



Comparative analysis of the impact of trawl and longline fishing on the Barents Sea ecosystem

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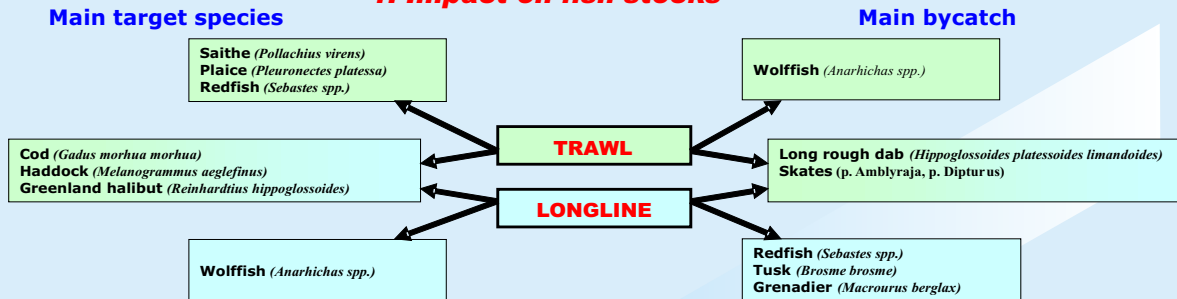
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SUMMARY

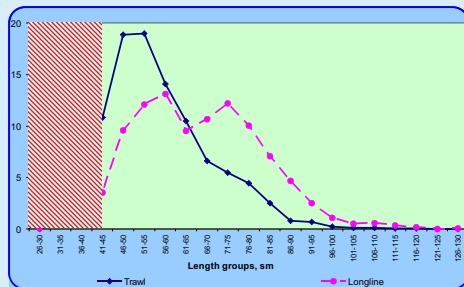
The paper gives a comparative analysis of the impact of bottom trawling and longlining in the Barents Sea on separate elements of its ecosystem. Analysed was the effect of those gears on bottom biocenoses, fish stocks and bird community.

1. Impact on fish stocks



A total of 40-50 fish species are harvested with trawls and about 30 fish species are taken with long-lines in the Barents Sea commercial fisheries.

Size and age selectivity



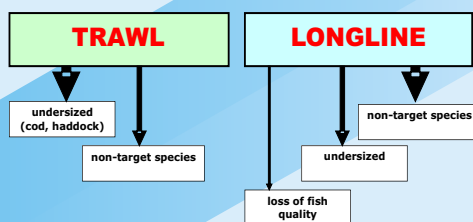
A portion of undersized juvenile cod (< 42 cm) from the same aggregations of cod was 14% in trawl catches (125 mm mesh size) and less than 5% in long-line catches (hooks EZ-13/0).

Cod at age 3 recruit to the fishable stock and are harvested with trawls (up to 11.6% in 2005-2010), but they are scarcely available to long-lining (about 0.5 %). The long-line fishing pressure has shifted to larger fish from older age groups, including fish which constitute the spawning stock and determine reproductive capacity of the population.

Fig.1. Length composition in trawl and long-line catches taken from the same aggregation of cod (Barents Sea, June 2005).

Discards of fish (unregistered catch)

In trawl fishing, discards of juvenile gadoids can reach 30-40% of the catch and discards of other fish species taken as bycatch can be 50-65%. When long-lining, additional losses of fish occur because they are bitten out by bottom crustaceans and marine mammals when captured on the hook.



Survival of fish after escaping from fishing gear

According to different estimates, from 5 to 30% of fish escaping through the codend meshes die. In long-lining, fish which got off the hook suffer barotrauma injuries and jaw injuries. Survival of such fish is doubtful. Some fish, however, show remarkable resilience. Fish with swallowed hooks or cicatrised wounds are quite often recaptured by long-lines.



2. Impact on bottom biotope.

In 1955-1985, the total sea-floor area in the Barents Sea affected by the Russian trawl fleet was estimated to range from 6.2 to 59.3 thou km².

SRTMK-type trawlers, in order to take the catch equal to that taken by long-liners, have to dredge the sea-floor area, which is by 196 times larger than the area affected by bottom long-lines.

3. Impact on biocenoses

Zoobenthos biomass in the Barents Sea was reduced by 70% during the years of highly intensive trawl fishing.

Considerable quantities of *Spongia*, *Mollusca*, *Actiniaria*, *Crustacea* and other benthic organisms can be harvested from the sea-floor by trawls in some areas of the Barents Sea.

Trawl fishing destroys bottom biocenoses and deteriorates conditions in feeding grounds. A trail of sediments is formed in the water that hampers the ability in marine organisms to breathe and covers sessile benthos. The area affected by the trawl is larger than the area where the trawl was directly pulled.

Dredging of the sea-floor with trawls allows biogenic matters, which are needed by autotrophic organisms, including phytoplankton, to be transferred from the bottom into the water. However, the advantage of this is doubtful due to the following reasons: 1. Positive effect of biogenic matters can be significant only in spring-summer time of phytoplankton's vegetation but trawl fishing is conducted throughout the year; 2. Trawl fishing operations are conducted at considerable depths and it is unknown what portion of biogenic matters reach the surface level, where autotrophic organisms occur.

Non-target benthic organisms such as sea anemones, crabs and others are accidentally caught by long-line hooks rather than on a large scale.

Sea birds getting snared on long-line hooks remains to be a problem in the Barents Sea long-line fishing. We have identified two species of sea birds which are snared on long-line hooks: northern fulmars (*Fulmarus glacialis*) and, occasionally, young glaucous gulls (*Larus hyperboreus*). According to our estimates, annual mortality of fulmars caused by Russian long-liners ranges from 10,900 to 29,100 individuals in 1999-2007.

Recommendations to mitigate a negative impact of fishing on the ecosystems (Conclusions)

Only an integrated combination of trawling and long-line gears in the Barents Sea fisheries will make it possible to rationally exploit its living marine resources and reduce the fishing pressure on some age groups of fish species harvested.

To reduce ecological damage, there is a need to improve current fishing methods and gear (sorting grids, rockhoppers, streamers and etc.) and to develop fishing with other gear (pelagic trawls).