	Fog
Wind shifts to W or NW	•	•				
Decreasing Clouds	•					
Barometer steady or rising	•					
Heavy dew or frost at night	•					
Light winds, clear sky	•	•				
Thickening, lowering cirrus clouds				•		
Rapidly moving lower clouds				•		
Chaotically moving clouds				•		
Barometer falling steadily			•	•		
Approaching front			•	•		
Cloud bases increasing	•					
Cold front has passed	•	•				
Darkening western sky			•	•		
Increasing S wind			•	•	•	
Overcast night sky					•	
Wind shifts to S				•	•	
Warm front has passed					•	
In advance of warm front			•	•		•
Southerly flow of warm air over colder water						•

Note: While they should never be considered more than the roughest of guides in forecasting, weather signs can have some predictive value, particularly when several point the same way.

Table 7-3. Some useful weather signs.

Marine forecasts for the coastal area seaward are broadcast on a 24-hour basis and updated at least every six hours. When necessary, they are updated more frequently. Forecasts for Georges Bank and offshore waters southward are also transmitted.

In addition to standard forecasts, advisories and warnings are issued when conditions warrant them. They are classified as follows:

Small Craft Advisory

Threshold wind conditions are 26 knots in winter, 21 knots in summer, reaching as high as 33 knots.

Gale Warning

Winds within the range of 34 to 47 knots.

Storm Warning

Forecast winds of 48 knots and above. If the winds are associated with a hurricane, storm warnings indicate forecast winds of 48 to 63 knots.

Hurricane Warning

Issued only in connection with a hurricane, it means that winds of 64 knots or higher are forecast for the area.

Special Marine Warning Bulletin

Issued whenever a severe local storm or strong wind of brief duration is imminent and not covered by existing warnings and advisories. To receive it, keep tuned to a NOAA Weather Radio station or to the Coast Guard and commercial radio stations carrying weather information.

NOAA's coastal marine forecasts include another important item of information for fishermen and boaters: wave height forecasts. These are for average wave conditions to be encountered in open coastal waters unless otherwise indicated. Values are for waves produced by wind and do not take into account areas of normally higher or steeper waves found near bars, shoals, or restricted entrances to sounds or inlets. Occasionally, waves can combine and peak out at twice the forecast value. Where possible, swell waves are separately described.

All Coast Guard stations broadcast severe emergency weather warnings (Special Marine Warning Bulletins) on VHF-FM frequency 156.8 MHz (Channel 16).

Commercial AM and FM radio stations, as well as television stations that include marine information in their weather forecasts, are other sources. Radio stations near busy harbors carry the most complete weather information. They may not be as up-to-date as the NOAA or aerobeacon reports, however, and because of time constraints, they don't permit the forecaster to predict alternative weather patterns if his primary forecast does not hold true.

Forecasting Aids

There are two pieces of equipment that can help you forecast the weather in your area: a barograph and a weatherfax. The barograph is a recording barometer that allows you to see the trends of the barometer over the previous day (Figure 7-15). This is particularly helpful, since it is the change (rise and fall) of the barometer that is the tell-tale of changing weather.

Radiofacsimile (Weatherfax) recorders are capable of providing pictures, charts, maps and satellite images - weather information that is far more detailed than voice broadcasts (Figure 7-16). Fortunately, today a Weatherfax machine is small and inexpensive enough for fishermen to have on their vessel. Radiofacsimile equipment consists of a radio receiver, a facsimile recorder, and an FM to AM signal converter. You only need a simple wire or whip antenna.

FAX transmitter sites are located along the Atlantic coast. Table 7-4 shows the sites, frequencies (Hz) and areas covered.

```
NORTH ATLANTIC

Frobisher, Canada
Area: Hudson Strait, Hudson Bay, East Coast
      Baffin Island, Foxe Basin, Lancaster
      Sound, Queen Elizabeth Islands
Freq: 3253,7710,15644

Halifax, N.S. Canada
Area: Western North Atlantic
Freq: 4271,6330,9890,13510,122.5

Boston, MA
Area: Western North Atlantic
Freq: 8502,12750

Brentwood, NY
Area: Western North Atlantic
      (Transmissions beamed toward
      Caribbean, Central and South
      America)
Freq: 9290,9389.5,11035,17438.5

Lewis, DE
  (National Weather Center)
Area: North Atlantic
Freq: 4233

Norfolk, VA
  (U.S. Navy Fleet Broadcast)
Area: North Atlantic Ocean
Freq: 3357,4975,8080,10865,16410,20015

Washington, D.C.
  (U.S. Air Force Broadcast)
Area: North Atlantic Ocean
Freq: 4793.5,6912.5,10185,12201,13479.5,14671.5
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Table 7-4. FAX transmitter sites, frequencies (kHz), and areas covered.

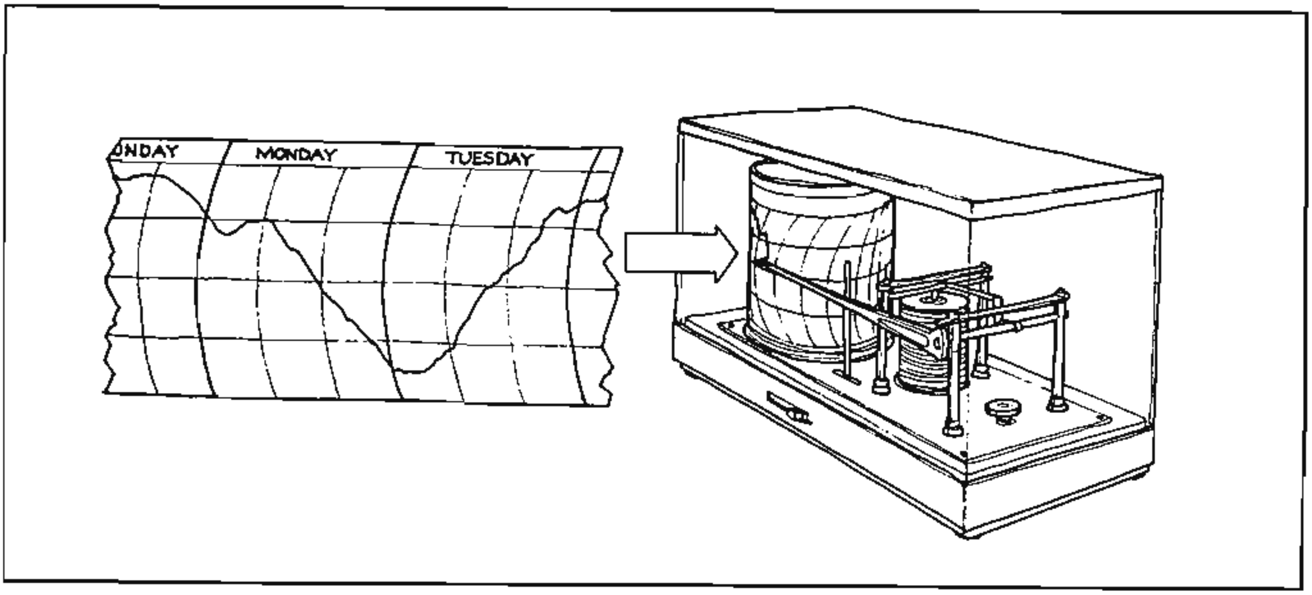

Figure 7-15. The barograph is a recording barometer. It provides a clear indication of the trend of barometric pressure.

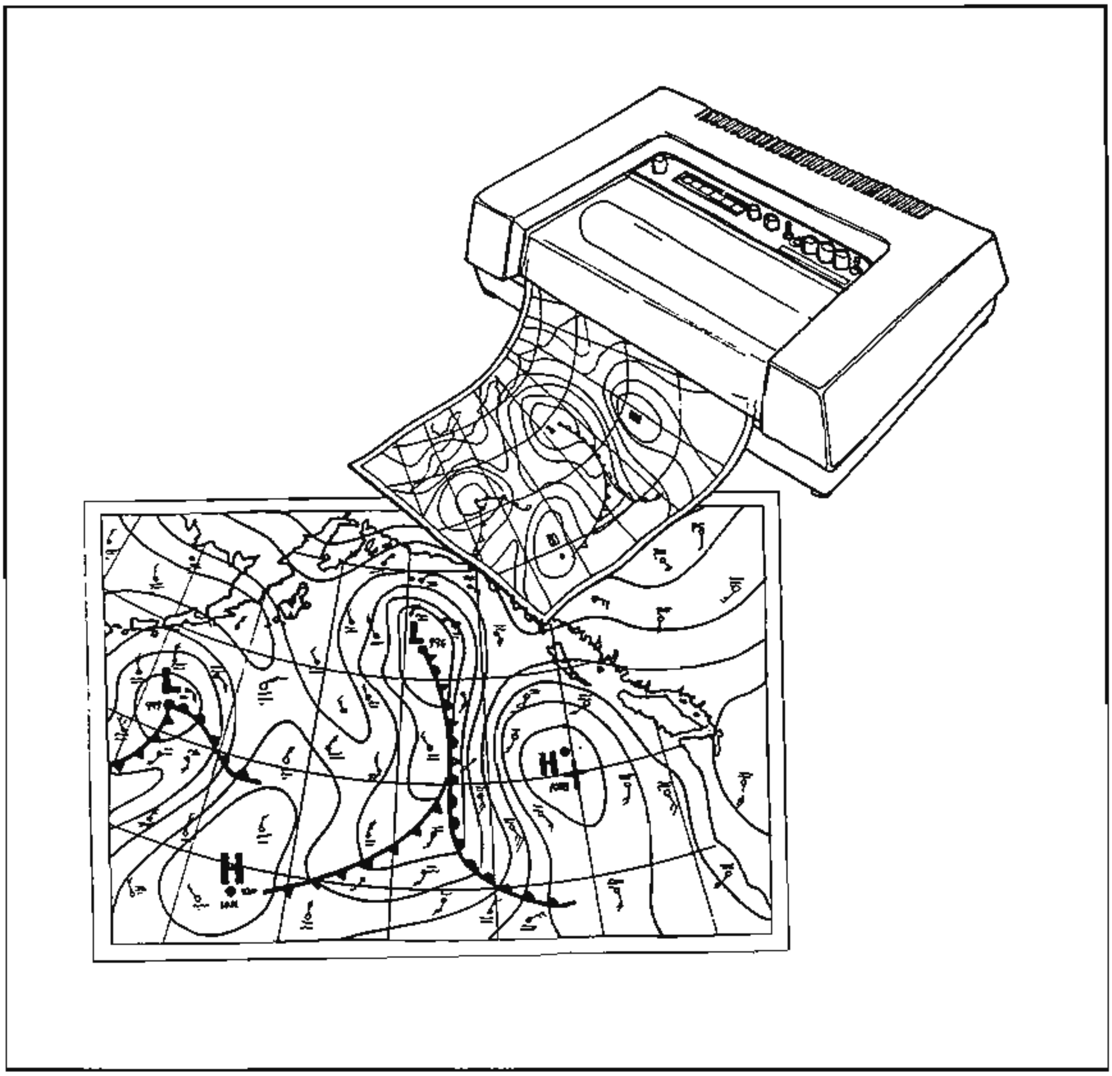

Figure 7-16. A radiofacsimile recorder is a vital piece of equipment for fishermen.

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NOTES

CHAPTER 8

VESSEL SYSTEMS AND ENGINEERING

Photo courtesy of VIMS Sea Grant Marine Advisory Program

CHAPTER 8

VESSEL SYSTEMS AND ENGINEERING

8.1 Machinery Systems

8.1.1 Proper Use of Machinery & Safeguards

Don't use a machine unless you know how to use it correctly. If you're a new hand, you must wait until the captain or rigman gives you permission before operating winches or lifting appliances (Figure 8-1).

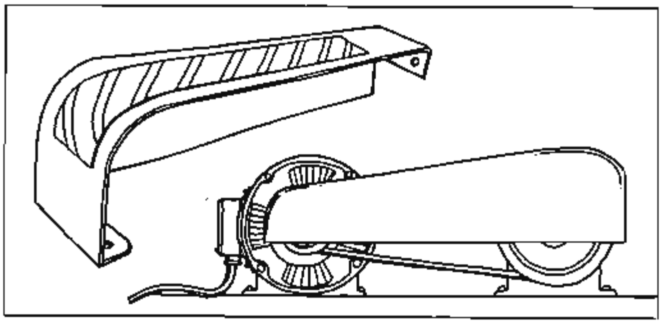

Figure 8-1. Never remove a machinery guard without the captain's permission.

Proper operation includes the use of all safeguards provided with the equipment. Never remove safety guards or covers from mechanical equipment without permission from the captain and then only if the machinery is stopped.

Remember that you are responsible for taking care of the vessel and its equipment. If you don't understand how to use a machine, ask for help, and if you see a defect in the equipment you are using, report it.

Whenever you use a machine, do so in a way that ensures your safety, that of your crewmates and your vessel.

8.1.2 Machinery Installations

Fence or guard engines, electric motors, gearing, chain and belt drives, friction clutches, and shafts that can cause injury to personnel, as long as the guards do not impede the safe operation of the vessel.

Insulate or screen off hot exhaust pipes that can cause accidents or burns. Keep hot surfaces separate from flammable liquids and combustible material, since the heat may ignite those materials.

Permanently mark with their purpose all machinery controls, gauges, pumping systems, valves, cocks, air pipes, inlets, and sounding pipes. Mark handwheels to show the direction of closure, generally clockwise.

Keep a safe and free access to all machinery spaces that may require servicing at sea.

Secure all spare machinery or heavy equipment to prevent movement in heavy seas. Keep engine room floor plates, ladders, and handrails free from grease and oil. All machinery platforms should have handrails or hand holds, and you should paint all machinery space gratings, handrails, guardrails and toe boards yellow.

Secure floor plates in place and install non-skid on these surfaces. Maintain all machinery space ladders, and make sure they have handrails and non-skid on the rungs. Any machinery spaces that are periodically unattended at sea should have proper alarm, detection and machinery control systems.

Single Person Operation

Vessel with a single operator should have a way to climb back on board after a fall overboard. A lifeline can be designed to stop the engine when a person falls overboard.

Keep a complete log of engine condition, servicing, inspections, repairs, etc.

8.1.3 Engines and Propulsion

Loss of power at sea can quickly put a vessel in danger. At best, it means loss of fishing time and costly repairs. At worst, it may mean catastrophe. Have the manufacturer's operating and maintenance manuals aboard, and follow them.

Run the engine at designed loads and speeds, since it will last longer than if it is idled or run under excessive speeds and loads.

Keep the engine room absolutely clean. Only then can you spot leaks or other potential hazards.

Do not allow rags or other flammable materials to accumulate, and dispose of used rags in a metal container with a lid.

Keep the fuel and lubricating systems clean. Your routine maintenance should include changing oil and fuel filters and sea strainers. Keep fuel tanks clean; most fuel supply problems are the result of water or sediment in the tanks. Additives to prevent biological fouling should be used in the tanks. Check the day tank for water condensation every day. Use corrosion prevention mechanisms, such as zinc anodes in fresh and raw water systems.

Stow and secure equipment and tools against movement. Keep passageways clear. Install handholds wherever possible, to prevent accidents involving hot surfaces and moving parts. Only remove guards, fences and safety devices during repairs, and replace them immediately when repairs are done. Post signs in areas of danger in the engine room; paint the signs in high-visibility colors.

8.1.4 Seawater Cooling Systems

You should have at least two ways to supply cooling water to the main propulsion machinery. The sea inlets and discharges for the cooling system should be fitted with shutoff valves located as near the shell plating as practicable. Such valves can be controlled locally in manned spaces.

Inlet and discharge valves in unmanned machinery spaces should be remotely operable from an accessible location outside the compartment in which they are located. Clearly mark all valve controls; have them readily accessible, and provide them with an indicator that shows whether the valve is open or closed (Figure 8-2). Only the captain should operate engine room valves.

All cooling system seawater suctions for essential machinery should have strainers that can be cleaned without interrupting the water supply.

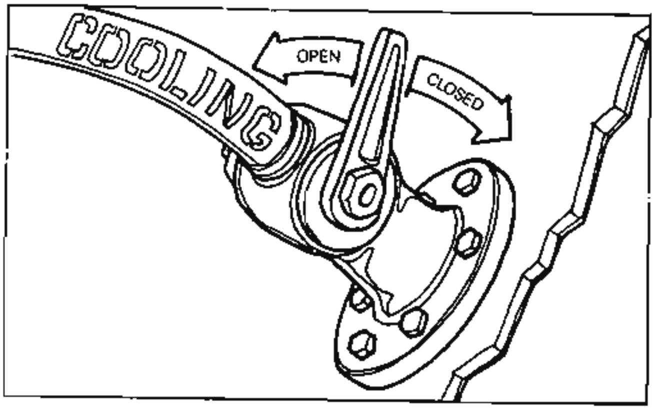

Figure 8-2. Through hulls should be marked to show their function and means of closure.

Cooling system piping should be rigid wherever practicable. If you must use flexible pipe to accommodate vibration, it should be an approved type, capable of standing up to seawater, and secured with double, stainless steel hose clamps.

Inspect all piping annually, and replace flexible pipe regularly, because it gives little warning of failure. Install flow to warn of leaks or problems in the system.

8.1.5 Lubricating and Hydraulic Oil Systems

You must understand the safe operation of hydraulic equipment before you use it, including stopping the equipment by means of control handles or brakes and using fluid cutoffs to control leaks. Keep fittings tight.

If there is a leak that can't be stopped immediately, find a means of catching and containing the fluid to prevent its spread.

If leaks occur, they must be promptly reported and repaired, and spilled hydraulic fluid cleaned from the deck.

Check lubricating oil levels daily, and keep the sump topped up to prevent overheating. Install audible alarms on the oil pressure and temperature gauges to indicate a failure in the lubrication system. Since cleanliness is vital to the lubrication system, install the filters in an easily accessible place, and change them frequently.

Hydraulic tanks should incorporate low level alarms, with oil reserved in the lower half of the tank for an emergency loss of hydraulic oil. To prevent spills, don't overfill the hydraulic tank.

Cleanliness is also essential in a hydraulic system. Dirt hinders the operation of valves, and destroys motors and pumps. Use only clean oil, and change filters regularly. Drain water condensation daily.

Piping Runs

Circulating oil systems are subject to very high pressures, and leaks can be dangerous. Pipes and hoses should be made of suitable material and fitted securely to prevent movement and wear. Regularly inspect them for signs of wear, especially at joints or fittings. If hose coverings are worn to show the underlying mesh, replace them.

Before using pipes, joints and fittings for the first time, test them hydrostatically at twice their rated pressure; then clean and blow dry them.

Hose is used to accommodate vibration at moving components, but never use hoses to replace hard piping runs. Hose is a likely source of failure, and a definite source of contamination as rubber sloughs off inside. Do not run hoses over engines or hot surfaces. Do not install connecting joints where a leak will fall on hot surfaces or on electrical connections. Protect hoses that lay against corners from wear caused by vibration. Keep fittings to a minimum, and keep them tight.

Hydraulic Do's and Don'ts

* Keep oil clean.
* Don't start pumps without an adequate oil supply.
* Clean suction strainers frequently.
* Watch temperatures. If you can't touch it, it's too hot, and you have a problem that you need to investigate. Hydraulic oil deteriorates at temperatures over 140 degrees F and causes premature wear of machinery.
* Install sheet metal shields around hydraulic valves or fittings that are located near the engine; they will contain atomized oil in the event of a leak.

Beware of the fire hazard posed by hydraulic oil. It is more flammable than diesel.

In working with machinery, remember that you can't hold a load with hydraulics. Since hydraulic cylinders "creep" as oil leaks within the system, you need to engage the shaft brake to hold a load.

Never weld on a hydraulic cylinder. The heat distortion will permanently damage it.

8.1.6 Rudder and Propeller

All nuts on rudder and propeller fittings must be locked in place, since repairs are impractical at sea. Inspect rudder and propeller gear for signs of wear at annual dry-dockings. Any increase in vibration in the steering system is a sign of trouble, and should be investigated. Repair stern gear at the first signs of wear, since problems in rudder or stern tube bearings will increase rapidly. Measure and record stern bearing and rudder stock clearances at every dry docking.

You must render the rudder and propeller incapable of moving when repairs are underway. In port, a crewman preparing to engage the rudder or propeller should check that the stern is clear.

Gearbox

Gearbox failure usually occurs because of inadequate oil level or a failure to change oil at regular intervals. Check and change the oil regularly. Your vessel should have alarms to warn of low gearbox oil or overheating.

Propeller Shaft

Lock in place all nuts on the propeller shaft flanges and stern tubes. Stern gland packing must be properly installed and regularly inspected for leaking or overheating.

8.1.7 Exhaust System

Exhaust pipes should be water-jacketed or effectively insulated. Do not connect together the exhaust pipes from several engines. Run them separately to the atmosphere, unless they are arranged to prevent the return of gases to an idle engine. Also, do not connect boiler uptakes and engine exhaust lines. Annually inspect exhaust systems for fire and fume hazards. If the engine room makes you sick, you may have a carbon monoxide hazard. Inspect lagging or insulation where exhaust pipes pass through combustible materials. Exhaust pipes that pass through the side of a vessel must be watertight and prevent the inflow of water.

Engine Exhaust and Crank Case Vents

Open drain valves on main and auxiliary engines when the engines are not operating; this will drain any water that has accumulated in the lines. Close the valves when the engines are running.

8.1.8 Compressed Air Systems

Inspect pressure relief valves in compressed air systems frequently. Make provisions to regularly drain condensation from air systems, and to minimize the possibility of oil getting into these systems. Install an approved, flexible connection between the air compressor and the air receiver.

8.1.9 Fuel System

When you are transferring fuel, avoid overfilling and overflow into adjacent tanks; this can jeopardize stability. Always keep in mind the effects of fuel in tanks on trim and stability (Section 11.3.3).

Place pans under every fuel oil pump and filtersthat will keep escaping oil from coming in contact with heated surfaces (Figure 8-3).

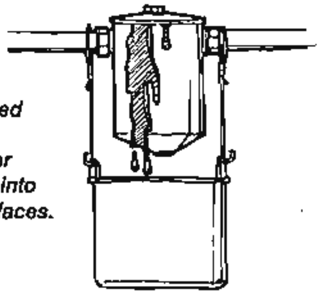

Figure 8-3. A means of catching leaked or spilled oil must be provided wherever there is danger of escaping oil coming into contact with heated surfaces.

Check fuel oil filters at least once every 72 hours of continuous operation. Drain day tanks periodically to remove the sludge that accumulates on the tank bottom. Service centrifuges according to manufacturer's instructions. Diesel engines require clean fuel.

8.1.10 Fueling Precautions

* Tie up the vessel securely.
* Extinguish open flames and cigarettes near the fueling operation.
* Ensure that the tank vents are clear and aimed overboard, away from other vessels.
* Know which deck flanges are for oil, and which are for fresh water. To avoid mistakes, mark fluid types on filler flanges (Figure 8-4).
* Be sure that you are filling the tank with *clean* fuel.
* Hold fuel nozzle securely in the filler pipe.
* Maintain a constant watch to monitor fuel flow and to prevent spills.
* Close the filler pipe after fueling.
* Clean spills on deck. Dishwashing detergent is an excellent oil cleaner.
* Place overfill containment dams or buckets under fuel oil vent terminals when fueling or transferring fuel.

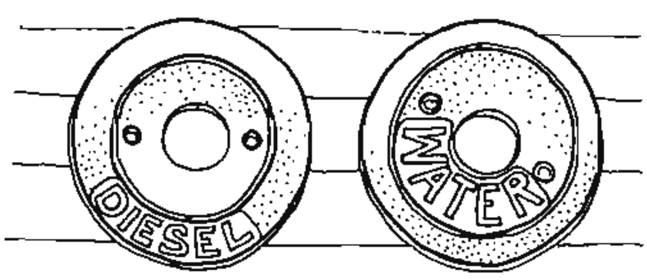

Figure 8-4. Deck flanges should be marked to avoid mistakes in filling tanks.

Tank Shut-offs

Each fuel tank should have a shut-off valve that can be secured in the event of fire or leakage. Shut-off spindles should extend to deck level so the tank valve can be closed without entering the engine room.

Tank Sight Glasses

Only use sight glasses made of heat-resistant Pyrex and protected by expanded metal guards. You can also get steel or bronze sight glass tank attachment valves. These valves, in addition to being heat resistant, are also equipped with internal check valves that prevent a leak if the sight glass is broken.

Fuel Lines

Fuel hoses should be made of an approved, flexible material that is flame and heat resistant, and not of substances, like plastic, that would quickly melt in the event of a fire. Secure all fuel lines to prevent any movement. Pipe bends should be smooth, and padded where they pass over sharp edges. Do not install pipes where they will be walked on or hit.

Pipe joints should be metal to metal, and leaks must be eliminated.

Topping Up

It is advisable to keep fuel tanks topped up as much as possible to reduce tank condensation and free surface effect.

Tank Entry

If someone is going to enter a fuel tank to clean it, be sure that the tank is free of gases. Otherwise you run the risk of asphyxiation or explosion, if sparks or flame are nearby.

Tenders Carrying Gasoline

Tenders carrying gasoline on deck must observe special precautions.

* Mark the area around gasoline tanks where smoking, open flames and electrical appliances are prohibited.
* Maintain a constant watch during all fueling operations.
* Watch the fuel flow, not the meter, and don't rely on estimates of how much fuel will be required. A captain who thinks he needs 500 gallons may only require 300, which creates the possibility of a spill if the crew is not alert.
* Check your insurance policy to be sure it covers dispensing fuel.

8.1.11 Deck Machinery

Gear systems, including catheads, a horizontal rope winding drum on a trawl winch, winches, tackle, nets, etc., should provide safe and convenient operation. Wires and warps should be of adequate strength for the anticipated loads. Moving parts of winches and of warp and chain leads which may present a hazard should have adequate guards. Repairs to winches, tackle, and lifting gear should be to original standards of construction. Repairs should be tested using dead loads before the gear is placed back in service.

Protection should be provided around winch foundations to prevent a person from being caught or dragged under. Sheaves should be guarded where practicable. Blocks and sheaves should be properly lubricated at regular intervals. All shackles used aloft should be a locking type, or should be seized (secured so they cannot come loose accidentally).

Handholds, rails or guards should be placed around winches and drums where practicable. Gear stowed on deck should never be allowed to obstruct the working area around winches and drums.

When the gear is running, there should normally be at least two men on deck. Winch operators should not leave winches unattended with gear running, or with a load suspended.

If a winch has local and remote controls, they should be arranged to prevent simultaneous operation. The operator should have a clear view of the winch and adjacent working areas.

Winches should have a means of stopping and holding the safe working load. Brakes should be proof-tested with a dead load in excess of the maximum safe working load. Brakes should be easy to adjust. Every winch drum which can be uncoupled from the drive should have a separate brake.

Experienced hands should normally operate winches and other deck machinery, especially in bad weather. New hands should practice in calm conditions, under supervision. It is advisable to mark the function of winch controls on or near the equipment (e.g. forward, reverse, stop).

The winch operator is directly responsible for the safety of gear-handling operations. If he has any doubt about safety, he should stop the winch immediately and refuse to proceed until safety has been assured. He must be competent in all phases of winch operation and know the safe working loads of his equipment.

If you get overwinds or bad wraps on the winch drum, clear the drum immediately. To clear bad wraps on a vessel equipped with level winds, let the wire out past the problem area and reset the level wind to wrap evenly. Keep in mind that bad wraps or overwinds cause accelerated wear on wire rope. Ropes subjected to bad wraps or overwinds should be inspected and may have to be replaced.

Never operate a winch with less than 1 1/2 layers of wire on the drum. The upper half-layer locks the wire and keeps it from unreeling. At the bitter end, wire should be attached to the drum with clamps or shackles.

If you are operating a winch with a cathead, do not lay on too many turns or you may get an overlap. If the line shows any tendency to overlap, remove a turn. Stand as far back from the cathead as possible to prevent being pulled onto it, and stand at right angles to the direction of pull if at all practicable. Coil down the line as it comes off of the cathead, but never step into the coil.

Leads, Blocks and Sheaves

Leads should be made as fair as possible, and lead blocks kept to a minimum to reduce friction. Fixed lead blocks are preferable to swinging blocks, but correct angles must be maintained. All blocks must be regularly inspected and maintained. Sheaves and rollers should be lubricated frequently. Shackles and eyes should be examined for wear. Swinging blocks should be tied up when not in use to prevent injuries and wear in the eyes. If there is a problem at a block, crewmen should observe a safe means of getting to it.

When "corrugations" or grooves appear in block sheaves, the blocks are not turning freely and wire rope will be quickly damaged (Figure 8-5).

Be careful of-

- Slick decks around the winches.
- If the wire is loose or fouled on the drum, it may cause the winch to reverse itself by allowing the wire to bind, or may cause the load to jump, endangering crewmen and rigging.
- Loose lines or materials that may foul the wire.
- A loose or defective control handle.
- Slack in the brake.

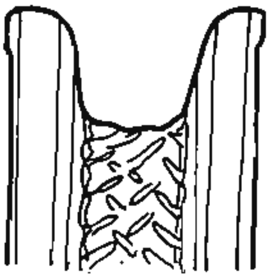

Figure 8-5. Corrugated sheaves can damage wire rope.

Winches, Tackle and Lifting Gear

Operation of winches, tackle, lifting gear and other types of moving machinery must be in accordance with rules established by the vessel's operating plan. Using such equipment is the job of experienced crewmen, especially in rough conditions. New hands should practice under supervision and in calm conditions, and be certified as competent by the captain before using such equipment on their own.

All guards provided for the moving parts of winches, hoists and other gearhandling machinery must be in place.

Mashed hands, arms or feet are common injuries where wire or line runs over blocks or around winches and drums, so take care. Do not attempt to use your hands, feet or hips to guide wire on a winch drum, or to free a fouled wire. Always use a cable guide and watch for shackles and bridles which can catch the guide and move it unexpectedly.

Be sure there is someone at the controls whenever you work around running gear. Stand clear of running rigging so the motion of the boat doesn't throw you on the wire or line, and don't grab the running gear if you must clutch for support.

Don't stand in the direct line of pull of a wire or line under tension in case it parts and snaps back. Always leave at least a layer and 1/2 of wire on a winch drum to "lock" it in place.

Lifting and hoisting gear must always be used within safe working load ranges. Stand well clear of a load in the air, especially when the boat is rolling. Never stand between the load and the rail or a fixed object against which you could be crushed. Remember that rocks or other debris may fall out of the cod end. Always have a hiding place in mind in case something breaks loose.

If you are operating a winch or hoist, be sure everyone is clear of the danger zone before applying a load, and never leave the equipment unattended when it is running or when there is a load in the air. Make sure snatch blocks are closed and properly latched when used. Never pass a suspended load over another crewman. Be sure the area around the controls is unimpeded, and that your view is as unobstructed as possible. Before each operation, test the control handles to make sure they return automatically to the neutral or stopped position.

When using a "cathead" to lift anchors or rigging, never use frayed whip lines which can overlap and continue wrapping. If this occurs, shut off the winch to take the strain off the whip and untangle the line off the cathead. Never use two catheads for one line because you have no control for slippage when slacking the line.

8.2 Electrical Systems

Only qualified marine electronics personnel should install electronic equipment.

Until proven otherwise, electric circuits should always be treated as though they are live.

Make electrical equipment as accessible as possible for operation and maintenance. As far as practicable, install electrical equipment where it is protected from dust, oil, fuel vapors, and any source of water or moisture. The equipment should be rugged, and suitable for marine use; it should be designed, constructed and installed to prevent accidental contact with energized parts. Installations must be secure enough to accommodate the roll, pitch and vibration of the vessel underway.

All electrical equipment, and especially that designed to be explosion-proof, ignition-protected or intrinsically safe, should bear the label of a nationally recognized testing laboratory.

Electrical equipment that will be exposed to spray or moisture should be waterproof or watertight.

Don't smoke or introduce sources of sparks or heat into spaces containing electric storage batteries, and make sure such spaces are well ventilated at the overhead. Battery fumes rise and create explosive hazards.

When you are using portable electrical equipment, check the condition of power cables and connections for damaged or broken insulation. Portable electrical equipment exposed to the elements must be protected from dampness, corrosion or mechanical damage.

8.2.1 Corrosion

Faults in the electrical system can produce a fire hazard, the failure of vital onboard systems, and corrosion in the hull. The main consideration in maintaining or modifying the electrical system is to keep salt water away from the bare metal of the circuitry. There are usually dissimilar metals at junction boxes, switches and fittings, and water at these locations will cause rapid corrosion. Seawater will cause corrosion whether or not there are dissimilar metals, and the result can be a broken circuit that causes arcing and a fire hazard. Or, the corroded circuit may simply build up so much resistance that it stops working.

Water can come from spray, leaks, condensation or drips from wet clothing or wet gear. Keep junctions, fittings and switches away from windows or vents where water may enter, and keep wet clothing or wet gear away from electrical connections.

8.2.2 Explosion and Fire Hazards

Do not install electrical equipment in lockers, pipes or tanks that contain flammable liquids such as oil, paint, solvents and turpentine. If lighting or other equipment is essential in such spaces it must be explosion-proof or intrinsically safe.

Ventilate spaces that house internal combustion engines to prevent the build-up of fumes that could be ignited by defective electrical equipment. Spaces that contain gasoline-powered engines should have both natural and powered ventilation, and any electrical equipment introduced into such a space should be ignition-protected, explosion-proof and intrinsically safe for use in gasoline atmospheres.

Metallic enclosures for electrical equipment should be grounded. Portable electrical equipment should be double-insulated, or have exposed metal parts grounded through a conductor in the supply cord to a grounding pole on the receptacle. Regularly inspect all portable electrical equipment, paying special attention to the condition of power cables and connections. Protect portable electrical equipment from dampness, corrosion and mechanical damage.

8.2.3 Main Source of Electric Power

Construction standards require that every vessel have at least two sources of electric power for vital loads. Designated crewmen must understand how to switch sources to maintain the services necessary for the propulsion and safety of the vessel. Safety-related services include bilge pumping firefighting, engine and machinery space ventilation, lighting, steering, communication and alarm systems, automatic control equipment, navigation lights and navigation equipment.

8.2.4 Emergency Source of Electric Power

In addition to the main source of electric power; an emergency source should be provided to supply services necessary for the safety of the vessel and crew.

For vessels less than 79 feet, and not relying upon electrical power for propulsion and steering, only emergency lighting and battery-powered navigation and communication systems need be considered. For vessels 39 feet or less in length, the emergency lighting may consist of flashlights located in the wheelhouse and near the engine. For vessels between 39 and 79 feet in length, emergency lighting may consist of battery-operated relay-controlled lanterns with rechargeable marine batteries, and an automatic battery charger that maintains the batteries in a fully charged condition (Figure 8-6).

Vessels 79 feet long and greater should have an emergency source of electric power outside the machinery spaces. The emergency source should be either a generator or batteries capable of providing power for six hours to the following loads: communication equipment (internal and radio), fire detection systems, signaling systems, navigation lights, emergency fire pump, and sufficient lighting to permit operation and evacuation of the vessel.

8.2.5 Switchboards

Switchboards must be located in as dry a space as possible, away from piping, windows and deadlights. They should have a drip shield to protect against dripping water. All insulating material in and around the switchboard should be moisture-resistant and fire-retardant.

There should be an adequate working space around the switchboard to permit operation and maintenance. Switchboards should have no exposed live parts. They should be fitted with non-conducting handrails or some other safe hand holds that the crew can use when operating the switchboard in heavy weather. Install non-conducting deck materials, mats or gratings around switchboards.

Make sure the metal cases of switchboard equipment are grounded, and that all circuits and equipment are clearly identified. Switchboard wire should be flame-retardant, and all equipment must be the proper size for the load it will handle. Protect each power source against over-current with a fuse, circuit breaker or overcurrent relay. Mark the proper rating or setting of the protective devices for each circuit, and make sure the over-current device is the proper size.

8.2.6 Batteries

Never put batteries in living spaces. Batteries and battery installations should be able to withstand vessel roll, pitch and vibration. Even the slightest motion can cause starter cables to flex and break, which could produce a fire hazard or loss of power. Lead acid batteries need lead or fiberglass drip trays, while alkaline batteries need steel drip trays. The trays should be able to contain any electrolyte that may be spilled during charging or testing. Battery cells should not spill electrolyte if the battery is inclined at 30 degrees.

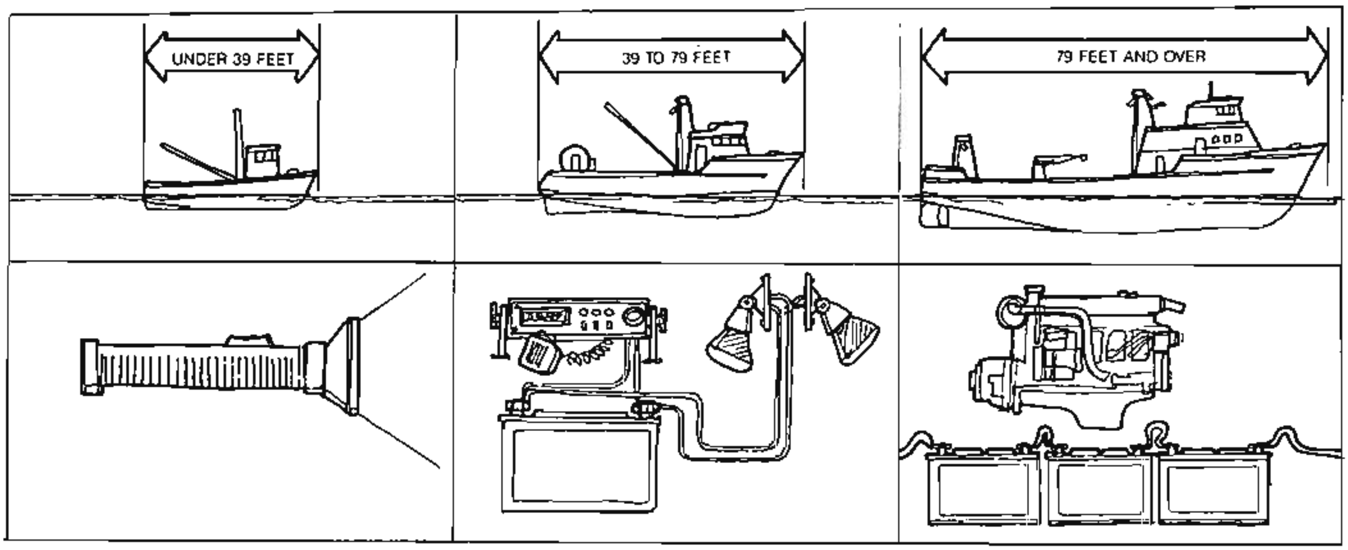

Figure 8-6. Emergency power: vessels 39 feet and under (left) require only flashlights in the wheelhouse and engine room. Vessels between 39 and 79 feet (center) should have rechargeable batteries and a battery charger. Vessels 79 feet and greater (right) should have a generator or batteries capable of providing emergency power for at least 6 hours.

Leave enough room around the batteries for easy removal and terminal access. If the batteries are installed where items can fall on the terminals, cover them with insulated terminal covers. Battery connections should be permanent, not spring clamps or other temporary connectors.

Keep batteries tops clean and dry, and place them where they will not be exposed to seawater or bilge water. There must be adequate ventilation to remove the dangerous hydrogen gas that accumulates during charging. Since hydrogen is lighter than air, it can accumulate in overhead pockets, creating an explosive hazard. Keep sparks, flames and electrical equipment away from the area above the batteries. Do not allow smoking in battery storage areas. Batteries are explosive.

8.2.7 Cable Installations

All cable and wire should have copper conductors of the appropriate size and voltage rating for the circuit. Use stranded copper wiring onboard vessels, because it is more flexible than solid wiring, and it is less likely to fracture because of vibration and movement. Do not use aluminum wiring aboard vessels under any circumstances.

Protect cable runs from the weather as much as possible. Support wire and cable to avoid chafing and other damage. Screw or bolt fireproof wire clips about every six inches. Do not simply nail them, since nails can damage the wire insulation.

Do not place plastic conduit where it can be used as a hand hold. Since trouble usually starts at bends, keep cable runs as straight as possible. Cable should enter fittings from the bottom to keep water from running along the cable and into the fitting. Provide drip loops where wire must run downward toward a fitting or horizontally toward a fitting, especially on exterior watertight fittings (Figure 8-7).

Protect cables that may be subject to mechanical abuse with metal coverings or angle irons. Cable runs and fittings in fish storage areas should be watertight and have mechanical protection. Cables installed in refrigerated compartments should be suitable for low temperature and high humidity. Cable should not be located in a tank unless the cable provides power to equipment in the tank, and it must be compatible with the fluid in the tank. Cable on hinged panels or subject to movement should be extra flexible.

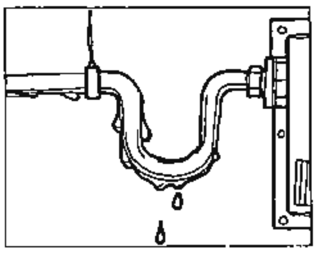

Figure 8-7. Provide drip loops where cable enters a fitting horizontally.

Route cable that serves vital or emergency loads, as far as practicable, away from high risk fire areas such as galleys, laundries and machinery spaces.

Wherever possible, cables serving duplicated equipment should be separated so that a casualty that affects one does not affect the other.

All metallic cable armor should be electrically continuous, and grounded. Terminations and connections should be housed in fire-retardant enclosures. Splices should retain the original electrical, mechanical, flame-retardant and watertight properties of the cable. Terminations, connections and splices should be vibration-resistant and accessible.

Use watertight caps on exterior sockets. Keep an eye out for cracked insulation where wires enter fittings. This is a sure sign of trouble, and the wires should be replaced.

8.2.8 Safety Tips

The vessel's electrical maintenance program should include knowledgeable personnel and regular inspection, testing and servicing. Use sound judgment when you evaluate inspection and test results correcting deficient conditions, and keep adequate records. You should check electrical connections for tightness annually.

The following are important to remember:

* Be sure that the circuits you will work on have been de-energized and tagged to prevent their being accidentally re-energized. If there is any doubt, test the circuit with a voltmeter or voltage tester.
* Some equipment or accessories may be energized by more than one circuit. Be sure that all power sources have been disconnected.
* Beware of energy storage devices (capacitors or condensers that can cause severe shock after the power has been disconnected.) These devices can be discharged by connecting their terminals to the ground and then to one another.

If unusual circumstances make it impossible to de-energize the equipment you are working on, take special precautions. Insulate the person performing the work from ground and from energized parts. That person should observe the following precautions (as applicable):

* Do not work alone.
* Provide ample illumination.
* Do not wear wrist watches, rings, chains, metal articles, or loose clothing that might make accidental

contact with live parts. Clothing and shoes should be as dry as possible.
* Use insulating material to cover grounded metal to which the worker might be exposed.
* Cover metal portions of hand tools with insulating material.
* Insofar as practicable, provide insulating barriers between the work and any other live parts.
* Use only one hand to accomplish the work, it possible.
* Wear rubber insulating gloves.
* Protect your eyes and face.
* Have someone standing by to turn off the power.
* Protect motors against overload.
* In large machinery spaces, provide lighting from at least two circuits, or have a portable power supply so the failure of one does not leave the area without light. Lighting fixtures in machinery spaces, fish holds and other areas subject to mechanical abuse, should have impact-resistant globes or guards.
* Vessels should have a high-intensity light with an on-off switch to use for signaling; it should be powered by a rechargeable battery or emergency power source.
* Keep electrical apparatus in the wheelhouse as far as possible from doors and opening windows to minimize corrosive problems.

8.3 Refrigeration Systems

Refrigerants produce toxic and flammable hazards Familiarize yourself with alarms that indicate leakage, with exits from refrigerated areas that can be opened from the inside, with the location and use of any breathing equipment carried aboard the vessel, and with all instructions posted for safe use of refrigeration systems (Figure 8-8).

Don't smoke or use flame producing equipment near flammable refrigerants. Remember that all installations charged with refrigerant are under pressure so they must be protected from bumps and shocks as well as from heat. Ammonia is highly pungent and will let your nose know immediately if there is a leak.

Beware, however, that ammonia desensitizes your nose so that over time you will lose your ability to smell it. Freon can be just as lethal and is difficult to detect by smell. Although it is not toxic, it can exclude oxygen, causing you to pass out (Section 2.4.18).

If you have any reason to suspect that refrigerants are leaking aboard your vessel, get out of the space immediately, seal the door and warn the captain. If someone else collapses in a refrigeration area, don't go in after him without the proper breathing apparatus.

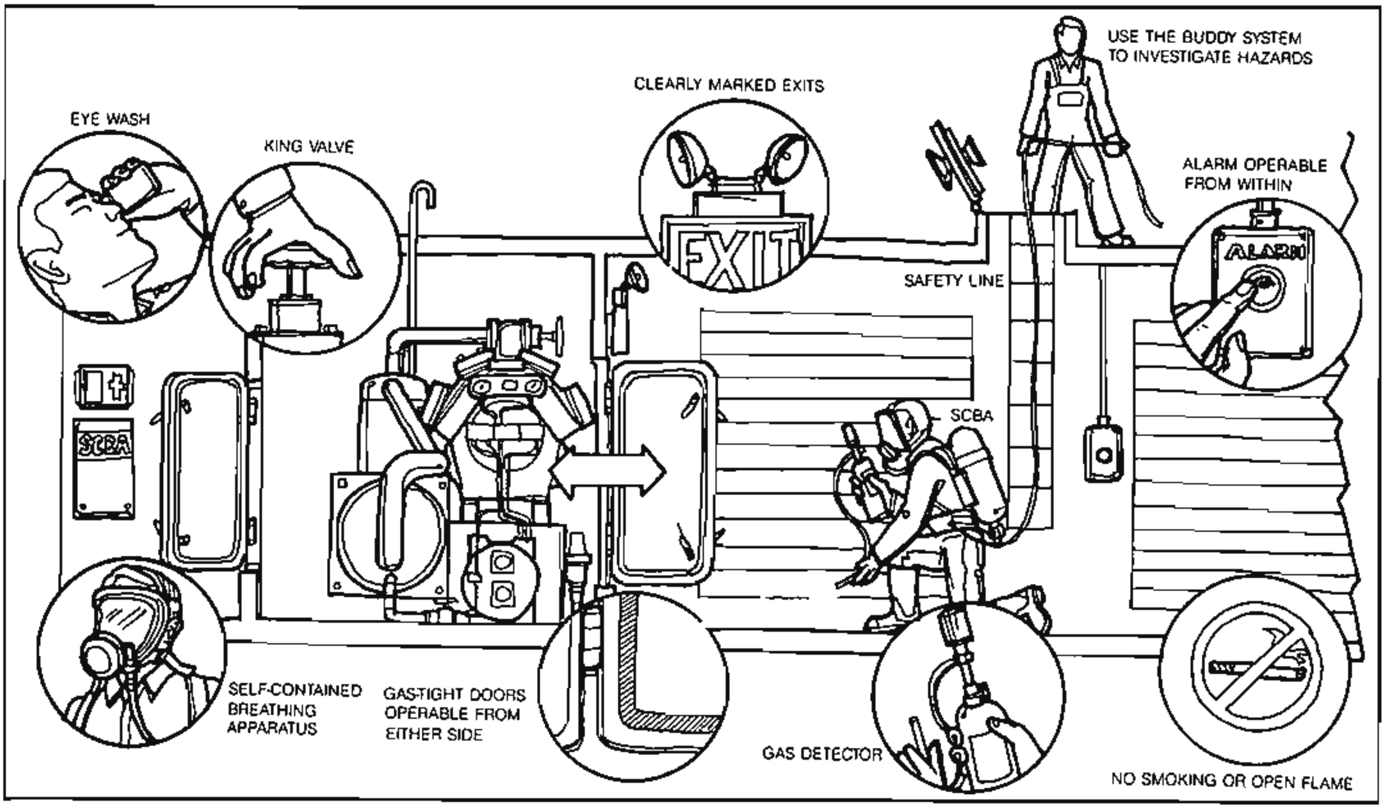

Figure 8-8. Refrigeration safety. The king valve shuts down the system and should be clearly marked. SCBA's and medical supplies should be stowed outside the space. A gas detector enables you to pinpoint the source of a leak.

8.3.1 Safety Tips

* Installations charged with refrigerant are always under pressure.
* Never smoke or use open flame in refrigeration areas. Prior to beginning welding or soldering operations in such areas, they should be purged completely and tested for explosive hazards.
* Refrigerants that have leaked or escaped into enclosed spaces create highly dangerous toxic hazards. If you suspect a toxic hazard, get out of the area immediately and report the problem to the captain.

Refrigeration spaces should be provided with:

* Tight fitting doors operable from each side.
* Alarms operable from within that generate a signal at the control station.
* Means for indicating the location of the exit door in the event the lights fail.
* A venting system for extracting leaking refrigerants that is separate from venting in accommodations or work spaces, with controls operable from inside and outside the refrigeration space.
* A portable means of detecting concentrations of harmful leaking gas.
* A means of escape from spaces where toxic refrigerants are used, leading to the weather deck.

Where harmful gases are used in a refrigeration system, at least one approved breathing apparatus should be located adjacent to the refrigeration area, but not where leakage will make the apparatus inaccessible. An approved breathing apparatus used as part of the vessel's fire-fighting equipment may be used if it is suitably placed to serve both purposes.

If someone collapses in a refrigeration area, don't go after him without wearing a breathing apparatus, or two victims may be the result.

Use a face guard as protection against liquid refrigerants. If emergency drainage of refrigerants is required, it must be done in spaces suitable to ensure the safety of the crew. Containers holding refrigerant should be opened slowly and cautiously, and should be protected against damage from bumps or shocks. Don't permit them to be overturned, dumped, dropped or rolled. They must be protected against heat radiation.

8.4 Steering

All vessels should have two steering systems: a main steering gear and an auxiliary or emergency system. The steering gear, rudder and associated fittings should be capable of steering the vessel at maximum speed ahead or astern, and during all maneuvers required by fishing operations.

The main steering gear should be able to move the rudder from hard-over (35 degrees) to hard-over in 30 seconds, with the vessel at designed service speed.

The auxiliary steering gear should be able to move the rudder from 15 degrees on one side to 15 degrees on the other in no more than 60 seconds, with the vessel at one-half its designed service speed ahead, or 7 knots, whichever is greater. Acceptable types of auxiliary steering gear is a tiller; a block and tackle operating tillers or quadrants; chain falls; or a winch operating a block and tackle, if they produce the movement described above.

Steering equipment should be readily available and tested periodically, and instructions for its use should be posted.

If the auxiliary steering gear would expose the crew to extreme danger in heavy weather, you should consider an alternative. Have all tools and equipment necessary for transferring to auxiliary steering readily available. Duplicate main steering gears must satisfy the requirements for main and auxiliary systems. Carry on board a block and tackle, chain falls, restraining lines, or another suitable means of centering and steadying the rudder(s) in an emergency. This permits you to tow the vessel, or to transfer from main to auxiliary steering.

Arrange the wheelhouse to give the helmsman maximum all-around vision. You should have a way to pass steering orders between the wheelhouse and any other location intended for control of the main or auxiliary steering gear.

Where the steering gear is power-operated, have an independent rudder angle indicator at the wheelhouse controls. Steering systems should have effective rudder stops, and powered systems should incorporate a limit switch to stop the gear before it reaches the stops.

Mark all switches, valves and other steering components with their purpose and operating instructions.

8.5 Maintenance and Repairs

It is the responsibility of the captain and crew to inspect and maintain the vessel systems constantly.

Always be sure that machinery has been turned off and left so it can't be accidentally restarted before you attempt repairs. Similarly, be sure that no one else is working on a machine before you turn it on.

Machinery parts should not be lubricated, adjusted or repaired while they are in motion. In port, always be sure that the stern is clear before moving the rudder or turning the propeller. Propulsion and steering gear should be effectively prevented from moving before repairs are attempted at sea.

Before work is attempted on pressurized valves or equipment, the pressure must be relieved. In doubtful cases, ease securing nuts slightly before breaking the joint.

Any secured valves, controls, circuit breakers, etc., should be tagged by the person conducting repairs, the tag stating that the equipment is not to be restarted or operated until he gives his permission.

If you remove a guard or safety device during maintenance or repair work, it should be replaced prior to operation.

Control levers on winches and other hydraulic equipment should always be well lubricated and should snap back automatically to stop the gear the moment hand pressure is removed (Figure 8-9). There should be no resistance in control lever snap back. Similarly, all components of the gear system should be in good working order.

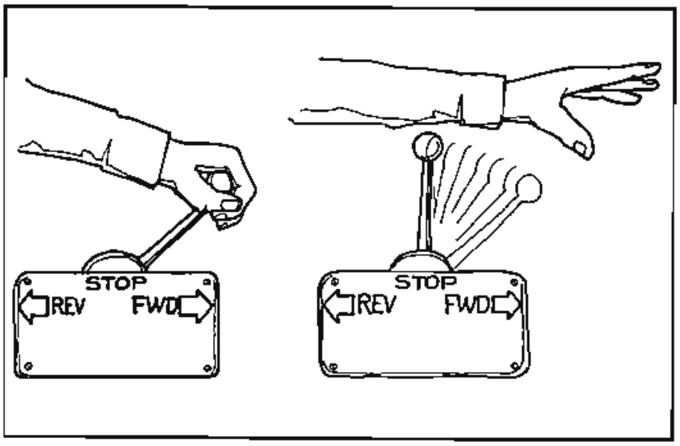

Figure 8-9. Hydraulic winch controls should snap back to the neutral or stop position when hand pressure is removed.

Periodically, check brake bands on winch to be sure the pin holding ends of the bands are in good condition as well as the bands themselves.

8.5.1 General Maintenance Schedules*

(* May need modification based on specific application.)

Daily

* Test propulsion engine controls before you leave the dock.
* Test electronics.
* Test lights, horn, wind-shield wipers.
* Test alarms.
* Check fluid levels such as fuel oil, engine coolant, lube oil, power steering fluid, and marine gear lube oil.
* Inspect engines externally, including alternator belts and controls.
* Check engines while they are running for proper operation and fluid leaks.
* Check drip rate at propeller shaft packing gland.
* Make sure bilges are dry, and test bilge pumps.
* Check the operation of winches.
* Secure equipment and watertight closures.
* Exercise steering system from full left to full right rudder.
* Inspect navigation lights.
* Drain water trap.

Weekly

* Perform a visual and operational check of electronic systems including VHF-FM and SSB transceivers, internal communications, depth sounders, radars and antennas.
* Check operation of auxiliary generators.
* Inspect galley and fish processing equipment.
* Inspect starting system batteries.
* Clean seawater strainers.
* Inspect fuel oil filters, and replace them if necessary.
* Inspect fuel system for leaks.
* Check and test batteries and battery electrolyte.
* Verify proper operation of propulsion, auxiliary and steering systems while underway.
* Check hydraulic system for leaks.
* Inspect condition of steering gear, especially bearings in rudder and stern tube.
* Check operation of chain stoppers, brakes, clutches and controls for hoisting or lifting systems.
* Grease winches, winch controls and lead blocks.

Monthly

* Test shipboard lights.
* Inspect emergency equipment such as flares, potable water, food, personal flotation devices, immersion suits, anchor and rode, emergency communications equipment, liferafts and fire extinguishers.
* Lubricate windshield wipers.
* Check alternator belt tension and pulley alignment.
* Change engine and gearbox oil and filters.
* Check for corrosion of machinery, equipment and compartments.
* Check main engine expansion tank, salt water pump and raw water tank.
* Inspect galvanic anode system.
* Inspect compartments for leaks.
* Inspect lines, wire ropes and chains.
* Lubricate all moving and sliding parts on the vessel, especially within the hoisting, hauling and steering systems.

* Replace main engine final fuel filter.

Quarterly
* Inspect electrical distribution system.
* Replace primary fuel filters.
* Adjust alternator belt tension, check connections and components.
* Clean air filter units.
* Visually check engines for leaks, change fuel oil filters and crankcase breather fittings.
* Change water filters on diesel engines.
* Check and lubricate steering system.
* Check condition of non-skid coatings.
* Check winch hydraulics.

Semi-Annually
* Visually inspect water-tight bulkheads and fittings.
* Replace fuel filter and strainer.
* Change marine gear oil and clean filter.
* Test main engine under full load.

Annually
* Replace PVC valve.
* Renew lube oil filter elements and change lube oil (or every 500 hours, whichever is sooner).
* Adjust and clean valves in fuel system and clean fuel injection pumps and injectors.
* Examine exhaust system for leaks.
* Inspect hull structure for cracks and corrosion.
* Examine propulsion system for corrosion, fracture, bent blades or shafts, worn bearings and loose fittings.
* Inspect sea chest covers and through hull valves by opening them.

8.6 References

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CHAPTER 9

RULES OF THE ROAD

Photo courtesy of Ron Larsen

CHAPTER 9

RULES OF THE ROAD

9.1 Introduction to the Navigational Rules of the Road

Based on the *Navigation Rules International-Inland* (Commandant Instruction M16672.2A, Dated 23 December 1983).

This chapter provides an overview of portions of the Rules which are of particular interest to the fishing vessel operator. This overview is only provided as a guide in developing a greater understanding of and familiarity with the Navigation Rules.

Remember, the vessel operator is responsible for knowing and following all the Navigation Rules, not just the Rules provided in this Chapter.

The Navigation Rules of the Road are laws and regulations for preventing vessel collisions. Vessel operators in and around the United States are required to know and follow the International and/or Inland Navigation Rules. The Inland Navigation Rules apply to vessels that operate on the waters inside the Navigational Lines of Demarcation, called COLREGS Demarcation Lines. Vessels operating to seaward of the Demarcation Lines follow the International Navigation Rules. Both the International and Inland Rules set out Rules 1 through 38-the main body of the Rules. The five Annexes are technical regulations which support the main rules. It is important to note that with the exception of Annex V to the Inland Rules, the International and Inland rules and Annexes are very similar in both content and format.

9.2 It's the Law

The Inland Navigation Rules are laws, and every operator of a vessel is required to know and follow all the rules.

The law requires the operator of each self propelled vessel of 39.4 feet (12 meters) or more in length to carry on board and maintain for ready reference a copy of the Inland Navigation Rules.

NOTE: Any vessel engaged in fishing is a fishing vessel, no matter what the means of propulsion.

A fishing vessel not actually engaged in fishing, if powered by machinery, is a power-driven vessel.

A fishing vessel not actually engaged in fishing, if powered only by sail, is a sail vessel. If under sail and power, it is a power-driven vessel [see Rules 3 (b)(c), 25(e), and 26 (a)(e)].

NOTE: If you have questions concerning the Navigational Rules of the Road, contact the nearest Coast Guard Marine Safety Office or the Navigation Rules and Information Branch at Coast Guard Headquarters in Washington, D.C. at (202) 267-0357.

The book *Navigation Rules International-Inland* (COMDTINST M16672.2A) contains the complete version of the Rules, the five Annexes, Interpretative Rules, Lines of Demarcation, Penalty Provisions, Alternative Compliances, Vessel Bridge-to-Bridge Radio Telephone Regulations, Legal Citations, and Metric-to-U.S. Measurement Table. The book's table of contents is included at the end of this chapter for reference. An order form for obtaining the book is also included.

Any operator in violation of either of these sets of Rules faces a civil penalty of not more than $5000 for each such violation. Any vessel operated in violation of the Rules is also subject to a $5000 civil penalty for each such violation and may be seized and proceeded against in the District Courts of the United States.

GENERAL: Navigation Rules apply to all vessels (from Rule 1).* Nothing in the Navigation Rules shall exonerate any vessel, or owner, master, or crew thereof, from the consequences of any neglect to comply with these rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or the special circumstances of the case (from Rule 2).*

9.3 Definitions (from Rules 3, 16, 17)*

Vessel Engaged in Fishing means any vessel fishing with nets, lines, trawls, or other fishing apparatus that restricts maneuverability, but does not include a vessel fishing with trolling lines or other fishing apparatus that does not restrict maneuverability.

Vessel Not Under Command means a vessel unable to keep out of the way of other vessels because some exceptional circumstance (steering failure, engine breakdown, etc) is hindering her maneuverability.

Vessel Restricted in Her Ability to Maneuver means a vessel which is unable to keep out of the way of other vessels because the nature of its work is hindering its ability to maneuver.

* Rules taken from Navigation Rules International-Inland.

Examples: 1) buoy tender picking up a buoy; 2) vessel engaged in transferring persons, provisions, or cargo while underway.

Underway means a vessel that is not at anchor, aground or made fast to shore.

Give-way vessel (G) or **burdened vessel** is the one that does not have the right-of-way when a risk of collision develops.

Stand-on vessel (S) or **privileged vessel** is the one that has the right-of-way when a risk of collision develops.

9.4 Look-Out (from Rule 5)*

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

9.5 Safe Speed (from Rule 6)*

All vessels must proceed at a safe speed at all times. This rule is intended to make mariners aware of the need to operate at a safe speed in all conditions of visibility. A speed that is safe in good visibility may not be safe in restricted visibility. The prudent mariner must use his best judgment in determining what constitutes safe speed for the vessel, in order that prompt and effective action to avoid a collision and stop within a distance appropriate to the prevailing conditions-fair weather or foul, daylight or dark-is possible.

What is a safe speed? You must be the judge, using all due prudence and caution.

You must be going slowly enough to prevent a collision, no matter what the conditions.

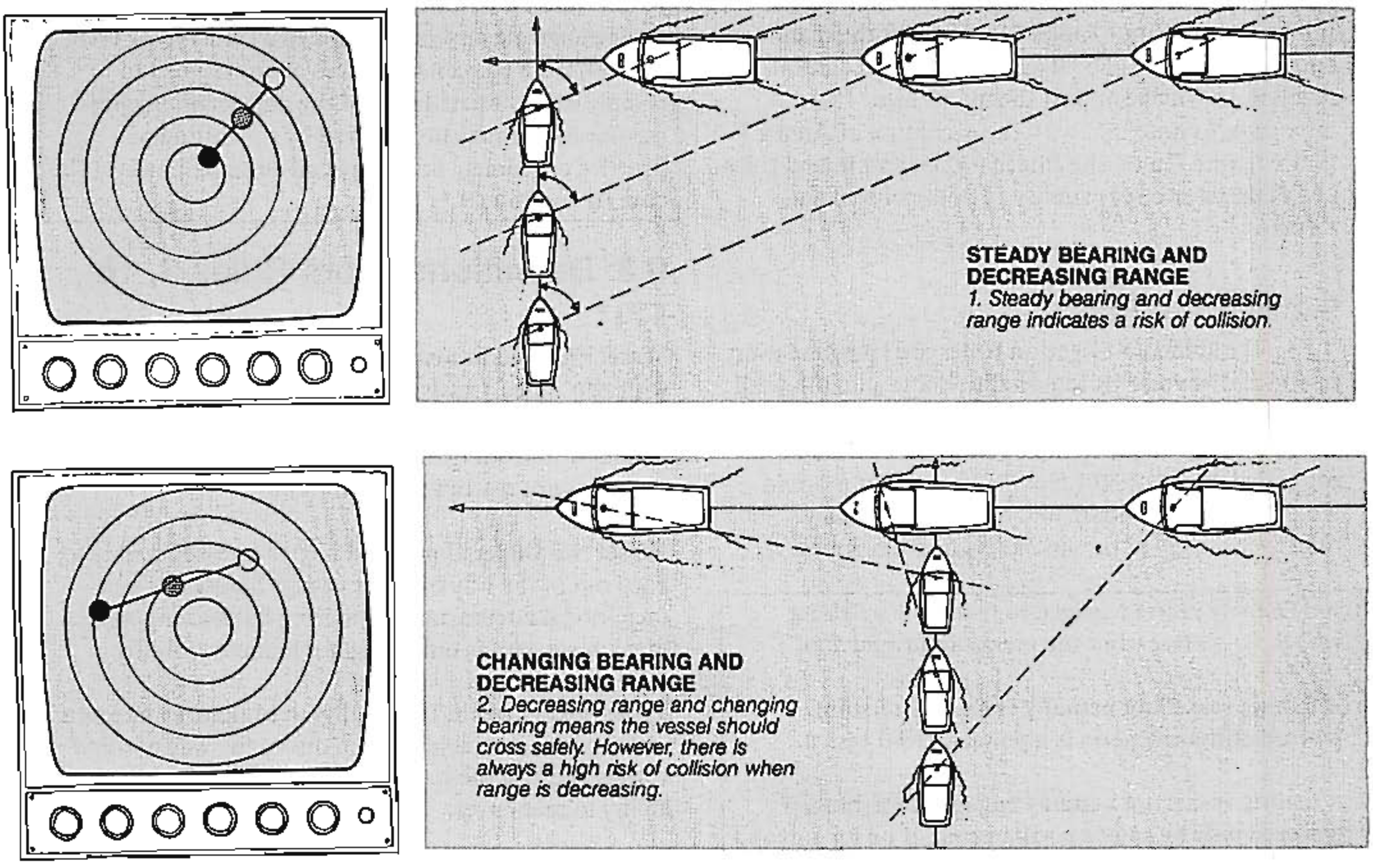

Figure 9-1. Determining the risk of collision.

9.6 Determining the Risk Of Collision (from Rule 7)*

Every vessel must use all available means appropriate, including look-out (eyes and ears), radar, and radio, to determine if the risk of collision exists. If the vessel is equipped with radar, a radar plot should be maintained to detect any risk of collision (Figure 9-1). Where possible, contact the other vessel by radio and ask what its intentions are.

9.7 Action To Avoid Collision (from Rule 8)*

Action to avoid a collision should be taken well in advance of any potential meeting. Any course or speed change should be large enough to be obvious to any approaching vessel. A succession of small alterations of course should be avoided (Figure 9-2).

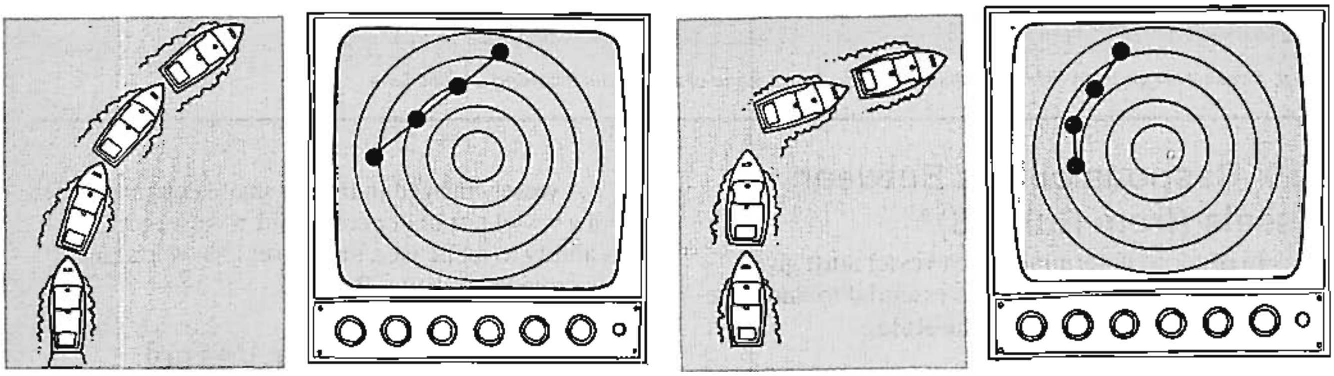

Figure 9-2. When you are making a course change, avoid small course changes (left). Use large course changes (right).

CAUTION: A vessel operator is required to know and follow all the navigational rules of the road. This introduction is only a partial coverage of those rules. Remember - This chapter is only an overview of the Navigation Rules. In no instance in this chapter has a complete rule from the "*Navigation Rules International-Inland*" been reprinted. The rule number cited in each section of this chapter refers to the rule from which this information was extracted. The information is not intended to be, nor may it be interpreted as, a substitute for the actual "*Navigation Rules International-Inland*" contained in the Commandant Instruction M16672.2A.

9.8 Narrow Channels (from Rule 9)*

A vessel engaged in fishing shall not impede the passage of any vessel navigating in a narrow channel or fairway (Figure 9-3).

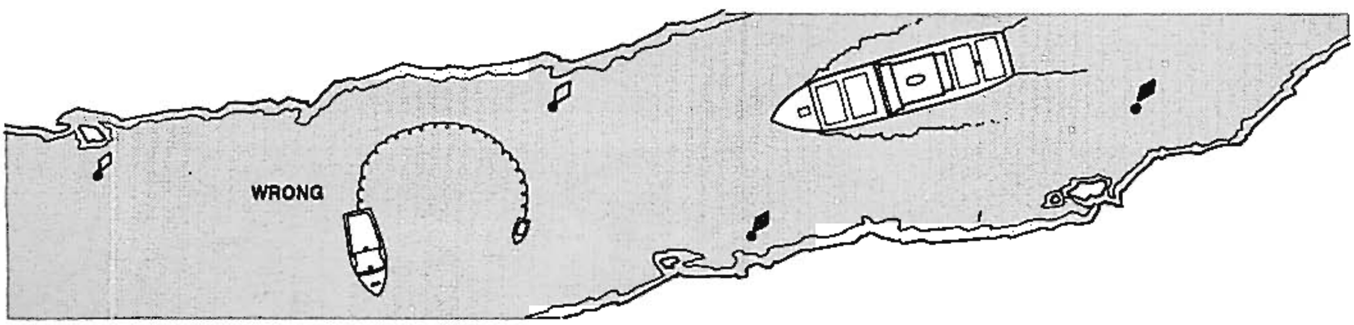

Figure 9-3. A vessel engaged in fishing shall not impede the passage of any vessel navigating in a narrow channel or fairway.

9.9 Traffic Separation Schemes (from Rule 10)*

A vessel engaged in fishing **shall not** impede the passage of any vessel following a traffic lane (Figure 9-4).

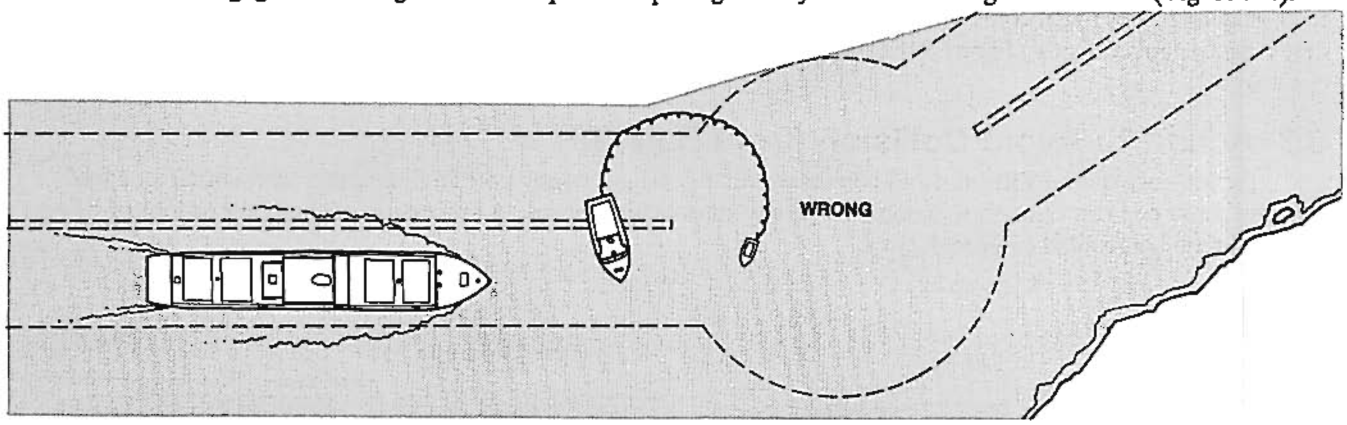

Figure 9-4. A vessel engaged in fishing shall not impede the passage of any vessel following a traffic lane.

9.10 Responsibilities Between Vessels (from Rule 18)*

In order to determine which vessel must give way in an approach situation, it is essential to know the "pecking order" established by the Rules.

1st: Any vessel being overtaken (from Rule 13);*
2nd: Vessel not under command;
3rd: Vessel restricted in ability to maneuver;
4th: Vessel engaged in fishing;
5th: Sailing vessel;
6th: Power-driven vessel.

Power-driven vessels and sailing vessels must keep out of the way of a vessel engaged in fishing (except as provided by Rules 9, 10, and 13. See the definition of vessel engaged in fishing in Rule 3).*

A vessel engaged in fishing shall keep out of the way of a vessel not under command, a vessel restricted in its ability to maneuver, any vessel it is overtaking, and as provided in Rules 9 and 10.

9.11 Meeting Another Vessel Head-On (from Rules 14 and 18)*

This rule applies to head-on situations between two power-driven vessels that are on the same level in the "pecking order", except that a special provision in Rule 14(d) provides for power-driven vessels of the Great Lakes and Western Rivers.

Vessels meeting on reciprocal (head-on) or nearly reciprocal courses so as to involve the risk of collision shall each alter course to starboard so that they pass port-to-port (except as provided by Rules 9, 10, 14 and 18)* (Figure 9-5).

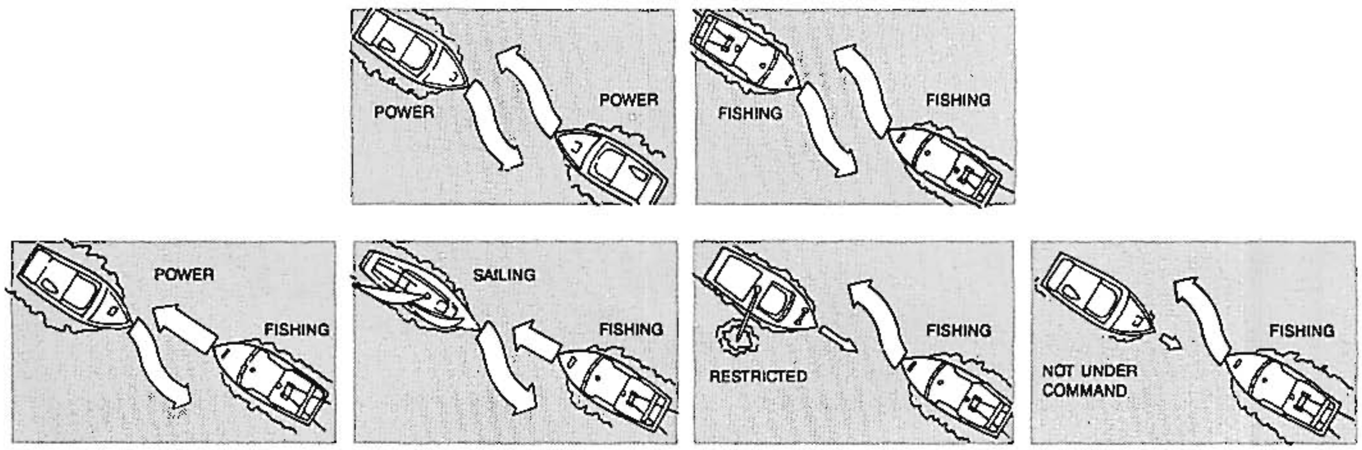

Figure 9-5. Meeting another vessel head-on.

9.12 Crossing Situations (from Rules 15, 16,17 and 18)*

This rule applies to crossing situations between two power-driven vessels that are on the same level in the "pecking order", except that a special provision in Rule 15(b) provides for vessels on the Great Lakes and Western Rivers.

When two vessels are crossing so as to involve the risk of collision, the vessel on the right has the right-of-way, while the vessel on the left must keep clear (Figure 9-6).

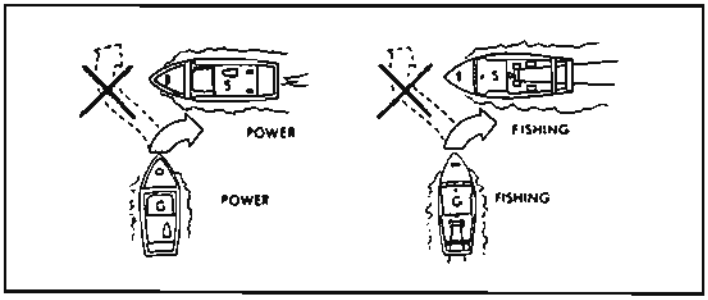

Figure 9-6. Crossing situations.

CAUTION: The crossing, meeting and overtaking rules (Rules 11-18) apply to vessels in sight of one another. These rules do not apply in situations where vessels cannot see each other, as in restricted visibility.

If at all possible, the vessel keeping clear (usually the vessel on the left) shall avoid crossing ahead of the other vessel (except as provided by Rules 9, 10, 15 and 18) (Figure 9-7).

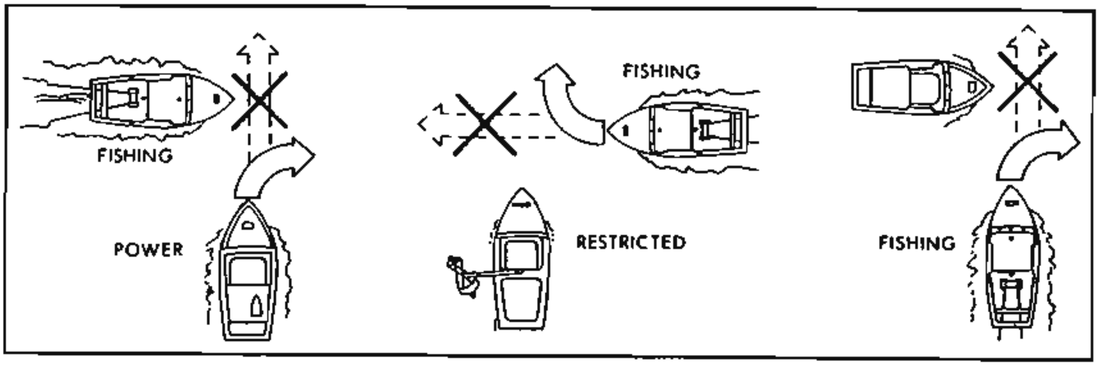

Figure 9-7. Keeping clear by avoiding crossing in front of the stand-on vessel. Pecking order applies.

9.13 Conduct of Vessels in Restricted Visibility (from Rule 19)*

If you hear a fog signal forward of your beam, or if you detect another vessel by radar forward of your beam, take avoiding action in ample time. Unless you are overtaking, avoid if at all possible altering your course to port. You should, whenever possible, alter course to starboard. Also, remember to adjust to a safe speed adapted to prevailing circumstances and conditions, including restricted visibility. This includes, if necessary, taking all way off your vessel (see Rules 2, 6 and 19).

The idea here is that if you detect a vessel forward of your beam and you turn to starboard while the other vessel (using the same rule) also turns to starboard, the chances of a collision are usually reduced. In other words, if everyone turns to starboard, everyone will normally be turning away. This is not always the case and every situation must be considered on its own merits and avoiding action taken in ample time to prevent a collision (Figure 9-8a).

If you detect a vessel abeam or abaft (behind the beam), either by radar or by the sound of its fog signal, avoid if at all possible turning toward the vessel (Figure 9-8b).

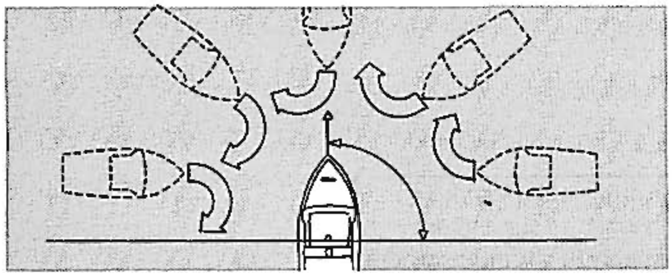

Figure 9-8a. Restricted visibility. Everyone turns to starboard.

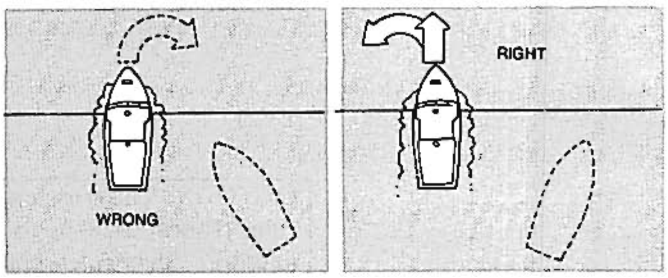

Figure 9-8b. Restricted visibility. Avoid turning toward the vessel.

REMEMBER: In restricted visibility, when you cannot see other vessels, you must reduce speed, take avoiding action, and use extreme caution as necessary. You do not apply Rules 11-18 until you can see the other vessel.

9.14 Overtaking Another Vessel (from Rules 13 and 17)*

A vessel that is being over-taken shall keep her course and speed, but may take action to avoid collision by her maneuver alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action.

Example: A vessel engaged in fishing should maintain its course and speed when being over-taken by a power-driven vessel, unless the power-driven vessel fails to follow the rules by keeping clear (Figure 9-9).

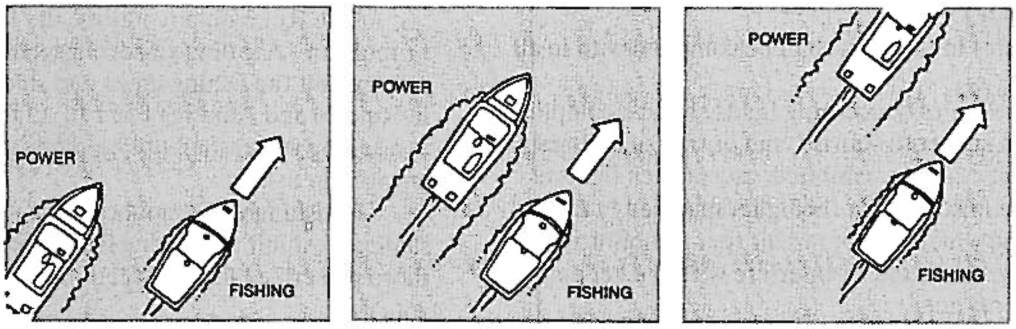

Figure 9-9. Overtaking another vessel.

Example: A vessel is overtaking when it approaches the other vessel from more that 22.5 degrees abaft (behind) its beam.

Any overtaking vessel must keep out of the way of the vessel it is overtaking. The "pecking order" is not considered in this situation (Figure 9-10).

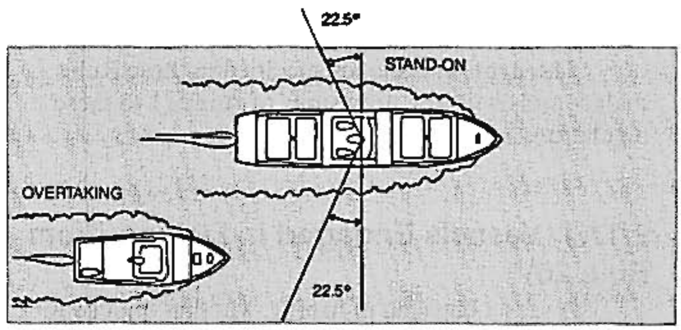

Figure 9-10. Overtaking another vessel.

9.15 Action by the Give-Way Vessel (from Rule 16)*

Every vessel which is directed to keep clear of another vessel shall, so far as possible, take early and substantial action to keep clear.

9.16 Action by the Stand-On Vessel (from Rule 17)*

When one of the two vessels is required to keep clear, the other vessel (the one with the right-of-way) shall maintain its course and speed.

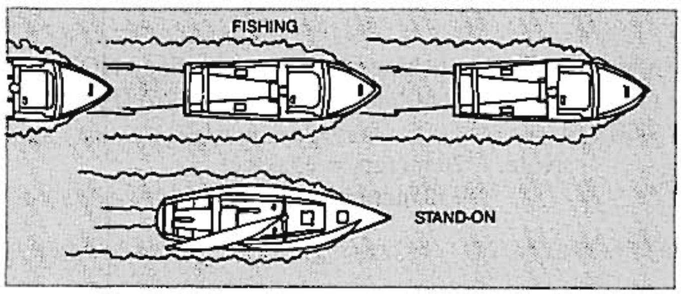

Figure 9-11. Action by the stand-on vessel.

Example: A vessel engaged in fishing must keep clear when overtaking a sailing vessel, a power-driven vessel or another vessel engaged in fishing.

The stand-on vessel must maintain course and speed until the overtaking vessel is past and clear (Figure 9-11).

When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.

9.17 Lights and Shapes (from Rule 20)*

Rules in this part shall be complied with in all weather.

The Rules concerning lights shall be complied with from sunset to sunrise, and during such times no other lights shall be exhibited, except such lights as cannot be mistaken for the lights specified in these Rules, and which do not impair their visibility or distinctive character, or interfere with the keeping of a proper look-out.

The lights prescribed by these Rules, if carried, shall also be exhibited from sunrise to sunset in restricted visibility and may be exhibited in all other circumstances when it is deemed necessary.

The Rules concerning shapes shall be complied with by day.

The lights and shapes specified in these Rules shall comply with the provisions of Annex 1 to these regulations.

9.17.1 Vessels Engaged in Fishing (from Rule 26)*

A vessel engaged in fishing, whether underway or at anchor, shall exhibit only the lights and shapes prescribed in Rule 26, and Annexes I and II.

The Rules do not address the fishing vessel's propulsion. A sailing vessel engaged in fishing will only exhibit the fishing lights and shapes as prescribed in Rule 26 and Annexes I and II. Lights identifying it as a sailing vessel shall not be exhibited while it is engaged in fishing.

A fishing vessel not actually engaged in fishing, shall not exhibit the fishing lights and shapes, but only those prescribed for a vessel of her length [see Rule 26(e)].

9.17.2 Vessel Not Under Command or Restricted in its Ability to Maneuver (from Rule 27)*

When a vessel is not under command or restricted in its ability to maneuver, the lights and shapes provided in Rule 27 shall be exhibited (Note: A fishing vessel trawling when the net has come fast upon an obstruction will exhibit the lights provided by Rule 26 and Annex II.)

Vessel engaged in fishing other than trawling - NOT making way (International & Inland Rule 26) (Figure 9-12).

Note: 20 meters = 65.6 feet
150 meters = 492 feet

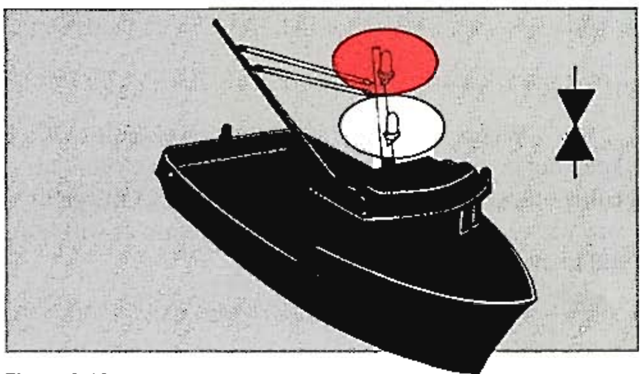

Figure 9-12

When there is outlying gear extending more then 150 meters horizontally from the vessel, an all-round white light or a cone apex upwards in the direction of the gear.

Optional day shape for a vessel of less than 20 meters in length.

Vessel engaged in fishing, other than trawling - making way (Figure 9-13).
(International & Inland Rule 26)

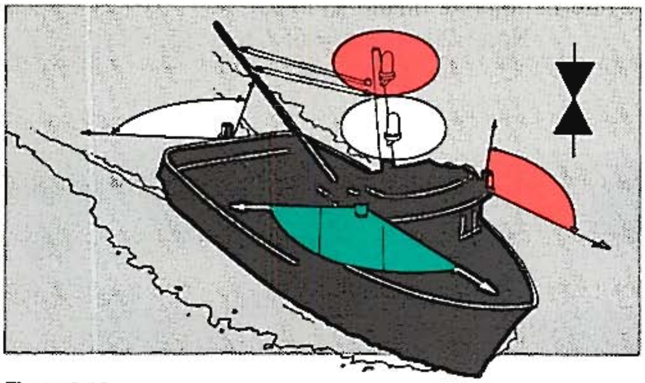

Figure 9-13.

Where there is outlying gear extending more than 150 meters horizontally from the vessel, an all-round white light or a cone apex upward in the direction of the gear.

Optional day shape for a vessel of less than 20 meters in length.

Vessel engaged in trawling - making way; vessel 164 feet (50 meters) or more in length (Figure 9-14).
(International & Inland Rule 26)

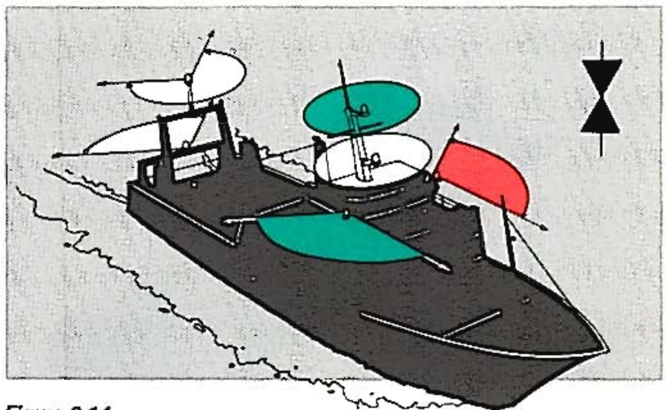

Figure 9-14.

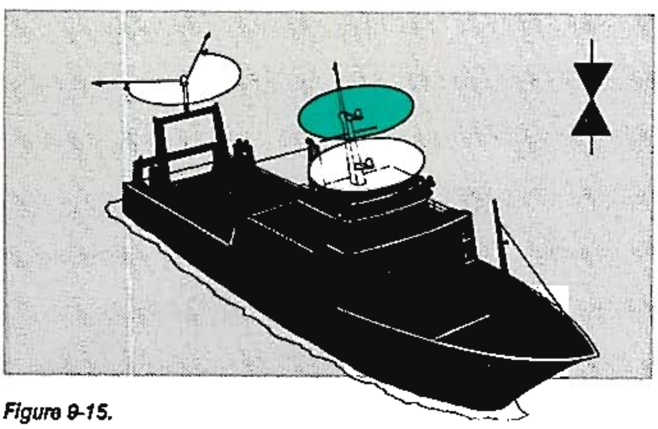

Figure 9-15.

Vessel engaged in trawling NOT making way; vessel 164 feet (50 meters) or more in length (Figure 9-15).
(International & Inland Rule 26)

Vessel engaged in trawling making way; vessel less than 164 feet (50 meters) in length (Figure 9-16, a). (International & Inland Rule 26)

Vessel engaged in trawling - NOT making way; vessel less than 164 feet (50 meters) in length (Figure 9-16, b).
(International & Inland Rule 26)
Note: 20 meters = 65.6 feet

Optional day shape for a vessel of less than 20 meters in length.

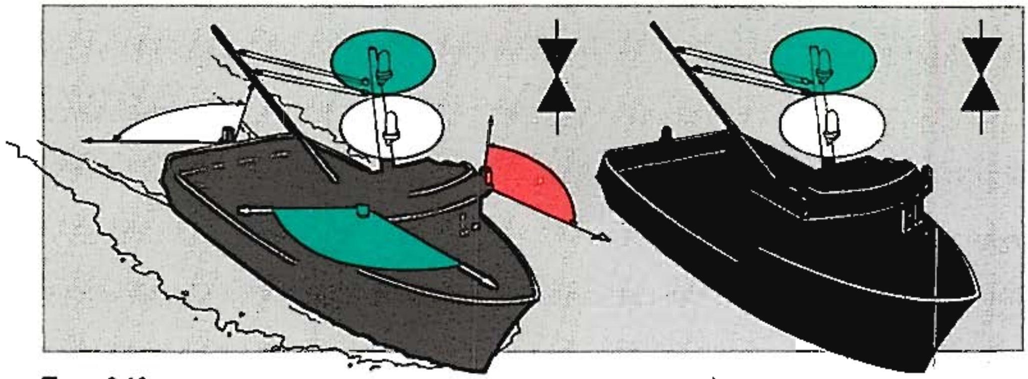

Figure 9-16, a. *b.*

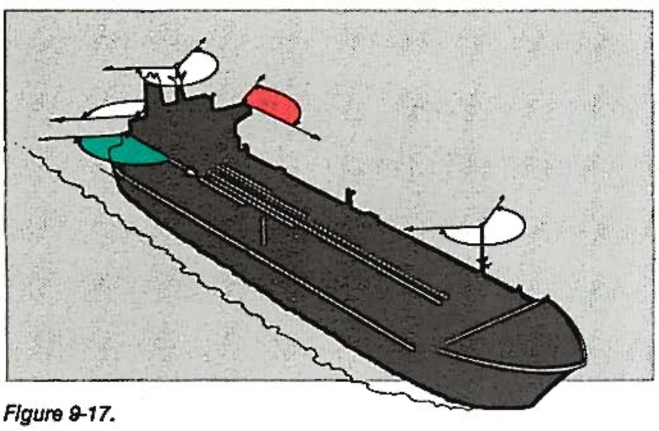

Figure 9-17.

Power-driven vessel underway 164 feet (50 meters) or more in length (Figure 9-17).
(International & Inland Rule 23)

Power-driven vessel underway less than 164 feet (50 meters) in length (Figure 9-18).
(International & Inland Rule 23)

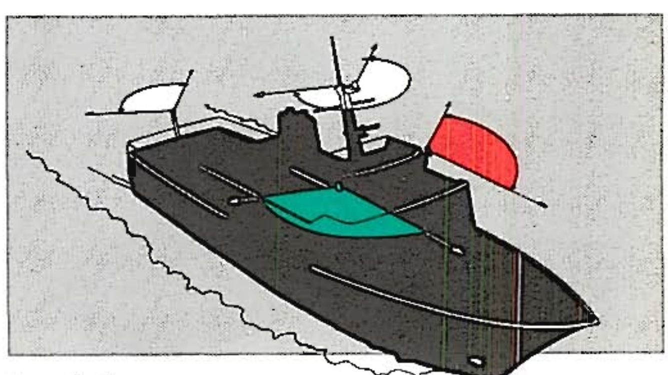

Figure 9-18.

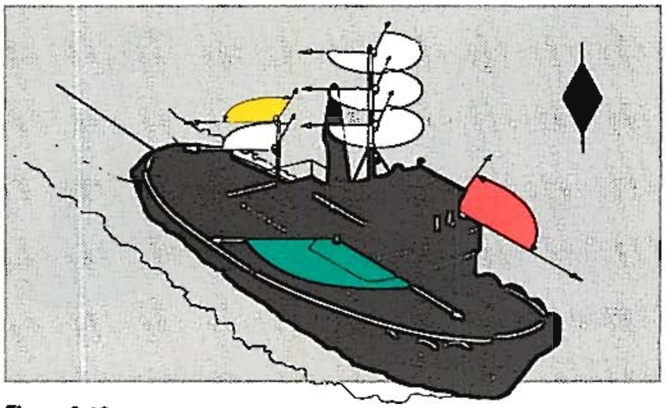

Figure 9-19.

Power-driven vessel towing astern - towing vessel less than 164 feet (50 meters) in length; length of tow exceeds 656 feet (200 meters) (Figure 9-19). (International & Inland Rule 24).

Power-driven vessel pushing ahead or towing alongside - towing vessel is less than 164 feet (50 meters) in length (Figure 9-20). (International ONLY, Rule 24)

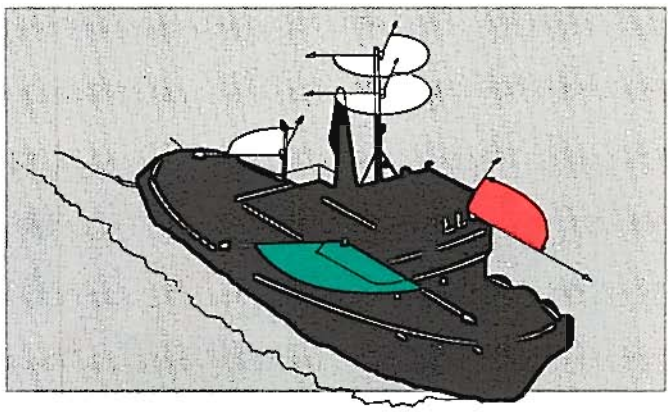

Figure 9-20.

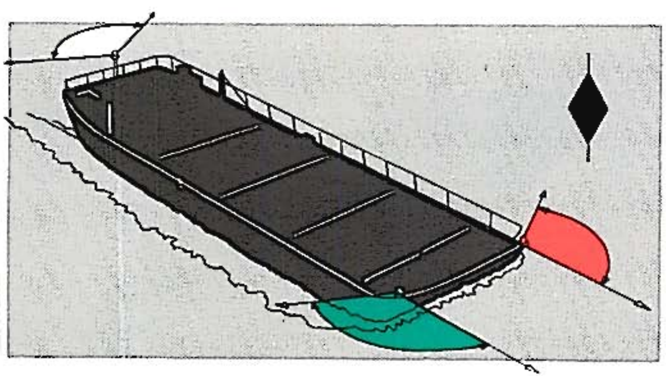

Figure 9-21.

Vessel or object being towed - length of tow exceeds 656 feet (200 meters) (Figure 9-21). (International & Inland Rule 24)

Sailing vessel underway (Figure 9-22, a).
(International & Inland Rule 25)

Sailing vessel underway - less than 20 meters in length (Figure 9-22, b).
(International & Inland Rule 25)

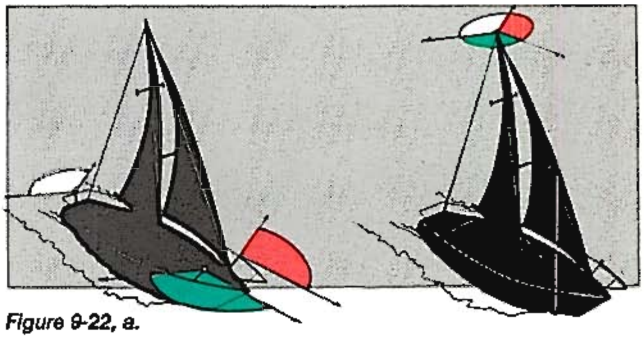

Figure 9-22, a.

Vessel under oars (Figure 9-22, c).
(International & Inland Rule 25)

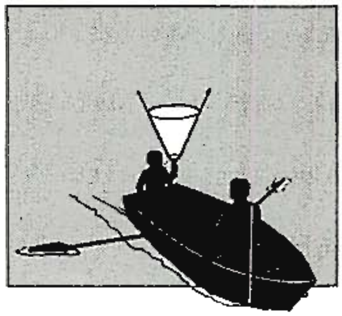

Figure 9-22,c.

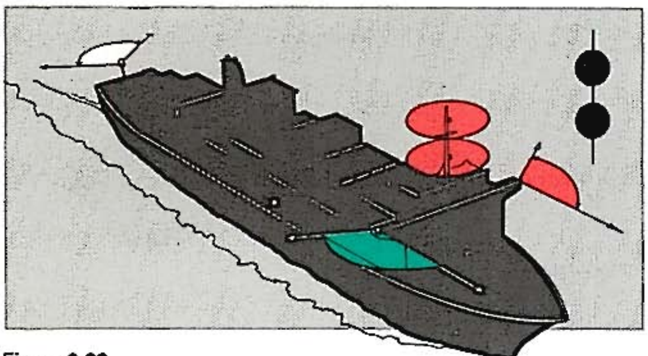

Figure 9-23.

Vessel not under command - making way (Figure 9-23).
(International & Inland Rule 27)

Vessel not under command- NOT making way (Figure 9-24).
(International & Inland Rule 27)

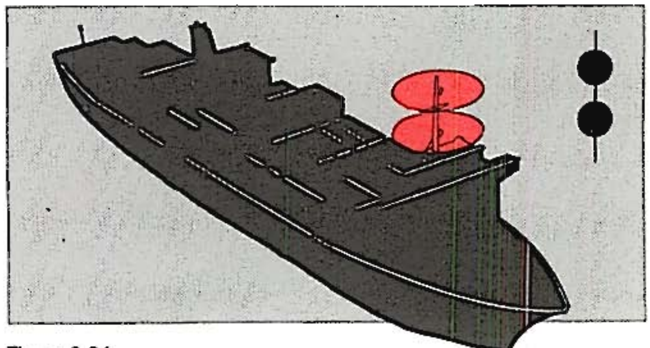

Figure 9-24.

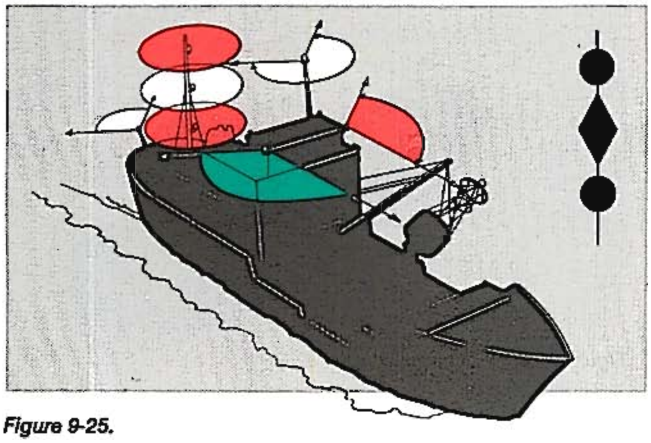

Figure 9-25.

Vessel restricted in her ability to maneuver - making way; vessel less than 164 feet (50 meters) in length (Figure 9-25).
(International & Inland Rule 27)

Vessel restricted in her ability to maneuver - at anchor; vessel less than 164 feet (50 meters) in length (Figure 9-26).
(International & Inland Rule 27)

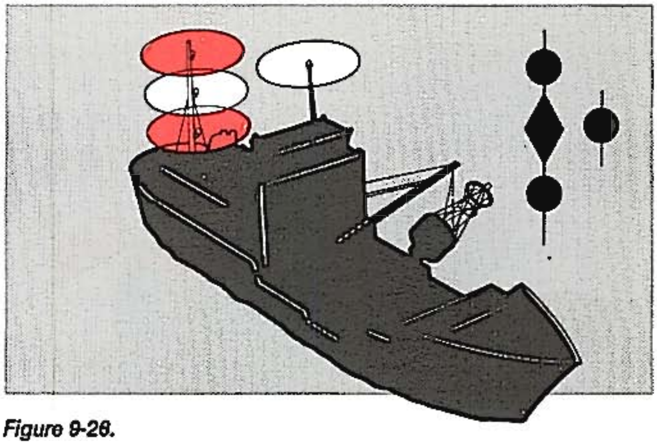

Figure 9-26.

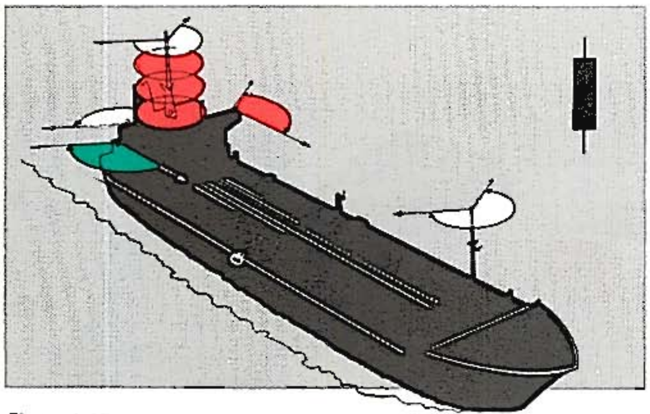

Figure 9-27.

Vessel constrained by her draft (Figure 9-27).
(International ONLY, Rule 28).

Vessel towing - unable to deviate from course - length of tow does not exceed 656 feet (200 meters). Towing vessel less than 164 feet (50 meters) (Figure 9-28). (International & Inland Rule 27)

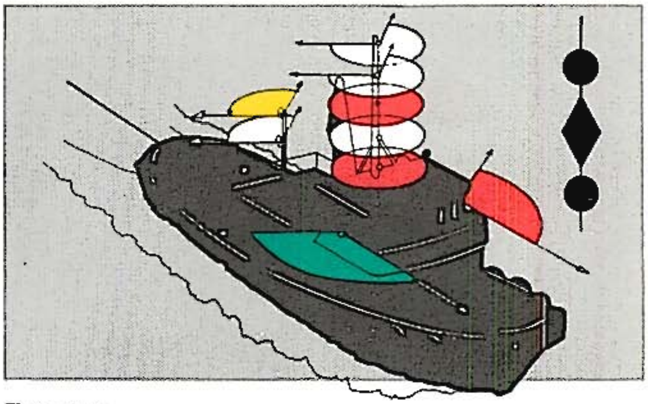

Figure 9-28.

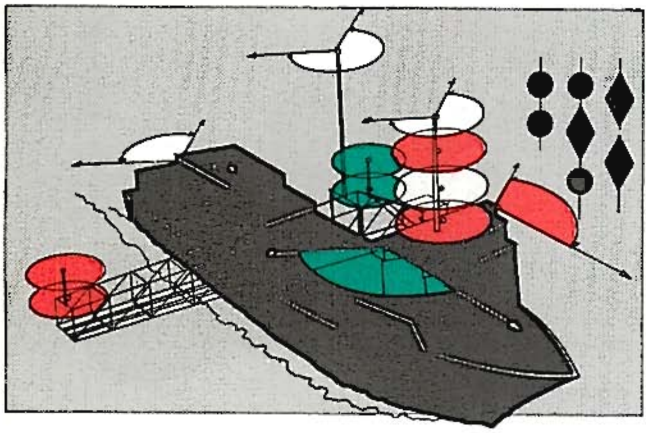

Figure 9-29.

Vessel engaged in dredging or underwater operations - restricted in ability to maneuver - making way with an obstruction on the starboard side (Figure 9-29). (International & Inland Rule 27)

Vessels engaged in dredging or underwater operations restricted in ability to maneuver - not making way with an obstruction on the starboard side (9-30). (International & Inland Rule 27).

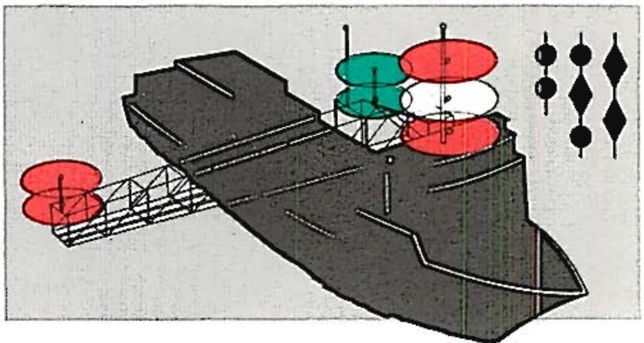

Figure 9-30.

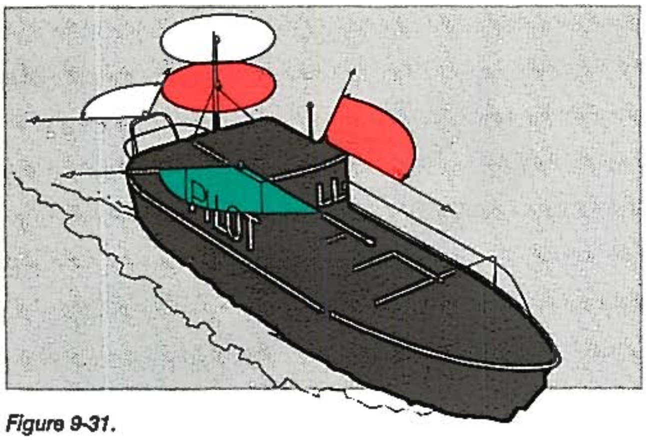

Figure 9-31.

Vessel engaged in pilotage duty - underway (Figure 9-31).
(International & Inland Rule 29)

Vessel engaged in pilotage duty at anchor, vessel less than 164 feet (50 meters) in length (Figure 9-32).
(International & Inland Rules 29 and 30)

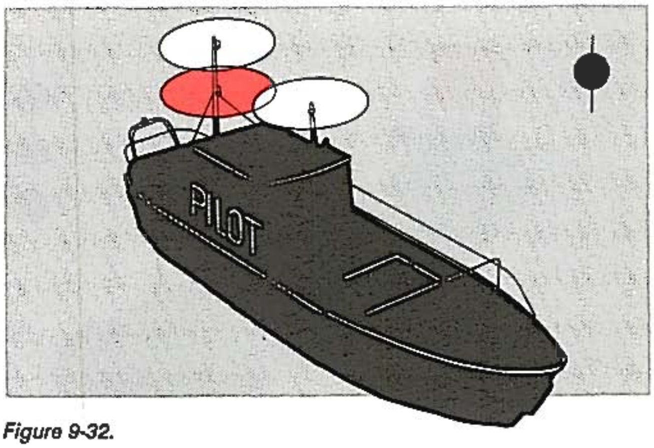

Figure 9-32.

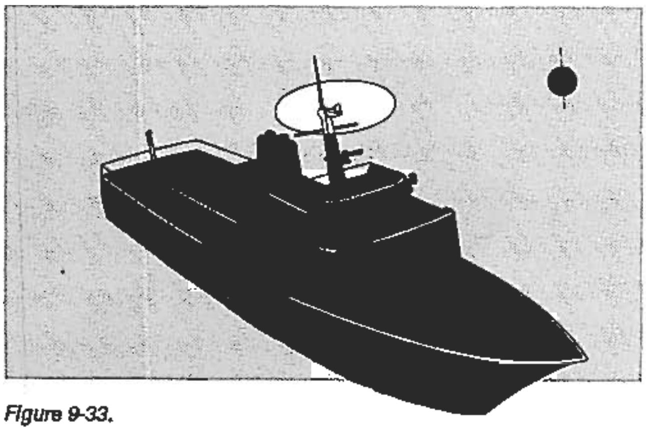

Figure 9-33.

Vessel at anchor - less than 164 feet (50 meters) in length (Figure 9-33).
(International & Inland Rule 30)

Vessel at anchor with deck illumination (Figure 9-34).
(International & Inland Rule 30)

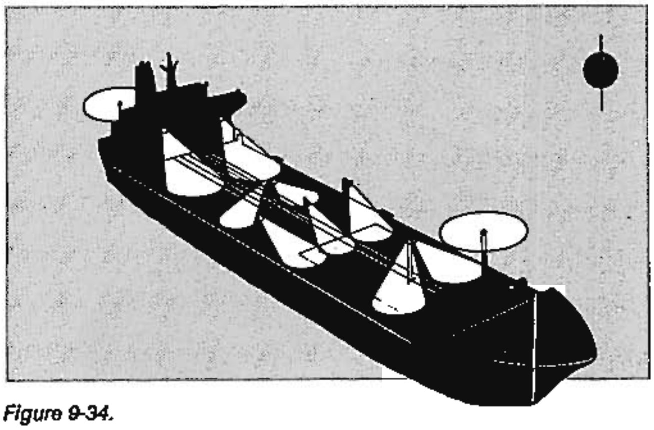

Figure 9-34.

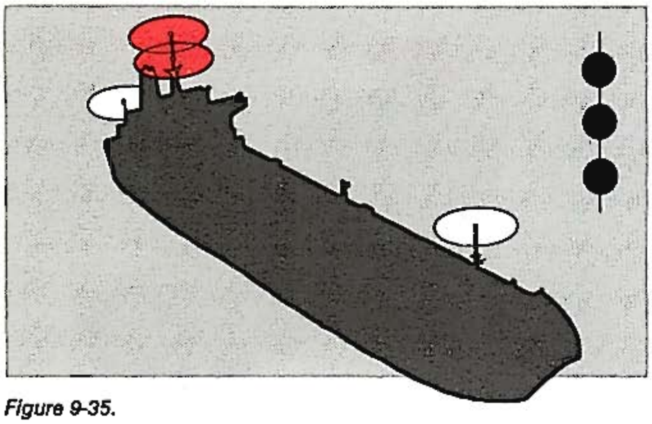

Figure 9-35.

Vessel aground greater than 164 feet (50 meters) (Figure 9-35).
(International & Inland Rule 30)

Vessel aground - less than 164 feet (50 meters) (Figure 9-36).
(International & Inland Rule 30)

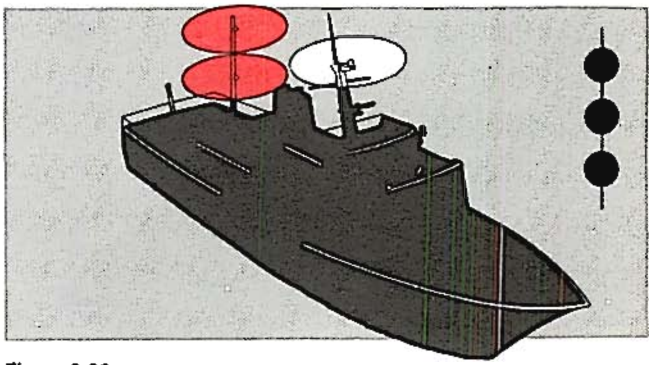

Figure 9-36.

9.18 Maneuvering and Warning Signals (from Rule 34)*

Power-driven vessels underway *in sight of one another* (International), and maneuvering at a distance within half a mile of each other (Inland) shall follow the requirements of Rule 34 (Table 9-1).

International		Inland	
•	I am altering course to stbd	•	I intend/agree to port to port passing
••	I am altering course to port	••	I intend/agree to stbd to stbd passing
•••	I am operating astern propulsion	•••	I am operating astern propulsion
	In a Narrow Channel/Fairway		
— —•	I intend to overtake you on your stbd side	•	I intend/agree to overtake you on your stbd side
— —••	I intend to overtake you on your port side	••	I intend/agree to overtake you on your port side
—•—•	Agreement to overtaking signal		
•••••	Danger signal	•••••	Danger signal
—	Bend signal	—	Bend signal
		—	Departing dock or berth

Table 9-1. Note: Dash " - " is a 4-6 second blast. Dot " · " is a 1 second blast.

9.19 Sound Signals in Restricted Visibility (from Rule 35)*

In or near an area of restricted visibility, whether by day or night, the signals prescribed in Rule 35 shall be used (Table 9-2).

International		Inland	
—	Making Way	—	Making Way
— —	Underway but stopped and making no way	— —	Underway but stopped and making no way
—••	Vessel not under command, vessel restricted in her ability to maneuver, vessel constrained by draft, sailing vessel, vessel engaged in fishing, vessel engaged in towing or pushing	—••	Vessel not under command, vessel restricted in her ability to maneuver underway or anchor, sailing vessel, vessel engaged in fishing underway or at anchor, vessel engaged in towing or pushing another vessel
—•••	Vessel being towed or last vessel of tow	—•••	Vessel being towed or last vessel of tow
rapid ringing of bell for 5 seconds every minute •—•	anchored	rapid ringing of bell for 5 seconds every minute •—•	anchored
rapid ringing of bell for 5 seconds followed by rapid ringing of gong every minute	Anchored over 100 meters	rapid ringing of bell for 5 seconds followed by rapid ringing of gong every minute	Anchored over 100 meters
three strokes of bell before and after bell signal every minute	Aground	three strokes of bell before and after bell signal every minute	Aground
••••	Pilot vessel engaged on pilotage duty	••••	Pilot vessel engaged on pilotage duty

Table 9-2. Note: Dash " - " is a 4-6 second blast. Dot " · " is a 1 second blast. Signal intervals are 2 minutes unless otherwise noted.

9.20 Distress Signals (from Rule 37 and Annex IV)*

The signals of Rules 37 and Annex IV, used or exhibited either together or separately, indicate distress and need of assistance.

When a vessel is in distress and requires assistance she shall use or exhibit the signals described in Annex IV to these Regulations (Figure 9-37).

NOTE: The high-intensity white light flashing at regular intervals from 50-70 times per minute is *only authorized as a distress signal.* The use of this (commonly called a strobe light) for anything other than a distress signal on *inland waters is unlawful*, and is a violation of the Navigation Rules.

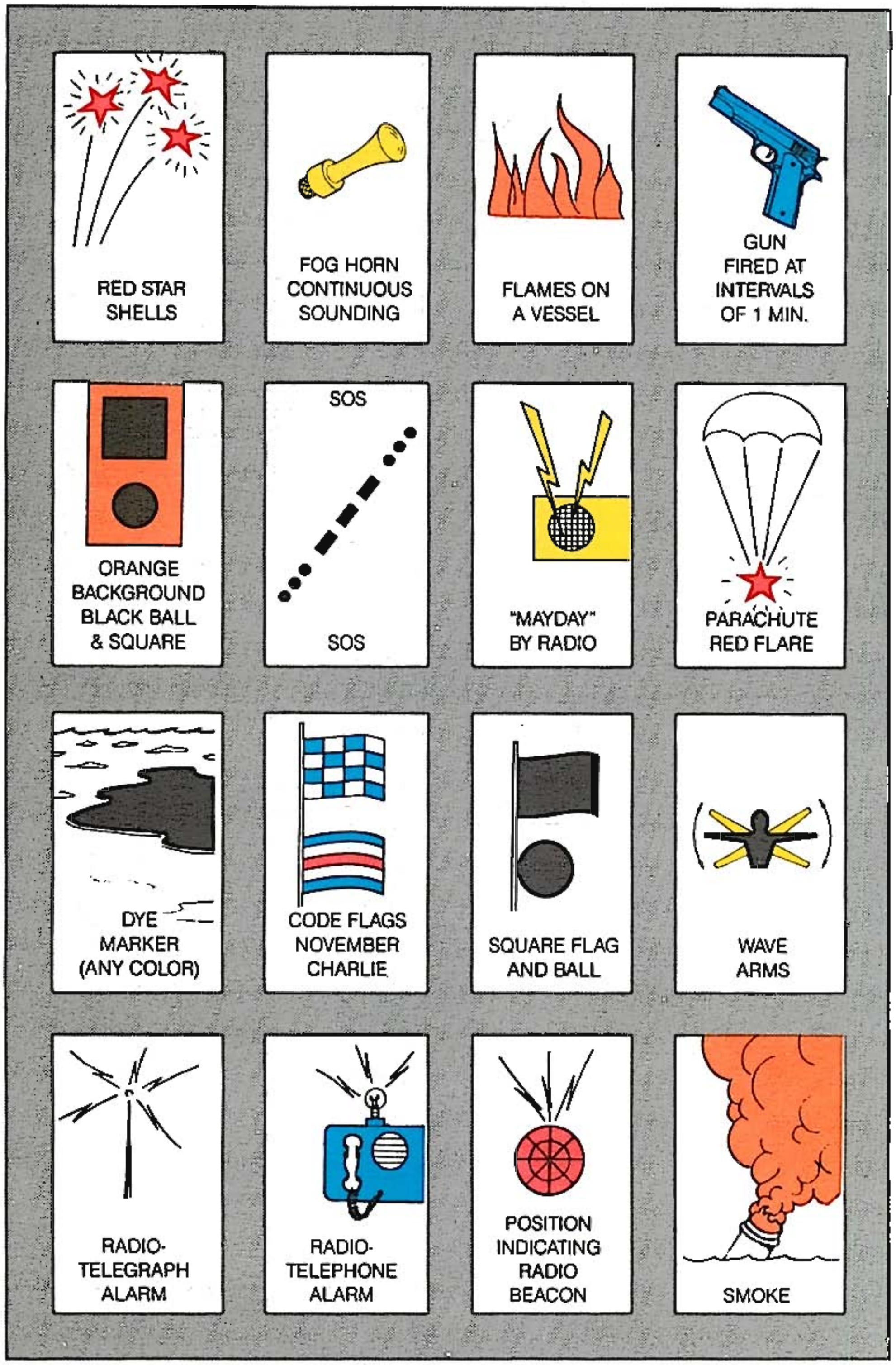

Figure 9-37. A vessel in distress shall use or exhibit these signals, either together or separately.

9.21 *NAVIGATION RULES, International-Inland.* U.S. Department of Transportation, United States Coast Guard.

TABLE OF CONTENTS

Navigation Rules: International-Inland:

A new version of this publication, dated April 20, 1984, and provided with a new durable, water-resistant cover, is available for purchase from the U.S. Government Printing Office. This book contains the rules of the nautical road applicable to all vessels on the navigable waters of the Unites States as well as on the high seas. It has more than 50 color illustrations of vessel lighting. The book also includes sections on the COLREGS demarcation lines, penalty provisions, alternative compliance procedures, and the vessel bridge-to-bridge radio telephone regulations.

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9.22 References

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U.S. Department of Transportation, U.S. Coast Guard. *Navigation Rules, International-Inland.* April, 1984.

NOTES

CHAPTER 10

COAST GUARD STANDARDS & PROCEDURES

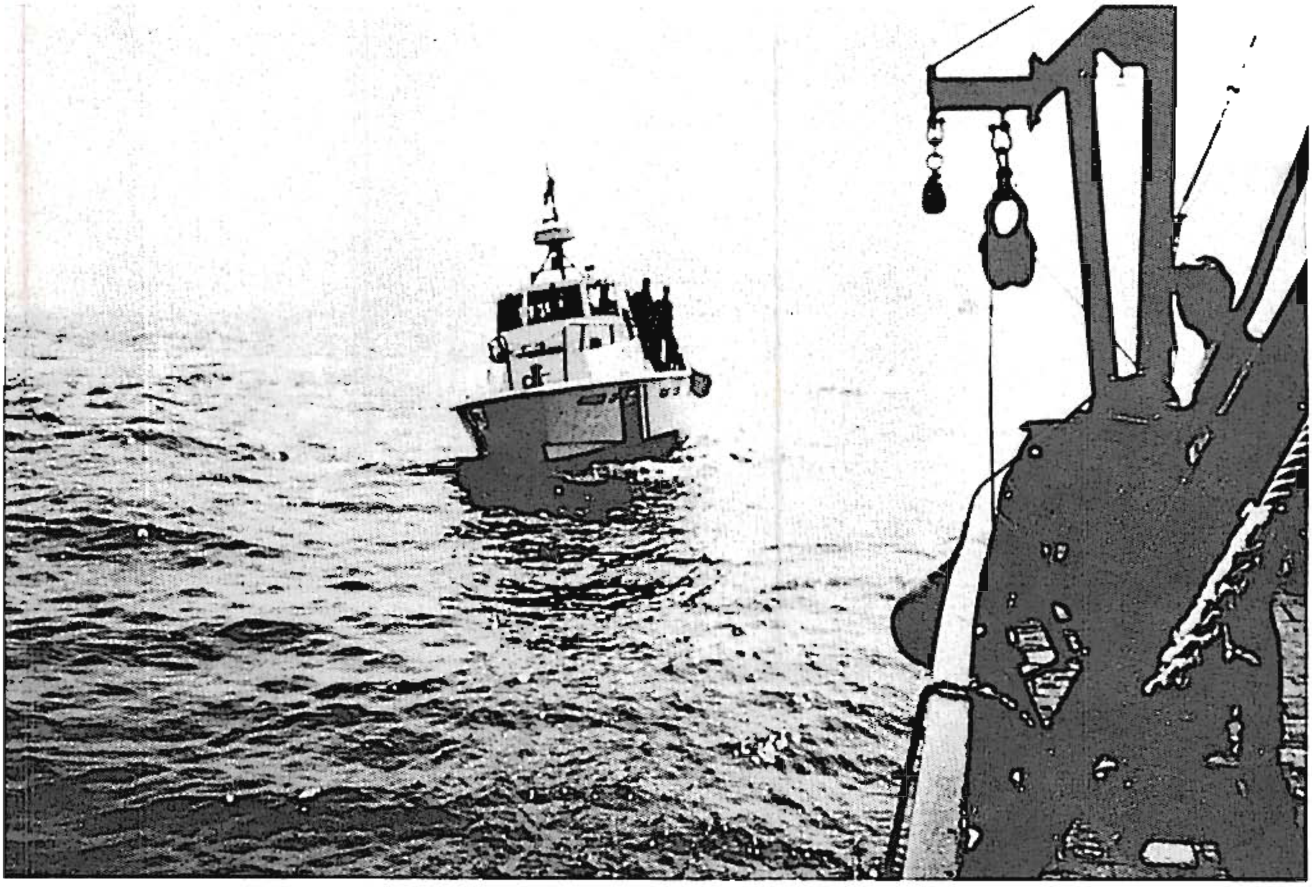


Photo courtesy of Kathy Castro

CHAPTER 10

COAST GUARD STANDARDS & PROCEDURES

Page

10.1 Float Plan

The Coast Guard recommends that the captain prepare a float plan before each trip begins. It should contain information needed to conduct a search for the vessel: the itinerary, time and place of departure, proposed fishing grounds, estimated length of trip, a list of everyone aboard, and the communications schedule. Whenever possible, the captain should report his position at intervals of no more than 24 hours.

Leave the float plan with the vessel owner or another responsible person ashore. The captain should tell the same person when he returns to port. That way, in the event of an emergency, the Coast Guard will have an idea where to search.

If the radio fails, the captain should pass his position to another vessel that has a functioning radio, and ask that his position be reported.

As required by the Federal law 46USC 2306 (a) (2), an owner, or another responsible person, having reason to believe (because of the lack of communication with or non-appearance of a vessel or any other incident after a 48 hour period) that a vessel may have been lost or imperiled, shall notify the Coast Guard, and use all available means to determine the status of the vessel.

Below is a suggested float plan format.

10.1.1 Suggested Float Plan

Voyage and Vessel Information

Date information furnished ____________ Type & Name of Vessel ____________

Planned Itinerary

Depart ____________ at ______ for ____________ ETA ________

Enroute or Alternate Ports ____________ ETA ________ ETD ________

____________ ETA ________ ETD ________

____________ ETA ________ ETD ________

Misc.Info: ____________

Purpose of Trip: ____________

Vessel Description

Official Number: ________ Homeport: ________ Length: ________

Beam: ________ Draft: ________ Freeboard: ________

Type of rig: ________ Any hull markings: ________

Colors: Hull: ________ Superstructure: ________ Deck: ________

Owner: ____________

Built by: ________ Year: ______ Hull Material: ________

Prominent features: Bowsprit: ________ Fish Pulpit: ________ Fly Bridge: ________

Boat Stowage: ________ Other: ________

Photo Attached: ________

Survival Equipment

Food and water on vessel (in days):________________

Boat: Type________________ Material________________ Length________

Capacity________________ Color________ Markings________________

Raft: Type________________ Material________ How Stowed________________

Capacity________________ Color________ Markings________________

Portable radio: Transmitter?________ Freqs________ Signal________________

Auto?________ Receiver?________ Remarks________________

EPIRB: Yes/no Class? (A) (B) (C) or Type I Where stowed?________________

Emergency gear: Flares?________ Smoke?________ Mirror?________

Radar?________ Reflector?________ Dye?________

Water?________ Rations?________ Lights?________

Other________________________________

Number, type, color, markings of life jackets, immersion suits, signs and other flotation gear: ________

____

Personnel

Operator's qualifications and experience:________________________________

____

Number of persons on board________

Data on persons on board:

Name	Address	Age	Sex	Citizenship

Remarks

Use this space to record any other desired information: ________________________________

____

____

Communications

Frequencies available________________________ Call Sign:________________

Transmitter power________________________ Aux Gen________________ Batteries________________

Communications schedule:

Will contact ________________________ on Freq ________________ at ________________

Will contact ________________________ on Freq ________________ at ________________

Will contact ________________________ on Freq ________________ at ________________

Name and addresses of points of contact:

At point of departure: ____

At destination:____

Others:____

To whom & by what means will arrival be reported________________________________

____

Navigation and Propulsion

Compass? ________ Condition ________________ Sextant?________ Proficiency ________________

Radio direction finder? __________ Freq. ______________ Range ____________ Calibrated? ____________

Loran? ______ Radar? __________ Fathometer? ________

Number, type & HP of engines ____

Cruising Speed ________________ Range ________________ Fuel Capacity ________________

If sail, estimated speed under various wind conditions: ________________________

If sail, type rig____

Spare sails________________________ If auxiliary, when is engine used? ________________

Search and Rescue Units

The following people and organizations should be notified as soon as there is reason to believe (because of the lack of communication with or non-appearance of this vessel or any other incident) that the vessel may have been lost or imperiled.

Name________________________________ Phone Number________________________

US COAST GUARD____

____

____

10.2 Signals

Signal AA AA AA

A Coast Guard unit may use the signal AA AA AA to attract attention. This signal, which is transmitted by a flashing light, consists of groups of the Morse code symbol A. It is continued until the vessel responds. The signal would appear as follows:

dot-dash-dot-dash . - . -
dot-dash-dot-dash . - . -
dot-dash-dot-dash . - . -

A vessel seeing this signal should identify itself.

Coast Guard signals to fishing vessels

All domestic fishing regulations contain enforcement provisions. A Coast Guard cutter or another authorized enforcement vessel may use one of several signals that appear in the *International Code of Signals* (HO-102).

10.2.1 Boarding Signals

Signal *L* - The signal *L* means: *you should stop or heave-to; I am going to board you.* It may be transmitted by flaghoist, flashing light or voice signal. Domestic vessels receiving this signal should stop for boarding. The flag signal *L* has four rectangles, two black and two yellow, at opposing corners (Figure 10-1).

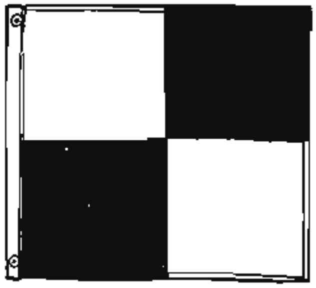


Figure 10-1. Flag signal L.

Lima - The flashing light signal consists of the Morse code symbol for L: *dot-dash-dot-dot*, . - . . The voice signal, which may be transmitted by radio telephone or by loudhailer, consists of the spoken word *LIMA* (pronounced LEE MAH). The word *LIMA* is spoken when a language barrier exists. Normally, however, once radio or loudhailer communications are established, the cutter will simply tell the vessel to "heave-to."

Signal SQ3 - The signal SQ3 means: *You should stop or heave-to; I am going to board you.* Although SQ3 is most commonly signaled by flaghoist, it may also be signaled by flashing light or voice.

The flaghoist consists of two flags and a pennant. The first flag is white, with a blue rectangle in the center, and the second flag is all yellow. The pennant has three vertical stripes: the inside stripe red, the middle stripe white, and the outside strip blue (Figure 10-2).

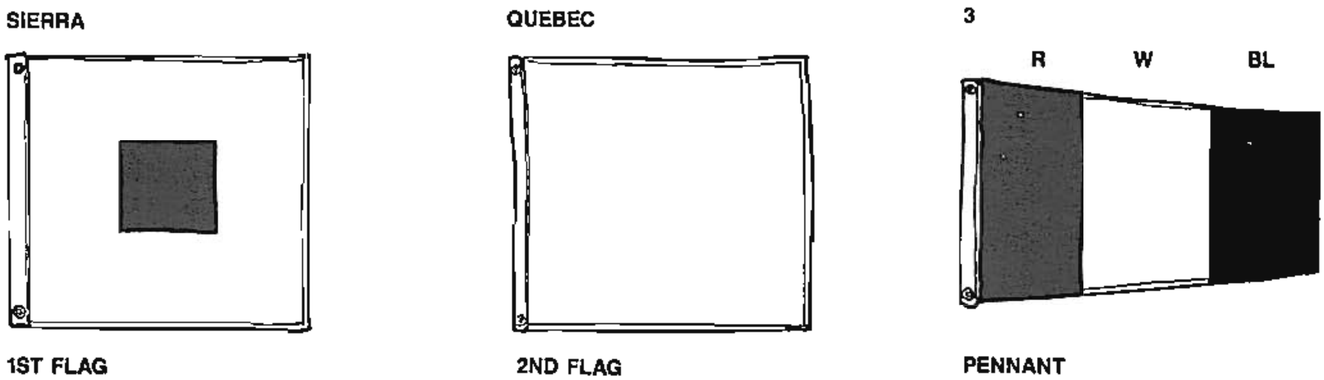


Figure 10-2. Signal flags for SQ3, Sierra Quebec 3.

A Coast Guard vessel showing the SQ3 three-flag signal may also display a red and white vertically-striped pennant at the top of the hoist. This pennant means: *I am using the International Code of Signals* (Figure 10-3).

The flashing light signal consists of three groups of Morse code symbols as follows:

S *dot-dot-dot* . . .
Q *dash-dash-dot-dash* - - . -
3 *dot-dot-dot-dash-dash* . . . - -

The voice signal consists of the spoken words: *Sierra Quebec Three.*

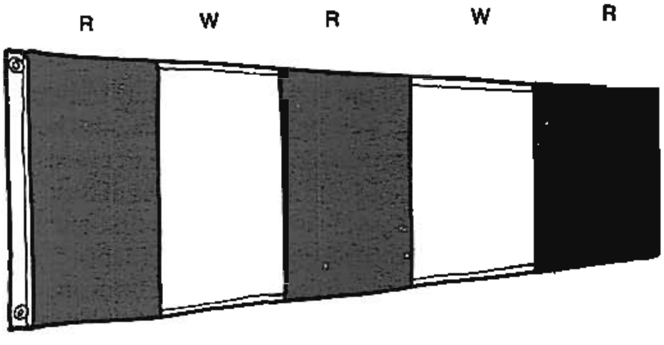


Figure 10-3. Pennant meaning: I am using the International Code of Signals.

10.3 Assistance & Rescue

The Coast Guard is the primary maritime search and rescue organization in the United States. It stands ready to assist vessels and people in distress.

However, in order for them to help, you *must notify the Coast Guard immediately* and provide all the necessary information. An accurate position is especially important.

You should have the means to survive the abandonment of your vessel until rescue units can locate and recover you from the water.

10.4 Coast Guard Towing Policy

In an emergency where there is an immediate threat to life and/or property, the Coast Guard will provide immediate assistance. In a non-emergency, where a vessel is disabled, but in *no immediate danger*, the Coast Guard will adhere to the following guidelines:

* Before committing Coast Guard resources, every effort will be made to determine if private commercial assistance is:
  a) available,
  b) willing, and
  c) qualified to provide the needed assistance in a reasonable time.

* If commercial assistance is not available, willing or qualified, the Coast Guard will, to the extent that resources are reasonably available, assist as follows:

a) Provide technical assistance, miscellaneous supplies and/or equipment to make temporary repairs on scene so the vessel can proceed safely under its own power to port, where permanent repairs can be made.

b) If repairs cannot be made on scene, the Coast Guard will tow the vessel to the *nearest safe port* where emergency (temporary) repairs can be made. It may not necessarily be the vessel's home port; nor will it necessarily have the facilities to perform permanent repairs.

c) If the vessel is carrying perishable cargo, the Coast Guard will make an effort to tow the vessel to a port where the cargo can be discharged.

10.5 Recommended Preparations for Towing

* Follow directions given by the Coast Guard.
* Clear the fo'c'sle and have the towing bridle ready.
* Have material handy to be used as chafing gear for the tow line.
* Have everyone put on their personal flotation devices (lifejackets).
* If the Coast Guard uses a line-throwing gun, keep all personnel under cover until the projectile clears your boat.
* Secure the tow line to your bridle.
* Clear everyone off the bow once the tow line is attached.
* Once in tow, keep a 24-hour watch in the pilot-house to steer and/or maintain the communications schedule with the towing vessel (Figure 10-4).

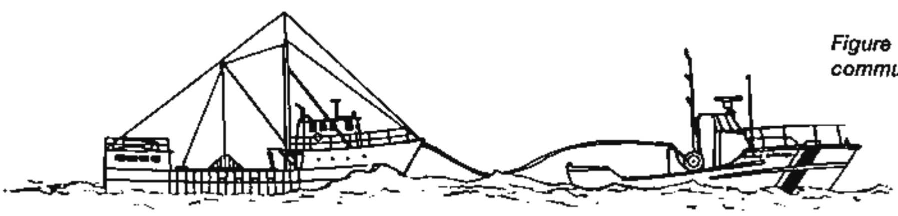


Figure 10-4. Steer and maintain the communications schedule with the towing vessel.

10.6 Medical Advice and Information

The captain of the vessel is ultimately responsible for the safety and well-being of the crew, and he should have a basic knowledge of first-aid and evacuation procedures. The Medical Emergencies at Sea chapter in this manual, and comprehensive first-aid manuals, will help you treat injured or ill patients. However, the captain and crew should take both an Advanced First-Aid and CPR course. The American Red Cross, the YMCA, community colleges and adult education programs frequently offer these courses.

In the event of a serious injury or illness, however, the Coast Guard and other private agencies are available to advise you over the radio. The Coast Guard may even decide that a Medical Evacuation is necessary. Therefore, the more accurately and completely you describe the patient's condition, the faster doctors can decide how to treat and/or transport him.

Without good communications, however, it is nearly impossible to make good decisions concerning the care of the patient. You must be able to establish clear communications with a shore station. Your radio should be equipped with a variety of Coast Guard working channels, and it must be maintained in good working condition. If you routinely fish outside the range of your VHF-FM radio, you should have single side band (SSB) equipment.

Medical cases are complicated enough without the handicap of language barriers. Someone on the vessel should be able to speak clear, understandable English, since translators are seldom available at shore stations.

Once you have given the Coast Guard the necessary information (name of vessel, position, number of persons on board, description of vessel, official number, lifesaving equipment, vital signs and symptoms of the injured), you can expect the following:

Evaluation - The Coast Guard will use its medical resources to evaluate your patient's condition based on the information you provide. They may suggest how to treat the patient, or at least how to make him more comfortable until he reaches professional care.

Evacuation - If the patients's condition is not serious, and the vessel is close to port, you may be advised to steam to port, or to meet a Coast Guard vessel that can transport him to shore. However, if the condition of the patient warrants, and weather conditions permit, the Coast Guard may decide that a helicopter evacuation is necessary.

Below is a suggested Medical Assistance Form format. It is designed to help you gather the information that the Coast Guard will need to determine if an evacuation is necessary.

10.6.1 Suggested Medical Assistance Form

Patient Information:

Name:______________________ Age: ________ Nationality: ______________________

Type ailment/injury: ____

____

When occurred: ____

Treatment administered/time: ____

Previous medical history: ____

Medicine chest: yes/no Medicine available: ____

Vital Signs:

Pulse: (strength) weak/normal/pounding (speed) slow/normal/rapid

Body temperature: cold/cool/warm/hot

Respirations: (strength) none/shallow/normal/deep (speed) none/normal/rapid

Blood pressure: ______________

General Symptoms:
Pain: (location) ______________________________

(strength) mild/moderate/severe (type) dull aching/steady/sharp throbbing

Skin condition: dry/sweaty (color) blanched/yellow/red/normal

(describe any rashes, where, when appeared) ______________________________

Patient conscious: yes/no Patient able to walk: yes/no

Eyes: (dilated) yes/no (reactive) yes/no (pupils equal) yes/no

Convulsions: yes/no Signs of shock: yes/no

Vomiting: yes/no (when started, how long) ______________________________

Specific Ailment/Injury Description:
Bleeding wounds:
(length, depth, location) ______________________________

(type) clean laceration/jagged tear (cause) ______________________________

(blood loss) yes/no (amount) ______________________________

(blood appearance) bright red spurting/dark red oozing

(bleeding controlled) yes/no (method of control) ______________________________

Burns: 1st/2nd/3rd Degree (Appearance) red/white/charred blistered/peeling

(size, location) ______________________________

Chemical injuries (ingestion, skin/eye contact)

(description of chemical) ______________________________

(amount/concentration) ______________________________

(if ingested, when, what, & how much did patient last eat) ______________________________

____

Striking wounds (broken bones, falls, concussions):

(what areas affected) ______________________________

(size, amount of swelling) ______________________________

(mobility of affected area) ______________________________

Head, Neck, Spinal injuries:
(loss of feeling) yes/no (where) ____________________

(mobility of extremities) ____________________

Additional Ship Information:

Last port of call/Destination: ____________________ ETA __________

Type/Vessel description: ____________________

Agent/Owner: ____________________

Contact phone number: ____________________

Communication schedule: ____________________ Freq.: __________

10.7 Medical Evacuation by Helicopter

Helicopter evacuations are only used when an injury is severe and life-threatening, because the procedure is dangerous for both the patient and the helo crew. Helicopter evacuation is not intended for a slightly injured crewmember, just so the vessel can keep fishing. However, if you believe that the injured crewman's life is threatened, contact the Coast Guard as soon as possible, so that they can gather medical information and dispatch a rescue team.

The decision to launch a helicopter is never easy. This is particularly true at night or in bad or worsening weather conditions. Coast Guard personnel need your complete cooperation to evaluate the patient's condition and to decide on the need for a helo evacuation.

Even though helicopters can fly more than 100 miles, the danger of the mission increases with distance. If a helo evacuation is required, you should stop fishing and steam toward the nearest port.

10.7.1 The Initial Radio Call

Set your VHF radio to channel 16, or your HF radio to 2182 KHz, call "Mayday" three times, and give the name of your vessel. When a Coast Guard unit responds, pass the requested information, such as your present position, the nature of the emergency, number of crew, and a visual description of your vessel. For more information on Distress Communications, refer to Section 5.7, Radiotelephone Operating Procedures.

The initial radio call should end with a request for a Medevac, the name of your vessel, and your call sign. The Coast Guard unit will ask you to shift to a working frequency to establish a communications schedule (comm schd).

It is important to establish a communication schedule with the Coast Guard, since an evaluation will take several minutes. The communication schedule is the only way for the Coast Guard to not only stay informed about the status of your emergency, but also relay medical instructions from the surgeons. Make sure that your radio is left on, that it is tuned to the correct channel, and that it is always manned.

The radioman will relay all your information to the appropriate Rescue Coordination Center (R.C.C.). Before a medical evacuation is authorized, the R.C.C. will contact a flight surgeon who evaluates the medical injury and determines whether immediate hospitalization is warranted. The R.C.C. authorizes an aircraft response only if it is required and feasible.

You may need to provide additional information on weather and sea conditions. Pilots are particularly interested in the visibility (distance you can see to the horizon) and ceiling (the distance you can see up). Wind speed and sea state are also very important.

10.7.2 Pre-Hoist Preparations

The crew of both the helicopter and your vessel must be in close communication, both before and after the helicopter is in flight. It is important that the Coast Guard know as much as possible about your situation, since pre-flight preparations include loading the proper equipment for the type of emergency: fire extinguishers, portable dewatering pumps, and/or medical equipment.

The helicopter crew will call you on the designated frequency 15 to 30 minutes before their arrival on scene, and they will ask you to make a short count. Key your microphone and count to five and back down to one. This transmission allows direction finding equipment aboard the helicopter to locate your position from the air.

After determining your location, the helicopter crew will begin the pre-hoist briefing. Assemble crewmembers near the radio, and prepare to follow the helicopter crew's instructions as they approach your position.

10.7.3 The Pre-Hoist Briefing

The pre-hoist briefing enables the rescue crew to update its information about your situation, and give you instructions on how to prepare your vessel for the hoist (see box). Make sure you understand these instructions for both your safety and the safety of the helicopter crew.

If the hoist is to take place at night, light the vessel's pick-up area as well as possible. Do not shine lights on the helo or use flash cameras. These lights will blind the pilot and destroy his night vision. Shine a light on any obstructions in the vicinity to warn the pilot be aware of their positions.

There will be a high noise level under the helicopter, making voice communications on the deck of your vessel virtually impossible. Arrange for, and agree on, a set of hand signals to be used among the crew who will be assisting in the hoist operations. Assign a crewmember to pass information from the pilothouse to the hoist area.

If the patient's condition permits, move him as close to the hoist area as possible before the helo arrives. *Time is crucial.*

Make sure the patient is wearing a tag indicating if and when you gave him any medication. Place any other necessary documents in a plastic bag and attach them to him: wallet, passport, visa, hospital insurance card, etc.

Have the patient in a lifejacket or a survival suit if his condition permits.

10.7.4 Arrival on Scene

The pilot will survey your vessel to identify any potential hazards, and he will then designate the hoist area. Be prepared to clear this area by disassembling all vertical obstructions, such as masts, antennas, riggings and guys. Leave all outriggers down.

Haul back any traps or trawls that were in the water. If this is impossible, you may have to cut the gear loose. If you tie a buoy to a trawl, you can clear the gear quickly and return to pick it up later.

As the helicopter approaches, the pilot may instruct the captain to change course direction and speed. He will want your vessel to steam upwind at an angle which makes the wind come over the port bow (Figure 10-5). This enables the pilot to maintain a steady hover into the wind, and keep the helicopter

Helicopter Evacuation Briefing

"A Coast Guard Helicopter is enroute to your position. Request that you make the following preparations for hoisting. Lower all masts and booms that can be lowered. Provide a clear area for hoisting, preferably on the stern. Keep all unnecessary personnel out of the way. When the helicopter arrives in your area, change course to place the wind 30 degrees on your port bow, and continue at standard speed. This may be modified on request from the helicopter pilot. The helicopter will provide all of the required equipment. The rescue device should be guided to the selected location on deck by the ship's crew by means of the steadying line. On each approach, allow the rescue device to touch your vessel, to discharge static electricity. If the rescue device has to be moved to the person being evacuated, unhook it from the cable. Do not move the rescue device from the hoisting area with the hoist cable still attached. If the cable is unhooked, do not, I repeat, do not attach the cable to any part of your vessel. For safety, the helicopter may move to one side while the patient is being prepared for hoisting. Ensure that the person being hoisted is wearing a lifejacket, if his condition permits. The patient should be informed of the instructions on the rescue device. Upon signal from your vessel, the aircraft will move back over the vessel and lower the hook. Allow the hook to touch your vessel to discharge static electricity. Then refasten the hook to the rescue device. When the vessel is ready to hoist, a "thumbs up" signal should be given to the aircraft. Ensure that personnel are tending the steadying line to prevent the rescue device from swinging excessively. During the hoist, strong gale force winds may be developed by the helicopter. These winds make it difficult to steer your vessel. Ensure that all loose gear on the vessel is securely tied down. Attempt to contact Coast Guard Rescue Helicopter (number) on (frequency) at (time)."

backwash behind the vessel and crew. Make sure you secure all loose objects on deck.

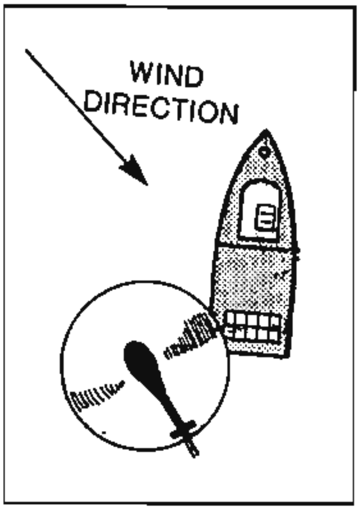


Figure 10-5. The helicopter pilot will ask you to steam upwind with the wind coming over your port bow.

10.7.5 The Hoist

Once the vessel is on the proper heading and the helicopter is hovering at the vessel's stern, you are ready to begin the hoist.

Rescue Device

The helo will provide the rescue device used to hoist the injured crewman. Do not use your own! Two rescue devices commonly used for the hoist are the Stokes litter and the rescue basket (Figure 10-6).

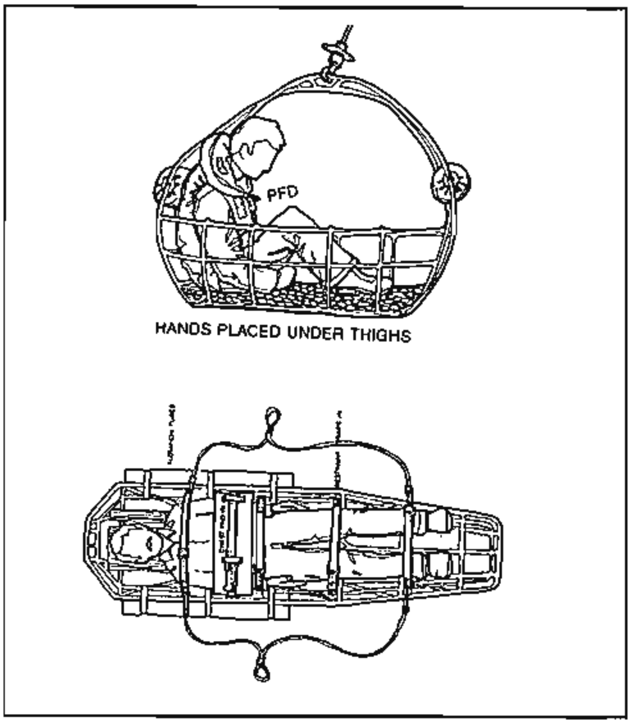


Figure 10-6. The rescue basket and stokes litter are used for hoisting patients under different conditions.

The stokes litter is used when a back or head injury requires immobilization of the neck and spine. Because of the severity of such an injury, a Coast Guard EMT (Emergency Medical Technician) swimmer is usually lowered to the vessel first, to help handle the patient. The rescue basket is used when the patient can sit up with no problem.

As the helo moves in, the hoist operator will usually lower a weighted trail line to the vessel. Let him drop the line directly onto the deck. Grab it and take up the slack as he pays it out. However, be careful as you approach the line that you are not injured by the weight bag.

Use the line to guide the basket or litter to the deck of the vessel. A common mistake is to allow the device to drop vertically. Your crew should pull the trail line so as to bring the device to the deck at an angle. Keep the line clear *at all times*.

The rotor blades of the helicopter build up a powerful static charge on the rescue device. Do not touch it until the device has made contact with a part of the vessel (Figure 10-7).

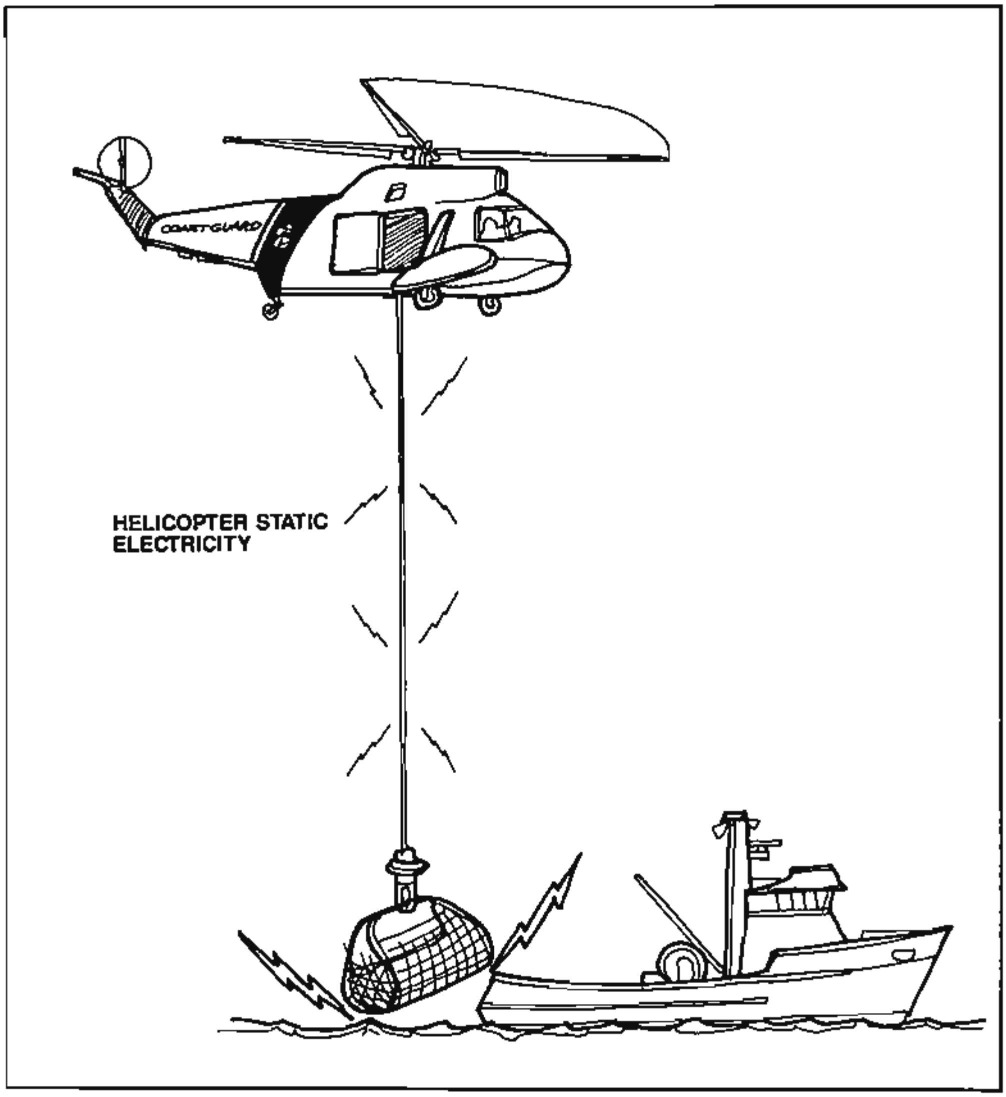
The pilot will instruct you whether or not to disconnect the device from the hoist cable. Normally, this is not necessary if the patient can be safely moved to the hoist area. However, if necessary, you can unclip the device and move it to the patient. The hoist operator will retrieve the hook and a crewman must continue to tend the trail line until the patient is ready to be hoisted. Make certain to re-hook the hoist cable to the larger snap hook prior to the hoist.

Under no circumstances should any crew member tie the trail line, or hook the hoist cable, to the vessel.

If the rescue basket is used, the crewman should be wearing a lifejacket. He can climb right in the basket, taking care to keep his hands clear of the sides. If the litter is used, and no Coast Guard personnel are available, follow the instructions on securing the patient. You must adjust four restraint straps and a chest pad.

When everything is ready on deck, check to make sure that the device is properly secured to the cable, and that both the trail line and the cable are clear to run free. Signal the hoist operator to begin the During the hoist, tend the trail line from the deck to steady the cage and to keep the cable from twisting. Keep your feet clear of the line.

If you are being hoisted in the basket, do not get out of the device until directed to do so by the hoist operator. He will pull the basket slightly above the hatch of the helicopter and lower it as he pulls you aboard.



WARNING A helicopter in flight builds up a static charge that must be removed prior to contact between any portion of the helicopter and an individual on the surface. Allow the hoist equipment to ground itself on the boat or contact the water prior to touching.

Figure 10-7. Static charges build up and should be discharged prior to touching.

Once the basket or litter is in the helo, the helo crewman will probably disconnect the trail line and drop it into the water. Retrieve it as quickly as possible to ensure that it does not get tangled in the vessel's propeller. Likewise, do not throw the line into the air, because it might get tangled in the helo's rotor blades.

Remember: Only call for a Medical Evacuation if you feel that the injured crewman's life is threatened.

A video is available on Coast Guard Air-Sea Rescue Procedures (See References).

10.8 Delivery of Coast Guard Dewatering Pumps

To prepare for the arrival of the helicopter or jet, follow the procedures discussed in the previous section - the initial radio call and pre-hoist preparations (Sections 10.9.1 and 10.9.2).

The Coast Guard will deliver a pump one of two ways, depending on the distance from shore and the sea conditions: the direct method, by helicopter; and the indirect method, by jet. The pump will be delivered packed inside a floatable container.

10.8.1 Direct Method of Delivery

With this method, the pump will be delivered directly to the deck of your vessel using the same procedure as in a Medevac hoisting (Section 10.9.5). The helo will come to a hover over a cleared space on deck and lower the floatable pump container using its winch cable. You can steady the pump with the attached trail line. Unhook the cable and keep it free for the helicopter to haul back in.

To avoid a static shock, allow the floatable container to contact the boat or water first to ground itself.

10.8.2 Indirect Method of Delivery

With this method, the jet will drop the floatable pump container from the aircraft into the water. A trail line is attached to the pump, which the aircraft tries to cross over the vessel. In some cases several pumps will be linked to each other by several trail lines. Personnel need only pull the pump to the vessel with the trail line and lift it aboard.

For this delivery, the vessel must be dead in the water, and there must be enough people aboard to lift the pump over the side.

Occasionally the trail line does not reach the vessel in distress. If the vessel is able to maneuver on its own, it can recover the line. However, if the vessel is without power, the Coast Guard can drop the pump down wind of the vessel; or, if another vessel is nearby, it can recover the line (Figure 10-8).

10.8.3 Operating Coast Guard Dewatering Pumps

The Coast Guard has adopted the CG-P1 pump as its standard dewatering pump. However, other dewatering pumps are still in use at many search and rescue (SAR) facilities. Each pump will come with an instruction card explaining how to operate it (Figure 10-9).

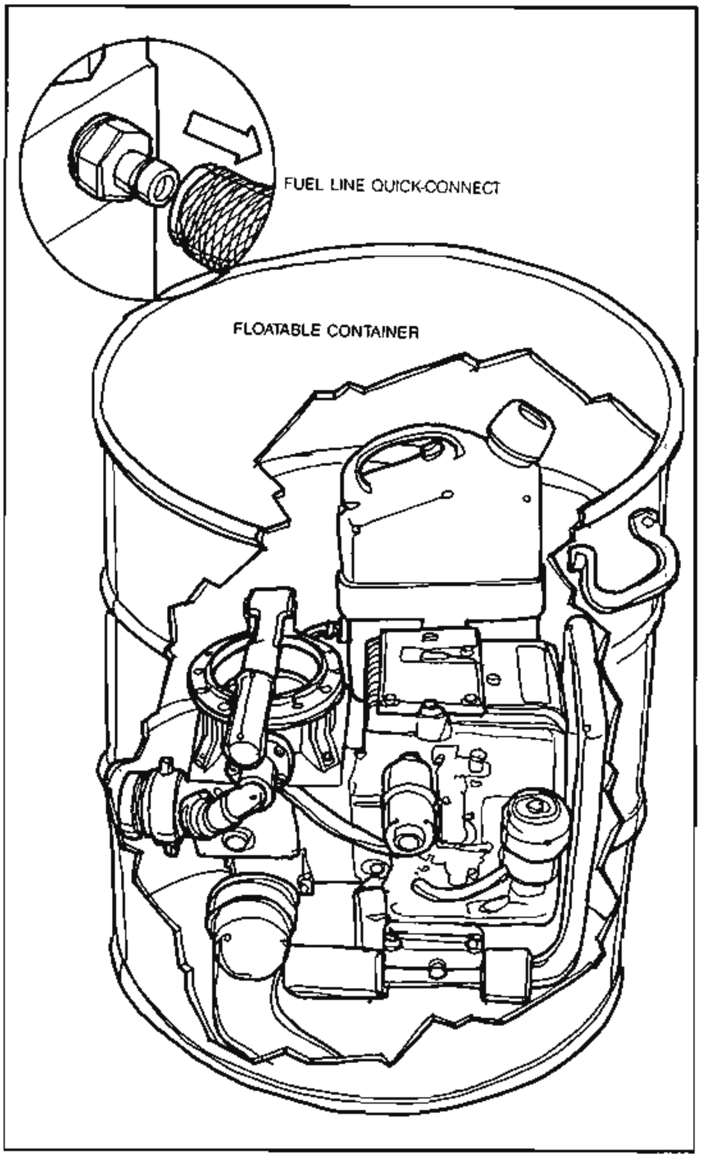


Figure 10-9. The CG-P1 dewatering pump.

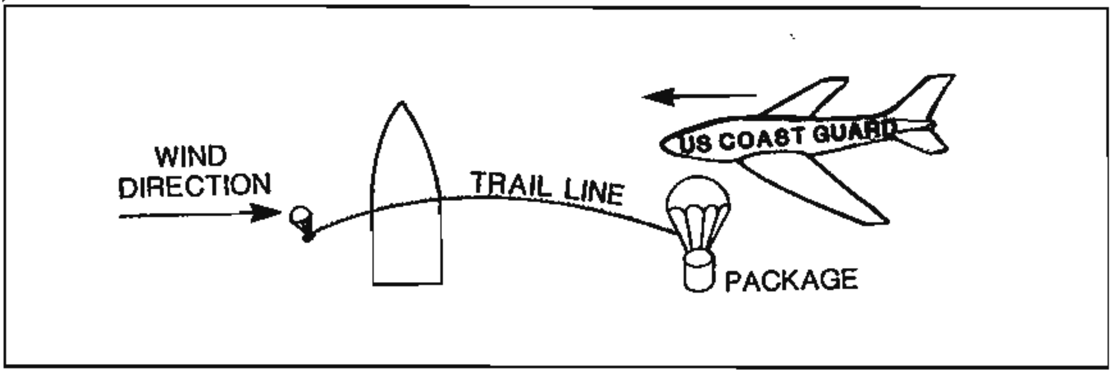
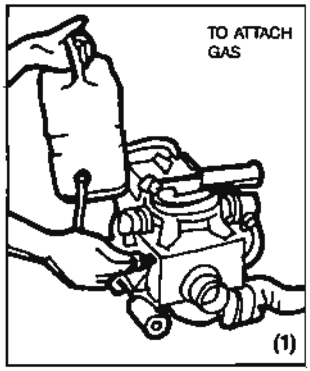
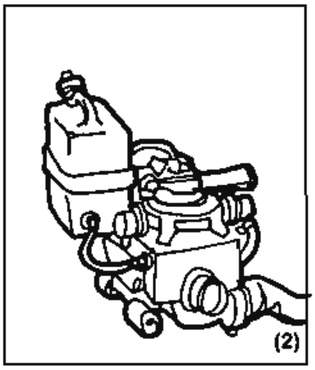


Figure 10-8. The Coast Guard aircraft can quickly deliver emergency equipment to your vessel.

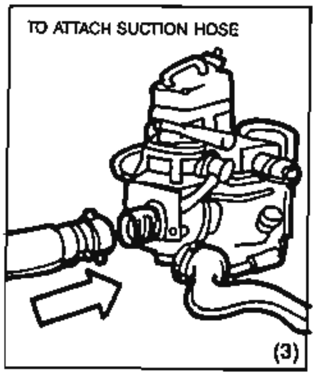
The following sample instructions are for the CG-P1 pump: (Figure 10-10)

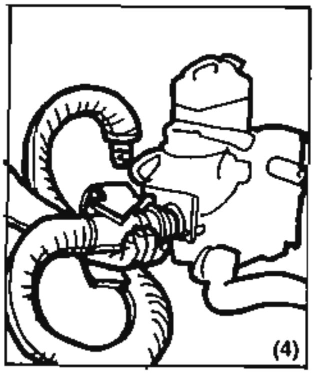
A. Before starting pump:
* Mount fuel tank to engine and connect fuel line to quick connect/disconnect fitting (1,2).

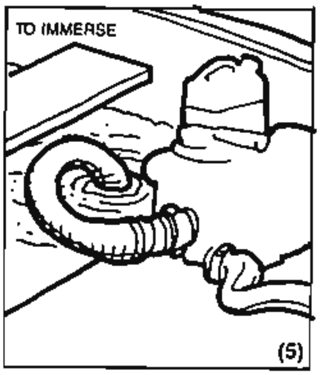




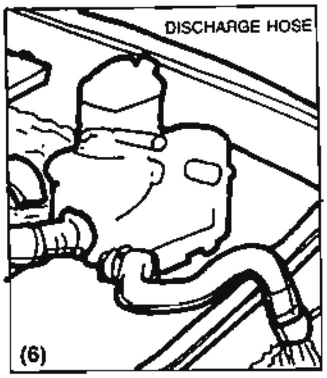
* Put strainer end of suction inlet hose into water being pumped and connect coupling to pump. Be sure strainer and end of hose are submerged. If air gets into inlet hose or strainer, the pump will not pump. If strainer is not used, large solids may plug or damage pump (3,4,5).

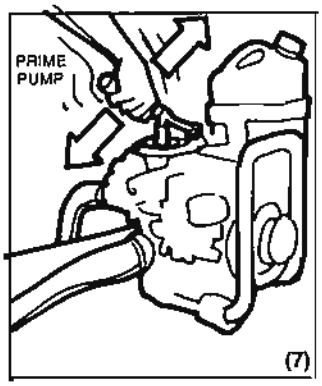






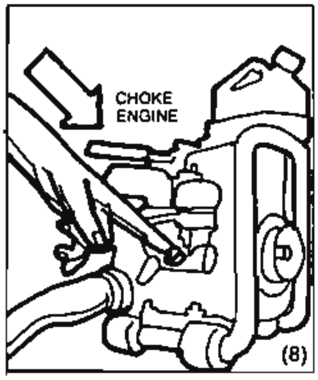
* Outlet (discharge) hose should be laid out with minimum of kinks or sags and placed overboard (6).



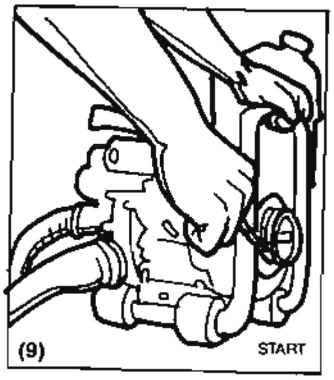


* Prime the pump with water by actuating hand pump until water discharges from plastic outlet of the hand pump (7).

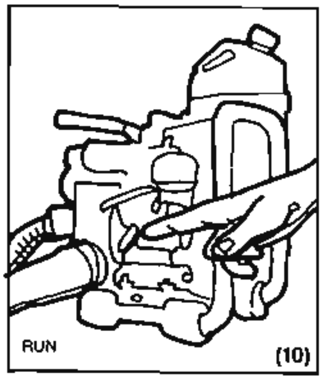
*Place the choke lever on engine to "choke" (8).



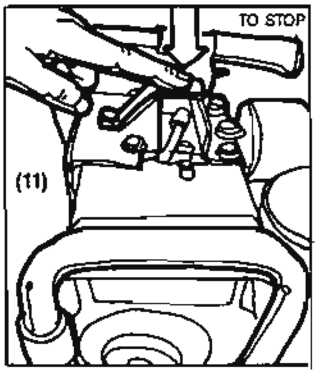
B. Operating pump:



* Wrap starter rope on pulley and pull (9).
* After second pull (if engine hasn't started), set choke half way and crank again. Then set choke at 1/4 to prevent flooding the engine.



* After starting, adjust choke for best operation (10).
* After pump and engine are started, actuate hand priming pump until pump is pumping water.
* Be sure inlet hose and strainer are kept under water.



* Stop engine before adding gasoline (11).
* Keep pump and engine as nearly level as possible.

C. To stop engine and pump:
* Disconnect fuel line. Engine will continue pumping for approximately one minute and then stop.
* When finished pumping, drain and flush the pump and hoses with fresh water.

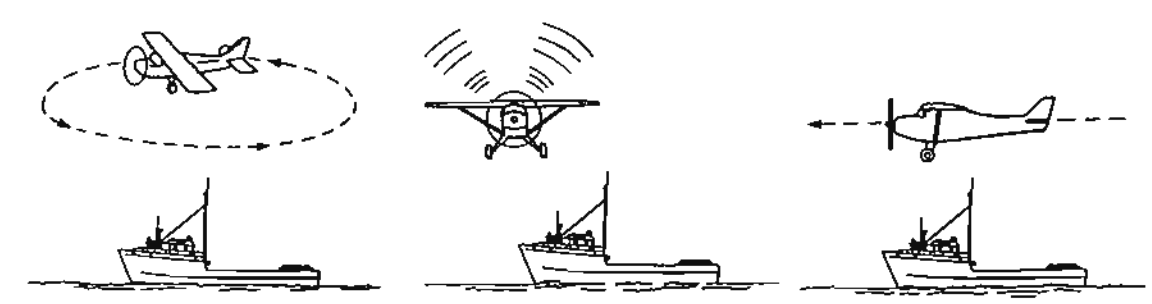
10.8.4 General Safety Instruction for Coast Guard Dewatering Pumps

* Refuel only in well-ventilated areas.
* If gasoline is spilled, move pump away from spill.
* Do not refuel gasoline tank while engine is running.
* Do not run engine in an enclosed area. Exhaust gases contain carbon monoxide, an odorless, colorless poison.
* To prevent accidental starting, always remove the spark plug from engine before working on engine or equipment.
* Do no tamper with exhaust system.
* Do not operate engine if air cleaner is removed (except for adjustment).
* Always keep hands and feet clear of rotating parts.
* Do not disconnect either suction or discharge hose during pump operation.
* Do not check oil or fuel level while engine is running.
* Use caution handling pump during and after running until engine has cooled.

10.9 Aircraft Rescue Signal

Important note - The international signal for an aircraft that wants to direct a surface craft to the scene of a distressed vessel is: *Circling your vessel while opening and closing his throttle or changing the pitch of his propellers* (Figure 10-11). This will give you a noticeable change in the sound of the aircraft. This will be done while crossing ahead of your vessel and proceeding in the direction of the distressed craft. You should follow the aircraft if you receive such a signal. In addition, you should attempt to communicate with the aircraft on 156.8 MHz (Channel 16 VHF-FM) when the aircraft makes the above attention-getting maneuvers. When your assistance is no longer needed, the aircraft will cross your wake and open and close the throttle and/or change the pitch of his propellers.

Note: Changes in speed and sound of some modern aircraft may be difficult to detect.



1. Aircraft circles the surface craft at least once.

2. Crosses the surface craft course close ahead at low altitude opening and closing throttle or changing the propeller pitch.

3. Heads in the direction in which the surface craft is to be directed.

Figure 10-11. Procedures performed in sequence by aircraft.

10.10 Coast Guard Search Patterns

The Coast Guard uses the following patterns when they are searching for a vessel. If you are a vessel in distress, and you are familiar with and can identify the search patterns being used, then you will be better able to determine the best time to use your distress signals. You should wait until the searching unit is close enough to your position and *looking* in your direction before using your signals. You'll be wasting your signals if you use them when a searching aircraft is pointed away from your position.

10.10.1 Track Crawl (route search)

This pattern is used when all that is known is the intended route of the missing craft. This search pattern works best when the rescuers can assume that the distressed craft is on or adjacent to its proposed route, that it will be easily discernible, and that there are survivors capable of signaling when they hear or see the search craft (Figure 10-12).

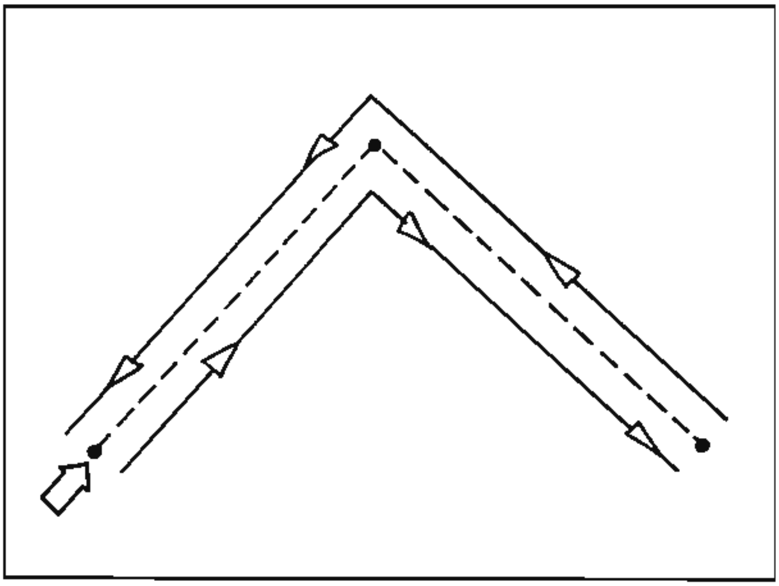


Figure 10-12. Track crawl search pattern.

10.10.2 Parallel Track Pattern

This pattern in used when the rescuers know the approximate location of the distressed vessel; the search area is large, therefore uniform coverage is necessary (Figure 10-13).

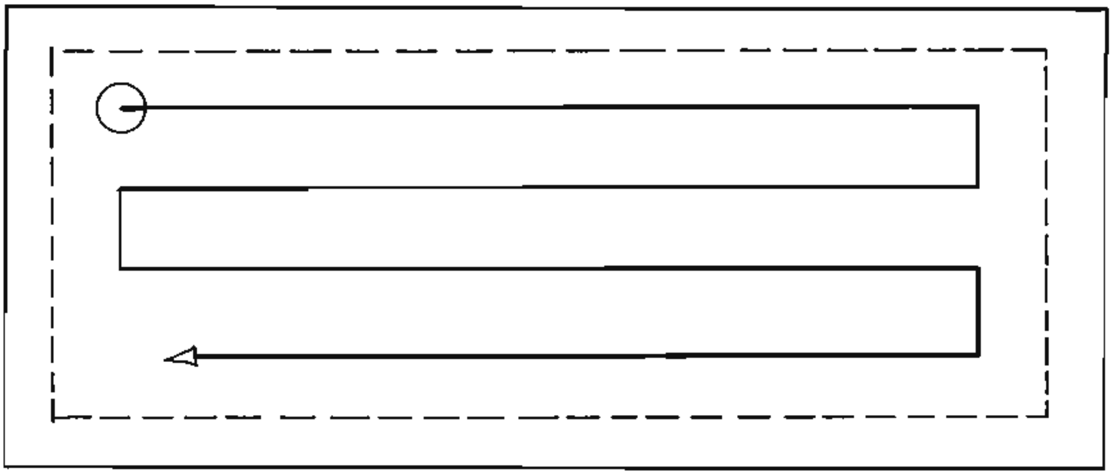


Figure 10-13. Parallel track search pattern.

10.10.3 Creeping Line Patterns

These patterns are used when information about the distressed vessel is limited to a line between two points, and when the vessel may be on either side of that line due to navigational error or drift (Figure 10-14). These patterns are generally selected when (1) rapid advancement of successive search legs along a given track is desired; (2) for coverage of the most probable area first.

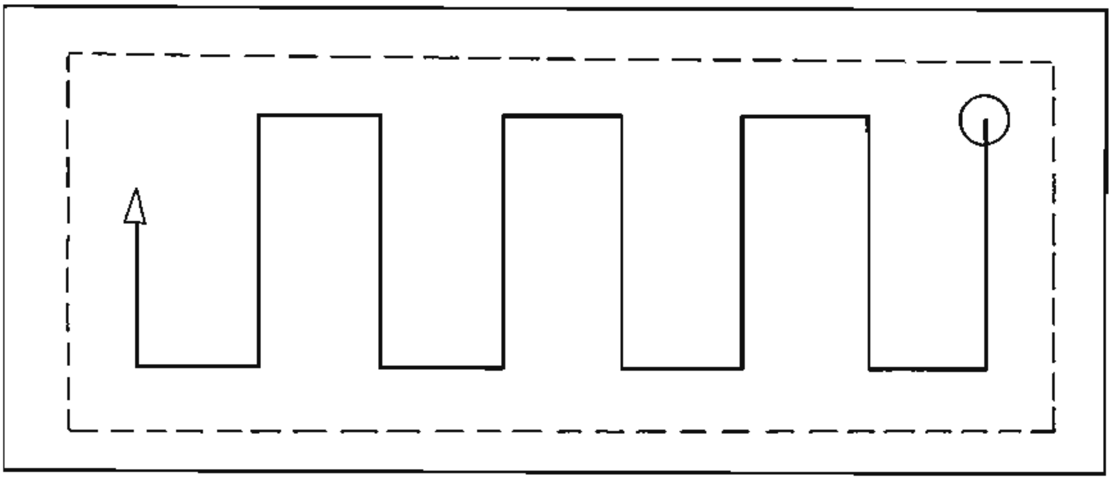


Figure 10-14. Creeping line search pattern.

10.10.4 Expanding Square

These patterns are started at the most probable location of the target, and expanded outward (Figure 10-15).

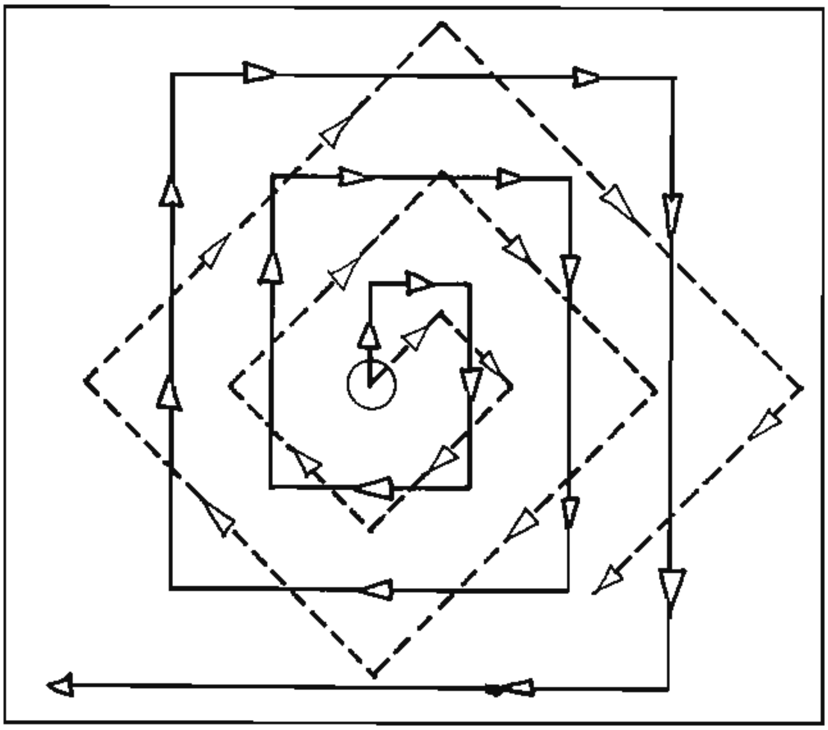


Figure 10-15. Expanding square search pattern.

10.10.5 Sector search pattern

This pattern is used when the rescuers know the position of the distressed vessel within close limits, and the search area is not large. The pattern resembles the spokes of a wheel, and covers a circular search area

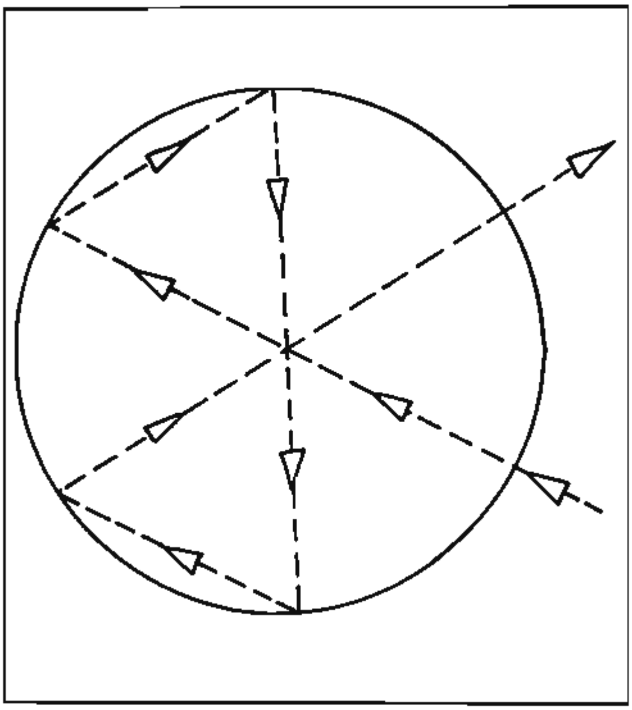


Figure 10-16. Sector search pattern.

10.11 Requirements for Reporting Marine Accidents

The owner, agent, master or person-in-charge of a documented or state numbered fishing vessel involved in an accident shall notify, as soon as possible, the nearest Coast Guard Marine Safety Office whenever the casualty involves any of the following (Fishing Vessel Safety Regulations, Section 28.080):

1). Loss of life;
2). An injury to an individual that causes that individual to remain incapacitated for a period in excess of 72 hours;
3). Loss of a vessel; or
4). Damage to or by a vessel, its apparel, gear, or cargo, except for fishing gear while not on board a vessel, that impairs the seaworthiness of the vessel or that is initially estimated at $2,500 or more.

Vessels involved in casualties, after initially notifying the Coast Guard, are required to forward a "Report of Marine Accident, Injury or Death" (Form CG-2692) to the nearest Marine Safety Office or Detachment. Form CG-2692 is available from Coast Guard Marine Safety Offices. A copy is in the appendix of this manual.

If filed without delay, the Form CG-2692 may also serve as the initial notification.

The law in 46 U.S. Code, Section 6103, states that if the above notification is not provided to the Coast Guard, the owner, charterer, managing operator, agent, master or individual in charge of the vessel is liable for a civil penalty of $1,000.

10.12 Correct Use of Strobe Lights

Many people use high-intensity strobe lights for purposes other than to request HELP. These other uses are not only against maritime law, but they can also confuse Search and Rescue units trying to locate individuals in distress.

Only use a strobe light when you are in distress and you want to attract the attention of Search and Rescue units. Avoid using strobe lights to mark fixed fishing gear, or as a warning or 'stay-away' signal.

Any light to attract the attention of another vessel shall be such that it cannot be mistaken for any aid to navigation. For the purpose of this Rule the use of high intensity intermittent or revolving lights, such as strobe lights, shall be avoided (Rule 36, Navigational Rules, International).

The Rules state, however, that you are to use all available means to avoid a collision, and in such a case, you may have to use a strobe light to attract the attention of the other vessel.

Strobe lights are recommended on immersion suits, personal flotation devices (lifejackets), and as man-overboard and liferaft lights.

10.13 Suggested Sources of Information

NAVIGATION AND VESSEL INSPECTION CIRCULAR LISTING

Number	Subject
1-63	Notes on Inspection and Repair of Wooden Hulls
10-65	Stability Determination in Capsizing Cases Involving Uninspected Vessels
7-68	Notes on Repair of Steel Vessels

6-72	CH-1 Guide to Fixed Fire-Fighting Equipment Aboard Merchant Vessels
8-80	Fire Hazard of Polyurethane and other Organic Foams
4-82	Uninspected Commercial Vessel Safety
12-82	Recommendations on Control of Excessive Noise
17-82	Intact Stability of Small Vessel; Recommendations
12-83	Intact Stability of Towing and Fishing Vessels; Research Results
5-86	Voluntary Standards for U.S. Uninspected Commercial Fishing Vessels
7-86	Information on the Adequacy and Currency of Nautical Charts
13-86	Use of Underwriters (UL) Listed Fire Extinguishers
1-87	Installation of Retroreflective Material on Lifesaving Equipment
8-87	Notes on Design, Construction, Inspection and Repair of Fiber Reinforced Plastic (FRP) Vessels.

The following U.S. Coast Guard regulations also may be useful:

Title 46 Code of Federal Regulation (CFR) Parts 24 through 27 - Subchapter C: Uninspected Vessels.
46 CFR 66 through 106 - Subchapter I: Cargo and Miscellaneous Vessels.
46 CFR 175 through 187 - Subchapter T: Small Passenger Vessels.
33 CFR 151 through 159 - Subchapter 0: Pollution.
33 CFR 173 through 183 - Subchapter S: Boating Safety.

We also suggest that you read the recommendations and rules of both the American Bureau of Shipping and the American Boating and Yacht Council. The Torremolinos International Convention for the Safety of Fishing Vessels, 1977, Parts A and B (developed for the International Maritime Organization), is especially useful for reference in new vessel construction.

Special Note:

Much of the material used to develop safety standards for commercial fishing vessels already exists: however, it is scattered throughout several publications and documents. The Commercial Fishing Industry Vessel Safety Act of 1988 is a significant step in improving safety in the industry (see Appendix). This manual covers all current safety regulations, but it does not project what future regulations will be implemented by the U.S. Coast Guard and other agencies responsible for fishing vessel safety.

Other

Additional publications are listed in the Appendix.

10.14 References

University of Rhode Island and the United States Coast Guard. Video on *Air-Sea Rescue Procedures*. 14 minutes. Rhode Island Sea Grant Publication. 1990.

US Coast Guard First District. *Local Notice to Mariners*. Special Edition. 1990.

CHAPTER 11

STABILITY

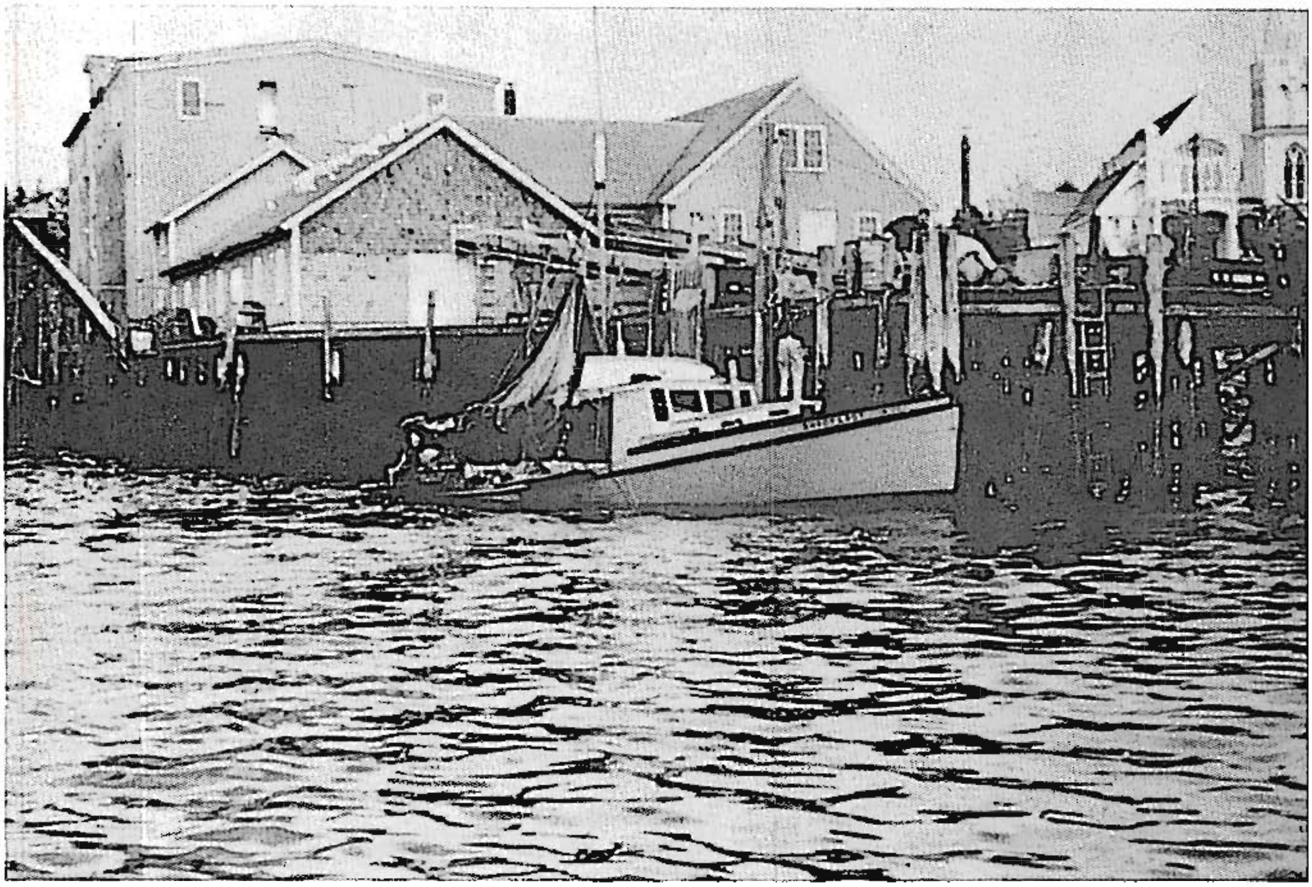


Photo courtesy of Phil Averill

CHAPTER 11

STABILITY

Page

11.1 Stability

Approximately 70% of deaths involving commercial fishing industry vessels are related to stability. In an effort to reduce these casualties, Sub-chapter E of the Fishing Vessel Safety Act addresses stability requirements for commercial fishing vessels. The regulations will apply to all vessels built after or substantially altered after December 31, 1989. Refer to the Appendix for more detailed information about these requirements.

Maintaining proper stability on fishing vessels is one of the most difficult tasks for the fisherman. Making decisions in favor of your own safety often means reducing the size of the catch you can bring aboard. The more you learn about stability, especially the stability limits of your own boat, the safer you will be.

A properly designed and evaluated vessel should have enough *built in* stability reserve to survive a storm at sea, provided you handle the vessel prudently. Since your vessel's stability is reduced when you are fishing - hauling nets and opening hatches to stow the catch - *you* must be the stability judge.

11.1.1 Your Part as Captain

The most important thing to remember while you are fishing and stowing catch, is to keep to a *minimum* the number of stability hazards present at the same time. For instance, while you are lifting the codend aboard, be aware of the hazards posed by an open hatch. Be aware of the effects of shifting catch on deck, or of a partially filled fish hold or ballast tank. Do your ballasting either after the catch is stowed or before it is lifted clear of the water; and shift your fuel and top off the tanks *before* lifting the catch on deck.

It is important to stress here that no design is *guaranteed* stable under all conditions, and that stability must be maintained by *you*, the operator. Since stability changes continuously, it is not sufficient just to get a *stability test*, and assume your boat is safe forevermore. Stability changes with every gallon of fuel, ice, and water that is used. It changes with every shift in ballast, and with every load of fish; and it makes a difference whether you put the cargo down low or on deck. Finally, the stability of your boat changes with every wave that passes under the boat, since stability varies with the position of your vessel on the wave.

It is common for fishermen to use as small a boat as possible to carry a given payload. However, the safety margins inherent in the vessel's design may be reduced to unacceptable levels. Stability and load-carrying capacity are competing requirements which you must satisfy on a day-to-day basis.

Commercial fishing boats tend to grow as they get older, both in weight (displacement), and in the height of the center of gravity. Since both of these changes result in a reduction in stability, be aware of them at all times.

Most fishermen understand that they need a stability evaluation for any major modifications to a boat, but they tend to ignore the cumulative effect of many small changes. If you have any doubt as to the effects of any modification, get a professional opinion.

As the marine insurance industry increases its emphasis on stability assessments for commercial vessels, these assessments are sure to play a major role in assigning risk categories in the near future.

11.1.2 The Designer's Part

The boat designer or naval architect can help you determine how your fishing operations affect the stability of your vessel. He will need to know:

* how much cargo you will carry at one time
* whether you will carry it on a long or short voyage
* when you will be exposed to seaways
* whether you will operate during icing periods
* when and where you expect to refuel, add more ice and replenish stores
* whether you will change rigs.

With this information, the designer can produce a boat (or the naval architect can provide you with loading recommendations) that allow for a margin of safety in all these situations. With this information, he can also give you instructions on when to modify stability by shifting fuel, ballast, etc.

The architect combines the information on fishing and operating conditions, the weight of the vessel, and the center of gravity. He then estimates the loads, fuel and consumables for the typical conditions on most voyages, including *departing for the fishing grounds, fishing, departing for home port, arriving at the home port, and off-loading.*

With this information, he combines the location of the center of gravity in these loaded conditions, with information he has in a computer model of your boat's hull, and he evaluates the boat's stability against a standard. The Coast Guard is currently recommending the *IMO Fishing Vessel* or *Torremolinos* criteria. This standard not only covers initial stability with the boat on an even keel, but it also requires a range of stability and a minimum total righting energy (discussed in Section 11.2.8).

For details on this standard, look in the Coast Guard's Navigation and Vessel Inspection Circular (NVIC) 5-86. Keep in mind that whatever the standard, it is useful only if your vessel meets it in all conditions of operating, fishing and loading. To be sure that this is the case, your naval architect must be intimately familiar with your fishing and operating practices, and any changes you make in your vessel or its rig.

11.2 Principles of Stability

A floating body is acted upon by forces of gravity and forces of buoyancy. The algebraic sum of these forces must equal zero if equilibrium is to exist.

Any object exists in one of three states of stability: stable, neutral, or unstable. We may illustrate these three states by placing three cones on a table top, as shown in Figure 11-1. When cone A is tipped so that its base is off the horizontal plane, it tends up to a certain angle of inclination, to assume its original position again. Cone A is thus an example of a stable body - that is, one which tries to attain its original position through a specified range of angles of inclination. Cone B is an example of neutral stability. When rotated, this cone may come to rest at any point, reaching equilibrium at some angle of inclination.

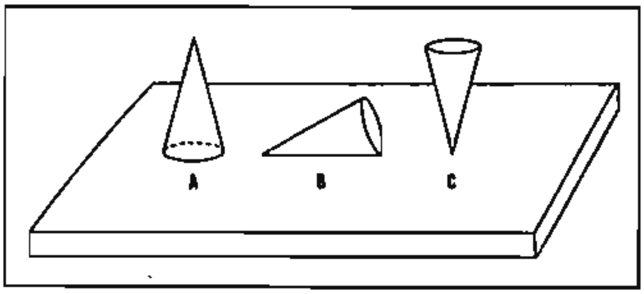


Figure 11-1. Three states of stability.

Cone C, balanced upon its apex, is an example of an unstable body. Following any slight inclination by an external force, the body will come to rest in a new position where it will be more stable.

From Archimedes' law, we know that an object floating on or submerged in a fluid is buoyed up by a force equal to the weight of the fluid it displaces. The weight (displacement) of a vessel depends upon the weight of all parts, equipment, stores, and personnel. This total weight represents the effect of gravitational force. When a fishing vessel is floated, she sinks into the water until the weight of the fluid displaced by her underwater volume is equal to the weight of the vessel. At this point, the vessel is in equilibrium - that is, the forces of gravity (G) and the forces of buoyancy (B) are equal, and the algebraic sum of all forces acting upon the vessel is equal to zero. This condition is shown in part A of Figure 11-2.

If the underwater volume of the vessel is not sufficient to displace an amount of fluid equal to the weight of the vessel, the vessel will sink (part B of Figure 11-2) because the forces of gravity are greater than the forces of buoyancy.

The depth to which a fishing vessel will sink when floated in water depends upon the density of the water, since the density affects the weight per unit volume of a fluid. Thus we may expect a vessel to have a deeper draft in fresh water than in salt water, since fresh water is less dense (and therefore less buoyant) than salt water.

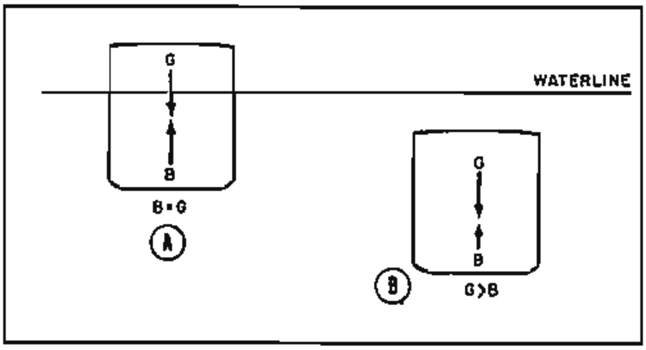


Figure 11-2. Interaction of force of gravity and force of buoyancy.

Although gravitational forces act everywhere upon the vessel, it is not necessary to attempt to consider these forces separately. Instead, the total force of gravity is regarded as a single resultant or composite force which acts vertically downward through the vessel's *center of gravity* (G). Similarly, the force of buoyancy may be regarded as a single resultant force which acts vertically upward through the *center of buoyancy* (B) located at the geometric center of the vessel's underwater body. When a vessel is at rest in calm water, the center of gravity and the center of buoyancy lie on the same vertical line.

11.2.1 Displacement

Since weight (W) is equal to the displacement, it is possible to measure the volume of the underwater body (V) in cubic feet and multiply this volume by the weight of a cubic foot of sea water, in order to find out what the vessel weighs. This relationship may be written as:

(1) $W = V \times \frac{1}{35}$ or (2) $V = 35W$

where

V = volume of displaced sea water, in cubic feet
W = weight, in tons
35 = cubic feet of sea water per ton (When dealing with vessels it is customary to use the long ton of 2240 pounds.)

It is also obvious, then, that displacement will vary with draft. As the draft increases, the displacement increases. This is indicated in Figure 11-3 by a series of displacements shown for successive draft lines on the midship section of a fishing vessel.

The volume of an underwater body for a given draft line can be measured in the drafting room by us-

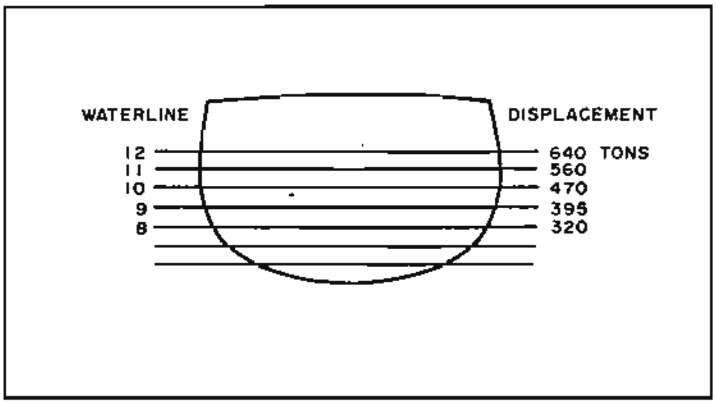


Figure 11-3. Displacement data.

ing graphic or mathematical means. This is done for a series of drafts throughout the probable range of displacements in which a vessel is likely to operate. The values obtained are plotted on a grid on which feet of draft are measured vertically and tons of displacement horizontally. A smooth line is faired through the points plotted, providing a curve of displacement versus draft, or a *displacement curve* as it is generally called. The result is shown in Figure 11-4 for a fishing vessel.

To use the curve shown in Figure 11-4 for finding the displacement when the draft is given, locate the value of the mean draft on the draft scale at left and proceed horizontally across the diagram to the curve. Then drop vertically downward and read the displacement from the scale. For example, if the mean draft is 10 feet, the displacement found from the curve is approximately 470 tons.

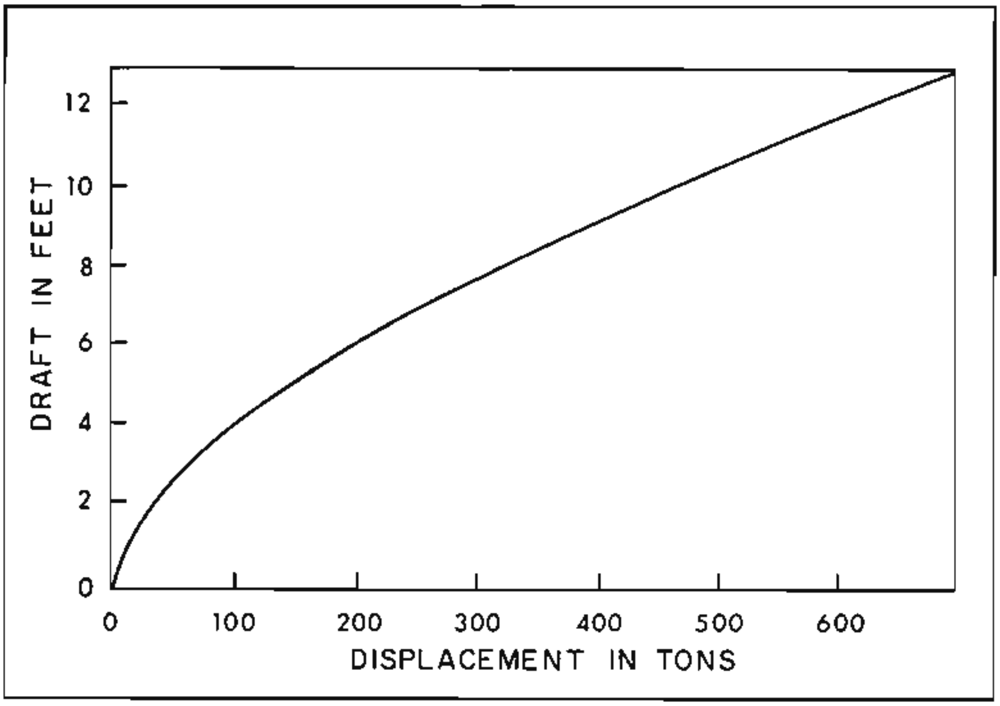


Figure 11-4. Displacement curve for a 120 foot fishing vessel.

11.2.2 KB Versus Draft

As the draft increases, the center of buoyancy (B) rises with respect to the keel (K). Figure 11-5 shows how different drafts result in different values of KB, the height of the center of buoyancy from the keel (K). A series of values for KB is obtained and these values are plotted on a curve to show KB versus draft. Figure 11-6 illustrates a typical KB curve.

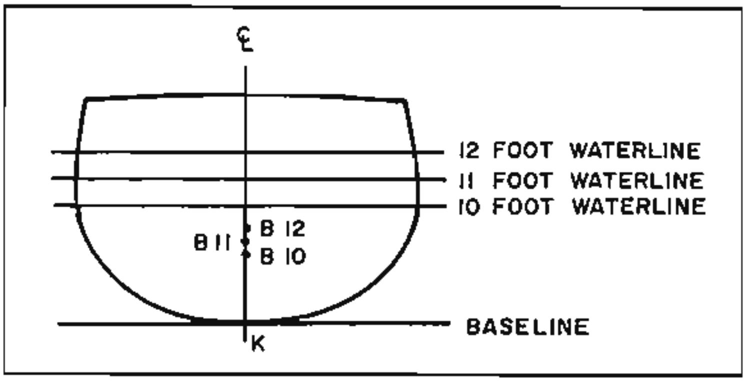


Figure 11-5. Successive centers of buoyancy (B) for different drafts.

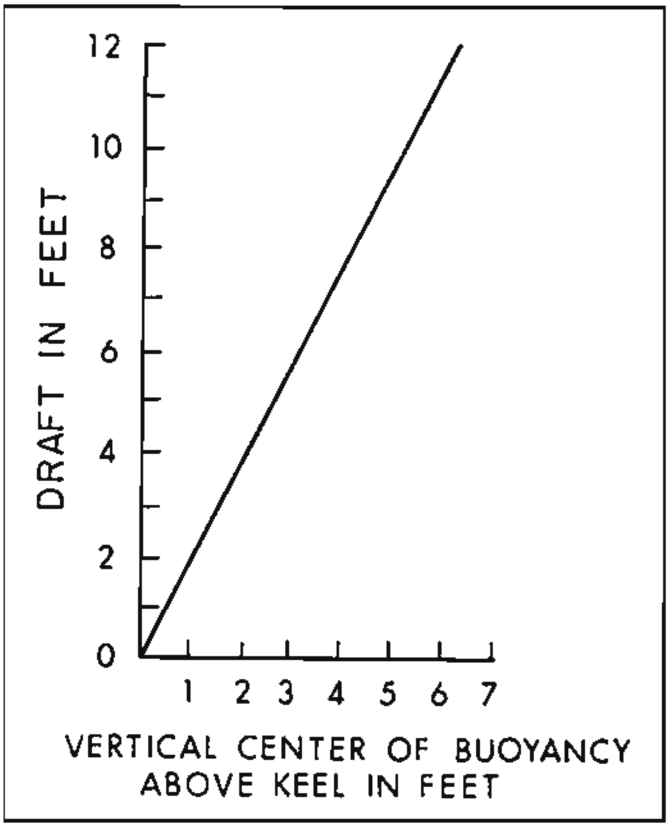


Figure 11-6. KB curve.

To read KB when the draft is known, start at the proper value of draft on the scale at the left and proceed horizontally to the curve. Then drop vertically downward to the baseline (KB). Thus, if a vessel were floating at a mean draft of 10 feet, the KB found from the chart would be approximately 5 feet.

11.2.3 Reserve Buoyancy

The volume of the watertight portion of the vessel above the waterline is known as the vessel's reserve buoyancy. *Freeboard*, a rough measure of the reserve buoyancy, is the distance in feet from the waterline to the main deck. Freeboard is calculated at the midship section. As is indicated in Figure 11-7, freeboard plus draft is equal to the depth of the hull in feet.

When weight is added to a ship, draft and displacement increase in the same amount that freeboard and reserve buoyancy decrease. Reserve buoyancy is an important factor in a vessel's ability to survive flooding due to damage. It also contributes to the seaworthiness of the ship in very rough weather.

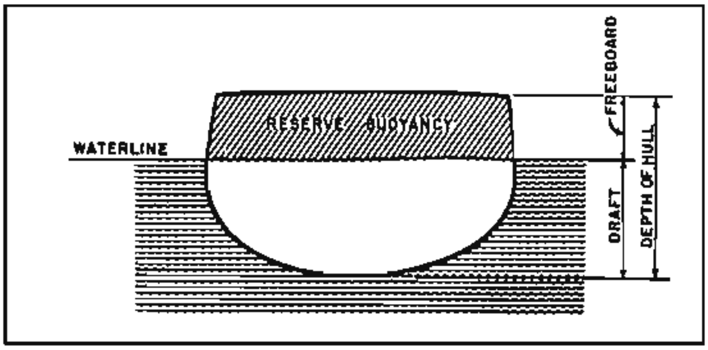


Figure 11-7. Reserve buoyancy, freeboard, draft, and depth of hull.

11.2.4 Inclining Moments

The *moment* of a force is the tendency of the force to produce rotation or to move an object about an axis. The distance between the point at which the force is acting and the axis of rotation is called the *moment arm* or the *lever arm of moment*. To find the value of a moment, we multiply the magnitude of the force by the distance between the force and the axis of rotation. The magnitude of the force is expressed in some unit of weight (pounds, tons, etc.) and the distance is expressed in some unit of length (inches, feet, etc.); hence the unit of the moment is the foot-pound, the foot-ton, or some similar unit.

When two forces of equal magnitude act in opposite and parallel directions and are separated by a perpendicular distance, they form a *couple*. The *moment of a couple* is found by multiplying the magnitude of one of the forces by the perpendicular distance between the lines of action of the two forces.

When a disturbing force exerts an inclining moment on a fishing vessel, causing the vessel to heel over to some angle, there is a change in the shape of the vessel's underwater body and a consequent relocation of the center of buoyancy. Because of this shift in the location of B, B and G no longer act in the same vertical line. Instead of acting as separate equal and opposite forces, B and G now form a couple.

The newly formed couple produces either a *righting moment* or and *upsetting moment*, depending upon the relative locations of B and G. The fishing vessel illustrated in Figure 11-8 develops a righting moment, the magnitude of which is equal to the magnitude of one of the forces (B or G) times the perpendicular distance (GZ) which separates the lines of action of the forces. The distance GZ is known as the *righting arm* of the vessel.

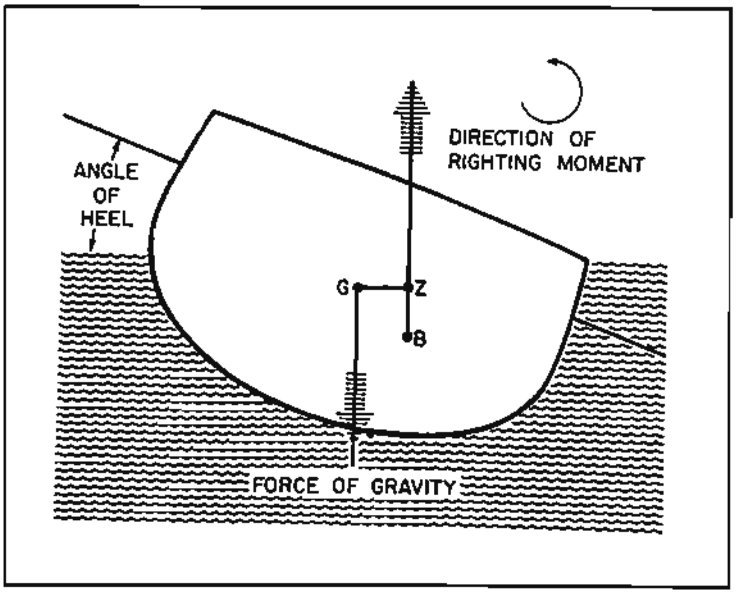


Figure 11-8. Development of righting moment when a stable ship inclines.

Mathematically,

$$RM = W \times GZ$$

where:

RM = righting moment (in foot-tons)
W = displacement (in tons)
GZ = righting arm (in feet)

For example, a fishing vessel which displaces 500 tons and has a 2-foot righting arm at a certain angle of inclination has a righting moment of 500 tons times 2 feet, or 1000 foot-tons. This 1000 foot-tons represents the moment, which in this instance tends to return the ship to an upright position.

Figure 11-9 shows the development of an upsetting moment resulting from the inclination of an unstable ship. In this case, it is apparent that the high location of G and the new location of B contribute to the development of an upsetting moment rather than a righting moment.

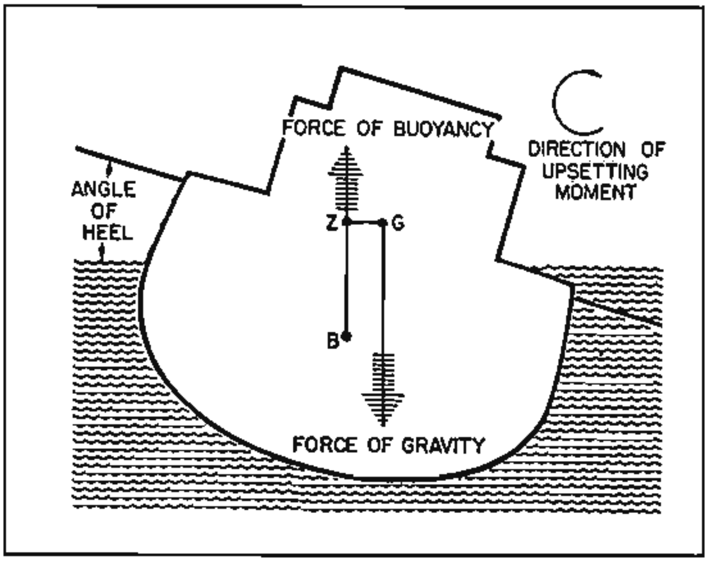


Figure 11-9. Development of upsetting moment when unstable ship inclines.

11.2.5 The Metacenter (M)

A fishing vessel metacenter is the intersection of two successive lines of action of the force of buoyancy as the ship heels through a very small angle. Figure 11-10 shows two lines of buoyant force. One of these represents the ship on an even keel. The point where they intersect is the initial position of the metacenter.

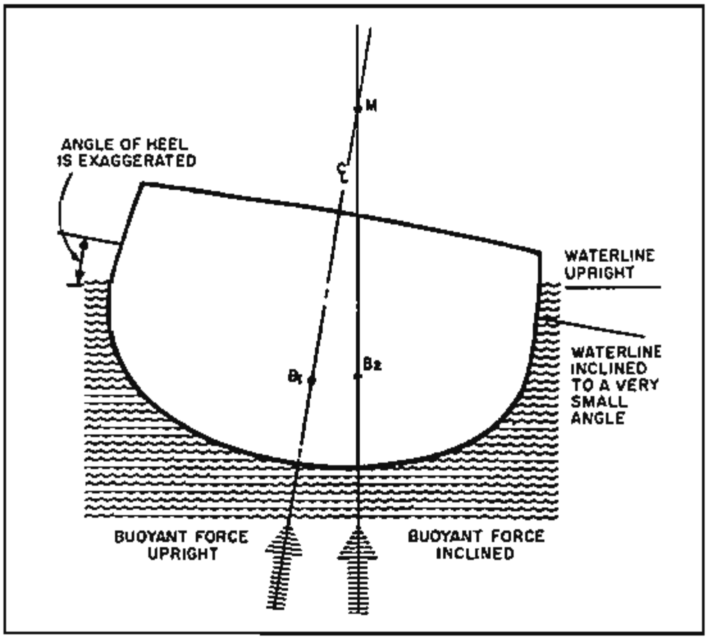


Figure 11-10. The metacenter.

When the angle of heel is greater than the angle used to compute the metacenter, M moves off the centerline and the path of movement is a curve. However, it is the *initial position* of the metacenter that is most useful in the study of stability. In the discussion which follows, the initial position is referred to as M. The distance from the center of buoyancy (B) to the metacenter (M) when the ship is on an even keel is the metacentric radius.

11.2.6 Metacentric Height (GM)

The distance from the center of gravity (G) to the metacenter is known as the fishing vessel's metacentric height (GM). Figure 11-11 shows a vessel heeled through a small angle (the angle is exaggerated in the drawing), establishing a metacenter at M. The fishing vessel's righting arm GZ is one side of the triangle GZM. In this triangle GZM, the angle of heel is at M. The side GM is perpendicular to the waterline when the vessel is inclined.

It is evident that for any angle of heel not greater than 7°, there will be a definite relationship between GM and GZ because GZ=GM sin (Ø). Thus, GM acts as a measure of GZ, the righting arm.

GM is also an indication of whether the fishing vessel is stable or unstable at small angles of inclination. If M is above G, the metacentric height is positive, the moments which develop when the fishing ves-

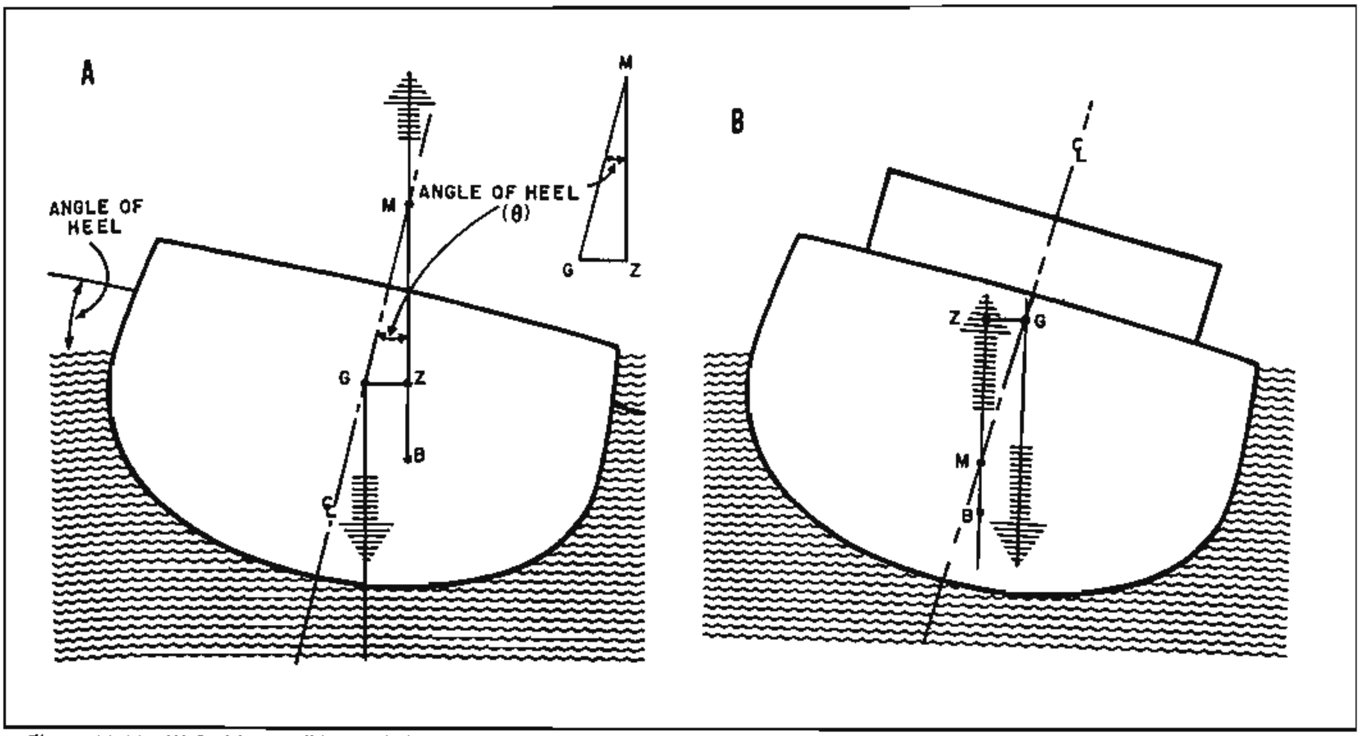


Figure 11-11. (A) Stable condition, G is below M; (B) Unstable condition, G is above M.

sel is inclined are righting moments, and the vessel is stable (part A of Figure 11-11). But if M is below G, the metacentric height is negative, the moments which develop are upsetting moments, and the vessel is unstable (part B of Figure 11-11).

11.2.7 Influence of Metacentric Height

When the metacentric height of a fishing vessel is large, the righting arms that develop at small angles of heel are also large. Such a vessel resists roll and is said to be *stiff*. When the metacentric height is small, the righting arms are also small. Such a vessel rolls slowly and is said to be *tender*.

Large GM and large righting arms are desirable for resistance to the flooding effects of damage. However, a smaller GM is sometimes desirable for the slow, easy roll which makes a comfortable work environment. Thus the GM value for a fishing vessel is the result of compromise.

11.2.8 Stability Curves

When a series of values for GZ at successive angles of heel are plotted on a graph, the result is a *stability curve*. The stability curve shown in Figure 11-12(a) is called a *curve of static stability*. The word *static* indicates that it is not necessary for the fishing vessel to be in motion for the curve to apply; if the vessel were momentarily stopped at any angle during its roll, the value of GZ given by the curve would still apply (Figure 11-12(b)).

To understand the stability curve, it is necessary to consider the following facts:

1. The fishing vessel's center of gravity does not change position as the angle of heel is changed.
2. The fishing vessel's center of buoyancy is always at the center of the vessel's underwater hull.
3. The shape of the ship's underwater hull changes as the angle of heel changes.

Putting these facts together, it can be seen that the position of G remains constant as the fishing vessel heels through various angles, but the position of B changes according to the angle of inclination. Initial stability increases with increasing angle of heel at an almost constant rate; but at large angles the increase in GZ begins to level off and gradually diminishes, becoming zero at very large angles of heel.

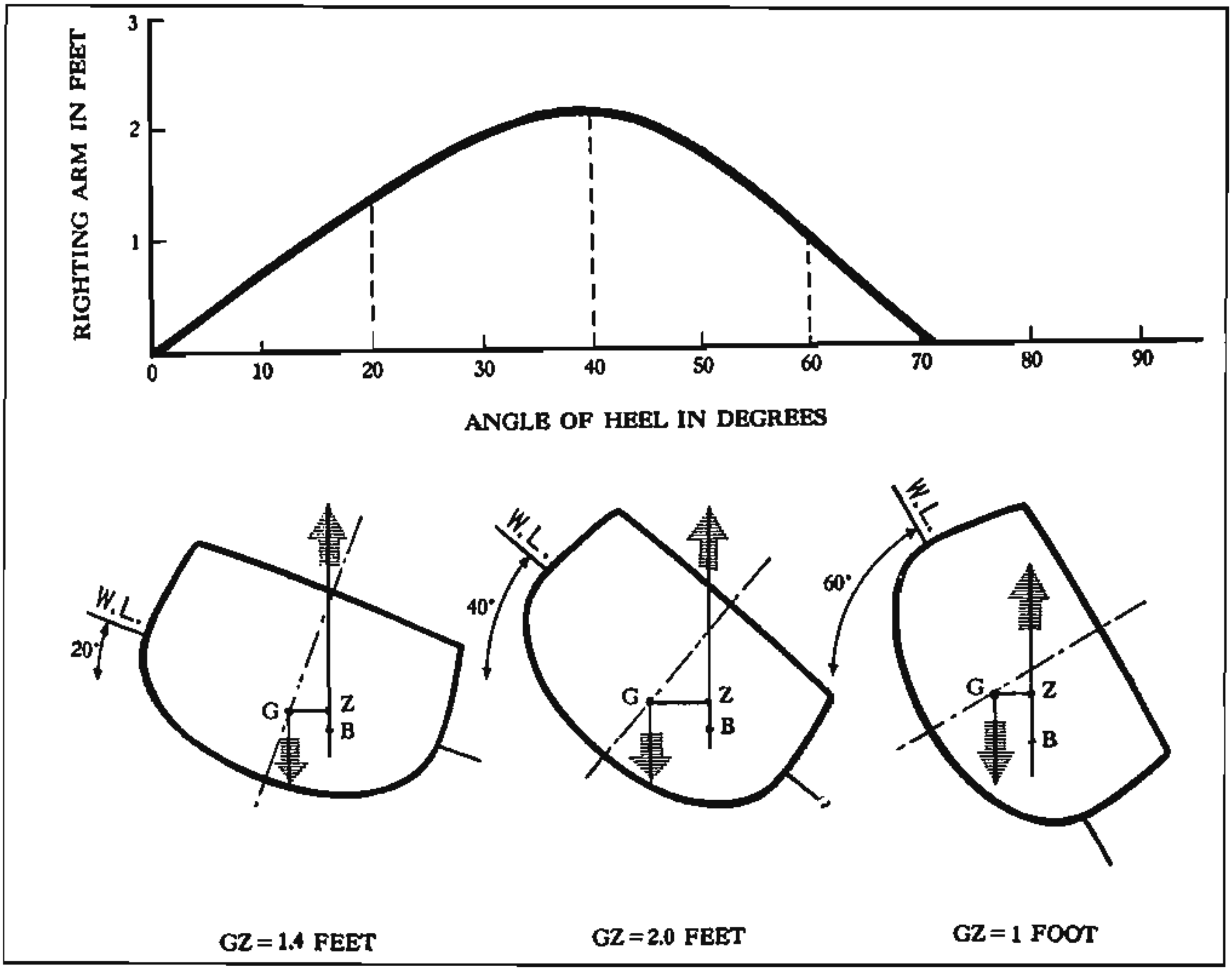


Figure 11-12. Righting arms of a ship inclined at successively larger angles of heel.

11.2.9 Cross Curves of Stability

To facilitate stability calculations, the designer inclines a lines drawing of the fishing vessel at a given angle, and then lays off on it a series of waterlines. These waterlines are chosen at evenly spaces drafts throughout the probable range of displacements. For each waterline the value of the righting arm is calculated, using an *assumed* center of gravity rather than the *true* center of gravity. A series of such calculations is made for various angles of heel - usually 15°, 30°, 45°, 60°, 75° - and the results are plotted on a grid to form a series of curves known as the *cross curves of stability* (Figure 11-13). Note that, as draft and displacement increase, the curves all slope downward, indicating increasingly smaller righting arms.

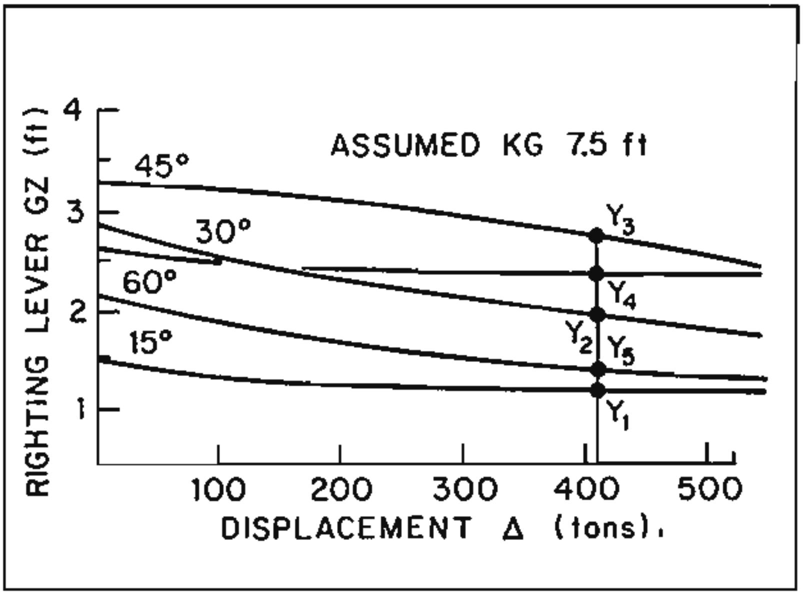


Figure 11-13. Cross curves of stability.

The cross curves are used in the preparation of stability curves. To take a stability curve from the cross curves, a vertical line (such as line MN in Figure 11-13) is drawn on the cross curve sheet at the displacement which corresponds to the mean draft of the vessel. At the intersection of this vertical line with each cross curve, the corresponding value of the righting arm on the vertical scale at the left can be read. Then this value of the righting arm at the corresponding angle of heel is plotted on the grid for the stability curve. When a series of such values of the righting arms from 15° through 75° of heel have been plotted, a smooth line is drawn through them and the *uncorrected* stability curve for the vessel at that particular displacement is obtained. The curve is not corrected for the actual height of the vessel's center of gravity, since the cross curves are based on an assumed height of G. However, the stability curve does embody the effect on the righting arm of the freeboard for a given position of the center of gravity.

Figure 11-14 shows an uncorrected stability curve (A) for the fishing vessel operating at 415 tons displacement, taken from the cross curves shown in Figure 11-13. This stability curve cannot be used in its present form, since the cross curves are made up on the basis of an *assumed* center of gravity. In actual operation, the fishing vessel's condition of loading will affect its displacement and, therefore, the location of G. To use a curve taken from the cross curves, therefore, it is necessary to correct the curve for the *actual* height of G above the keel (K) - that is, it is necessary to use the distance KG. As far as the new center of gravity is concerned, when a center of gravity can be found by taking moments of the old system plus that of the new weight and dividing this total moment by the total final weight.

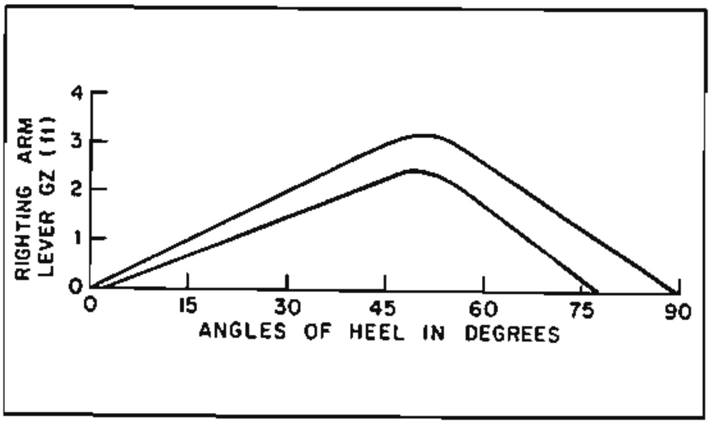


Figure 11-14. (A) Uncorrected stability curve taken from cross curves. (B) Corrected stability curve.

11.2.10 The Inclining Experiment

The vertical location of the center of gravity must be known in order to determine the stability characteristics of a fishing vessel. Although the position of the center of gravity as estimated by calculation is sufficient for design purposes, an accurate determination is required to establish the ship's stability. Therefore, an inclining experiment is performed to obtain a precise measurement of KG, the vertical height of G above the keel (base line), when the fishing vessel is completed. An inclining experiment consists of moving one or more large weights across the fishing vessel and measuring the angle of list produced (see Figure 11-15).

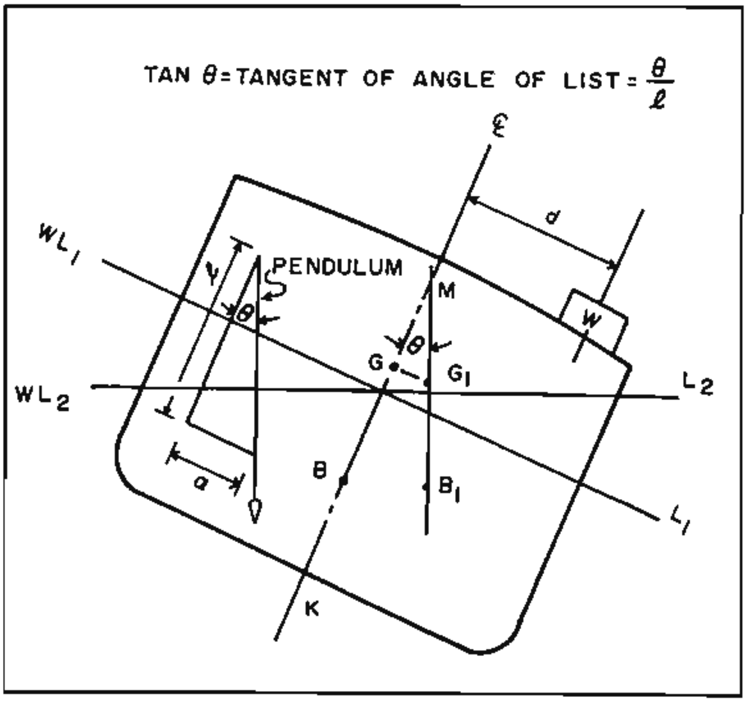


Figure 11-15. Measuring the angle of list produced in performing the inclining experiment.

This angle of list, produced by the weight movement and measured by means of a pendulum and a horizontal batten or an inclinometer device designed for this purpose, usually does not exceed two degrees.

The metacentric height is calculated from the formula:

$$GM = \frac{wd}{W \tan(\emptyset)}$$

where

w = inclining weight, in tons
d = distance weight is moved athwartships, in feet
W = displacement of vessel, including weight w, in tons
tan (Ø) = tangent of angle of list

The result of this experiment are calculated and tabulated in the *Stability Booklet*..

The KG obtained from the inclining experiment is accurate for the particular condition of loading in which the ship was inclined. This is known as Condition A, or the "As-Inclined" condition. The fishing vessel may have been in any condition of loading at the time of the experiment and this may not have been in operating condition. In order to convert the data thus obtained to practical use, KG must be determined for various operating conditions. The standard loading conditions as found in the *Stability Booklet* are as follows:

Condition 1. Depart Port
Condition 2. Arrive Fishing Grounds
Condition 3. Fishing - 20% Catch on Board
Condition 4. Fishing - 50% Catch on Board
Condition 5. Depart Fishing Grounds
Condition 6. Arrive Port - 20% Reserve

Condition A - Light Condition assumes that the vessel is complete and in all respects ready for sea, but with no load aboard - no fuel oil, stores, crew and effects, or water. Although not an operating condition, Condition A is the basic condition from which other conditions are calculated.

After obtaining the displacement and locating the center of gravity for the vessel in Condition A, corresponding valued may be computed for other standard conditions of loading. The weights and vertical moments of all consumables to go aboard are determined and, starting with the displacement and KG for Condition A, a new displacement, KG, and GM are calculated for each of the other conditions of loading. The GM thus obtained is in each case corrected for the free surface assumed to exist in the fishing vessel's tanks for that particular condition of loading (Free surface is discussed later in this chapter).

Having determined displacement and KG, it is possible to draw a curve of stability for each condition of load.

11.3 Factors Influencing Stability

The following figures illustrate factors that you can control, and how they affect your vessel's stability. The illustrations show changes in righting energy, range of stability and maximum righting arm in the normal operation of the vessel. If you are aware of how your actions affect stability, you can take precautions to improve or maintain stability. You should also be aware that these effects can be cumulative; that is, that they add together and can reduce your stability to unacceptable levels.

11.3.1 Effect of Load Height

Figure 11-16 shows a typical fishing vessel with its catch in the hold (Condition 1). The vessel is stable as indicated by the large total righting energy, range of stability and maximum righting arm. If the same catch werem loaded on deck (Condition 2), notice the dramatic reduction in all of the important values. A vessel in this condition would be extremely tender, and it might not recover from a minor roll.

When the catch is loaded on the deck, the center of gravity is raised, resulting in a dramatic reduction in righting energy, range of stability and maximum righting arm. You can also raise the center of gravity by moving weight up higher in the vessel, burning fuel from bottom tanks, and by loading a large weight onto the vessel. You should be aware that any rise in the center of gravity can, and usually will, adversely affect the stability of your vessel.

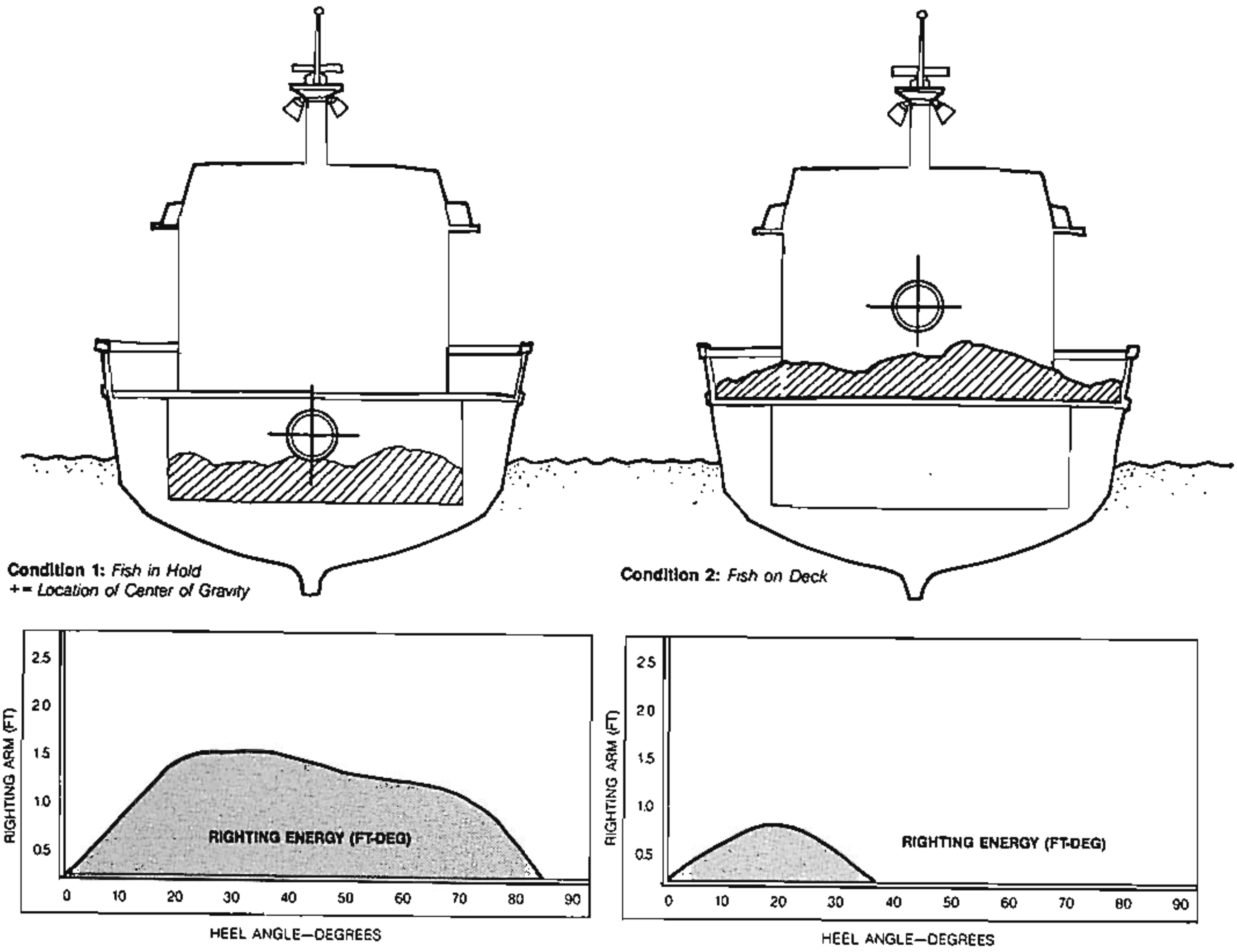


Figure 11-16. Effect of load height on righting energy.

11.3.2 Effect of Lifting Weights

Figure 11-17 shows the negative effect of lifting a weight such as a net full of fish off the deck. Lifting any weight off the deck (on centerline) raises the center of gravity and slightly reduces the area under the righting arm curve. The last part of the figure shows the worst situation, where a *substantial* weight is lifted *over the side* of the vessel. This action has two adverse effects on the stability of the vessel:

* The center of gravity is raised, since the force acts at a point at the *top of the boom.*
* The center of gravity is also shifted to the side on which the hauling is being done.

The end result is a reduction in righting energy accompanied by a list of several degrees. In the case illustrated, this small list angle is not a problem, but in a more heavily loaded condition, this small list could make the difference between surviving and capsizing. Once again, remember the cumulative effects of your actions on the stability of your vessel.

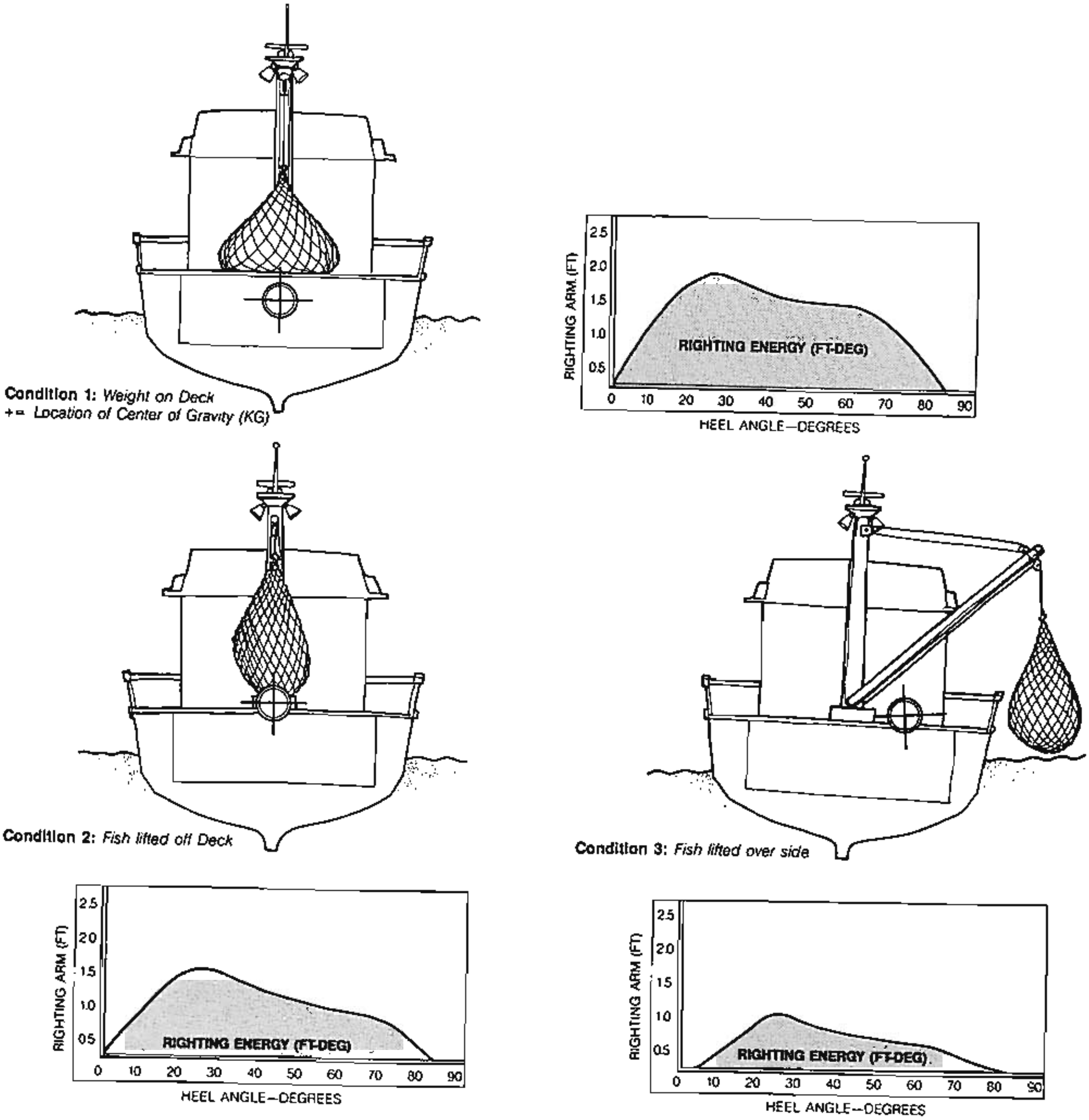


Figure 11-17. Effect of lifted weight on righting energy.

11.3.3 Effect of Free Surface

A *free surface* is any fluid surface that can shift as the boat rolls. You have free surface in half filled fuel tanks, water tanks, and fish holds. You can also have free surface effect with water that is trapped on deck, when it cannot escape fast enough through the scuppers. As the liquid moves, so does the center of gravity. Notice how in Figure 11-18, a half-full fish hold seriously reduces the righting energy of the vessel. The figure shows a very large compartment, but do not forget the effects of several small compartments with free surface.

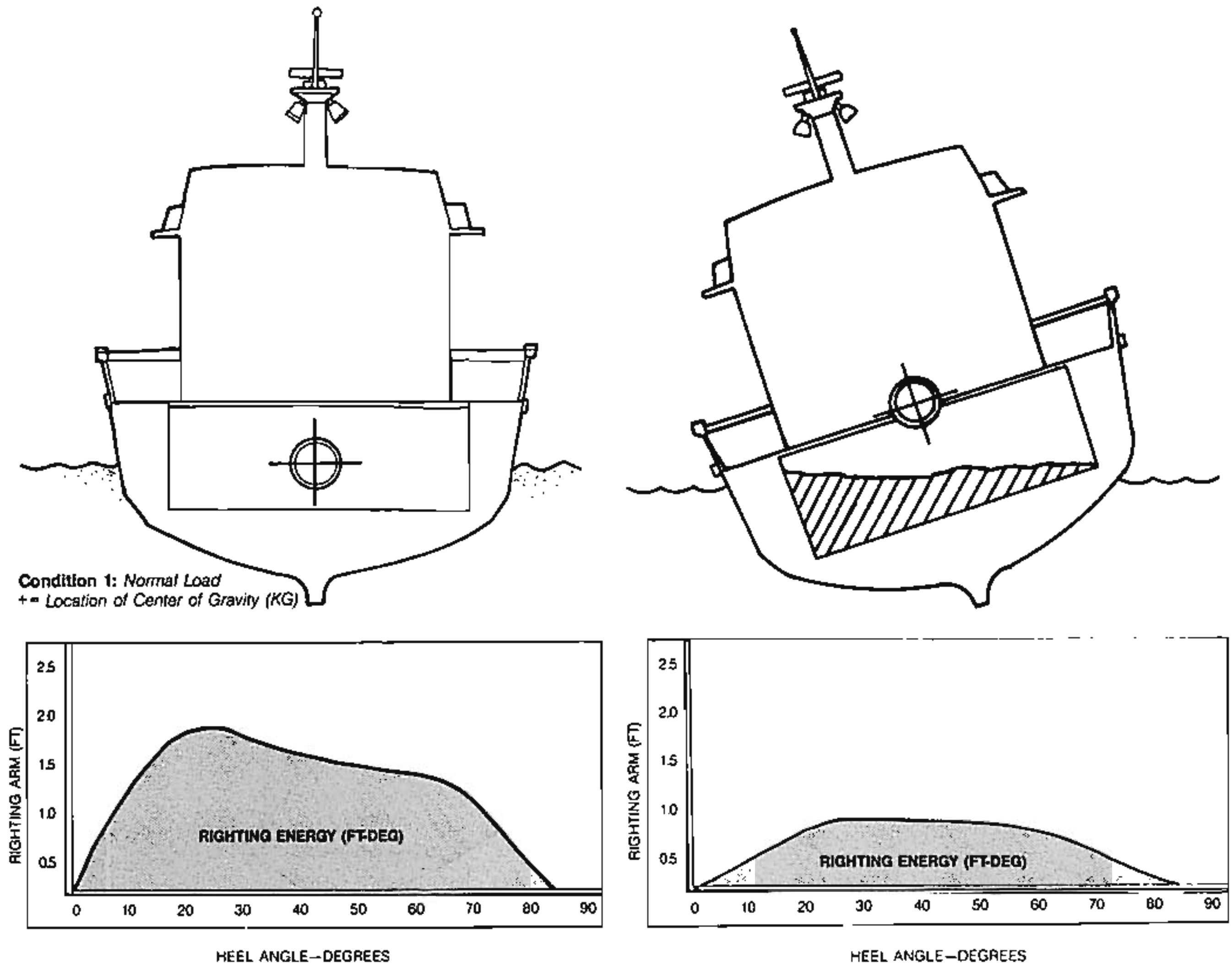


Figure 11-18. Effect of free surface on righting energy.

You should be aware that the free surface effect is controlled by the width of the tank much more than by the length, depth or volume of the tank. The free surface effect is also greater for a half-filled tank than for other tank levels. You can avoid or reduce free surface by:

* working with a minimum number of partially filled (slack) tanks at one time (fuel, fresh water, etc.)
* maintaining your fish holds completely empty or filled to overflowing at all times. The act of filling or emptying any large tank at sea causes a loss of stability during the transition period until the tank is either pressed up or completely emptied.
* breaking up a large fish hold into several smaller compartments using binboards.

To get a feel for how free surface affects stability, consider carrying an ice cube tray across the kitchen. First remove the divider from the tray, and then fill the tray with water. As you carry the tray across the room, water is likely to spill, because it is free to move in the tray. With the divider in the tray, water is less likely to spill. Dividing a fish-hold into small cells has exactly the same effect.

11.3.4 Effect of Downflooding

Downflooding is the entry of water into the hull, resulting in flooding and loss of stability. Your vessel may be designed with a substantial amount of righting energy and a broad range of stability. However, these design features may be negated if you allow water to enter the hull.

Figure 11-19 shows a sample vessel in two different downflooding scenarios. In Condition 1, all doors, hatches and vents are properly secured, thereby allowing the vessel to use its full righting energy. Condition 2, on the other hand, shows a door left open, allowing water to flood into the vessel as soon as the door is immersed. If the vessel takes on water, the hull cannot use its full righting energy.

The importance of closing off openings cannot be overemphasized, particularly in heavy weather. Always keep watertight hatches and doors closed, except when they are being used. If this becomes a habit, you will significantly improve your chances of survival in heavy weather. Pay close attention to doors into engine room and crew spaces, hatches into fish wells, lazarettes, and portholes.

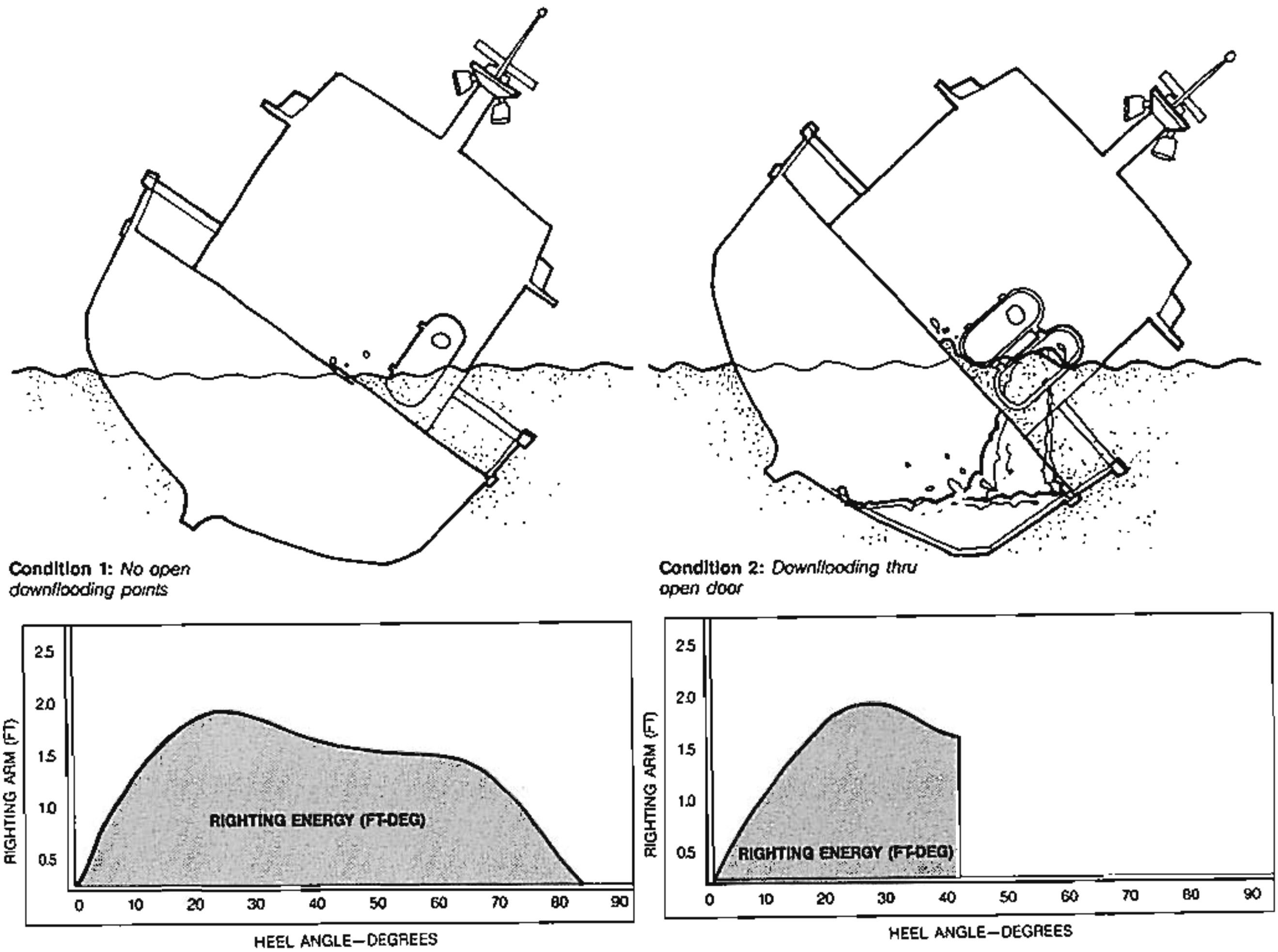


Figure 11-19. Effect of downflooding height on righting energy.

11.3.5 Effect of Reserve Buoyancy

Figure 11-20 shows how reserve buoyancy can affect righting energy. In Condition 1, the designer included a two-level watertight deck house and a large forward compartment, increasing the reserve buoyancy and righting energy.

In Condition 2, the deck house is only one level high, and the large forward compartment is not included. The area under the curve is much smaller, leaving a smaller range of stability and a smaller maximum righting arm.

When you consider reserve buoyancy, you should also think of the draft. Many fishermen load a vessel until it is low in the water, because the vessel tends to roll more slowly. They believe that a slower roll means the vessel is more *seakindly. In fact, this is not the case.* Assuming that the center of gravity stays in the same place, a vessel that is operated at a lesser draft (i.e. high in the water) has better stability than a vessel operated at a deeper draft. Always consult the stability information provided by your naval architect to insure the proper loading of your vessel.

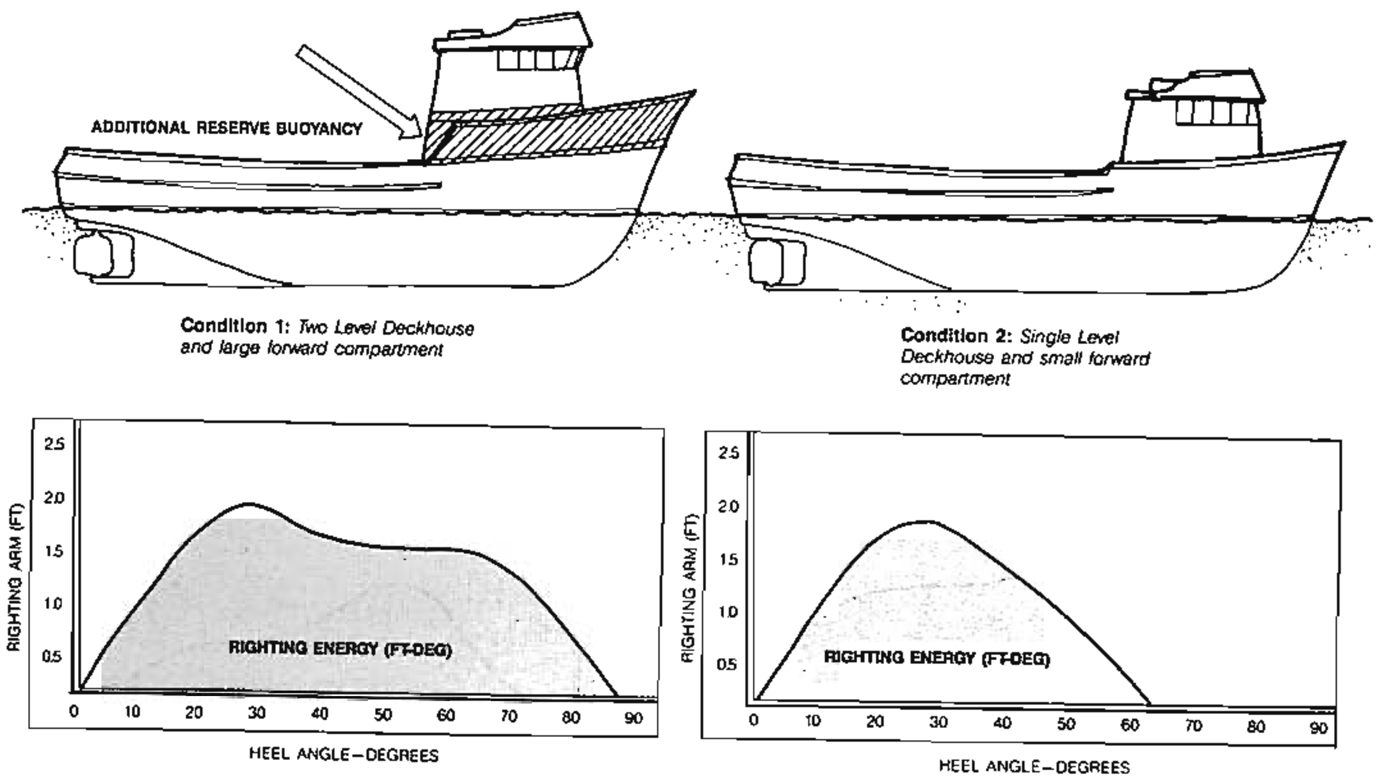


Figure 11-20. Effect of reserve buoyancy on righting energy.

11.3.6 Effect of Draft

Figure 11-21 shows the effect of excessive draft on stability. In Condition 1, the vessel has a 9-foot draft and a satisfactory amount of righting energy. In Condition 2, the same vessel has been loaded down to a 12-foot draft. The vessel in Condition 2 would have a slower roll, but it would probably have inadequate stability. The effect of overloading the vessel is almost identical to the reduced reserve buoyancy example shown earlier. At any rate, this figure should help clarify that deeper draft *does not* improve stability.

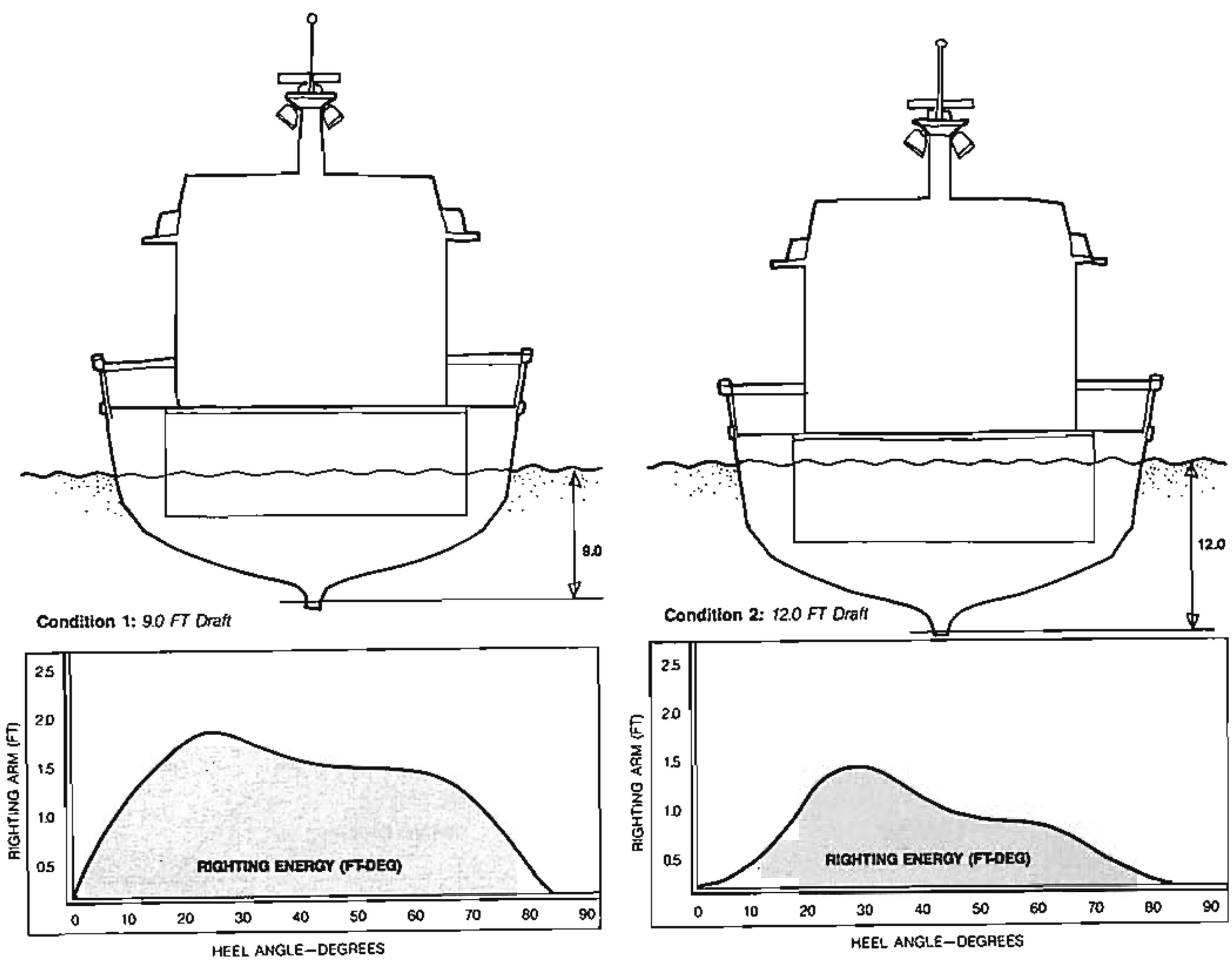


Figure 11-21. Effect of excessive draft on righting energy.

11.3.7 Effect of Excessive Trim

Figure 11-22 shows the effect of trim on righting energy. Although changing the trim does not have a drastic effect on stability, always remember the cumulative effect of small changes. If you load the vessel with a full catch further aft than normal, or if the remaining fuel and water onboard is in the after tanks, lifting the net or rolling, which would normally not be a problem, could be disastrous. Uneven trim also makes downflooding much more likely.

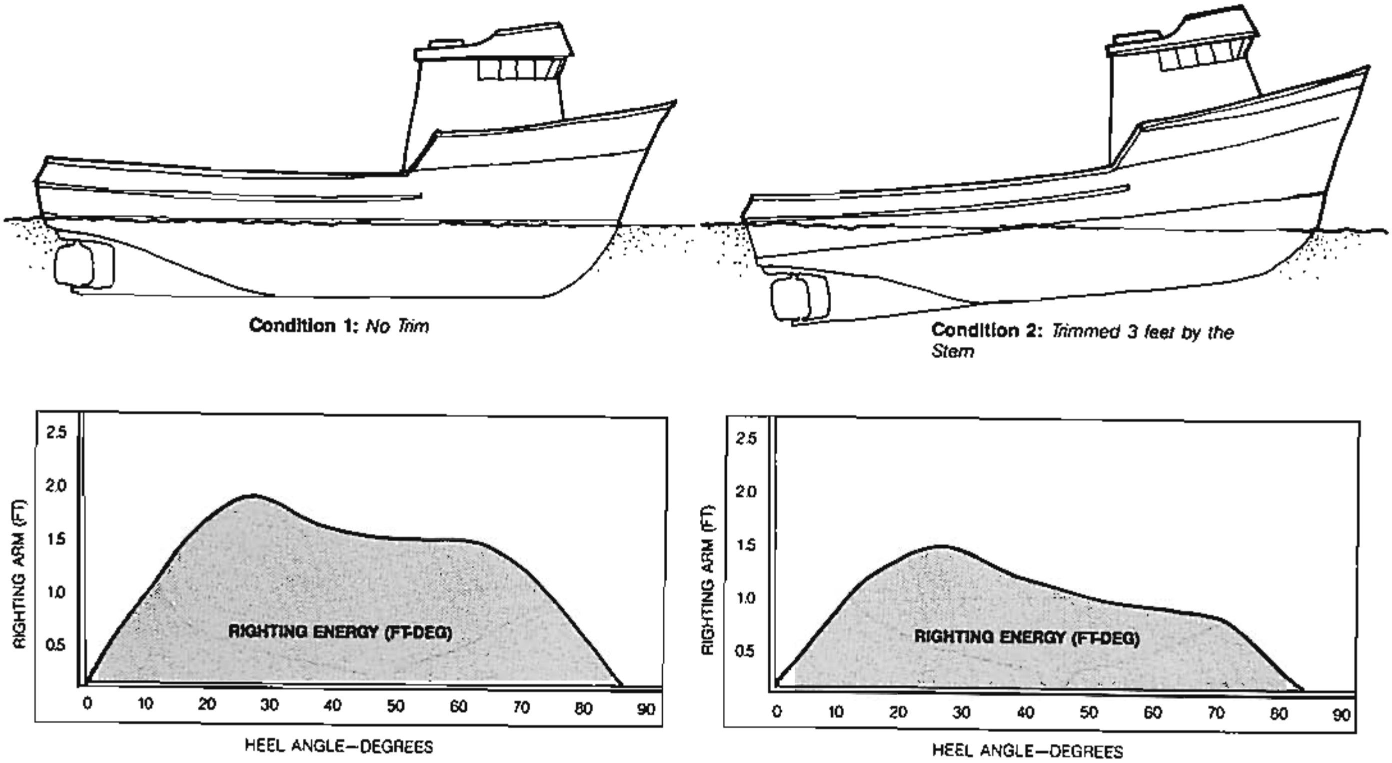


Figure 11-22. Effect of trim on righting energy.

11.3.8 Effect of Water on Deck

Figure 11-23 shows how water on deck can degrade the righting energy of a hull. Water on deck has four detrimental effects on the stability of the vessel:

* It causes a rise in the center of gravity (similar to moving the load up onto the deck)
* It increases displacement (increasing draft and probably changing the trim)
* It contributes a free surface effect
* It can amplify the rolling motion of the vessel which may result in capsizing.

Use the following guidelines:

* Do what you can to keep water off the deck by balancing trim, increasing freeboard, installing flappers on scuppers and changing course and/or speed.
* If you take water on deck, make sure that drainage openings (freeing ports, scuppers, etc.) are unobstructed.
* Ask the naval architect how he has accounted for water on deck in the design of the vessel. He may have increased the number of freeing ports, or changed their location. He might have reduced the height of the bulwarks, and he may have accounted for water on deck in the loading condition recommendations.

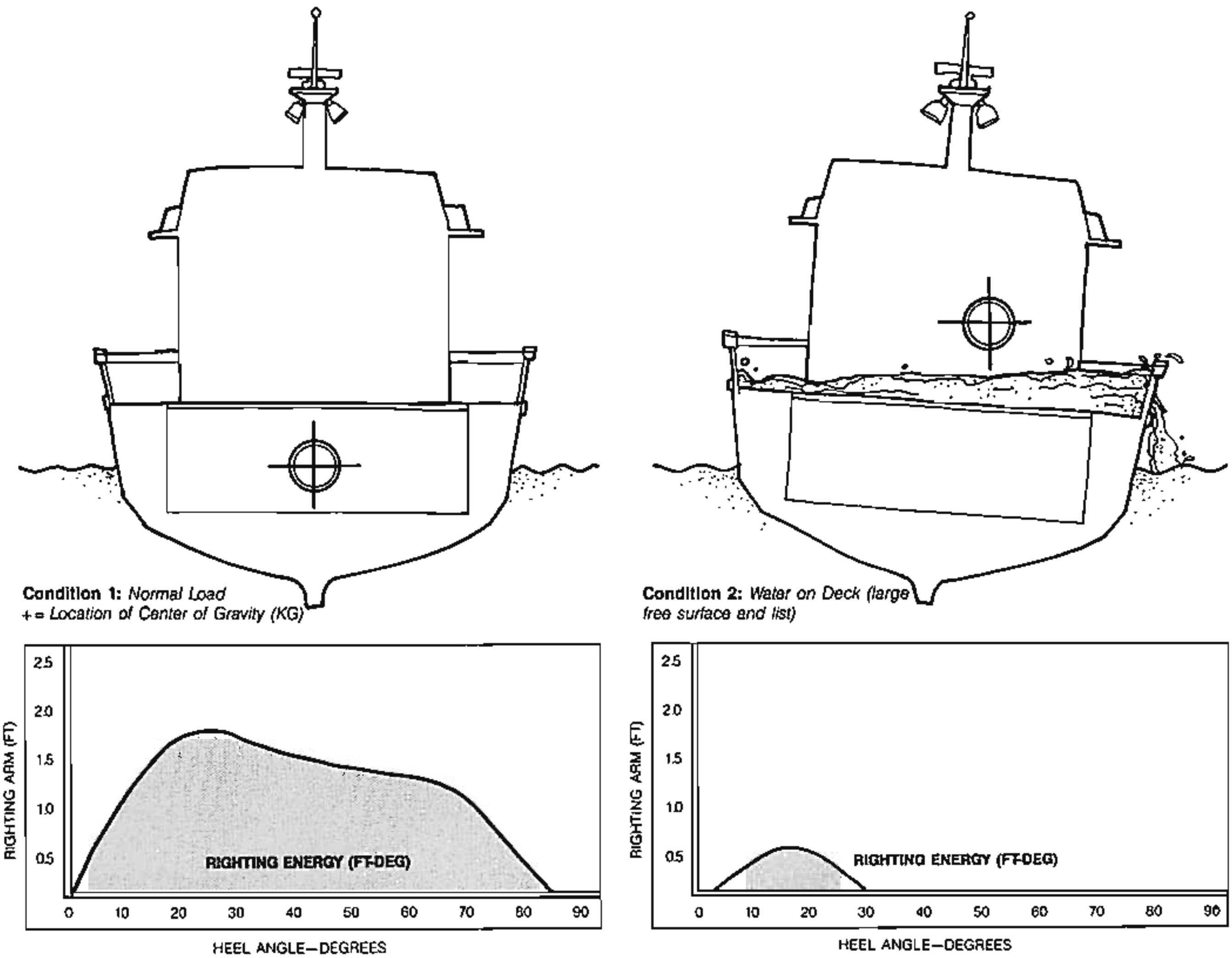


Figure 11-23. Effect of water on deck on righting energy.

11.3.9 Effect of Following Seas

Avoid following seas whenever possible. Unfortunately an old piece of advice is to turn tail to a storm and run. *This is not good advice!!* Following seas are dangerous because of the chance of being swamped by a wave, which will reduce a vessel's stability. Shipped waves may also cause a marginally stable vessel to capsize.

When the length of the wave is twice that of the vessel, and the vessel's speed is the same as the wave speed, the vessel can sit on the wave. At this point, a large part of the vessel is out of the water, and the hull develop only a small part of its possible righting energy.

Figure 11-24 shows the effect of following seas on the sample vessel. Under normal conditions, the area under the righting arm curve is substantial. However, when a vessel is perched atop a wave, there is a significant reduction in the righting energy, range of stability and maximum righting arm. The exact amount of reduction in energy depends on the hull.

If the weather is rough, you might try reducing your speed or changing course to reduce the risk to your vessel. Remember, however, that quartering seas are also difficult to handle, especially in breaking waves or in shallow water.

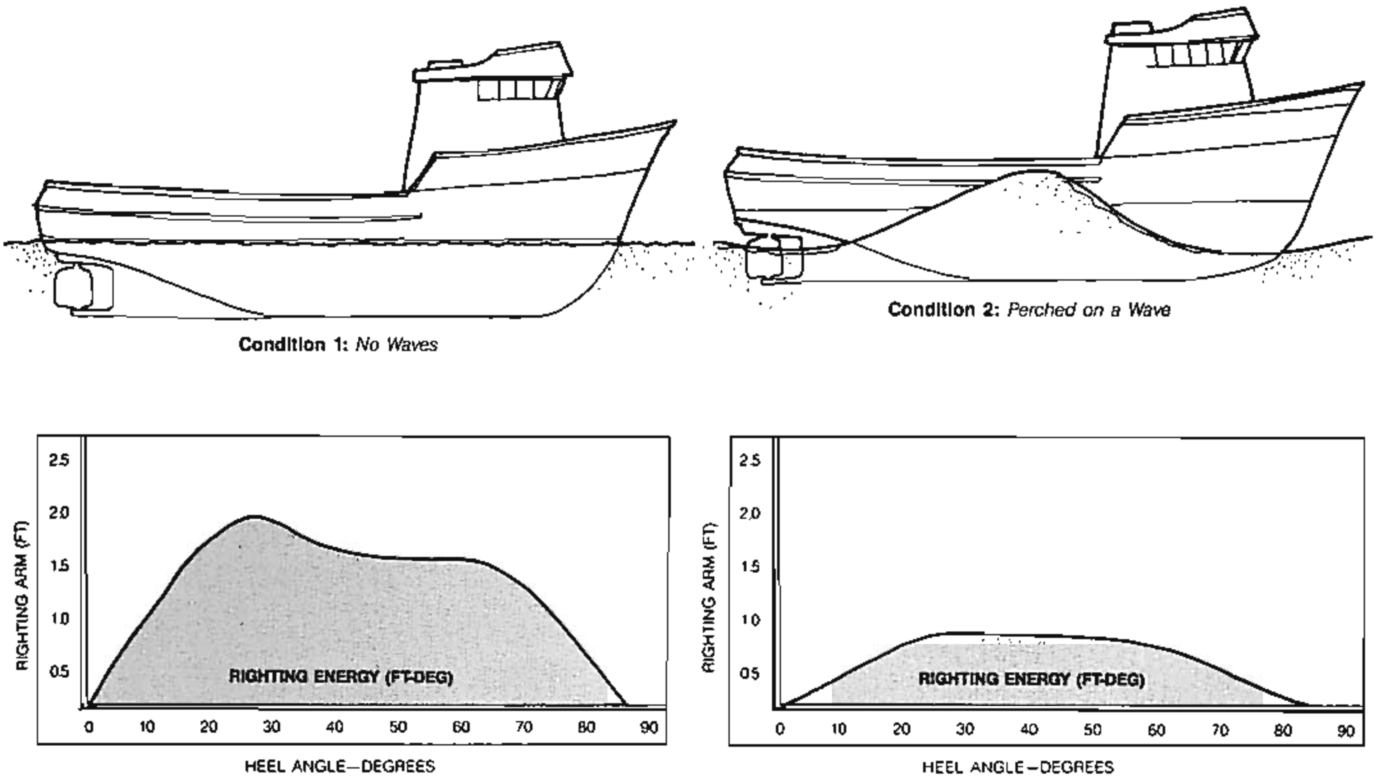


Figure 11-24. Effect of following seas on righting energy.

11.4 References

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CHAPTER 12

MEDICAL EMERGENCIES

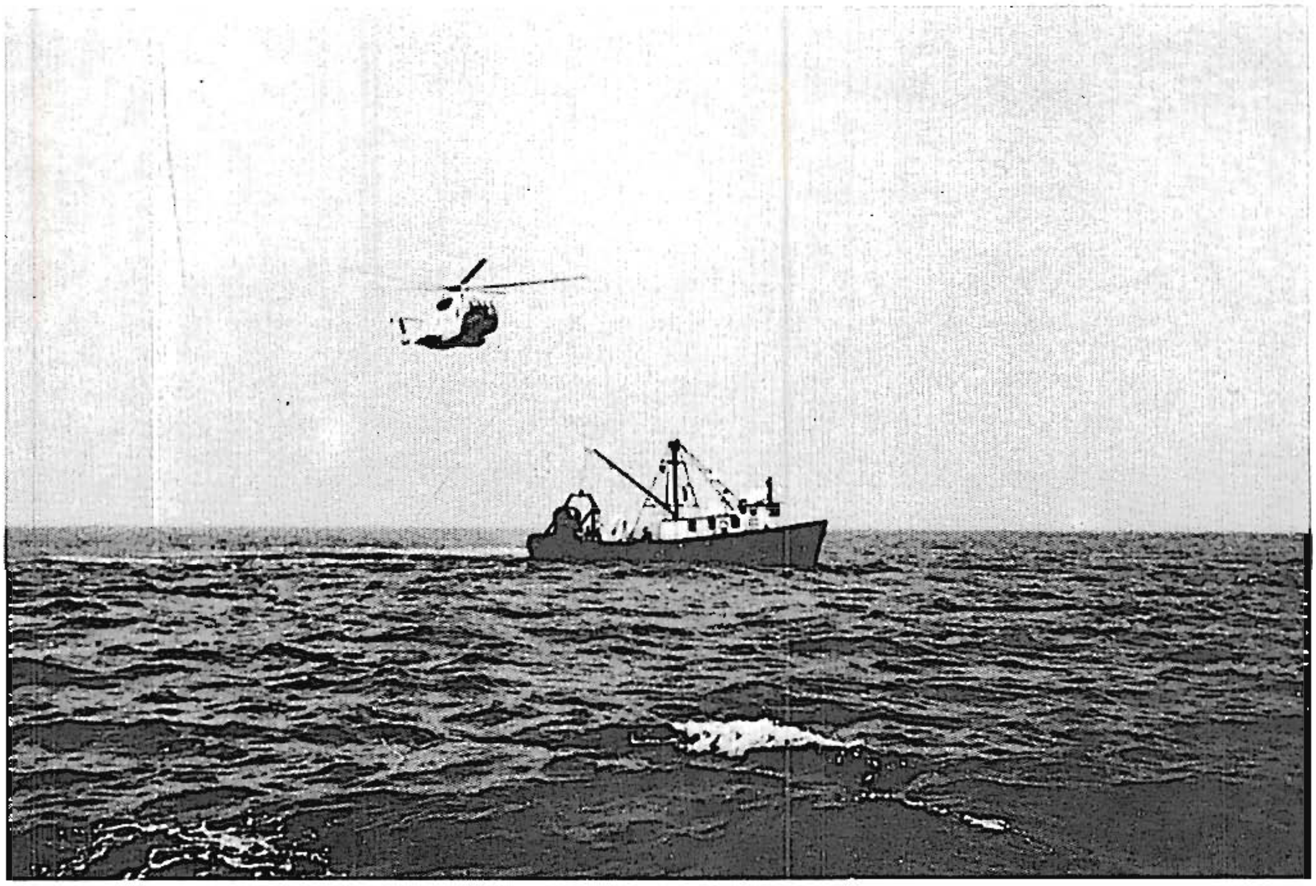


Photo courtesy of Kathy Castro

CHAPTER 12

MEDICAL EMERGENCIES

12.1 First-Aid

First-aid is temporary care given to sick or injured persons. It does not take the place of professional medical treatment, but it can mean the difference between life and death, between quick recovery and long hospitalization, and between temporary disability and permanent injury.

At sea, fishermen can only depend on each other in an emergency, and they should learn as much first-aid as possible.

While it is vital that fishermen learn how to react positively and effectively in coping with medical emergencies, it is also important that they be realistic. Because conditions are complicated on board fishing vessels, and because professional help may be far away, a fisherman's first-aid may not always prevent permanent injury or death.

Do the best you can under the circumstances, but do not blame yourself if your efforts fail.

You are important in two ways during a medical emergency at sea. First, you must ensure the victim's immediate survival. Second, you are an extension of medical professionals that you should contact by radio as soon as you can accurately describe the problem. If you can help the professionals understand the injury or illness, they can help guide your first-aid efforts.

This chapter will help you cope with the conditions that represent immediate threats to a victim's survival, and help you gather the information necessary to obtain professional advice by radio. It includes information about medical issues that must be dealt with differently at sea than onshore, and suggests ingredients for a first-aid kit.

This chapter is only an introduction to emergency first aid, however, and your vessel should carry an in-depth first-aid manual for more detailed information on treating injuries and illnesses at sea. Our recommended text appears later in this chapter, and you are strongly urged to get it.

Study the Environment and Protect Yourself

Before you rush into the site of the accident, study the environment from a distance. There may be continuing danger to you and to the victim. If he has been struck by a block swinging in the rigging, for example, you must secure the block before you help him.

Your first responsibility is to protect yourself.

Work quickly, but not frantically. Don't waste time looking for ready-made materials. Do the best you can with whatever is at hand. When it is necessary, call for medical help as soon as the victim is out of immediate danger.

Survey the Damage

Try to determine the nature and extent of the problem by means of the steps suggested below. There are two stages of examination. The primary survey and the secondary survey. The primary survey includes taking care of immediate threats to the victim's survival. Once he is breathing, has a heartbeat, has stopped bleeding severely and is in a safe place, you must conduct a secondary survey to determine the extent of his injuries.

The Primary Survey

To save a badly injured victim, you must deal with the threats that could kill him immediately. Once these threats have been controlled, or if they don't occur, you have time to stop and read a medical manual or call for help.

The vital steps, in their normal order of importance, are:

1) Clear the AIRWAY
2) Restore BREATHING
3) Check CIRCULATION - do chest compressions if necessary
4) Control GROSS BLEEDING
5) Improve the ENVIRONMENT

Circumstances may necessitate changing the order. For example, you can't begin giving first aid if the environment is unsafe because of fire or some other danger. The first priority is to move the victim away from further harm. Keep cool and determine the worst threat. Keep in mind that blood loss may look much worse than it is.

Survey Before you Move the Victim

Do not move a victim until you have carefully examined his injuries. If there are fractures or injuries to the back or neck, moving the victim improperly could lead to further injuries (see Transporting the Injured, section 12.20).

The Radio Call

If the accident is severe and you have dealt with the immediate threats, you should contact the Coast Guard to obtain professional advice. The more information you can give about the victim, the better the Coast Guard can help you treat him. It is best if you know the victim's *vital signs*, and if you have his medical history available for reference. Included in the Coast Guard Procedures chapter (Chapter 10) is a section on seeking medical assistance, with a form to help you determine the kind of information you need.

12.2 ABC'S (Airway, Breathing, and Circulation)

12.2.1 Airway and Breathing

The first and most important step in first-aid is to determine whether or not the victim is breathing. Time is critical. After 6 minutes without oxygen, brain damage is extremely likely. In cases of cold water drowning, when a person is submerged in water colder than body temperature, hypothermia will protect the vital organs from the lack of oxygen. Because of this reflex, many people have fully recovered after an extended period underwater.

Assessment of Breathing

In order to determine if a person is breathing, you must first put them in a position that you can look, listen and feel for signs of breathing (see Turning the Patient, section 12.20.1). You should LOOK to see if the chest rises and falls, LISTEN closely for exhalation or inhalation, and FEEL for air entering or leaving the nose and mouth. If breathing alone is inadequate or absent, opening the airway may be all that is necessary.

Airway

(Figure 12-1)

Open the airway by tilting the head back and lifting the chin with your hand under the bony part of the lower jaw (Figure 12-1 (a)). (Note: The hand under the neck is no longer a recommended procedure.)

Figure 12-1 (a) . Open the airway using the head tilt/chin lift.

If you suspect a broken neck, use the jaw-thrust maneuver. Places your fingers behind the angle of the patient's jaw and forcefully bring it forward *without* moving the neck (Figure 12-1(b).

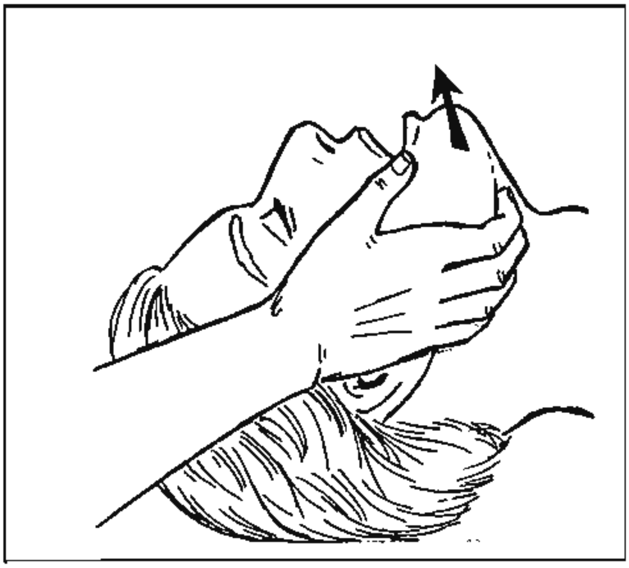


Figure 12-1 (b). Jaw thrust.

Use the finger-sweep method to clear foreign matter or other breathing obstructions, being careful not to push anything further into the throat (Figure 12-1 (c)).

Look, listen and feel to see if opening the airway has allowed the victim to start breathing on his own.

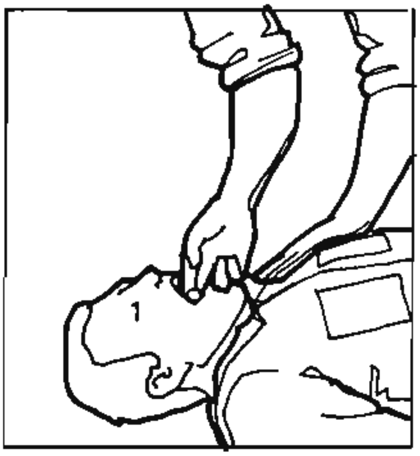


Figure 12-1 (c). Use the finger sweep to clear foreign matter.

Breathing

If there is no breathing, pinch the victim's nostrils together (Figure 12-1 (d)).

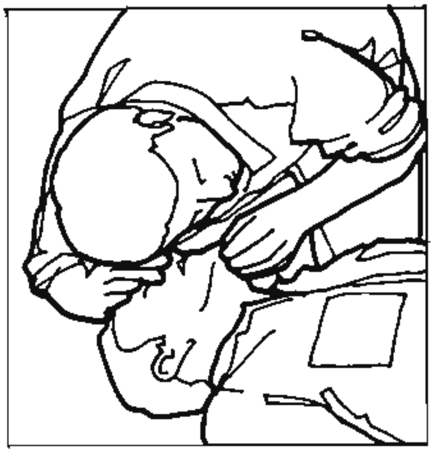


Figure 12-1 (d). Pinch the nose together.

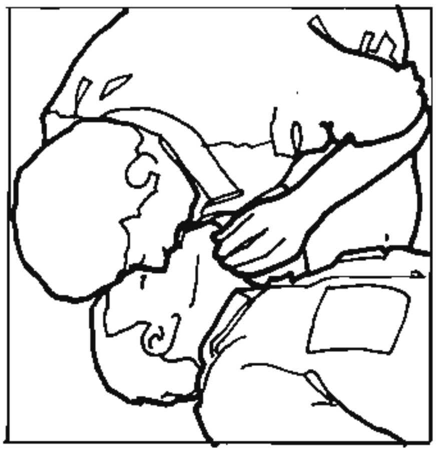


Figure 12-1(e). Give two quick, full breaths.

* Tightly seal the victim's mouth with your mouth and give two quick, full breaths (Figure 12-1 (e)).

* Remove your mouth slightly from the victim's mouth after each breath .

* Observe the victim's chest and abdomen to see if he has started breathing (f).

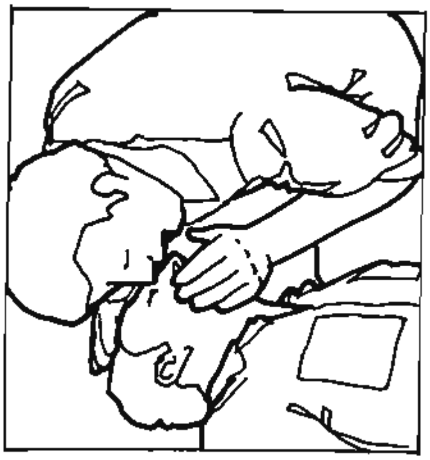


Figure 12-1 (f). Remove your mouth each time you give a breath. Observe the persons chest to see if breathing has begun.

* Allow him to exhale passively. There is no need to compress the chest (h).

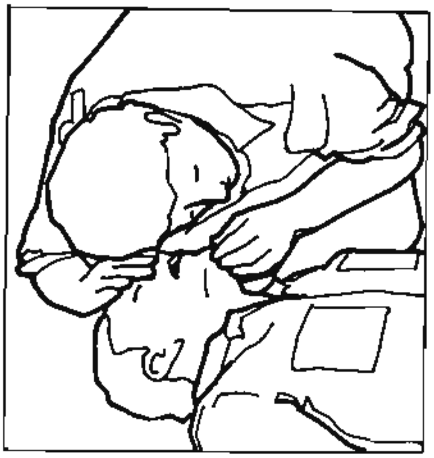


Figure 12-1 (g). Allow the person to exhale before giving another breath.

* For your protection, it is now advisable to use a pocket mask for artificial ventilation (Figure 12-2).

Figure 12-2. Use a pocket mask for mouth to mouth.

12.2.2 CPR

Cardiac arrest means that the heart is no longer able to pump enough blood to the vital organs to sustain life. Pulses cannot be detected in any arteries.

Cardio-pulmonary resuscitation (CPR) is the artificial establishment of circulation of the blood and movement of air into and out of the lungs in a pulseless, non-breathing patient. The American Heart Association and The American Red Cross offer training courses for the general public. This safety manual does not replace these training courses. The reader is urged to take a CPR course.

Assessment

The ABC's stand for **Airway, Breathing** and **Circulation** (heartbeat). Always remember that the ABC's come first.

Cardio-Pulmonary Resuscitation (CPR)
(Figure 12-3)

* Gently touch the victim's shoulders and shout to see if he is conscious (a).
* If you are alone, call for help.
* Position the victim on his back on a hard, flat surface. A victim with suspected neck injuries who is lying on his stomach needs his neck stabilized as you roll him on his back (see Turning the Victim, section 12.20.1).

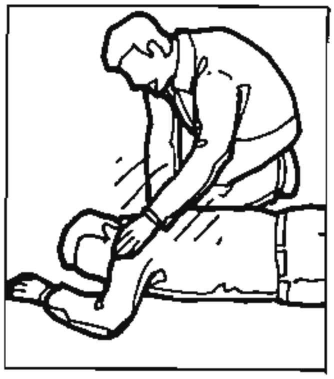
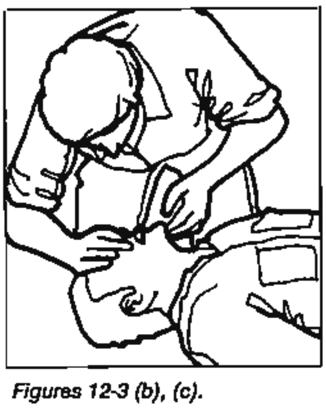


Figure 12-3 (a). Check to see if person is unconscious.

Airway

* If the victim does not respond, tilt the head and lift the chin to clear the tongue out of the airway (b).
* Look to see if the chest or stomach is rising or falling.
* Listen for the sound of breathing (c).
* Feel for the exhaled air against your cheek.



Figures 12-3 (b), (c).

Breathing

* If the victim is not breathing, clear the mouth and throat of any foreign matter.
* Seal the victim's mouth with yours (or use a pocket mask).
* Give two successive, full-lung breaths ("puffs") into the victim's mouth within five seconds (d).
* Check to see if the victim's chest rises or falls.
* Check the victim's *carotid* pulse at the neck. Do not push too hard or you can obstruct circulation.

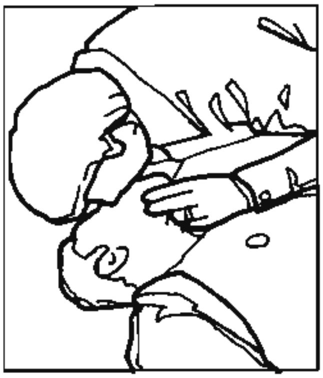


Figure 12-3 (d). Check for a carotid pulse.

To Find Carotid Pulse:

(1) Tip head back and locate Adam's Apple (e).
(2) Slide index and middle fingers into groove between throat and neck muscle at side closest to you (f).

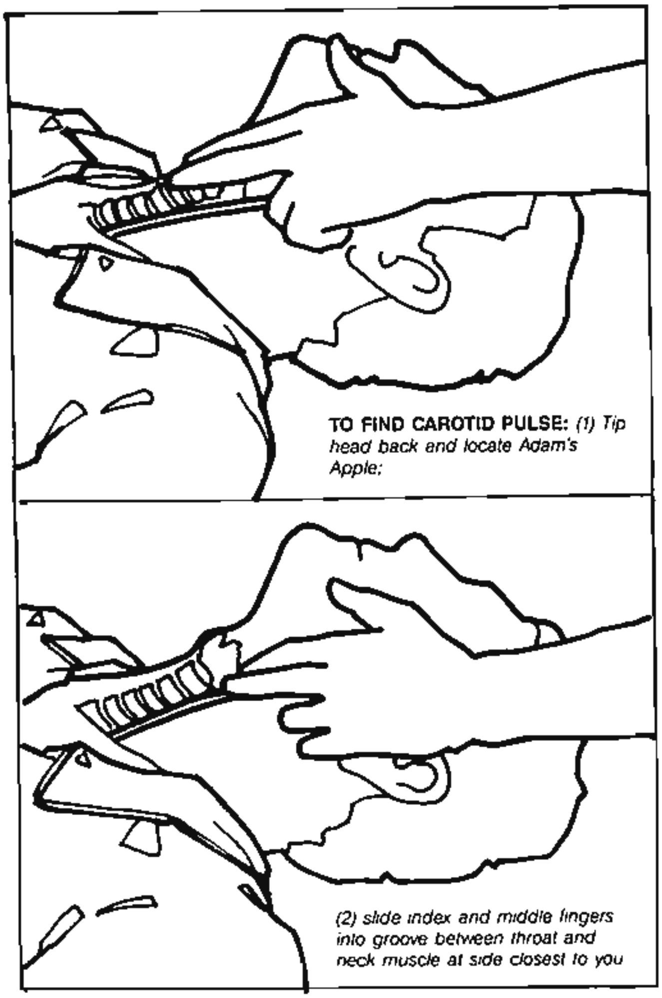


Figure 12-3 (e). Tip head back; (f). Find carotid pulse.

If there is a pulse, continue rescue breathing at the rate of 12 times per minute (once every 5 seconds.)

* If there is no pulse, remove obstructive clothing from the victim's chest.
* Feel for the lower end of the breastbone with 2 or 3 fingers (g).
* Place the heel of one hand just above your fingers, so that the heel rests on the lower half of the breastbone (h).
* Place the other hand on top of the first. Keep your arms straight (i). Compress the breastbone straight down 1 1/2 to 2 inches (for adults).

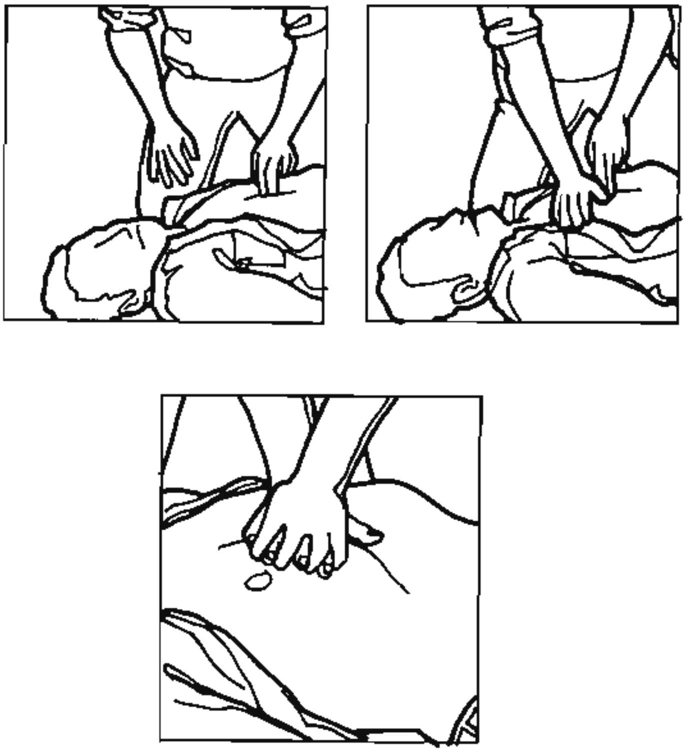


Figure 12-3 (g), (h), (i), Positioning the hands and performing compressions.

One person: give 2 rescue breaths after 15 chest compressions at the rate of 80-100 compressions per minute.

* Call for help.

12.3 Bleeding and Shock

Arterial bleeding from a major blood vessel can cause the victim to bleed to death in a very short time. Rapid loss of as little as 1 quart of blood in an adult can cause shock and result in death.

Bleeding from veins or capillaries may scare you, because even a small amount of blood mixed with water can appear to be a large amount. However, these types of bleeding are not as life-threatening as gross arterial bleeding. Therefore, it is important to recognize the different types of bleeding, and to treat gross bleeding quickly.

12.3.1 Types of Bleeding

(Figure 12-4)

Arterial bleeding - blood is bright red and gushes forth in jets or spurts in rhythm with the victim's heartbeat. It is much redder than the blood you see from minor cuts or scrapes (a).

Bleeding from veins - blood is dark red and bleeds in a steady flow (b).

Capillary bleeding - blood is also dark red in color and oozes from the wound (c).

12.3.2 Treatment of Bleeding

Direct Pressure and Elevation

* Apply *direct pressure* to the wound using a thick pad of cloth as a dressing between your hand and the wound. It should be sterile, or at least as clean as possible. Use clothing if nothing better is available.
* *Elevate* the injured arm or leg to a level higher than the heart, unless movement will cause further damage (as in the case of fractures).

Never remove the dressing even if it becomes blood-soaked. Add another dressing on top of the first one, and continue to apply direct pressure and to elevate the body part.

* A pressure bandage can replace direct hand pressure on most body parts. Center the bandage over the dressing, wrap the ends around the body part and tie the knot directly over the dressing (Figure 12-5).
* After you control bleeding with a pressure bandage, check it frequently for swelling and other signs that the pressure is too great.

Be sure the pressure bandage has not become a tourniquet.

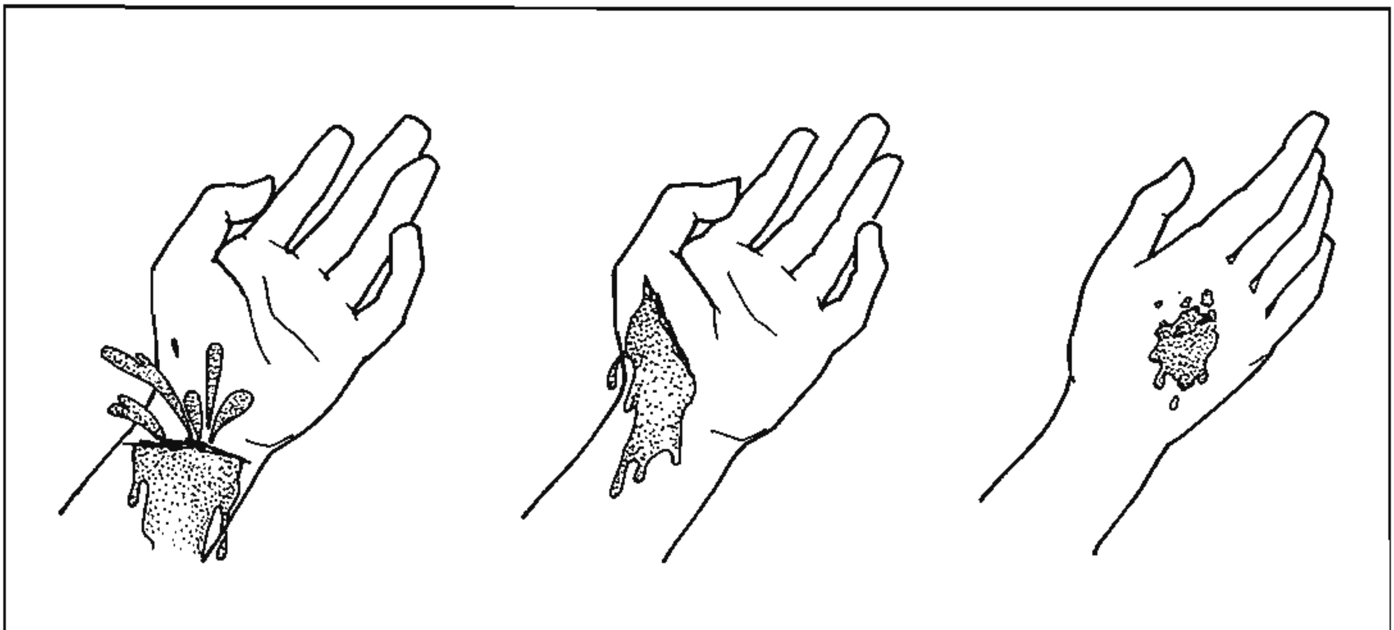


Figure 12-4. a) arterial bleeding; b) bleeding from veins; c) capillary bleeding.

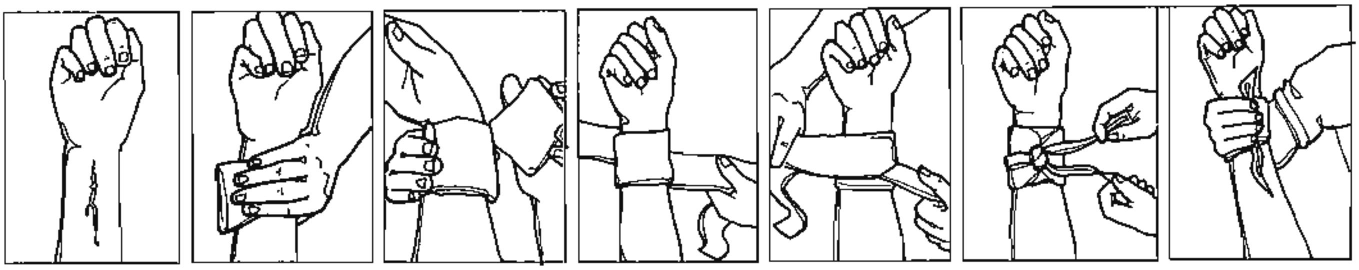


Figure 12-5. Check a pressure bandage frequently for signs of excessive pressure.

Warning signs for excessive pressure include swelling next to the bandage, numbness to touch, sensation of pins and needles, the limb becoming white or purple, and pain beyond the site of the injury.

Direct pressure is effective in stopping the bleeding from nearly all wounds. It almost always eliminates the need for a tourniquet.

12.3.3 Pressure Points

Pressure points are the places where an artery passes over a bone, and where you can feel a pulse. You can use pressure points as a temporary means of controlling gross bleeding until a pressure bandage can be applied. Also use pressure points in combination with direct pressure and elevation. A conscious victim can apply pressure to his own wound so that you can attend to other injuries or treat other victims.

Pressure is always applied between the wound and the heart. For example, bleeding in the upper leg would be controlled from the femoral artery, not the dorsalis pedis in the foot (Figure 12-6).

* Only compress the carotid artery in dire emergencies, where all other attempts at controlling severe bleeding have failed. (Usually only necessary in a neck wound causing disruption of the artery itself.) There is the risk of causing a stroke or cardiac disturbances in some patients.

* Never exert pressure on the carotid arteries on both sides of the neck at the same time.

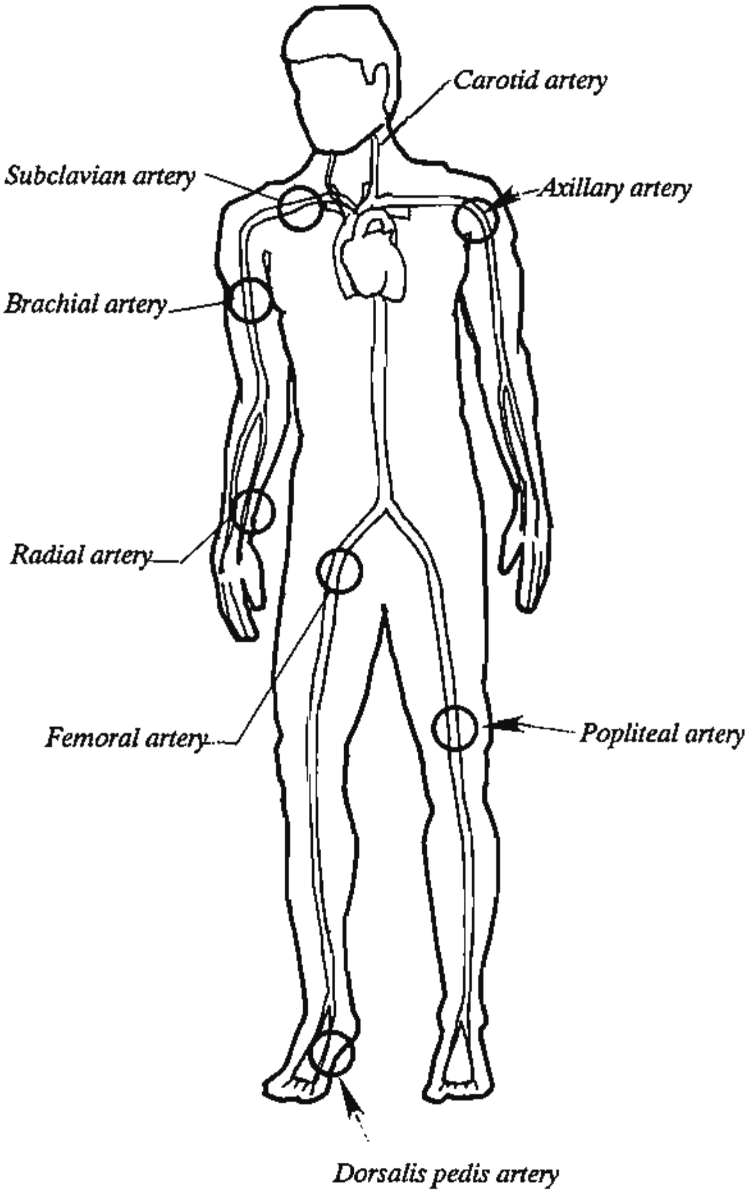


Figure 12-6. Arterial pressure points for control of excessive bleeding.

12.3.4 Tourniquets

NEVER use a tourniquet unless the bleeding is so severe that it cannot be stopped by any other means. Direct pressure by hand will control bleeding in nearly all cases. However, if it doesn't, a tourniquet may be the *last resort* for saving the victim's life.

A tourniquet can only be used on an arm or leg. Never use it below the elbow or knee, because blood flow in these extremities is small enough to be controlled by other means.

Applying a tourniquet

* Place the tourniquet just above the wound. If the wound is at a joint, put the tourniquet just above the joint.
* Use a wide band, one that won't cut into the tissue.
* Apply a pad over the artery to be compressed.
* Take two tight wraps around the limb and tie an overhand knot.
* Place a short, strong bar on the overhand knot and tie a second overhand knot above it.
* Twist the bar until the bleeding stops - no tighter.
* Secure the bar in place.
* Record on the victim's forehead the time when the tourniquet was applied.
* Don't loosen the tourniquet until a doctor tells you to.
* Treat the victim for shock and get medical attention immediately.

A victim wearing a tourniquet should be evacuated.

12.3.5 Internal Bleeding

Internal bleeding is not always obvious. Suspect it if the victim has suffered a hard fall or a heavy blow to the body. Closed fractures are common sources of internal bleeding. A fractured femur (upper leg) can quickly cause the loss of a liter or more of blood without any external signs.

Symptoms

* Feelings of doom.
* Lightheadedness and restlessness.
* Thirst.
* Confusion.
* Dizziness, weakness, fainting.
* Any bleeding from the nose, mouth, or ears.
* Vomit that looks like "coffee grounds."
* Coughed-up blood that is bright red or bubbly.
* Paleness.
* Rapid, hard-to-feel pulse.
* Falling blood pressure.

Immediate treatment

* Check the ABC's.
* Treat for shock.
* Seek medical advice.
* Do not give the victim anything to eat or drink.
* Look for injuries such as broken bones which may have caused the bleeding. Splint them.
* Stay calm and reassure the victim.

Additional treatment for bleeding

Treat bleeding victims for shock, even if no symptoms are visible, because all victims who have lost blood suffer some degree of shock.

In all cases of bleeding, keep the victim quiet to allow the blood to clot. Don't move the victim, unless it is absolutely necessary. If you must move him, handle him gently. Keep the injured part elevated, as long as doing so doesn't cause further injury or pain. Keep him as comfortable as possible.

12.3.6 Shock

Shock is caused by reduced blood supply to body parts and tissues; it is a serious condition that may cause death. Some degree of shock occurs in almost all injuries. However, the signs of shock may not appear until the condition is severe.

Even if no symptoms are visible, treat for shock as a preventative measure. Only the ABC's and treatment of gross bleeding should have priority over the emergency care of shock.

Symptoms of Shock

(Figure 12-7).

* Pulse rapid and weak, usually over 100 heartbeats per minute.
* Low blood pressure.
* Rapid, shallow breathing.
* Eyes glassy or lackluster, pupils dilated.
* Skin and lips pale and bluish-gray.
* Clammy sweat.
* Nausea and vomiting.
* Thirst.
* The victim may be restless or anxious and excited, becoming confused, finally unresponsive.
* The victim may faint if he is sitting or standing.

Treating Shock

It is much easier to prevent shock than to treat it after it has developed. Although you are limited, as a non-professional, in the treatment you can administer, you can do a great deal to prevent shock, or to minimize its effect:

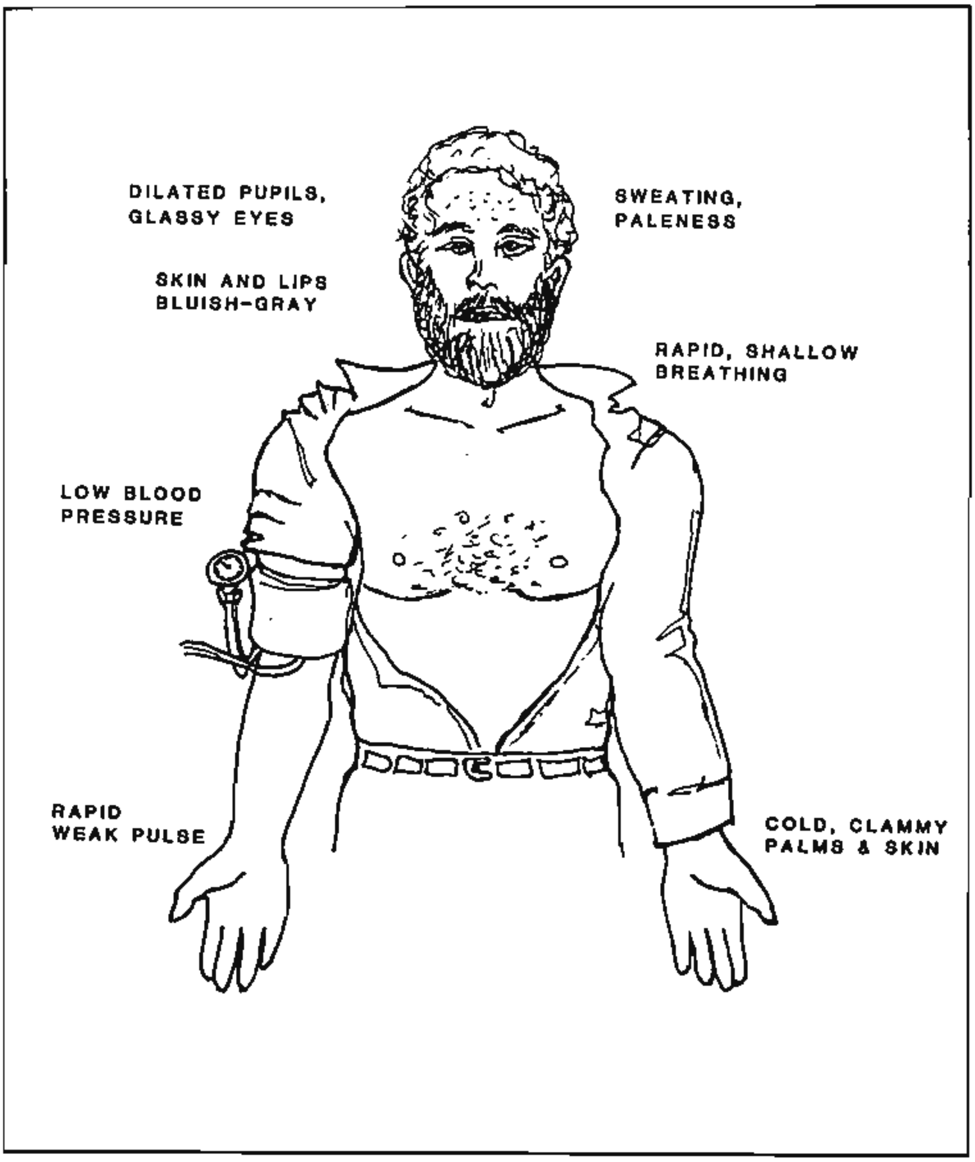


Figure 12-7. Symptoms of shock.

1) Check the ABC's.
2) Eliminate the cause. For example, restore breathing, control bleeding, seek to alleviate pain.
3) Keep the victim lying down, with his feet raised to maximize circulation to the heart and brain. *Exceptions to this rule:*
a) Neck and back injuries. In these cases, the victim should not be moved until he is prepared for transport (See transporting the injured, section 12.20);
b) Victims who are suffering facial injuries that involve bleeding or fluid loss. Such victims should be stabilized on a solid platform on their backs, and turned to the side. That way, blood or vomitus can drain out of the mouth, rather than pool in the pharynx and obstruct the airway.
4) Keep the victim warm, but not hot. Use blankets under and over his body to maintain normal body temperature.
5) Continue to observe the victim. Check the ABC's and note any worsening of the condition.
6) Reassure the victim.
7) Seek medical advice by radio.
8) In general, don't give the victim anything by mouth until you get the doctor's okay. If you are in a remote area and must treat the victim for an extended period of time without professional advice, you may give water to a conscious victim.
9) Victims in severe shock should be given high priority for evacuation and professional treatment.

12.4 Secondary Survey

Once you have checked the ABC's, examined the victim for gross bleeding and provided preventative care for shock, you have coped with the immediate threats to life. Now you can catch your breath before making a secondary survey. If other people are available, have them write down what you find. Use the following list to guide your examination.

* Be alert to possible injuries to the neck or spine. If you suspect neck or spine fractures or other serious injuries to the victim's back or neck, *do not move him unnecessarily*. Go on with the secondary survey, but keep the victim absolutely still, with his head and neck in alignment.
* If the victim is conscious, talk to him. Ask him what is wrong. Tell him that you are going to examine him. Reassure him. Continue to talk to him at each stage of the examination. Ask him what hurts as you examine his body.
* Use your fingers to examine his neck, head and face, taking care not to move the head. Look for discharge at the nose or ears.
* Examine his eyes - are his pupils normal and reactive, or unreactive, dilated, constricted, unequal? Is there any blood, or are the whites yellowed?
* Slip your hands underneath his lower back and examine upwards to the shoulder blades. You are feeling for injured areas. Look at your hands after each step in the examination to see of they have come in contact with blood or other fluids.
* Place your hands along each side of his chest and lightly compress the chest and sternum to check for injuries there.
* Use your fingers to press lightly on each of four abdominal quadrants to detect damage to internal organs.
* Lightly press the hips together; press down at the hip crests and on top of the pelvic bone.
* Slide your hands along the insides of his legs up to the groin. Check your fingers for blood, urine or feces. The latter indicate loss of bladder or bowel control.
* Feel each leg and foot; test for equal strength by having him push against your palms with his feet.
* Feel shoulders, arms and hands. Have him squeeze your fingers to test for equal grip.

Don't be shy in making the secondary survey. This is not the time to be afraid of touching your crewmate. You are looking for things that don't feel right - wounds, fractures, a spongy spot on the skull, areas that cause the victim pain or that have no feeling.

Up to this point, unless there has been gross bleeding or problems with the ABC's, you still haven't begun treatment. You haven't moved him, put on a bandage, or called the Coast Guard, depending on the symptoms. You are still trying to compile information that will help you seek professional advice, call for an evacuation, or treat the victim yourself.

12.4.1 The Vital Signs

These are key indicators that will help medical professionals evaluate the victim's condition. There are four vital signs:

* pulse rate
* respiration rate
* temperature
* blood pressure

In the event of any serious illness or injury, check the vital signs frequently (every 5-10 minutes) and write them down with the time. Changes in the vital signs tell the professional (who is trying to assess the situation by radio) whether the victim is getting better or worse.

To take vital signs, you need a watch with a second hand, a thermometer, and a blood pressure cuff and stethoscope. If you have never used them, it is very easy to learn; a medical professional can teach you how to take a blood pressure reading in a few minutes. If one crew member learns how, then he can teach the rest of the crew.

A cuff and stethoscope are inexpensive enough that *every* first-aid kit should have them.

Pulse

Pulse measures the heart rate. Pulse is most easily felt at the *carotid* artery on either side of the neck. Because the carotid artery is large and close to the heart, the carotid pulse is usually the last to disappear.

On a conscious victim, the *radial pulse* at the wrist may be more convenient:

* Place your middle finger over the victim's artery on the thumb side of his wrist.
* Move your finger and press lightly until you find the pulsebeat.
* Don't use your thumb because it has its own pulse.
* Count the beats per minute.

Temperature

Body temperature measures the balance between heat production and heat loss. You can use an oral thermometer if the victim is conscious and alert. A rectal thermometer is more accurate, and it often gives medical professionals a better indication of what is wrong with the victim. Do not use an oral thermometer if the victim is unconscious; if his mouth is dry, parched or inflamed; if he is restless, delirious or irrational; or if there is a danger that he may bite the glass tubing.

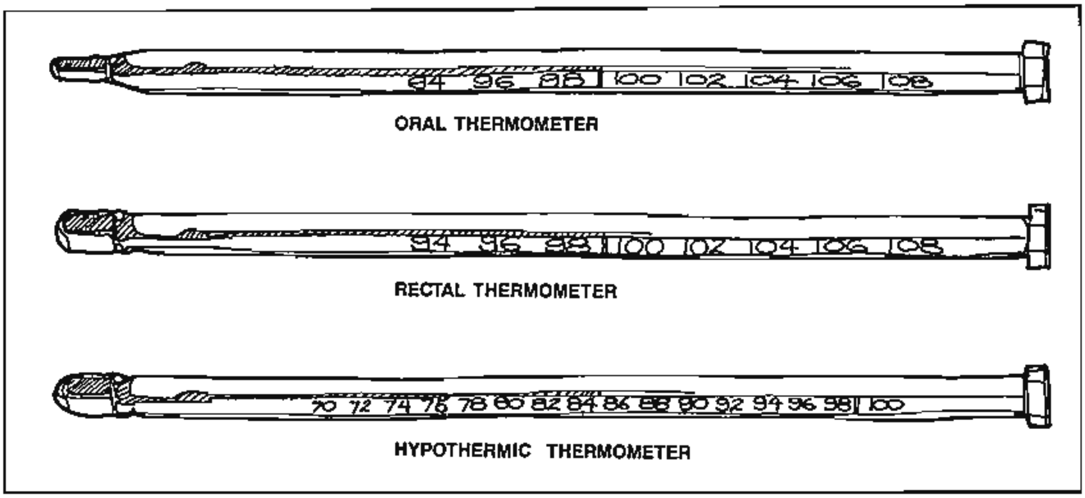


Figure 12-8. A good first aid kit should include all three thermometers: oral, rectal and hypothermic.

To take an oral temperature, use a sterile thermometer and shake the mercury down to about 96 degrees F. Place it under the victim's tongue and have him close his lips tightly without biting. Leave it in for 3 minutes. Normal mouth temperature is 98.6 degrees F. Readings below 95 degrees or above 105 degrees represent critical temperatures.

To take a rectal temperature, select the proper thermometer and lubricate the tip with vaseline or K-Y jelly. Insert the tip about 1 1/2 inches into the rectum and hold it in place for 3 minutes. Wipe the thermometer free of jelly before reading. Normal rectal temperature is 99.6 degree F.

For treating hypothermia, a rectal thermometer that measures body core temperatures down to 70 degrees F is best. A normal, household thermometer only reads down to 92 degrees F (Figure 12-8).

Respirations

Respirations measure the number of breaths per minute. The normal respiration rate is 14 to 20 breaths per minute (count one breath each time the victim breathes in and out). To get an accurate rate, it is best to count respirations when he is unaware that you are doing so.

Blood Pressure

Blood pressure readings measure the force blood exerts on the walls of the blood vessels during each heartbeat. A reading of 120/80 is generally considered normal for a healthy adult. However, individuals vary greatly. The normal blood pressure should be noted for each crew member on a medical record maintained by the captain.

The first figure represents the pressure when the heart is pumping, and the second figure represents the pressure when the heart is at rest. Slight variations are insignificant, but large changes or fluctuations are important to monitor.

Request for medical assistance

Please refer to Chapter 10 - Coast Guard Procedures for evacuation procedures. There are also private medical advisory systems which provide service to fishing vessels.

12.5 Heat Exhaustion And Heat Stroke

During the hot summer months when temperatures soar up into the 90's, some crewmen over-exert themselves into heat exhaustion or heat stroke. This can be a life threatening situation if the victim is not properly treated.

Heat Exhaustion Symptoms:

Heat exhaustion symptoms include moist skin, cramps or muscle spasms, normal body temperature, and sweating. Heat exhaustion happens when the victim loses too much fluid, and he goes into mild shock.

Treatment:

Heat Exhaustion: move victim to cool, shaded, well-ventilated area. Remove clothing and have victim lie down. Cool victim with fans, air conditioning or wet cloths. If victim is conscious, give sips of salt water (one teaspoon per glass) every few minutes for an hour. If the person does not feel better within 30 minutes, he should be transported to a hospital.

If heat exhaustion is not treated, it can become heat stroke. Heat stroke will always result in death if not treated.

Heat Stroke Symptoms

Heat stroke symptoms include: body temperature is extremely high; skin is flushed and dry; no perspiration.

Treatment

Heat stroke: Remove the patient's clothing, and place the victim in partially filled tub of cold water, if available. Sponge entire body with light brisk strokes, until temperature lowers. If tub is not available, take victim to cool, well ventilated area and wrap him in wet sheets until temperature lowers.

12.6 On Board Treatment

General First-Aid Rules

Although each injury or illness presents its own special problems, there are some general rules that apply to most situations.

* Treat the immediate threats (ABC's, gross bleeding and shock) first. Excessive bleeding and lack of breath or heartbeat are so important that, if possible, one person should apply direct pressure to stop the bleeding while another administers CPR.
* Move the victim no more than is absolutely necessary. You may have to remove clothing to determine the degree of the injury. Rip or cut it if you have to, and be careful not to disturb the victim too much or to irritate the injury, especially in the case of fractures. Leave enough clothing on the victim to keep him warm.
* Unless you must move the victim to get him out of danger, keep him lying still with his head level with the rest of his body until you determine the nature and seriousness of his injuries. The following problems represent exceptions to this rule and require different positions.

If the victim is most comfortable in a different position, let him be the judge. For example, a victim with rib fractures may be most comfortable lying on the injured side (Figure 12-9).

* Keep the victim as comfortable as possible, and reassure him. Restoring his confidence is essential.
* Avoid allowing the victim to see the extent of his injuries.
* Do not touch open wounds or burns with your fingers or other unsterile objects unless sterile dressings are unavailable and it is absolutely necessary to stop the bleeding.
* Do not attempt to give an unconscious victim anything by mouth.
* In transporting an injured victim, carry him feet forward except when you must raise him up an incline. This will enable the rear carrier to watch the victim for breathing difficulties or other problems (see Transporting the Injured).
* Keep the injured person warm enough to maintain normal body temperature.
* In most situations, you will not be called upon to do very much for an injured person. Very serious and mutilating injuries may require heroic first-aid efforts on you part, but most cases require only that you use good judgment and common sense.
* At least two crewmen should be trained in first-aid and CPR. They should carry valid First-Aid and CPR cards.
* Every vessel should carry an in-depth first aid manual. A good one is *Prehospital Emergency Care & Crisis Intervention, Second Edition.* Morton Publishing Co., 925 W. Kenyon, Suite 4, Englewood, CO 80110. (303) 761-4805.

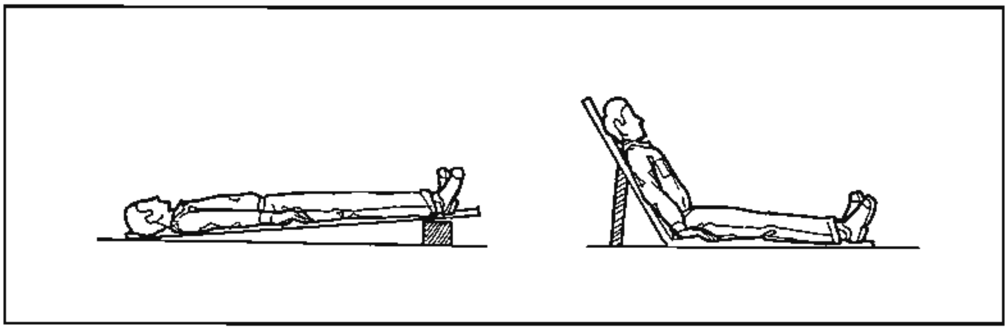


Figure 12-9. a) If the victim is in severe shock, place him on his back with his head slightly lower than his feet (condition permitting); b) If the victim has a chest injury or respiratory obstruction, he would probably be most comfortable and breathe easiest in a sitting or semi-sitting position.

ACCIDENT MANAGEMENT SUMMARY

Size-Up
Does situation threaten boat or other crewmembers?

Determine Responsiveness
Does person need help? Can person talk? What happened? How urgent is this?

Get Help
Might you endanger the boat, the patient or yourself without help?

Set Wheelhouse Watch
Who's looking out for the boat?

Remove patient from threat
What can cause immediate harm to the patient?

Establish Airway
Could patient breathe okay if he tried?

Get Rescue Chest
Can you stabilize the patient with nothing at hand? Do you want to do unprotected mouth-to-mouth rescue breathing?

Perform Rescue Breathing
Is patient breathing Okay? Can you feel/hear exhalations? Is there a pulse?

Light Up The Scene
Can you see well enough to avoid further injury and to find further threats?

Control Bleeding
Is patient bleeding?

Provide Shelter and Reduce Motion
Will a course/speed change be helpful? Do you need to haul back?

Splint Neck
Are you sure there is no neck injury?

Splint Back
Are you sure there is no back injury?

Maintain Airway
Could patient still breathe okay if he tried?

Continue Rescue Breathing
Is patient still breathing okay? Can you still feel/hear exhalation?

Examine Patient
What looks or feels obviously abnormal?

Add Dressings
Is external bleeding controlled?

Splint Extremities
What's deformed? What closed fracture could become an open fracture?

Package patient
Is patient protected against heat loss and jarring?

Move Patient to Shelter
Will package remain intact? Have you picked the safest route and method?

12.7 Burns

First, second and third degree burns can happen on a fishing vessel at any time. Burns from touching heat exhaustion pipes, hot cooking utensils, and overheated equipment can be painful and incapacitating.

First degree burns are identified by redness of the skin, some mild swelling and pain. If the burn is still hot, run cold water over the burn area. Then apply dry, sterile bandages. If the burn has cooled, simply cover with dry sterile bandages. **DO NOT** apply ice directly to a burn.

Second degree burns are more severe and have a deeper burn area with blisters. **DO NOT** break blisters, remove skin tissue or apply lotions, ointments or oil dressings to the burn area. Blot the area dry with sterile cloth (not cotton) and apply dry, sterile bandages over the burn. Also treat for shock.

Third degree burns are the most severe; they are usually the result of direct contact with an open flame. The symptoms include a very deep burn with loss of all layers of skin. The victim may be in shock and feel very little pain. Run cool water over the burn **ONLY** if the skin is still burning. If it has stopped burning, cover the burn with sterile bandages or clean cloth, and treat victim for shock. **DO NOT** remove charred clothing sticking to burn, and **DO NOT** apply any medication. **DO** remove smoldering clothing.

Chemical burns on the skin or in the eyes should be "flushed" with large quantities of water for 10-20 minutes. After flushing, cover with a clean, dry, protective dressing and treat for shock.

12.8 When to Administer Oxygen

When breathing is impaired during medical emergencies, the patient usually requires some method of artificial breathing assistance. However, some patients may have illnesses or accidents which require high concentrations of oxygen - as in heart attacks, shock, severe burns, heavy loss of blood, or extreme breathing difficulties. It may be necessary to administer oxygen to save the person's life. The person who suffers such traumas as heart attack, shock, and carbon monoxide poisoning can even fully recover with oxygen therapy.

Unfortunately, few fishing vessels carry medical oxygen supplies; but fortunately, in many states, you can purchase oxygen tanks without a prescription, as long as it is not administered with a positive pressure device. Oxygen should be included in every ship's first-aid kit; and several crewmembers should be trained in resuscitation and using oxygen equipment.

Contact your state or local health department for information on training, and the purchase and maintenace of reliable oxygen equipment. Many SCUBA diving programs offer such training.

In an emergency, if you do not know how to operate the oxygen tank, guidance is usually available through radio contact. The Coast Guard can also deliver oxygen by helicopter or Falcon jet.

12.9 Hypothermia

12.9.1 Stages of Hypothermia

Hypothermia happens when a person has been exposed to the cold long enough for the inner body temperature to be lowered below 95 degrees F (or 35 degrees C). Wetness and windchill compound the problem. The normal range is 96-101 degrees F. We can tolerate wider ranges only for a short time.

Early hypothermia (93-95 degrees F) is characterized by intense shivering, leading to violent shivering. When shivering stops, the victim is suffering from moderate hypothermia (86-90 degrees F). When the body temperature falls below 78 degrees, the victim has severe hypothermia, which can lead to coma and death (Figure 12-10).

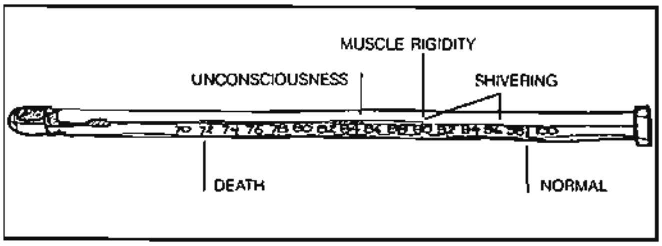


Figure 12-10. The stages of hypothermia.

12.9.2 Water and Hypothermia

Most hypothermia victims on fishing vessels have fallen overboard wearing only clothes. Our bodies lose heat twenty times faster in water than in air, and wet clothing does little to retain body heat - especially denim jeans. If you must be in the water at all, you should wear a wet-suit, dry-suit or immersion suit.

If you do not know what stage of hypothermia the victim is in, assume that it is advanced. The victim should exert himself as little as possible; even the minimal amount of physical activity causes more heat loss, and worsens the condition. A crewman wearing an immersion suit and safety line should be ready to go into the water to assist with the rescue. Handle the victim gently. Rough treatment could cause his heart to stop. Keep the victim lying down to prevent shock.

12.9.3 Treatment

It is important to treat anyone who has been exposed to cold and/or displays the signs of hypothermia, *even if he looks and feels alright!* In 1980, sixteen fishermen were forced to jump into the North Sea when their fishing boat foundered. They spent 1 1/2 hours in the water before they were rescued. The men were able to climb into a safety net, cross the deck, and go below unassisted. However, all the men died later of hypothermia (Forgey, W.W., 1985).

The victim's body temperature will continue to drop even when he is no longer exposed to the elements. Call the Coast Guard for professional advice and evacuation. While you wait for instructions, administer the following first-aid to the victim immediately.

* Check the ABC's. Administer CPR, if necessary. Because the body's metabolism has slowed down, check for 1-2 minutes for breathing and pulse. If the victim is breathing, and you can feel his pulse, gently transfer him to a warm place.
* Treat the victim gently. Jostling may cause an irregular heartbeat and worsen his condition. Do not massage him or manipulate his extremities.
* Remove or cut away wet clothes with a minimum of movement. Keep him as dry as possible.
* Place an unconscious or semi-conscious victim in a level, face-up position. If the victim vomits, turn his head to one side to clear the airway. Continue observing the ABC's.
* Stop further heat loss. For example, put victim in a plastic garbage bag with a hole cut for his head. A garbage bag makes an excellent protective device to keep the victim out of the heat-robbing wind.
* Rewarm the victim gradually. Re-warming must be slow, to avoid shock to his system that could lead to a heart attack. *NEVER PUT THE VICTIM IN A HOT SHOWER OR BATHTUB!* There are two ways to re-

warm a hypothermia victim gradually. One way is to apply warmed objects wrapped in towels (hot water bottles, chemical heat packs, warmed rocks) to the groin, chest, neck, and head. Be careful not to cause skin burns. Another way is to place the victim nude in a sleeping bag with another person (Figure 12-11).

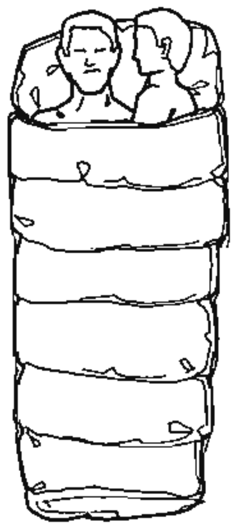


Figure 12-11. A victim can be gently warmed in a sleeping bag with another person.

* If available, have the victim breathe warm, moist air or oxygen.
* Don't give him coffee or alcohol. Unconscious or semi-conscious victims should not be given anything to eat or drink. A conscious, clear-headed victim who has stopped uncontrollable shivering may be given warm fluids.
* Treat for shock. Do not leave the victim alone in case delayed reactions occur.

12.10 Frostbite

Frostbite - the freezing of body tissues - often accompanies hypothermia. In cases where they both occur, care of hypothermia ALWAYS takes precedence. It is difficult to assess the actual extent of damage by looking at frostbite, particularly if the tissue has not yet been thawed.

12.10.1 Symptoms

While it is still frozen, even severely frostbitten tissue may look almost normal - usually pale and firm to the touch, with a gray or waxy color. There may be some purplish tint. The affected area is usually very painful as it freezes or thaws, but it is numb while it is frozen.

During thawing, the skin turns purplish blue and develops large blisters; gangrene may also result. Fishermen must take care because frostbite is always worse if the victim's skin is wet.

12.10.2 Treatment

* If the tissue is still frozen, keep it frozen until you can begin care. Also, never begin thawing procedures if there is any danger of refreezing. Keeping the tissue frozen is less dangerous than submitting it to refreezing.
* It is a mistake to thaw frostbitten tissue gradually. Thaw the tissue rapidly in water at 105 or 110 degrees F. Check the temperatures with a thermometer and maintain the right level by adding more warm water. The heat must by evenly distributed and must be kept constant. This will be very painful for the victim - reassure him. Slower re-warming leads to tissue loss, and temperatures above 110 degrees F may add a burn injury to the frostbite. Do not place the affected area near an open flame or fire.
* If the affected tissue is an eye or nose, pour warm water over the area instead of submerging it.
* Continue the re-warming process until the area turns deep red or bluish; this may be as long as 30 minutes. Do not rub or massage.
* After re-warming, the part should be cleaned carefully with providone-iodine skin cleanser and water, or soap and water, taking care not to break the blisters. Bandage thawed areas gently with sterile dressings; place cotton between affected toes and fingers.
* Place the victim in bed with affected part elevated and kept from contact with bedding. It may be necessary to position boxes or other objects in the bed to keep sheets and blankets from touching frostbitten areas.
* Call the Coast Guard for professional advice and evacuation.

12.11 Immersion Foot

Immersion foot happens to fishermen whose feet are wet for hours or days at a temperature slightly above freezing. Symptoms include swelling of the feet and lower legs, numbness, tingling, itching, pain, cramps, and white, wrinkled skin. After the feet are warmed, they become red, hot, and swollen, and the skin often blisters. If circulation was cut off, immersion foot can lead to gangrene.

Treatment

* Dry the foot completely, but do not rub or massage vigorously. Take care not to break blisters.

* Gradually re-warm the foot using blankets, clothing, a warm hot-water bottle, or body heat (place the foot in a crewmate's armpit or between a crewmate's thighs).
* Give 10 grains of aspirin every 6 hours.
* Give the victim plenty of hot liquids to drink during the re-warming phase, as well as high-calorie foods and vitamin supplements.

If you have any doubt as to whether the injury is immersion foot or frostbite, you may have both. Treat for frostbite.

12.12 Cold Water Near-Drowning

Sudden contact with cold water (below 70 degrees F) sometimes touches off a primitive response called the *mammalian diving reflex.* This body response shuts off blood circulation to most parts of the body except the heart, lungs and brain. What little oxygen remains in the blood is transported to where it is needed most.

A similar response enables whales, porpoises and seals to survive long periods underwater. This reflex *may* mean that it is possible to revive someone who has been underwater for up to one hour.

Treatment:
* Begin mouth-to-mouth rescue breathing and CPR immediately. Don't worry about getting water out of the victim's lungs-it will be absorbed by the body.
* Prevent the victim from losing more body heat, but DO NOT re-warm him. Improper re-warming may cause harm.
* Call for medical advice and assistance.
* Don't give up. *People have been revived even after an being underwater for an hour.* Therefore, CPR should be administered for as long as you are able. The victim may look dead, with cold, bluish skin and no detectable heartbeat or breathing. The eyes may be fixed and dilated, and there may be no visible sign of life. If the water was cold, however, there may still be a chance of survival.

12.13 Marine Skin Reactions/ Injuries

12.13.1 Catfish and Stingray Stings

The sting from these fish can result in a painful cut or puncture, swelling, discoloration, possible nausea, vomiting, muscle spasms, convulsions, and difficulty breathing. The quicker you treat the wound, the better. Use the hottest water you can stand. For maximum healing, maintain the treatment for two hours or more. First wash the wound with soap and water; control the bleeding and remove the barb ONLY when possible. Place a band 2-4 inches above the wound. Soak in hot water or apply hot compress for 30 minutes; then remove the band. Treat for shock.

12.13.2 Jellyfish and Man-o-War Stings

Symptoms
* Intense burning pain.
* Reddening of the skin.
* Skin rash.
* Muscle cramps.
* Nausea and vomiting.
* Difficulty breathing.
* Possible shock.

Treatment:
* If there is difficulty breathing, check the ABC's and call for medical advice.
* The affected part should be bathed with seawater. *DO NOT* use fresh hot water; the stinging cells will burst, causing the victim more pain.
* Wear gloves to gently remove any tentacles or jellyfish pieces.
* Immediately apply a solution of 1 part household ammonia, vinegar or meat tenderizer to 10 parts water, or 1 part aluminum sulfate, baking soda or alcohol to 20 parts water. Urine is actually one of the best solutions to neutralize the stinging cells.
* Then apply a paste of baking soda and sea water to the affected part for 15 minutes. Gently scrape off the paste with a knife. Apply more paste and leave it on the affected part for 5 minutes. Then scrape it off.
* Observe the victim for signs of shock.

12.13.3 Fish and Blood Poisoning

Fish Poisoning

It is common for fishermen to get skin rashes from fish bacteria entering the body through cuts and scratches. There are many names for this condition, which is characterized by redness, itching, and sometimes blisters or cracking of the skin. It can be very uncomfortable and dangerous if it isn't treated.

Prevention is the best treatment. Wash your hands and other exposed areas thoroughly with soap and water after you handle fish.

Blood poisoning has the same symptoms as fish poisoning. However, you may also have redness, swelling, pus and a red streak running from the wound up the arm or leg. You may also have a fever. Antibiotics may be necessary. Since blood poisoning is a dangerous condition, you should seek medical advice.

12.13.4 Salt Water Boils

These boils are common around the wrist, where rain gear and damp woolen sweaters rub the skin. Wash the area thoroughly with fresh water. Apply a protective coating, such as petroleum jelly, to prevent further contact with salt water. It may also be helpful to wear rubber gloves or to apply a dry, sterile dressing.

12.14. Fishhook Injuries

Embedded straight-shank fishhooks are a fisherman's occupational hazard. It may be best to leave the embedded hook alone, if it doesn't need to come out. If you are within 24 hours of professional medical treatment, keep the wound clean, protect the area with a bandage or splint, and let a doctor remove it.

If you decide to treat the injury onboard, the most common method is to force the hook onwards until the point pierces the skin again, then break or file the barb and remove the hook along the path of entry. This method can be extremely painful and increases the chances of infection. If you try it, sterilize the hook and the entry and exit points with a providone-iodine scrub.

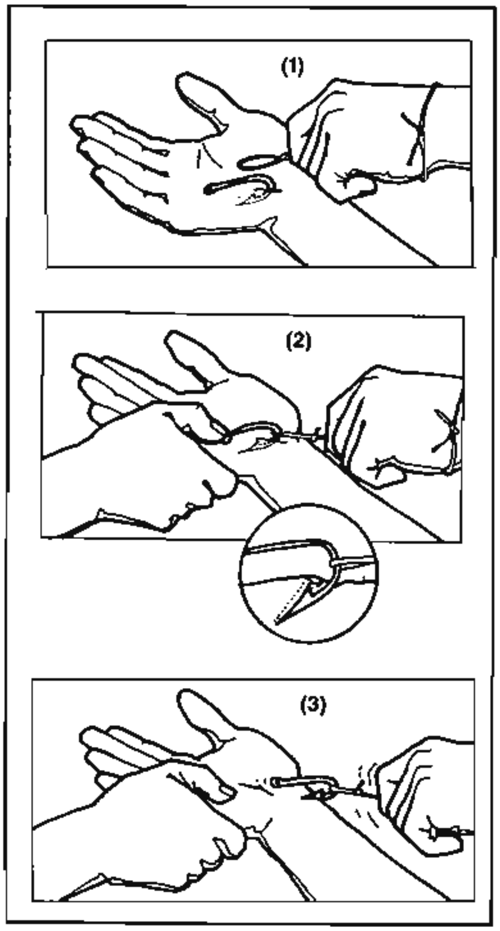


Figure 12-12. Removing a fish hook.

Another method is to flick the hook out with a loop of fishing line about 20 inches long (Figure 12-12).

* Tie a knot in the loose ends of the line forming a 10-inch loop. Place the loop around the back of your hand and run the other between your thumb and forefinger (1).
* Place the loop over the eye of the hook and center it in the middle of the hook's bend. Immobilize the hand and apply pressure down and back. At the same time, give a sharp jerk on the line (2).
* The hook should pop out of the same hole it entered, leaving a minimal wound to heal (3).

Cleanse the wound with soap, or antiseptic such as providone-iodine, and apply an adhesive bandage. Use an antibiotic to fight infection and reduce pain.

Remember to immobilize the finger or hand from which a hook is going to be removed. If the hook has entered in the area of an eye, call for medical advice.

12.15 Other Common Medical Emergencies/Injuries

12.15.1 Choking

Occasionally a crewman will choke while eating. If the person can speak or cough on his own, let him try to cough the food out himself. However, if he becomes unable to breathe, speak or cough, then he needs your help to clear his airway.

If the person is still standing, place your arms around the person from the back with the thumb side of your fist against his stomach near his naval. Grasp your fist with your other hand and make four quick upward thrusts (Figure 12-13 (a)).

If the person is lying down, kneel astride the person's hips, facing him. With one hand on top of the other, place heel of bottom hand on the abdomen at naval level. Apply a quick upward thrust. If the person vomits, quickly turn him on his side and wipe out his mouth (Figure 12-13 (b)).

Be sure to adjust the force of the thrust according to the choking person's size to avoid chest injury.

Repeat the procedure if necessary. Watch breathing closely. Administer artificial breathing if necessary. If this abdominal thrust method is used, advise the person to see a physician, since internal damage can result from this procedure.

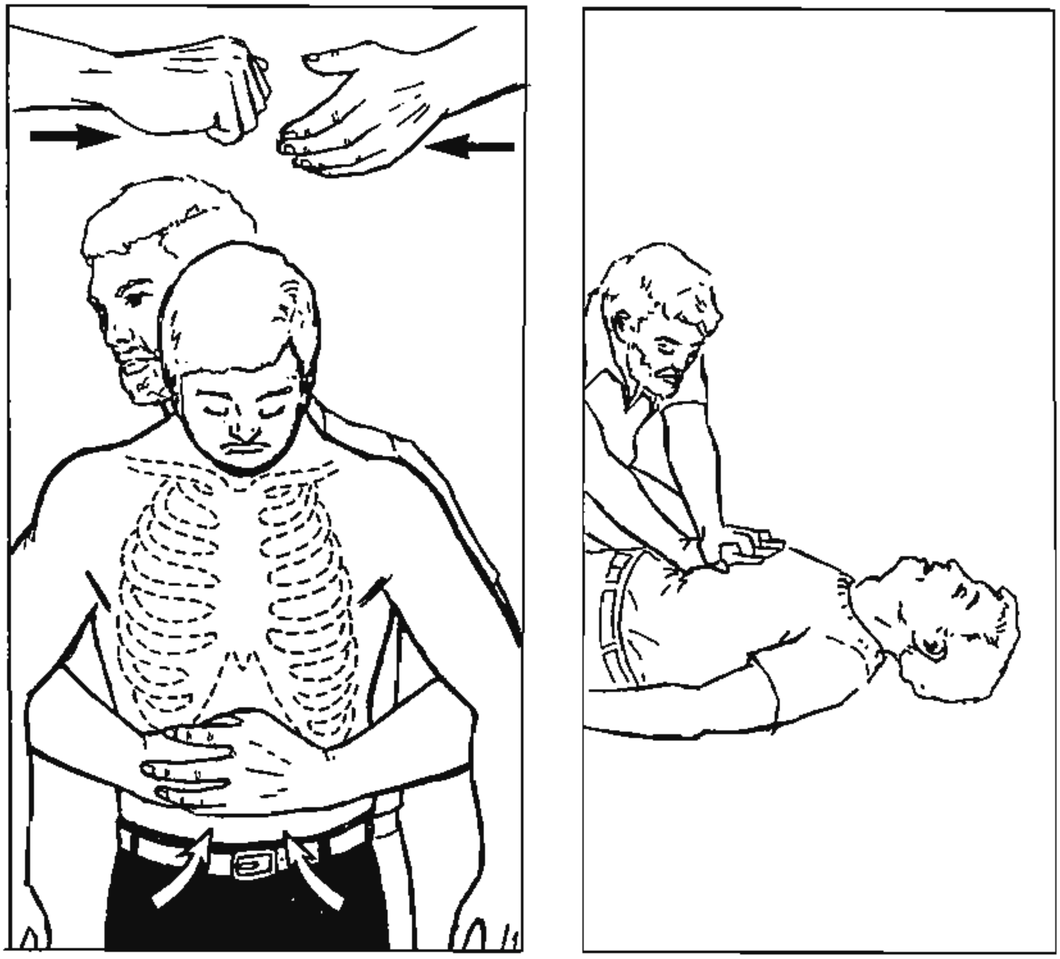


Figure 12-13. a) Proper positioning of the hands for applying abdominal thrusts in an adult who is sitting or standing; b) Proper positioning of the hands for applying abdominal thrusts in the person lying down.

12.15.2 Breaks, Fractures, Dislocations

Broken bones, fractures and dislocated limbs are fairly common injuries on fishing vessels because of the work with heavy, powerful gear. A *closed fracture* or break is identified by a deformed limb, pain and swelling, as well as an inability to use the extremity. The bone may actually break through the skin in an *open fracture*. Cover with a clean sterile dressing to avoid infection and help control bleeding. Keep the limb still. DO NOT attempt to reset bones. Stabilize the fractured area by splinting the limb above and below the fracture. Do not tie anything on top of the break.

A fracture occurs as a result of significant force. This can travel throughout the body and cause damage in other areas. Conduct a thorough secondary survey, and treat any other injuries.

In the event of a suspected back or neck injury, DO NOT move the injured person unless absolutely necessary. Keep the victim's head and body still.

12.15.3 Poisoning

Although it is not common, crewmen can be exposed to various types of poison on a fishing vessel. Fishermen should be familiar with poison treatment, since their family members may be accidentally poisoned. The symptoms of various types of poisoning include:

* Acid and alkali - burns around mouth, lips and tongue
* Petroleum - burning irritation, coughing, coma
* Burning sensations in mouth, throat, stomach
* Cramps, disorientation, bloody diarrhea

* Others - nausea, dizziness, drowsiness, slurred speech, lack of coordination, cold clammy skin, thirst, convulsions, coma.

If possible, you should contact a poison control center or doctor immediately. Save the poison container. Watch the victim's breathing very closely and administer artificial breathing if necessary. For acid, alkali or petroleum poisoning, DO NOT induce vomiting, but give the victim, if conscious, one or two glasses of milk or water to help dilute the poison.

For other types of poisons, you can dilute the poison with one or two glasses of milk or water or induce vomiting by giving him a tablespoon of ipecac or by placing your finger or a spoon on the victim's tongue. When vomiting has stopped, give the victim a glass of water containing one or two tablespoons of activated charcoal.

12.16 Injury by Ammonia

In the event of an injury involving ammonia inhalation and difficulty in breathing, seek immediate medical help and indicate that the situation requires an inhalator so that the victim can be placed on oxygen.

Remove person immediately from the contaminated area, into a heated room with fresh air circulation. Keep him lying down, with head and shoulders raised slightly.

Administer artificial respiration if the victim is not breathing.

Loosen tight clothing around the upper part of the body to ease breathing and reduce coughing.

Victims who have inhaled large quantities of ammonia gas must have an oxygen supply as soon as possible. The victim must be kept quiet.

Unconscious victims should not be given water or other drinks.

Eye Injury

Immediately raise the eyelids and rinse with plenty of water for at least 15 minutes. Rinsing with water is critical, because ammonia binds to the protein in the eye and is not easily removed.

Skin Injury

Immediately rinse the affected area with plenty of water for at least 15 minutes. Never cover the burned spots with clothes, bandages, oil or lineament.

Swallowing Liquid Ammonia

Seek medical advice immediately. This is a life-threatening situation.

12.17 Injury by Freon

Asphyxiation

Freon released in a confined space, causes a victim to suffocate and lose consciousness. Immediately move the victim to fresh air, and loosen any tight-fitting clothing.

If the victim is not breathing, begin artificial respiration immediately. Continue until he starts to breathe, or until medical help arrives, and the victim can be placed on oxygen.

Frost Injuries

Direct contact with liquid refrigerant may burn the skin as the liquid evaporates. Rinse the affected area immediately with water and apply dressings as needed.

Injuries to the Eyes

Freon vapors are not normally injurious to the eyes. If liquid drops get into the eyes, keep the victim from rubbing his eyes. Immediately administer drops of sterile mineral oil, and then flush with water.

If the irritation continues, the eyes should be washed with a weak boric acid solution.

12.18 Drugs

12.18.1 Drug Overdose

Although owners and captains are making efforts to keep their vessels "drug-free," there may be cases of drug overdose that must receive prompt treatment. Treatment varies, however, with the type of drug taken, its effect on the victim, the way it was taken, and whether drugs were mixed.

Barbiturates cause symptoms from mild drowsiness to coma. Vomiting, respiratory arrest, and reduced blood circulation are common. The victim is very prone to fall and be injured by heavy, fast-moving gear.

Stimulants induce restlessness and severe anxiety. This can lead to paranoia.

Hallucinogens induce perceptual alterations of sound, sight, and other sensory data.

Treatment

A few general rules apply when a rescuer is faced with a drug overdose victim. Information about the drug, the route of administration, and whether he is a chronic user is absolutely necessary for a doctor to determine treatment. Try to get all this information while calling for assistance.

Depressants
* If depressed, gently try to stimulate the victim by talking or light shaking.
* Check the ABC's.
* Do not induce vomiting if patient is drowsy.

Stimulants & Hallucinogens
* Handle victim in a calm manner. Talk him down.
* Do not use restraints unless the victim is violent.
* Administer oxygen if available.
* Never leave the victim unattended.

12.18.2 Drug Withdrawal

Patients who are addicted to drugs may experience a severe reaction when drugs are not available for a long period of time. These reactions are characterized by anxiety, nausea, vomiting, convulsions, delirium, profuse sweating, abnormal heart rhythms, hallucinations, and severe abdominal cramps. Usually the person is aware of the problem.

Individuals experiencing withdrawal are as ill as those suffering from drug overdose. They should be treated in an emergency department as soon as possible.

12.19 Emotional Distress

Just because you leave the dock and head out to sea, doesn't mean that your problems stay behind. Many times, they worsen, and they can dominate your energy and time. If severe, they can become physically and mentally incapacitating, and can lead to depression and suicide.

Treatment
* Try to assess the situation, find out what's wrong and see if talking it out helps.
* Check for drug abuse, head injury, diabetes, other medical problems.
* Is there a history of this type of behavior?
* Protect yourself and the person in distress. Maintain a watch on the victim. Do not attempt to deal with an armed person.
* Take charge, act confidently.
* Describe the person's condition to a medical expert. Get help.
* Assume that the victim's complaints are real and genuine. The person is usually frightened - do not accuse or frighten him more.

12.20 Transporting the Injured

In order to prevent further injury, it is essential that you transport an injured man correctly. Choosing the proper method to transport a seriously injured victim is as important as any other first-aid procedure. The victim's life may depend on how you move him after the injury.

12.20.1 Turning the Patient

If the person is face down, it is usually best to put him on his back for ease of transport and treatment. If there are head, neck or spinal injuries, it is crucial that this is properly done to avoid further injury. Each crewman should know how to turn the patient, instead of waiting for help to arrive. If possible, 3 people should be available for this roll: one at the head, securing the neck; one holding the shoulder and hip; and one holding the hip and knee. The person at the head controls the procedure by counting "1-2-3 go," then the rescuers gently turn the victim (Figure 12-14).

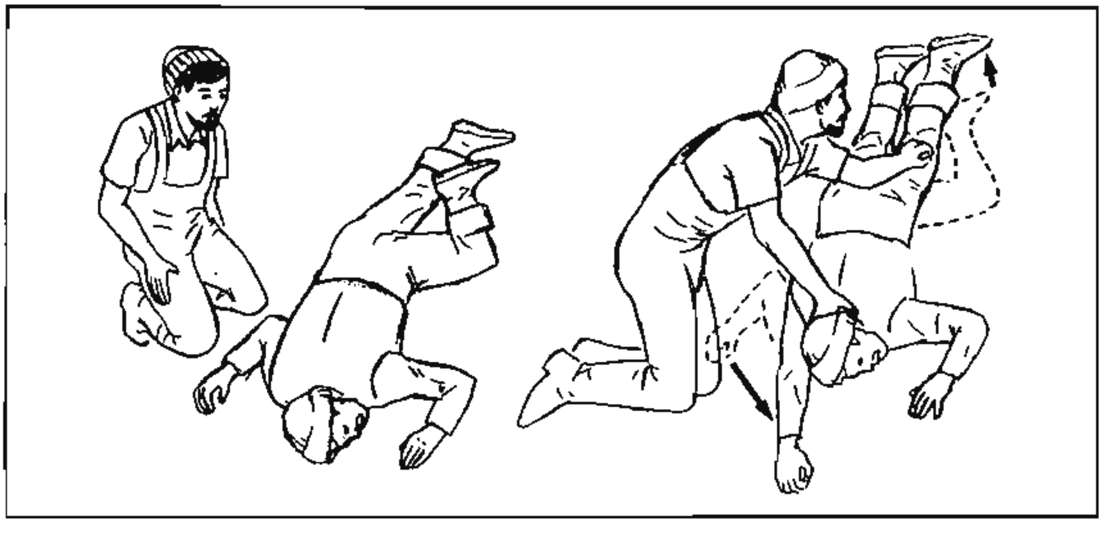


Figure 12-14. Turning the person should be done carefully to avoid further injury.

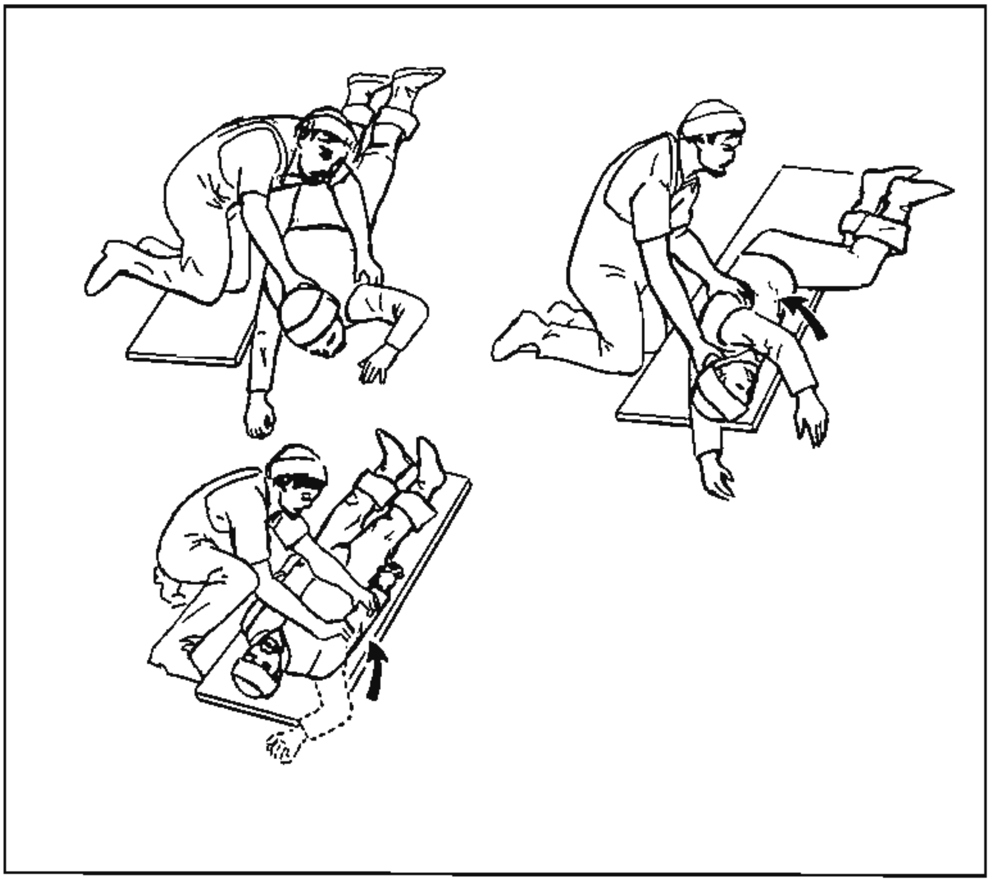


Figure 12-15. The rescuer should roll the person into a flat position following these steps: a) Kneel about 18 inches away from the persons shoulder; b) Bring the persons nearest arm above the head and straighten persons legs; c) Place one of your hands behind the persons head and neck and the other hand on the distant shoulder; d) Roll the person toward you by pulling the shoulder; e) Once the person is flat, bring the extended arm back to the side.

Whenever possible, place the patient onto a hard, non-flexible board to help stabilize him against moving with swells and during movement. Use litters, stretchers, backboards or improvised articles (checkerboards, doors, etc.). Secure the person to the board using belts, cloths, netting, etc. Do not use narrow pieces of cloth or thin line, as this may cut into the victim's skin. Secure the head and neck with pillows, towels, and tie over the chin and the forehead (Figure 12-15). If a cervical collar is available (one should be included in the First-Aid kit), it should be placed snugly around the neck.

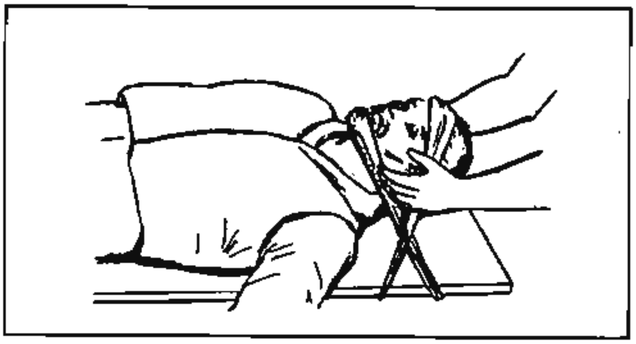


Figure 12-15. Secure the head carefully to avoid movement.

Take the stretcher to the victim - don't move the victim to the stretcher. Make him comfortable and cover him. Be gentle.

Manual carries should be used only to get a victim away from immediate danger such as fire, or to move a slightly injured victim a short distance.

Perform essential first aid before moving the victim. The list includes:

* Check the ABC's
* Control gross bleeding
* Treat for shock
* Wounds dressed/fractures immobilized

A Stokes litter (Figure 12-16 (a)) is used with a backboard or Miller board. The litter itself does not adequately support the spine or neck. You can use an improvised backboard to stabilize the injured person until help arrives (Figure 12-16 (b)). It is important to only move an injured person in a way that will not cause more injury. The U.S. Coast Guard will use a litter to hoist a victim who is unable to sit in a basket. Normal procedure includes first placing an EMT trained swimmer on your vessel to prepare the patient. The Coast Guard will not use a litter provided by the vessel.

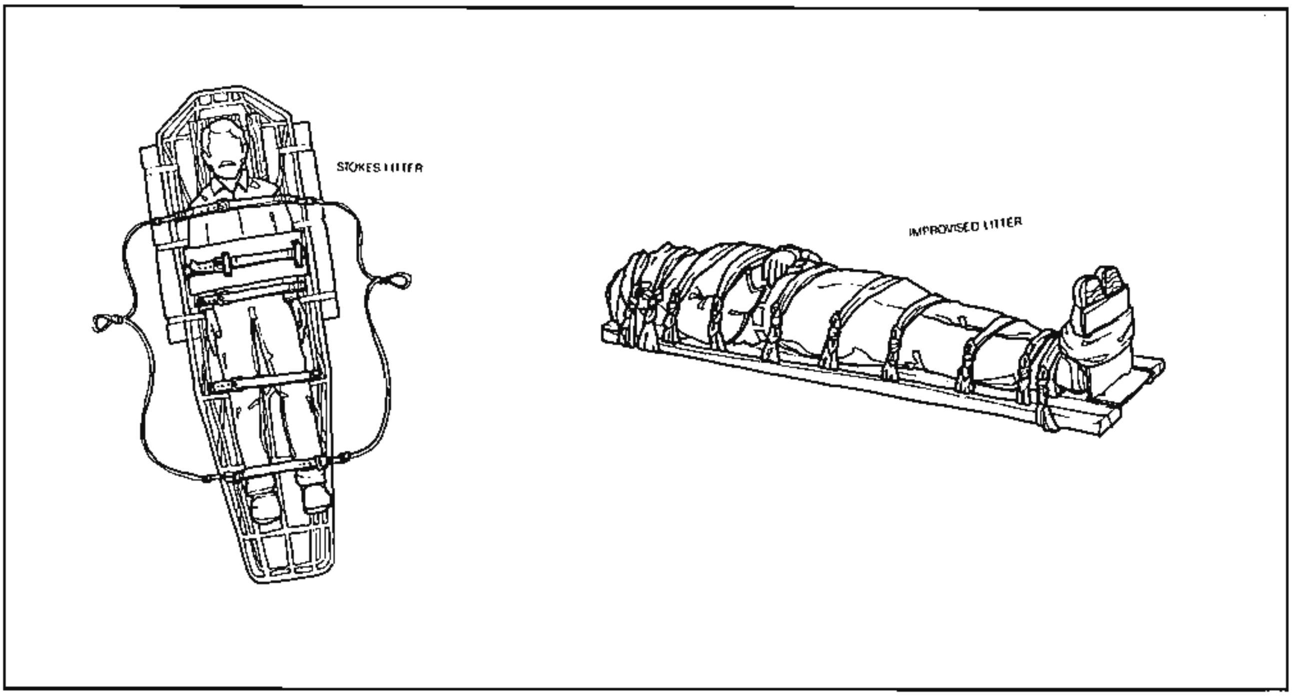


Figure 12-16. a) The Stokes litter; b) An improvised litter.

12.20.2 Manual Carries

Fireman's Carry

This one-rescuer carry is probably the easiest way to move an unconscious victim (Figure 12-17)

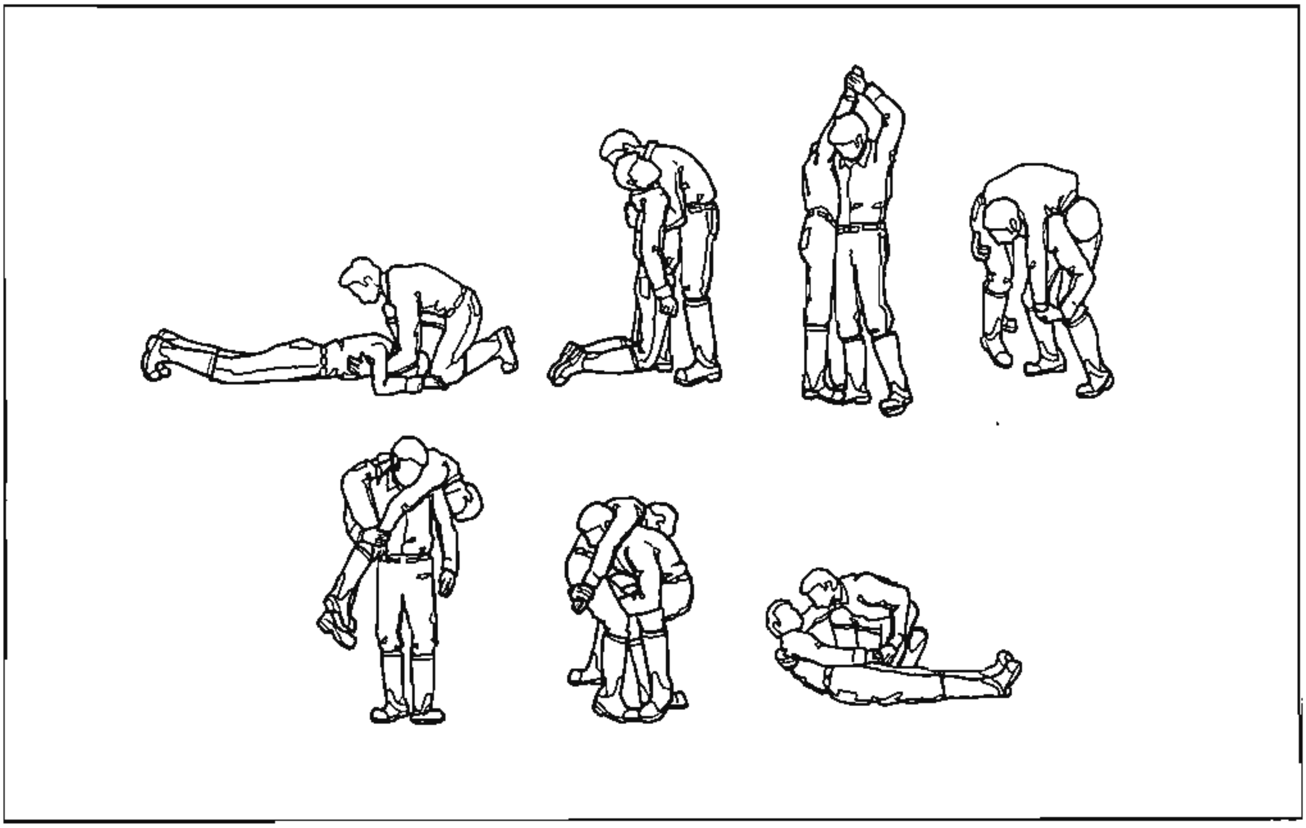


Figure 12-17. The fireman's carry.

Pack-Strap Carry

If the victim is on a bed or in a chair, this carry is convenient. The victim's arms are brought across the shoulders taking care that they are well up, i.e. that his armpits rest on the shoulders of the rescuer. His arms are then crossed in front and grasped firmly (Figure 12-18).

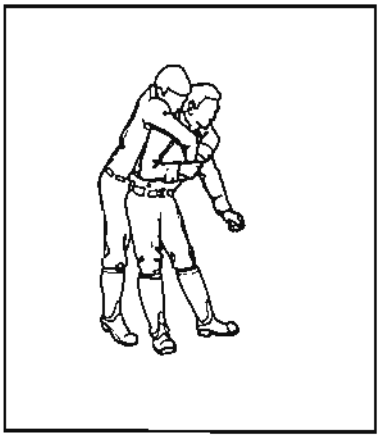


Figure 12-18. Pack strap carry.

Drag Carry

One-rescuer method for hauling an unconscious victim for a short distance. First the victim's hands are tied, then placed behind the rescuer's neck (Figure 12-19).

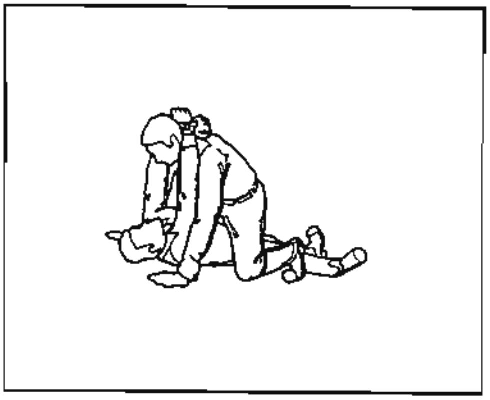


Figure 12-19. Drag carry.

Blanket Drag

The victim is placed on a blanket and moved by pulling on one end of the blanket. This method is used when the victim is unconscious and has injuries which forbid handling or lifting by a single person (Figure 12-20).

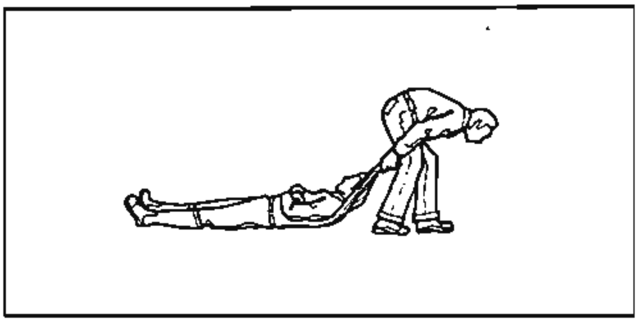


Figure 12-20. The blanket drag.

12.21 First -Aid Kits

The difficulty in treating medical emergencies aboard fishing vessels is compounded by being far from help, heavy weather, unsanitary conditions, and limited medical supplies and equipment. Choosing the appropriate medicines and supplies is one of the more difficult tasks you will encounter. It is essential that you adequately stock, inspect, and replenish your vessel's first-aid kit. Each member of the crew must know the exact location of all the first-aid supplies on board. Trauma supplies are often kept separately from drugs and medications, particularly those which are prone to abuse.

Store your first-aid kit near the survival equipment you would take with you if abandoning ship. Store the contents in a weatherproof container with individually sealed packages, labeled with the trade name, generic name and expiration date. Check the contents before getting underway for each trip, and replace items that have been used.

Always check the first-aid kit before fishing season begins. Scissors may rust or bandages may mildew during a layover. Inspect and replenish your kit's supplies at the beginning of the season, and log and replace items that are used during the season. Pay careful attention to the use of drugs and medications.

Contents of unopened or intact, sterile, disposable packages should remain sterile until opened. However, to be sure that the contents have not deteriorated, replace them at least every five years or on the expiration date. Assign a first-aid trained crewman the responsibility of maintaining the kit.

Base your medical supplies on the age and size of the crew, and the type of fishing you will do. For example, fishermen that use knives often would want to carry extra bandages. Each crewmember should be responsible for bringing and storing any prescribed medications. This would be particularly important for crewmembers suffering from diabetes or asthma.

Below is a list of supplies, equipment and medications recommended for a basic first-aid kit. Since your boat may have special needs, we suggest that you consult a medical supply vendor who is familiar with the medical requirement of fishing vessels to help you stock your first-aid kit.

Instruments and Equipment
* Complete first-aid manual, such as: *Prehospital Emergency Care & Crisis Intervention, 2nd Edition*. Morton Publishing Company
* scrub brush, hand
* eye magnet and nylon loop
* scissors
* rescue shears
* forceps
* tweezers, needle point
* scalpel, with #11 blade
* airway, pharyngeal
* blood pressure cuff
* stethoscope
* thermometer, oral
* thermometer, rectal
* thermometer, hypothermic
* cyalume lite
* pen lite
* cervical collar
* splint, full arm (inflatable)
* splint, full leg (inflatable)
* splint, finger
* safety pins
* burn sheet
* space blanket
* cotton swab sticks
* gauze pads, sterile (assorted sizes)
* gauze roller bandages (assorted sizes)
* non-adherent pads, sterile
* Vaseline gauze stretch bandages, sterile (assorted widths)
* compresses (assorted sizes)
* Band-Aids (assorted sizes)
* triangular bandages
* adhesive tape
* paper tape
* butterfly closure and steri-strip package
* hot water bottles, 2

Optional
* oxygen cylinder, regulator, tubing and mask.
* urinary catheter

Medicines
* aspirin
* acetaminophen (Tylenol)
* Ibuprofen (Advil)
* antacids
* eye antibiotic and cortizone drops
* ammonia inhalent
* providone-iodine (solution and scrubs)
* Hibiclens, or equivalent
* triple antibiotic ointment
* lubricant
* oil of clove
* mineral oil
* boric acid
* Blistex, tube
* Insta-glucose, tube
* benzoin, can
* silver sulfadiazine burn cream
* cold pack
* ipecac syrup
* ammonia
* rubbing alcohol
* meat tenderizer

Note: for prescription medicines, consult your medical supply vendor.

12.22. References

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APPENDIX

(CHECKLISTS & FORMS)

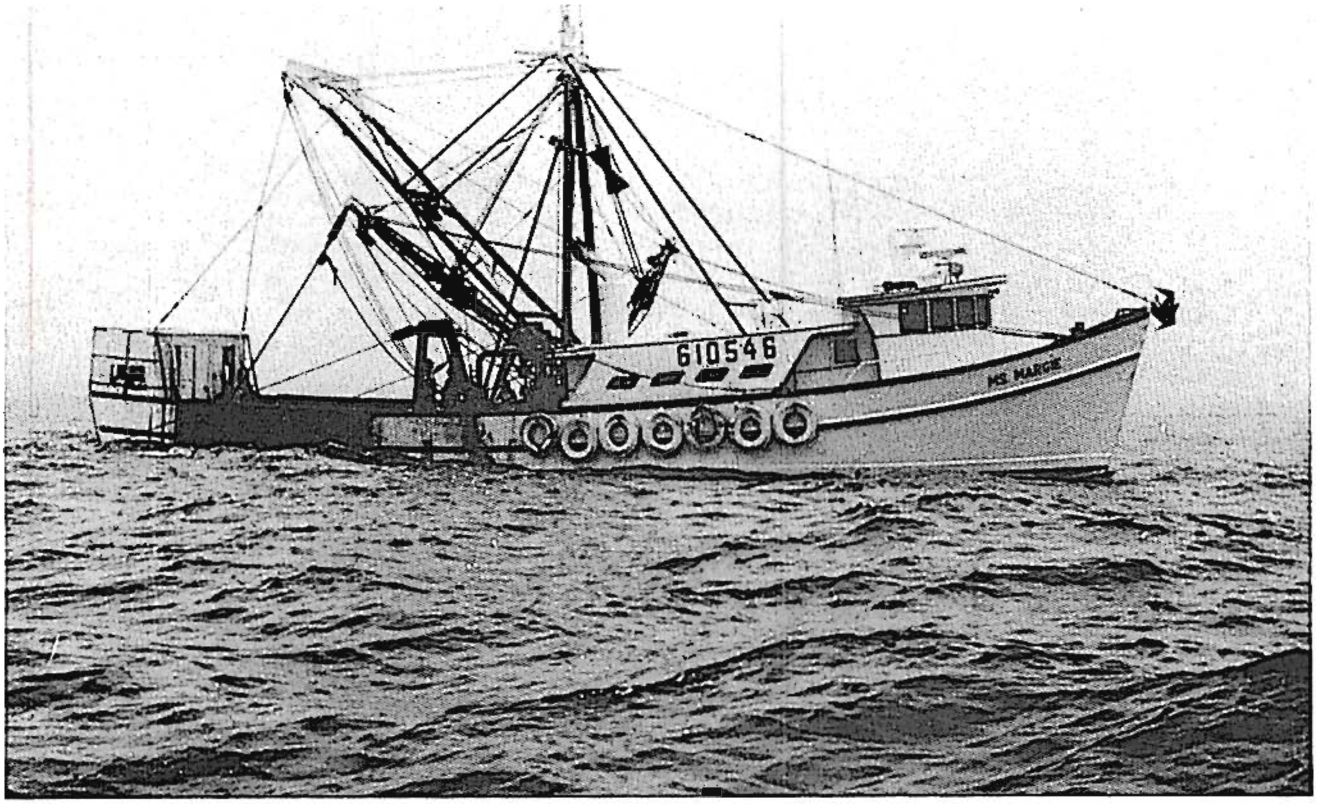

Photo courtesy of VIMS Marine Advisory Program

APPENDIX

CHECKLISTS & FORMS

1) Checklist of Federal Requirements
2) Sample Station Bill
3) Sample Medical Form
4) Sample Report of Personal Injury or Illness
5) Sample Personal Injury Report (Crewman)
6) Sample Captain's Report of Personal Injury
7) Sample Personal Injury Report (Captain)
8) Sample Personal Injury Report (Witness)
9) Sample Non-Injury Statement
10) Sample Report of Physical Damage
11) Sample Inshore Vessel Safety Inspection Guidelines
12) Sample Offshore Vessel Safety Inspection Guidelines
13) Requirements for Reporting Marine Accidents
14) Sample Insurance Safety Incentive Program Checklist
15) Instructions for Completion of Form CG-2692
16) Form CG-2692 (Report of Marine Accident, Injury or Death)
17) Public Law 100-424, "Commercial Fishing Industry Vessel Safety Act of 1988"
18) US Coast Guard - Final Rule on EPIRBs
19) International Law, Annex V of the MARPOL treaty on Prevention of Pollution from Vessels
20) Distress Communications Form
21) Sample Letter of Agreement
22) Sample Employment Agreement
23) Sample Release of Liability Agreement
24) Sample Contract for Crew Member Employment
25) Model Letter of Agreement

Checklist Of Federal Requirements

(Note: These may change after May 1991 when the Fishing Vessel Safety Regulations are put in place)

Documented vessels
(Vessel of 5 Net tons or more - 46 CFR 67-69)
* The Commercial Fishing Industry Vessel Safety Act of 1988 sets in place requirements to insure that fishing vessels are provided with basic safety equipment and reasonable stability properties; this includes the use of EPIRBs (emergency position indicating radio beacons). One EPIRB will be required on every vessel operating on the high seas.
* Vessel name and hailing port on stern, name on each bow.
* Certificate of Documentation on board vessel at all times.
* Official numbers clearly marked on an internal structural part of the hull. (Note: Vessels are no longer required to have the net tonnage marked on the main beam of the vessel, nor is it required that the tonnage be removed if it is so marked.)

State numbered vessels - (33 CFR 173)
* Certificate of Numbers on board.
* Numbers - properly spaced - on each bow.
* Current validation sticker.

Personal floatation devices (PFDs.) - (46 CFR 25) (Chapter 2 on Safety Equipment and Survival Procedures)
* Vessels under 40' - serviceable CG-approved Type I, II, III PFD or immersion suit of suitable size for each person on board.
    - Readily available.
* Vessel 40' and over-serviceable CG-approved Type I PFD or immersion suit of suitable size for each person on board.
    - Readily available.
* Vessel 26' and over - in addition - at least one serviceable CG-approved Type IV Ring Buoy, 20", 24", or 30" in diameter.
    - Immediately available. Note: A Coast Guard-approved immersion suit may be substituted for a Type I, II or III PFD.

Retro-reflective tape on PFDs - (46 CFR 25)
* Required amount of retro-reflective material, properly spaced - front and back - on all Type I, II, III PFDs and immersion suits.

PFD lights - ocean, coastwise and Great Lakes - (46 CFR 25)
* Approved PFD light (approval number 161.012) securely attached to the shoulder area of each Type I, II, III PFD and immersion suit, with an up-to-date power supply attached.

Fire Extinguishers - (46 CFR 25) (Chapter 4 on Fire Prevention and Control)
* All fire extinguishers marked with a permanent name plate showing CG and/or UL approval for marine use.
* All fire extinguishers in good and serviceable condition.
* Minimum number of fire extinguishers for the size of vessel on board

Flame arrester - (46 CFR 25)
* One approved flame arrester on each carburetor of all gasoline engines except outboard engines.

Ventilation - (46 CFR 25)
* At least two ventilator ducts fitted with cowls or their equivalent for the purpose of properly and efficiently ventilating the bilges of every engine and fuel tank compartment on vessels using gasoline as fuel and/or fuels having a flash point of 110°F or less, except "open boats."

Navigation lights/day shapes - (Navigation rules)(Chapter 9, Rules of the Road)
* "Running Lights" and "Identity Lights" arranged as per COLREGS or Unified Rules.
* Dayshapes available for display.
* Deck lights should not hinder navigation not hinder recognition of your vessel from another vessel.
* Sidelight screens painted matt black.

Sound Signaling devices - (Navigation rules)
* Vessel less than 40 feet (12 meters) - Whistle and bell not specifically require by COLREGS or Unified Rules; however, some means of making an "efficient sound signal" must be carried.
* Vessel 40 feet (12 meters) to 328 feet (100 meters) must carry whistle (horn) and a bell.

Pollution prevention - (33 CFR 155 and 159)
* Vessels 26 feet and over - oil discharged prohibition warning placard posted.
* Fixed or portable means to remove oily bilge slops to shore.
* Vessels 100 gross tons and over - fuel oil and lubricating oil discharge containment.
* Oil transfer operation requirements for vessels with a capacity of more than 250 barrels (10,500 gallons) of oil.
* Certified Marine Sanitation Device installed where toilet facilities are part of the vessel.
* Vessels 400 gross tons and over - International Oil Pollution Prevention (IOPP) Certificate.

Fishing numbers -
* Official numbers or state registration numbers on each side of the deckhouse or hull, and on weather deck or top of deckhouse.

Radio -
* Current radio station license on board.
* Radiotelephone operator permit.

Sample Station Bill

General Instructions

1. All crew members shall familiarize themselves with their assigned location in the event of an emergency immediately upon boarding the vessel.

2. All crew members shall be thoroughly familiar with the duties they are assigned to perform in the event of an emergency.

3. Each person shall participate in emergency drills and shall be properly dressed including a properly donned personal flotation device or exposure suit.

4. ______________________________ shall be responsible for the maintenance and readiness of all lifesaving appliances and equipment.

Fire And Emergency

1. Any person discovering a fire shall notify the wheelhouse by sounding the alarm and then take initial action as appropriate.

2. Upon hearing the fire and emergency signal all watertight doors, fire doors, scuppers, and designated discharges shall be closed and all fans, blowers and ventilating systems shall be stopped. All safety equipment will be prepared for immediate service.

3. Upon seeing a 'MAN OVERBOARD', immediately throw a ring buoy (with a light attached if at night) and notify the wheelhouse by reporting "MAN OVERBOARD PORT (STARBOARD) SIDE." In all cases keep the man in sight.

4. During abandon ship dress for survival, put on plenty of warm clothing and an exposure suit, if at all possible don't get wet.

Signals

FIRE AND EMERGENCY SIGNAL (______________)

The fire and emergency signal shall be a continuous blast of the whistle for a period of not less than 10 seconds followed by a continuous ringing of the general alarm for not less than 10 seconds.

MAN OVERBOARD SIGNAL (* * *)

The man overboard signal shall be the letter "O" sounded several times (at least 4) times on the ship's whistle followed by the same signal on the general alarm.

ABANDON SHIP SIGNAL (* * * * * * * ______________)

The abandon ship signal shall be at least 7 short blasts followed by one long blast on the ship's whistle followed by the same signal of the general alarm.

Personnel And Duties

		FIRE & EMERGENCY		ABANDON SHIP		MAN OVERBOARD	
	NAME	REPORT TO	BRING	REPORT TO	BRING	REPORT TO	BRING
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

Sample Medical Report

Reprinted from Safety at Sea/Texas A&M University Sea Grant

Dr. ______________________________

Please furnish (company name and addres)

____

____

the following report regarding my condition.

Signed ______________________________

(To be detached and retained by reporting physician if desired)

PATIENT	Name ______ Age ______ Address ______ Occupation ______ Employed by ______
HISTORY OF CONDITION	Date of Accident ______ 19 ______ History as described by patient ______ ______ ______ ______ ______ Date of your first treatment ______ 19 ______
X-RAY	Date taken ______ 19 ______ Where taken ______ Findings ______
DIAGNOSIS (Describe and locate character and extent of injury)	______ ______ ______ ______ ______ ______
CONTRIBUTING FACTORS	In your opinion, is disability solely a result of above described accident? ______ ______ ______
PROGNOSIS (Your estimate)	Total Occupational Disability ______ weeks ______ days. Ended ______ 19 ______ Partial Occupational Disability ______ weeks ______ days. Ended ______ 19 ______ (50 percent or more) Probable period of measurable discomfort ______ weeks ______ days. ______ Ended ______ 19 ______ Estimated amount of your bill ______ If patient has been discharged give ______ (Date of discharge) and ______ (Amount of your bill) Estimated cost of medical treatment other than your own ______

Signed ______________________________

Date ______ 19 ______ Address ______________________________

Sample Report Of Personal Injury Or Illness

Reprinted from Safety at Sea/Texas A&M University Sea Grant

To be Completed by Injured Party

The following detailed information is requested by owners

Name of Vessel ____________

Owner, Operator ____________

Injured's Full Name ____________ Social Security No. ____________

Home Address ____________

Age ______ Position ____________ Married/Single ____________

Name of Nearest Relative ____________ Address ____________

____________ Number of Dependents ____________

Length of Employment ____________ Earnings Per Month ____________

Date Joined Vessel ____________ Date Left Vessel ____________

Date and Time of Injury or Illness ____________ To Whom First Reported ____________

Location of Vessel at Time of Accident or Illness ____________

Injured's Statement of How the Accident or Illness Occurred and Cause Thereof, If Known

____

____

____

____

____

(Injured's Signature)

Nature of Injuries or Illness ____________

____

Had Crew Member Been Drinking Intoxicants? ____________ Name and Address of Former Employer ____________

____

What Was Done for Man After the Accident or Illness? ____________

Name and Address of Doctor and Hospital if Any ____________

Condition of Injured When Leaving Vessel ____________

Remarks of Captain in Charge of Vessel at Time of Accident ____________

____

Sample Personal Injury Report

Reprinted from Safety at Sea/Texas A&M University Sea Grant

TO BE COMPLETED BY INJURED CREWMAN

THIS REPORT IS IMPORTANT; PLEASE ANSWER IN COMPLETE DETAIL

YOUR NAME ______________________________

ADDRESS ______________________________

YOUR OCCUPATION ______________ HOW MUCH EXPERIENCE IN THIS OCCUPATION? ______________

ON WHICH VESSEL DID ACCIDENT HAPPEN? ______________________________

WHERE ON VESSEL DID ACCIDENT HAPPEN ? ______________________________

WHEN DID ACCIDENT HAPPEN? Date ______________ HOUR ______________ AM/PM

WHAT PART OF YOUR BODY WAS INJURED? ______________________________

DID YOU LOSE CONSCIOUSNESS? YES _____ NO _____ IF SO, FOR HOW LONG? ______________

WHAT WERE YOU DOING WHEN ACCIDENT HAPPENED? ______________________________

____

DID ANYONE ELSE SEE THE ACCIDENT? YES _____ NO _____ IS SO, WHO? ______________

WHAT WERE THEY DOING WHEN THE ACCIDENT HAPPENED? ______________________________

____

WAS FIRST AID NECESSARY? YES _____ NO _____ IF SO, WHO PROVIDED IT? ______________

NAME AND ADDRESS OF DOCTOR WHO TREATED YOU, IF TREATED ______________________________

____

HAVE YOU EVER HAD THE SAME OR SIMILAR INJURY BEFORE? ______________________________

EXPLAIN ______________________________

SIGNED, INJURED CREWMAN ______________

DATE ______________

CAPTAIN ______________

DATE ______________

TO WHOM IT MAY CONCERN:

YOU ARE HEREBY AUTHORIZED TO RELEASE TO THE BEARER HEREOF ALL HOSPITAL RECORDS AND MEDICAL INFORMATION CONCERNING MY PHYSICAL CONDITION

SIGNED ______________________________ DATE ______________

Sample Captain's Report Of Personal Injury

Reprinted from Safety at Sea/Texas A&M University Sea Grant

Report to be submitted in all cases of injury

Crewman's Full Name ____________________

Position Held ____________________ Social Security ____________________

Vessel ____________________

How Long In This Position? ____________________

Date & Time of Injury ____________________ , 19 ______ at ____________________ AM/PM

To Whom Reported? ____________________ Date Reported ____________________

Where Did Injury Take Place? Onboard Vessel ____________ Ashore ____________

Exact Location ____________________

Was Crewman on Duty at Time of Injury? Yes ______ No ______

Nature of Injury (Please describe in detail. Use back page if necessary.)

____

____

How was Injury Treated? ____________________

____

Was Crewman Placed Ashore? Yes ______ No ______ If yes, How and When ____________________

____

Has Crewman Returned to Work? ______ Yes ______ No

Weather Conditions at Time of Injury:

Wind Direction ____________________ Wind Velocity ____________________ MPH

Sea State ____________________ Wave Height ____________________ FT

Rainy or Dry ____________________ Location of Vessel ____________________

What Happened? ____________________

____

Why Did it Happen? ____________________

____

What Action Have You Taken to Prevent A Similar Occurrence? ____________________

____

What Action Do You Recommend To Prevent A Similar Occurrence? ____________________

Captain's Signature ____________________ Date ____________________

Sample Personal Injury Report

Reprinted from Safety at Sea/Texas A&M University Sea Grant

TO BE COMPLETED BY CAPTAIN OF VESSEL

Name of Injured ______________________ Occupation ______________________

F/V ______________ Enroute From ______________ To ______________

Date of Report ______________ Date of Accident ______________ Hour ______________

Exact Location of Vessel ______________________________

State What Crewman Was Doing When Accident Occurred; Give Exact Location on Boat; Draw Sketch on Back of This Report

____

____

____

Weather Conditions ______________________________

Gear, Equipment, Tools or Machinery Involved, If Any ______________________________

____

Name of Immediate Supervisor ______________________ Position ______________

When was Immediate Supervisor Made Aware of Injury? ______________ A.M. ______ P.M. ______

Description of Injury ______________________________

____

Was First Aid Given? ______________ By Whom ______________

Did Injured Go Ashore for Treatment? ______________ Where? ______________

Did Injured Return to Duty After Receiving Treatment? ______________ If Not, Why ______________

____

What Verbal Statement Did Injured Make as to Cause of Accident and To Whom? ______________

____

List Name, Rating and Address of All Witnesses ______________________________

____

____

Captain's signature ______________________ Date ______________

Sample Personal Injury Report

Reprinted from Safety at Sea/Texas A&M University Sea Grant

To be Completed by Witness to Injury

NAME OF INJURED CREWMAN ______________________________

OCCUPATION ______________________________ DATE ____________

VESSEL INVOLVED ______________________________

EXACT LOCATION ON VESSEL ACCIDENT OCCURRED ______________________________

____

DESCRIBE IN DETAIL WHAT INJURED WAS DOING AT TIME OF INJURY? ____________

____

____

____

____

____

WHAT WERE YOU DOING AT TIME OF ACCIDENT? ______________________________

____

____

HOW FAR WERE YOU FROM THE INJURED CREWMAN? ______________________________

____

GIVE IDENTITY OF ANY OTHER WITNESSES ______________________________

____

____

____

SIGNATURE ______________________________ DATE ____________

POSITION ______________________________

ADDRESS ______________________________

____

HOME TELEPHONE ______________________________

Sample Non-Injury Statement

Reprinted from Safety at Sea/Texas A&M University Sea Grant

VESSEL: ____ DATE: ____________

I certify that I have not had an injury during this trip:

SIGNATURE	POSTION	CREW CHANGE From ______ To ______

MASTERS COMMENTS

INSTRUCTIONS TO MASTER

1) The above information must be completed upon completion of crew change.
2) It should be attached to the vessel log and turned in along with the log.
3) If any crew member reports an injury, a personal injury report must be completed immediately and turned into the general manager or designated owner's representative.

Sample Report Of Physical Damage

Reprinted from Safety at Sea/Texas A&M University Sea Grant

Name of Vessel ____________________

Owner, Operator ____________________

Date and Time of Incident ________________ Location ____

Wind ____________________ Seas ____________________ Visibility ____________________

F/V Enroute From ______________________________ To ______________________________

Name of other Vessel(s) or Property Involved ____

Owner of other Vessel(s) or Property ____

Name of Captain of other Vessel ____

Describe the Incident ____

____

____

____

____

____

____

Describe Damage to all Vessel(s) and/or Property ____

____

____

____

Names of Personnel Injured (also fill out Report of Personal Injury or Illness form)

____

____

____

____

Captain's Signature ______________________________

Inshore Vessels Minimum Recommendations

These recommendations were developed by the Point Club Survey Committee in cooperation with Richard Learned Associates and Mr. Richard Miner of Hull and Cargo, and approved by the Point Club Board of Directors for use in evaluating boats for membership in the Point Club. Compliance with these recommendations does not automatically produce a seaworthy vessel; however, these recommendations represent the consensus view of the most appropriate equipment design and operational standards. The use of these recommendations is meant to further enhance the operational safety of the Point Club member vessels.

HULL & TOPSIDES FITTING

H-1. The vessel should be segregated into the maximum number of water tight compartments as designed.

H-2. The work deck should be covered with a non-slip surface or bridge tiles.

H-3. Exterior decks other than the work deck should have some type of non-slip surface.

H-4. All decks should be protected by bulwarks or rails, and the height of these should be a minimum of 20".

H-5. **Handrails or safety lines should be installed where applicable from the superstructure to the bow.**

H-6. The transom opening should be equipped with secured board, safety chain, or rope for the protection of crew personnel at any time the stern ramp is not in use.

H-7. Stanchions and checkers of adequate strength should be installed on the work deck **and in fish hold** to control loose fish cargo.

H-8. All deck gear and cargo should be secured.

H-9. Adequate lighting should be installed for the work deck.

H-10. Adequate clearing ports and scuppers should be installed in the port and starboard bulwarks to permit rapid clearing of deck water.

H-11. All ladders and stairs should:

1) be permanently secured or otherwise secured at the upper end.
2) have non-slip surfaces on the treads.
3) be equipped with secure rails in good condition, where applicable.

H-12. Vessels engaged in inshore operations should have the forward facing rubber gasketed windshields eliminated. The forward facing windows of these vessels should be poly carbonate or safety glass. The windows should be bolted to the superstructure or be in adequate wooden frames, or be equipped with manufactured windows ie: Kearfoot, Cornell Carr or equivalent.

(Rev 10/90 I)

H-13. Exposed exterior exhaust pipes should be enclosed, where necessary, with guards.

H-14. Pressurized gas tanks such as LPG and CNG should be secured on deck. Tank heads should be equipped with shutoffs and regulators which are in good operating condition and protected from the environment.

H-15. All openings to holds should be protected by hatches or deck plates which can be sealed watertight. Hatches should have minimum 12" coamings and covers of sufficient weight to prevent removal by deck water.

H-16. Entrance to the superstructure on inshore vessels should have adequate coamings above the weather deck level.

H-17. All main deck doors and hatches should be kept in good working order to insure the watertight integrity of the vessel.

H-18. All hatches used as escape routes from engine room or accommodations must be secured and opened from the interior only with no separate outside securing.

H-19. The vessel should be equipped with an anchor of adequate holding capacity for the vessel. This anchor should be accessibly located on deck and equipped with a shot of chain and adequate anchor rode.

<u>RIGGING & FISHING EQUIPMENT</u>

R-1. Safe access should be provided to the masthead and coach top.

R-2. All overhead shackles and hooks should be safety wired.

R-3. Trawl blocks and overhead blocks should be safety chained or wired. Safety straps should be installed on all deck ballards.

R-4. All winches must have an emergency kill switch, located in the immediate area of the winch. If the winch is not visible by the operator, a crew member should be standing by the emergency kill switch, whenever the winch is in operation.

R-5. All rotating machinery on the workdeck should be enclosed or guarded. Safety bars should be installed in front of winch drums.

R-6. Net drum controls should have valve controls that are spring loaded to the neutral position.

R-7. Net drums with spoked flanges should be refitted to eliminate any openings.

R-8. Hydraulic lines crossing the workdeck surface should be relocated along the bulwarks or below decks. They may also be covered by a metal plate.

ENGINE ROOM, TANKAGE & MACHINERY

M-1. All valves for below waterline through hull fittings should be accessibly located or marking should indicate the locations and function of valves which are not readily accessible.

M-2. All valves attached to below waterline through hull fittings should be in working order.

M-3. Exposed propeller shaft couplings should be guarded.

M-4. All hoses in systems connected to below waterline through hull fittings should be double clamped.

M-5. All plastic hose connected to below waterline through hull fittings or connected systems should be replaced with heavy duty rubber hose, or another suitable material. (See M-6)

M-6. All PVC plumbing should be at least schedule 80 or replaced with a suitable material. PVC plumbing should be properly braced and provided with flex sections at the connections.

M-7. Guards should be installed on all exposed rotating belts, pulleys, chains and sprockets in the engine room.

M-8. Exhaust piping in the engine room should be covered where necessary with thermal insulating materials on dry exhaust systems where there is danger of burns to crew members.

M-9. Alarms should be installed on the propulsion engine oil pressure and water temperature.

M-10. An alarm should be installed, if technically feasible, to indicate low water in the engine cooling system.

M-11. The generator should be equipped with automatic shut down connected to oil pressure and water temperature. On smaller units such as Petter, Lister, etc. this would not be required.

M-12. All below deck fuel fills should be eliminated. All fuel fills should be located at or above weather deck level or should be sealed flush deck plates.

M-13. All fuel tanks should vent above weather deck adjacent to or within sight of that tank's fill.

M-14. The fuel line should be equipped with a shut off in operating order at each tank.

M-15. The fuel supply system should be equipped with a fuel filtering method, preferably of the dual parallel type to permit cleaning of one filter while the system is in operation.

M-16. All tanks should be baffled to prevent excessive movement and free surface effect of liquid contents.

M-17. Adequate engine and fuel compartment ventilation shall be installed.

ELECTRICAL SYSTEM

E-1. All batteries should be secured in acid proof containers. The containers should be of sufficient size and capacity to retain the acid contents of the batteries. Ventilated nonconductive covers should be installed over all batteries in exposed locations.

E-2. The electrical system should be equipped with a master disconnect. Vapor proof switches are recommended if technically feasible.

E-3. All knife switches should be protected from accidental grounding wherever they may be exposed especially on steel vessels.

E-4. All circuits should be protected by accessible over current protection of adequate capacity of each circuit.

E-5. All lights should be installed or protected to eliminate safety hazards.

PUMPING SYSTEMS

P-1. All watertight compartments should have a means of being pumped. In one compartment boats there should be at least two bilge suctions with one at the deepest part of the bilge and one at the stern.

P-2. All valves on the pumping system should be marked as to function.

P-3. Bilge water level alarms should be installed in all watertight compartments. Alarms for the system should be of sufficient volume and located as to be audible and visible. In one compartment boats, install alarms in the deepest part of bilge and at stern.

P-4. A minimum of two pumping systems capable of pumping all compartments should be installed with each pump powered from independent sources such as main engine (s), generator, or auxiliary engine.

P-5. The salt water systems should be isolated from the bilge pumping system and all bilge suctions should have check valves installed. **If the same pump is used for bilge and deck washdown purposes a three way valve must be installed and the discharge line provided with a vent. No shutoff can be installed on the vent line.**

On certain boats where conditions do not allow for self priming pumps a raw water line may be installed provided it meets the following:

1) Shutoff valve is installed on the prime line.
2) Prime line is routed well above the waterline.
3) Discharge pipe is vented on deck.

P-6. All bilge pickups should be equipped with screens.

SAFETY & FIRE FIGHTING EQUIPMENT

S-1. The vessels portable fire extinguisher protection should have at least one B/C-II extinguishing unit more than the minimum USCG requirements and preferably at least two more. Extinguishers should be distributed about the vessel where they can easily be seen. Extinguishers should be located where they are handy to potential fire sources but not likely to become involved in a fire and inaccessible. Future consideration will be given to automatic fire extinguishing systems.

S-2. All fire extinguishers should be recertified annually and have tags and seals in place.

S-3. The vessel should be equipped with an up to date, well equipped first aid kit of industrial quality which should include a basic instruction manual.

S-4. **All vessels should be equipped with a U.S.C.G. approved EPIRB that has a battery with a current date.**

S-5. The vessel should be equipped with a life raft which is currently inspected by the life raft manufacturer or its designee and of sufficient capacity for all crew personnel. Life rafts should be designed and built to SOLAS or Coast Guard Specifications.

S-6. Life raft should be in a float free rack or equipped with a pressure release device. Hydrostatic releases should be checked and maintained in working order.

S-7. Life raft should be located so as to permit it to clear rigging in the event of automatic underwater release.

S-8. The life raft's painter should be secured to the vessel.

S-9. The vessel should be equipped with one (1) Coast Guard approved survival suit for each person aboard which should be equipped with reflective tape, and lights **with a current inspection date.**

S-10. Survival suits should be stored at or above weather deck level.

S-11. The vessel should be equipped with a visual distress kit which should include hand held flares and meteor flares with current dates.

S-12. The vessel should be equipped with the minimum of one (1) throwable ring marked with the vessel's name and located on the workdeck and equipped with **an automatically activated** strobe and minimum 100' of poly line attached to the ring.

S-13. **No gasoline powered generators or pumps should be permanently installed inside the wheelhouse, deck house, or below decks.**

NAVIGATIONAL EQUIPMENT

N-1. The vessel should be equipped with an operating VHF radio, radar, depth sounder and loran.

N-2. The vessel should be equipped with up-to-date charts and tide tables.

N-3. The vessel should be equipped with an operating horn and bell.

N-4. The vessel should be equipped with an operating compass which is currently deviated.

N-5. Pilothouse shall have an unobstructed view ahead and to both sides. Electronics are not to take up excessive window space.

N-6. An emergency battery with a method of recharging should be installed in the wheelhouse to permit emergency operation of at least one VHF radio. A trickle charger is an acceptable method of charging. **On any system not equipped with a permanent automatic system a battery charge indicator must be installed.**

N-7. **An effective means of communicating between the bridge and workdeck should be installed.**

N-8. An emergency engine shut down which can be activated from the wheelhouse should be installed if technically feasible.

ACCOMMODATIONS

A-1. The fuel supply line system should be equipped with shut offs at tank and range.

A-2. No LPG appliances should be aboard the vessel except for the range which should not be located below weather deck level.

A-3. Fire-o-matic valves should be installed on the fuel feed at all oil fired galley ranges and on oil fired heating systems.

GENERAL

G-1. Inclining tests should be performed on those vessels that: fish in a partially flooded condition such as refrigerated seawater; any non-traditional usage; or have a major structural change.

G-2. Due to the uniqueness of every fishing vessel the surveyor has the option to add additional requirements.

G-3. **Wood vessels are to be dry docked every 12 months. Steel and fiberglass vessels are to be dry docked for inspection every 18 months. (Note: Steel and fiberglass boats are still required to be surveyed annually in the water.)**

G-4. **Vessels shall meet U.S.C.G. requirements with regard to all lights and safety equipment etc.**

NOTES: All recommendations which have been changed or added since the prior list have the new language in bold face type.

Boat Owners are advised to keep abreast of USCG EPIRB regulations under the Coast Guard Authorization Act of 1986, and the Commercial Fishing Vessel Safety Act. These government regulations are being phased in at this time. Requirements over and above the Point Club recommendations may be mandated under the new Government Regulations.

Offshore Vessels Minimum Regulations

These recommendations were developed by the Point Club Survey Committee in cooperation with Richard Learned Associates and Mr. Richard Miner of Hull and Cargo, and approved by the Point Club Board of Directors for use in evaluating boats for membership in the Point Club. Compliance with these recommendations does not automatically produce a seaworthy vessel; however, these recommendations represent the consensus view of the most appropriate equipment design and operational standards. The use of these recommendations is meant to further enhance the operational safety of the Point Club member vessels.

HULL, FISH HOLD & TOPSIDES FITTING

H-1. The vessel should be segregated into the maximum number of water tight compartments as designed.

H-2. The work deck should be covered with a non-slip surface or bridge tiles.

H-3. Exterior decks other than the work deck should have some type of non-slip surface.

H-4. All decks should be protected by bulwarks or rails, and the height of these should be a minimum of 27".

H-5. Hand rails or safety lines should be installed from the superstructure to the bow.

H-6. The transom opening should be equipped with secured board, safety chain, or rope for the protection of crew personnel at any time the stern ramp is not in use.

H-7. Adequate clearing ports and scuppers should be installed in the port and starboard bulwarks to permit rapid clearing of deck water.

H-8. Stanchions and checkers of adequate strength should be installed on the work deck and in fish hold to control loose fish cargo.

H-9. All deck gear and cargo should be secured.

H-10. Adequate lighting should be installed for the work deck.

H-11. All holds should be provided with adequate lighting.

H-12. All ladders and stairs should:

1) be permanently secured or otherwise secured at the upper end.
2) have non-slip surfaces on the treads.
3) be equipped with secure rails in good condition, where applicable.

H-13. Safe access should be provided to the vessel's coachtop.

H-14. Vessels engaged in offshore operations should have the forward facing rubber gasketed windshields eliminated. **The forward facing windows of these vessels should be polycarbonate or safety glass. The windows should be bolted to the superstructure or be in adequate wooden frames, or be equipped with manufactured windows ie: Kearfoot, Cornell Carr or equivalent.**

H-15. Exposed exterior exhaust pipes should be enclosed, where necessary, with guards to a height of 6' above the deck.

H-16. Pressurized gas tanks such as LPG and CNG should be secured on deck. Tank heads should be equipped with shut offs and regulators which are in good operating condition and protected from the environment.

H-17. **All openings to holds and compartments accessed from weather decks should be protected by hatches or deck plates which can be sealed watertight or hatches which have minimum 12" coamings and covers of sufficient weight to prevent removal by deck water. Compartments and holds with flush deck hatches of over 360 square inches opening size must be kept sealed watertight at all times at sea* and a personnel hatch with either a 12" raised coaming or watertight hatch sized under 360 square inches in opening size shall be installed.**

*** This recommendation is not intended to preclude opening net lockers to remove or stow gear under appropriate sea conditions.**

H-18. Entrance to the superstructure on offshore vessels should have minimum 12" coamings above the weather deck level.

H-19. All main deck doors and deck hatches should be watertight and kept in good working order to insure the watertight integrity of the vessel's decks and superstructure.

H-20. Two (2) separate egress routes should be provided from the engine room. All hatches located in these exit routes must be secured and opened from the interior only with no separate outside securing.

H-21. The vessel should be equipped with an anchor of adequate holding capacity for the vessel. This anchor should be accessibly located on deck and equipped with a shot of chain and adequate anchor rode.

<u>RIGGING & FISHING EQUIPMENT</u>

R-1. Safe access should be provided to the masthead and coach top.

R-2. All overhead shackles and hooks should be safety wired.

R-3. Trawl blocks and overhead blocks should be safety chained or wired. Safety straps should be installed on all deck ballards.

R-4. **All winches must have an emergency kill switch, located in the immediate area of the winch. If the winch is not visible by the operator, a crew member should be standing by the emergency kill switch, whenever the winch is in operation.**

R-5. All rotating machinery on the workdeck should be enclosed or guarded. Safety bars should be installed in front of winch drums.

R-6. Net drum controls should have valve controls that are spring loaded to the neutral position.

R-7. Net drums with spoked flanges should be refitted to eliminate any openings.

R-8. Hydraulic lines crossing the workdeck surface should be relocated along the bulwarks or below decks. They may also be covered by a metal plate.

R-9. Control valves on the hydraulic system should be marked as to function.

ENGINE ROOM, TANKAGE & MACHINERY

M-1. All valves for below waterline through hull fittings should be accessibly located or marking should indicate the location and function of valves which are not readily accessible.

M-2. All valves attached to below waterline through hull fittings should be in working order.

M-3. All hoses in systems connected to below waterline through hull fittings should be double clamped.

M-4. All plastic hose connected to below waterline through hull fittings or connected systems should be replaced with heavy duty rubber hose, or another suitable material (See M-6).

M-5. All PVC plumbing should be at least schedule 80 or replaced with a suitable material. PVC plumbing should be properly braced **and provided with flex sections at the connections.**

M-6. Guards should be installed on all exposed rotating belts, pulleys, chains, and sprockets in the engine room.

M-7. Exhaust piping in the engine room should be covered where necessary with thermal insulating materials.

M-8. Alarms should be installed on the propulsion engine oil pressure and water temperature.

M-9. An alarm should be installed, if technically feasible, to indicate low water in the engine cooling system.

M-10. The generator should be equipped with automatic shut down connected to oil pressure and water temperature. On smaller units such as Petter, Lister, etc. this would not be required.

M-11. All below deck fuel fills should be eliminated. All fuel fills should be located at or above weather deck level or should be sealed flush deck plates.

M-12. All fuel tanks should vent above weather deck adjacent to or within sight of that tank's fill.

M-13. The fuel supply line should be equipped with a shut off in operating order at each tank.

M-14. The fuel supply system should be equipped with a fuel filtering method, preferably of the dual parallel type to permit cleaning of one filter while the system is in operation.

M-15. All tanks should be baffled to prevent excessive movement and free surface effect of liquid contents.

ELECTRICAL SYSTEM

E-1. All batteries should be secured in acid proof containers. The containers should be of sufficient size and capacity to retain the acid contents of the batteries. Ventilated non-conductive covers should be installed over all batteries in exposed locations.

E-2. The electrical system should be equipped with a master disconnect.

E-3. All knife switches should be protected from accidental grounding wherever they may be exposed, especially on steel vessels.

E-4. All circuits should be protected by accessible over current protection of adequate capacity of each circuit.

E-5. All lights should be installed or protected to eliminate safety hazards.

PUMPING SYSTEMS

P-1. All watertight compartments should have a means of being pumped.

P-2. All valves on the pumping system should be marked as to function.

P-3. Bilge water level alarms should be installed in all watertight compartments. Alarms for the system should be of sufficient volume and located as to be audible and visible. In one compartment boats, install alarms in the deepest part of bilge and at stern.

P-4. A minimum of two pumping systems capable of pumping all compartments should be installed with each pump powered from independent sources such as main engine (s), generator, or auxiliary engine.

P-5. The salt water systems should be isolated from the bilge pumping system and all bilge suctions should have check valves installed. **If the same pump is used for bilge and deck washdown purposes, a three way valve must be installed and the discharge line provided with a vent. No shutoff can be installed in the vent line.**

On certain boats where conditions do not allow for self priming pumps, a raw water prime line may be installed provided it meets the following:

1) Shutoff valve is installed in the prime line
2) Prime line is routed well above the waterline
3) Discharge pipe is vented above deck

P-6. All bilge pickups should be equipped with screens.

<u>SAFETY & FIRE FIGHTING EQUIPMENT</u>

S-1. The vessels portable fire extinguisher protection should have at least one B/C-II extinguishing unit more than the minimum USCG requirements and preferably at least two more. Extinguishers should be distributed about the vessel where they can easily be seen. Extinguishers should be located where they are handy to potential fire sources not likely to become involved in a fire and inaccessible.

S-2. All fire extinguishers should be recertified annually and have tags and seals in place.

S-3. The vessel should be equipped with an up to date, well equipped first aid kit of industrial quality which should include a basic instruction manual.

S-4. **All vessels should be equipped with a U.S.C.G. approved EPIRB that has a battery with a current date.**

S-5. The vessel should be equipped with a life raft which is currently inspected by the life raft manufacturer or its designee and of sufficient capacity for all crew personnel. Life rafts should be designed and built to SOLAS or Coast Guard specifications.

S-6. Life raft should be in a float free rack or equipped with a pressure release device. Hydrostatic releases should be checked and maintained in working order.

S-7. Life raft should be located so as to permit it to clear rigging in the event of automatic underwater release.

S-8. The life raft's painter should be secured to the vessel.

S-9. The vessel should be equipped with one (1) Coast Guard approved survival suit for each person aboard which should be equipped with reflective tape, and lights **with a current inspection date.**

S-10. Survival suits should be stored at or above weather deck level.

S-11. The vessel should be equipped with a visual distress kit which should include hand held flares and meteor flares with current dates.

S-12. The vessel should be equipped with a minimum of two (2) throwable rings marked with the vessel's name **and with both rings located on the weather decks. One of the above rings to be located on the working deck and one adjacent to the pilothouse door. Rings to be equipped with an automatically activated strobe light** and minimum 100' of poly line attached to the ring.

S-13. An emergency battery with a method of recharging should be installed in the wheelhouse to permit emergency operation of at least one VHF radio. A trickle charger is an acceptable method of charging. **On any system not equipped with a permanent automatic system, a battery charge indicator must be installed.**

S-14. Vessels with hold refrigeration machinery should have a self contained breathing apparatus and gas detectors aboard.

S-15. **No gasoline powered generators or pumps should be permanently installed inside the wheelhouse, deck house, or below decks.**

NAVIGATIONAL EQUIPMENT

N-1. The vessel should be equipped with an operating VHF radio, radar, depth sounder and loran. Offshore vessels should consider a SSB radio.

N-2. The vessel should be equipped with up-to-date charts and tide tables.

N-3. The vessel should be equipped with an operating horn and bell.

N-4. The vessel should be equipped with an operating compass which is currently deviated.

N-5. Pilothouse shall have an unobstructed view ahead and to both sides. Electronics are not to take up excessive window space.

N-6. An emergency engine shut down which can be activated from the wheelhouse should be installed if technically feasible.

N-7. All vessels maintaining watches (day boats excepted) should be equipped with an effective watch alarm (audible alarm of sufficient volume).

N-8. An effective means of communicating between the bridge and work deck should be installed.

ACCOMMODATIONS

A-1. The fuel supply line system should be equipped with shut offs at tank and range.

A-2. No LPG appliances should be aboard the vessel except for the range which should not be located below weather deck level.

A-3. Fire-o-matic valves should be installed on the fuel feed at all oil fired galley ranges and on oil fired heating systems.

GENERAL

G-1. Inclining tests should be performed on those vessels that: fish in a partially flooded condition such as refrigerated sea water; any non-traditional usage; or have a major structural change.

G-2. Due to the uniqueness of every fishing vessel, the surveyor has the option to add additional requirements.

G-3. **Wood vessels are to be dry docked for inspection by a surveyor every twelve (12) months. Steel and fiberglass vessels are to be dry docked for inspection every eighteen (18) months. (NOTE: Steel and fiberglass boats are still required to be surveyed annually in the water.)**

G-4. **Vessels shall meet U.S.C.G. requirements with regard to all lights and safety equipment etc.**

Requirements For Reporting Marine Accidents

Documented Fishing Vessels–The owner, agent, master or person-in-charge of a documented fishing vessel involved in a accident shall notify, as soon as possible, the nearest Coast Guard Marine Safety Office whenever the casualty involves any of the following (Ref. 46 CFR 4.05-1):

1. All accidental groundings and any intentional grounding which also meets any of the other reporting criteria or creates a hazard to navigation, the environment or the safety of the vessel;

2. Loss of main propulsion or primary steering, or any associated component or control system, the loss of which causes a reduction of the maneuvering capabilities of the vessel. Loss means that systems, component parts, sub-systems, or control systems do not perform the specified or required function;

3. An occurrance materially and adversely affecting the vessel's seaworthiness or fitness for service or route, including but not limited to fire, flooding, or failure or damage to fixed fire extinguishing systems, lifesaving equipment, auxiliary power generating equipment or bilge pumping systems;

4. Loss of life;

5. Injury to a person causing the person to remain incapacitated for a period in excess of 72 hours;

6. An occurrence not meeting any of the above criteria but resulting in damage to property in excess of $25,000. The damage figure includes the cost of labor and material to restore the property to the service condition which existed prior to the casualty. It does not include such items as the cost of salvage, cleaning, gas freeing, drydock and demurrage.

This initial notice must include the name and official number of the vessel involved, the name of the vessel's owner or agent, the nature and circumstances of the casualty, the locality in which the accident occurred, the nature and extent of injury to persons (if any) and the damage to property.

Vessels involved in casualties, after initially notifying the Coast Guard, are required to forward a "Report of Marine Accident, Injury or Death" (Form CG-2692) to the nearest Marine Safety Office or Detachment. Form CG-2692 is available from Coast Guard Marine Safety Offices.

If filed without delay, the Form CG-2692 may also serve as the initial notification.

The law in 46 United States Code, Section 6103, states that if the above notification is not provided to the Coast Guard, the owner, charterer, managing operator, agent, master or individual in charge of the vessel is liable for a civil penalty of $1,000.00.

State Numbered Fishing Vessels–The operator of a non-Coast Guard documented fishing vessel must report to the authority that issues the numbers in the state where the accident took place if:

1. A person dies *or* is injured and requires medical treatment beyond first-aid, or

2. damage to the vessel and other property totals more than $200, *or* there is a complete loss of the vessel, or

3. a person disappears from the vessel under circumstances that indicate death or injury.

The report must be filed with the proper authority within ten days of the occurrence or death, unless:

1. A person dies within 24 hours, *or* is injured and requires medical treatment beyond first-aid, or

2. a person disappears from a vessel.

In these cases, the report must be filed within 48 hours of the occurrence.

Date ______________

Sample Insurance Safety Incentive Program Checklist

Reprinted from Safety at Sea/Texas A&M University Sea Grant

	YES	NO	ACTION
DECK			
1. Non-skid decks Comments:	________	________	
2. Proper handrails Comments:	________	________	
3. Ladders checked and secured Comments:	________	________	
4. Safety straps on overhead blocks installed Comments:	________	________	
5. All bottled gas to be strapped with metal belting Comments:	________	________	
MACHINERY			
1. Engine manifold cooling and exhaust properly installed Comments:	________	________	
2. No soft plastic lines or hoses below deck where subject to pressure Comments:	________	________	
3. Screening or filtering on bilge suction lines adequate Comments:	________	________	
4. Alarm signals for oil pressure and oil temperatures in working order Comments:	________	________	
5. Check rigging for wear of pins, blocks and lines Comments:	________	________	
6. Check mast and boom — safety chains used where possible Comments:	________	________	
7. All portable equipment to have adequate tie-downs Comments:	________	________	
8. Anchor should be proper size Comments:	________	________	
9. Reel drive and belt guards where necessary Comments:	________	________	
10. Guardrails on winch Comments:	________	________	

Inspected by: ______________
Safety group member

SAFETY EQUIPMENT

1. Fire and smoke alarms in engine room and galley ______________ ______________
   Comments:

2. Bilge alarm ______________ ______________
   Comments:

3. All safety equipment to be checked on a scheduled basis ______________ ______________
   Comments:

4. Distress flares and beacons (if not included in life raft) ______________ ______________
   Comments:

5. Adequate first-aid equipment ______________ ______________
   Comments:

6. Emergency rations (if not included in life raft) ______________ ______________
   Comments:

7. Automatic life raft ______________ ______________
   Comments:

8. Safety glass in front windows ______________ ______________
   Comments:

9. VHF radio with CH 16 capability ______________ ______________
   Comments:

FIRE PROTECTION

1. Extinguishers handy in all areas of need ______________ ______________
   Comments:

2. Extinguishers checked every 12 months or after use ______________ ______________
   Comments:

3. Extinguishers NOT TO BE USED AS COAT HANGERS, etc. ______________ ______________
   Comments:

4. Galley stove, properly insulated with automatic shutoff on fuel lines. No pilots without thermocouple shutoff valve ______________ ______________
   Comments:

ELECTRICAL EQUIPMENT

1. All wiring should be permanent, with overload protection ______________ ______________
   Comments:

2. Should have main battery disconnect ______________ ______________
   Comments:

Signatures: ______________________________ ______________________________
Owner or Captain Vessel Name

INSTRUCTIONS

FOR COMPLETION OF FORM CG-2692

REPORT OF MARINE ACCIDENT, INJURY OR DEATH

AND FORM CG-2692A, BARGE ADDENDUM

WHEN TO USE THIS FORM

1. This form satisfies the requirements for written reports of accidents found in the Code of Federal Regulations for vessels, Outer Continental Shelf (OCS) facilities, mobile offshore drilling units (MODUs), and diving. The kinds of accidents that must be reported are described in the following Instructions.

VESSELS

2. A vessel accident must be reported if it occurs upon the navigable waters of the U.S., its territories or possessions; or whenever an accident involves a U.S. vessel wherever the accident may occur. (Public vessels and recreational vessels are excepted from these reporting requirements.) The accident must also involve one of the following (ref. 46 CFR 4.05-1):

A. All accidental groundings and any intentional grounding which also meets any of the other reporting criteria or creates a hazard to navigation, the environment, or the safety of the vessel;

B. Loss of main propulsion or primary steering, or an associated component or control system, the loss of which causes a reduction of the maneuvering capabilities of the vessel. Loss means that systems, component parts, subsystems, or control systems do not perform the specified or required function;

C. An occurrence materially and adversely affecting the vessel's seaworthiness or fitness for service or route including but not limited to fire, flooding, failure or damage to fixed fire extinguishing systems, lifesaving equipment or bilge pumping systems;

D. Loss of life;

E. Injury causing any person to be incapacitated for a period in excess of 72 hours.

F. An occurrence not meeting any of the above criteria but resulting in damage to property in excess of $25,000. Damage cost includes the cost of labor and material to restore the property to the condition which existed prior to the casualty, but it does not include the cost of salvage, cleaning, gas freeing, drydocking or demurrage.

MOBILE OFFSHORE DRILLING UNITS

3. MODUs are vessels and are required to report an accident that results in any of the events listed by Instruction 2-A through 2-F for vessels. (Ref. 46 CFR 4.05-1, 46 CFR 109.411)

OCS FACILITIES

4. All OCS facilities (except mobile offshore drilling units) engaged in mineral exploration, development or production activities on the Outer Continental Shelf of the U.S. are required by 33 CFR 146.30 to report accidents resulting in:

A. Death;

B. Injury to 5 or more persons in a single incident;

C. Injury causing any person to be incapacitated for more than 72 hours;

D. Damage affecting the usefulness of primary lifesaving or firefighting equipment;

E. Damage to the facility in excess of $25,000 resulting from a collision by a vessel;

F. Damage to a floating OCS facility in excess of $25,000.

5. Foreign vessels engaged in mineral exploration, development or production on the U. S. Outer Continental Shelf, other than vessels already required to report by Instructions 2 and 3 above, are required by 33 CFR 146.303 to report casualties that result in any of the following:

A. Death;

B. Injury to 5 or more persons in a single incident;

C. Injury causing any person to be incapacitated for more than 72 hours.

DIVING

6. Diving casualties include injury or death that occurs while using underwater breathing apparatus while diving from a vessel or OCS facility.

A. COMMERCIAL DIVING. A dive is considered commercial if it is for commercial purposes from a vessel required to have a Coast Guard certificate of inspection, from an OCS facility or in its related safety zone or in a related activity, at a deepwater port or in its safety zone. Casualties that occur during commercial dives are covered by 46 CFR 197.486 if they result in:

1. Loss of life;
2. Injury causing incapacitation over 72 hours;
3. Injury requiring hospitalization over 24 hours.

In addition to the information requested on this form, also provide the name of the diving supervisor and, if applicable, a detailed report on gas embolism or decompression sickness as required by 46 CFR 197.410(a)(9).

Exempt from the commercial catagory are dives for:

1. Marine science research by educational institutions;
2. Research in diving equipment and technology;
3. Search and Rescue controlled by a government agency.

B. ALL OTHER DIVING. Diving accidents not covered by Instruction (6-A) but involving vessels subject to Instruction (2), VESSELS, must be reported if they result in death or injury causing incapacitation over 72 hours.
(Ref. 46 CFR 4.03-1(c)).

HAZARDOUS MATERIALS

7. When an accident involves hazardous materials, public and environmental health and safety require immediate action. As soon as any person in charge of a vessel or facility has knowledge of a release or discharge of oil or a hazardous substance, that person is required to immediately notify the U. S. Department of Transportation's National Response Center (telephone toll-free 800-424-8802 - in the Washington, D.C., area call 202-426-2675). Anyone else knowing of a pollution incident is encouraged to use the toll-free telephone number to report it. If etiologic (disease causing) agents are involved, call the U. S. Public Health Service's Center for Disease Control in Atlanta, Ga. (telephone 404-633-5313). (Ref. 42 USC 9603; 33 CFR 153; 49 CFR 171.15)

COMPLETION OF THIS FORM

8. This form should be filled out as completely and accurately as possible. Please type or print clearly. Fill in all blanks that apply to the kind of accident that has occurred. If a question is not applicable, the abbreviation "NA" should be entered in that space. If an answer is unknown and cannot be obtained, the abbreviation "UNK" should be entered in that space. If "NONE" is the correct response, then enter it in that space.

9. When this form has been completed, deliver or mail it as soon as possible to the Coast Guard Marine Safety or Marine Inspection Office nearest to the location of the casualty or, if at sea, nearest to the port of first arrival.

10. Amplifying information for completing the form:

A. Block 16 - "LOCATION" - Latitude and longitude to the nearest tenth of a minute should always be entered except in those rivers and waterways where a mile marker system is commonly used. In these cases, the mile number to the nearest tenth of a mile should be entered. If the latitude and longitude, or mile number, are unknown, reference to a known landmark or object (buoy, light, etc.) with distance and bearing to the object is permissible. Always identify the body of water or waterway referred to.

B. Tug or towboat with tow - Tugs or towboats with tows under their control should complete all applicable portions of the CG-2692. SECTION II should be completed if a barge causes or sustains damage or meets any other reporting criteria. If additional barges require reporting, the "Barge Addendum," CG-2692A, may be used to provide the information for the additional barges.

C. Moored/Anchored Barge - If a barge suffers a casualty while moored or anchored, or breaks away from its moorage, and causes or sustains reportable damages or meets any other reporting criteria, enter the location of its moorage in Block (1) of the CG-2692 and complete the form except for Blocks (2) through (13). The details will be entered in SECTION II for one barge and on the "Barge Addendum," CG-2692A, for additional barges.

D. SECTION III - Personnel Accident Information -SECTION III must be completed for a death or injury. In addition, applicable portions of SECTIONS I, II and IV must be completed. If more than one death or injury occurs in a single incident, complete one CG-2692 for one of the persons injured or killed, and attach additional CG-2692's, filling out Blocks (1) and (2) and SECTION III for each additional person.

NOTICE: The information collected on this form is routinely available for public inspection. It is needed by the Coast Guard to carry out its responsibility to investigate marine casualties, to identify hazardous conditions or situations and to conduct statistical analysis. The information is used to determine whether new or revised safety initiatives are necessary for the protection of life or property in the marine environment.

Approved OMB No. 2115-0003

DEPARTMENT OF TRANSPORTATION
U. S. COAST GUARD
CG-2692 (Rev. 6-82)

REPORT OF MARINE ACCIDENT, INJURY OR DEATH

RCS No. G-MMI 2115-0003
UNIT CASE NUMBER

SECTION I. GENERAL INFORMATION

1. Name of Vessel or Facility
2. Official No.
3. Nationality
4. Call Sign
5. USCG Certificate of Inspection Issued at:
6. Type (*Towing, Freight, Fish, Drill, etc.*)
7. Length
8. Gross Tons
9. Year Built
10. Propulsion (*Steam, diesel, gas, turbine...*)
11. Hull Material (*Steel, Wood...*)
12. Draft (*ft. - in.*) FWD. AFT.
13. If Vessel Classed, By Whom: (*ABS, LLOYDS, DNV, BV, etc.*)
14. DATE (*of occurrence*)
15. TIME (*Local*)
16. Location (*See Instruction No. 10A*)
17. Estimated Loss or Damage TO:
VESSEL $ ____
CARGO $ ____
OTHER $ ____
18. Name, Address & Telephone No. of Operating CO.
19. Name of Master or Person In Charge — USCG License ☐ YES ☐ NO
19a. Street Address (*City, State, Zip Code*)
19b. Telephone Number ( )
20. Name of Pilot — USCG License ☐ YES ☐ NO — State License ☐ YES ☐ NO
20a. Street Address (*City, State, Zip Code*)
20b. Telephone Number ( )

21. Casualty Elements *Check as many as needed and explain in Block 44.)*

NO. OF PERSONS ON BOARD ____
- ☐ DEATH- HOW MANY? ____
- ☐ MISSING- HOW MANY? ____
- ☐ INJURED- HOW MANY? ____
- ☐ HAZARDOUS MATERIAL RELEASED OR INVOLVED (*Identify Substance and amount in Block 44.*)
- ☐ OIL SPILL-ESTIMATE AMOUNT: ____
- ☐ CARGO CONTAINER LOST/DAMAGED
- ☐ COLLISION (*Identify other vessel or object in Block 44.)*
- ☐ GROUNDING
- ☐ FLOODING; SWAMPING WITHOUT SINKING
- ☐ CAPSIZING (*with or without sinking*)
- ☐ FOUNDERING OR SINKING
- ☐ HEAVY WEATHER DAMAGE
- ☐ FIRE
- ☐ EXPLOSION
- ☐ COMMERCIAL DIVING CASUALTY
- ☐ ICE DAMAGE
- ☐ DAMAGE TO AIDS TO NAVIGATION
- ☐ STEERING FAILURE
- ☐ MACHINERY OR EQUIPMENT FAILURE
- ☐ ELECTRICAL FAILURE
- ☐ STRUCTURAL FAILURE
- ☐ WAKE DAMAGE
- ☐ FIREFIGHTING OR EMERGENCY EQUIPMENT FAILED OR INADEQUATE (*Describe in Block 44.)*
- ☐ LIFESAVING EQUIPMENT FAILED OR INADEQUATE (*Describe in Block 44.)*
- ☐ BLOW OUT (*Petroleum exploration/production*)
- ☐ OTHER (*Specify*) ____

22. Conditions

A. Sea or River Conditions (*wave height, river stage, etc.*)

B. WEATHER: ☐ CLEAR ☐ RAIN ☐ SNOW ☐ FOG ☐ OTHER (*Specify*) ____

C. TIME: ☐ DAYLIGHT ☐ TWILIGHT ☐ NIGHT

D. VISIBILITY: ☐ GOOD ☐ FAIR ☐ POOR

E. DISTANCE (*miles*) (*of visibility*) ____

F. AIR TEMPERATURE (F) ____

G. WIND SPEED & DIRECTION ____ ____

H. CURRENT SPEED & DIRECTION ____ ____

23. Navigation Information
☐ MOORED, DOCKED OR FIXED
☐ ANCHORED ☐ UNDERWAY OR DRIFTING
SPEED AND COURSE ____

24. Last Port Where Bound
24a. Time and Date of Departure

25. FOR TOWING ONLY
25a. NUMBER OF VESSELS TOWED — Empty | Loaded | Total
25b. TOTAL H.P. OF TOWING UNITS
25c. MAXIMUM SIZE OF TOW WITH TOW-BOAT(S) — Length | Width
25d. (*Describe in Block 44.)*
- ☐ PUSHING AHEAD
- ☐ TOWING ASTERN
- ☐ TOWING ALONGSIDE
- ☐ MORE THAN ONE TOW-BOAT ON TOW

SECTION II. BARGE INFORMATION

26. Name
26a. Official Number
26b. Type
26c. Length
26d. Gross Tons
26e. USCG Certificate of Inspection Issued at:
26f. Year Built
26g. ☐ SINGLE SKIN ☐ DOUBLE SKIN
26h. Draft FWD AFT
26i. Operating Company
26j. Damage Amount
BARGE $ ____
CARGO $ ____
OTHER $ ____
26k. Describe Damage to Barge

PREVIOUS EDITIONS MAY BE USED

SN 7530-00-F01-1730

REVERSE OF CG-2692 (REV. 6-82)

SECTION III. PERSONNEL ACCIDENT INFORMATION

27 Person Involved
☐ MALE or ☐ FEMALE
☐ DEAD ☐ INJURED
☐ MISSING

27a. Name *(Last, First, Middle Name)*

27b. Address *(City, State, Zip Code)*

27c. Status
☐ CREW
☐ PASSENGER
☐ OTHER *(Specify)*

28. Birth Date

29. Telephone No.
(   )

30. Job Position

31. *(Check here if off duty)* ☐

32. Employer *-(If different from Block 18., fill in Name, Address, Telephone No.)*

33. Person's Time

	YEAR(S)	MONTH(S)
A. IN THIS INDUSTRY -		
B. WITH THIS COMPANY -		
C. IN PRESENT JOB OR POSITION -		
D. ON PRESENT VESSEL/FACILITY -		
E. HOURS ON DUTY WHEN ACCIDENT OCCURRED -		

34. Industry of Employer *(Towing, Fishing, Shipping, Crew Supply, Drilling, etc.)*

35. Was the Injured Person Incapacitated 72 Hours or More? ☐ YES ☐ NO

36. Date of Death

37. Activity of Person at Time of Accident

38. Specific Location of Accident on Vessel/Facility

39. Type of Accident *(Fall, Caught between, etc.)*

40. Resulting Injury *(Cut, Bruise, Fracture, Burn, etc.)*

41. Part of Body Injured

42. Equipment Involved in Accident

43. Specific Object, Part of the Equipment in Block 42., or Substance *(Chemical, Solvent, etc.)* that directly produced the injury.

SECTION IV. DESCRIPTION OF CASUALTY

44. Describe How Accident Occurred, Damage and Recommendations for Corrective Safety Measures. *(Attach Additional Sheets if necessary).*

45. Witness *(Name, Address, Telephone No.)*

46. Witness *(Name, Address, Telephone No.)*

SECTION V. PERSON MAKING THIS REPORT

47. Name (PRINT) *(Last, First, Middle)*

47a. Signature

47b. Address *(City, State, Zip Code)*

47c. Title

47d. Telephone No.
(   )

47e. Date

FOR COAST GUARD USE ONLY

REPORTING OFFICE:

APPARENT CAUSE

CASUALTY CODE A B C	INVESTIGATOR *(Name)*	DATE	APPROVED BY *(Name)*	DATE

PUBLIC LAW 100-424—SEPT. 9, 1988 102 STAT. 1585

Public Law 100-424
100th Congress

An Act

To provide for the establishment of additional safety requirements for fishing industry vessels, and for other purposes.

Sept. 9, 1988
[H.R. 1841]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Commercial Fishing Industry Vessel Safety Act of 1988.
46 USC 2101 note.

SECTION 1. SHORT TITLE.

This Act may be cited as the "Commercial Fishing Industry Vessel Safety Act of 1988".

SEC. 2. UNINSPECTED COMMERCIAL FISHING INDUSTRY VESSEL SAFETY REQUIREMENTS.

(a) IN GENERAL.—Chapter 45 of title 46, United States Code, is amended to read as follows:

"CHAPTER 45—UNINSPECTED COMMERCIAL FISHING INDUSTRY VESSELS

"Sec.
"4501. Application.
"4502. Safety standards.
"4503. Fish processing vessel certification.
"4504. Prohibited acts.
"4505. Termination of unsafe operations.
"4506. Exemptions.
"4507. Penalties.
"4508. Commercial Fishing Industry Vessel Advisory Committee.

"§ 4501. Application

46 USC 4501

"(a) This chapter applies to an uninspected vessel which is a fishing vessel, fish processing vessel, or fish tender vessel.
"(b) This chapter does not apply to the carriage of bulk dangerous cargoes regulated under chapter 37 of this title.

"§ 4502. Safety standards

46 USC 4502.
Regulations.

"(a) The Secretary shall prescribe regulations which require that each vessel to which this chapter applies shall be equipped with—
"(1) readily accessible fire extinguishers capable of promptly and effectively extinguishing a flammable or combustible liquid fuel fire;
"(2) at least one readily accessible life preserver or other lifesaving device for each individual on board;
"(3) an efficient flame arrestor, backfire trap, or other similar device on the carburetors of each inboard engine which uses gasoline as fuel;
"(4) the means to properly and efficiently ventilate enclosed spaces, including engine and fuel tank compartments, so as to remove explosive or flammable gases;
"(5) visual distress signals;

"(6) a buoyant apparatus, if the vessel is of a type required by regulations prescribed by the Secretary to be equipped with that apparatus;

"(7) alerting and locating equipment, including emergency position indicating radio beacons, on vessels that operate on the high seas; and

"(8) a placard as required by regulations prescribed under section 10603(b) of this title.

Regulations.

"(b) In addition to the requirements of subsection (a) of this section, the Secretary shall prescribe regulations for documented vessels to which this chapter applies that operate beyond the Boundary Line or that operate with more than 16 individuals on board, for the installation, maintenance, and use of—

"(1) alerting and locating equipment, including emergency position indicating radio beacons;

"(2) lifeboats or liferafts sufficient to accommodate all individuals on board;

"(3) at least one readily accessible immersion suit for each individual on board that vessel when operating on the waters described in section 3102 of this title;

"(4) radio communications equipment sufficient to effectively communicate with land-based search and rescue facilities;

"(5) navigation equipment, including compasses, radar reflectors, nautical charts, and anchors;

"(6) first aid equipment, including medicine chests; and

"(7) other equipment required to minimize the risk of injury to the crew during vessel operations, if the Secretary determines that a risk of serious injury exists that can be eliminated or mitigated by that equipment.

"(c) In addition to the requirements described in subsections (a) and (b) of this section, the Secretary may prescribe regulations establishing minimum safety standards for vessels to which this chapter applies that were built after December 31, 1988, or that undergo a major conversion completed after that date, and that operate with more than 16 individuals on board, including standards relating to—

"(1) navigation equipment, including radars and fathometers;

"(2) life saving equipment, immersion suits, signaling devices, bilge pumps, bilge alarms, life rails, and grab rails;

"(3) fire protection and firefighting equipment, including fire alarms and portable and semiportable fire extinguishing equipment;

"(4) use and installation of insulation material;

"(5) storage methods for flammable or combustible material; and

"(6) fuel, ventilation, and electrical systems.

Regulations.

"(d)(1) The Secretary shall prescribe regulations for the operating stability of a vessel to which this chapter applies—

"(A) that was built after December 31, 1989; or

"(B) the physical characteristics of which are substantially altered after December 31, 1989, in a manner that affects the vessel's operating stability.

"(2) The Secretary may accept, as evidence of compliance with this subsection, a certification of compliance issued by the person providing insurance for the vessel or by another qualified person approved by the Secretary.

"(e) In prescribing regulations under this chapter, the Secretary—

"(1) shall consider the specialized nature and economics of the operations and the character, design, and construction of the vessel; and

"(2) may not require the alteration of a vessel or associated equipment that was constructed or manufactured before the effective date of the regulation.

"(f) The Secretary shall examine a fish processing vessel at least once every two years to ensure that the vessel complies with the requirements of this chapter.

"§ 4503. Fish processing vessel certification 46 USC 4503.

"(a) A fish processing vessel to which this section applies may not be operated unless the vessel—

"(1) meets all survey and classification requirements prescribed by the American Bureau of Shipping or another similarly qualified organization approved by the Secretary; and

"(2) has on board a certificate issued by the American Bureau of Shipping or that other organization evidencing compliance with this subsection.

"(b) This section applies to a fish processing vessel to which this chapter applies that—

"(1) is built after July 27, 1990; or

"(2) undergoes a major conversion completed after that date.

"§ 4504. Prohibited acts 46 USC 4504.

"A person may not operate a vessel in violation of this chapter or a regulation prescribed under this chapter.

"§ 4505. Termination of unsafe operations 46 USC 4505.

"An official authorized to enforce this chapter—

"(1) may direct the individual in charge of a vessel to which this chapter applies to immediately take reasonable steps necessary for the safety of individuals on board the vessel if the official observes the vessel being operated in an unsafe condition that the official believes creates an especially hazardous condition, including ordering the individual in charge to return the vessel to a mooring and to remain there until the situation creating the hazard is corrected or ended; and

"(2) may order the individual in charge of an uninspected fish processing vessel that does not have on board the certificate required under section 4503(1) of this title to return the vessel to a mooring and to remain there until the vessel is in compliance with that section.

"§ 4506. Exemptions 46 USC 4506.

"(a) The Secretary may exempt a vessel from any part of this chapter if, under regulations prescribed by the Secretary (including regulations on special operating conditions), the Secretary finds that—

"(1) good cause exists for granting an exemption; and

"(2) the safety of the vessel and those on board will not be adversely affected.

"(b) A vessel to which this chapter applies is exempt from section 4502(b)(2) of this title if it—

"(1) is less than 36 feet in length; and

"(2) is not operating on the high seas.

46 USC 4507.

"§ 4507. Penalties

"(a) The owner, charterer, managing operator, agent, master, and individual in charge of a vessel to which this chapter applies which is operated in violation of this chapter or a regulation prescribed under this chapter may each be assessed a civil penalty by the Secretary of not more than $5,000. Any vessel with respect to which a penalty is assessed under this subsection is liable in rem for the penalty.

"(b) A person willfully violating this chapter or a regulation prescribed under this chapter shall be fined not more than $5,000, imprisoned for not more than one year, or both.

46 USC 4508. Establishment.

"§ 4508. Commercial Fishing Industry Vessel Advisory Committee

"(a) The Secretary shall establish a Commercial Fishing Industry Vessel Advisory Committee. The Committee—

"(1) may advise, consult with, report to, and make recommendations to the Secretary on matters relating to the safe operation of vessels to which this chapter applies, including navigation safety, safety equipment and procedures, marine insurance, vessel design, construction, maintenance and operation, and personnel qualifications and training;

"(2) may review proposed regulations under this chapter;

"(3) may make available to Congress any information, advice, and recommendations that the Committee is authorized to give to the Secretary; and

"(4) shall meet at the call of the Secretary, who shall call such a meeting at least once during each calendar year.

"(b)(1) The Committee shall consist of seventeen members with particular expertise, knowledge, and experience regarding the commercial fishing industry as follows:

"(A) ten members from the commercial fishing industry who—

"(i) reflect a regional and representational balance; and

"(ii) have experience in the operation of vessels to which this chapter applies or as a crew member or processing line worker on an uninspected fish processing vessel;

"(B) three members from the general public, including, whenever possible, an independent expert or consultant in maritime safety and a member of a national organization composed of persons representing owners of vessels to which this chapter applies and persons representing the marine insurance industry;

"(C) one member representing each of—

"(i) naval architects or marine surveyors;

"(ii) manufacturers of equipment for vessels to which this chapter applies;

"(iii) education or training professionals related to fishing vessel, fish processing vessel, or fish tender vessel safety or personnel qualifications; and

"(iv) underwriters that insure vessels to which this chapter applies.

Federal Register, publication.

"(2) At least once each year, the Secretary shall publish a notice in the Federal Register and in newspapers of general circulation in coastal areas soliciting nominations for membership on the Committee, and, after timely notice is published, appoint the members of the Committee. An individual may be appointed to a term as a member of the Committee more than once.

"(3)(A) A member of the Committee shall serve a term of three years.

"(B) If a vacancy occurs in the membership of the Committee, the Secretary shall appoint a member to fill the remainder of the vacated term.

"(4) The Committee shall elect one of its members as the Chairman and one of its members as the Vice Chairman. The Vice Chairman shall act as Chairman in the absence or incapacity of, or in the event of a vacancy in the office of, the Chairman.

"(5) The Secretary shall, and any other interested agency may, designate a representative to participate as an observer with the Committee. These representatives shall, as appropriate, report to and advise the Committee on matters relating to vessels to which this chapter applies which are under the jurisdiction of their respective agencies. The Secretary's designated representative shall act as executive secretary for the Committee and perform the duties set forth in section 10(c) of the Federal Advisory Committee Act (5 App. U.S.C.).

"(c)(1) The Secretary shall, whenever practicable, consult with the Committee before taking any significant action relating to the safe operation of vessels to which this chapter applies.

"(2) The Secretary shall consider the information, advice, and recommendations of the Committee in consulting with other agencies and the public or in formulating policy regarding the safe operation of vessels to which this chapter applies.

"(d)(1) A member of the Committee who is not an officer or employee of the United States or a member of the Armed Forces, when attending meetings of the Committee or when otherwise engaged in the business of the Committee, is entitled to receive—

"(A) compensation at a rate fixed by the Secretary, not exceeding the daily equivalent of the current rate of basic pay in effect for GS-18 of the General Schedule under section 5332 of title 5 including travel time; and

"(B) travel or transportation expenses under section 5703 of title 5.

"(2) Payments under this section do not render a member of the Committee an officer or employee of the United States or a member of the Armed Forces for any purpose.

"(3) A member of the Committee who is an officer or employee of the United States or a member of the Armed Forces may not receive additional pay based on the member's service to the Committee.

"(4) The provisions of this section relating to an officer or employee of the United States or a member of the Armed Forces do not apply to a member of a reserve component of the Armed Forces unless that member is in an active status.

Termination date.

"(e)(1) The Federal Advisory Committee Act (5 U.S.C. App. 1 et seq.) applies to the Committee, except that the Committee terminates on September 30, 1992.

"(2) Two years prior to the termination date referred to in paragraph (1) of this subsection, the Committee shall submit to Congress its recommendation regarding whether the Committee should be renewed and continued beyond the termination date.".

46 USC 4508 note.

(b) Initial Appointments to Commercial Fishing Industry Advisory Committee.—

(1) TERMS OF INITIAL APPOINTMENTS.—Of the members first appointed to the Commercial Fishing Industry Advisory Committee under section 4508 of title 46, United States Code (as amended by this Act)—

(A) one-third of the members shall serve a term of one year and one-third of the members shall serve a term of two years, to be determined by lot at the first meeting of the Committee; and

(B) terms may be adjusted to coincide with the Government's fiscal year.

(2) COMPLETION OF INITIAL APPOINTMENTS.—The Secretary shall complete appointment of members pursuant to this subsection not later than 90 days after the date of the enactment of this Act.

(c) REPEAL.—Subsection (e) of section 4102 of title 46, United States Code, is repealed.

46 USC 7101 note.

SEC. 3. PLAN FOR LICENSING OPERATORS OF FISHING INDUSTRY VESSELS.

The Secretary of the department in which the Coast Guard is operating shall, within two years after the date of enactment of this Act, and in close consultation with the Commercial Fishing Industry Vessel Advisory Committee established under section 4508 of title 46, United States Code (as amended by this Act), prepare and submit to the Congress a plan for the licensing of operators of documented fishing, fish processing, and fish tender vessels. The plan shall take into consideration the nature and variety of the different United States fisheries and of the vessels engaged in those fisheries, the need to license all operators or only those working in certain types of fisheries or vessels, and other relevant factors.

SEC. 4. ACCIDENT DATA STATISTICS.

(a) COMPILATION AND SUBMISSION OF DATA.—Chapter 61 of title 46, United States Code, is amended by adding at the end the following new section:

Records.
Insurance.
46 USC 6104.

"§ 6104. Commercial fishing industry vessel casualty statistics

"(a) The Secretary shall compile statistics concerning marine casualties from data compiled from insurers of fishing vessels, fish processing vessels, and fish tender vessels.

"(b) A person underwriting primary insurance for a fishing vessel, fish processing vessel, or fish tender vessel shall submit periodically to the Secretary data concerning marine casualties that is required by regulations prescribed by the Secretary.

Regulations.

"(c) After consulting with the insurance industry, the Secretary shall prescribe regulations under this section to gather a statistical base for analyzing vessel risks.

"(d) The Secretary may delegate to a qualified person that has knowledge and experience in the collection of statistical insurance data the authority of the Secretary under this section to compile statistics from insurers.".

(b) PENALTY.—Section 6103 of title 46, United States Code, is amended as follows:

(1) before "An" insert "(a)"; and

(2) add the following new subsection:

"(b) A person failing to comply with section 6104 of this title or a regulation prescribed under that section is liable to the Government for a civil penalty of not more than $5,000.".

(c) CONFORMING AMENDMENT.—The analysis for chapter 61 of title 46, United States Code, is amended by adding at the end the following:

"6104. Commercial fishing industry vessel casualty statistics.".

SEC. 5. STUDIES. 46 USC 4502 note.

(a) FISHING INDUSTRY VESSEL INSPECTION STUDY.—The Secretary of Transportation, utilizing the National Academy of Engineering and in consultation with the National Transportation Safety Board, the Commercial Fishing Industry Vessel Advisory Committee, and the fishing industry, shall—

(1) conduct a study of the safety problems on fishing industry vessels;

(2) make recommendations regarding whether a vessel inspection program should be implemented for fishing vessels, fish tender vessels, and fish processing vessels, including recommendations on the nature and scope of that inspection; and

(3) submit the study and recommendations to Congress before January 1, 1990.

(b) UNCLASSIFIED FISH PROCESSING VESSEL STUDY.—The Secretary of the department in which the Coast Guard is operating, in consultation with the Commercial Fishing Industry Vessel Advisory Committee established under section 4508 of title 46, United States Code (as amended by this Act), and with representatives of persons operating fish processing vessels—

(1) shall conduct a study of fish processing vessels that are not surveyed and classed by an organization approved by the Secretary;

(2) shall make recommendations regarding what hull and machinery requirements should apply to vessels described in paragraph (1) to ensure that those vessels are operated and maintained in a condition in which they are safe to operate at sea; and

(3) shall submit the study and recommendations to Congress before July 28, 1991.

SEC. 6. FISHING VOYAGE REQUIREMENTS.

(a) ENACTMENT OF NEW CHAPTER IN TITLE 46.—Title 46, United States Code, is amended by inserting after chapter 105 the following:

"CHAPTER 106—FISHING VOYAGES

"Sec.
"10601. Fishing agreements.
"10602. Recovery of wages and shares of fish under agreement.
"10603. Seaman's duty to notify employer regarding illness, disability, and injury.

"§ 10601. Fishing agreements

46 USC 10601.

"(a) Before proceeding on a voyage, the master or individual in charge of a fishing vessel, fish processing vessel, or fish tender vessel shall make a fishing agreement in writing with each seaman enployed on board if the vessel is—

"(1) at least 20 gross tons; and

"(2) on a voyage from a port in the United States.

"(b) The agreement shall be signed also by the owner of the vessel.

"(c) The agreement shall—

"(1) state the period of effectiveness of the agreement;

Wages. "(2) include the terms of any wage, share, or other compensation arrangement peculiar to the fishery in which the vessel will be engaged during the period of the agreement; and

"(3) include other agreed terms.

46 USC 10602.

"§ 10602. Recovery of wages and shares of fish under agreement

"(a) When fish caught under an agreement under section 10601 of this title are delivered to the owner of the vessel for processing and are sold, the vessel is liable in rem for the wages and shares of the proceeds of the seamen. An action under this section must be brought within six months after the sale of the fish.

"(b)(1) In an action under this section, the owner shall produce an accounting of the sale and division of proceeds under the agreement. If the owner fails to produce the accounting, the vessel is liable for the highest value alleged for the shares.

"(2) The owner may offset the value of general supplies provided for the voyage and other supplies provided the seaman bringing the action.

"(c) This section does not affect a common law right of a seaman to bring an action to recover the seaman's share of the fish or proceeds.

46 USC 10603.

"§ 10603. Seaman's duty to notify employer regarding illness, disability, and injury

"(a) A seaman on a fishing vessel, fish processing vessel, or fish tender vessel shall notify the master or individual in charge of the vessel or other agent of the employer regarding any illness, disability, or injury suffered by the seaman when in service to the vessel not later than seven days after the date on which the illness, disability, or injury arose.

Regulations. "(b) The Secretary shall prescribe regulations requiring that each fishing vessel, fish processing vessel, and fish tender vessel shall have on board a placard displayed in a prominent location accessible to the crew describing the seaman's duty under subsection (a) of this section.".

(b) CONFORMING AMENDMENT.—The table of contents at the beginning of title 46, United States Code, is amended by inserting after the item relating to chapter 105 the following:

"106. Fishing voyages....................10601.".

(c) REPEALS.—Sections 4391, 4392, 4393, and 4394 of the Revised Statutes of the United States (46 App. U.S.C. 531-534) are repealed.

46 USC 4501 note. Termination date.

SEC. 7. TRANSITIONAL PROVISION.

Until July 28, 1990, a foreign built fish processing vessel subject to chapter 45 of title 46, United States Code, is deemed to comply with the requirements of that chapter if—

(1) it has an unexpired certificate of inspection issued by a foreign country that is a party to an International Convention for Safety of Life at Sea to which the United States Government is a party; and

(2) it is in compliance with the safety requirements of that foreign country that apply to that vessel.

SEC. 8. TECHNICAL AND CONFORMING AMENDMENTS.

(a) IMMERSION SUITS.—

(1) REQUIREMENT.—Section 3102 of title 46, United States Code, is amended by striking "exposure" each place it appears and inserting in lieu thereof "immersion".

(2) SECTION HEADING.—The section heading for section 3102 of that title is amended by striking "**Exposure**" and inserting in lieu thereof "**Immersion**".

(3) ANALYSIS.—The chapter analysis for chapter 31 of that title is amended by striking "Exposure" and inserting in lieu thereof "Immersion".

(b) OTHER UNINSPECTED VESSEL REQUIREMENTS.—Section 4101 of title 46, United States Code, is amended by inserting "not subject to chapter 45 of this title" after "uninspected vessel".

(c) MAJOR CONVERSION DEFINED.—

(1) DEFINITION.—Section 2101 of title 46, United States Code, is amended by inserting after paragraph (14) the following:

"(14a) 'major conversion' means a conversion of a vessel that—

"(A) substantially changes the dimensions or carrying capacity of the vessel;

"(B) changes the type of the vessel;

"(C) substantially prolongs the life of the vessel; or

"(D) otherwise so changes the vessel that it is essentially a new vessel, as decided by the Secretary.".

(2) REPEAL.—Section 3701(2) of title 46, United States Code, is repealed.

Approved September 9, 1988.

LEGISLATIVE HISTORY—H.R. 1841:

HOUSE REPORTS: No. 100-729 (Comm. on Merchant Marine and Fisheries).
CONGRESSIONAL RECORD, Vol. 134 (1988):
June 27, considered and passed House.
Aug. 11, considered and passed Senate.

31004 Federal Register / Vol. 53, No. 159 / Wednesday, August 17, 1988 / Rules and Regulations

thereto. The authorized officer shall make appropriate informational material, including maps, available for public review.

[FR Doc. 88-18574 Filed 8-16-88; 8:45 am]

BILLING CODE 4310-84-M

DEPARTMENT OF TRANSPORTATION

Coast Guard

46 CFR Part 25

[CGD 87-016]

Emergency Position Indicating Radio Beacons for Uninspected Fishing, Fish Processing, and Fish Tending Vessels

AGENCY: Coast Guard, DOT.

ACTION: Final rule.

SUMMARY: The Coast Guard is amending the uninspected vessel regulations by requiring emergency position indicating radio beacons (EPIRBs) to be carried on uninspected fishing, fish processing, and fish tender vessels operating on the high seas. The Coast Guard Authorization Act of 1986 amended the shipping laws of the United States by requiring those vessels to have the number and type of EPIRBs prescribed by regulation. By implementing the law, the regulations will ensure rapid and effective search and rescue during emergency situations.

EFFECTIVE DATE: October 3, 1988.

ADDRESSES: Between the hours of 8:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays, comments are available for inspection and copying at the Marine Safety Council (C-CMC) Room 2110, U.S. Coast Guard Headquarters, 2100 Second St., SW., Washington, DC 20593-0001, (202) 267-1477. The Final Evaluation may also be inspected or copies at the Marine Safety Council.

FOR FURTHER INFORMATION CONTACT: LCDR Stanford W. Deno, Survival Systems Branch, Room 1404, U.S. Coast Guard Headquarters, 2100 Second St. SW., Washington, DC 20593-0001, (202) 267-1444. Normal office hours are between 7:30 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays.

SUPPLEMENTARY INFORMATION: On November 10, 1986, the Ninety-Ninth Congress passed Pub. L. 99-640, known as the "Coast Guard Authorization Act of 1986" (100 Stat. 3545). Section 16 of that Act amended Section 4102 of Title 46 of the United States Code by adding paragraph (e) which requires uninspected fishing, fish processing, and fish tender vessels operating on the high seas to carry the number and type of EPIRBs prescribed by regulation. This Final Rule implements that law. A Notice of Proposed Rulemaking (NPRM) was published in the Federal Register on September 3, 1987 (52 FR 33448) and invited comments for a 45 day period ending October 19, 1987. On October 16, 1987, the comment period was extended for one month to expire on November 19, 1987. Notice of that extension was published in the Federal Register on October 22, 1987 (52 FR 39546). Twenty-six comments were received. Two comments expressed a general objection to the concept of requiring EPIRBs on fishing vessels, while eight comments generally supported the proposal. A discussion of the other, more specific comments follows.

Drafting Information.

The principal persons involved in drafting these regulations are: LCDR William M. Riley, Project Manager, and Mr. Stanley Colby, Project Counsel, Office of Chief Counsel.

Discussion

Definition of "high seas" Several comments asked for clarification of the term "high seas." In addition to the written comments, many telephone calls expressed confusion about the applicability of 3 mile, 12 mile, and 200 mile limits as well as the boundary lines for international and inland "rules of the road."

High seas are simply international waters as defined in 33 CFR 2.05-1(a); that is, waters which are neither U.S. territorial waters nor territorial waters of another country. The U.S. still claims only a 3-mile territorial waters boundary. The "12 mile limit" refers to the Contiguous Zone, a band of high seas within 9 miles of the territorial waters over which nations traditionally exert limited authority. Similarly, the "200 mile limit" refers to the Exclusive Economic Zone, a band of the high seas over which the U.S. unilateraly asserts authority to regulate fisheries and seabed mining under the Magnuson Fishery Conservation and Management Act, as amended (16 USC 1801, *et. seq.*)

Definition of "fishing vessel" A number of comments also requested definition of the term "fishing vessel." Three written comments and a significant number of telephone comments addressed this issue. Several asked whether pleasure boats engaged in sport fishing were considered "fishing vessels." Others asked whether small passenger vessels and party fishing boats were affected by these rules. One comment asked whether inspected small passenger vessels not carrying passengers for hire, but fishing commercially on a particular voyage, would be affected. Another asked if "fishing" included clamming, dredging oysters, and catching shrimp.

"Fishing vessel," "fish processing vessel," and "fish tender vessel" are defined by law in 46 USC 2101. Recreational boats are regulated under 33 CFR Subchapter S. The regulations being amended, in Part 25 of 46 CFR Subchapter O, apply only to uninspected commercial vessels such as fishing boats and tugboats. Therefore pleasure boats are not affected. Small passenger vessels, carrying more than six passengers, are *inspected* under 46 CFR Subchapter T, and are therefore not affected by this rule. However, small passenger vessels temporarily operating as uninspected fishing vessels are subject to these rules. Commercial party fishing boats carrying six or less passengers for hire are uninspected and are regulated under 46 CFR Subchapter O. However, it is not the intent of these rules to require EPIRBs on such vessels, unless they too are operating temporarily to harvest fish rather than to carry passengers. The definition of "fish" (46 USC 2101(11)), which is applicable to uninspected vessels (46 USC Chapter 41), includes finfish, mollusks, crustaceans, and all other forms of marine animal and plant life, except marine mammals and birds.

Cost Five comments stated that the estimated cost of $600 in the proposed rule for satellite EPIRBs was too low. Four of these comments included alternate costs estimates, ranging from $1000 to $2200. The most credible of these estimates was $1450, from a manufacturer who intends to introduce a satellite EPIRB at that price. We believe this price will gradually decrease as other suppliers enter the market. The estimate of $1450 has been accepted and incorporated into the Final Evaluation.

Phase-out period Sixteen comments addressed the proposed phase-out period for existing EPIRBs. Two comments supported the proposed 10-year phase-out period. Six comments supported the alternative proposal of 6 years contained in the preamble of the NPRM. Two comments suggested a period of 5 years. Three comments suggested a period of 3 years. One comment suggested a period of 2 years. Two comments objected to any phase-out period at all. Since the satellite EPIRBs are so far superior to the existing EPIRBs, and the existing EPIRBs are relating inexpensive, and there seems to be general support for a shorter phase-put period than 10 years, the final rule has been rewritten to include a 6-year phase-out period.

Existing Class A EPIRBs Several comments addressed a statement in the NPRM concerning the failure of up to 25% of existing 121.5/243 MHz Class A EPIRBs to meet FAA Technical Standard Order C–91a (TSO C–91a). Four comments stated that EPIRBs which do not comply with TSO C–91a should not be allowed. One comment stated that non-complying EPIRBs should be allowed in warm-water, near-shore fisheries. However, two comments asked how to identify a complying EPIRB, and two comments pointed out that no existing EPIRB is labeled to show it complies with TSO–C91a.

No existing EPIRB is certified by either the FCC or the Coast Guard as meeting TSO C–91a, since this FAA Technical Standard Order will apply only to future aircraft Emergency Locating Transmitters (ELTs). Therefore, the rules were not changed and no reference to TSO–C–91a has been added. Instead, the Coast Guard will take action, separate from this rulemaking process, to identify and withdraw the approvals of those Class A EPIRBs which do not operate reliably with the COSPAS/SARSAT satellite system because of inadequate frequency stability and power spectrum. This future action will be accomplished in accordance with 46 CFR 2.75–50(a).

Existing Class B and O EPIRBs Nine comments discussed the status of exsting EPIRBs other than Class A during the phase-out period. One comment stated that any EPIRB purchased in good faith should be allowed. One comment stated that non-float-free EPIRBs should be allowed because of the risk of theft, washing overboard, or deterioration due to exposure. The remaining comments all stated that Class B and O EPIRBs were inferior and should not be allowed to replace a float-free EPIRB. Since the problems with Class B and O EPIRBs are acknowledged and there is little support for their continued use, no change has been made in the final rule to allow their use during the phase-out period.

Type acceptance Four comments called for more technical requirements for certification of EPIRBs to be included in these rules. These comments were rejected because the vessel requirements of 46 CFR Subchapter O do not include technical standards for equipment that must be approved. Satellite EPIRBs will be type accepted by the FCC, a process which includes Coast Guard review. The technical standards will be addressed in FCC rules. Therefore no change has been made in the final rule.

Registration Three comments suggested that these rules contain a requirement that the EPIRB be registered with NOAA to enable identification. Registration of the EPIRBs is expected to be required by FCC rules and need not be included in these rules.

Other radio equipment One comment stated that a VHF–FM radio should be required as a prerequisite to having an EPIRB. This rulemaking was intended to address only the implementation of 46 USC 4102(e) which only provides for EPIRBs. There is no indication that, in amending 36 USC 4102, Congress intended to broaden the Coast Guard's authority to require other radio equipment aboard uninspected fishing, fish processing, and fish tender vessels. Therefore this comment is rejected.

EPIRBs installed in inflatable liferafts. One comment stated that EPIRBs in inflatable liferafts should only be permitted as optional equipment in addition to the required EPIRB, because they are exempt from testing under the rule. This is a misconception. Testing of the EPIRB in the inflatable liferaft is accomplished during annual servicing of the raft. In order to include an EPIRB in the equipment package of a Coast Guard approved inflatable liferaft, the raft manufacturer will have to incorporate instructions for testing and re-arming the EPIRB in the Coast Guard approved servicing manual for the raft. A Coast Guard approved servicing facility will have to follow the procedures in the manual when servicing the raft. For clarification, the Final Rule has been modified to except from the testing only those EPIRBs installed in rafts if they are Coast Guard approved and serviced annually by an approved facility. Section 25.26–1 requires the EPIRB to be float-free and automatically activated. If the EPIRB is in a float-free liferaft and the EPIRB is rigged to activate automatically when the raft floats free and inflates, then the EPIRB would satisfy these rules.

Testing and Servicing. One comment stated that the master should not be held responsible for testing because there is no longer a master on the document. Another comment agreed that the "owner/operator" should be responsible, adding that a log of tests should be kept on board. One comment stated that a battery test of the EPIRB was not enough, while another comment cautioned that the test should not involve radiating an actual signal. Both suggested language to the effect that the manufacturer's instructions be followed. One comment stated that monthly tests were too frequent because each test drains the battery, may result in a false alarm, may result in improper resetting, and would be difficult to enforce. The Coast Guard did not accept these comments. None of the arguments were convincing. There is still a master of every vessel, who is responsible for its current condition and operation. "Operator" is a vague term. The Coast Guard anticipates that FCC will include procedures for the tests in the type acceptance standards. Proper testing should not wear out a properly designed EPIRB or its battery. Frequent testing will develop familiarity with test procedures and result in fewer mistakes such as false alarms and improper resetting.

Enforcement and penalties. One comment stated that a penalty for violation was not provided by the proposed rules. Penalties for violation of these rules are already provided by 46 USC 4106 and do not require rulemaking.

Availability of satellite EPIRBs Two comments expressed concern that the satellite EPIRB is a product that does not yet exist, may not work, and that fishing vessels should not be the first to have to try out the new technology. Satellite EPIRBs do exist, have been tested extensively by the COSPAS/SARSAT partners (US, USSR, France, and Canada), and do work. They are not commercially available in this country currently due chiefly to the absence of regulations requiring them or providing for their use. Necessary final rules permitting manufacture and sale of such beacons are expected to be completed by the FCC in the fall of 1988. The beacons should be readily available before mid-1989. To allow adequate time for installation of satellite EPIRBs, the final rule establishes a compliance date one year after the effective date. The Coast Guard will continue to consult with the FCC and manufacturers and will adjust the compliance date, if necessary, to allow approximately six months for installation of satellite EPIRBs after the units are readily available. If production is delayed, adjustments to the compliance date will be made and published in the Federal Register. Availability of the technology now coincides with the Coast Guard's newly obtained authority to require EPIRBs on fishing vessels. The Coast Guard's position is that it is preferable to require the prompt installation of EPIRBs having superior performance, rather than to require fishing vessels to install an inferior EPIRB now, then go through a costly replacement program at some later date.

MARPOL V UPDATE PLACARDS AND WASTE MANAGEMENT PLANS

The final rule for the Prevention of Pollution From Vessels went into effect on July 31, 1990. Under 33 CFR 151.59 all vessels 26 feet or more in length are required to have a Pollution Placard, which reminds them of their pollution prevention responsibilities. The placards are to be displayed in prominent locations and in sufficient numbers so that they can be read by the crew and passengers. These locations must be readily acessible to the intended reader. The placard must include information on what the penalties and fines are for discharging plastics or garbage into the navigable waters of the United States. The placard must contain the information as included in the enclosed sample with the minimum size indicated.

Most vessels 40 feet or more in length are now required to have a Waste Management Plan as required by 33 CFR 151.57. The plan must be in writing and must describe procedures for collecting, processing, storing and discharging garbage. The plan also must contain the name or names of personnel who are authorized to carry out the plan. These new regulations will help reduce the number of unlawful garbage discharges and the resulting pollution. As a minimum, the plan must contain procedures for collecting, processing, storing and discharging garbage in compliance with MARPOL Annex V, and it must also designate a person who is in charge of carrying out the plan. Sample plans, for fishing boats and pleasure boats, which exceed the minimum are enclosed.

§ 151.57 Waste management plans

(a) This section applies to the following:

(1) Each manned oceangoing ship (other than a fixed or floating platform) of 40 feet or more in length that is documented under the laws of the United States or numbered by a state and that either is engaged in commerce or is equipped with a galley and berthing.

(2) Each manned fixed or floating platform that is—

(i) Documented under the laws of the United States; or

(ii) Operating under the authority of the United States, including, but not limited to, a lease or permit issued by an agency of the United States.

(b) The master or person in charge of a ship under paragraphs (a)(1) and (a)(2) of this section shall ensure that the ship is not operated unless a waste management plan meeting paragraph (c) of this section is on the ship and that each person handling garbage follows the plan.

(c) Each waste management plan under paragraph (b) of this section must be in writing and—

(1) Provide for the discharge of garbage by means that meet Annex V of MARPOL 73/78, the Act, and §§ 151.51 through 151.77;

(2) Describe procedures for collecting, processing, storing, and discharging garbage; and

(3) Designate the person who is in charge of carrying out the plan.

§ 151.59 Placards.

(a) This section applies to the following:

(1) Each manned U.S. ship (other than a fixed or floating platform) that is 26 feet or more in length.

(2) Each manned fixed or floating platform that is—

(i) Documented under the laws of the United States; or

(ii) Operating under the authority of the United States, including, but not limited to, a lease or permit issued by an agency of the United States.

(b) The master or person in charge of each ship under paragraphs (a)(1) and (a)(2) of this section shall ensure that one or more placards meeting the requirements of paragraph (c) of this section are displayed in prominent locations and in sufficient numbers so that they can be read by the crew and passengers. These locations must be readily accessible to the intended reader and may include embarkation points, food service facilities, garbage handling spaces, and common spaces on deck. If the Captain of the Port determines that the number or location of the placards is insufficient to adequately inform crew and passengers, the Captain of the Port may require additional placards and may specify their locations.

(c) Each placard must—

(1) Be at least nine inches wide by four inches high, made of a durable material, and lettered with letters at least ⅛ inch high; and

(2) Notify the reader of the following:

(i) The discharge of plastic or garbage mixed with plastic into any waters is prohibited.

(ii) The discharge of all garbage is prohibited in the navigable waters of the United States and, in all other waters, within three nautical miles of the nearest land.

(iii) The discharge of dunnage, lining, and packing materials that float is prohibited within 25 nautical miles of the nearest land.

(iv) Other unground garbage may be discharged beyond 12 nautical miles from the nearest land.

(v) Other garbage ground to less than one inch may be discharged beyond three nautical miles of the nearest land.

(vi) A person who violates the above requirements is liable for a civil penalty of up to $25,000, a fine of up to $50,000, and imprisonment for up to five years for each violation.

(vii) Regional, State, and local restrictions on garbage discharges also may apply.

Marine Distress Communications Form

Remember to speak slowly, clearly and calmly.

1) Make sure your radio or radiotelephone is on.
2) Select 156 MHz (channel 16) or 2182 KHz.
3) Press microphone button and say **"Mayday — Mayday — Mayday."**
4) Say: **"This is ______, ______, ______, ______, over."**
5) Release the microphone button briefly and listen for acknowledgement. If no one answers, repeat steps 3 and 4. If there is no acknowledgement or if the Coast Guard or another vessel responds,
6) Say: **"Mayday ______."**
7) **Describe your position in lat/long coordinates, in Loran-C coordinates, or by range and bearing from a known point.**
8) **State the nature of your distress.**
9) **Give the number of persons aboard and the nature of any injuries.**
10) **Estimate the present seaworthiness of your boat.**
11) **Describe your boat:** ______
12) Say: **"I will be listening on channel 16/2182."**
13) End message by saying: **"This is ______, over."**
14) If your situation permits, stand by the radio to await further communication from the Coast Guard or another vessel.

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Sample Letter of Agreement

THIS AGREEMENT is entered into on ________________ ________, ________, between the F/V ________________ ________________ (the "Vessel"), a ________________ and [name of crewmember] ________________, as crewmember, and sets forth the understanding of the parties with respect to the crewmember's service aboard the F/V ________________ and the manner of his compensation.

1. **Term.** The term of this Agreement shall extend through the coastal bottomfish season off Washington, Oregon, and southeast Alaska, and such other places as the captain of the Vessel shall from time to time determine, from approximately ____________, ________ through ____________, ________.

2. **Duties.** All crewmembers are expected to diligently apply themselves to the best of their abilities to any and all tasks assigned to them by the captain of the Vessel or another with authority, to promptly obey all commands, comply with rules set forth by the captain and owner of the vessel, and refrain from disorderly behavior on board the Vessel. In addition to the usual duties imposed upon a deck hand, the crewmembers entering into this Agreement shall also serve as the Vessel's ________ ________________.

3. **Port Duties.** When the Vessel is in port during the term of this Agreement, the crewmembers shall perform such work as commanded by the captain of the Vessel.

4. **Crewshare.** Crewmembers will be entitled to share in the net proceeds earned by the Vessel during the term of this Agreement. The crewmembers to whom this Agreement pertains shall be entitled to ________ share, defined as being not less than ________ percent (______%) of the net proceeds from the sale of the catch of the Vessel. The net proceeds from the catch of the Vessel is defined as the gross proceeds of the catch of the Vessel less deduction for: (1) ice; and (2) food at the rate of $ ________ per day. In addition, the crewmember's share shall also be reduced by the amount of any draws against crewshare taken by the crewmember.

5. **Jumping Ship.** Any crewmember who willfully leaves the service of this Vessel prior to the completion of the term of this Agreement without the permission of the captain shall forfeit his rights to any share in the proceeds earned by the Vessel after he has left the service of the vessel. [In addition, such crewmember may, at the option of the owners of the Vessel, be subject to forfeiture of a portion of his share by the deduction of one percent (1%) from the agreed crewshare, set forth above. In other words, if a crewmember agrees to a twelve percent (12%) share and then later quits the Vessel without permission, that crewmember is only entitled to an eleven percent (11%) crewshare].

6. **Discharge.** The captain of the Vessel may discharge any crewmember from the crew of the Vessel at any time for good cause. A discharged crewmember shall not be entitled to a share of the proceeds earned by the Vessel after his discharge.

7. **Compliance with Fishing Laws and Regulations.** Each crewmember agrees that he will comply with all applicable fishing laws and regulations, and that he will indemnify the owners of the Vessel for any fines or penalties imposed on the owners as a result of violations in which he knowingly or willfully participated.

8. **Termination.** The owners of the Vessel may, at their sole discretion, terminate the operation of the Vessel, with five days' notice thereof to the Vessel's crew.

9. **Payment Dates.** Crewmember's shares shall be paid within ________________ (______) days after the conclusion of the fishing season in which they were earned. This also applies to crewmembers who either willfully terminate their service aboard the Vessel or who are discharged.

10. **Insurance.** While serving aboard the vessel, crewmembers are covered by major medical and accident insurance, more fully described in the attached pamphlet.

11. **Applicable Law; Venue.** All provisions of this Agreement shall be construed, given effect, and enforced according to the laws of the State of Washington. Any suit or action to enforce this Agreement shall be brough in the State of ______________.

Agreed:

____

Captain, F/V ________________________

Agreed:

____

Crewman

____

(print name)

Sample Employment Agreement

THIS AGREEMENT, is entered into by and between the owners of the F/V ____________________ a commercial fishing vessel and ____________________ hereafter referred to as Crewman.

It is represented and agreed by and between the parties as follows:

1. Crewman has been hired to perform the duties of ____, for and on behalf of the vessel.

2. **Duration of Contract.** This contract shall commence on the date of signing of this contract and shall continue until such time as all gear is in and stored, the vessel and equipment is cleaned, required maintenance work is completed, and the vessel is tied up, following the conclusion of any one trip whereupon Owner or Crewman may terminate this contract.

3. **Compensation**

(A) Crewman's share shall be computed and paid by owners based upon ________% of the adjusted gross earnings of the vessel received by owners. Due to the length of the joint venture fishing employment in which the vessel will engage owners agree to make interim payments to the crewman at least monthly; such payments shall be due on or before the 25th day of each month for the crewshare earned in the preceding month. Crewman agrees that owners may make reasonable deduction from such interim payments to cover crewman's estimated share of fuel, ice, groceries and gloves for the fishery; Owners may also deduct Crewman's cash advances, travel expenses and any personal items charged by the Crewman to the vessel.

(B) Adjusted gross earnings of the vessel for the purpose of this agreement shall be defined as the gross earnings from the vessel actually received by owners, less fuel, unloading and ice. If owners are not paid for fish caught and sold, no compensation will be due crewmen for production of the vessel for which owners are not paid.

(C) Owners shall endeavor to make final settlement for each fishery within thirty (30) days of its completion; but it is understood and agreed that final settlement cannot be made before all invoices and billings are received from suppliers in Alaska of fuel, groceries, personal items etc.

4. **Crew Rotation**

Crewman agrees to cooperate with and participate in a crew rotation program under the direction of the Captain. During his rotation cycle Crewman will receive a rotation share of ________% of the adjusted gross earnings of the vessel for the time he is ashore, provided that the Crewman returns to the vessel on the date specified by the Captain. If the Crewman fails to return to the vessel on that date, his rotation share will be forfeited to the vessel and the other crew at the discretion of the Captain. During rotation schedule Crewman is not in the employ of the vessel. If the vessel does not have any earnings during the Crewman's rotation schedule, the Crewman shall not be entitled to any rotation share.

5. **Transportation**

The Crewman agrees to pay for his own transportation expenses to and from the vessel, and in that regard authorizes the vessel's owners to deduct from crew shares payable any amounts advanced by the vessel's owners in relationship to the Crewman's transportation.

6. **Groceries and General Provisions**

It is agreed that the crew and the vessel's Captain shall provide at their own expense, all necessary groceries, gloves and related provisions, and in that regard, Crewman agrees to pay an equal share of all groceries, gloves and related provisions purchased by the vessel's Captain or the Captain's designess, and authorizes the vessel's owners to deduct from the Crewman's crew share any amounts due the vessel's Captain or the vessel's owners pursuant to this provision.

7. Crewman agrees to conform to all reasonable health, safety and living standards set by the Captain and Owner and shall in no circumstances commit any action which endangers the safety of other members of the crew or the Vessel.

8. **Crewman's Duties**

The Crewman shall perform such duties as are customarily performed by one holding a similar position on similar vessels employed in fisheries in which the vessel is then engaged. Crewman is additionally expected to diligently and competently apply himself to any and all tasks assigned to him by the vessel's Captain or the Captain's designee. The Crewman agrees to at all times faithfully, industriously and to the best of the Crewman's ability, experience and talent, perform all of the duties that may be required of and from the Crewman pursuant to the express and implicit terms hereof, and to the reasonable satisfaction of the Captain and the owners of the vessel. The Crewman understands and agrees that:

(A) All crew members aboard the vessel are expected to perform services aboard the vessel when the vessel has returned to its home port area, or to any other port for the purposes of repairs, maintenance or any other reason related to the use of the vessel.

(B) All crew members are expected to prepare the vessel and its fishing gear for the Fishery and to maintain it during the Fishery.

(C) All crew members are expected to clean the vessel to the satisfaction of the Captain.

(D) All crew are expected to replenish water supplies and fuel supplies on board the vessel as required.

(E) All crew members must verify that the vessel is properly tied when necessary, and if the vessel is in port during inclement weather, if the Captain so requests, all crew members must remain on board the vessel.

(F) The Captain of the vessel is the final authority with regard to all operational matters pertaining to the vessel and with regard to supervising Crewman, and Crewman agrees to abide by all orders and directives of the Captain.

9. **Compensation for Work Performed in Preparation for Fishing**
In the event the Crewman shall have assisted in the preparation of the vessel and its gear and equipment for fishing, and if the employment of the employee is terminated prior to the time that the vessel engages in fishing activities, the vessel and Crewman agree that the Crewman shall be compensated at the then minimum wage rate in effect in the jurisdiction in which the work was performed by the Crewman. The Crewman shall not be entitled to any additional compensation for such services as have been rendered by the Crewman and the Crewman specifically releases the vessel and its owners, employees and agents from any claim on behalf of the Crewman for additional compensation for services performed, or for any payment based upon the operation of the vessel during the fishing activites which occur after the termination of the employee.
10. **Unauthorized Conduct**
Each of the following are considered unauthorized conduct and is expressly prohibited:
(A) Failure to abide by and enforce watchkeeping standards as attached hereto.
(B) Sleeping or having eyes closed while on watch.
(C) Failure to use watch alarm while on wheel watch.
(D) Use or possession on board of any drugs or narcotics, including tranquilizers.
(E) Intoxication on or about the vessel or its skiff; use of alcohol on board the vessel or its skiff.
(F) Use of the vessel's skiff without specific permission of the Captain. The vessel's skiff shall not be used for recreational purposes or activities.
(G) Leaving the vessel unattended at anytime i.e. at least one crewman must be onboard at all times in port or at anchor.
(H) Unauthorized use of the vessel's radio transmitters.
(I) Failure to meet vessel departure schedules or other schedules set for the crew by the Captain.
(J) Improper treatment of the vessel or its equipment.
(K) Failure to work and live in harmony with other members of the crew.
(L) Failure to capably perform the duties for which the Crewman has been hired.
(M) Failure to wear a protection helmet when working on or above deck or in the vessel's holds.
11. No passengers will be permitted without Owner's specific approval.
12. **Loss of Property**
In case of loss of property in the event of Vessel loss, Owner will pay Crewman Two Hundred Fifty Dollars ($250.00) for any and all personal property lost by Crewman. Any additional coverage desired by Crewman must be provided by Crewman. Owners will not be responsible for loss by theft.
13. **Representation of the Crewman**
(A) Creman represents that he is an able bodied and experienced seaman, and that there is no medical or physical reason why Crewman will be unable to perform the duties required on board the vessel.
(B) Crewman acknowledges that it has been explained to Crewman and Crewman is fully aware that the working conditions on board the vessel are difficult, strenuous and sometimes hazardous and enters into this agreement with the full knowledge of the risks associated therewith.
(C) Crewman acknowledges that he has been issued a U.S. Coast Guard approved survival suit, protection helmet, and approved life jacket, which Crewman acknowledges that he has inspected and that the same is in good condition, and agrees to return the same to Owners at the end of the season in good condition.
(D) That the sea duties of the Crewman while the vessel is fishing or travelling have been fully explained to him, and that he understands those duties and is fully capable of performing those duties.
(E) Crewman certifies that he has examined the gear and machinery of the vessel, the vessel itself, and has found the vessel and its equipment and gear to be in good seaworthy condition. Crewman agrees to immediately advise the Captain if, at any time hereafter, he finds any condition on board the vessel to be unsafe, and if not immediately remedied by the Captain to immediately advise the vessel's owners.
(F) Crewman acknowledges that he has examined and understands operation of the life rafts and has found the same to be in good condition and with ready access to the same.
(G) Crewman warrants and represents that under no circumstances will Crewman engage in any illegal activity while on board the vessel (including, without limitation, illegal fishing or hunting), nor will the Crewman use the vessel or its property for any unlawful purpose during the term of this agreement. In the event that any action of the Crewman subjects the vessel or its owners or Captain to any administrative or judicial penalty, or to any damages whatsoever, the Crewman agrees to indemnify and hold the vessel, its owners and its Captain harmless from any such penalty or damages and the Crewman further agrees to reimburse the vessel, its owners and its Master for any such penalties and damages, plus related costs and attorneys' fees, resulting as a consequence of the illegal activity, and consents to the vessel and its owners deducting the cost thereof or such costs as may be estimated to be incurred in the future from any crew share payable to the Crewman.

14. **Miscellaneous**

(A) This agreement constitutes the entire agreement between the parties and all prior arrangements and negotiations between the parties are hereby deemed to be merged herein.

(B) This agreement shall be enforced and interpreted pursuant to the laws of the State of Washington.

(C) In the event that any action or legal proceedings are commenced to enforce any of the terms or conditions hereof or to terminate this agreement, the prevailing party shall receive from the other a reasonable sum as attorneys' fees, together with costs.

(D) This agreement is terminable in writing at the will of either the owners or the Crewman, with or without cause, at any time.

(E) If any of the provisions of this agreement shall prove to be invalid, void or illegal, it shall in no way affect, impair or invalidate any of the other provisions.

IN WITNESS WHEREOF, this agreement has been delivered and executed.

F/V: ______________________________

By: ______________________________ Captain

By: ______________________________ Managing Owner

Date: __________

CREWMEMBER:

____

Date: __________

Sample Release of Liability Agreement

KNOW ALL MEN BY THESE PRESENTS:

WHEREAS I, ____, residing at ____

am about to take a cruise as a guest passenger on board the F/V ____________________, and whereas I am about to do so entirely upon my own initiative, risk and responsibility.

Now, therefore, in consideration of the permission extended to me by ____________________, to take said cruise and other good and valuable considerations, I do hereby for myself, my heirs, executors and administrators, release and forever discharge ____________________, its vessels, officers and all personnel of and from any and all claims, demands, actions, causes of actions, in law admiralty or equity, on account of my death, or on account of any injury to me or my property which may occur from any cause during said cruise or continuance therefore, including operations incident to getting underway and return to port.

I have read and understand this release.

____
(SIGNATURE)

This release was read and signed on the ________ day of ________, 19_____, in the presence of ____.

Sample Contract For Crew Member Employment

Contract For Employment As Crew Member:

This is to confirm my employment as a crew member on the F/V DAY LIGHT on the following terms and conditions.

1. Payment: (Fill in the correct paragraph below and strike out the paragraph which is not applicable.)

I understand that I am to be paid a share of _______ of the vessel's gross stock after deduction of ______________ for the ______________ fishing season. This will be my sole compensation and I understand that I shall receive no extra compensation for services whether or not the vessel completes her season for any reason. All work performed by me in terms of making the vessel ready for sea, repairs, and taking the vessel out of service shall be paid for by my share. This share shall be my compensation whether or not the vessel completes her season for any reason.

Instead of working on a share basis, I will be employed as a seaman and crew member for _________ per _________ in total compensation of work, as directed while the vessel is in port or otherwise.

2. Term:

This agreement shall last until ____________.

3. Transportation:

I shall be responsible for my own transportation expenses if for any reason I choose to leave the vessel or if I am terminated for failing to abide by the conditions of employment.

4. Conditions of Employment:

I understand that I am subject to termination when in the judgment of the master I am not efficiently carrying out my duties. Examples are as follows:

a. Insubordination;
b. Inefficient or dangerous performance of my duties;
c. Being absent without leave in port;
d. Use of drugs or alcohol aboard vessel or while on duty;
e. Harassing fellow employees.

5. Maintenance:

If injured, I agree that maintenance may be paid at the rate of $_____ per day.

6. Medical Condition:

I warrant that the attached information is accurrate.

Dated this _______ day of ___________, _______

____

Model Letter of Agreement

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THIS AGREEMENT is entered into on *(date)* ______________________, ______
between the F/V *(vessel)* ______________________, a
(form of organization) ______________________
and *(name of crewman)* ______________________
as crewman, and sets forth the understanding of the parties with respect to the crewman's service aboard the F/V ______________ and the manner of his compensation.

1. Terms. The term of this Agreement shall extend through *(for example, Alaska King crab season)* ______________________

2. Duties. All crewmen are expected to diligently apply themselves to the best of their abilities to any and all tasks assigned to them by the captain of the vesel or another with authority, to promptly obey all commands and refrain from disorderly behavior on board the vessel. In addition to the usual duties imposed upon a deck hand, the crewman entering into this Agreement shall also serve as the vessel's ______________________.

3. Crewshare. Crewmen will be entitled to share in the net proceeds earned by the vessel during the term of this Agreement. The crewman to whom this Agreement pertains shall be entitled to one (1) share, defined as being not less than __________ percent (________%) of the net proceeds from the sale of the catch of the vessel. The net proceeds from the catch of the vessel is defined as the gross proceeds of the catch of the vessel less deduction for: (1) fuel, oil and filters; (2) bait; and (3) food at the rate of $__________ per day. In addition, the crewman's share shall also be reduced by the amount of any draws against crewshare taken by the crew member.

4. Jumping Ship. Any crewman who willfully leaves the service of this vessel prior to the completion of the term of this Agreement, without the permission of the captain, may, at the option of the owners of the vessel, be subject to forfeiture of a portion of his share by the deduction of one percent (1%) from the agreed crewshare, set forth above. In other words, if a crewman agrees to twelve perccent (12%) share and then later quits the vessel without permission, that crewman is only entitled to an eleven percent (11%) crewshare.

5. Discharge. The captain of the vessel may discharge any crewman from the crew of the vessel at any time for good cause.

6. Payment Dates. Crewman's shares shall be paid within ______________ (______) days after the conclusion of the fishing season in which they were earned. This also applies to crewmen who either willfully terminate their service aboard the vessel or who are discharged.

7. Insurance. While serving aboard the vessel, crewmen are covered by major medical and accident insurance, more fully described in the attached pamphlet.

Agreed:

____

Captain, F/V ______________

Agreed:

____

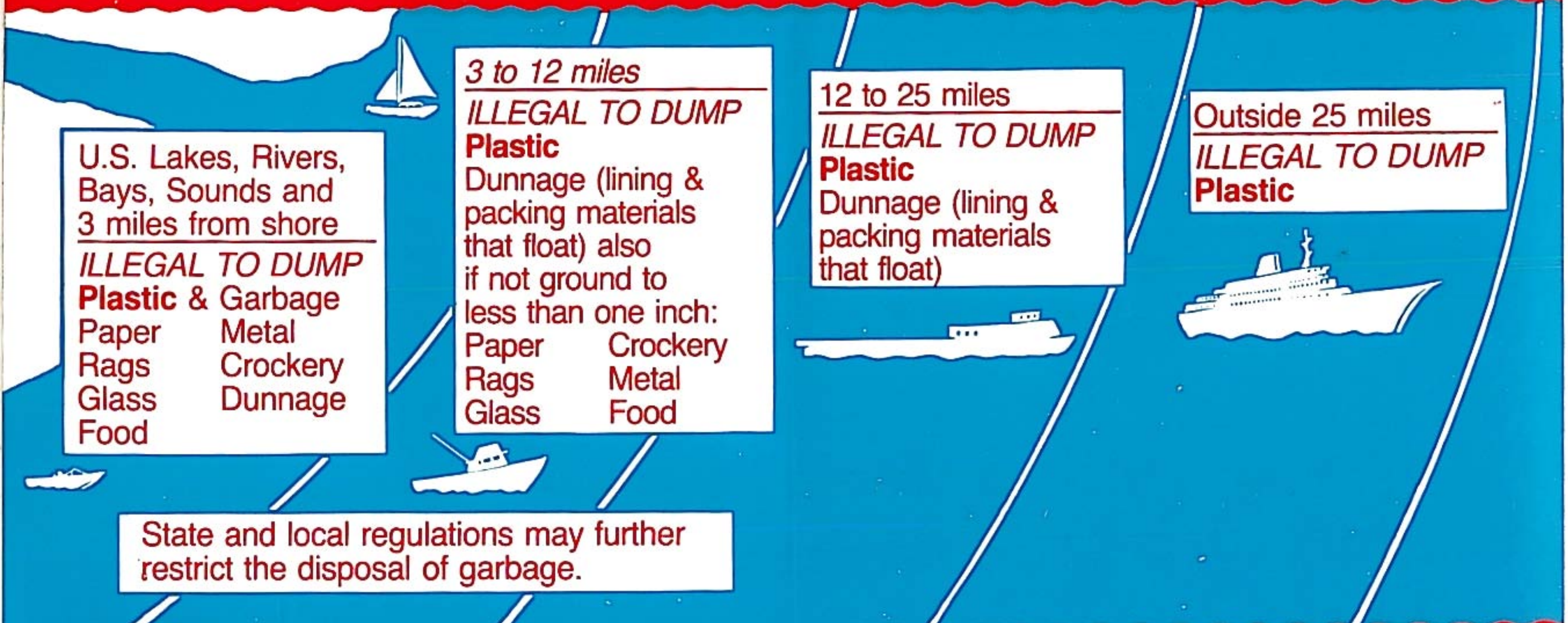
Crewman

____

(print name)

Note: All clauses are subject to negotiation between parties. This sample is intended as an example of a single agreement between owner and crewman and is not intended to cover specific situations or seasons. Owners and crewmen shall consult competent legal counsel to answer specific questions about their respective rights and responsibilities.

It is illegal for any vessel to dump plastic trash anywhere in the ocean or navigable waters of the United States. Annex V of the MARPOL TREATY is a new International Law for a cleaner, safer marine environment. Each violation of these requirements may result in civil penalty up to $25,000, a fine up to $50,000, and imprisonment up to 5 years.

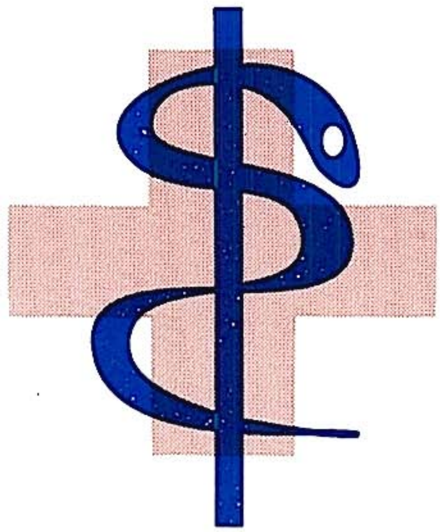


WORKING TOGETHER, WE CAN ALL MAKE A DIFFERENCE!

RHODE ISLAND SEA GRANT, University of Rhode Island Bay Campus, Narragansett, RI 02882-1197, (401) 792-6842

Designed by the CENTER FOR MARINE CONSERVATION, Washington, DC

Report All Injuries



United States law, 46 United States Code 10603, requires each seaman on a fishing vessel, fish processing vessel, or fish tender vessel to notify the master or individual in charge of the vessel or other agent of the employer regarding any illness, disability, or injury suffered by the seaman when in service to the vessel not later than seven days after the date on which the illness, disability, or injury arose.

This placard must be posted in a prominent place accessible to the crew, under the terms of the Commercial Fishing Vessel Safety Act of 1988.

Provided by:
Rhode Island Sea Grant
The Point Club and Ocean Marine Underwriters Inc.