Review

Recent advances in fishing gear technology

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The major concern of fisheries and aquaculture is to reduce the widening gap between fish demand and supply and achieve the ultimate goal of self-sufficiency in fish production, but this can only be achieved if technology advances. This paper reviews the recent advances that have been made in fishing gear technology. In fishing gears, gears like turtle excluder devices, Nordmore grid, purse seine, lift net, trawling, dredges etc., are now being used in replacement of the old gears, such as hooks made from wood and bone. Fishing craft like bamboo, floating logs, papyrus rafts were used before they were replaced with canoes. Technology has really played a crucial role in the development of fisheries and aquaculture worldwide.

Key words: Extruder, net, turtle, nordmore, pots, sonar, seine, spear

INTRODUCTION

Shortage in the supply of protein of animal origin precipitated the prominence of fish in the diet of man. Over the years the demand for fish has been on the increase with supply never up to demand. However, reducing the widening gap between fish demand and supply and achieving the ultimate goal of self-sufficiency in fish production has been the major concern of fisheries and aquaculture. Fishery simply refers to the activities involved in catching a species of fish or shellfish or a group of species that share the same habitat. It involves distribution, occurrence, abundance, racial studies, food and feeding habit, reproduction and handling etc. Generally, it is an entity engaged in raising or harvesting fish which is determined by some authority to be fishery (Fletcher et al., 2002). Over the last decade, spectacular growth has taken place in fisheries and aquaculture some of which are discussed in this work under fishing gear technology.

FISHING GEARS

Fishing gear can be described as any kind of equipment used in harvesting, cropping or capturing fish from any water body (Nuhu and Yaro, 2005). According to Moses (1992), tracing the history of fishing at first, the catching implements (or gear) must have been simple tools such as arrows, spears and traps (Figure 1) which were used in hunting the land animals. Later, implement more specific for catching fish were made, thus, hooks were made progressively from wood, then bone and finally metals; plant fibres were woven into nets and used to trap, entangle or surround a school of fish. Many of the fishing gear in use today have been well known for some centuries B.C.

Nowadays, however, fishing gears have generally undergone a lot of modification and improvements, in consonance with advances in modern technology.
although the basic principle of wounding, hooking, trapping (by gills, fins and spines) encircling, scooping and filtering can still be detected. The development of fishing gear was accompanied by that of the fishing craft. Fishing had to be carried out beyond the banks and shore-lines and so arose the necessity for some craft or vessel with which the fishermen could move into deeper water. The early fishing crafts were simple devices such as floating logs, bamboo, papyrus rafts and calabash craft. Canoes, probably came later, as an improvement on these. Most of these ancient crafts are still seen today particularly in the developing countries of the tropics. But, as in the case of the fishing gear, modern fishing craft have generally undergone great changes in size, quality and sophistication made possible only through modern technology. Sails on fishing vessels were replaced by stem engines and later by petrol and diesel engines. Today, Japanese, American, Polish, Russian and Korean fishermen fish in all oceans of the world using fishing type vessels of up to 5,000 gross ton displacement.

The development of rather sophisticated fishing gear and the improvement in vessel designs and size were
followed by the improvement in fish detection methods or
the invention of new fish finding and detection equipment
such as echo sounders (Plates 1 and 2) and sonars. 
According to FAO (2011), fishing gears can be classified
into some main categories, based on the recent
advances or development that has taken place. This
includes:

(a) Surrounding nets (including purse seines)
(b) Seine nets (including beach seines and boat, 
Scottish/Danish seines)
(c) Trawl nets (including bottom: beam, Otter and Pair
trawls and midwater trawls: otter and pair trawls)
(d) Dredges
(e) Lift nets
(f) Filling gears (including cast nets)
(g) Gill nets and entangling nets (including set and drifting
gillnets; trammel nets)
(h) Traps (including pots, stow or bag nets, fixed traps)
(i) Hooks and lines (including handiness, pole and lines, 
set or drifting long lines, trolling lines)
(j) Grappling and wounding gears (including harpoons, 
spears, arrows etc)
(k) Stupefying devices.

This classification is being slightly modified to
accommodate the most recent development of fishing
gears and methods.

**Surrounding nets**

Surrounding net, also known as encircling or round haul
net, is fishing net which surrounds fish on the sides and
underneath. These nets take advantage of the shoaling
behavior of the target species. The nets surround densely aggregated schools of pelagic fish like the Pacific sardine and market squid in coastal waters and various species of tuna, in the open ocean (FAO, 2012). Surrounding nets can be lampara net, purse seine or ring net. FAO (2012), describes a Lampara net as a surrounding net having the shape of a spoon or a dustpan with a short leadline under a longer floatline (Figure 2a and b). As the vessel tow the lampara net forward, the bottom and the top of the net close and the fish are retained in a collection area called central bunt. They are used for capturing pelagic fish, those swimming near the water surface.

**Purse seine**

The purse seine is a preferred technique for capturing fish species which school, or aggregate, close to the surface: such as sardines, mackerel, anchovies, herring, certain species of tuna (schooling); and salmon, before they swim up rivers and streams to spawn (aggregation) (Figures 3 and 4). The advance that has occurred in the purse seine is the invention of the puretic power block line which was introduced in 1950s and was the key factor in the mechanization of purse seining. The puretic power block is a special kind of mechanized winch used to haul nets on fishing vessels. The combination of these blocks with advances in fluid hydraulics and the new large synthetic nets changed the character of purse seining fishing. Another advance that occurred in purse seine net recently is that of an underwater camera which is mounted in a steel frame surrounded by a polythene protection unit as shown in (Figure 5). This underwater
camera is built for the observation of fish in water.

**Ring nets**

Ring nets are a cross between lampara nets and purse seines, used in waters all over the world (Gabriel et al., 2005). Similar to lampara nets, ring nets have tapered panels due to a shorter leadline and central bunt. However, ring nets also have rings and a purse line along the bottom of the net, thus allowing the net to be closed without having to drag it behind the vessels as shown in (Figure 6).
Figure 5. An underwater camera.

Figure 6. Ring nets.
Dredge

As shown Figure 7, a fishing dredge, also known as a scallop dredge, oyster dredge etc., is a kind of dredge which is towed along the bottom of the sea by a fishing boat in order to collect a targeted edible bottom-dwelling species (scallops, oysters and other species of clams, crabs and sea cucumber). Dredges may or may not have teeth along the bottom bar of the frame. These teeth raked or ploughed the sand and mud, digging up buried clams (Moore et al., 2000).

Seine nets

A seine is a fishing net that hangs vertically in the water with its bottom edge held down by weight and its top edge buoyed by floats. Seine nets can be deployed from the shore as a beach seine, or from a boat. Seine nets include beach seines and boat, Scottish/Danish seines.

Trawl nets

These are cone-shaped net (made from two, four or more panels) which are towed by one or two boats, on the bottom or in mid water (pelagic). The cone-shaped ends in a bag or coded. Trawling is a method of fishing that involves pulling the fishing net through the water behind one or more boats. The net that is used for trawling is called a trawl. Trawling can be divided in bottom and mid water trawling depending on how high the trawl (net) is in the water column. Several advances have taken place in the trawl technology in which the main reasons are:

1) to reduce the rate of by-catch which involves improving the selectivity of trawls.
2) To monitor the movement and behavior of fishes.

Turtle excluder device (TED)

Turtle excluder device can be defined as a soft or rigid device fitted to a net or inserted in front of the cod end or modification that allows turtles to escape immediately after capture in the net. TEDs were originally designed to exclude the capture of turtle or other large animals in shrimp nets so as to lend protection to this endangered species from capture. They are also equipped with a trap door or escape cover that allows sea turtles to escape from the trawl nets and may be either rigid or soft in design, active or passive, depending on how by catch is excluded (Figure 8).

Nordmore grid

Nordmore grid is primarily designed to exclude large animals from prawn trawls. It features an aluminum grid as shown in (Figure 9), secured to the trawl at 45-60 degrees from the vertical. Bar spacing is typically 100 mm. A panel of netting guides all animals to the bottom of the grid. Large animals are guided by the grid towards the escape opening in the top of the cod end while shrimps and other small animals pass through the grid and enter the cod end. The Nordmore grid is effective in reducing up to 90% of unwanted by catch, with no reduction in catches of prawns. The Nordmore grid is
based on a rigid filtering system similar to a TED, and was developed in Norway in the late 1980s to reduce the capture of non-wanted by catch of juvenile fin fish in northern deep water shrimp (*Pandalus borealis*) fisheries. Advances have also occurred in trawl in the area of meshes. Traditionally, trawl nets are made from diamond shaped meshes, but now square meshes are used. When a diamond-mesh net is towed through the water, many of the meshes close under tension, providing little escape opportunity; for it has been seen that when diamond-mesh netting is rigged at a right angle, the meshes adopt a square shape. But, during trawling, square-shaped meshes remain more open thereby allowing fish to escape and this made the nets now to be used in different locations to provide escape opportunities for unwanted fish (Figure 10).

### Lift nets

These are horizontal netting panel or bag shaped like a...
The target species of lift nets are small pelagic fish species, and squid.

Gillnets and entangling nets
These are strings of single, double or triple netting walls,
vertical, near by the surface, in mid water or on the bottom, in which fish with gill, entangle or enmesh. Gill nets and entangling nets have floats on the upper line (head rope) and, in general, weights on the ground-line (foot rope). Gill nets or entangling nets consist in single, or less commonly double or triple netting (trammel net) mounted together on the same frame ropes. Several types of nets may be combined in one gear (for example, combined gill nets-trammel nets). These nets can be used either alone, or, as is more usual, in large numbers placed in line (fleet of nets). The gear can be set, anchored to the bottom or left drifting, free or connected with the vessels. The target species are pelagic, demersal and benthic species.

**Pots and creels**

These are small traps (Figure 12) baited with fresh or salted fish which are set down on the seabed to catch crabs, lobsters and Nephrops. They may be fished singly but most commercial fishermen use them in strings as shown in (Figures 12 and 13). Almost all creels now used are constructed from 8 or 10 mm steel rods dipped in plastic for corrosive protection. Most creels are usually made in the traditional ‘D’ shape (Figure 13) but some box shape creels are still used.

**Pots**

The construction of pots has changed from using natural materials such as cane to plastic piping frames with a netting cover with plastic ‘bucket’ entrance with a heavy plastic matrix base as shown in (Figure 14). The stanchions, base and top area are protected with either rope or old car tyre.
Conclusion

Technology has played a crucial role in the development of fisheries and aquaculture. Monumental changes have been witnessed and are on-going in fishing gear technology, among others. Hooks, which are made from woods, were later replaced with metals. There is the use of trawls, purse seine, dredges, pots and creels etc.

Authors’ declaration

We declare that this study is an original research by our research team and we agree to publish it in the journal.

REFERENCES


