

Gillnet

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Oil painting of gillnetting, *The salmon fisher* by Eilif Peterssen.

Gillnetting is a common fishing method used by [commercial](#) and [artisanal](#) fishermen of all the oceans and in some freshwater and estuary areas. The gillnet also is used by [fisheries scientists](#) to monitor fish populations.^[1] Because gillnets can be so effective their use is closely monitored and regulated by fisheries management and [enforcement](#) agencies. [Mesh size](#), twine strength, as well as net length and depth are all closely regulated to reduce [bycatch](#) of non-target species. Most [salmon fisheries](#) in particular have an extremely low incidence of catching non-target species.^[2]

Gillnet, the name of the [net](#) employed, illustrates the method used to snare target fish. They try to swim through deliberately sized mesh openings but are unable to squeeze through swimming forward. Once in this position, they are prevented from backing out due to the tendency for their gills to become caught. This effectively captures them until they are removed by the fisher.

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[\[edit\]](#) History

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[Fish and Wildlife Service](#) worker on boat checking gill net full of fish

Gillnets existed in ancient times as archaeological evidence from the Middle East demonstrates.^[3] In North America, aboriginal fishermen used cedar canoes and natural fiber nets, e.g., made with nettels or the inner bark of cedar.^[4] They would attach stones to the bottom of the nets as weights, and pieces of wood to the top, to use as floats. This allowed the net to suspend straight up and down in the water. Each net would be suspended either from shore or between two boats. Native fishers in the Pacific Northwest, Canada, and Alaska still commonly use gillnets in their fisheries for [salmon](#) and [steelhead](#).

Both drift gillnets and setnets also have been widely adapted in cultures around the world. The antiquity of gillnet technology is documented by a number of sources from many countries and cultures. [Japanese](#) records trace fisheries exploitation, including gillnetting, for over 3,000 years. Many relevant details are available concerning the [Edo period](#) (1603-1868).^[5] Fisheries in the [Shetland](#) Islands, which were settled by [Norsemen](#) during the [Viking](#) era, share cultural and technological similarities with Norwegian fisheries, including gillnet fisheries for herring.^[6] Many of the Norwegian immigrant fishermen who came to fish in the great Columbia River salmon fishery during the second half of the 19th century did so because they had experience in the gillnet fishery for cod in the waters surrounding the [Lofoten](#) Islands of northern [Norway](#).^[7] Gillnets were used as part of the seasonal round by [Swedish](#) fishermen as well.^[8] Welsh and English fishermen gillnetted for Atlantic salmon in the rivers of [Wales](#) and [England](#) in [coracles](#), using hand-made nets, for at least several centuries.^[9] These are but a few of the examples of historic gillnet fisheries around the world.

Gillnetting was an early fishing technology in Colonial America, used for example, in fisheries for Atlantic salmon and shad.^[10] Immigrant fishermen from northern Europe and

the Mediterranean brought a number of different adaptations of the technology from their respective homelands with them to the rapidly expanding salmon fisheries of the Columbia River from the 1860s forward.^[11] The boats used by these fisherman were typically around 25 feet (8 m) long and powered by oars. Many of these boats also had small sails and were called "row-sail" boats. At the beginning of the 1900s, steam powered ships would haul these smaller boats to their fishing grounds and retrieve them at the end of each day. However, at this time gas powered boats were beginning to make their appearance, and by the 1930s, the row-sail boat had virtually disappeared, except in Bristol Bay, Alaska, where motors were prohibited in the gillnet fishery by territorial law until 1951.^[12]

In 1931, the first powered drum was created by Laurie Jarelainen. The drum is a circular device that is set to the side of the boat and draws in the nets. The powered drum allowed the nets to be drawn in much faster and along with the faster gas powered boats, fisherman were able to fish in areas they had previously been unable to go into, thereby revolutionizing the fishing industry.

During World War II, navigation and communication devices, as well as many other forms of maritime equipment (ex. depth-sounding and radar) were improved and made more compact. These devices became much more accessible to the average fisherman, thus making their range and mobility increasingly larger. It also served to make the industry much more competitive, as the fisherman were forced to invest more into their boats and equipment in order to stay up to date with the current technology.

The introduction of fine [synthetic fibres](#) such as [nylon](#) in the construction of fishing gear during the 1960s marked an expansion in the commercial use of gillnets. The new materials were cheaper and easier to handle, lasted longer and required less maintenance than natural fibres. In addition, [multifilament nylon](#), [monofilament](#) or [multimonofilament fibres](#) become almost invisible in water, so nets made with synthetic twines generally caught greater numbers of fish than natural fibre nets used in comparable situations.

Nylon is highly resistant to abrasion and degradation, hence the netting has the potential to last for many years if it is not recovered. This [ghost fishing](#) is of environmental concern. Attaching the gillnet floats with biodegradable material can reduce the problem.^[13] However it is difficult to generalize about the longevity of ghost-fishing gillnets due to the varying environments in which they are used. Some researchers have found gill-nets to be still catching fish and crustaceans for over a year after loss^[1], while others have found lost nets to be destroyed by wave action within one month^[2] or overgrown with [seaweeds](#), increasing their visibility and reducing their catching potential to such an extent that they became a microhabitat used by small fishes^[3].

This type of net was heavily used by many [Japanese](#), [South Korean](#), and [Taiwanese](#) fishing fleets on the high seas in the 1980s to target [tunas](#). Although highly selective with respect to size class of animals captured, gill nets are associated with high numbers of incidental captures of [cetaceans](#) ([whales](#) and [dolphins](#)). In the Sri Lankan gill net fishery, one dolphin is caught for every 1.7-4.0 tonnes of tuna landed^[4]. This compares poorly

with the rate of one dolphin per 70 tonnes of tuna landed in the eastern Pacific [purse seine](#) tuna fishery. Gillnets were banned by the [United Nations](#) in 1993 in international waters, although their use is still permitted within 200 nautical miles (400 km) of a coast.

[\[edit\]](#) Selectivity

Selectivity properties of a gillnet on a hypothetical population.

Gill nets are basically a series of panels of meshes with a weighted "foot rope" along the bottom, and a "headline", to which floats are attached. By altering the ratio of floats to weights, buoyancy changes,^[14] and the net can therefore be set to fish at any depth in the water column. The meshes of a gill net are uniform in size and shape, hence highly selective for a particular size of fish. Fish which are smaller than the mesh of the net are able to pass through unhindered, while those which are too large to push their heads through the meshes as far as their gills are not retained. This gives a selectivity [ogive](#) which is skewed towards medium sized fishes, unlike active gears such as [trawling](#), in which the proportion of fish entering the net which are retained increases with length^[5].

Commercial gillnet fisheries are still an important method of harvesting salmon in Alaska, British Columbia, Washington, and Oregon. In the [Columbia River](#), non-Indian commercial salmon fisheries for spring chinook have developed methods of selectively harvesting adipose fin clipped hatchery salmon using small mesh gillnets known as tangle nets or tooth nets. Non-fin clipped (primarily natural origin salmon) are required to be released. Fishery management agencies estimate a relatively low release mortality rate on salmon and steelhead released from these small mesh gillnets.

Gillnets are sometimes a controversial gear type especially among sport fishers who sometimes argue they are inappropriate especially for salmon fisheries. Most salmon fisheries are strictly managed to minimize total impacts to specific populations and salmon fishery managers continue to allow their use.

[\[edit\]](#) Types of gillnets

The [FAO](#) classifies gillnet gear types as follows:

[\[edit\]](#) Set gillnets

Set gillnets consist of a single netting wall kept vertical by a floatline (upper line/headrope) and a weighted groundline (lower line/footrope). Small [floats](#), usually shaped like eggs or cylinders and made of solid plastic, are evenly distributed along the floatline, while [lead weights](#) are evenly distributed along groundline. The lower line can also be made of lead cored rope which does not need additional weight. The net is set on the bottom, or at a distance above it and held in place with anchors or weights on both

ends. By adjusting the design these nets can fish in surface layers, in mid water or at the bottom, targeting [pelagic](#), [demersal](#) or [benthic](#) species. On small boats gillnets are handled by hand. Larger boats use hydraulic net haulers or net drums. Set gillnets are widely used all over the world, and are employed both in inland and sea waters. They are popular with [artisanal fisheries](#) because no specialized gear is needed, and it is low cost based on the relationship of fuel/fish.^[13]

[\[edit\]](#) Encircling gillnets

Encircling gillnets are gillnets which are set vertically in shallow waters with the floatline remaining at the surface so they encircle fish. Small open boats or canoes can be used to set the net around the fish. Once the fish are encircled, the fishers shout and splash the water to panic the fish so they gill or entangle themselves. There is little negative impact on the environment. As soon as the gear is set the scaring takes place and the net is hauled back in. The fish are alive and [discards](#) can be returned to the sea. Encircling gillnets are commonly used by groups of small-scale fishers, and does not require other equipment.^[15]



[\[edit\]](#) Combined gillnets-trammel nets

This bottom-set gear has two parts

- the upper part is a standard gillnet where semi-[demersal](#) or [pelagic fish](#) can be gilled
- the lower part is a trammel net where bottom fish can entangle.

The combined nets are maintained more or less vertically in the usual way by floats on the floatline and weights on the groundline. They are set on the bottom. After a time depending on the target species, they are hauled on board. Traditional combined nets were hauled by hand, especially on smaller boats. Recent hydraulic driven net haulers are now common. The gilled, entangled and enmeshed fish are removed from the net by hand. Of some concern with this method is [ghost fishing](#) by lost nets and [bycatch](#) of diving seabirds. Nets combined in this way were first used in the Mediterranean.^[16]

[\[edit\]](#) Drift nets

Main article: [Drift net](#)

A **drift net** consists of one or more panels of webbing fastened together. They are left free to drift with the current, usually near the surface or not far below it. Floats on the floatline and weights on the groundline keep them vertical. Drift nets drift with the current while they are connected with the operating vessel, the driftnetter or [drifter](#).

Drift nets are usually used to catch [schooling forage fish](#) such as [herring](#) and [sardines](#), and also larger [pelagic fish](#) such as [tuna](#), [salmon](#) and pelagic [squid](#). Net haulers are usually used to set and haul driftnets, with a drifter capstan on the forepart of the vessel. In developing countries most nets are hauled by hand. The mesh size of the gillnets is very effective at selecting or regulating the size of fish caught. The drift net has a low fuel/fish energy consumption compared to other fishing gear. However, the issue of concern with this type of net is the [bycatch](#) of species which are not targeted, such as marine mammals, seabirds and to a minor extent turtles. The use of drift nets longer than 2.5 kilometres on the [high seas](#) was banned by the United Nations in 1991. Prior to this ban, drift nets were reaching lengths of 60 kilometres. However, there are still serious concerns with ongoing violations.^[17]

[\[edit\]](#) Gillnets and entangling nets

The tangle net, or tooth net, originated in British Columbia, Canada, as a gear specifically developed for selective fisheries.^[18] Tangle nets have smaller mesh sizes than standard gillnets. They are designed to catch fish by their nose or jaw, enabling bycatch to be resuscitated and released unharmed. Tangle nets as adapted to the mark-selective fishery for spring Chinook salmon on the lower Columbia River have a standard mesh size of 4-1/4 inches (10.8 cm.). Short net lengths and soak times are used in an effort to land fish in good condition. Only fish marked by an adipose fin-clip may be retained. All fish retaining their adipose fins must be returned to the water. Tangle nets are used in conjunction with a live recovery box, which acts as a resuscitation chamber for unmarked fish that appear lethargic or stressed before their release into the water.^{[19] [20]}

<http://en.wikipedia.org/wiki/Gillnet>