Off-bottom trawling

Trawl gear without any bottom contact during fishing is certainly not harmful to the bottom habitat. Trawling off-bottom is called pelagic trawling and is conducted in the water column anywhere from the surface to the vicinity of the bottom. Pelagic trawling is primarily used to exploit pelagic fish resources either in schools or in layers. However, some species are known to have seasonal and diurnal vertical migrations and are therefore available for both pelagic and bottom trawls. Catching such species with pelagic trawls when they are off-bottom is thus an option that will reduce the bottom impact significantly.

There are several examples of pelagic trawling for species with both demersal and pelagic vertical distribution. In the North Atlantic a major pelagic trawl fishery has developed since 1975 for blue whiting. Prior to 1975 this resource was captured with bottom trawls in the North Sea. Until 1977 cod, haddock and saithe in the Barents Sea were captured with pelagic trawls as well as with bottom trawls. Poor size-selectivity and large catches of small-sized fish was the main reason for the introduction of a ban on pelagic trawling in the Barents Sea in 1977.

Alaskan pollock (*Theragra chalcogramma*) was only captured with bottom trawls prior to 1990. Concerns about the bycatch of crabs and other ground fish species, such as Pacific halibut, initiated a switch to pelagic trawling for the pollock. As pelagic trawling soon proved to be as efficient as bottom trawling the industry quickly adopted this new trawling technique, resulting in a bottom trawl ban by the North Pacific Fisheries Management Council (NPFMC) since 1999 (NRC, 2002).

In recent years, the size-selective properties of trawls have been improved with the introduction of new mesh configurations (square meshes, T-90 meshes and exit windows, etc.) and sorting grids. Pelagic trawl techniques have also become more efficient during the last two decades with the introduction of megasized large mesh trawls and advanced instrumentation to monitor trawl performance (Valdemarsen, 2001).

Alternative gears to catch demersal species

Most demersal organisms can be captured with other fishing gears than trawls. Bottom-set longlines and gillnets, as well as pots and traps are, obvious alternatives. Other alternative gear types are the seine net and, to a lesser extent, the purse seine. For some species, however, the only feasible technique is with trawls, as is the case with the deepwater shrimp and some small size fish species, e.g. sand eel (Ammodytes). Although the bottom impact of these alternative gears might be less than with a bottom trawl, they may have other disadvantages that outweigh the environmental bottom impact of a bottom trawl.

BOTTOM-SET GILLNETS

Gillnetting is one of the predominant and most efficient fishing gears used by all sizes of fishing vessels all over the world, from tropical regions to under-ice fishing in the Arctic region, and in marine as well as in freshwater. It is certainly one of the most energy effective methods in terms of fuel used per kilogram of fish caught, Gillnets are size-selective fishing gears and, by using appropriate mesh sizes, the size of the target can be chosen with great accuracy. The most obvious weaknesses of gillnetting are occasional poor quality of captured fish and ghost fishing of lost gillnets. A future expansion of bottom-set gillnetting as a possible replacement for bottom trawling, to a large extent depends on solving these two negative issues. These negative issues are mostly related to the operationa more responsible fishing operation may well solve these problems.

BOTTOM-SET LONGLINES

Bottom-set longlining is another low-fuel demanding fishing technique for demersal fish. Its impact on bottom is also considered to be marginal (Bjordal and Løkkeborg, 1996), so that longlining is seen to have many environmentally positive characteristics. The incidental catch of seabirds when setting longlines has partly been mitigated by the use of various devices resulting in the general belief that longlining is no longer considered a major environmental problem (Valdemarsen and Suuronen, 2003). The main weakness of longlining is therefore the cost of bait which sometimes makes fishing uneconomical. Longlining is an obvious alternative to exploit certain bottom fishes such as cod and haddock, whereas saithe is not captured efficiently with such gear.

TRAPS AND POTS

Baited pots and unbaited traps are common alternative gears to exploit several bottom species. These gears can be operated by a wide range of vessel sizes and used in areas where bottom conditions are too rough for bottom trawling. Pots and traps are commonly used in small-scale fisheries in tropical regions. In temperate waters, where trawling is the most common gear to exploit bottom fish, there are only a few success stories of economical capture with traps and pots and they are therefore not in widespread use. However, research to improve the capture efficiency for species such as cod is ongoing.

The bottom impact of pots and traps is considered to be low but ghost fishing of lost pots and traps is a major problem in some areas. Loss of fish traps is quite common in tropical regions occasionally affected by strong winds and rough sea, as in the Caribbean.

SEINE FISHING

Seining is a fishing method which, in many aspects, has similarities with bottom trawling. The fishing method consists of a bag-shaped net that is dragged over the bottom. Instead of trawl doors that open the net horizontally, long ropes are set in a triangle surrounding the target fish which are then herded into the path of the net by the long ropes. Both the net and the ropes are in contact with the bottom and, except for lesser gear weight and no trawl doors, seines may have impact on protruding bottom organisms similar to a bottom trawl.

Seine-netting can exploit the same resources as a bottom trawl, except for non-herded organisms such as shrimp and nephrops. Another drawback of a seine net might be the fishing depth, which is presently limited to approximately 500 metres.

PURSE-SEINING

Purse-seining is a traditional fishing method to catch schooling pelagic fish. Thus it is not an obvious alternative to dragged bottom gear for exploiting bottom resources. However, some fish species migrate vertically and therefore traditional bottom fish might occasionally be available for purse-seining. For capture of species such as cod and haddock, purse-seining has been used successfully when these are aggregating for e.g. spawning or feeding. As a purse seine is off-bottom during the fishing operation, the bottom impact of this gear is zero.

Increased catch rates to reduce seabed impact

Some management regimes (e.g. vessel quota regulated-fisheries) encourage the use of minimum effort to catch an allocated quota of fish.

As seabed impact is very dependent on the duration of contact between a fishing gear and the seabed, improvement of the efficiency of the gear might be a significant contribution to reduce any adverse seabed impact.

Several options that can improve catch rates for dragged gear are known and these are briefly introduced in this chapter.

SEABED MAPS

For some target species, density is often related to bottom topography and sediment characteristics. As catch rate is related to density, better knowledge of the bottom topography and sediment types will help reduce fishing effort, particularly in quota-regulated fisheries.

In the Canadian scallop fishery, seabed characteristics typical for high scallop density was mapped with multibeam technology. Fishers used detailed 3-D topography with information on bathymetry, sediments and benthic habitat to identify scallop beds. Vessel captains optimized dredge efficiency by towing directly on those areas. Average fishing time per metric tonne of scallop meat was reduced from 6.37 hours to 2.41 hours, fuel consumption was reduced by 36 percent and 74 percent less seabed was dredged (BIO, 2002).

Although the above example refers to a stationary organismthe scallopdetailed information about the bottom topography and its sediments can be a useful planning tool to reduce trawling on a bottom with low density of fish species and shellfish.

MULTIRIG BOTTOM-TRAWLING

Multirigged bottom trawls sometimes produce higher catch rates per trawl than single-rigged trawls (Engås, unpublished). Even with similar catch rates per trawl, the catch corrected impact from multirigged bottom-trawling is expected to be less than that for single rig trawling. A single-rigged trawl uses two trawl doors while a multirigged trawl uses two doors and one less weight than the number of trawls. Provided that the impact of a weight is less than that of a trawl door, the impact of the operation will be in favour of a multirigged trawl.

GEAR MONITORING INSTRUMENTS

Gear monitoring systems are useful tools to optimize the efficiency of trawl gears. Instruments that monitor spread, bottom contact and symmetry of the trawl are examples of such equipment.

Advantage of using lesser impacting gears

Fishing is a commercial activity and therefore profit is its key driving force. Maximizing revenues and minimizing operation costs are what fishers consider as their main challenge. In recent years concern about the environmental impact of fishing operations has become an important issue and it is also of increasing concern for the fishing industry. In a context where consumers demand certificates on the origin of fish products, the method of fish capture will play an even greater role in the future. Certainly a certification process might encourage fishers to use low-impact fishing gears, as the alternative might be reduced market access and possibly a lower price for the captured fish as well.

Another extreme threat is that bottom-trawling might be banned because of the potential negative impact on the bottom habitat. Several initiatives in that direction have been launched in recent years.

Such external pressure is certainly a driving force towards implementing more environmentally-friendly fishing methods. This pressure may force fishers out of the industry, resulting in reduced harvest of food from the sea, or may lead to a change to using only low-impact gear.

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Bottom trawling is a diversified fishing method which uses numerous types of gear designs, sizes, rigging and operational methods. Therefore, impact on the bottom habitat will differ among the various bottom trawl fisheries and also to a large extent depend on the bottom conditions in the area fished. During bottom trawling the primary function of the forward parts of the trawl is to maintain bottom contact, provide spread and herd the target species. These parts are the trawl doors, sweeps and bridles, and are essential for proper gear performance and capture efficiency. This document describes the basic principles that can be used to reduce the impact of trawling, some of which are already developed as practical solutions and implemented in commercial fisheries. Overall, however, there are presently few examples of low bottom-impact trawl gears in use in commercial fisheries. These basic mitigation measures aim at reducing pressure on the bottom of various trawl components and minimizing the impacted area while trawling. Implementation of reduced bottom-impact solutions may result in reduced capture efficiency for target species and acceptance of the technology by the fishing industry in their commercial fishing activity might therefore be difficult. Thus, research communities face many challenges to further develop bottom habitat friendly options.

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