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Many of the illustrations have been based on diagrams and figures provided by the above people and on the illustrations of fishing gear in the *FAO catalogue of small-scale fishing gear,* second edition and the *FAO catalogue of fishing gear designs.*

Coonamessett Farm, Massachusetts, USA also kindly provided a drawing.

1. WHAT IS TRAPPING?

Fishing is one of the oldest ways by which people have fed themselves and their families. Except for gathering shellfish by hand and spearing fish (Figure 1), primitive trapping is probably the oldest form of fishing.

In early times, flowing water caused by tidal movement and changes in river and lake levels were probably used to trap fish behind rudimentary barriers, often made from sticks and stones. It is likely that early humans found that fish catches could be improved by driving fish into these barriers. They would have found that catches from these barriers decreased over time, as fish became accustomed to them, and would have had to move the traps to fresh areas where more fish could be caught. It would have been hard work to construct new traps, either by moving stones from the old trap or finding new ones. Primitive fishers probably tried making barriers from lighter, more readily available material such as tree branches, brush and vines (Figure 2). This led to the fishers inventing lighter, movable traps made from brush and nets made from vines which they could carry with them when they moved to new areas. They may even have tried bigger, more complicated corral-type fish traps in lakes, rivers and coastal waters.

Either by accident or by inspiration, fishers then found that:

- fish were caught in traps as the tide fell, were forced into them by the current or could be chased into them by the fisher;
- fish entered the trap for protection or simply followed other fish seeking shelter;
- objects in the traps such as white stones attracted the fish;
- bits of fish or meat would attract more fish.

It is from such beginnings that modern traps and pots have developed.

Traps and pots do not seem to have developed in only one part of the world. As fish became an important food source, many types of traps and pots were developed. We will look at some of this variety later in the manual, concentrating on portable traps and pots and giving less detail about corrals and other herding devices.

WHAT ARE TRAPS?

Traps are simple, passive fishing gear that allow fish to enter and then make it hard for them to escape. This is often achieved by:

- putting chambers in the trap or pot that can be closed once the fish enters;
- having a funnel that makes it difficult for the fish to escape (Figure 17, p. 20).

Smaller traps are generally fully covered except for the entrance or entrances, while larger traps that extend above the water level are often left open at the top.

TYPES OF TRAPS AND POTS

People in different parts of the world are not always referring to exactly the same things when they use the words "trap" and "pot". In general, traps are large structures fixed to the shore. Pots are smaller, movable traps, enclosed baskets or boxes that are set from a boat or by hand.

A simple system for the naming of traps and pots was produced by von Brandt in 1959 for FAO and is used in this manual. General types of traps and pots include:

- traps that form barriers to fish movement, including walls or dams, fences, fyke nets, gratings and watched chambers that can be closed by the fisher after the fish enters (Figure 2);
- traps that make hiding places (habitat traps), including brush traps and octopus pots (Figures 3a and 3c);

- tubular traps, which are narrow funnels or hoses that stop the fish from getting out backwards; eel tubes fall into this category (Figure 3b);
- traps that are mechanically closed by the fish, including gravity traps or box traps, bent-rod traps (whipping bough traps), torsion traps and snares;
- baskets, which are enclosed traps and pots usually with a structure to make escape difficult; they include pots made of wood, wire or plastic, conical and drum-like traps made of netting with hoops and frames (e.g. drum nets) and box-like traps made with strong frames (Figures 4, 5 and 6);
- large open traps or corrals with a part or mechanism to stop fish from escaping, which can be fixed on sticks or anchors, set or floating (Figure 7);
- traps set out of the water to catch fish such as flying fish that jump off the tops of waves and glide over the surface when in danger; these can be box-shaped, rafts, boats or nets ("veranda" net types); scoop nets are sometimes used for making fish jump. Pitfall traps can be used for marine animals that migrate over land, such as coconut crabs.

In this manual we will concentrate on how you can make and use the various types of transportable traps and pots, the "basket" type. The making and use of other types will be looked at only very briefly.

HOW DO TRAPS AND POTS WORK?

Trapping is a passive way to catch fish, shellfish, crustaceans (crabs, prawns, etc.) and cephalopods (octopus, squid, etc.) and is different from active fishing methods such as dredging and trawling. Traps can vary, from simple structures such as rock corrals able to hold various fish species passing by, to highly specialized equipment such as lobster pots.

Simple trapping and potting can be carried out from small boats or canoes (Figure 8) or from large vessels. The efficiency of fishing with pots or traps can be improved by the use on board vessels of such equipment as power winches and haulers (Figure 9).

Fish that enter a trap or pot find it difficult to get out and this gives the fisher time to take the fish that are caught.

An advantage of trapping is that it allows some control over the species and sizes of the fish you catch. The trap entrance, or funnel, can be regulated to control the maximum size of fish that enter. The size of the holes, or mesh, in the body of the trap can regulate the minimum size that is retained. To a large extent, the fish species that will be caught depend on the type, model and characteristics of the pot or trap being used.

Figure 1
Primitive hunter spearing fish

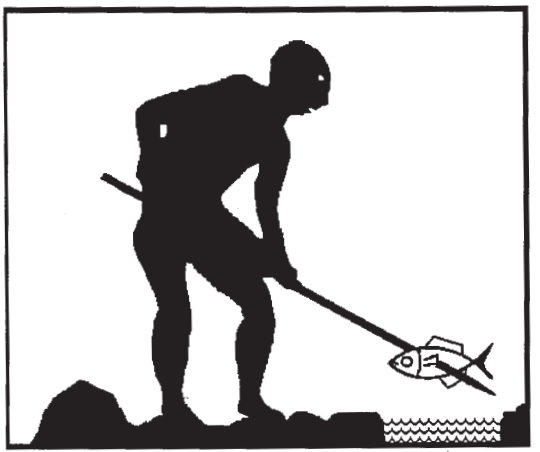


Figure 2
Primitive barriers

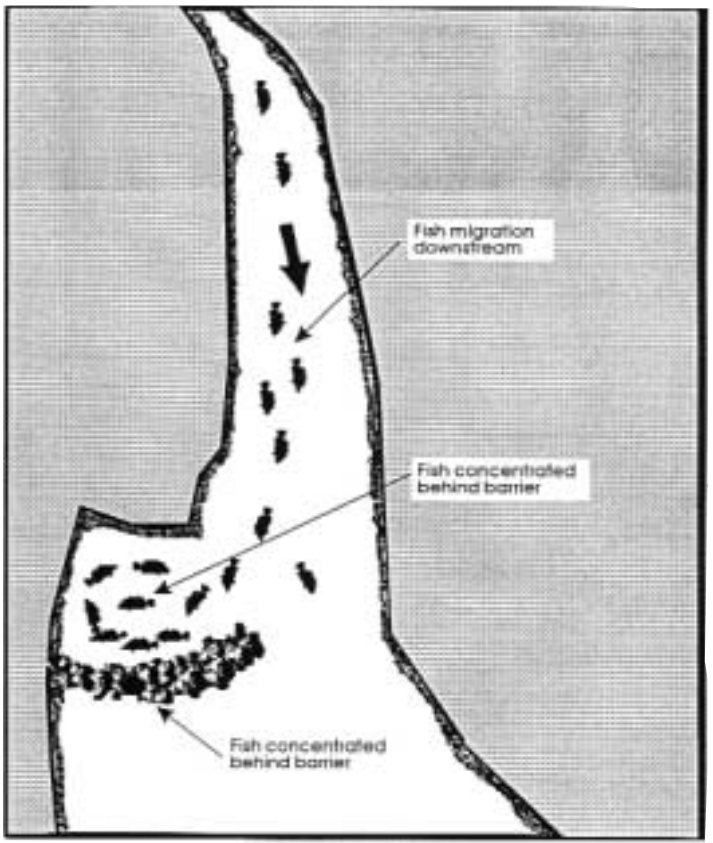


Figure 3
Traditional pots made from natural materials

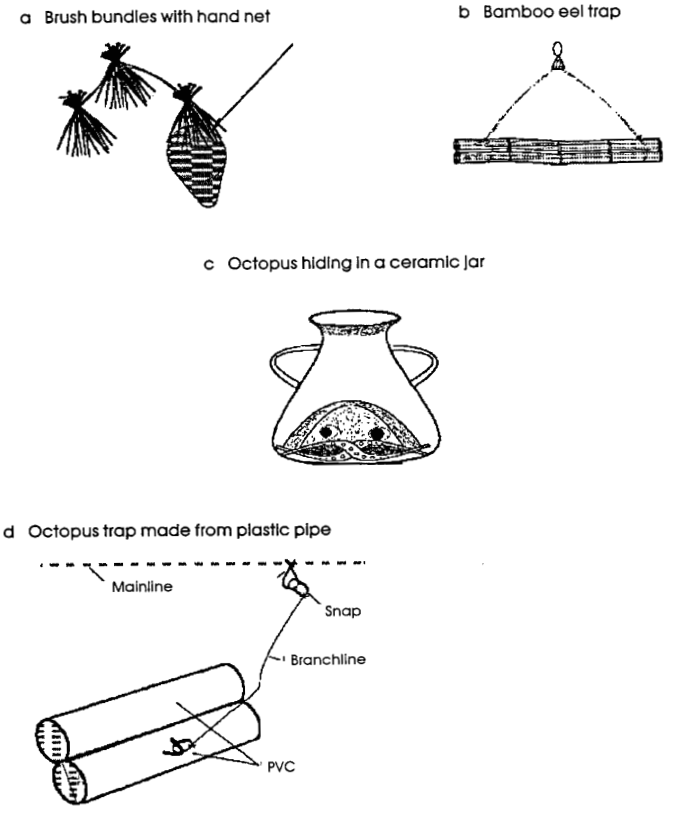


Figure 4
The various elements of a box-like trap

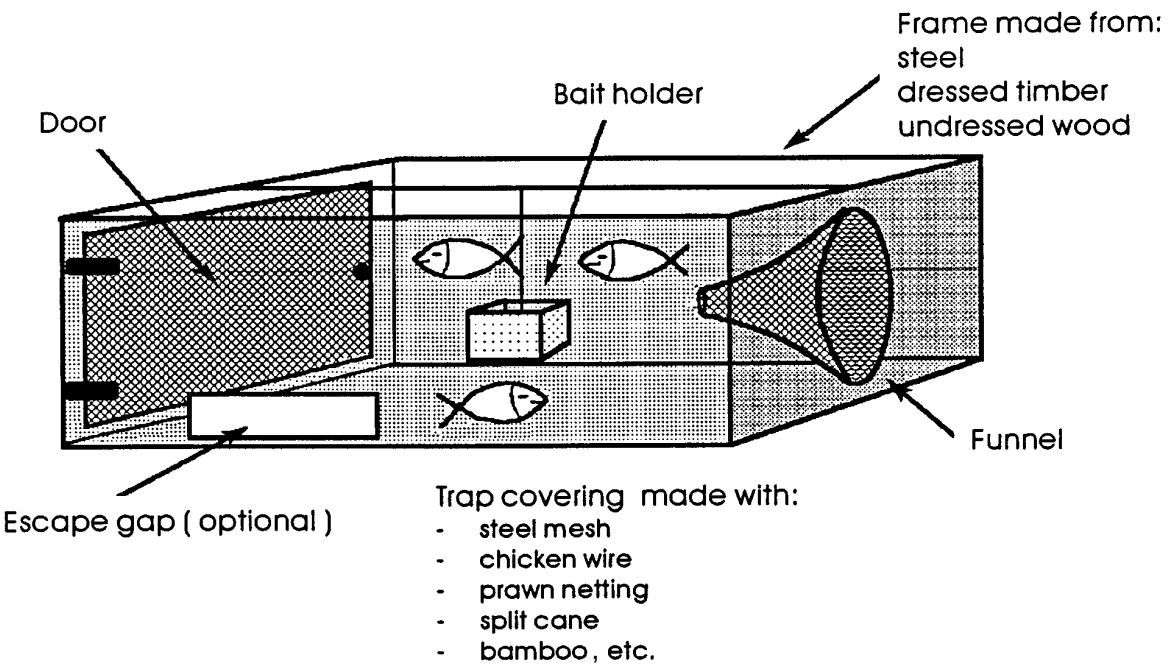
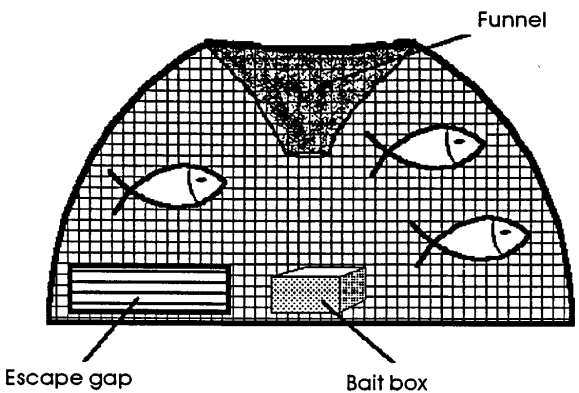


Figure 5
The various elements of a beehive pot



Outer covering of pots made from :
- Cane
- Wooden slats
- Wire mesh
- Sticks, etc.

Figure 6
The various elements of a slat pot

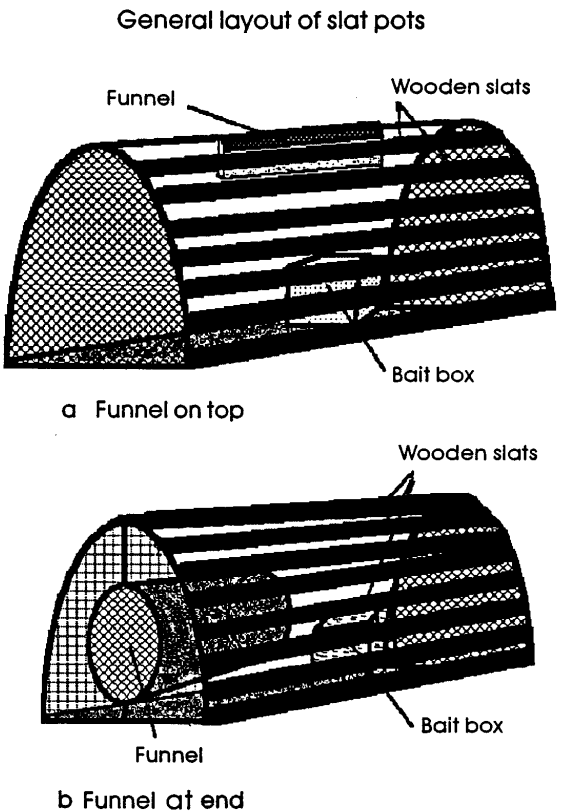


Figure 7
Large open fixed trap or arrowhead trap

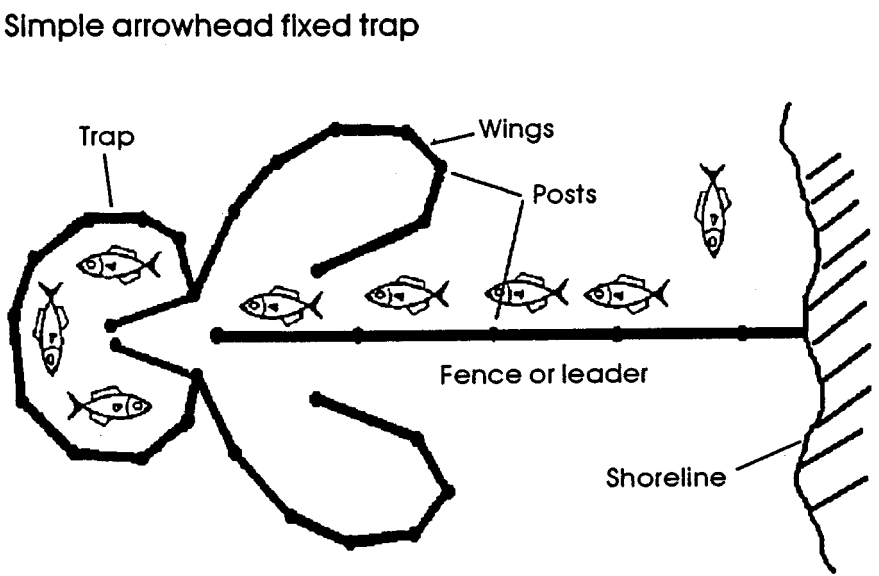


Figure 8
Transporting traps to the fishing ground

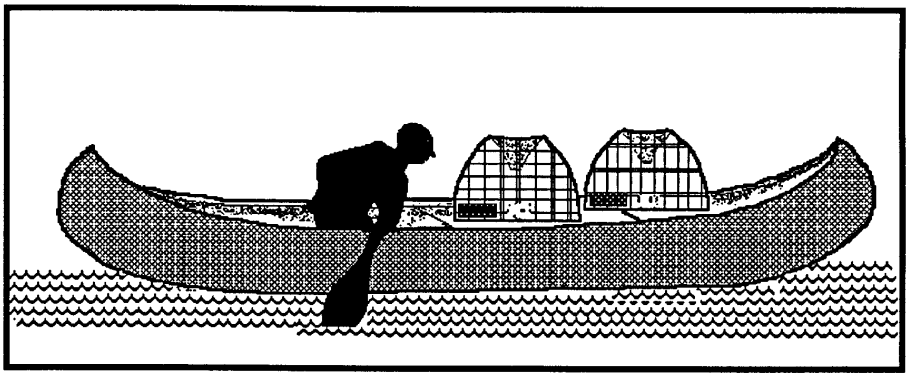
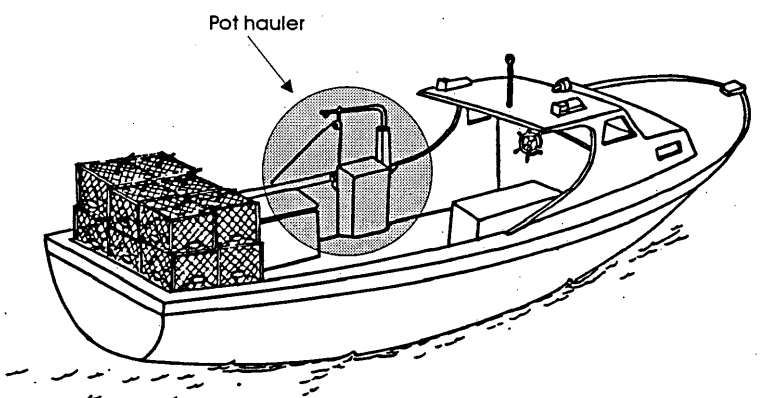


Figure 9
Small boat equipped for potting



2. WHAT TYPES OF FISH, CRUSTACEANS AND CEPHALOPODS CAN YOU CATCH WITH TRAPS?

Most fish, crustaceans (lobster, shrimps, crabs, etc.) and cephalopods (squid, cuttlefish, octopus, etc.) can be caught with traps and pots. As early fishers found, these animals often see traps and pots as a hiding place or a place where food can be found. Thus, fish that are seeking shelter, migrating or looking for food can usually be caught in numbers great enough to feed a family or to sell or barter.

The number that you catch depends on how many fish, crustaceans and shellfish are in the area and how concentrated they are in the water. If they are not concentrated in patches, are not in large numbers in an area or do not move around seeking food, they are not usually good fishing targets, unless you can attract them into the traps and pots. Most bottom trapping and potting is carried out in reefy areas, where fish and other animals are concentrated by the reefs and rough bottom, either for protection or because of the presence of food. The use of other fishing methods such as gillnetting, and even more trawling, can be difficult on this reefy ground. The fish and crustaceans that you want to catch may live in burrows, bury themselves in the bottom sand or mud or hide under ledges. However, if they leave this protection at a certain time of the day or night to feed, mate or look for better hiding places, it is probable that you can make good catches. Remember, you can only make good catches if the traps and pots are attractive to the fish you want to catch. The choice of a bait that is preferred by your target is critical, as is placing the trap or pot where it can easily be encountered by targeted species.

The species of fish, crustaceans and cephalopods caught in the different regions of the world are often characteristic of those regions. Some types, however, are found in a wide range of marine and estuarine areas, for example snappers, sharks and squids. The more common fish, cephalopods and crustaceans that can be taken with pots or traps in the tropical, subtropical, temperate and colder regions of the world are described in this chapter.

TROPICAL AREAS

In tropical areas, shallow-water reef and estuarine fish and shellfish are commonly caught with traps and pots, although sometimes deep-water fish are also trapped (Figure 10). Most pots and traps used in the tropics have been designed for fishing in reefs, rocky areas and on the rough bottom. The fish, cephalopods and crustaceans taken include snappers, emperors, groupers, parrot fish, surgeon fish, squirrelfish, angelfish, tropical rock lobsters and others. Pot fishery is widespread in mangrove creeks and estuarine areas for various crabs (mud crabs, swimmer crabs, spanner crabs, etc.), adult prawns (mud shrimp, yellow shrimp, etc.) and a number of offshore shrimps. Various types of squid and octopus are also trapped in most tropical waters.

SUBTROPICAL AND TEMPERATE AREAS

A variety of fish, cephalopods and crustaceans are taken with traps and pots from these waters, ranging from inshore types such as eels, terapons, wrasses, sea bass (barramundi), breams, croakers, rock lobsters and crabs and deeper water fish and shellfish such as snappers, grunts, trevallies, squid, octopus and prawns, hermit crabs and shrimp.

In deep offshore waters pandalid shrimps, tilefish, zebra fish, etc. are taken (Figure 11).

Figure 10
Some tropical marine fish taken by traps

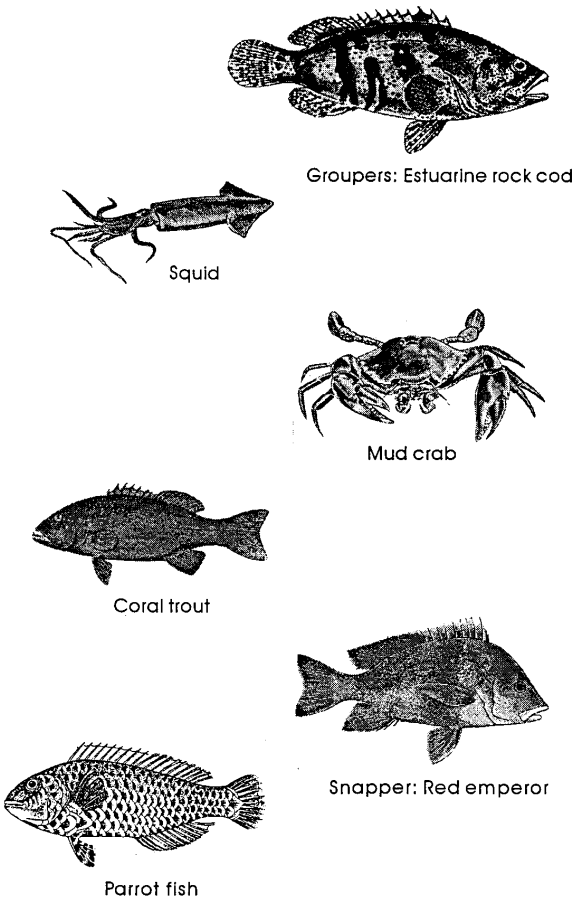
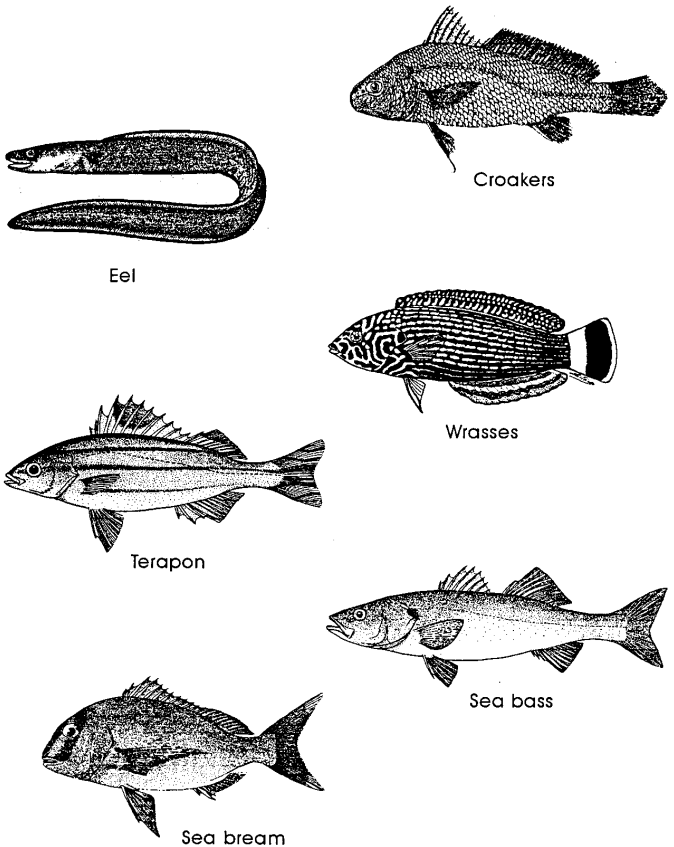


Figure 11
Some temperate and subtropical fish taken by traps

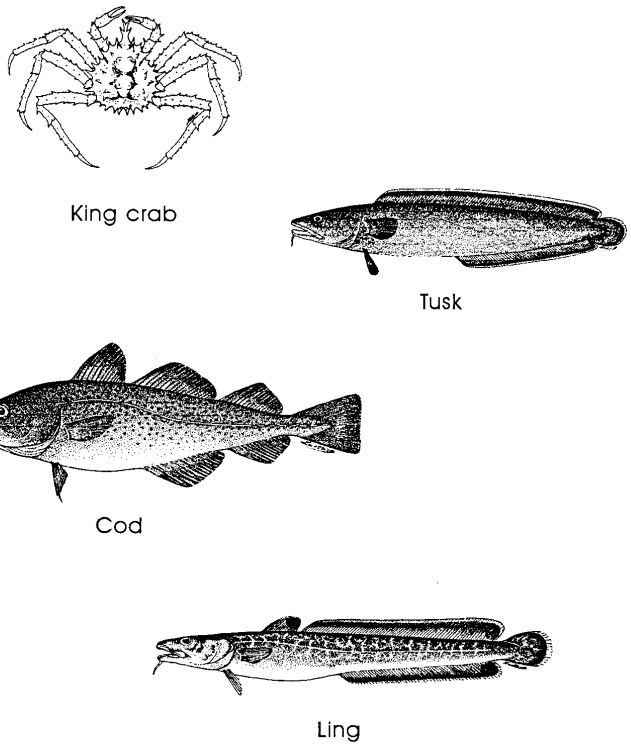


COLDER WATERS

There is some trapping and potting in the northern Atlantic, the English Channel and the northern Pacific, although it is not so widespread as in the warmer areas. Cod, tusk or ling are sometimes targeted with traps, and there is a substantial pot fishery for lobsters in the English Channel and off the west coast of France. King crab and shrimps are caught off Alaska (Figure 12).

Figure 12

Some colder water species taken by traps



3. IS TRAPPING SUITABLE FOR YOU?

There are many very good reasons why you should consider trapping or potting. These include:

- Trapping is an easy and convenient way to provide fish and other seafood for your family.
- The cost of making simple traps is usually low and in many cases cheap local materials can be used.
- The costs of setting and hauling traps are usually not great: simple traps can be set and hauled from a canoe or a vessel without a motor.

Even when more advanced trapping methods are used, fuel and equipment costs are low when compared with fishing methods such as trawling, gillnetting or purse seining.

In general, trapping and potting is good for fishing areas as it does little damage to the underwater reefs and it allows some control of the amount of unwanted and wasted bycatch.

4. GEAR NEEDED FOR TRAP AND POT FISHING

There are three things that you must have if you want to fish with traps and pots:

- trap- and pot-making materials;
- ropes and floats to mark, set and retrieve your gear;
- a vessel and equipment to operate the traps or pots and to transport the fish back to shore.

TRAP- AND POT-MAKING MATERIALS

The choice of trap-making materials depends on the type of trap you want to make and the fish you want to catch. You can construct many traps from locally available materials. For example, fish and lobster pots are often made from the sticks and branches of local trees, shrubs, mangroves, etc. If you are using mangrove wood to make pots, it is essential that you do not destroy the mangrove forests, as they provide important breeding grounds, shelter and food for many young and adult commercial fish and crustaceans. You can often use discarded material such as old tyres, plastic and earthenware piping to make effective traps (Figure 13).

Your choice of manufactured trap-making materials will depend on the local availability of these materials and on their prices. For example, if wire mesh is too expensive or unavailable, it can often be substituted by a piece of used nylon or cotton gillnet.

The ways to make traps and the various types of materials that can be used are discussed in more detail in Chapter 6.

GOOD BAIT

Good bait is essential for effective trap fishing. Bait types vary according to the types of fish that you are targeting. Bait types and techniques for baiting are looked at in more detail in Chapters 5, 6 and 8.

VESSEL AND ONBOARD EQUIPMENT

Vessel

The size of the vessel that you need depends on the type and number of traps you intend to use, the prevailing sea conditions in your area, the distance you need to travel to the fishing grounds, how long you want to stay at sea, the number of crew, etc.

Trap handling equipment

As pointed out above, many traps and pots can be operated by being pulled up manually, using the attached buoy rope. The use of trap/pot haulers and tippers on larger vessels using bigger traps can increase the efficiency of the operation.

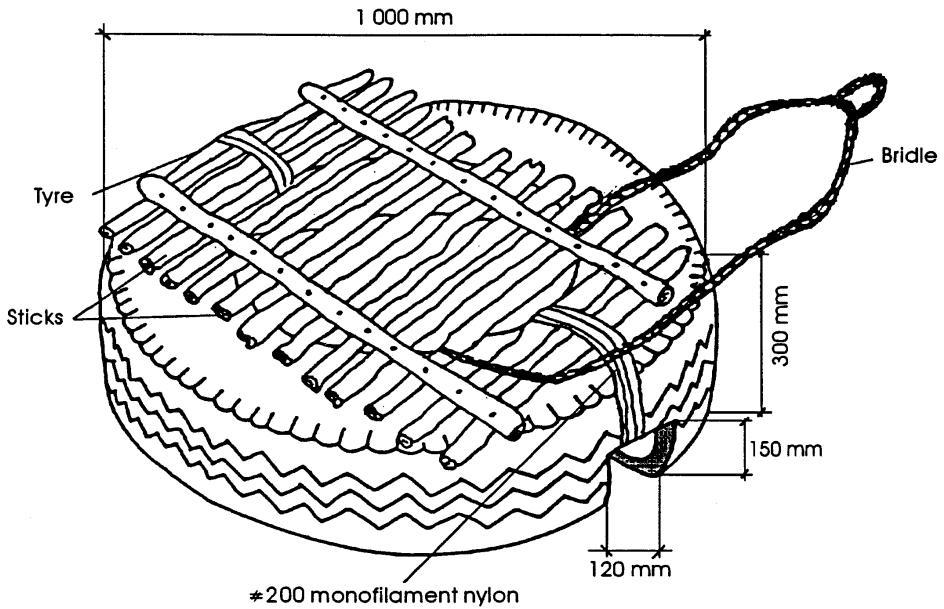
Bait storage

It is essential to find a suitable way to store your bait, both while you are fishing and onshore. Salted or dried bait only requires a dry place on the vessel. Fresh or frozen bait should be kept frozen or on ice or it will become rotten and unusable after a short time, depending on the temperature in which you are working.

Equipment for handling and preserving the catch

To maintain the catch in good condition on board your vessel, you need to have the correct handling and preserving equipment. This may include ice and ice boxes, freezers, brine tanks, filleting boards or tables, gutting knives and catch washing equipment (buckets, deck hoses, etc.). The care of your catch is looked at in more detail in Chapter 9.

Figure 13
Lobster trap made from an old tyre



5. WHAT YOU NEED TO KNOW TO GO TRAPPING

Before you start trapping there are several things you will need to know:

- the type(s) of fish you want to catch and the type(s) of traps or pots that will catch them;
- the type(s) of bait needed for these fish and where you can get it;
- suitable landing and storage for your catch on board;
- a market for your catch.

TYPES OF FISH TO CATCH AND THE TRAPS THAT WILL CATCH THEM

Although this manual gives general information on traps and pots, there are several other sources of local information on the fish that you wish to catch and the gear needed to catch them. These include:

- the results from various types of fishing operations in the area;
- private local knowledge from fishers, fishing companies and fresh fish markets and from fishing companies in other areas and countries;
- public surveys by local fishing companies, the government, FAO or other international organizations.

TYPES OF BAIT AND/OR OTHER ATTRACTANTS NEEDED AND WHERE TO FIND THEM

Good bait is normally essential in successful trap fishing, although some subsistence fishers use only white or shining objects to attract the fish. Sometimes the trap itself will lure the fish inside (e.g. habitat traps).

Bait must be:

- effective in attracting fish;
- readily available;
- easy to store and conserve;
- cheap enough to allow the operation to be profitable.

The most effective baits are usually oily fish such as sardines and mullet. Soft fish that break up after the trap has been set form a good "plume" that will readily attract fish. If traps or pots are set for longer periods, however, harder baits may be needed, or a combination of both soft and hard.

SUITABLE LANDING PLACES

When you start trapping, you will often land the catch on existing wharves or on the beach. Here you can sell it, pass it on to your family, ice it or preserve it by freezing, salting, drying, smoking, etc. If your trapping venture becomes well established and profitable, you will need to be sure that the catch can be landed easily, cheaply and in good condition. Although existing landing places may be good enough during the initial phase of your operation, you may need new or upgraded landing places as your fishery develops.

A MARKET FOR YOUR CATCH

If you wish to sell all or part of your catch, it is very important that you preserve it in a way that suits your customers. The best method of preservation will vary according to:

- the time and distance from catching to the point of sale;
- the climate in the area where you fish;
- the value of the fish.

You should always try to land your fish in the best possible condition (see Chapter 9) but you should also always balance the rewards of landing high-quality fish against the cost of achieving that quality. There is no point landing fish in first-

class condition if it costs more to do so than the selling price you can expect to earn.

FUNDING FOR NEW VESSELS AND EQUIPMENT

The source of finance for fishing operations is outside the scope of this manual and is an aspect that can only be looked at locally. However, in some areas specific schemes are sponsored and funded by local organizations and banks. You should talk to your local fisheries organization about these schemes.

6. HOW TO MAKE VARIOUS TYPES OF TRAPS AND POTS

Many types of fish and other aquatic animals have been taken with simple traps and pots for hundreds of years.

Of the main types of trap (see Chapter 1), this manual will concentrate on enclosed traps and pots.

HIDING PLACES OR HABITAT TRAPS

You can create artificial shelters and hiding places to attract and concentrate fish by placing bundles of branches, sticks or brush in the water. This method was probably used by ancient peoples and is still used in some areas of Europe, Africa and Asia. In more recent times, artificial reefs made from old car bodies, old motor tyres, concrete blocks, sunken vessels, etc. have been constructed to provide hiding places that concentrate fish. Floating devices for fish aggregating are sometimes used to concentrate commercial pelagic fish.

Brush traps

You can make these traps simply by tying branches, sticks, brush etc. into bundles and either placing them flat or upright on the bottom or suspending them in the water. Fish and crustaceans sheltering in the brush trap can be caught by quickly lifting the bundles from the water. The bundles can be put in the centre of a woven basket to catch fish that try to escape when the trap is lifted. Alternatively, you can put a dip net under the bundles while you are lifting them (Figure 3a, p. 3). Brush traps can be set in long rows or on longlines for easy hauling.

Eel tubes

Eels and other long thin fish can be caught by setting tubes for them to use as shelter. Such tubes are often closed at one end and you can make them from bamboo, hollow logs, steel, plastic or earthenware piping, etc. (Figure 3b, p. 3). They are usually tied into groups of two. Bait can be placed inside the tubes to attract the eels or fish. When lifting the tubes, you must take care that the eels do not escape. In some places divers seal the ends before the tubes are lifted.

Octopus pots and traps

Traditionally, unglazed earthenware pots were used in the Mediterranean and Asia to catch octopus. However, you can use other materials, including plastic, steel or earthenware piping, old motor tyres and empty large mollusc shells. Octopus will enter almost any receptacle that provides shelter (Figures 3c and 3d, p. 3).

Further details on making and setting octopus pots and traps are covered later in this chapter.

BARRIERS TO FISH MOVEMENT

Simple barriers made from stone or wood were probably one of the first types of trap used by prehistoric peoples. Many such barrier traps (fish screens, labyrinth traps, corrals) are still used today throughout the world. Each area has its own particular designs for permanent barrier traps, based on the types of fish in that area, their behaviour and migration and the area being fished. These traps will not be considered further in this manual, but the design of a simple arrowhead trap is given in Figure 7 (p. 6).

These traps are normally constructed with a long arm or leader, usually from the shore outwards, with an arrowhead-shaped trap on the outer end. The design of this trap varies

widely in its complexity according to the species of fish being targeted and their movements.

ENCLOSED TRAPS AND POTS (BASKETS)

Enclosed transportable traps and pots (which are often referred to as "pots") are by far the commonest types of trap used throughout the world. Although there are many types and shapes, including rectangular, circular, hexagonal, conical, semi-cylindrical, chevron-shaped and heart-shaped (arrowhead), the way they work is the same: fish enter the trap by one or several entrances or funnels and are prevented from escaping.

The common parts of traps and pots are shown in Figures 4, 5 and 6 (p. 4 and 5). These are:

- frame;
- outer covering;
- entrance funnel;
- bait holder;
- door to empty the pot or trap;
- escape gap;
- ballast;
- (sometimes) a corrosion anode when the frame is metallic.

Frame

Frames are made from strong materials that prevent the traps and pots from losing their shape during fishing and storing. Trap frames are often made from steel rods, although sawn timber and strong sticks are used in some places. In northeastern Brazil, rock lobster pots are traditionally made from mangrove and other sticks (Figure 14). In Canada and northeastern areas of the United States, while lobster pots were traditionally made from sawn timber, now more plastic-coated wire is used (Figure 15). Beehive pots are usually made from flexible material such as cane or bamboo, often with a base of bent steel rods (Figure 16). In Australia and New Zealand, pots and traps are now often made entirely from welded steel mesh that does not need a frame to support it.

In some cases, the frames are made so that pots can be folded in order to save space when they are stored on the deck of the boat.

Covering

Modern rectangular traps and pots are covered with wire netting, nylon mesh, plastic-covered steel, welded steel mesh, etc. The choice of material depends on traditional usage, availability and cost. Tests to see if there are any differences in catch rates between wire and nylon mesh have shown that in most cases there are not. In some areas, bamboo or plaited cane is still used. Beehive pots are commonly made from cane or flexible branches without a frame, although in some areas they are made with a solid frame and covered with cane, wire or nylon netting. Moulded plastic pots appear to be cheap and easy to stack and there is no reason to believe that their catch rates would be inferior. If you are fishing in an area where sharks are common you should use steel mesh rather than nylon mesh.

Funnels

Although beehive pots have only a single funnel at the top, other trap and pot types may have several funnels. The inner ends of funnels are often directed downwards ("horse-neck") or constricted in some way to prevent escape (Figure 17). Some pots, mainly for lobsters, also have the "bedroom and parlour" design. This consists of a funnel or funnels leading from the outside to an initial chamber (the "parlour") and a second funnel to an inner or holding chamber (the "bedroom").

Research has shown that traps with more than one funnel catch more than traps with a single funnel, although the quality of the catch is often reduced as a result of injury to the fish caused by the increased number of projections on the inside of the trap.

Door

A door is usually placed in the main body of the trap to make it easy to remove the catch. Most traps have a properly made door. A few have an area where the outer mesh can be opened and closed at an edge near the frame. Lobsters and rock lobsters caught in beehive pots are normally taken out through the funnel at the top.

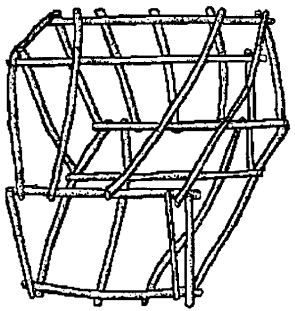
Bait holder

Bait is normally secured in the catching chamber of the trap or pot. Large, solid pieces of fish, animal bone, small land animals, etc. are tied into the pot with wire or twine. If small pieces of bait such as small fish (e.g. sardines or sprats) or chicken heads are used as bait, they should be placed in a bait container made from wire, plastic or synthetic netting to hold them together and in place. In some cases, the bait is put in a plastic or metal container with a few small holes punched in it to save the bait. This can only be done if the bait is extremely attractive to the fish you want to catch.

In some fisheries traps are not baited, as fish or squid use the pots as shelters. This is especially the case in Caribbean trap fisheries, where the reef fish that are targeted use the traps for shelter.

Figure 14

Rock lobster pot made from mangrove sticks (northeastern Brazil)



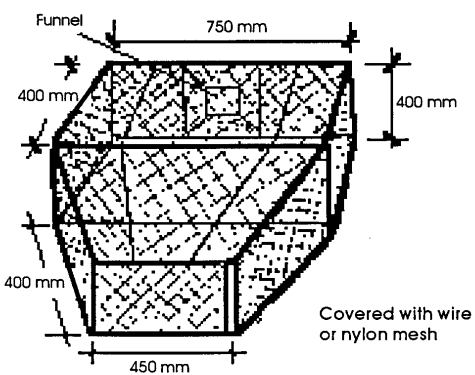
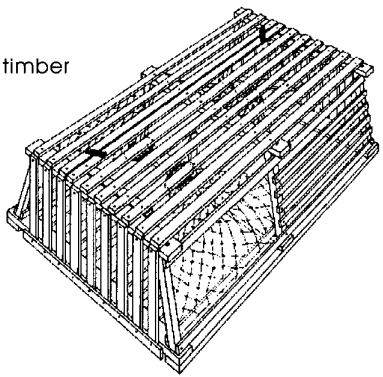


Figure 15
Lobster pots used in northeastern United States

a. Sawn timber



b. Plastic-coated wire

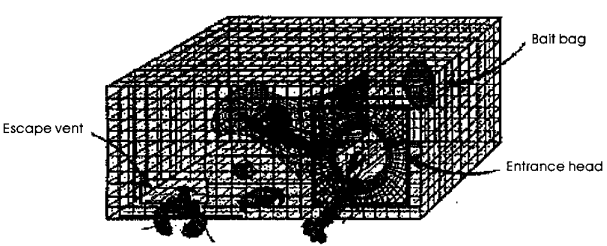
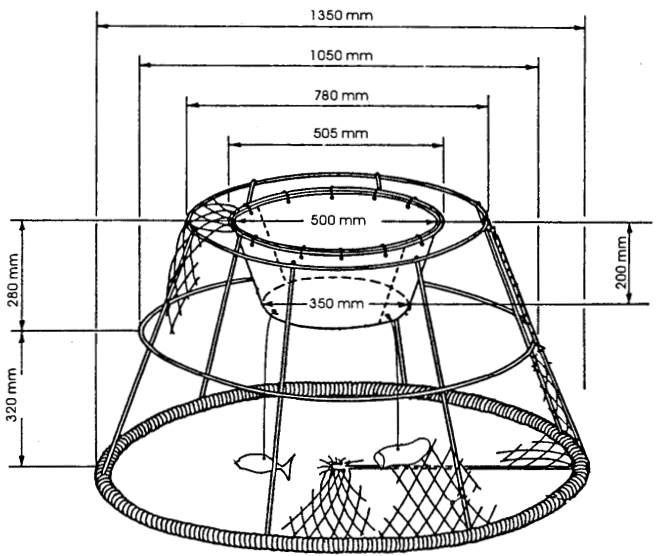
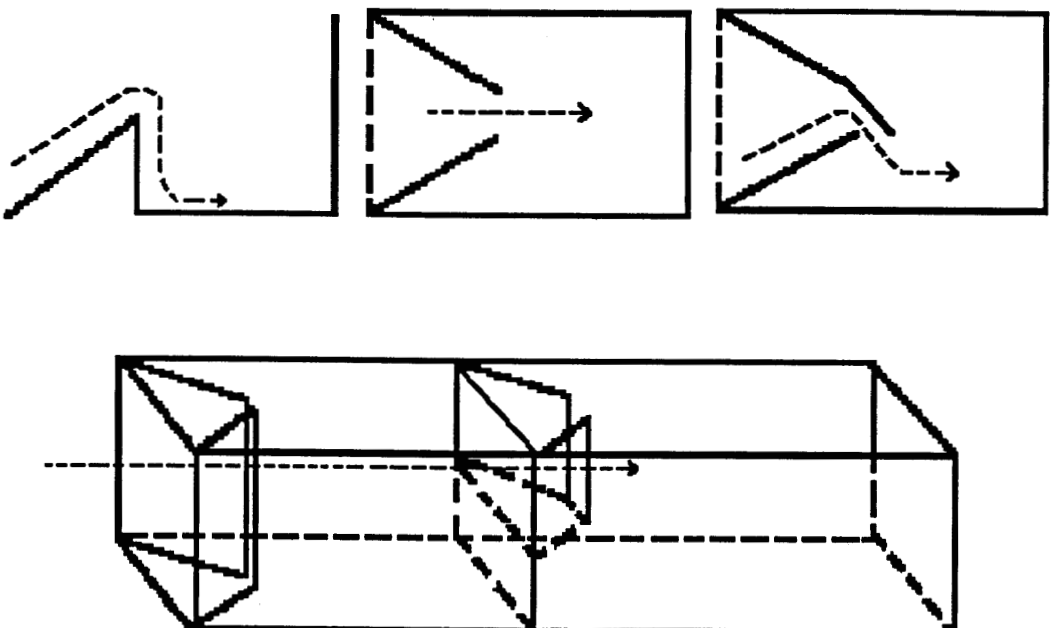


Figure 16
Beehive pot type, cone iron frame, 8 mm diameter (used in Japan for deep crab fishing)



Covered with knotless netting 100 mm mesh size

Figure 17
Diagram of different funnel types

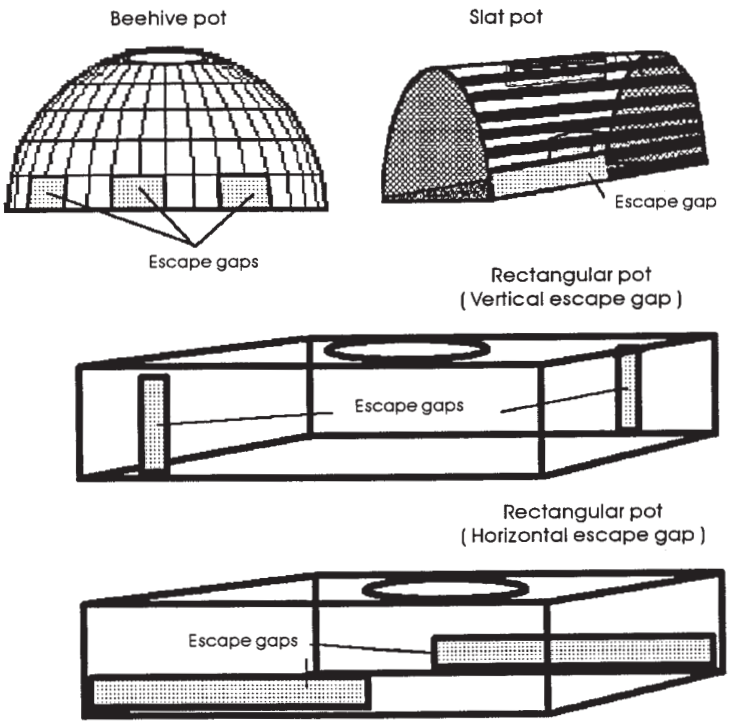


Escape gaps

Escape gaps are often fitted into pots and traps to make sure that undersize fish or crustaceans, especially lobster and rock lobster, are not taken. Government regulations have often been passed to ensure that escape gaps are used to let small fish and crustaceans escape (Figure 18). In many rock lobster fisheries, including Australia, New Zealand and Cuba, escape gaps are compulsory in all pots to allow the escape of juveniles. In Australia and New Zealand, rock lobsters with head (carapace) lengths less than 76 mm must be released or allowed to escape.

Figure 18

Escape gaps for lobster pots



Ballast

Weights or ballast are often placed in pots and traps before setting to prevent tidal flows and currents from moving them from where they are set. This is especially the case for traps and pots made of wood or other light material. Weights may be concrete blocks, steel bars or other heavy material such as bricks, stones or rocks. Strategically placed ballast may also help the trap to land the right way up.

Anodes for metallic framed pots or traps

Because of the corrosive effect of seawater on steel and other metals, an anti-corrosion anode is often attached to steel traps and pots to extend their useful life. Anodes are usually made from a block of zinc with a wire through it to tie it to the pot or trap. They are not cheap and should only be attached to metal traps and pots that are costly to make. Galvanized wire netting also reduces the rate of corrosion in seawater. If the ongoing cost of replacing traps and pots that have been damaged by corrosion is high, you should consider using plastic mesh for the outer covering of your traps and pots and plastic-covered metal for the frames.

MAKING TRAPS TO CATCH DIFFERENT TYPES OF FISH, CRUSTACEANS AND CEPHALOPODS

As different species react in different ways to traps and pots, we will look at how traps can be made for three important target groups. The groups we are considering are:

- finfish;
- lobsters, shrimps, prawns, crabs and other crustaceans;
- octopus, squid, cuttlefish, etc.

Finfish traps and pots

Pots and traps for taking finfish are used in most parts of the world and there are many types and variations. To simplify this manual we will look only at some common types and their more popular or innovative variations.

Traps and pots are frequently used to take fish in areas where coral or the rocky bottom does not allow the use of other types of fishing gear. For example, in the Caribbean traps are the primary fishing gear. In many other areas a large number of fishers use simple traps made from mangrove poles covered with wire mesh.

The most common types of finfish traps used throughout the world include:

- Caribbean traps (arrowhead, "Z", "S", etc.);
- round traps;
- rectangular traps;
- "D"-shaped traps;
- collapsible traps;
- pelagic fish traps;
- North Atlantic cod pots;
- plastic multipurpose traps.

Caribbean traps (arrowhead, "Z" and "S" traps). The four most common fish trap designs used in the Caribbean are the:

- Antillean "Z" trap (Figures 19a and 19b);
- "S" trap (Figure 20);
- arrowhead or chevron trap (Figure 21);
- rectangular trap (Figure 30, p. 30).

Arrowhead (or chevron), "Z" and "S" traps are also used in Asia and the Mediterranean. They are principally used in tropical waters and have been successfully used to take emperors (*Lethrinidae*), snappers (*Lutjanidae*), cod (*Epinephalidae*), bream (*Sparidae*), parrot fish (*Scaridae*), goat fish (*Mullidae*) and trevallies (*Carangidae*).

The most common of these designs is the Antillean "Z" trap (Figures 19a and 19b). This takes the form of a double chevron or "Z" with two down-curving "horse-neck" entrance funnels. Typically, these measure between 180 and 230 cm in length and are 60 cm high. In the Caribbean, specialized artisans construct these traps in a number of stages.

Figure 19a

Typical Caribbean “Z” pot: frame and dimensions

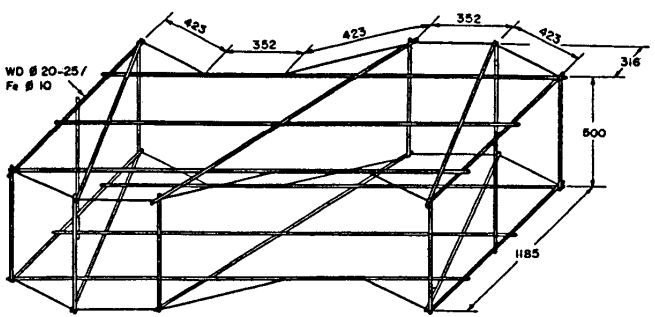
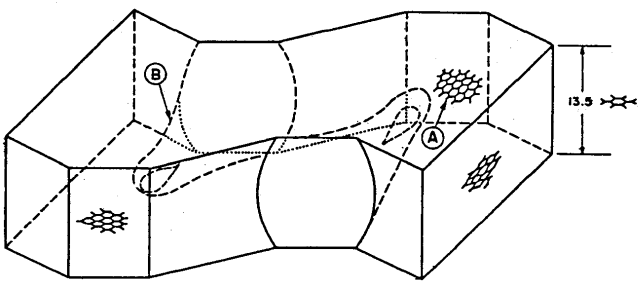
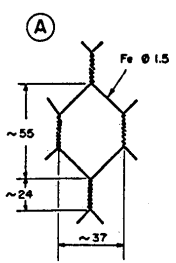


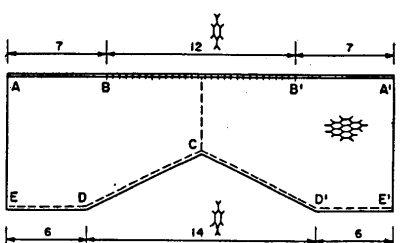
Figure 19b
Typical Caribbean “Z” pot: details for construction



General layout



Wire mesh



Horse-neck construction details

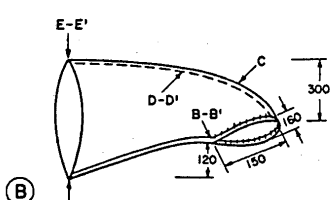
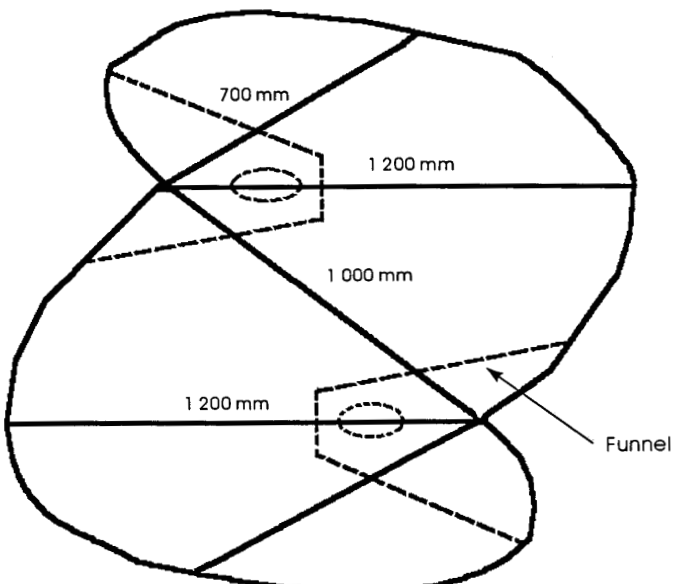


Figure 20
A typical “S”-shaped trap



- Trap 700 mm deep
- All frames made from 10 mm iron rod
- Trap covered with wire mesh
- Funnel covered with polyethylene stretched mesh or chicken mesh

Figure 21a
Arrowhead or chevron fish trap

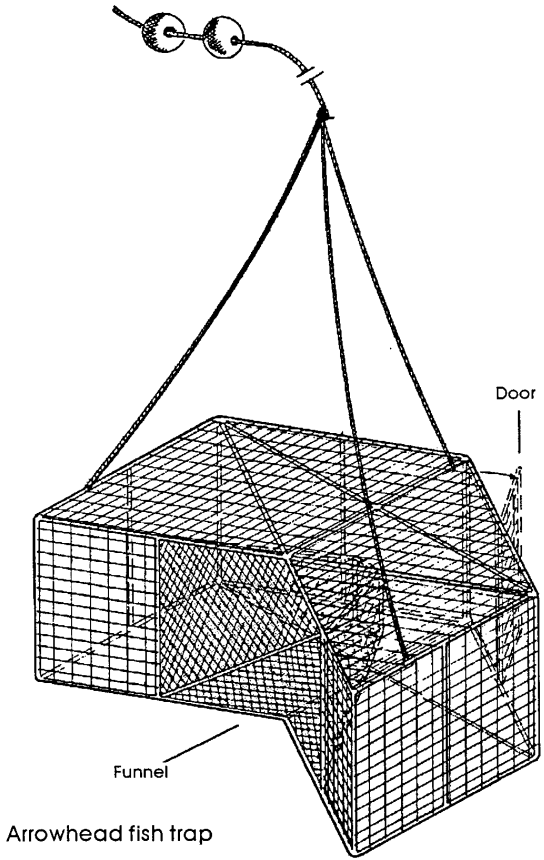
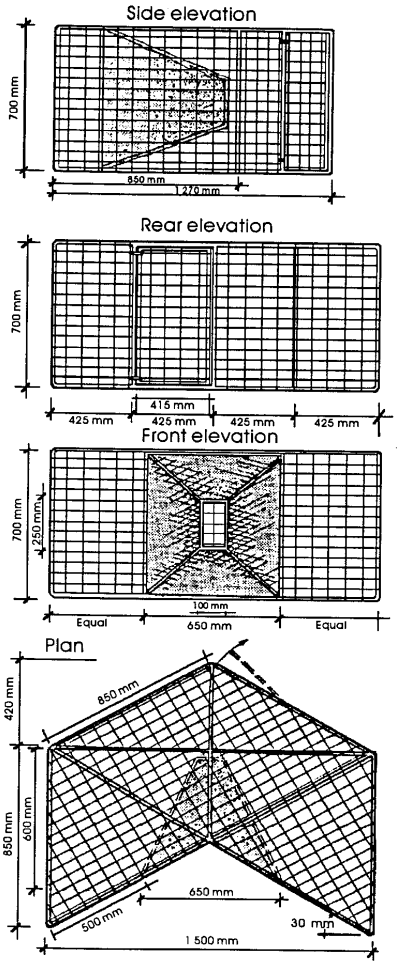


Figure 21b
Design details of the arrowhead fish trap



Making finfish traps. If you want to construct a "Z" trap, the materials that you need are:

- a 50 x 1.2 m roll of galvanized hexagonal-weave wire mesh;
- 24 hardwood sticks or poles about 2.0 m long;
- 1 kg of 3 cm nails;
- tools: hammer, saw, wire-cutting pliers and machete or hatchet.

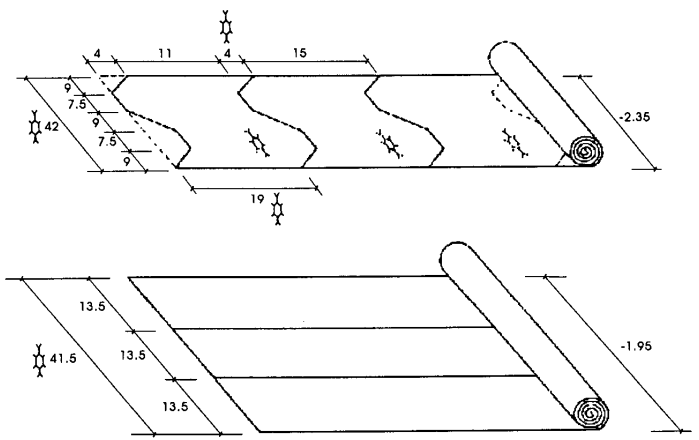
With these materials you can make four pots 270 cm long, five pots 240 cm long or six pots 210 cm long.

The essential stages in making a typical 240 x 120 cm Antillean trap are:

1. Cut the roll of wire into 240 cm lengths.
2. Cut the overall "Z" shape into the wire. Each "Z"-shaped pattern will be the top or bottom of a pot (Figure 22).
3. Cut two lengths that are the height of the pot to be constructed; 120 cm in this case (Figure 22). These are the sides of the pot.
4. Set the sides on the ground and attach the top and bottom, forming a pot without a funnel or wooden supports.
5. Cut the two funnels, using 150 cm lengths of wire for each.
6. Double over the funnel material to make the two "horse-neck" or down-curving funnels; burr the edges.
7. Fit the funnels into the opening cut in each corner of the pot and form the downward curve of the "horse-neck" by hand.
8. Fit a 30 cm "V"-shaped or square door in a corner of the pot.
9. Fit the pot sticks and wire them tightly into place to make up the framework in the previously formed pot. Leave a 10 cm overhang at the lower ends of the vertical sticks to hold the pot off the bottom.
10. Fit three long "key" sticks to the whole length of the top and bottom of the pot. The "top-back" and "bottom-back" sticks are important, as they are used as attachments for the buoy ropes.

Figure 22

Diagram for cutting rolls of mesh for a typical Caribbean “Z” pot



The mesh used in Caribbean fish pots is usually galvanized hexagonal-weave chicken wire with 4 cm ($1^1/_4$ inch) openings. In some parts of the Caribbean, mainly Jamaica, finely woven bamboo cane is used to replace the wire over the wooden frame. Steel reinforcing bars are sometimes used to make pot frames.

Changes to the trap design and modification to the entrance funnel have been found to make big differences to the catch rates of these traps. Straight funnels seem to have higher catch rates (and escape rates) than those with a "horse-neck". "S" traps were found to outfish "Z" traps by a factor of about 25 percent, while both were found to perform better than arrowhead traps.

Recently, modified arrowhead traps have been introduced into Australia. The trap frame is made from 10 mm mild steel which is covered with 50 x 75 mm rectangular 1 to 3 mm diameter mesh. An outward-opening door is placed in the rear of the trap. The details of the design of these traps are shown in Figures 21a and 21b. The buoy lines are made from 12 mm rope adjusted to one-and-a-half times the depth of the water being fished. The traps are set with the point towards the tide.

Round traps. These are illustrated in Figure 23. As with other types of trap, the size and height of round traps vary with the area being fished, the type of fish being targeted and the availability of trap-making materials. The number of funnels in round traps varies, but one, two or three are usual (Figure 24). Additional funnels can increase the catch rates by allowing fish to enter the trap more quickly, but there is a higher escape rate and the additional internal projections from the extra funnels cause greater damage to the fish in the trap.

The western Australian snapper trap is a typical commercial round trap. It is also popular in northern Australia and has been used in the development of the tropical snapper fishery in that area (Figures 25 and 26). The dimensions and construction details of these traps can vary. A version of the western Australian trap has three funnels and a frame made from 10 mm mild steel rod. This frame is 180 cm in diameter, 70 cm high and has three braces top and bottom to support the funnels and the attached buoy ropes. In this trap the funnels are straight, tapered to a 25 x 11 cm opening. The frame is usually covered with welded wire mesh of about 75 x 50 mm but it can be covered with other types of wire, heavy nylon netting, etc. Similarly, the funnels can be made from steel rod and covered with heavy nylon mesh or the same material as the body of the trap. In some traps, the funnel is shaped from welded mesh without a frame. A door is normally placed in the side of the trap to make it easier to take the catch. As with other traps with more than one funnel, the catch rates increase with the number of funnels but damage to the fish is increased by the extra projections from the funnels inside the trap.

The main fish caught in tropical Australian waters with round traps are tropical snappers (*Lutjanidae*), emperors (*Lethrinidae*) and groupers (*Epinephlidae*).

A simple round trap can be made from a horizontal cylinder of wire netting with a wire mesh funnel at one end or funnels at both ends (Figure 27). A similar trap can be made of nylon mesh covering a steel frame constructed from hoops and steel rods. These simple traps are often referred to as "drum nets". They are used in rivers, streams and lakes to catch fish moving close to the bank. A freshwater fish pot or drum net used in Germany for catching tench, roach and carp is shown in Figure 28.

Drum nets are normally set by rolling them into the water from the bank and down the underwater slope to the preferred fishing place. A line attached to the trap winds round its centre as it is rolled down the slope (Figure 29). The trap is taken

from the water by pulling on the line, which rolls it back up to the bank. Drum nets can either be baited or placed unbaited in an area where fish swim in currents.

Figure 23
Round fish trap for snapper (Western Australia)

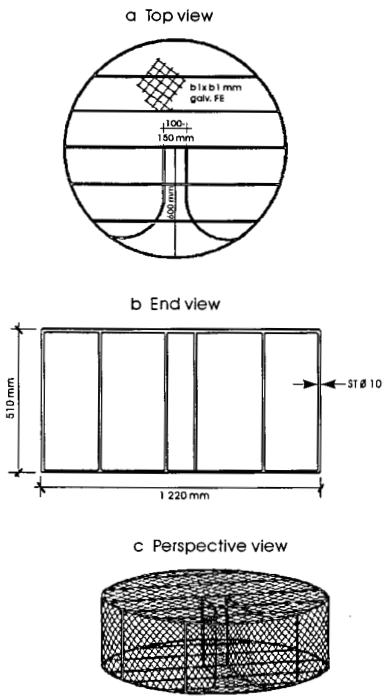
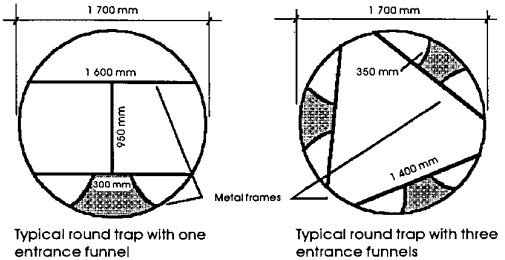


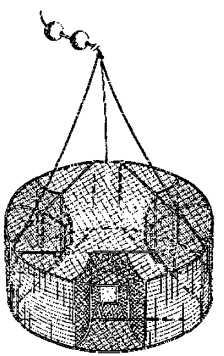
Figure 24
Positioning of funnels in round trap



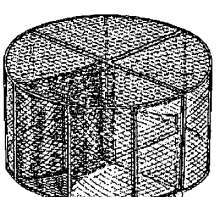
Typical round trap with one entrance funnel

Typical round trap with three entrance funnels

Figure 25
Australian round traps



Three-funnel round fish trap
(Northern Territory)



Single-funnel round fish trap
(Western Australia)

Figure 26
Three-funnel round trap from Australia

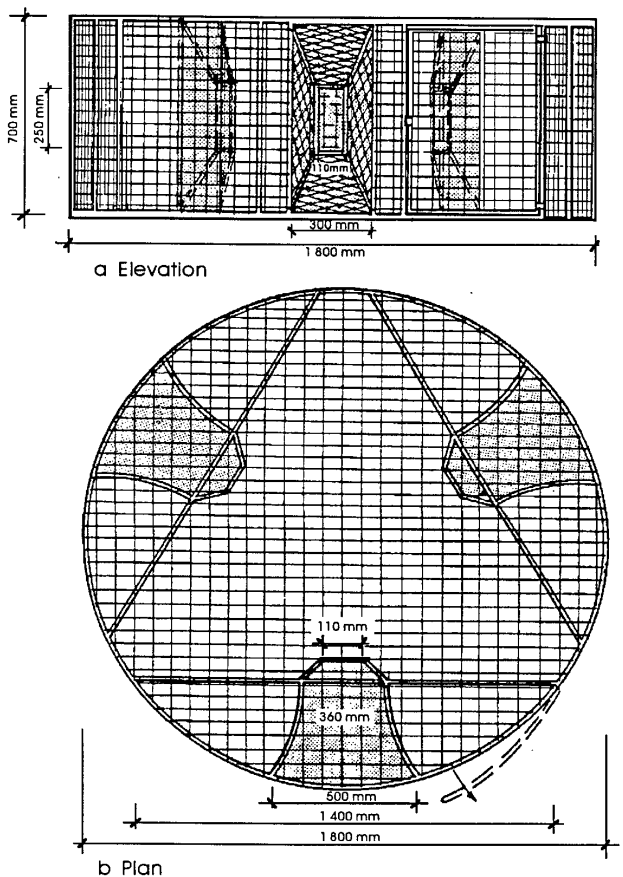


Figure 27
Drum net type of trap

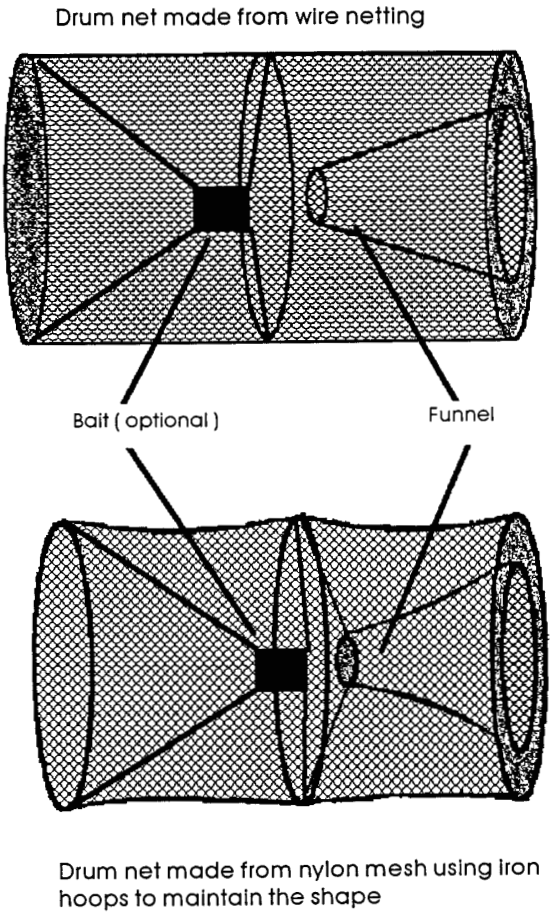


Figure 28
Drum net fish trap for inland fisheries (Germany)

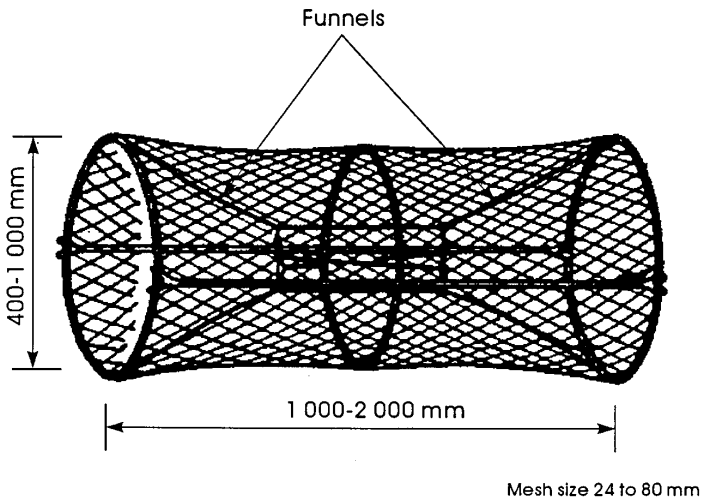
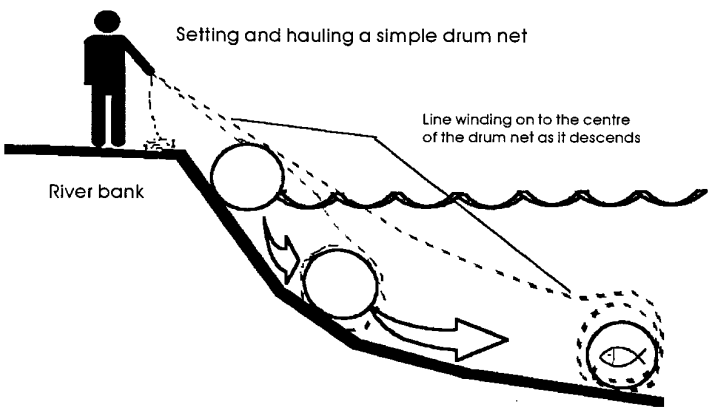


Figure 29
Setting and hauling a simple drum net



Rectangular finfish traps. These are illustrated in Figure 30. Rectangular traps vary greatly in size and construction material, but modern traps are usually made from steel rod or welded mesh. Because of their tendency to roll, they are used in areas where the current flow is not great.

Rectangular trap frames of different sizes are made from dressed, rough or natural timber, including mangrove branches. Wooden traps are used to take snappers, sea bass and many other bottom-dwelling species in temperate and tropical waters.

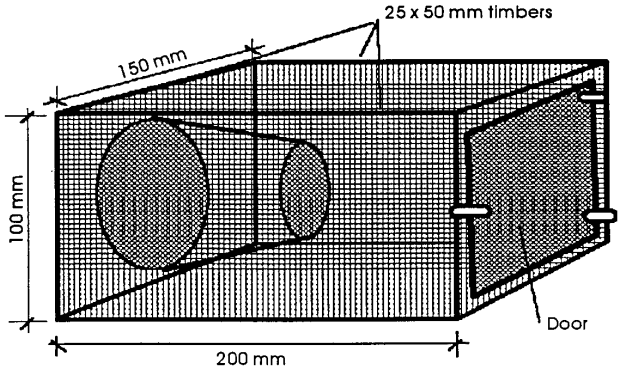
Rectangular traps are very common throughout Australia and have been modified to fish in various conditions. They are typically constructed from mild steel and are covered with welded mesh, chicken wire, wire netting or nylon netting.

A typical wooden trap is about 2.0 x 1.5 x 1.0 m overall and constructed from 50 x 25 mm timber bolted together. Chicken wire is then stretched tightly over the frame, giving the trap further strength. It has a funnel placed at one or both ends, also made from chicken wire or from a frame covered with nylon netting. Heavy ballast is positioned in the bottom of the trap to sink it and to hold it on the bottom.

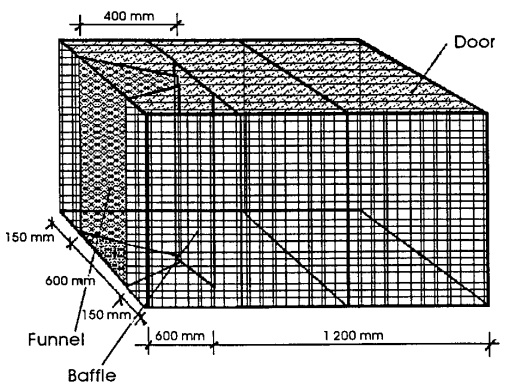
A rectangular trap often used in southern Australia is made from a single sheet of 50 x 50 mm welded mesh cut and bent into shape (Figure 31). The bait is tied or placed in a bait basket (or bait saver) in the centre of the trap. A baffle is often placed in front of the funnel to prevent fish from escaping back through it.

A modified rectangular trap made from a sheet of 50 x 50 mm welded steel mesh has been developed in Australia. This trap is 32 x 32 meshes (i.e. 1.6 x 1.6 mm) square, with rounded corners. The sides and funnel are bent from a piece 15 meshes deep. The mesh is supported by a frame made from 13 mm round steel bar (Figure 32).

Figure 30
Rectangular fish traps



a Trap with wooden frame



b Trap made from iron welded mesh

Figure 31
Welded mesh fish trap (South Australia)

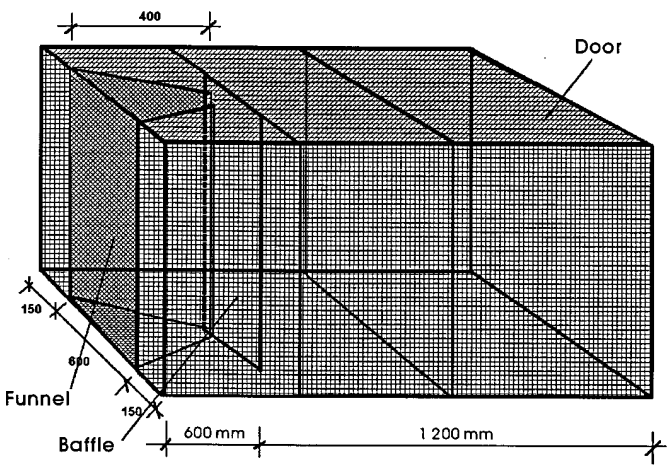
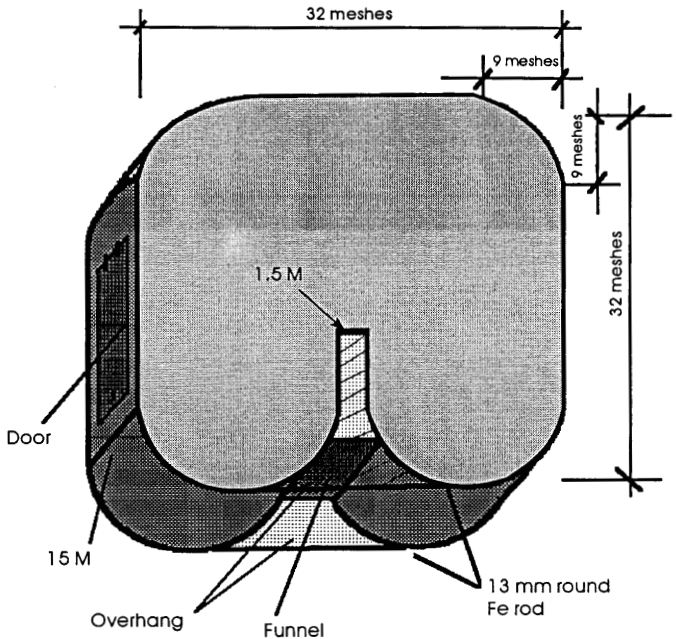


Figure 32
Australian welded mesh fish trap



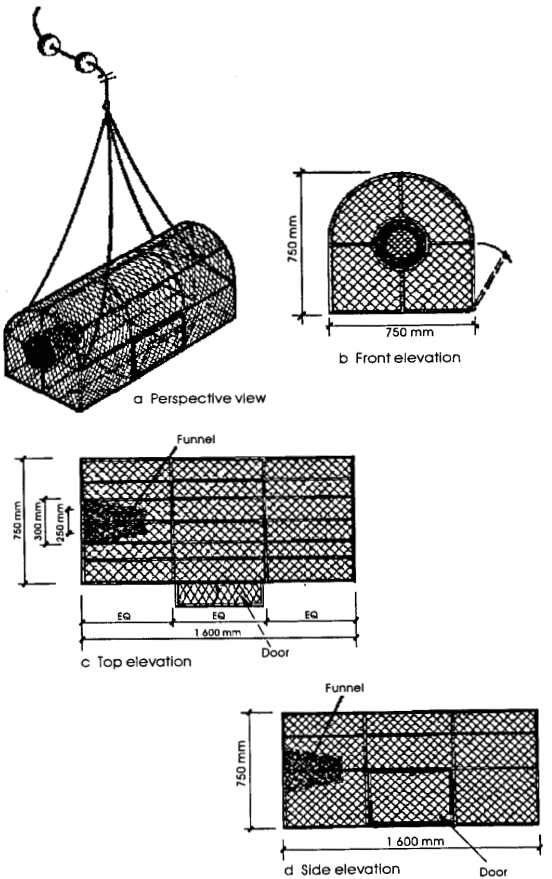
Trap is constructed from a sheet of 50 mm welded mesh
Frame is made from 13 mm iron rod

"D"-shaped finfish traps. These are shown in Figure 33. The "D" shape is preferable to the traditional rectangular fish trap in areas of stronger currents, as it offers less resistance to water flow and is less likely to roll.

Although "D"-shaped finfish traps are common throughout the world, the design illustrated in this manual is one that was modified for Australian conditions. This trap is 160 cm long and 75 cm high. It has a funnel at one end and a hinged door at the side for baiting the trap and removing the catch. Typically, the frame is welded together from 12 mm round mild steel (Figures 33a and 33b), although other materials such as wood are occasionally used. The traps are usually covered with chicken wire, but welded mesh or prawn netting can also be used. The funnel tapers from 30 to 25 cm. It is made of similar material to the main trap and is fixed into the centre of one end (see Figures 33a and 33c). The internal funnel opening can be oval-shaped with the longest axis vertical.

These traps are used in southern Australia to take leatherjackets (*Monocanthidae*) in deeper waters of the continental shelf and pink snappers (*Pagridae*) and other bottom-dwelling fish in shallower waters. In tropical Australia they are used to take fish such as jacks and trevallies.

Figure 33
"D"-shaped fish trap (Australia)



Collapsible finfish traps. The collapsible finfish traps described here and illustrated in Figure 34 were developed in the Northern Territory of Australia to fold up when not in use, thus increasing the number of traps that can be transported on board vessels to the fishing grounds. They are showing considerable promise in the developing fishery off northern Australia.

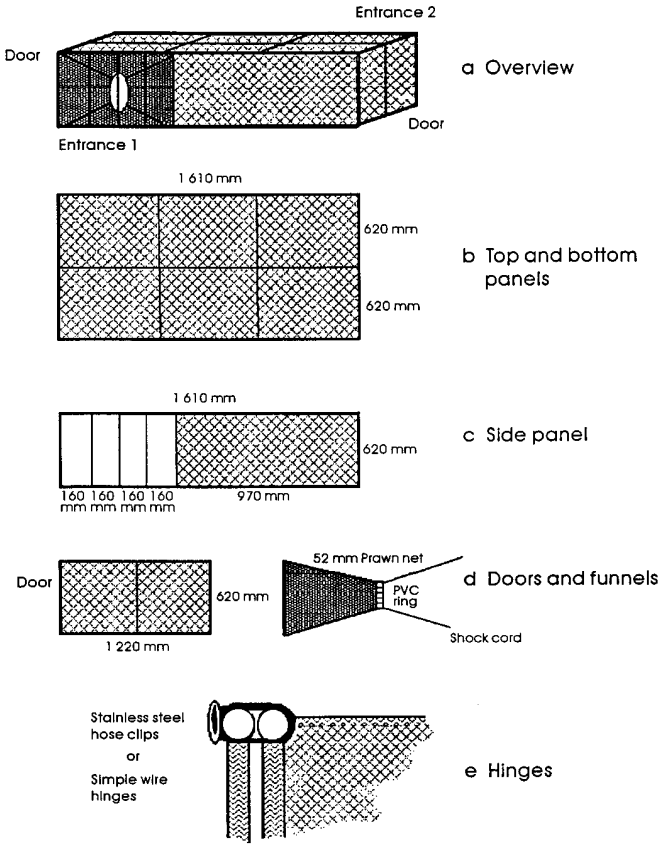
All frames are constructed from 6 to 10 mm diameter steel bars. Traps are covered with chicken wire, welded mesh or shrimp netting. The panels are constructed from similar steel bars and covered with galvanized wire mesh (50 mm diamond). This mesh is laced on to the frames with 1.20 mm tie wire. The round entrance funnel is also constructed from 50 x 50 mm wire mesh. The entrance is laced to the frame with twine or light tie wire, which may be more durable.

The mouth of the entrance is made from a 25 to 30 mm diameter disc cut from 100 mm PVC piping. This disc is softened in boiling water and formed into an oval shape to approximate the shape and size of the target fish. Two holes 25 mm apart are then drilled in the disc, which is cut between the holes. A ring is laced through the last meshes of the funnel and the cut closed with tie wire or twine. The funnel is held open by shock cords running from the PVC disc to the top and bottom panels, with enough slack to collapse the trap.

A hauling yoke made from 14 to 20 mm rope is spliced on to the side of the top panel at the end of one of the cross members.

The target species and operation of these traps are similar to those described for other finfish traps.

Figure 34
Collapsible finfish trap (Australia)



All frames are constructed from 6-10 mm diameter steel bar
Trap is covered with chicken wire, welded mesh or prawn netting

Pelagic fish traps. These are illustrated in Figure 35. Although they are not yet widely used, these traps are effective in some areas for taking pelagic fish. They work on the same principle as a fish aggregating device, by attracting pelagic fish to the "protection" that they provide.

The trap illustrated in this manual is used in southern Australia to take mid-water fish such as king fish, rainbow runners, trevallies and jacks (*Carangidae*). It is constructed in the same manner as the wooden trap but without the weights. In addition, a marine ply roof is fitted to the trap and painted black. The shade created by this roof lures the fish into the trap for shelter, so no bait is needed.

The method of setting these traps is shown in Figure 35. When the trap is hauled up, it is tied to the side of the vessel and fish are taken from it with a scoop net before it is brought on deck.

North Atlantic tusk and cod pots. Tusk or torsk (*Brosme brosme*) have been caught in pots off the Norwegian coast for a number of years.

Norwegian technologists have developed an effective pot for taking live cod, following a recent trend for fishers to take these fish for the high quality of the end product. A requirement for an alternative to gillnets has helped the development.

The pot has two chambers and is somewhat larger than the traditional tusk pot. It has two fairly wide entrance funnels leading into the lower chamber, with a narrow entrance leading to the upper chamber (Figure 36). A bait bag or saver is fixed in the lower chamber between the two funnels. The pots are baited with squid and set on a string or longline at depths varying from 50 to 300 m.

Figure 35
Pelagic fish trap

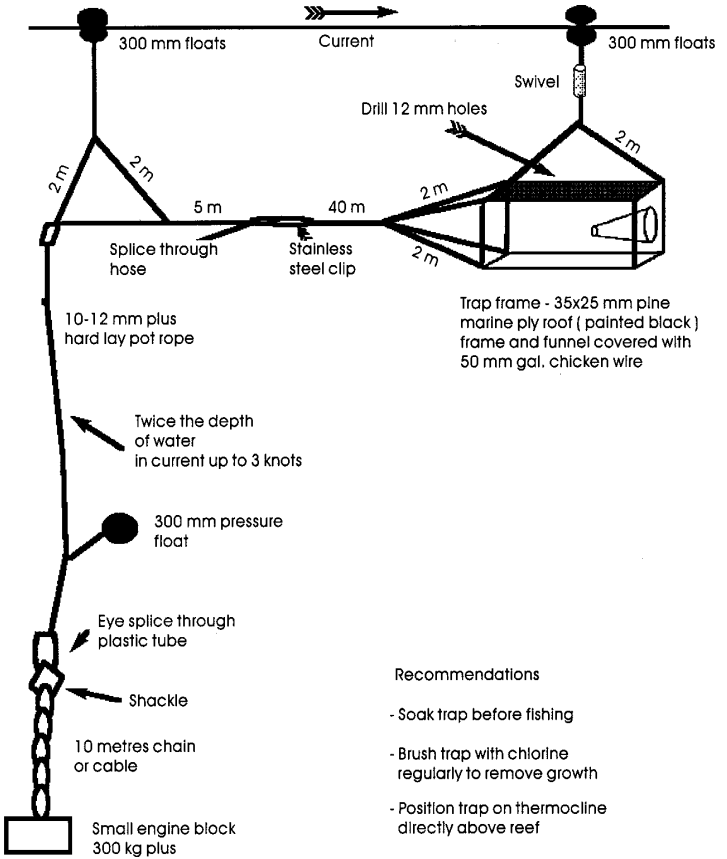
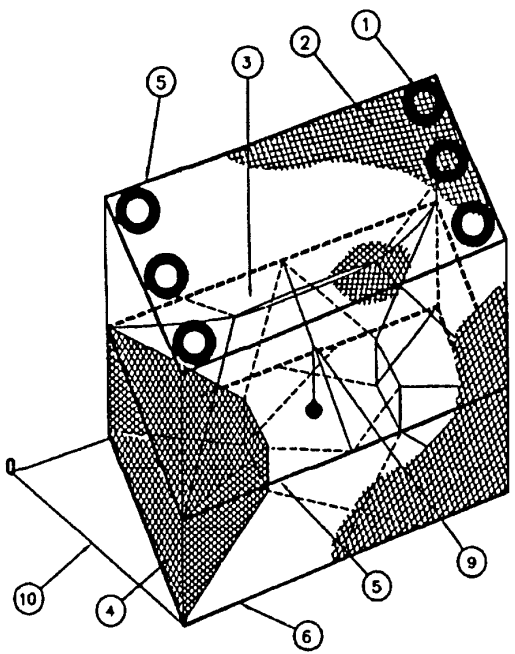
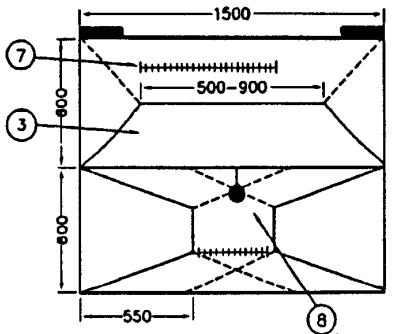
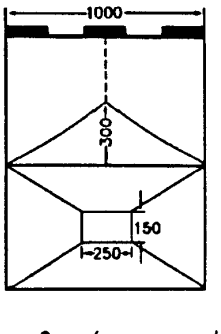


Figure 36
Norwegian two-chamber pot for cod







1. Float rosendal 205/46 extra
2. Main net: Nr. 14 EK 28.5 mm 1/2 msk. black
3. Inner entrance
4. Monofile 25 mm 1/2 msk. blanc
5. Aluminium frame 10 mm
6. Steel frame 12 mm
7. Zipper
8. Bait bag
9. Hook for bait bag
10. Rope with hook to be connected to the buoy-line

Plastic multipurpose finfish/lobster traps. A number of trap and plastics manufacturers are experimenting with multipurpose traps and they have been tried out in many fisheries. They are not considered in this manual as they cannot be constructed from readily available local materials and require expensive plastic moulding equipment.

Traps and pots to catch lobsters, shrimps, prawns, crabs and other crustaceans

Shrimp pots. The terms "shrimp" and "prawn" refer to different animals in different parts of the world: larger types being referred to as prawns and smaller types as shrimps. However, the common tropical shrimps (*Penaeidae*) are referred to as shrimps in most places. Temperate types (*Pandalus* and *Palaemon*) are usually called prawns. In this manual we will conform to this usage as far as possible.

Several types of pot are used for prawns in the northern Atlantic. The details of a square wooden pot to take prawns (*Palaemon*) from the English Channel are illustrated in Figure 37 and a round pot to take prawns (*Pandalus*) on the western coast of France is detailed in Figure 38.

The most successful commercial fishing method for tropical prawns and shrimps, both shallow- and deep-water, is trawling. Some preliminary experimental trapping of deep-water prawns (*Hetrocapus* spp.) has been carried out off Thailand (Figure 39), eastern Australia and some islands in the Pacific.

Recent experiments in northern Australia used a number of trap designs (Figure 40) for penaeid shrimp with little success.

Figure 37
Prawn pot used in the English Channel

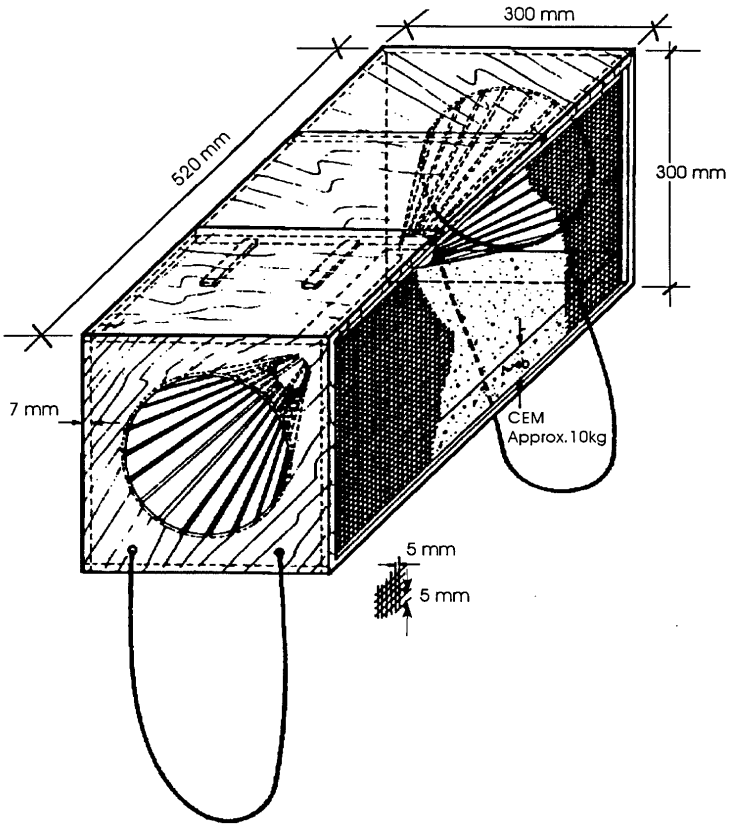


Figure 38
Shrimp pot used on the western coast of France

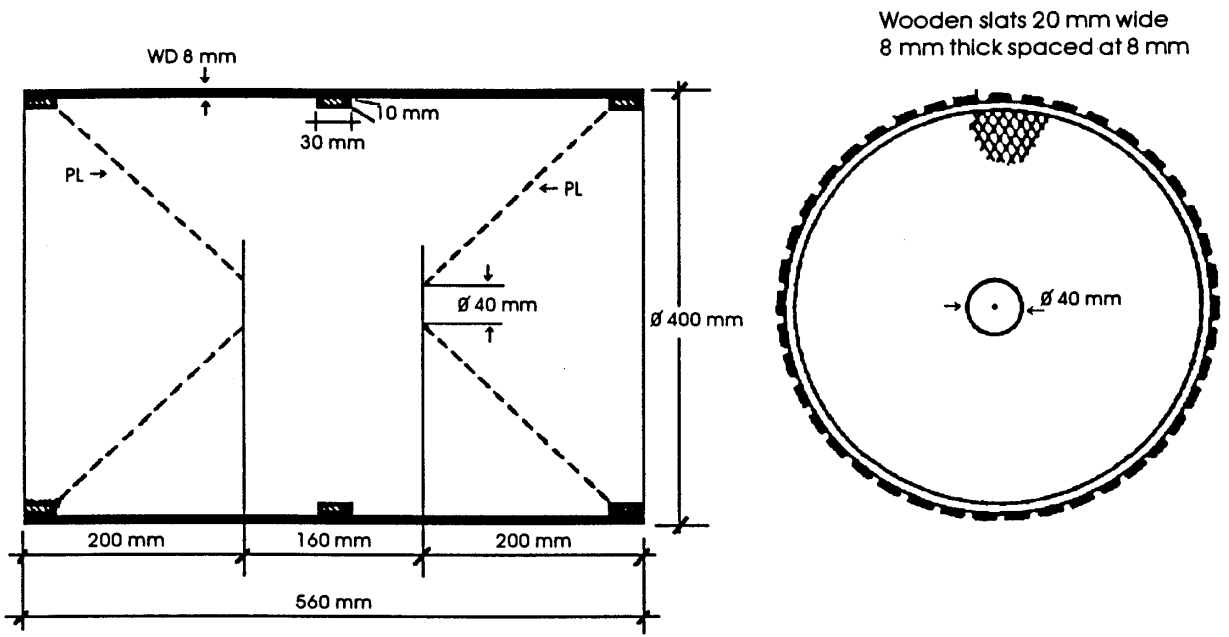


Figure 39
Experimental deep sea prawn pot (Thailand)

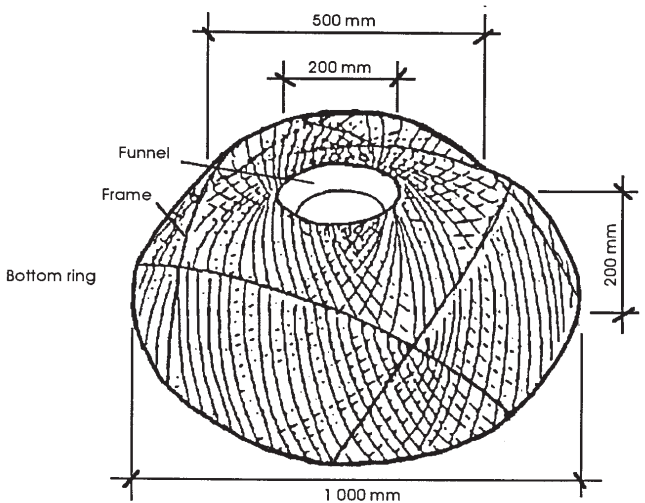
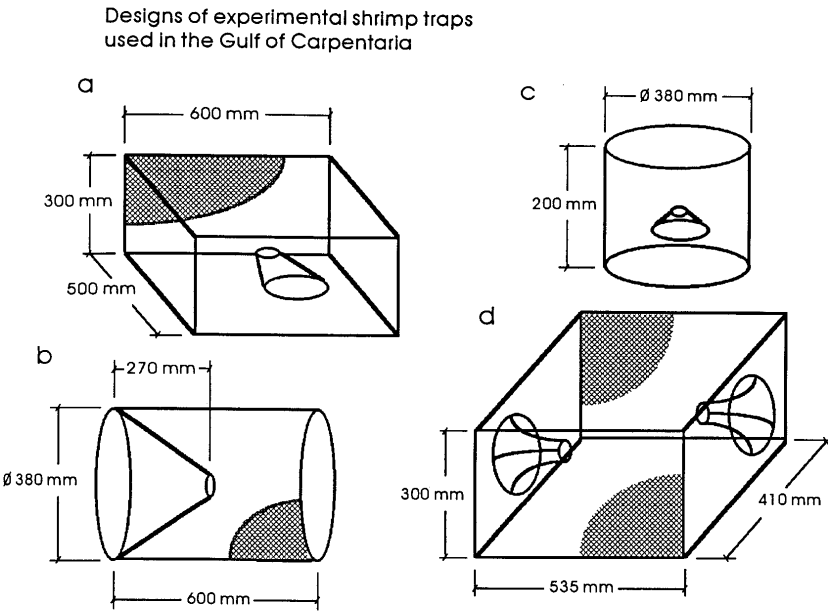


Figure 40
Australian experimental shrimp trap



Lobster and rock lobster pots. There are two main types of lobsters: temperate clawed lobsters (*Homarus*), and tropical and subtropical rock lobsters (*Panilurus*) which do not have claws.

In Canada and North America, lobsters are taken principally with pots that have wooden frames, although there is a recent move towards the use of plastic-coated metal. Canadian lobster pots are usually made from timber and are covered with 80 mm diamond mesh made from PARtex 1030 twine. The two funnels are also made from this mesh. The details of two common pots used in Canada are shown in Figures 41 and 42. Details of a pot made from plastic-covered metal are given in Figure 43. It should be noted that all these pots have the "bedroom and parlour" design.

Similar pots are used in North America and Europe. Beehive pots are also commonly used (Figure 44).

The two most common types of rock lobster pots are the beehive and the slat. Both rectangular and "D"-shaped wooden slat pots and beehive pots are used in the western Australian rock lobster fishery; a common design for a rectangular slat pot is shown in Figure 45. The beehive pots used in this and the southern and eastern Australian rock lobster fisheries are of similar design to those used in other parts of the world. In eastern Australia, "D"-shaped pots covered with wire mesh are also used (Figure 46). In New Zealand, rock lobster traps are made from welded mesh and require no internal frames.

The rock lobster fishery on the northeast coast of Brazil traditionally uses pots made from mangrove branches covered with chicken wire or synthetic mesh. The details of these pots (*covos*) are given in Figure 14 (p. 18).

In Nicaragua, rock lobsters are fished with pots made from 50 x 25 mm galvanized steel mesh with a funnel woven from cane or bamboo. The details of these pots are given in Figure 47.

Figure 41
Lobster pot (east coast of Canada)

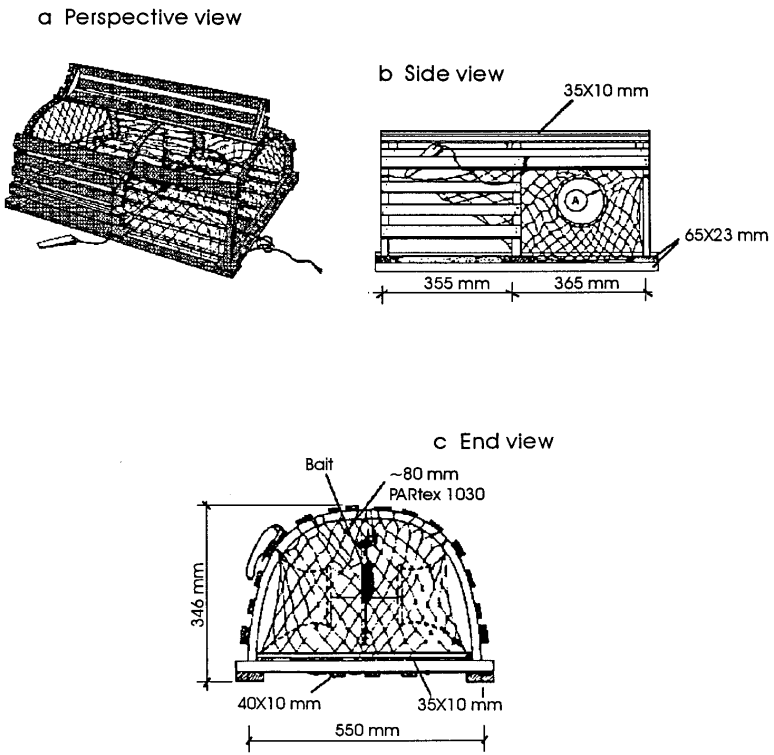


Figure 42
Lobster pot (east coast of Canada)

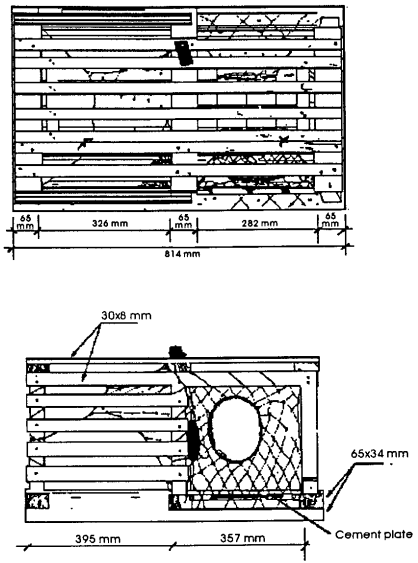
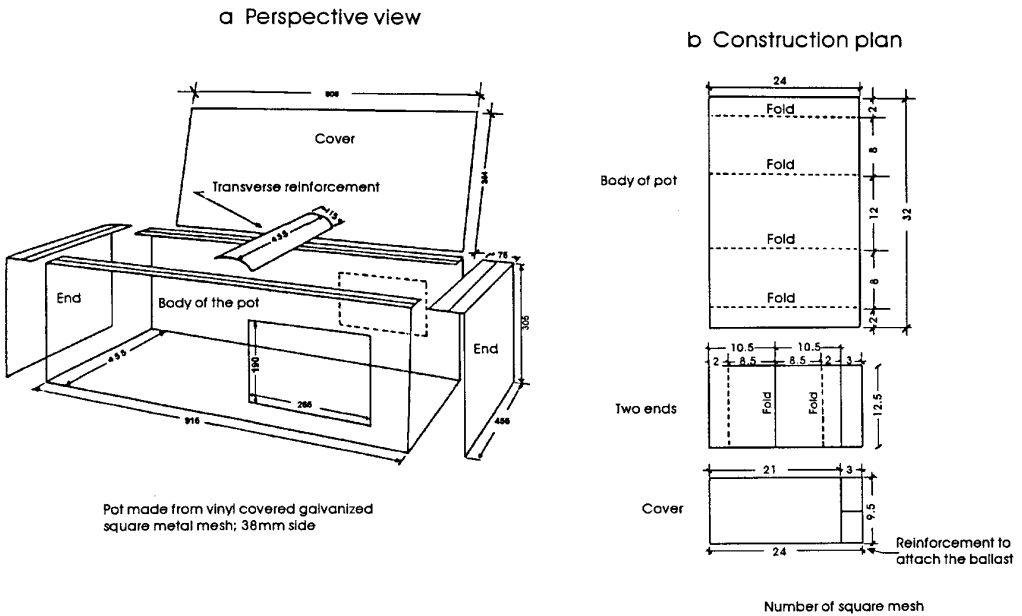


Figure 43
Canadian plastic-covered metal lobster pot



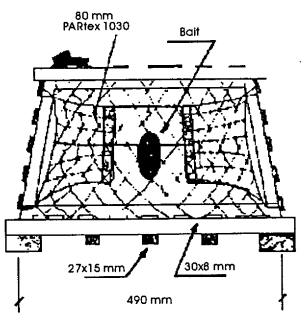


Figure 44
Lobster pot in plastic tube (Brittany, France)

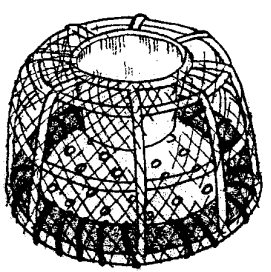


Figure 45
Western Australian batten rock lobster pot

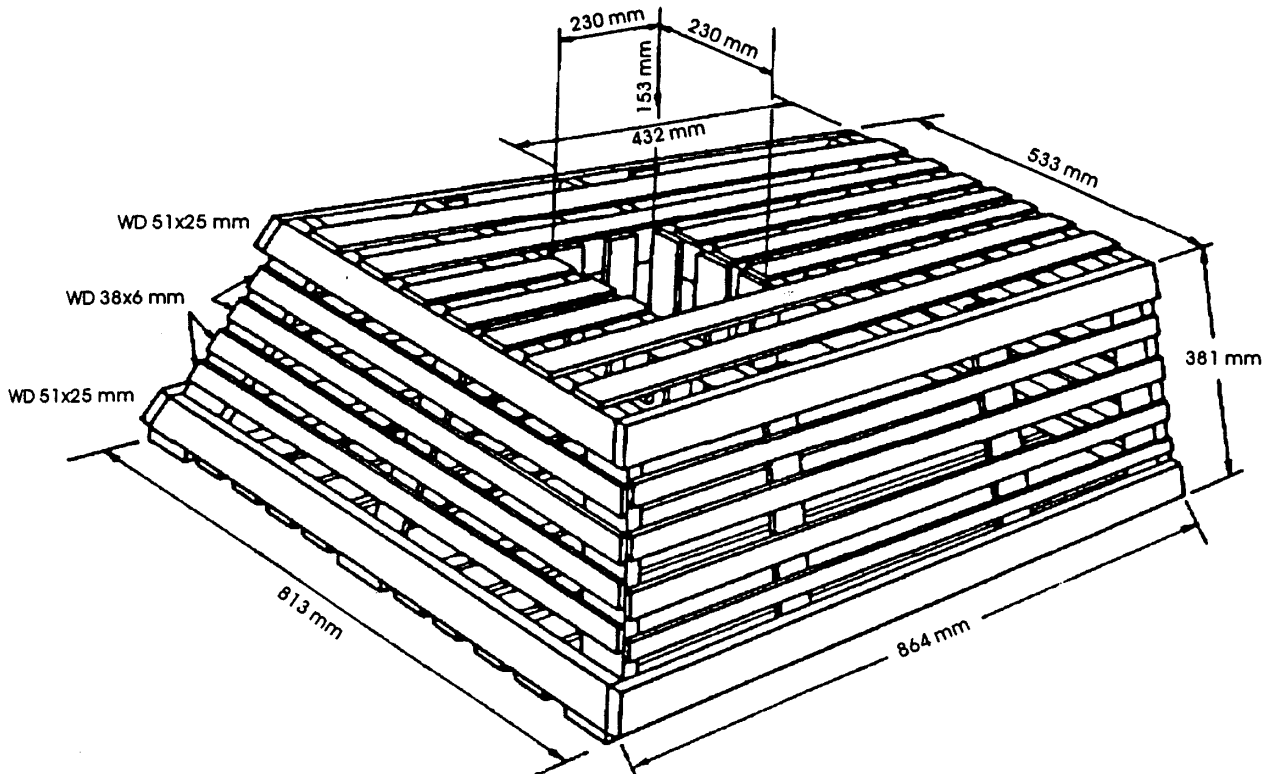


Figure 46
Eastern Australian wire netting rock lobster pot

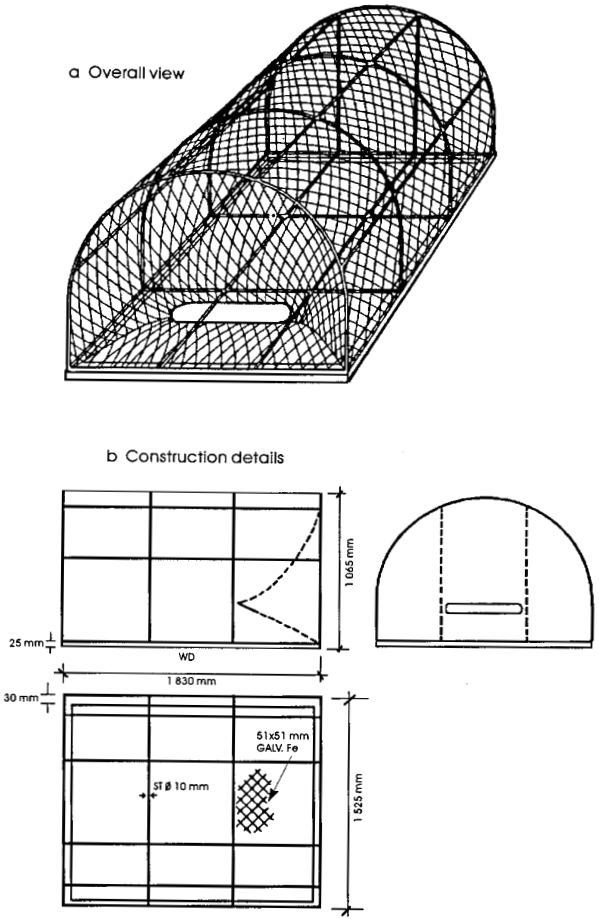
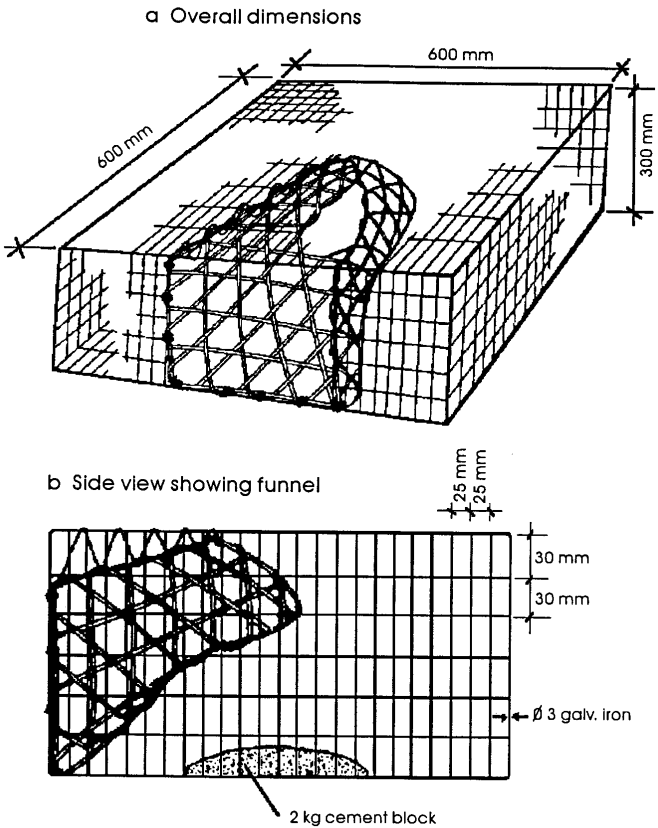


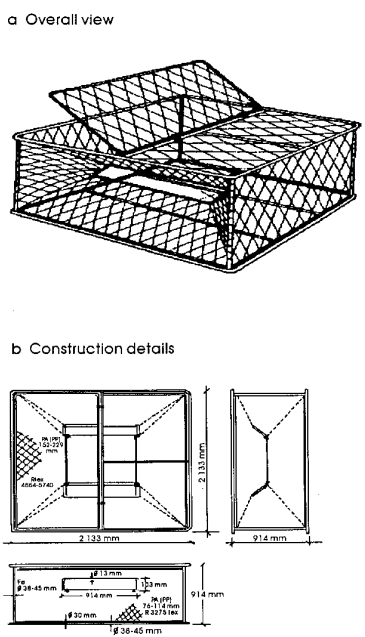
Figure 47
Rock lobster pots from Nicaragua



King crab traps. These are illustrated in Figure 48. Deep-water fishery for king crab in the northeastern Pacific and the eastern Bering Sea is carried out with large pots constructed from galvanized steel with frames of 213.3 x 213.3 x 91.4 cm. The frames for the funnels are also made from galvanized steel. The pot is covered with 152 to 229 mm polypropylene mesh and the funnels are covered with 76 to 114 mm mesh.

Swimmer crab pots. Estuarine and oceanic swimmer crabs provide an important fishery in some tropical and subtropical areas. Although the crabs are often taken by hand or with hand nets, potting is also an important fishing method. As crabs are generally not large and not very active swimmers, crab pots are small and simple in design. Crab pots can be shaped from wire netting or constructed from welded mesh. In some places a metal hoop with a strong synthetic mesh laced on to it is used. Such pots (sometimes called "dillies") are set with bait in the centre and hauled quickly so that the crabs cannot escape during hauling.

Figure 48
King crab pot



In northern Australia, mud crabs (*Scylla serrata*) are taken with a specially made trap, which is known locally as a pot (Figure 49). These are typically 600 x 700 x 200 mm and made from 50 x 75 mm galvanized wire welded mesh without a supporting frame.

To make the pots, a rectangular piece of mesh 1 800 mm long by 600 mm wide is cut for the top, bottom and sides of the traps. Two additional pieces of 700 x 200 mm are then cut to make the end of the trap. When cutting the mesh, leave the ends of each wire long, so that they can be twisted to secure the top and ends of the pot. The funnels are made as a straight oval from 15 x 15 mm square plastic mesh (sometimes known as "gutter mesh"), the oval being 225 mm wide by 100 mm deep, i.e. 3 x 2 meshes in the wire. As crabs' bodies are wider than they are high, these funnels are flattened to approximately 80 mm high at the inner end. Sometimes a ramp is placed up to each funnel to make it easier for the crabs to walk up. This ramp also places the funnel entrance above the crabs when they are inside. This shape will also discourage the entry of unwanted fish. A 300 x 200 mm door is placed in the back of the trap to make emptying easier. Access to the bait boxes or bag can be made easier by placing an opening on the bottom of the pot (Figure 50).

Depending on the tidal range where they are set, crab pots are rigged with approximately 7 m of rope and 10 cm (4 inch) buoys to mark their location.

Figure 49
Northern Territory (Australia) mud crab pot

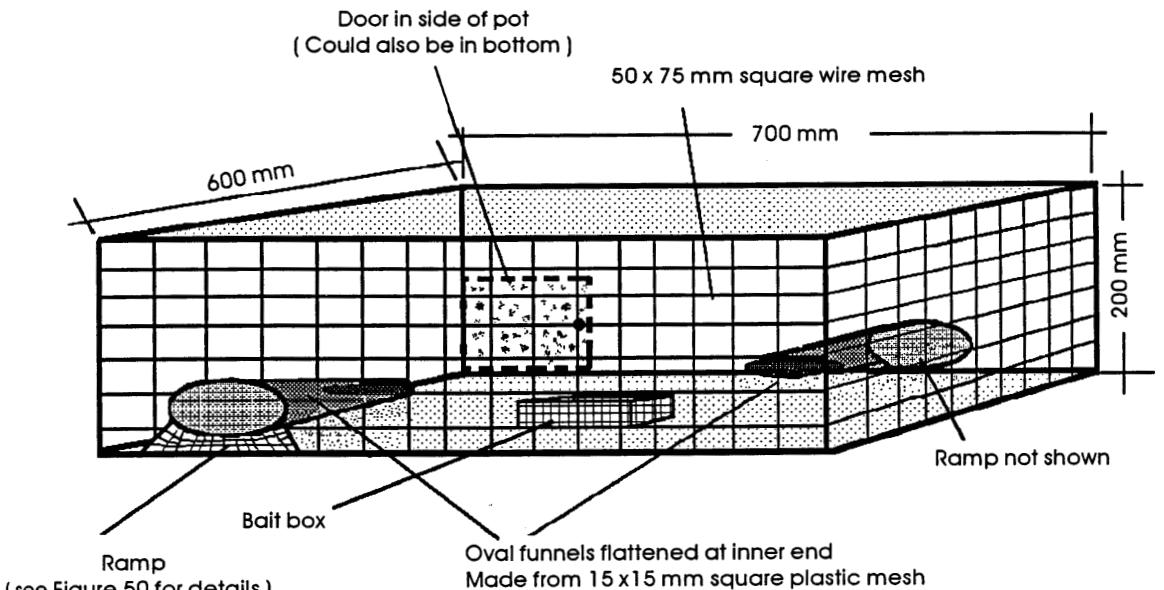
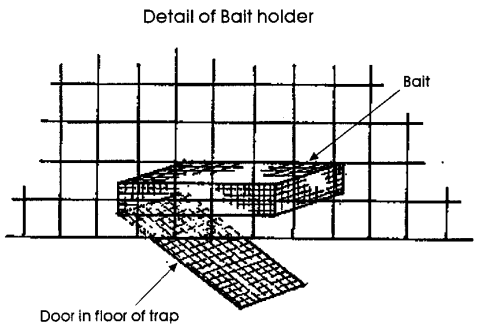
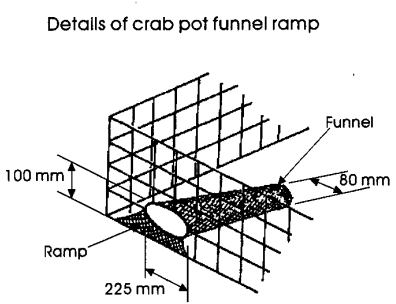


Figure 50
Bait holder and funnel ramp for crab pot

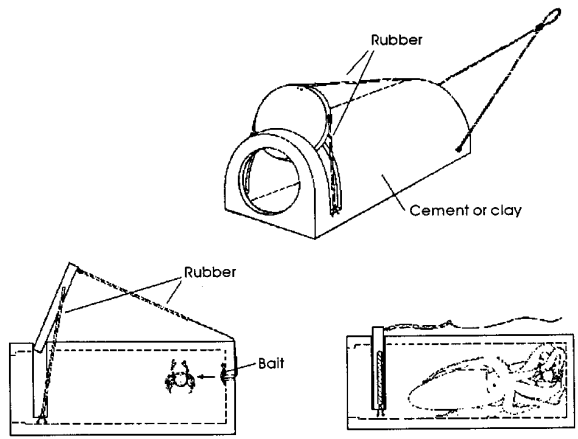




Octopus, squid and cuttlefish pots and traps
Although most squid and cuttlefish are taken with fishing gear other than pots and traps, some quite effective simple traps are used in several parts of the world. Octopuses are traditionally caught with traps as well as by hand.

Octopus traps. Unglazed earthenware pots are used in traditional octopus fishing in the Mediterranean and southeast Asia. The pots are placed on the sea bed for octopus to use as shelter. They differ in size and shape depending on the size, type and behaviour of the octopus being targeted. Although earthenware pots are traditional, you can also use other materials such as plastic piping, steel piping, old motor tyres and large empty mollusc shells to make traps for octopus, as they will enter almost any receptacle that can provide shelter (Figures 3c and 3d, p. 3, and Figure 51).

Figure 51
Baited octopus trap from Japan



Across the world, both baited and unbaited octopus and cuttlefish pots and traps are used. An example of a baited trap is shown in Figure 51. This Japanese trap is made from concrete or clay and has a door of stretched rubber that springs across its entrance when the octopus pulls on the bait. A type of unbaited trap used in Venezuela and Japan is shown in Figure 52.

Another kind of octopus trap can be made from two 50 cm long pieces of 150 to 200 mm diameter PVC piping lashed or bolted together lengthways. A flat concrete block is bolted into the centre of each pipe (Figure 53). These traps can easily be modified to include a door at each end of the tubes. The doors are connected to a bait inside the PVC pipe in such a way that when an octopus enters the trap and pulls the bait, the door closes behind it.

Pairs of tubes are attached to a buoyed main line and set in lines on the bottom.

Old tyres cut into pieces and split lengthways can also be used to make effective octopus traps. Figure 54 gives details of a way to make these traps. It has been reported that the rubber on the outside of the tyres peels off over time but, as old tyres cost little, they can be replaced regularly. These traps are set in the same way as the PVC piping traps and the earthenware pots.

Octopus pots are normally set overnight attached to longlines with up to 100 pots on each line. They are hauled back up in the morning. The number of traps on each line depends on the extent of the grounds and the size of your vessel.

Figure 52
Unbaited octopus pot from Japan and Venezuela

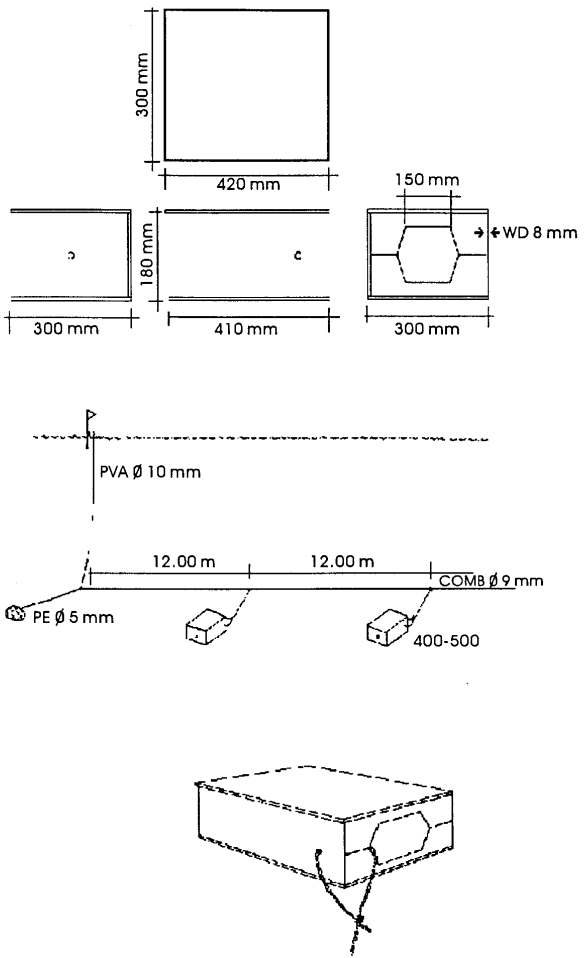


Figure 53
Unbaited PVC pipe trap for octopus

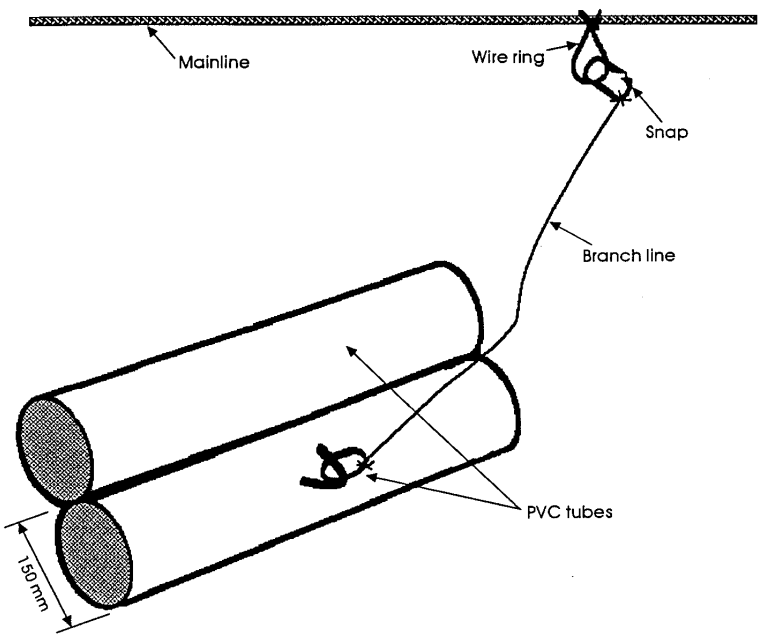
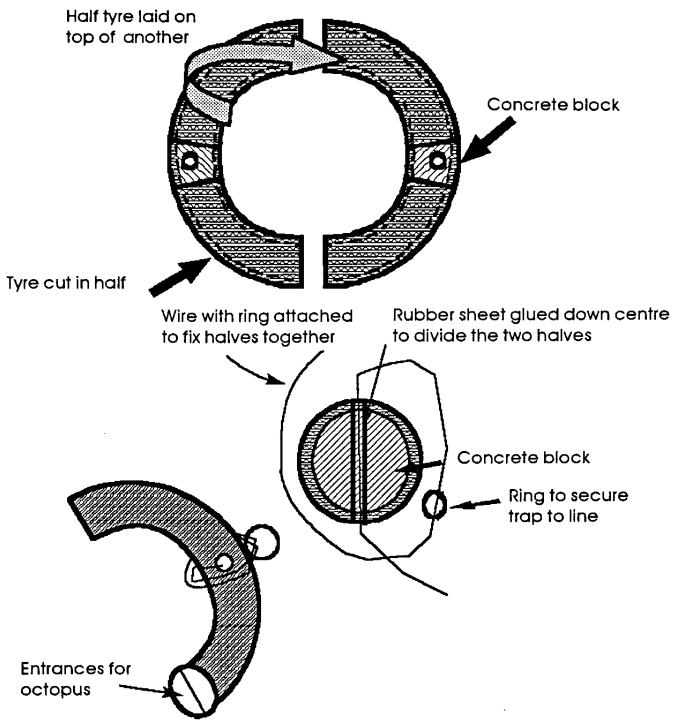


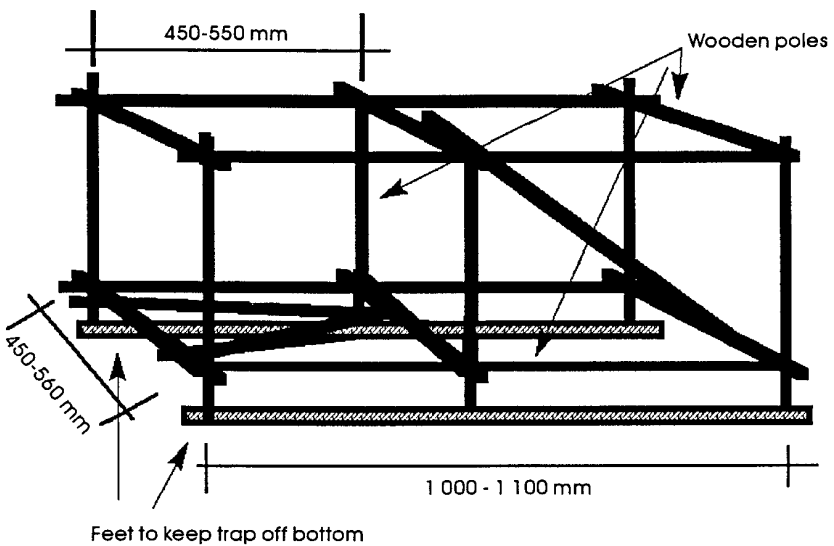
Figure 54
Octopus trap made from old tyre



Squid and cuttlefish traps. Several types of squid and cuttlefish traps are used in Southeast Asian countries. A rectangular Indonesian trap is described in detail in this manual.

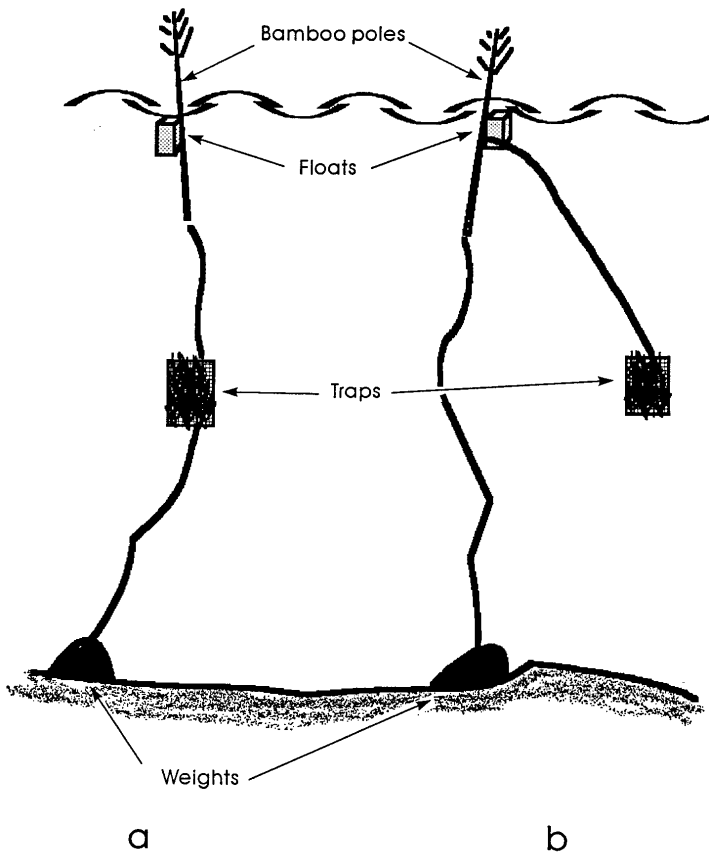
This rectangular trap is 100 to 110 cm long and 45 to 56 cm square at the ends. The frame is made from small wooden poles lashed together (Figure 55). This is then covered with PA 210/18 4.4 cm mesh. The funnel follows the two inside poles

Figure 55
Wooden frame for an Indonesian trap for squid



and is no wider that 35 cm at the inner end. When the trap has been completed, it is covered on the top and bottom with coconut or similar leaves. The traps are rigged either on a single line or on a double or side line (Figure 56). Squid eggs are used as bait for both squid and cuttlefish, but sometimes white plastic bags or broken white china are used instead. The trap should be set about 2 to 3 m from the sea bed, taking care not to allow it to touch the bottom.

Figure 56
Rigging of cephalopode Indonesian trap



7. SELECTION OF FISHING GROUNDS

BOTTOM SPECIES

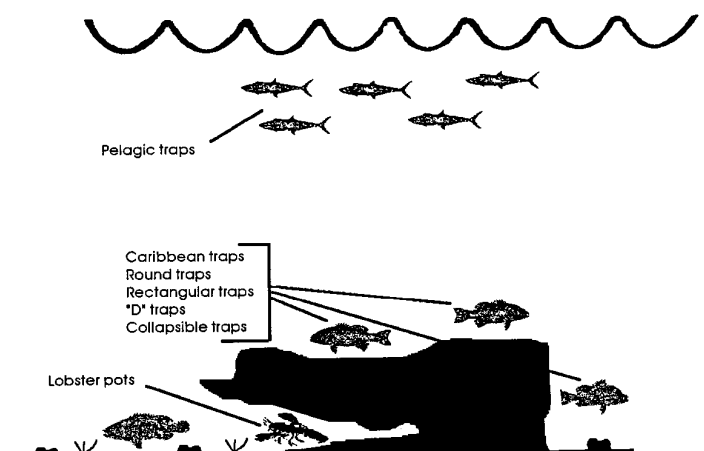
The selection of the type of trap to use will depend on the types of fish that you want to catch, where they live and how they behave (Figure 57). When you have decided on the fish you wish to take, you should then find out the type of bottom they prefer, their preferred depth and how they behave on the bottom. For example, if you live in a tropical area where there are reefs and you have decided to catch tropical snappers, you need to find out if they live in reef areas or in open water and at what depth. If the snappers live in reef areas, which they often do, it would help your proposed fishing operation if you knew whether they live near, under or over the reef. If other fishers in the area have used different gear such as handlines or nets, they may be able to give you some information on where the fish gather. If there has been no previous fishing, then look at the way similar fish living in other areas behave. Once you have a general idea of where they live, you can carry out your own tests with different traps and pots to find out the best ways to catch them.

When you know where your target fish or crustaceans can be caught and that they can be caught with traps or pots, you need to find out where to place the traps or pots on the bottom so that they have the best chance of getting good catches without being seriously affected by tides and currents. To place your traps or pots in the best fishing area, it is important to note the currents in the area and make allowances for them (Figure 58).

Trapping and potting fish, crustaceans and molluscs that are evenly distributed over the bottom is a special challenge. If you do not have any information on the bottom types that they prefer, how or when they migrate or their preferred food and/or shelter, it is very difficult to work out the best way to catch them. Again, it may be possible to find out about your target fish in other areas and use this information to carry out fishing tests in your area.

The key to successful fishing with pots and other gear is to develop the capacity to think as your target fish do, which means really knowing and understanding their habits, migrations, movements, feeding habits, etc. This capacity, once developed, will not only help you to find your target fish but will also allow you to make changes to your traps or pots that will increase your catch or the size and value of the fish or crustaceans that you take.

Figure 57
Diagram showing different traps to use



Considerable differences will be observed regarding living areas and conditions, feeding habits and behaviour of the targeted fish, crustaceans and molluscs. Shrimps and prawns, for example, normally live in burrows in sand or mud, away from reefs and rocks. There must be sufficient food for them in these areas to keep them there. Octopuses live in fairly open areas but need holes for shelter and an abundance of food. Commercial lobsters and rock lobsters normally live in cavities in or under reefs when they are not migrating to new locations, but they congregate where there is plenty of their preferred food.

In selecting your fishing area, you should look at how heavily it has already been fished and whether the numbers of fish have built up again after past fishing by either yourself or other fishers. Reefs, especially, should not be fished too heavily, as this will increase the time needed for recovery. Many reef fish grow quite slowly and if the numbers are reduced too drastically, a reef may take years to recover.

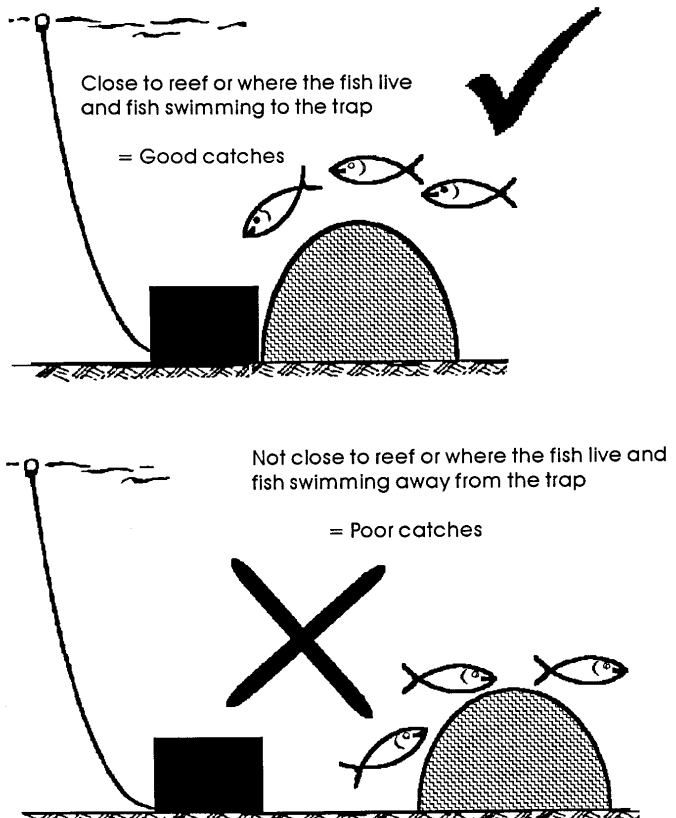
MID-WATER AND SURFACE SPECIES

Many of the things you need to know about locating fish that live in mid-water or near the surface are similar to those for bottom species.

Most free-swimming fish species (known as pelagic species) tend to congregate around floating objects or above objects such as reefs on the sea bed. Feeding sea birds are normally a good indicator of where pelagic fish are congregating. In shallow waters, if your fishing grounds are generally flat and pelagic fish normally swim past, it is possible to place objects on the sea bed to entice them to stay in the area. Alternatively, fish-aggregating devices placed in mid-water or on the surface can be used to concentrate these fish.

Figure 58

Setting traps near reefs or where the fish live and in the direction they swim to



8. THE FISHING OPERATION

RIGGING

Once a pot or trap has been constructed, it must be prepared for the fishing operation. Buoys or floats will mark the location of the pot, so buoy lines and bridles must be attached to the trap or pot for setting and hauling. Appropriate rigging is also important to ensure that the pot or trap lands the right way up on the bottom. The length of the buoy line will vary with the trap type, the tidal range and currents in the fishing area. The usual length of the buoy line is about one-and-a-half times to twice the water depth being fished, but may be greater if there are strong currents. Floats or buoys are attached to the line so that you can find your trap or pot again and pick up the buoy line to remove the catch. The size of buoys or floats varies with the depth and current. Flags, radar reflectors and radio beacons are sometimes attached to buoys to make them easier to find. The knots used to attach floats and traps to ropes must be simple and stay intact. Working with rope and tying knots are not covered in this manual, as other FAO manuals cover these topics in some detail.

Depending on the fishery, traps and pots are rigged to fish on individual lines (Figure 59) or are linked to a main line on the bottom with a buoyed line and an anchor at one or both ends (Figure 60). Such arrangements are called setting "in line" or "in row", or sometimes, setting "in gangs".

Figure 59
Rigging of traps – individual

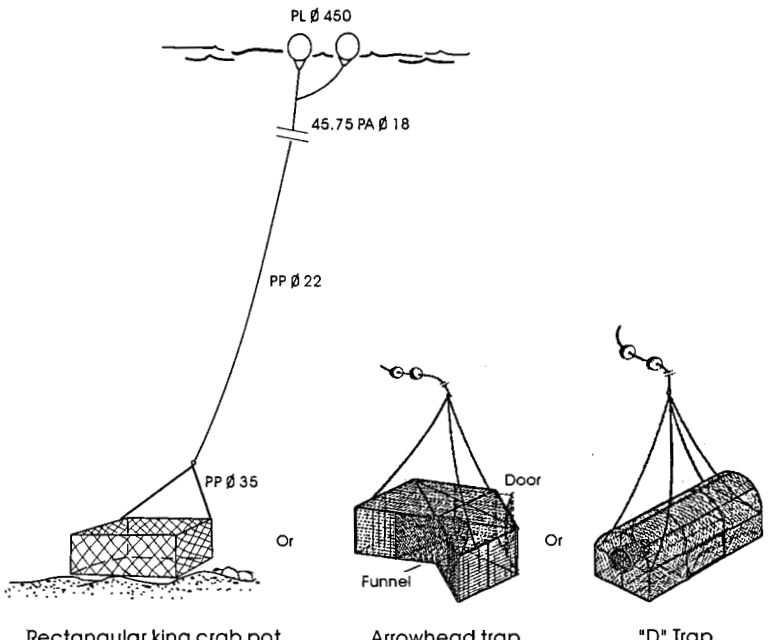
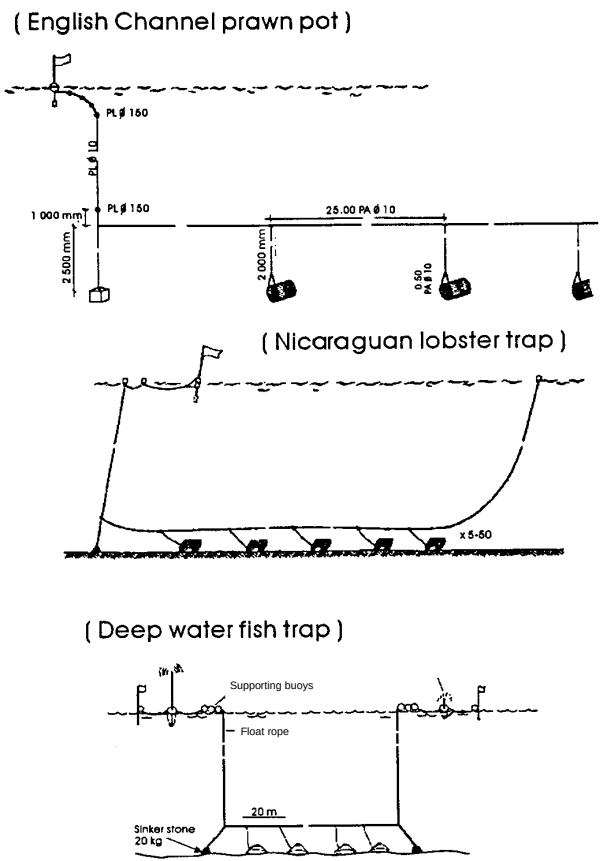


Figure 60
Rigging of traps – in line or row



BAITING

As stated earlier, some traps and pots (e.g. eel traps, octopus pots, pelagic traps and some Caribbean traps) do not require bait for their operation but attract fish by appearing to provide shelter. However, in most cases the placing of bait in the trap or pot gives an added reason for the fish to enter.

The relationship between the funnel and the positioning of the bait is critical in getting good catches. The bait has to be positioned so that a fish entering to take it cannot back out through the funnel or find the funnel exit and escape. Depending on the type of fish being targeted, the bait is placed off-centre from the funnel and well to the back of the trap. However, it is important not to place the bait so far towards the back that fish are attracted away from the funnel. The best position for the bait in the trap or pot can be found by trial and error or by following the indications given with the trap or pot design. It is important to use bait that is attractive and to place it in the trap or pot in a way that reduces escape. To achieve this, try to imagine how the target fish react.

Solid baits (e.g. whole fish, animal bones) are often secured directly in the capture chamber. Bait in small pieces (e.g. pilchards, chicken heads, minced fish) is usually placed in a small container or bait box (Figures 4 and 5, p. 4 and 5 and Figure 49, p. 44) made from wire or nylon mesh, or in plastic or metal containers (bait savers) that are perforated to allow the odour of the bait to escape.

Some unusual baits have sometimes proved to be quite effective in certain fisheries.

These include papaya wood, porous bricks soaked in fish oil and even shiny stones. If you do not have any conventional bait available it is worth trying some of these unusual baits. As a general rule, bait made from fish, especially oily fish, is the most reliable and effective.

A good bait is:

- effective at attracting the target fish;
- easy to secure in the trap;
- long-lasting;
- freely available when needed;
- not excessively expensive;
- easy to preserve and transport.

SETTING

A key factor in successful fishing with traps and pots is the location in which you set them. This positioning will depend on the types of fish you are targeting. It is very important that you develop the capacity to understand how the fish will react to your trap or pot. For fish that live under reefs or rocks and do not venture far from their shelter (e.g. rock lobsters, tropical cod), you must place the trap close to where they are sheltering. Some types of fish (e.g. coral trout, trevallies) swim over the tops of reefs and rocks. In these cases, taking into account the tide and current, the location of your trap is critical and may make the difference between a good catch and no catch (Figures 58, 61 and 62).

Other fish and crustaceans live in burrows in the sand or mud. In this case it is important to set your pots or traps in areas where there are the greatest concentrations of the animals and where any current will not carry the smell of the bait away from your target.

In cases where your target fish are attracted to the trap or pot for shelter, you should find out where they spend most of their time and where they are likely to seek shelter.

Traps and pots should not be set so close to each other as to affect individual catch rates. The distance between traps and pots depends on the bottom type, the number and distribution of your target fish in the area, the attractiveness of the bait and the size of the trap or pot. There is no easy way to find the best distance and so you will need to experiment by seeing whether the catch rate increases or stays the same as you set the pots further apart.

The location of the traps and pots is marked with a buoy attached to the hauling line. Where there is a possibility of theft or when the gear is set in an area where there is shipping traffic, you might not be able to use surface buoys. In this case, you will have to locate traps by using triangulation with land or sea marks and you will have to retrieve the pot using a grappling hook dragged along the sea floor.

If the setting comprises several pots or traps attached to a single line, a larger float is usually placed at one or both ends and marked with a flashing light. If the location is away from land, a radar reflector or a radio beacon may be attached to the buoy to make it easier to locate.

Figure 61
Setting traps near reefs against the tide

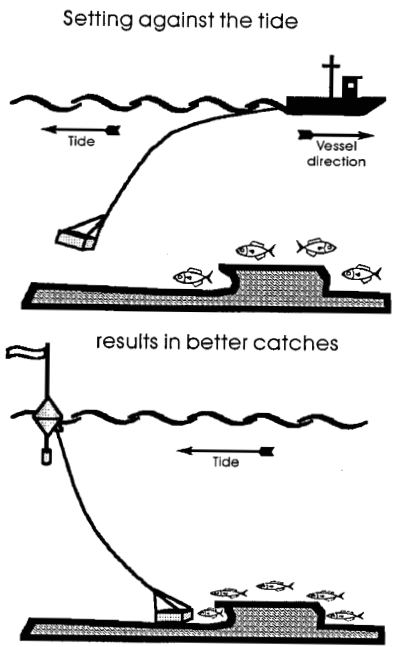
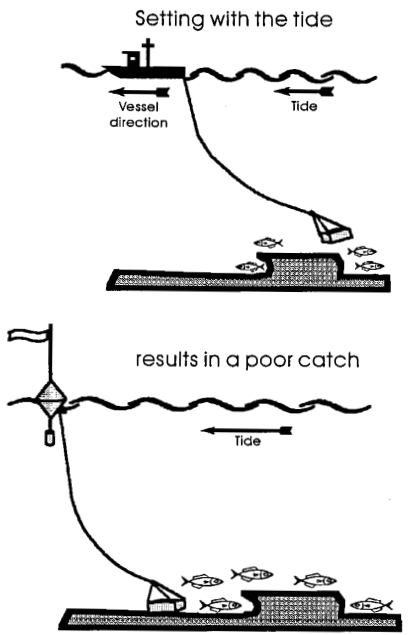


Figure 62
Setting traps near reefs with the tide



SOAK TIME

As with many aspects of trap and pot fishing, fishing time will vary with the target species and their behaviour. Some fish feed actively only at night so, if you are using baited traps, night fishing is indicated. Other fish feed mainly during the day and can only be taken during daylight. Unbaited traps and pots such as the pelagic fish trap (Figure 35, p. 34) and those used in the Caribbean should be set for short periods at times when the target fish are seeking shelter.

The duration of each set will also vary with the behaviour of the target fish and the durability of the bait. When fish are feeding very actively, the fishing time of each set may only need to be a few minutes. Some tropical snappers off northern Australia can be taken in only 30 minutes between setting and hauling. In other fisheries, the soak time may be several days depending on the fish and conditions. It has been found in the Caribbean that a soak time of two to three days is usual and that after four to five days the catch may actually decrease, possibly because the fish learn how to escape from the trap.

Normally, depending on local conditions, traps are hauled every one to three hours in shallow waters, while at greater depths they are frequently set for longer.

In some areas, new traps and pots are soaked in the water for some time before they are used for fishing to eliminate any foreign odours coming from the materials used or, in the case of cane and wooden pots, to eliminate any trapped air.

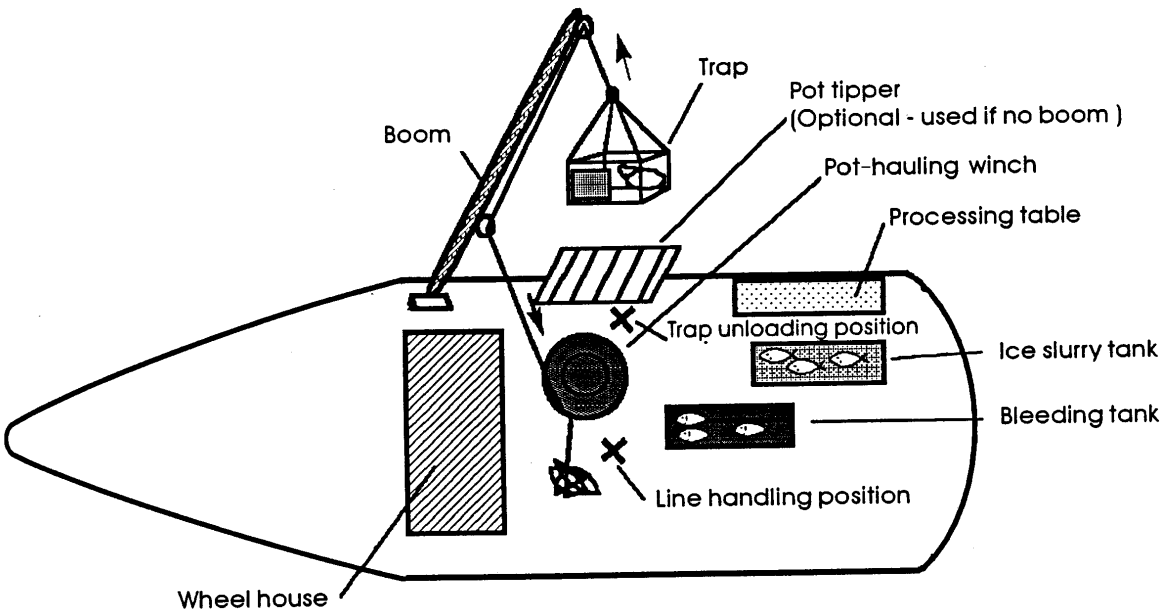
As with other fishing gear, special care must be taken to reduce the number of traps and pots lost during fishing operations. The replacement of those lost can be a financial drain on your operation. In addition, the lost gear may continue to attract fish for days or months, which is wasteful and reduces fish stocks without any return. In some fisheries, legislation has been passed to make it obligatory for fishers to design their gear with a section that will corrode quickly and make an opening for fish to escape from lost pots.

HAULING

Once the traps or pots have been found and the hauling line secured, they are hauled aboard and emptied. Hauling may be done by hand or by a mechanical hauler. In the case of hand hauling, the gear is usually brought alongside and the trap emptied. If it is to be set in the same location, it is rebaited (if bait is being used) and replaced in its location on the bottom. If the gear is to be shifted to a new location, it is hauled on board after the catch has been taken out and stored until the next set.

Modern trap and pot vessels usually have a mechanical pot hauler fitted and a pot tipper on the gunwale (Figure 63).

Figure 63
A pot hauler and tipper



9. CARE OF THE CATCH

If the catch is not needed by your family and is to be sold, it is very important to preserve it in a way that is required by customers. Preservation will vary according to:

- the time and distance from catching to the point of sale;
- the climate;
- the value of the fish.

There is always an advantage in landing fish in the best possible condition, but this must be balanced against the cost of producing this quality. There is no point in landing fish that are in first-class condition if you are spending more to do so than the value of your catch.

In tropical waters, if you want to produce fish of high quality for market, it is important to take special care of your catch. A set of guidelines to ensure that the fish you land are in the best condition possible is set out below. These guidelines are also applicable to catches in temperate areas.

TRAP AND POT CATCH HANDLING GUIDELINES

Removal of the catch from the trap or pot

Fish landed from traps and pots are usually very lively and should be taken from the gear as quickly as possible and immediately placed in a large container of fresh seawater. This helps to calm the fish and reduces bruising to the flesh. If fish are landed straight on to the deck they may thrash around violently, causing bruising and scale loss. A gaff should not be used to handle the fish as the injuries provoked will encourage spoilage.

A false bottom or a bag of nylon prawn mesh can be fitted to steel traps to further reduce bruising and scale loss.

Processing your catch

To obtain the best quality of product, fish should be processed immediately after capture or as soon as possible. If they are not processed immediately, they should be kept cool using ice, ice water or brine in a wet bag, or at least in the shade, protected from direct sunlight.

To ensure high quality, it is advisable to bleed or spike and bleed fish as soon as they are removed from the trap or from the seawater bin. Effective bleeding will reduce discoloration of the flesh, the start of spoilage and bruising. It can be done by cutting the gill rakers or a main artery. While fish are being bled, they can be either held in seawater contained in plastic bins in the shade or immersed in an ice slurry. The use of an ice slurry is the preferred method.

The best slurry can be made from four parts of freshwater ice mixed with one part of fresh seawater. Slurries should be maintained as close to freezing (0°C) as possible, but not below, as partial freezing will occur and bleeding will not be as effective.

It has been found that partial freezing (between -1°C and -6°C) will encourage spoilage. This makes it important not to add salt to the slurry, as this will make it freeze. Tests have shown that excessive soak time in the slurry will cause bleaching of the skin, especially in red fish, and cloudiness of the eyes. In tropical areas, if you bleed your catch in an ice slurry, fish of less that 1 kg should be processed within one hour of being placed in the slurry. Fish larger than 3 kg can be left for up to two hours.

Spiking, or *iki-jime*, will kill the fish instantly and prevent the stress conditions that occur when the fish is left to die in the normal way. There are two main *iki-jime* methods: from the top of the head or through the gill cover (Figure 64). The first method is used for most medium-sized fish where a sharp

spike is driven into the brain from the right side of the head. The position of spiking is diagonal and about 2 cm behind the eye. Smaller fish can be spiked through the gill opening with a sharp knife (Figure 64). This will both spike and bleed the fish. The aim of both methods is to destroy the hind brain of the fish, which is the part of the brain controlling movement. Another *iki-jime* method is to open a hole to the spinal cord of the fish and pass a stiff nylon fibre down the cord.

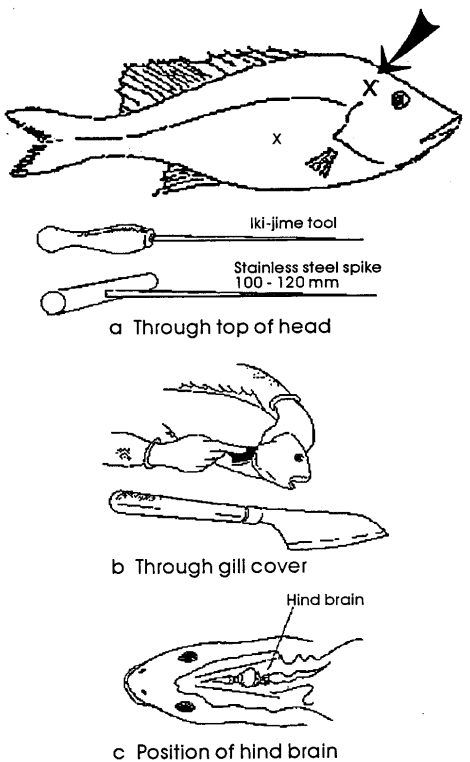
Spiking can significantly decrease spoilage if combined with rapid chilling. Spiking is only effective if the fish is alive when it is carried out.

If your market requires gilled and gutted fish, these operations should be carried out as soon as possible after bleeding. All gills, internal organs, gut contents, air bladders and the blood line along the backbone (equivalent to the kidney) should be removed completely. Care should be taken not to cut or damage the inside skin of the gut cavity or to spill gut contents on to any cut surfaces, as this will make the fish spoil more rapidly. A stiff brush or a high-pressure spray can be used to remove the blood line. All excess slime and blood should then be washed from the fish. If necessary, the fish should be placed in a clean ice slurry for a short time to make up for any rise in temperature during processing.

A similar washing and icing method should be used when your market wants good-quality whole fish. Care should be taken not to mark or injure the fish during the washing and cleaning process.

Scales are not usually removed from gutted or whole fish, unless the market requires their removal.

Figure 64
Spiking or *iki-jime* methods killing the fish instantly



Icing and storing

The cleaned fish should then be packed in ice ready for transportation to market. A good way to pack fish in ice is to use the "soldier" method, in which they are packed in freshwater ice in boxes or the insulated hold of your vessel, with the belly downwards or upwards (Figure 65). Saltwater ice is not recommended as its melting point can be as low as - 6°C, which can cause partial freezing of the fish.

To chill fish effectively it is important for the ice to be in contact with as much of the surface as possible. Contact between fish should be avoided, as this can cause discoloration.

If the fish are to be landed whole, it is especially important that they are cooled as quickly as possible, so that the internal organs do not start to rot or liquefy.

If the catch is filleted on board, it is still necessary to cool the fish prior to processing so that the quality of the flesh is maintained. After the fillets are removed, they should be thoroughly washed in clean water prior to icing or freezing.

When it is possible, freezing on board is the most effective way to preserve your fish catch, although there is some loss in the quality of the landed product. Whole fish or processed fish can be kept in good condition without serious deterioration for many months if they are snap frozen and kept at temperatures at or below -18°C. However, the installation of a freezer on board is costly and is not possible on all vessels, especially smaller ones. In addition, other factors have to be considered before a decision is taken:

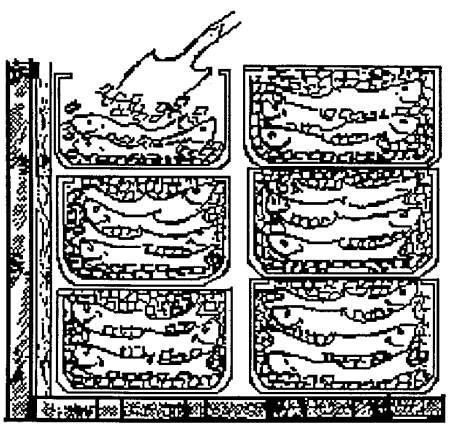
- many markets for high-quality fish give higher prices for fresh, unfrozen fish;
- operating the freezer will increase fuel costs;
- if the freezer does not operate correctly or at the correct temperatures, the product will deteriorate rapidly.

Unloading your catch

When your fish are unloaded for direct sale on the wharf or transportation to other markets, it is important to minimize temperature changes. Ideally, fish should be unloaded into a well-insulated, refrigerated transport vehicle, but as these may be scarce and are usually expensive, your catch should at least be well protected from the sun. Top up the ice when it melts.

If tropical reef fish are handled as set out above, they can be stored on ice for up to three or four weeks, depending on the species.

Figure 65
Soldier packing in ice



10. OTHER THINGS YOU NEED TO KNOW

In this manual we have not given details of other basic skills such as seamanship and navigation that you need to go fishing. We have only looked at trap and pot types, how to make them, how to use them and what to do with your catch. FAO has produced a series of other training manuals that tell you about bottom gillnetting, longlining, handlining and squid jigging, purse seining, pair trawling with small boats, the use of echo-sounders, etc. Basic instruction on subjects such as rope work, knots, net-making and mending and small boat maintenance are also provided in these manuals.

The last words in this manual on successful fishing with traps and pots are:

- learn to think as your target fish does;
- always look for better catches by experimenting with your gear.

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