

Answer to Special request on pulse trawl electrical fishing gear

The European Commission has requested ICES to evaluate the possible effect of the use of pulse-trawl electrical fishing gear to target plaice and sole in beam-trawl fisheries:

- a) *What change in fishing mortality could be expected following the adoption of such gear in the commercial fishery, assuming unchanged effort measured in KW-days at sea?*
- b) *What effect would such a widespread introduction have in terms of (i) the mixture of species caught; (ii) the size of fish caught?*
- c) *What, if any, effects would such introduction have on non-target species in the marine ecosystems where this gear was deployed?*

This response deals with questions b) and c). Due to resource constraints ICES has not been able to finish the response to question a). This will be delivered in the middle of June 2006.

Background

The tickler chain beam trawl makes substantial impact to the sea bottom. Tickler chains are iron chains in front of the ground rope attached to the ground rope or the shoes of the beam trawl. They stimulate the fish to leave the bottom and by that increase their catchability. As a side effect, the top layer of the bottom will be disturbed and mortality on various bottom organisms increase. Also considerable bycatches of bottom organisms can be made. These are usually discarded with a poor chance of survival. The pulse trawl may be an alternative which could reduce the impact on the sea bottom. Electrical systems have been used as a survey tool in freshwater environments for many decades and in some non-commercial marine fisheries since the 1960's. Until recently, use in commercial fisheries has been held back by technical problems.

Under EC regulation 850/98 (article 31.1) it is illegal to use such an electrical gear. The rationale for this was the potential increase in CPUE with the electrified beam trawl at a time when policy was aimed at reducing fleet capacity. However, the environmental concerns relating to physical impact on the sea floor caused by beam trawling and the increased fuel prices, have caused a renewed interest in this technology.

ICES comments

b) What effect would such a widespread introduction have in terms of (i) the mixture of species caught; (ii) the size of fish caught?

There were two main sources of data. (1) Comparative fishing trials were conducted on FRV "Tridens" with a conventional and a pulse beam trawl fished simultaneously at the relatively low speed of 5.5 knots. (2) The second source of data was from a year-long feasibility study onboard a commercial beam trawler fitted with a complete system of cable winches and two pulse beam trawls. In this case catch data were compared with similar commercial vessels fishing with two conventional beam trawls. These vessels fished at their normal operating speed (i.e. 6-7 knots) in the same weeks and at comparable locations.

The catch data from the research vessel trials showed a reduction in catch rates (in kg/hr) of undersized sole and an increase in catch rates of sole above the minimum landings size compared to the traditional beam trawl. There was a decrease of plaice catch rates over all length classes. The effects on other commercial species were variable.

Data on the comparison of catch rates of the pulse trawl system with conventional beam trawls on commercial vessels was only available shortly before the provision of this reply and could not be fully reviewed due to lack of time. However, the preliminary analysis by The Netherlands Institute of Fisheries Research revealed that the catch rates of commercial species were lower than those observed during the research vessel trials. In comparison to the reference vessels, the pulse trawl caught 22% less sole and 35% less plaice (in kg/hr) above the minimum landing size. The reasons for this reduction are subject to ongoing investigations.

The pulse trawl system is designed as an alternative to tickler chain beam trawls while beam trawls fitted with chain mat that traditionally operate on 'rough' ground are not expected to change to pulse trawling. The overall effect on catch rates will therefore be metier dependant.

c) What, if any, effects would such introduction have on non-target species in the marine ecosystems where this gear was deployed

The pulse trawl system that was tested in both trials showed:

- reduced catches of benthic invertebrates (~51%),
- reduced trawl path mortality on shallow burrowing in-fauna like sea potato (from 49 to 5%), artemis shell (from 38 to 6%) and sea mouse and increased trawl path mortality for helmet crabs
- reduction in the capture of undersized sole (~22%)
- considerable reductions in fuel consumption (~40%),
- decrease in swept area (~22%) due to the lower towing speeds

Compared to the traditional beam trawling with heavy tickler chains, the operation of the pulse trawl is likely to have less impact on the sea bottom and its fauna. However, it is not clear whether the gear could damage fish and whether survival rates of discarded animals would be reduced... For a full evaluation of the ecosystem effects of the gear, ICES considers that it is important to evaluate the effects that the gear could have on fish and on the survival rates of discarded animals.

Research in the freshwater environment has demonstrated that electrical fishing can damage fish. It can lead to mortality from stress, haemorrhaging, respiratory failure and spinal damage. Often mortality does not occur until some days after exposure to the electric field. The extent of the mortality depends on many factors in the technical specification of the pulse and the exposure, so there is no clear link between mortality and the electrical gear..

Some observations were made of cod with broken spines in the catches of the pulse trawl and there may be increased mortality on target and non-target species that contact the gear but are not retained.

The electric signals created by the pulse trawl could possibly affect electro-sensitive fish such as sharks and rays. However, the relation between behavioural change as a result of electric fields in general and from the pulse trawl in particular is not known and has not been studied. Aquarium tests should be carried out to assess the effect of the pulse system on elasmobranchs.

ICES Conclusion

The available information shows that the pulse trawl gear could cause a reduction in catch rate (kg/hr) of undersized sole, compared to standard beam trawls. Catch rates of sole above the minimum landings size from research vessel trials were higher but the commercial feasibility study suggested lower catch rates. Plaice catch rates decreased for all size classes. No firm conclusions could be drawn for dab, turbot, cod and whiting but there was a tendency for lower catch rates.

The gear seems to reduce catches of benthic invertebrates and lower trawl path mortality of some in-fauna species.

Because of the lighter gear and the lower towing speed, there is a considerable reduction in fuel consumption and the swept area per hour is lower.

There are indications that the gear could inflict increased mortality on target and non-target species that contact the gear but are not retained.

The pulse trawl gear has some preferable properties compared to the standard beam trawl with tickler chains but the potential for inflicting an increased unaccounted mortality on target and

non-target species requires additional experiments before final conclusions can be drawn on the likely overall ecosystem effects of this gear.

Other comments

Because the pulse system needs to be towed at a slower speed, there will be a reduction in effective effort (swept area) by approximately 22%. This change in efficiency does not affect nominal effort measured in kW days fishing with the existing fleet.

There appear to be some decrease in catch rates of both plaice and sole. These reductions could be partially compensated by the addition of one or a few tickler chain, but this would negate any reductions in benthos mortality, see answer to point c).

ICES recommendation on additional data needs

Further tank experiments are needed to determine whether injury is being caused to fish escaping from the pulse trawl gear. The experiments need to be conducted on a range of target and non-target fish species that are typically encountered by the beam trawl gear and with different length classes. In these trials it should be ensured that the exposure matches the situation *in situ* during a passage of the pulse beam trawl. Fish should be subjected to both external and internal examination after exposure.

If the pulse trawl were to be introduced into the commercial fishery, there would be a need to closely monitor the fishery with a focus on the technological development and bycatch properties.

Source of information

Report of the Ad-hoc Group on Pulse trawl evaluation. ICES April 2006

Report of the Working Group on Fish Technology and Fish Behaviour. ICES April 2006

Reports of the EU funded IMPACT study which provides data on mortality caused by beam trawls, see review by ICES (ACME report 2001, CRR 248).