

Information

How fish are caught

Wild fish can be caught in a variety of different ways, from the traditional rod and line to traps and trawl nets large enough to capture a passenger airplane. Here are the most commonly used fishing methods with a brief explanation of how they work and their environmental impacts.

Beam trawl

In this type of trawl, the mouth or opening of the net is kept open by a beam, which is mounted at each end on guides or skids which travel along the seabed. The trawls are adapted and made more effective by attaching tickler chains (for sand or mud) or heavy chain matting (for rough, rocky ground) depending on the type of ground being fished. These drag along the seabed in front of the net, disturbing the fish in the path of the trawl, causing them to rise from the seabed into the oncoming net. Electrified ticklers, which are less damaging to the seabed, have been developed but used only experimentally. Work is also being carried out to investigate whether square mesh panels (see below) fitted in the 'belly' or lower panel of the net can reduce the impact of beam trawling on communities living on or in the seabed. Modern beam trawls range in size from 4 to 12 m (weighing up to 7.5 tonnes in air) beam length, depending on the size and power of the operating vessel.

Demersal otter trawl

The demersal or bottom trawl is a large, usually cone-shaped net, which is towed across the seabed. The forward part of the net – the 'wings' – is kept open laterally by otter boards or doors. Fish are herded between the boards and along the spreader wires or sweeps, into the mouth of the trawl where they swim until exhausted. They then drift back through the funnel of the net, along the extension or lengthening piece and into the cod-end, where they are retained.

The selectivity of trawl fisheries may be increased by the use of devices known as separator trawls. Separator trawls exploit behavioural differences between fish species and can be used, for example, to segregate cod and plaice into the lower compartment of the net, whilst haddock are taken in the upper part. The mesh size for the two compartments can be altered according to the size of the adult fish being targeted. Insertion of square mesh panels also improves selectivity of the net because square meshes, unlike the traditional diamond shape meshes, do not close when the net is towed. Discarding of immature fish may also be reduced by increasing the basic mesh size in fishing nets. Sorting grids are compulsorily fitted in nets in some prawn and shrimp fisheries to reduce bycatch of unwanted or non-target species, including small prawns and shrimp.

Depending on the depth of water fished and the way in which the gear is constructed and rigged, trawling may be used to catch different species. Trawls can be towed by one vessel using otter boards, as in bottom-trawling, or by two vessels, each towing one warp, as in pair-trawling. Or more than one trawl can be towed simultaneously as in multi-rig trawling.

Multi-rigs

Multi-rigs are used widely for the capture of panaeid shrimps in tropical waters and more recently for Nephrops (langoustines or Dublin Bay prawns) and deep-water prawns in temperate waters. The speed at which the net is towed is important, varying with the swimming speed of the target species from about 1.5 to 5 knots for fast swimming fish.

Dive-caught

Free diving (using mask and snorkel) or scuba diving is a traditional method of collecting lobster, abalone, seaweed, sponges and reef dwelling fish (groupers and snappers) for example. In deeper waters helmet diving systems using air pumped from the surface are used. Species, including high value species such as geoduck (giant clam), urchins, sea cucumber, lobster and scallops are now widely harvested by divers. Hand-collection by divers is potentially one of the most species selective and least damaging fishing methods, provided harvesting is carried out responsibly.

Dredging

Dredging is used for harvesting bivalve molluscs such as oysters, clams and scallops from the seabed. A dredge is a metal framed basket with a bottom of connected iron rings or wire netting called a chain belly. The lower edge of the frame has a raking bar, with or without teeth, depending upon the species targeted. The catch is lifted off the seabed or out of the sea by the raking (or teeth) bar and passes back into the basket or bag. Depending on the size of the boat and the depth of water fished the number of dredges or 'bags' may vary from a single dredge towed behind the vessel to from 5 to 10 or more dredges per side. Dredges are generally attached to a towing bar and one is operated from each side of the vessel simultaneously.

Drift net

A gill net (see below) that is allowed to drift with prevailing currents.

Drift nets are not set or fixed in any way, are in fact 'mobile', and they are allowed to drift with the prevailing currents. Drift nets are used on the high seas for the capture of a wide range of fish including tuna, squid and shark, and off north-east England for salmon. Despite a global moratorium on large-scale drift nets (nets exceeding 2.5 km in length), introduced in 1992, problems still exist. For example, drift net fisheries in the Mediterranean for swordfish and albacore tuna pose a particular threat to striped dolphins. An EU-wide ban on

Marine Conservation Society

Protecting our **seas, shores and wildlife**

Registered Charity Number (England and Wales) 1004005

Registered Charity Number (Scotland) SCO374680

mcsuk.org

all drift nets was introduced from January 2002. The ban applies to fisheries such as tuna, shark and swordfish in all EU waters except the Baltic, and to all EU vessels on the high seas. EU fishermen are, however, considering challenging the ban if 'pingers' (see below) are found to be successful in deterring marine mammals from entanglement and subsequent drowning in nets.

Fish attraction devices (FADs)

Various species of fish often congregate or associate with other living creatures (e.g. tuna associate with dolphins and whale sharks) or objects floating or suspended in the sea. This natural phenomenon has been exploited to attract fish to floating or suspended structures. Such structures can provide known locations for congregating fish, around which vessels can operate a wide range of fishing techniques including purse seines, pole and line or trolling. FADs may be used to concentrate fish in sufficiently high numbers which are then surrounded with a purse seine net. Fishermen using pole and line or trolling methods may use the boat from which they are fishing as a FAD.

Fish farming

Aquaculture is a term used to describe the farming of marine and freshwater organisms. Mariculture only refers to the farming of marine organisms; it can be further defined as open mariculture (or semi-culture) where organisms are farmed in a natural environment, such as mussels, and closed mariculture (or intensive mariculture) where organisms are farmed in closed environments as used for some finfish such as halibut.

Currently 1 in 5 fish destined for the dinner tables worldwide comes from marine or freshwater farms. Fish that are commonly grown in cages include Atlantic salmon in Europe and America; Pacific salmon in America; the yellowtail in Japan; and seabass and groupers in Greece, Malaysia and Indonesia.

In Britain, two species of fish are principally farmed: Atlantic salmon in salt- water and rainbow trout in fresh water. This is changing with the introduction of farming of new marine species such as cod, haddock and halibut. The major growth sector in UK mariculture is farmed Atlantic salmon, whose production in Scotland has nearly trebled since 1990 and is predicted to increase.

Whilst fish farming relieves pressure from exploitation of wild stocks and could be managed in a sensitive and sustainable way, the scale of most modern fish farming in the UK has led to environmental impacts that negate any overall environmental gain. MCS believes the industry has developed too rapidly and to the possible detriment of inshore marine habitats, particularly sea lochs, wild stocks of Atlantic salmon and other fisheries such as shellfisheries.

One of the biggest impacts of fish farming on the marine environment is the production of fishmeal used to feed farmed fish. The protein for this fishmeal is sourced from small pelagic fish that are not targeted for human

Marine Conservation Society

Protecting our **seas, shores and wildlife**

Registered Charity Number (England and Wales) 1004005

Registered Charity Number (Scotland) SCO374680

mcsuk.org

consumption, but form the base of the food chain and are important prey for other species such as cod (see Industrial Fishing).

Gill or Fixed nets

Gill nets are walls of netting which may be set at or below the surface, on the seabed, or at any depth in-between. Gill netting is probably the oldest form of net fishing, having been in use for thousands of years. True gill nets catch fish that attempt to swim through the net, which are caught if they are of a size large enough to allow the head to pass through the meshes but not the rest of the body. The fish then becomes entangled by the gills as it attempts to back out of the net. The mesh size used depends upon the species and size range being targeted.

Tangle nets

Tangle nets resemble gill nets but are slacker, shorter and have less flotation. This results in a looser-hung net that entangles species rather than gilling them.

Trammel nets

Trammel nets are a wall of net divided into three layers. An inner fine-meshed net is sandwiched between two outer, larger meshed nets. The net is anchored at the base and floated by the headline, allowing it to hang vertically. The inner net is looser than the outer ones, ensuring that the fish become entangled within it.

Although static gears such as gill nets generally have less impact on the environment than mobile or towed gears they pose a particular problem for cetaceans (dolphins and porpoise). Methods to increase the 'dolphin-friendliness' of this fishing method include the attachment of acoustic devices or 'pingers' to the net to deter the animals; reducing the 'soak time'; i.e. the amount of time the net is left in the water; restrictions on the length of net used; and the introduction of closed areas to exclude fishermen from cetacean 'hot-spots'.

An EU Regulation (812/2004) came into force in January 2005 which lays down measures to: reduce incidental catches (by-catch) of cetaceans in fisheries through the mandatory introduction of acoustic devices (pingers) on vessels over 12m; monitoring of vessels (over 15m) in fisheries where by-catch of cetaceans has been implicated; phase out and eventually ban fishing with drift nets in the Baltic Sea. The first phase of the pinger requirements is to be implemented in certain North Sea fisheries by June 2005.

In the Cornwall Sea Fisheries District a voluntary Code of Practice has been jointly developed by Cornwall Sea Fisheries Committee, set-net fishermen and Cornish Fish Producers Organisation to minimise accidental cetacean by-catch in nets in and around St. Austell and Penzance Bays. To help prevent capture fishermen are required to: Inform each other as to where concentrations of cetaceans are being observed and to avoid setting nets in the vicinity of observed or reported concentrations of cetaceans. If an accidental cetacean bycatch does

Marine Conservation Society

Protecting our **seas, shores and wildlife**

Registered Charity Number (England and Wales) 1004005

Registered Charity Number (Scotland) SCO374680

mcsuk.org

occur fishermen are required to: let other fishermen know where nets are experiencing a cetacean bycatch and remove nets from a problem area. For more information contact Cornwall Sea Fisheries Committee.

Handline

Fishing with lines and hooks is one of the oldest fishing methods. They may be used from a stationary or moving boat. The catch is of very high quality as the fish is usually live when brought aboard. Handlining is also a highly selective fishery in terms of species and size. The method can be used while fish are spawning, as they will normally only bite after completion of spawning. Handlining is used to catch cod and other demersal species and pelagic species such as mackerel, squid and tuna (see below). In tropical waters handlines are used to catch groupers and snappers. Because hauling is slow, mechanised (electrical or hydraulic) systems have been developed to allow more lines to be worked by a smaller crew.

Jigging

Jigging is widely used to capture squid. A jig is a type of grapnel, attached to a line, which may be manually or mechanically jerked in the water to snag the fish in its body. Jig fishing usually happens at night with the aid of light attraction.

Trolling

Trolling involves towing baited hooks or lures through the water. The method is particularly suited to the capture of pelagic species of high individual value. Examples include tuna (albacore and skipjack), wahoo, dorado, barracuda and salmon.

Hand-gathering (picking) or collection

Traditional methods of harvesting molluscs involve the use of hand tools such as tongs and rakes. Mechanical methods using hydraulic or suction dredges (see below) at high tide, or tractor harvesting at low tide, may also be used to harvest molluscs such as clams and cockles.

Harpoon

This method is used for fish having high individual value such as swordfish and bluefin tuna. Harpooning is a completely selective fishery, since the target must be seen before striking, so the size and hence age can be determined and only mature fish taken.

Hydraulic dredges

Hydraulic dredges either use jets of water to disturb the ground in front of a towed dredge (see above) to capture bivalves, like razorshells and cockles, or use a pump to suck bottom sediments on board ship where bivalves are screened out and the spoil discharged back to sea. Impacts associated with this type of fishing are

Marine Conservation Society

Protecting our **seas, shores and wildlife**

Registered Charity Number (England and Wales) 1004005

Registered Charity Number (Scotland) SCO374680

mcsuk.org

removal of local populations of the target species, removal and disturbance of sediment with consequences for other species living there, and creation of spoil plumes and siltation.

Industrial fishing

Most fishing methods target fish for direct human consumption. Fisheries targeting species for reduction purposes i.e. the manufacture of fish oil and meal, are referred to as industrial fisheries. Fish meal and oil is produced almost exclusively from small, pelagic species, for which there is little or no demand for direct human consumption. The methods of capture are purse-seining and trawling with small mesh nets in the range of 16-32 mm. Important industrial fisheries in South America include the Chilean jack mackerel fishery and the Peruvian fishery for anchoveta. Industrial species in the North Sea and North-East Atlantic include: sandeel, sprat, capelin, blue whiting, Norway pout and horse mackerel. Fish oil is used in a range of products including margarine and biscuits. Fish meal and oil has more widespread use, however, in the manufacture of pelleted feedstuffs for intensively farmed poultry, pigs and, not least, aquaculture.

One of the main impacts associated with industrial fishing is the removal of large quantities of species from the base of the food chain. For example the sandeel fishery in the North Sea, the largest single-species fishery in the area accounting for over 50% by weight of total fish landings, has been implicated in the decline of breeding success in seabirds such as kittiwakes, and reducing food availability for marine mammals and other commercial fish species such as cod and haddock.

Long-lining

Long-lining is one of the most fuel-efficient catching methods. This method is used to capture both demersal and pelagic fishes including swordfish and tuna. It involves setting out a length of line, possibly as much as 50-100 km long, to which short lengths of line, or snoods, carrying baited hooks are attached at intervals. The lines may be set vertically in the water column, or horizontally along the bottom. The size of fish and the species caught is determined by hook size and the type of bait used.

Although a selective method of catching fish, long-lining poses one of the greatest threats to seabirds. Species such as albatross, petrels, shearwaters and fulmars scavenge on baited hooks, get hooked, are dragged underwater and drowned. The problem occurs whilst the baited hooks are on or near the surface i.e. before the hook sinks. Commonly the bait used is squid, the principal prey of many seabird species. Most globally threatened species, including the majestic wandering albatross, live in the Southern Ocean. A range of practical measures have been developed to help prevent seabirds being hooked and drowned on longlines. These include bird-scaring streamers that flap and scare birds away, setting lines at night when most albatross do not feed and weighting the line so it sinks quickly, bird scaring water cannons and setting the line nearer the water surface rather than over the side of the boat, thus minimising the length of time the bait is visible/available. Any of these measures will contribute to reducing seabird by-catch. Ask your supplier if the

Marine Conservation Society

Protecting our **seas, shores and wildlife**

Registered Charity Number (England and Wales) 1004005

Registered Charity Number (Scotland) SCO374680

mcsuk.org

longline caught fish you buy has been caught using "seabird-friendly" methods. For more information on 'seabird-friendly' fishing see www.birdlife.net.

Pelagic trawl

When trawling takes place in the water column or in mid-water between the seabed and the surface, it is referred to as mid-water or pelagic trawling. Pelagic trawls target fish swimming, usually in shoals, in the water column i.e. pelagic species. These include seabass, mackerel, Alaska pollack, redfish, herring and pilchards for example. Their effectiveness relies on traversing a considerable volume of water, and consequently nets are larger than bottom trawls and require a large vertical and horizontal mouth opening to provide net stability and capture large shoals of fish. The length of time the net is towed through the water is shorter than in bottom trawling in order to capture the shoals of fish the net passes through. To handle the large amounts of fish, pumps are used to transfer the catch from the cod-end to the boat.

In mid-water pair trawling the otter boards are replaced, and the mouth of the net kept open, by a pair of trawlers. This enables vast nets, often $\frac{1}{4}$ mile wide and $\frac{1}{2}$ mile long, to be towed through the water column to capture the fish.

Pelagic trawling affects marine mammals as they are caught accidentally when feeding on the same fish being targeted by fishermen; being unable to surface for air they eventually drown. Capture of marine mammals in fishing nets represents a very significant welfare problem. Animals can remain conscious for some time while struggling in the net, causing suffering and injuries such as lacerations and broken teeth and bones, before dying of suffocation. In response to the continuing slaughter of dolphins in pelagic trawl nets targeting seabass and other species, the UK Government is developing a marine mammal escape device which, if successful, will reduce the number of dolphin casualties in these fisheries. More information available from www.defra.gov.uk.

In the UK a Statutory Instrument came into force in December 2004 which bans fishing for bass with pelagic pair trawls within 12 miles of the coast of England in the Western English Channel. Other bass fisheries will be able to continue in the area. The legislation is however unlikely to reduce the amount of dolphins dying in the fishery as the major effort in it is concentrated outside 12 miles. The legislation does not affect vessels pair trawling for species other than bass.

Pole and line

Pole and line fishing (also known as bait boat fishing) is used to catch naturally schooling fish which can be attracted to the surface. It is particularly effective for tunas (skipjack and albacore). The method almost always involves the use of live bait (anchovies, sardines etc.) which is thrown over board to attract the target species near the boat (chumming). Poles and lines with barbless hooks are then used to hook the fish and bring them

on board. Hydraulically operated rods or automatic angling machines may be used on larger pole and line vessels.

Pots (or creels)

Pots (or creels) are small baited traps which can be set out and retrieved by the operating vessel. They are widely used on continental shelves in all parts of the world for the capture of many species of crustaceans and fish, together with octopus and shellfish such as whelks. Potting is a highly selective method of fishing, since the catch is brought up alive, and sorting takes place immediately, allowing unwanted animals to be returned to the sea, making the method potentially sustainable. However, in Britain, fishing effort in the potting sector is high, with currently no restrictions on the number and type of pot used or the amount of shellfish taken. Pots used to be constructed from 'withy' or willow, but are now constructed from plastic-coated or galvanised wire with nylon netting. This makes them virtually indestructible. Modern pots or 'parlour pots' are also more complex and fitted with 'pot-locks', making escape impossible for the crab or lobster entering it. These factors combined with mechanical hauling allow fishermen to haul more pots and to leave them on the seabed for longer, thus increasing efficiency and fishing capacity.

Purse seining

This is the general name given to the method of encircling a school of fish with a large wall of net. The net is then drawn together underneath the fish (pursed) so that they are completely surrounded. It is one of the most aggressive methods of fishing and aims to capture large, dense shoals of mobile fish such as tuna, mackerel and herring.

Purse seining for yellowfin tuna in the Eastern Tropical Pacific, specifically 'dolphin-fishing', where dolphins are deliberately encircled to trap the tuna swimming below them, is probably the most widely reported example of marine mammal by-catch. However, since the introduction of legislation to protect marine mammals in 1972 (Marine Mammal Protection Act) the number of yellowfin tuna taken in nets set deliberately on dolphins now only accounts for a very small proportion (3.3% in 1997) of tuna on the world market. The most stringent 'dolphin-friendly' standards are those developed by the Earth Island Institute (see www.earthisland.org for details) and HJ Heinz Corporation (the largest supplier of canned tuna in the world). Since their introduction in 1990 dolphin deaths in this area have been reduced by 98% to about 2-3,000 reported deaths per year. Companies participating in the EII project represent more than 90% of the world's canned tuna market.

Seine netting

This is a bottom fishing method and is of particular importance in the harvesting of demersal or ground fish including cod, haddock and hake and flat-fish species such as plaice and flounder. The fish are surrounded by warps (rope) laid out on the seabed with a trawl shaped net at mid-length. As the warps are hauled in, the fish are herded into the path of the net and caught. Effectiveness is increased on soft sediment by the sand or mud

Marine Conservation Society

Protecting our **seas, shores and wildlife**

Registered Charity Number (England and Wales) 1004005

Registered Charity Number (Scotland) SCO374680

mcsuk.org

cloud resulting from the warps' movement across the seabed. This method of fishing is less fuel-intensive than trawling and produces a high quality catch, as the fish are not bumped along the bottom as with trawling.

Trap (nets)

Walls or compounds of netting are set out in a particular way and anchored to the seabed so that fish, once they have entered, are prevented from leaving the trap. In some cases, e.g. salmon traps, long leader nets are arranged from the shore to intercept migrating fish and guide them into the trap. Other species taken in traps include bass, herring and tuna.

The selectivity of trap nets is determined by the mesh size used. Undersized or unwanted fish may be returned to the sea alive. However, in many tropical or subtropical fisheries where there is a large mix in species and size range, many fish are likely to become gilled as they attempt to escape from the trap. Seabirds and mammals are also prone to becoming entangled in the nets.

Use of explosives (dynamite) or poisons (sodium cyanide, bleach)

Dynamite fishing. In some countries such as the Philippines, explosives (dynamite or blast fishing) are used on coral reefs to capture fish. Blast fishing is a particularly destructive method of fishing and is prohibited in many regions. A single explosion can destroy square metres of coral in the immediate area, whilst shock waves can kill fish in a radius of 50m or more from the blast. Reefs in some parts of South East Asia have been reduced to rubble in this way.

Cyanide poisoning. Cyanide is used by fishermen in many areas of South East Asia, the Pacific and the Indian Ocean, to stun reef fish such as grouper and Napoleon wrasse which are then exported for the live reef fish food market or aquarium trade. Although its use is prohibited the practice continues because of the demand for certain species (e.g. Napoleon wrasse) as gourmet delicacies.

Main references:

Commercial fishing methods: an introduction to vessels and gears. Sainsbury JC (1996). Third Edition. Fishing News Books. Oxford.

Commercial fishing: the wider ecological impacts. Edited by G Moore & S Jennings (2000). Blackwell Science Ltd.