

# **Fish Catching Methods of the World**

**Fourth Edition**

**Otto Gabriel**

**Klaus Lange**

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# Preface to the Fourth Edition

Even at the beginning of the new millennium there are an almost unlimited number of new ideas, tools and techniques for harvesting fish and other aquatic organisms. However this is not only due to the development of technical equipment (new materials, mechanized fishing techniques, modern fish detection equipment). Declining stocks, enormous quantities of by-catch and discard, and the negative environmental impact of towed fishing gear provide the impetus to concentrate on finding a more responsible and sustainable basis for commercial fisheries.

Therefore the special aim of the fourth edition of *Fish Catching Methods of the World* is not only to present the technical developments since the third edition of 1984 but also to highlight the problems of fish stocks and the connected marine environment and to illustrate some possible solutions to these problems.

The increasing importance of research and development is considered in two new chapters at the end of the book, as are the technical measures needed for the protection of fish stocks and the marine environment.

The team of revising authors responsible for the fourth edition – the late Dr O. Gabriel, Dipl.-Ing. K. Lange, Dr E. Dahm, and Dipl.-Biol. J. Wendt – all work in the field of fisheries research and are familiar with all the aspects of fishing described in this book.

It was the intention of the team not to change the basic concept of the book but to modify it only slightly with respect to the latest developments in fishing techniques where these seemed to be useful. Adapted to the modern classification of fishing gear, the arrangement of chapters following Chapter 13 up to Chapter 30 has been revised. This also corresponds more closely to the relative importance of different fishing techniques. The chapter ‘Gods, Fishing and the Captain’s Nose’ has

been omitted. The reader will find some aspects of this chapter in ‘Fishery and Gear Research’ and in some other chapters. The position of the chapter on the art of net-making has also been changed.

In preparing the fourth edition, some improvements have been made. Photographs of low quality have been replaced, new photographs added, and the list of literature reorganized according to the Harvard system. The classification of fishing gear has been adapted to the FAO system.

For the revision of the main work of A. von Brandt, a number of colleagues all over the world were asked to support the team of revising authors in providing information and solving particular problems. In addition, commercial fishermen were contacted to complete some aspects of the practical fishing described in the book.

Important contributions were received from: Dr A. Berg, Langenargen, Germany; G. Brothers, St John’s, Canada; E. Erkamo, Helsinki, Finland; Professor L. Karlsen, Trondheim, Norway; Professor P. Suuronen, Helsinki, Finland; Professor Dr A. Tokazc, Izmir, Turkey.

Mrs H. Müller from the Federal Research Centre of Fisheries, Hamburg, helped to complete and verify the list of literature citations; Mrs B. Büttner and Mrs M. von Klinkowström processed the electronically stored pictures and the late Mrs I. Brandt undertook the text processing. Some new figures were prepared by Mr H.-J. Kuhlmann.

The revising authors thank them all.

Last but not least, the team of revising authors thanks the publishers for their constructive cooperation during the preparation of the fourth edition of this book.

On behalf of the revising team  
Hamburg, Germany



# 1

## Catching Methods in Fisheries: an Introduction

Fishing is a form of primary production. Older than agriculture, the history of fishing, including that of catching methods, is as old as humankind. It may be that fishing was already practised by pre-hominids before the advent of *Homo sapiens*. Their remains have been excavated, together with the prehistoric bones of fish and pebbles that have been shaped in a simple manner, in Olduvai Gorge in northern Tanzania. These pebbles may have been used for killing fish; they may have been the fishing gear of the predecessors of modern humans.

In prehistoric times, and sometimes even today, fishing is nothing more than gathering, one of the simplest forms of economy. Every object is taken that can be used in any way. It matters not whether it is taken from the water or gathered from the dry land.

When undisturbed and in natural balance, the waters of the world provide a rich choice of suitable materials, mostly of vegetable or animal origin. Fish may be the most important product of fresh and sea waters, but there may be some doubt that humans were always able to catch them in prehistoric times. In general they are too fast-moving to catch by hand. It is more likely that prehistoric humans had to look for plants and their products, such as the seeds of water nuts or reeds rich in starch, or for sessile and slow-moving animals like molluscs, worms, coelenterates and crustaceans.

A great number of algae and other water plants are, or have been, harvested for human food and for animal fodder as well as for fertilizer and for the extraction of various chemicals. Today fish provide a high percentage of the animal albumen so necessary for the whole of humankind. Not only are fishes and water plants the subject of modern

fishing methods in sea and fresh waters, but so too are other animals such as sponges, coelenterates, molluscs, crustaceans, insects, amphibians, reptiles, birds and mammals. Even frogs, crocodiles and snakes are often considered as 'fish' in the laws of different countries though they are not fish from the zoological point of view. In the following chapters of this book, the term 'fish' may include many other products of the water. Not all of them are used for food, fodder or fertilizers. Some of these products are needed to obtain raw materials for different purposes, including those which provide pharmaceutical and cosmetic products. Others are sought for decoration only, such as the vertebrae of fish, shells of mussels, corals or pearls and, as in the past, shells are collected by children as toys (Kristjánsson 1980). Fish skin can be made into clothes, as well as being used as membranes for drums (Thiel 1977), and even as armour with the help of the scales and spines. There are many other ways in which humans have used the products of fresh and sea water for making tools, for building houses and boats, and for meeting their everyday needs.

To obtain all these desirable products from fresh water and the sea, humans originally had to rely solely on their hands, occasionally also using their feet and teeth. It is understandable that these methods soon became inadequate for their growing needs. Simple tools were invented to improve the catching ability of humans. Some of these tools became so efficient that they are still used today. They were the basis of better gear, but thousands of years passed before specific fishing gear was developed.

The purpose of this book is to offer a review of fishing methods from all over the world. The basic

concepts of how a fish – in the broadest sense – can be caught are discussed. It may seem impossible to review all the fishing gear operated anywhere in the world, in use either now or in the past (much of which is now only found in museums), but when different types of gear are compared, surprisingly the catching methods are limited to a relatively small number of basic techniques, as will be explained in the following chapters. There are only a few ways in which a fish can be caught; probably only a dozen and a half or even fewer. The basic ideas of how a fish or other prey can be caught are used for the classification of all fishing methods, given at the end of this book. A careful reader, comparing earlier editions of this book with this one, will find that some revisions in the classification of gear have been made. Though the principles of classifying catching methods in general have remained unchanged for 30 years, this edition follows their development as documented in Nédélec & Prado (1990).

Fishing gear belongs to the material culture of most peoples, and fishing is a living occupation. Those who claim that fishermen are conservative people who do not change their fishing gear for generations should visit any modern fishing harbour. They will be surprised to find how much fishing gear has been changed or varied to increase efficiency or to improve handling, although the principles of the fishing methods may not have been altered. For this reason, little information about the *detailed* construction of fishing gear is given in this book. The book may continue to be in demand for many years, during which time fishing gear will undergo many alterations. Thus, this book will explain the principles of catching only, and how they have come about. Other books on the construction of fishing gear, its material and its size are available (e.g. *FAO Gear Catalogues*: Schärfe 1972, 1978; Nédélec 1975).

Some fishing methods may be more economically sound than others under special conditions, and these are therefore described in more detail. Nevertheless, there is no wish to make any distinction between ‘important’ and ‘unimportant’ fishing gear. This can change very quickly, and for many reasons. Even a fishing method such as trawling can lose its ‘importance’ as a result of an increase in the price of oil! For a small-scale fisherman, simple gear can be more important than the sophisticated gear of a

large-scale fishery. Therefore, all fishing methods are considered of equal value in one fishery or another. Before discussing the different fishing methods and their catching principles, some general remarks are necessary about fishing, and these are given in the following sections of this chapter.

## **1.1 Fisherman and hunter**

For gathering, no specific fishing gear is needed, and even today the simple tools used for gathering seafood cannot be considered as genuine fishing gear (Chapter 2). This can also be said for the beginnings of another old form of collecting economy – namely hunting.

Fishing and hunting can be traced to the same origin. Even today it is difficult to explain why harpooning a tunny is fishing and harpooning a swimming deer, often with exactly the same gear, is hunting, or to decide if catching waterborne but land-living crabs is fishing or hunting. Originally, hunting and fishing may have been one, using similar methods. There have always been interchanging techniques between them as between the catcher of animals on land or of fish from the water. Often it is not possible to distinguish whether a spear has been designed and used for fishing, hunting, fighting, or only as a symbol for ceremonial purposes.

Many methods of catching are known in both fishing and hunting, such as spearing, harpooning and shooting (Chapter 6); catching with hooks (Chapter 8); trapping with different types of mechanical (Chapter 18) or non-mechanical traps (Chapters 15 and 16). Some hunting is even done with the help of netting, which is so important for most fishing methods. According to drawings in Egyptian tombs, the use of netting is older in hunting than it is in fishing!

It is quite futile to discuss whether hunting is older than fishing or fishing older than hunting. The opinion is sometimes expressed that fishing must be younger because it is easier to catch an animal on land than to win a fish from the sea. This is not convincing. In primary and primitive lands there are many inundated parts in the interior and on the edges of the sea that would facilitate fishery rather than hamper it. Accordingly, there are some who strongly hold the contrary opinion; namely, that fishing is of older origin than the hunting of terres-



trial animals because only simple tools are necessary for its practice. According to these opinions, hunting requires the use of much better gear; indeed, of equipment which sometimes resembles the weapons of war. Therefore it is understandable that some authorities consider hunting and making war as different forms of ‘violent occupation of living creatures’ (Kuznetzow 1971) in contrast to the supposedly peaceful occupation of fishing.

In another view, hunters – through the use of their weapons – tend to become experienced warriors, while the fishermen, having less need of aggressive action in their pursuits, would fall into second place. As a consequence of this reasoning, the practice of fishing in some parts of the world is carried out by people of a socially lower standing.

But although their beginnings were undoubtedly essentially the same, hunting and fishing have developed down the centuries on very different lines. The prestige attached to ‘royal’ huntsmen can be contrasted with the lowlier plight and status of the ‘poor’ fisherman. According to the traditional view, a huntsman (today sometimes replaced by a cowboy or trapper) is considered to live a free and untroubled life, and the man who practises the royal sport of hunting, even if he lives in a log house, cannot be deemed to be poor. But the fisherman is always considered ‘poor’: the adjective clings to him as does blue to the sky and green to the meadow. Nevertheless, it seems that there is one exception to this generalization, and that is the sport fisherman, who is usually considered to have the status of a hunter.

Interestingly, modern fishing with sophisticated methods is considered as a form of hunting by the fishery industry itself. In this case, hunting is seen in contrast to stock breeding. The hunter is looking for single fish or small groups of wild animals – not tamed or domesticated, not controlled in their life history, nor influenced in their behaviour or properties, and which may be living over a wide area. The stock breeder manages more or less domesticated groups of well-known and numbered animals, bred according to some concept to get special bodily properties, and kept together in a more or less artificial limited area. These differences can be compared with fishing for wild fish populations in open fresh and sea waters on the one hand, and with fish culturing in artificial ponds or controlled waters on the other. Some think that the aim of all

branches of fishery should be to replace hunting by the management of controlled stocks in natural waters and in artificial ones. We are still far from this objective even though there are stock assessments and calculations about the quantities which could be harvested. Recent failures in fishery management raise doubts as to whether it will ever be possible to manage fish populations in the oceans in the same way that cattle are herded on land.

Because the hunter and fisherman in ancient times only had primitive gear, some modern fishermen seem surprised to learn that it was possible for them to achieve any worthwhile result. But the ancient hunters and fishermen (and also some of the small-scale fishermen today) have, in comparison with modern people in industrial fisheries, a striking superiority that comes from their fundamental understanding of the behaviour of their prey. With this knowledge they are able to outwit the fish and catch it even with their simple gear. In highly developed industrial fisheries with many sophisticated machines to operate fishing gear nearly automatically, and with electronic equipment for searching and finding the prey, very often the knowledge of fish behaviour has fallen into oblivion.

## **1.2 From subsistence fishing to commercial fisheries**

We do not know how long it was before a human made a gear which no longer proved as effective in hunting but was much more efficient than any other gear for fishing. This may have been the beginning of a clear division between hunter and fisher. At this stage of development, fishing with more or less specialized gear was pursued by humans to provide food for their own needs and those of their family, community or tribe. Only single fish were caught, maybe one large one and a few small ones. Today this would be a form of subsistence fishery – a small-scale fishery for which only simple gear is needed. As already noted, the knowledge of the fisherman about the behaviour of his prey was a major factor in his success. Spearing, and trapping with plaited fences and baskets, may have been the most important methods during this time. The art of net-making (Chapter 13) was not developed before the late Stone Age, and because it was difficult to get the right material for net-making, the

first fishing gear made of netting rather than crudely woven strips of wood was probably very small.

Originally humans were interested only in catching sufficient fish for their daily needs, and we know from some north European hunters and fishermen that nothing was allowed to be wasted by catching more than was necessary. At some point, however, it became possible to barter fish for other things, and so it became desirable to catch more – especially when it was found that fish could be preserved and stored by drying, smoking, salting or by some simple processes of fermentation. This gave a strong impetus for more fishing, and for better fishing gear to facilitate the development of a permanent artisan fishery. To catch more fish required not only more time, but also a larger quantity of fishing gear – more pots, more traps, or more lines with more hooks. Not only was the amount of gear operated increased, but its efficiency and size was also improved to catch bigger quantities of fish. Fishing for single fish or for small quantities, as in subsistence fishing, was replaced by an artisan commercial fishery sometimes related to special markets. This gave new impetus to the improvement of fishing methods.

The artisan fishery, mostly no longer in the old traditional form, has its importance even today in modern society. The trade in fish became increasingly important and this gave rise to the development of large-scale fisheries based on bulk fishing. In the Middle Ages in Europe, the first large-scale fisheries were already established to supply the markets with salted cod, salted herring and whale oil. These were also the first of the distant fisheries, fishing off shallow-water coasts, often of other continents. For their management, large quantities of gear as well as the material for making them were now needed by specialists. Lines and hooks had to be produced for line fishing for cod; large quantities of netting were needed for making driftnets (Chapter 19) for herring; and spears and harpoons had to be mass-produced for whaling.

With the increasing demand, especially in industrial areas, there came also another trend – the need for the large-scale fishery to abandon shallow waters and penetrate greater depths to find larger supplies of fish. Greater depth also meant bigger and heavier gear and greater manpower for its handling. Nevertheless, it was a long time before mech-

anization was introduced into fisheries. Deep-water fishing also extended to large lakes; so there is reference to, for instance, a ‘deep-sea fishery’ on Lake Constance even today, in contrast to the beach fishery. The same thing happened on the sea coasts. Here the development from the shallow-water fishery to the deep-sea fishery is still going on, which means not only fishing over deep water but also fishing at great depth. This brought new developments in bulk fisheries with beamtrawls and later large otterboard bottom trawls for demersal prey (Chapters 25 and 26); purse seines to catch large quantities of pelagic prey in the upper range of the waters (Chapter 29), and mid-water trawls to fish in the area where neither purse seines nor bottom trawls could be operated (Chapter 27).

Both small-scale artisan and large-scale industrial fisheries have an important place in the nutrition of people today and in the future; the one by its flexibility, even when sometimes only small quantities of fish (but higher quality) are landed, and the other by its large quantities of often cheaper products, which are needed to satisfy large markets and to serve the needs of the fish processing industry, including the production of fish meal for cattle food. Both needs can give impetus to the development and improvement of fishing gear and fishing methods as can be seen in the following chapters.

### **1.3 Sport fishing and commercial fisheries**

From the viewpoint of catching, sport fishing can be considered a form of small-scale fishery designed not to make a living from the catch, but to concentrate skill for fun and pleasure (Chapter 10). Both the commercial fisherman, setting lines with hundreds of hooks or operating a handline with only a few in the hope of getting a good catch, the sport fisherman waiting for a strong fighting game fish with his simple or sophisticated (sometimes also expensive) tackle, are the descendants of the prehistoric hunter.

Originally, fishing with hook and line was the method used by everyone. With the increasing privileges of the landowners, it became the sport of the rich well into the last century, but has now completely changed from a derided hobby to an important form of human recreation. As already

mentioned, sport fishermen were considered as hunters, living in supposedly unrestrained freedom like one of the last links between humans and nature. There are few ideas that have changed so completely in so short a time as those held by the public in regard to sport fishing! Therefore it is regrettable that in the modern life of many countries, especially the highly developed industrial ones, the art and practice of fishing has been divided into two ostensibly diverse and even adverse fields – sport fishing and commercial fishing. It must not be forgotten that both have the same origin, and from the viewpoint of fishing techniques, they represent only two variations of the same principle of catching fish with hook and line. Now it seems that there will be some change. Both sport and commercial fisheries are concerned to preserve nature against the worst influences of civilization. Moreover, fishing waters cannot be managed solely with the methods of sport fishing. Other more effective methods, as operated in commercial fisheries, must support the aim of managing fishing waters in a biological equilibrium. Sport fishermen and commercial fishermen have to work together not only to preserve, but also to defend, nature. Each simply represents a different variation of a fishing method. Thus, sport fishing is considered in a special chapter (Chapter 10) in this book, but it is given neither more nor less importance than any other fishing method.

#### **1.4 Active and passive fishing gear**

As mentioned before, there are relatively few basic principles which can be used to catch fish, in spite of the enormous variety of fishing gear operated in the world. In the classification at the end of this book there are only 16 different groups of fishing principles, and maybe even some of these could be grouped together for simplicity. Sometimes the same gear can be used for two or even more fishing methods with virtually no alteration in construction, but simply a change in the method of operation.

In this classification no account is taken of the fact that sometimes, in fishing laws, gear is grouped into ‘active’ and ‘passive’ equipment. For passive gear, the fish has to come voluntarily, e.g. traps, gill-nets and also some types of fishing hooks. Therefore much experience is needed to construct a

passive gear in such a manner that the prey will accept the gear and not be frightened by its construction, colour, visibility, smell or anything else. Knowledge of fish behaviour will help to make the most effective gear. The success of active gear, such as dredges, trawls and cast nets, and also spears, harpoons and some gear used for drive-in fisheries (Chapter 21), depends more or less upon a human’s skill or perseverance. The fisherman can influence the success of active fishing gear by leading the gear into the path of the fish, or by driving the fish into it by various methods. To influence the success of passive gear is much more difficult, because not all stimuli affecting the behaviour of fish or other prey near fishing gear are known. It must also be considered that the fish behaviour can change with age, or with the season, or maybe also by learning. Pollution can also influence fish behaviour as can be demonstrated with electrical fishing (Chapter 5).

Grouping gear into passive and active has nothing to do with the basic principles of catching. Examples of both types of fishing gear are present in many groups of fishing methods. In addition, sometimes not only the size but also the towing speed is critical to the efficiency of active gear. Increases in size and speed need more power for operating gear and this was often not available in early fisheries. Therefore, in ancient times passive gear was probably operated more often than active gear. Finally, it has to be stressed that active and passive fishing gear must not be confused with moving and stationary gear. A stationary set line and a towed troll line are both passive gear – passive fishing methods with hooks – which have to be accepted by the fish. On the other hand, a ripping hook moved up and down is usually an active fishing gear, with more or less random catching (in this case by fouling the fish) by a special form of line fishing with hooks.

#### **1.5 Basic ideas for fishing methods: their distribution and possible improvement**

At first glance a great many different types of fishing gear seem to have been developed in fisheries. The history of their creation, growth and distribution is still rather obscure. But when the fishing gear of various nations is compared, it becomes evident that fishing techniques have developed

from only a few basic ideas for capturing fish, either singly or in mass, for the benefit of humans. Most of these basic ideas for the manner of capturing fish are spread over the world and have become the common possession of mankind.

Ethnologists have discovered a striking similarity in the fishing methods of traditional, sometimes called primitive, fisheries. This cannot be explained by cultural exchange but rather by the like reaction of humans to similar problems. This is not surprising for, from time immemorial, fishing has presented similar problems again and again; and everywhere those problems have been solved by humans in the same or similar ways, just as an animal reacts in an experimental situation in rather the same way no matter whether the test is performed in Tokyo or in Hamburg. Nevertheless, there may have been a more direct exchange of knowledge about fishing gear in the past, not only between neighbouring areas but also between continents, especially in sea fisheries, in spite of all contradictory discussions in this respect.

Occasionally, the spread of a fishing method or a fishing gear is well known, especially when this has come about in modern times. A good example is the design of the so-called 'Madeira trap', made in a typical form and manner (Figure 16.38) which can be traced from India via the Seychelles, Zanzibar Island, Madagascar, and Madeira to as far west as the Caribbean Sea. There is also good reason for supposing that the ancient oceanic fishermen with their gear and vessels reached out on the one side to Madagascar and as far as South America on the other side. The ice-fishing methods of the Arctic are well known through all the polar regions. Cover pots (Chapter 22), well known in Asia as well as in Africa, were also found by the explorers of America. Therefore, it is possible that there were better contacts in the past than are accepted today.

Nowadays, of course, the exchange of knowledge about fishing methods scarcely meets any difficulties. International fishing areas, and worldwide organizations like FAO, facilitate very close contacts. The Republic of South Africa has adopted purse seining from California, and in the eastern Baltic, large pound nets of Japanese design have been used. Isolated fishing tribes of the south-west coast of Madagascar now make their netting of polyamide monofilaments, and a Stone Age tribe on the forgotten island of Lan Yü (Botel Tobago), off

the east coast of South Taiwan, know how to make netting from hard laid polypropylene. Knowledge of the importance of new fishing methods, or of new net materials, spreads quickly, and their development and testing will be carried out simultaneously in many parts of the world. Overall, as well as the duplication or multiple invention of fishing techniques, the often uncontrollable communication of fishing techniques from one country to another frequently occurs. This is the simple phenomenon of 'borrowed culture'.

In each fishing area, the known fishing methods have been improved and altered, sometimes by a single fisherman, according to local needs. Beginning with simple methods and primitive gear, the more complicated techniques soon begin to emerge. This development has been hastened and improved by various stimuli. Periods of explosive development have been followed by more stagnant times, and this is so even today. Some of the impulses encouraging gear development have already been mentioned, such as the endeavour to catch fish in larger quantities, or in deeper waters where more fish can be expected. In both cases, alterations in the construction of fishing gear are needed. Another stimulant for developing fishing methods and gear is the desire to progress from the original guarded or watched fishing gear needing many helping hands, to automatic unguarded gear that can be operated by limited manpower. To do this, the gear must be designed in such a way that no special guard or watchman is required to observe when fish enter the gear and to close it in time to prevent the fish from escaping. Moreover, a watchman controlling the quantity of the catch in a gear can work only during daytime and when the water is clear (Figures 15.20 and 15.25), which reduces the amount of time the gear can be operated.

More suitable, and independent of daytime, is another method for the control of the catch in a gear by attaching to the gear so-called 'feeler lines' held in the hand of the watching fisherman (Figure 24.37). Such lines have been used not only in fresh waters but also in sea waters with the aim of detecting fish entering the gear so it can be closed and hauled at the right time. To save time, some gear has been adapted to register the catch automatically, warning the fisherman to come and secure the catch. Bells fixed to the gear announce the catch, as

the Chinese have done and as some sport fishermen also do today (Figure 9.16). Of course such alarm devices help, and in some large Japanese pound nets, sonar buoys have been placed to allow remote control of the catch. On the other hand, it may be better to construct the gear in such a manner that the fish can be held alive by the gear for some time so that they can be taken at any convenient time later. Especially in trapping (Chapter 16), automatic catching gears were devised like mechanical traps (Chapter 18) – known also from hunting – and traps with non-return devices (Chapter 16), which proved so effective that they have been used not only for traps but also for other gear.

This gives a hint of another interesting development in fishing gear. Apart from the principles of catching, a limited number of single elements in the physical construction of fishing gear crop up in many different fishing methods. The use of a non-return device such as the funnel is one of these single elements that can be found in many types of fishing gear.

## **1.6 Division of labour and collective fishing**

Some fishing methods need little manpower and can be operated by a child; in others even the power of a strong man is not sufficient. This is why very often, in traditional fisheries, a clear division of labour on a sexual basis can be found. There are some fishing methods considered suitable for women (and children) while others are reserved for men only. This sex-based division of labour may be as old as mankind. In general, the more exhausting work needing more physical strength is done by men only; other work, requiring less bodily strength, is within the range of women. This has nothing to do with the quality of the status of women and men. This separation is based on the physical differences between men and women – often forgotten today with an increasing misunderstanding of man and nature. This old knowledge about the need to separate duties between men and women to overcome the physical demands of life is considered as one of the earliest recognitions of mankind (Koenig 1975).

In general, women are responsible for the collecting of food such as vegetables or small animals; for food preparation; for bringing up and rearing

the children; for tending the garden; for the home and similar things. The man is considered responsible for hunting; defending his family, his tribe or his living area; and for many types of hard work like grubbing, house building (sometimes), and other work which needs more physical power. An analogous development can be seen in the operation of the different fishing methods. Gathering is done by women only (Chapter 2) in so far as this method of collecting is not combined with diving, but even here some exceptions are known (Chapter 3). Fishing by stupefying, in the original form of poisoning, shows no strong separation, although today electrical fishing is in general done by men only (Chapter 5). In line fishing (Chapters 8 and 9), small-scale methods with a limited number of hooks can be used by women and men, but large-scale fishing, e.g. with longlines, is typically a fishing method for men only. This cannot be said of trapping (Chapters 14, 15 and 16) where small traps are also set mainly by men. In fishing with bagnets (Chapter 24), the small hand-operated gear is often used by women, while the operation of large-scale bagnets is a job for men. Fishing with dragged gear (Chapters 25–27), seine nets (Chapter 28), surrounding gear (Chapter 29) and generally also drive-in nets (Chapter 21) are fishing methods for men. With liftnets (Chapter 23), we again see that hand-operated smaller gear can be also used by women while large ones are operated by men only. Falling gear (Chapter 22), such as cover pots, are operated by men as well as women, but cast nets are operated by men only. Fishing with gillnets (Chapter 19), entangling nets (Chapter 20), and especially fishing with modern computerized systems or with harvesting machines (Chapter 30), seems to remain for men only, even when the physical power needed is very low. The conclusion can be that not many fishing methods are suitable for women. They operate small gear in most cases, but there are no statistics available about the quantities of food taken by fishing women to feed their families day-by-day all over the world, especially for the people of Africa and Asia. Some people think that the quantity taken by women in this manner is not much less than that which the commercial fishermen land with their heavy gear all over the world.

When, in contrast to men, the work of women is considered on an individual basis (Nachtigall 1966), it can be seen that very often the women do not fish



**Figure 1.1** Collective fishing by women and children with cover pots and scoop nets in Mali (1962). (Photo: FAO, P. Pittet.)

alone, but in a group like a loose collective, each woman with her own gear (Figures 1.1 and 22.3). This is done not just to chat during fishing but to secure a better catch by driving the fish together, and to prevent their escape when only a single gear is operated. It is also used to stupefy the fishes to some extent (Chapter 5) as when many persons disturb the mud by trampling.

Fishing in a collective with a single large gear is more typically the work of men. In fisheries, co-operation is very often needed for the construction of gear, especially when larger ones are needed. It may be a large barrier made of heavy wood for catching fish, or a large net with thousands of meshes. Co-operation is also needed for the opera-

tion and maintenance of the gear, especially in trawling (Chapters 26 and 27), seining (Chapter 28) and purse seining (Chapter 29). As in hunting, sometimes dozens of fishermen had to work together to get and to secure the catch. It seems that the voluntary alliance of men, even when for a limited time only to do common work, is elementary to the behaviour of humans (Koenig 1975). Such voluntary collectives that are not controlled by anyone outside the group, or by the state, survive in some fisheries today. Often these communities are for large-scale trapping, such as on the Isle of Rügen (Peesch 1961) or in the Mediterranean for large tuna traps. Even when two fishermen with their vessels work together, e.g. in pair trawling, this

can be considered as a survival of the old group hunting of ancient times. Often such co-operation is necessary because even today, despite mechanization, many fishing methods cannot be carried out by a single person. On the other hand, increasing mechanization progressively reduces the number of people working in a collective.

Increasing mechanization is also the reason why women can now become more engaged in fish catching. Until recently, wives could help only by rowing and steering a small vessel while the husband set the gear. Nowadays, women can also work in large-scale fisheries when the physical work is taken over by machines. It should not be forgotten, however, that there are other sections of fisheries where for a long time women have had a dominating and sometimes commanding position, such as in marketing the fishery products. This is especially so in Africa. Women have also dominated fish processing, not only in northern but also in many tropical countries. Only in a few cases are women engaged in net-making: often they are not allowed to do so for religious reasons (Chapter 13).

Speaking of manpower and catching methods, a third group of people must be mentioned who, sometimes, can have a special position in fishing. These are the older men who can no longer participate in the usual fishing methods, especially in sea fisheries. Sometimes they operate smaller gear, e.g. spears, as in northern Europe up to the 1970s, with special permission because they are generally prohibited. The most important contribution of the old men of a fishing community may be net-making and mending. The very quick introduction of monofilaments for the making of gillnets in south and East Asia may be because of the ability of the old fishermen in thousands of villages to knot more effective netting with the new material – even though this material is stiff and not easily knotted.

## **1.7 Manpower, mechanization and automation**

The wish to improve the efficiency of fishing gear stimulated the development of the known fishing methods and, as far as possible, the effort to find new fishing techniques. Many impulses pushed forward this tendency not only to catch more, but also to catch in deeper waters, and to replace labour-intensive attended fishing gear with auto-

matic catching gear requiring nobody to be in attendance. It seems that since olden times fishermen considered physical manpower as unavoidable in fishing. When larger catches were needed, and the amount of gear was increased or enlarged, it meant that more people had to co-operate. The problem of reducing manpower with the help of machines in fisheries seems not to have been resolved before the 18th century, when capstans with a vertical axis were introduced in the large-scale herring driftnet fishery. The Chinese may have known of mechanical help in fisheries long before. Manpower winches with a horizontal axis came later, perhaps first in coastal fisheries for the operation of beach seines. At the turn of the 20th century, fishing vessels became motorized and the winches motor-driven, which very much reduced manpower requirements in gear operation. Originally the idea was to ease handling of the gear by winches, but with increasing catch value and the rising cost of manpower, powered machines also had to replace people without decreasing the yield. In this development, motors replaced oars and sails, and power-driven winches reduced the number of crew while increasing profit and safety at the same time. The catch per person, per vessel or per tonnage of a vessel was increased rapidly and is still increasing. This development became very important in the increasing mechanization of large-scale and small-scale fisheries. The modern operation of gear in trawling with large stern trawlers; the handling of large purse seines with power blocks on modern seiners; the introduction of powered drums for netting and lines, and reels for ropes for seining, are all examples of successful methods not only to facilitate the work of many, but also to decrease manpower.

To reduce the number of crew by machines is especially important in industrial countries with a lack of, or very expensive, manpower. Mechanization is not so much of interest to developing countries, which try to keep as many people as possible in fisheries to give them labour and food, and also not for industrial countries during periods of recession with high unemployment. In these cases the jobs may be more important than a fishing method made labour-extensive by mechanization.

The most recent tendency in gear development is to alter fishing methods so that they operate automatically with little effort by humans. Especially in the operation of handlines, the slogan became:

'push a button and let it fish'; computers are used to make decisions to steer the gear. In the new systems, the overall operation of the gear is divided into a number of different steps, and each step runs automatically. That does not mean robots are replacing fishermen; they help not only by doing the work, but also by 'thinking' more quickly than humans. In any case, the fisherman has the final decision! The transfer of such ideas to trawling occupied the minds of fishermen and fishing gear technologists for a number of years following the first publication of this book (Chapter 26) until it became clear that the present fishing productivity surpasses the presently available fishing possibilities. In small-scale fisheries 'harvesting machines' have been developed (Chapter 30), which can provide a basis for computerization in the future as has already been achieved with many agricultural machines. For the time being, in most fisheries of the world, manpower, experience and knowledge of fish behaviour are decisive in the construction and successful operation of fishing gear.

## **1.8 Fishing technology**

One and the same fishing gear can be used in several different ways. When the method of fishing is not known it is hopeless to try to decide if, for example, a net is to be used for seining or dragging, for drive-in fishery, or even for gilling or entangling. This is one of the reasons why the classification of fishing gear and methods given at the end of this book is based not on the gear construction but on the principles of how the fishes or other prey are caught. These principles of catching can be used in different ways and sometimes the gear operation is supported by special fishing tactics, mostly based on methods of luring the prey, not so often on frightening them.

Gear construction, gear operation and fishing tactics are considered as parts of fishing technology and so are considered together in this book. But fishing technology also includes the materials used in gear construction and – as far as necessary – also the fishing vessels (Schärfe 1979). As regards net materials, it seems that the problem of replacing natural fibres by synthetic ones has been solved with the introduction of netting twines, e.g. polyamides (PA), polyolefins such as, for example, polyethylene (PE), polypropylene (PP) and others

with properties in accordance with the needs of different fishing gear. There is no doubt that methods like mid-water trawling would not have been possible without the introduction of finer and stronger synthetic twines, apart from the invention of echo sounders. Also, the improvement in purse seining was not possible without these new fibres, quite apart from the introduction of the power block. A last example is the recent success of gillnetting, which was not possible without the use of twines made of fibres with low visibility, or even those that are transparent, such as some monofilaments. This is now known more or less all over the world.

The improvements in the properties of the fibres and also by the mixture of different fibres used for netting yarns and ropes still offer reasons for surprise such as, for example, the recent fantastic success of the gel-melted polyolefin fibres. This, however, can only continue as long as the raw materials for the new high-technology fibres are affordable. The development of fishing methods, especially in sea fisheries, would not have been possible unless there had been a parallel development of more and more specialized fishing vessels, from rafts and rowing boats to sailing vessels, to steamers and motor vessels with increasing power, and eventually, perhaps, to vessels driven by atomic power. Thus, parallel with the development of fishing techniques, the development of fishing craft is ongoing. This extends from the bamboo raft still much used in Asia for short-term fishing, to the factory vessel operating with a catcher fleet or the self-catching factory ship capable of staying at sea in far distant fisheries for many months and processing the catch immediately on board. The fishing vessel is therefore no longer an all-purpose vessel from which it was possible also to do some fishing, but a specialized vessel with many typical arrangements. Nowadays, in modern sea fisheries, the fishing vessel and the fishing gear have become one unit.

The development of fishing gear and fishing methods cannot be seen as an isolated process. Success and progress in fisheries is based on the harmony between humans, their surroundings and fish, all three influencing the construction and operation of fishing gear and fishing vessels. In a situation where the exploitation of many fish stocks has passed a critical threshold, progress cannot lie in an increasingly productive fishery. Responsibility for a



sustainable yield in a fishery where the collateral damage to the ecosystem is reduced to a minimum must become the prime objective of fishermen and fishing gear technologists.

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# 2

## Fishing by Gathering

Long before any fishing gear was invented, humans used their hands along the shores of lakes, rivers and seas to capture fish and other aquatic animals; to collect mussels or seaweed; and to harvest amber or minerals thrown up by tide and wind. In a word, they gathered everything useful to their needs, from the river banks and the beaches and from shallow waters or flooded areas that were drying up. Some people think that gathering is the oldest and most important human activity and one to which we owe our present existence (Bolloré 1960). This old form of harvesting water products by walking along the dry beach looking for something that might be needed for food or as a working material, or wading for the same purpose in shallow waters, or diving in deeper ones, and doing this mostly without the help of boats or rafts, without tools, and using only the hands, has been known perhaps for millions of years, from the time of prehistoric humans and their predecessors right up to the present day.

Today, gathering by hand is not only done in countries with a low level of economy but also in highly developed industrial countries, though sometimes for different reasons. Also, modern people gather foodstuffs by hand (Figure 2.1) or other apparently useful objects which can be brought home, not because of need but more for fun or for souvenirs. Today, at suitable places, holidaymakers and hobby fishermen have replaced the hunters and collectors of the past. Even today commercial fishermen may continue to fish by simple collection, especially in tropical countries.

In some areas the inducement to continue fishing by simple gathering by hand, and with nearly no tools, was created by new ideas such as the so-called 'aesthetic' fishery (Wood & Johannes 1975) which

does not aim to get foodstuff, but to collect nice-looking shells or corals for decoration, or to catch living animals for the aquarium at home. The animals are mostly tropical fish but also include crustaceans and other animals of the lower orders. In some countries of southern Asia, beautiful little fish are collected for fighting contests for entertainment (Mohsin 1978). Many of these animals are found in small pools and are caught in a simple manner without any typical fishing gear. Another reason for fishing by gathering is to collect 'bait worms', the more northern and less valuable sandworm, *Nereis virens*, and the more expensive southern bloodworm, *Glycera dibranchiata*. It has been calculated that, in the USA, bloodworms bring the highest price for weight of any fishing product! Beside bait worms, other types of bait are also sought for line fishing by commercial and sport fishermen. Such simple collecting can form the basis of a profitable job in centres of sport fishing all over the world, such as the trade in fish and other animals for aquariums which has big centres in Hong Kong, Singapore, Djakarta, the Caribbean and Manila. Unfortunately this form of fishing, like other forms, shows symptoms of 'over-collecting' in some areas, especially on the sea coast (Joynor 1971). So far stocks of the interesting living resources in shallow, coastal and fresh waters have not yet been diminished by increasing pollution.

### 2.1 Hand-picking

Gathering by hand can be considered the simplest form of fishing, surviving the centuries and modern developments. Of course, what can be picked up is limited to some objects only and to the zones within



**Figure 2.1** Sunday morning on the French Atlantic coast. Father and son digging for shells.

the manual reach of humans. The largest quantities collected are from animals that may be sessile or only slow moving. Therefore it is understandable that mussels and snails, echinoderms and some small crustaceans are the main animals caught by hand-picking. Most fish, even when trapped in small pools, but in good physiological condition, are too quick and sensitive to be caught by hand. So it is known from former inhabitants of Tasmania that because of their inefficient fishing technique, their fishery concentrated on snails, mussels and crayfish. There were only a few scaled fish which the Tasmanians could get, maybe in the same manner (by bare hand) as their neighbours, the Maoris, in New Zealand are catching eels even today (Best 1977). Some fish may be grasped easily, as well as frogs, small alligators, crocodiles, turtles and other animals living in or near water. Fish roe is among the objects easy to collect by hand. Alaska had an important 'herring-roe-on-kelp' fishery until the turn of the last century.

Objects that can be collected by hand also include plants, especially seaweeds, many of them used for human consumption or as fodder for cattle, or for the extraction of other products such as iodine, agar from red algae, and alginic acid from

brown algae, principally kelp. Last, but not least, seaweeds are also collected for agricultural fertilizer. Heavy gales at sea tear seaweed off the rocks and, when it drifts ashore, people need only to collect it (Figure 2.2). At some places the seaweeds can be harvested very easily from the rocks during ebb tide or in shallow water and brought ashore (von Brandt 1956). In such places the Icelanders brought or bring their sheep and horses to graze on algae (Kristjánsson 1980).

The most interesting areas for hand-picking are those sea coasts that enjoy great differences in the rise and fall of tides, and where wide muddy areas are exposed twice a day. Here many species of shells can be collected or dug by hand from the sand or mud. Sometimes narrow populated mussel beds are hidden in the ground. In contrast to muddy areas, sandy beaches are of less interest. Nevertheless, it is known that on nearly all sandy beaches crabs can be dug out by hand during the daytime. Catching them with bare hands when they run over the beach during daytime or at night is difficult, but this is possible with the slower-moving hermit crab. In general, sandy beaches from which, during low tide, animals coming in with the flood can return unhampered with the ebb tide are not considered



**Figure 2.2** The spear and rake came about to lengthen the reach in retrieving fish or seaweed. These Breton fishermen harvest seaweed for fertilizer with long-handled rakes.

favourable for fishing by gathering by hand (Kollmannsperger 1972). Rocky coasts with many small pools, areas prolific in seaweed growth, or caverns and cliffs favourable for the growth of aquatic plants and with hiding places for animals, are all ideal areas for gathering. Here, molluscs, mussels as well as snails and sea urchins, are the main objects harvested by hand-picking (Figure 2.3). Moreover, various species of crustaceans, and even barnacles and fish, left behind in little pools or caverns, are secured when the water recedes. Mussels and snails are preferred, especially in low tide areas, because they move so slowly. Mussels are dug from the bottom, while snails are removed from the stones to which they adhere or are gathered from the ground.

In France, with large areas of low tides off the Atlantic coast, a special term is used for this fishery: this is the 'peche à pied' (fishing by foot) which still plays a great part, not only for the benefit and interest of occasional visitors or poachers and beachcombers, but also for meeting the practical needs of commercial fishermen (Renard 1955). The phrase 'fishing by foot' is not to be confused with 'fishing by horse'. That too is practised, for instance, where horses are used to frighten the fish by their movements in the water, or to drag a fishing gear. The term 'fishing by foot' is really thought of as a contrast to 'fishing from the boat', which method is obviously a step up in activity in the eyes of the poor. A restriction has to be made nowadays: 'pêche à pied' no longer means only hand-picking or gathering; nowadays it means any fishery operated

without a boat and this can also be catching with typical fishing gear, which will be shown later (Sinsolliez 1968, 1970). On the other hand, hand-picking is also carried out from boats in the open sea, e.g. for catching garfish. When taking turtles by hand, care must be taken to avoid being bitten (Chen 1976)! It is easier to catch small fishes by hand. It has been suggested that survivors of a shipwreck on a raft or in a lifeboat can pick up such fish which nibble the nails of their fingers (Robin 1977)! According to the same author, sharks up to 1.50 m long can be taken without difficulty by their dorsal fins! To avoid being bitten, a piece of wood or a rolled towel should be pushed into the mouth of the shark. (Unfortunately, it is not stated which type of shark can be caught by hand picking!)

Gathering by hand can be found on all sea coasts and also in freshwater areas. Here of particular interest are flooded territories adjoining rivers which regularly overflow after heavy rainfall. Like the sea, fresh waters offer many valuable products. To ensure their usefulness even more, many little artificial pools are constructed in which the animals or products desired are left behind when the water falls. The water can be bailed out to gather the fish, as is done even today in the small ponds which remain when rice fields are drained to permit the flowering and ripening of the paddy. Manual collecting is used where lagoons or annually flooded lands dry out, as along the great rivers of Asia, Africa and tropical South America (Lagler 1968). It has been said that the greatest of all tropical inland fisheries is that where, at the time of the floods, many fishes are caught by hand. But this fishery will be doomed in the future when the rivers are restrained between embankments and the land settled for intensive cultivation.

Areas of hand-picking can also include all shallow waters (Figure 2.4), and deeper ones as far as the fishermen can wade in. In water that reaches up to the chest or higher, the fisherman has to find his prey, e.g. clams, by feeling them with his feet. He can lift them from the bottom with one foot or by raking them with a foot into a basket held on the bottom (Figure 2.4.3). Sometimes the fisherman or woman dives briefly to pick up by hand what has been found with the feet. Of course, hand-picking in deeper water without a boat is also possible by a swimming and diving fisherman, as will be discussed in Chapter 3.



**Figure 2.3** Chinese women use simple implements to gather shellfish. In the foreground is the typical collector's basket.

Hand-picking along the beach in sea water and fresh water, in shallow water or by diving in deeper ones, is not only known all over the world today but also since prehistoric times. The prehistoric importance of such collecting activities is revealed by the monuments left behind in the form of so-called kitchen middens 'kjökken möddinger' found at various points in Europe, East Asia, North Africa and both of the Americas. The heaps of garbage left behind by the fishermen and huntsmen of that later mesolithic period are primarily composed of shells of sea mussels gathered and eaten then. The huge mounds of marine shells, sometimes up to 6 m thick, represent the accumulated food debris of centuries, of coastal fisher-collectors from *c.* 6000–7000 years ago (Cornwall 1968). But shell mounds have not only been found from prehistoric times. Hills up to 120 m long and 8 m high made of shells have been found near the old Phoenician town of Sidon (Kramer & Matschchoss 1963), but at this time the shells were gathered not for food but to gain the desired purple colour to dye the clothes of the dignitaries of this period. Hills of shells can be seen nowadays where large quantities of abalone are caught by modern diving food gatherers, such as in California or southern Africa. Not all abalone fishermen, however, are as lucky as those of New Zealand, who collect a type of abalone with a wonderfully coloured shell that fetches a high price on the world market.

Hand-picking was formerly considered an important method of catching fish and one demanding great skill. During the famous Nigerian fishing fes-

tival in the River Argungu (Nigeria), the contest between fishermen includes not only the usual boat racing but begins with fishing by hand. The first man to catch a fish is the winner, thereby honouring one of the oldest fishing methods.

Old European fishery books mention that this method of grasping the fish is the simplest method of fishing. But note this: a famous fish booklet of Nuremberg, dated 1758, comments rather disdainfully: '... that is a fishery of the poor common folk who sometimes wish to bring home a small meal'. The simplicity of hand-picking has the disadvantage that it is not only used all over the world but very often not by regular, authorized fishermen, but by big – and more often by smaller – poachers or fish thieves. If a Chinese philosopher failed to mention fishing as among those activities bestowing great happiness, it certainly means that he never roamed along brooks as a little boy tickling trout or grasping crayfish with his hand. This practice is universal; from Greenland, the Kuril Isles, and other northern areas it is known that even salmon can be caught by hand. 'Tickling' is the English expression for this method of fishing. To do this, the fisherman (or boy) dips his arm quite slowly into the water and tries very cautiously to approach a stationary salmon or trout. When he succeeds in touching it he moves his hand very carefully along the belly of the fish until he reaches the gills. Then, with thumb and middle finger grasping the gill openings, he endeavours quickly to whisk it on to the bank. He does not always succeed. The bigger the fish, the more chance it has of freeing itself at the last moment by struggling and, not infrequently, the fisherman, in his excitement, finds himself in the water instead of seeing the salmon on land (Conrad 1905). The Lengua Indians in the Gran Chaco guard against losing the fish by fixing a ribbon around the hand to which small vertebrae are fastened. This gives them a firm grip which prevents the fish from escaping (Krause 1904). Nowadays, gloves or a scouring clout are recommended when there is some chance of catching fish by hand – especially conger!

In general, hand-picking is a small-scale fishery, but it can become big business when precious products are collected, such as pearls, mother-of-pearl or corals. Marco Polo mentioned some Arabian islands where large quantities of ambergris had been collected along the coastlines, and this valuable material must have also been collected by the

Madagascans. Today there is big business in the field of fishing by gathering where the mass collection of seaweed or shell grit can be carried out from the shore. To do this economically, large-scale enterprises are developed. Large harvesting machines dredge tons of seaweed or shell debris from the low tide area or in shallow water, and so replace the human collector and his hand (see Chapter 30).

## 2.2 Stranded prey

Fishes or other water animals can become stranded involuntarily on beaches. Small fish can be seen jumping onto shore when frightened by predators, or flying fish, attracted and disorientated by light, landing on the deck of a vessel. Then even quick-moving fishes are easily caught by hand. This can happen even with large fishes such as salmon when they fail to jump over an obstacle during migration. It has been said of old Indian fisheries in North America that some tribes simply collected salmon which failed to jump over obstacles and thus fell on land or became stranded and exhausted after spawning (Treide 1965). Sometimes large schools of small fishes are driven by predators into shallow water and many are washed up on shore. The next wave may wash them back into the water if they are not taken by birds or humans. Here a strange fishery has to be mentioned although it is not strictly involuntary stranding on the beach. This is the fishery for grunion (*Leuresthes tenuis*) when, during the night, this strange fish comes on to land to spawn along the coast of California (Walker 1952; Idyll 1969). In this case, catching with bare hands is the only method allowed by law. The use of nets is illegal. Not only fish can be stranded; this can happen also with swimming snails and squid. In northern New England and eastern Canada strandings of enormous quantities of living shortfin squid (*Illex illecebrosus*) have been noticed (Lux *et al.* 1978). The causes of such mass strandings remain unknown. This is also the case with the ocean sunfish (*Mola*) and a few kinds of sea turtle which can be easily caught by hand after stranding.

Not so widely known is the fact that in Iceland well-known food fish like capelin (*Mallotus villosus*) and cod (*Gadus morhua*) can be washed up by the sea. In the 12th century the harvesting of this 'drift food' was combined with special 'drift-fish

rights' and could be important for surviving when, in late winter, food supplies often ran low and weather conditions made fishing impossible (Kristjánsson 1980). Beside capelin and cod, other fish have also been mentioned as swimming ashore – such as spiny dogfish (*Squalus acanthias*), saithe (*Pollachius virens*) and even redfish (*Sebastes marinus*) and wolf-fish (*Anarhichas lupus*).

The Maoris of New Zealand use a form of artificial stranding of fish in which stones dam up running water, which can then flow only in a trench excavated at the side. The fish are guided into the channel, and then the stone barrier is removed to re-route the water back along its former course and the trench suddenly runs dry. The stranded fish cannot escape and are gathered by hand (Best 1977).

Finally, whales can also be 'gathered' on the beach when involuntarily stranded in shallow waters or when driven inshore by humans, as formerly happened frequently on certain islands in the Pacific and is still practised with pilot whales in the Faeroes (Figure 2.5). The use of stranded whales is considered as the first form of whaling. From time to time news goes around the world that schools of whales or dolphins run themselves aground as an easy prey for humans. The reasons for this behaviour are not known. Nowadays, oil pollution is considered as a possible reason for the disorientation and stranding



**Figure 2.4** Women of the Zulu tribe collecting mussels on the coast of KwaZulu Natal near Durban, South Africa. (Photo: South African Panorama, 1979.)