Attraction of Fish by Lights, Electricity, Fads and Artificial Reefs

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FISHING WITH LIGHT

The Simplest method of using fire for fishing is to light a big fire on the beach, as near as possible to the water, which will attract certain fish and keep them for some time in the illuminated area. Fishing with fires on the beach was practiced until very recently in the Cameroons and in Australia. First the fire was made on heaps of stones ad the next step was to torches, which soon became a common means of transferring fire from place to place (movable source of illumination.). Light in water on a dark night either attracted or stunned fish, which could then be hooked, speared or clubbed. The technique of overhead torches fixed to a fisherman's back developed later. This age old torch fishing has been recorded in Europe, Asia, the America and Oceania show that this practice is found world over and primitive people are still using it. In this type of fishing spearing is most popular. Torches are used with various nets from simple handheld dip nets, (Thailand and Indonesia), drive-in-nets and small beach seines, scoop nets for flying fishes and jumping fishes (Japan and Taiwan).

Fishing with torches was eventually improved with the use of fuel oil, kerosene, gas and electricity. The latest and most modern torch fishing technique is practiced in skin diving. The fish are blinded and immobilized by an electric water torch so that they can be easily harpooned or even grabbed by hand. The light attraction further offshore depended on the development of suitable craft, such as log or papyrus rafts, dugout canoes and finally planked boats. Chinese fishermen brought method of fishing squid with fire at sea to Monterary (California) at the end of the last century. They burned pitch pine in a wire basket fixed at the bow of a small skiff and used two other skiffs to set a small purse seine around the

attracted squids. In coastal areas of Black Sea, a small fishing for horse mackerel exists. A rowing boat, with four lighted torches, moves shoreward attracting the fish to surface where they are caught with a purse seine. In Lake Tanganyka (East Africa) fishermen sued fires of reed and wood in catching small freshwater clupeids. The fish attracted during moonless nights by small canoes are concentrated and moved slowly towards the shore and fished with scoop nets. In Mediterranean Sea small pelagic fishes such as sardine, sardinella, anchovy, mackerel and horse mackerel are mostly scattered, since they are attracted and concentrated and caught through purse seining. Purse seining with light for small pelagic species is next to trawling. In marine fishery, it is almost the sole supplier of sardinella, sardine (*Sardine pilchardus*) , sprat , anchovy and mackerel. A typical fishing unit consists of a motorized catcher boat and a number of non-motorized light boats. The light boats and auxiliary boats are usually towed to the fishing grounds by the catcher boat, the largest unit. When a suitable area is found, the light boats are anchored several hundred meters to several km from each other. The period of light attraction depends on conditions and judgment and may be from an hour to a period covering most of the night. The purse-seine nets then encircle the attracted fish. The purse – seine nets are mostly between 180 – 700 m long are selectively deep, but are mounted with a very high hanging co-efficient. Kerosene pressure, propane gas and electric surface – underwater lamps are used. Italian fishermen were the first to use electric underwater lamps.

Beach seine, gill nets, lampara nets are also operated with light. Lake Tanganyika, the 7th largest and second deepest lake in the world, has seasonable stock of freshwater clupeids. There are four fisheries using light attraction – canoe fishing with luserga nets; Mediterranean type purse- seining, catamaran lift net fishing and Chironula net fishing. In the western part of the Indian Ocean, including the Gulf of Aden, Persian Gulf and the Arabian Sea, there is practically no light fishing. `Chinese ' stationary lift nets (Chinese dip nets) are used in India in backwaters at night with lanterns or kerosene pressure lamps or electric light. The main characteristic of lift nets is that the submerged net is hauled up more or less vertically or at least partly out of water to catch the fish. The same technique is

followed in scoop nets, hoop nets, blanket nets and lift nets. Lift nets are used to catch free swimming fish mostly migratory and those distribution pattern suits the lift netting with light attraction. The most important advantage of lift netting is the lower requirement for skill and investment for the gear, vessel and auxiliaries. Fishing with scoop nets and lights is claimed to be lucrative in Gulf of Mannar between India and Srilanka. The development of light fishing in USSR is noteworthy for its technological research and experiments.

For developing fisheries hand lining with light attraction has the following advantages. 1. Any type and size of vessel with adequate space is suitable. 2. Fishing tackle is simple, inexpensive and can be prepared locally. 3. technical and financial requirement for fishing lamps are basically moderate and 4. Hand lining is basically not labour intensive. The Japanese pole and line mackerel fishing is the most important commercial operation involving hooks and light attraction. Fish is located by echo sounding. Surface lamps ranging from 1 kW on a 1 ton boat or up to 10kW on a 50 t vessel is used. The fishing tackle consists of a short 1-2 m long bamboo pole, nylon monofilament of 0.5 mm dia leader line and a 10-15 m long 0.4 mm dia monofilament snood with a single 4.8 cm round unbarbed hook. Usually mackerel react quickly to the light and ascend towards surface, which is being caught by quick swings of the poles.

Another very important fishery employing light is the squid fishing. Modern Japanese squid jigging vessels are now about 300 t displacement carrying up to 20 automatic jigging machines and electric generators of up to 200 kW for fishing lamps. Simple pole and line gear consisting of a jig, line pole and handle were used originally to catch squid. Multiple squid hand line were developed to explore catching efficiency consisting of a series of jigs spaced at intervals of about 60-80 cm with a total length of 20-30 cm containing 15-20 jigs and a lead sinker at the end. The fishing lamp arrangement for the attraction of squid is specific. It consists of a row of lamps along the fore and aft line of the vessel which are hung to a pole between the fore mast and the mizzen mast. 0.5-2.0 kW lamps mostly with incandescent bulbs are common. Mercury vapour bulbs were found more

efficient than normal incandescent bulbs. A fishing trip of this type of Japanese fishing vessel may last for a week to 10 days.

The most important means for determining promising areas for fishing is knowledge and practical experience with local fishing conditions, oceanographic factors, temperature etc. that play a dominant role. In light fishing the water temperature is now used in the Far East to assist in locating saury concentration. Where fishes are spotted during the day, there is a fair chance that they will still be there or nearby during the night. Searchlights may be used to stir up fish and make them jump as is done with herring in Norway or saury in Far East by USSR and Japanese fishermen.

FISHING WITH ELECTRICITY

Electrical fishing in freshwater, which was developed at the beginning of the century. The basic is if the negative pole (cathode) of a direct current source of about 220 V is grounded or placed in a body of water and the positive pole (anode), connected to a metal plate about 30x30 cm in size (catching electrode), is dipped into the same water body at some distance from the cathode the fish in the immediate vicinity will swim towards the anode in a very short time. Shortly before reaching the electrode, most fish stop swimming, turn over and go into a state of narcosis. They can then easily be taken from water with a dip net. Physiologists have determined that the voltage over the fish body, between head and tail causes three reactions, i.e. attraction (electro taxis) stunning (electro narcosis) and electrocution, and that the required voltage differs according to the species. Since the given electrical field the voltage over large fish is greater than over small fish, the large fish of some species will be more affected. Electrical fishing is therefore selective.

A current of 10 amp would be sufficient in freshwater, but for the sea fishing it has to be increased to about 10,000 amp due to high conductivity of sea water. For physical reasons, electrical fishing in seawater must be done with current having

impulses of longer duration. In sea fishing, the simple method of electrode and dip net cannot be applied, but electro taxis an electro narcosis can be utilized in certain cases as a valuable auxiliary means for improving purse-seining and trawling.

The basic apparatus for this is

a) a generator which from the energy supplied by dry cells accumulator or gasoline engines, produces either direct, interrupted direct or alternating current. In an actual operation the set is located at the water's edge or placed in a boat or even carried on the back if it is very light.
b) A negative electrode (cathode) fixed to the bottom of the boat carrying the generator, or else anchored at the bottom of the water to be * close to the generator, or hauled behind the operator.
c) A positive fishing electrode (anode), which attracts or immobilizes by narcosis within its radius of action.
d) A landing net intended to catch the fish attracted or immobilized by the positive electrode.
e) Connections with generator and electrodes.

Electric fishing gear

Good results cab be obtained in inland waters with medium conductivity and restricted surface areas, with direct or pulsating currents produced by gasoline engines or accumulators with a range of 0.4 – 5 kW. From Israel it is reported that with an engine supplying 7.5 kW and a radius of action from 2-2.5 m the problem was to catch *Clarius lazera* which could not be captured with conventional gear in a lake of 13 km2 with a maximum depth about 3 m. fish were killed by electrocution only a few seconds after having been caught with electrified tuna lines or harpoons. It is also reported that fishes of the size of herrings already caught in a purse-seine could be attracted electrically to the mouth of a suction hose and pumped into the boat. Certain authors are of opinion that it was even

possible to shoot an electrode missile into a fish shoal to avoid the utilization of a purse seine. Fish concentrated around the electrode could thus be pumped into the boat.

In Federal Republic of Germany scientists have successfully tried an experimental screen to lead big tuna towards traps. Kuroki (1959) mentioned that proper electric equipment for trawls could increase their efficiency if the towing speed were increased and the depth of the net controlled more accurately. On the east coast of USA, menhaden fished by purse-seines use electricity to concentrate the fish to the fish pump. The use of screens to control fish is used where there is a danger that they will be diverted from a river into a water intake or outfall (particularly for migratory fishes).

Electrical installations for blocking or guiding fish in fresh water at present is used in the following circumstances in freshwater - as a barrier to prevent the migration of mitten crabs (*Eriocheir sinensis*). Or to prevent fish entering in turbine or pumps or hydroelectric stations, barrages etc. or to guide fish towards fish passes in complex watercourses, to isolate an area for management purposes. The principal component used for fish screens is a net acting as cathode, which should have copper cables in the lead line, connected to the negative pole of the supply unit.

Electrical fishing is yet to be commercialized. Otherwise it is used for qualitative sampling of fish populations, quantitative estimation of fish population, or control of unwanted species. The only places from commercial fishing were reported in Austria, Poland, Germany and Netherlands.

Other areas of fisheries research where electricity is applied

1. Physiological screens and guides
2. Fish counters
2. Activity recorders

3. Anesthesia
4. Electrocution.

FISH AGGREGATING DEVICES (FADs)

It has long been known that greater numbers and kinds of fishes in habit rocky coasts, reefs and banks than smooth sandy or muddy bottoms and also ship wrecks provide excellent fishing in otherwise non-productive areas. The main advantage of artificial reefs is to provide small boat fishermen with a good fishing. The theory of attraction of fishes to solid objects (thigmotropism) probably explains the success of artificial reefs in attracting and holding fishes. The attraction of fishes to each other (shoaling behaviour) also is necessary to a reef success. Finally availability of shelter and food help to explain the attractiveness of artificial habitats. Man-made marine installations like off shore oil drilling installations serve as artificial habitat. There is a growing interest in the fishing nations of the world in artificial aquatic habitat. Artificaial Reefs (ARs) and Fish Aggregating Devices (FADs) have been mainly used for three purposes. Commercial fishing in Japan, sport fishing in Japan and small scale fisheries in a few Asian countries. In many places it was experienced that properly constructed and sited artificial reefs and fish aggregating devices create convenient fishing sites. FADs have proved to be particularly effective in commercial tuna fisheries and for artisanal fisheries. The declaration of exclusive economic zones brought continuous decline in the distant sea-operations for many countries and the introduction of fish attracting devices has become imperative. At present Japan has the most extensive and technologically advanced AR programmes in the world.

In United States reef building is for a variety of purposes like commercial and sport fishing, fishery resources management, environmental mitigation and restoration, waste disposal and recycling, sport diving and tourism. In Thailand, ARs are deployed adjacent to coastal villages to increase biomass and species diversity and this has increased the catches substantially. In Philippines the use of payaos (a surface fish aggregating device intended to aggregate pelagic fishes)

increased tuna catches. In Indonesia, dumping discarded buses and tricycles in the Bay of Jakarta has resulted in increase of fish catches.

In India AFH technology was conceived and adopted by the artisanal fishermen with the help of non-governmental organizations working with them. The traditional fishermen of Trivandrum and Kanyakumari have been developing AR technology. The shark long line fishermen of Thoothoor in Kanyakumari District who have been fishing through out the Indian coast, from Gujrat to Andamans, several accidentally formed AFHs such as ship wrecks and boat wrecks located throughout the coast, serving as excellent fishing grounds. Also the oilrigs off Bombay provide potential ground for reef fishes.

For construction of artificial reef habitats, sites are selected in flat sandy areas where fishing is generally poor. Depths between 50 to 60 ft are considered suitable for many fishes to be attracted ad also for kelp plants to accumulate. Numerous planktonic organisms including dinoflagellates, ctenophores, and sea grass will accumulate depending upon the time of the year. Various species of tubeworms, sponges, barnacles, rock shrimps, crabs, oysters and mussels in succession on the hard objects which further serve as the abode of fishes.

Method of fishing

The fishing method employed is in general passive in nature using small boats as principal craft and hook and line as the major fishing gear. Other gears include gill nets, trammel nets, boat seine and shore seine. The throw line and pole and line fishermen also make use of this habitat for catching mullets, catfishes and carangids. Lift net also is used for fishing and AFHs. The mid water and pelagic fishes aggregated by the coconut leaves and tree trunks create habitats for fishes dwelling in different niches of the ecosystem.