DTU Aqua
National Institute of Aquatic Resources

Rikke Petri Frandsen
Research Scientist
Section for Ecosystem Based Management
DTU Aqua

Technical University of Denmark
National Institute of Aquatic Resources
Nordsøen Forskerpark, Postboks 101
DK - 9850 Hirtshals
Direct +45 35883270
rif@aqua.dtu.dk

Collecting bags used to quantify trawl disturbance of aquatic organisms

R. P. Frandsen, G. E. Dinesen, E. Savina, T. Noack, L. A. Krag

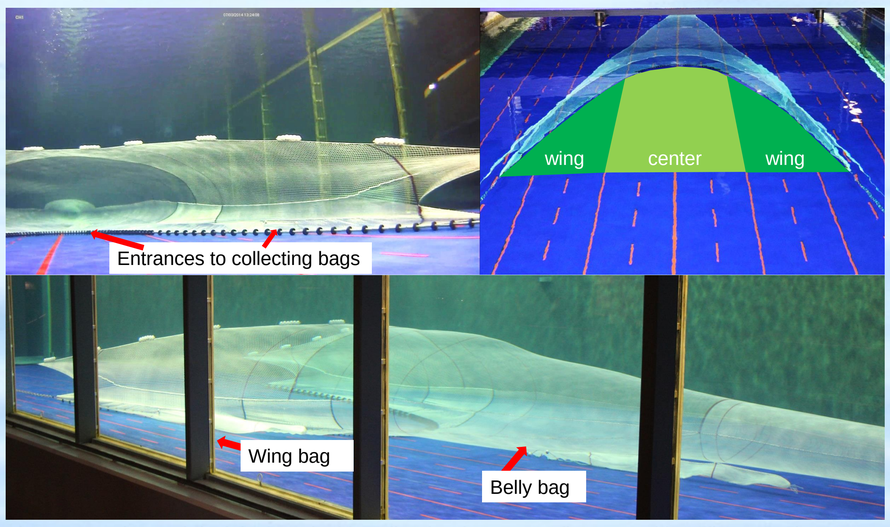

Fig. 1. A scale model of the trawl with collecting bags was first tested in a flume tank.

Background

The environmental impact of demersal trawling activities has been documented by collecting samples before and after the fishing process or by comparing areas of different fishing intensity. However, these investigations are inappropriate for documenting effects of smaller technological changes aimed at reducing trawling impact on commercial fishing grounds.

In this study we develop and test small-meshed collecting bags designed to retain juvenile fish and benthic megafauna.

Catches in the collecting bags provide information of the organisms that encounter the trawl, but are not retained by it. Combined with knowledge on behavior and habitat utilization of these organisms, their presence can be used to indicate differences in the mechanical effect, such as penetration depth of the ground gear of different trawl designs.

The collecting bags are mounted in pairs in the wings and in the belly of the trawl (Fig. 1) covering 8.3% of the meshes in the lower wing and 0.5% of the meshes in the belly. In a pair, one collecting bag is mounted behind the trawl panel thus collecting escapees and one is mounted likewise but with the trawl panel cut open. This bag collects the 'caught population'.

Fig. 2. Trials were conducted in areas with intensive commercial trawling activity.

Trial and results

The concept was tested using a 120 mm *Nephrops* trawl with a non-selective (42 mm) codend. Trials were conducted in Danish waters in April 2014 on board the research vessel 'Havfisken'. We fished in areas that are regularly trawled for Norway lobster (*Nephrops norvegicus*) and demersal fish (muddy substrates, Kattegat: 30-50 m depth, Skagerrak: 140-160 m depth).

Differences between the length distribution of the caught 'population' collected in the wing bag and in the codend indicate a size selective process in the trawl body. Selection in the full length of the trawl is in contrast to the traditional perception; that the selective process is efficient in the codend only. Such a difference was found for *Nephrops* (Fig. 3).

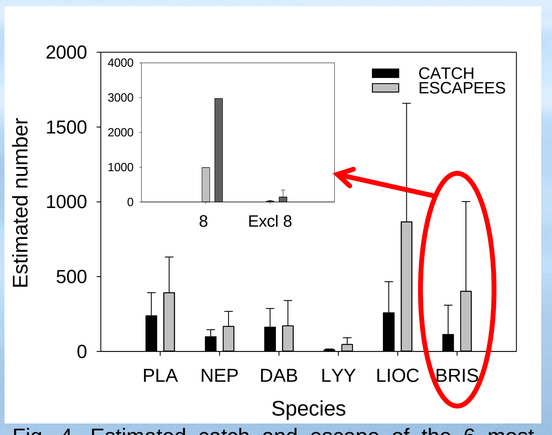

Fig. 4. Estimated catch and escape of the 6 most abundant species. The majority of *B. lyrifera* were caught in the 'mucus-curtains' (possibly hag-fish exudates) of haul 8. PLA: American plaice (*Hippoglossoides platessoides*), NEP: Norway lobster, DAB: dab (*Limanda limanda*), LYY: dragonet (*callionymus lyra*), LIOC: harbor crab (*Liocarcinus depurator*), BRIS: spiny mudlark (*Brissopsis lyrifera*).

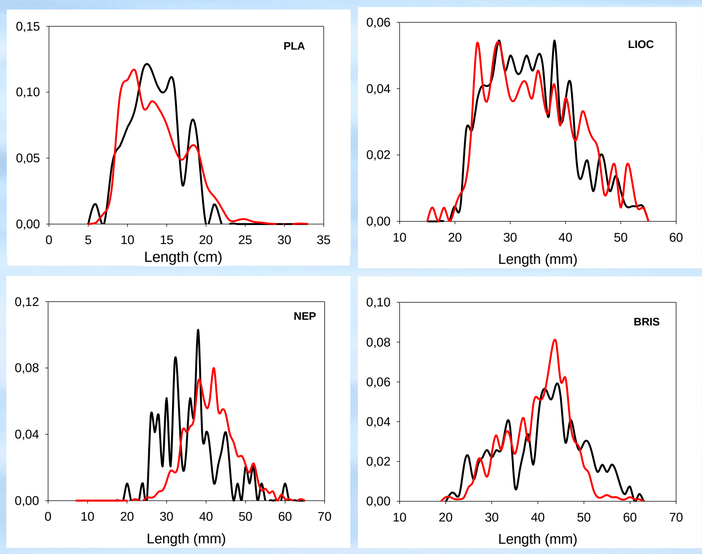

Fig. 3. Length distribution shown as proportion of the total catch in the wing (black) and in the codend (red). Species abbreviations are given in Figure 4.

- Codend catch, in particular of benthic megafauna, greatly underestimates both the number of species and individuals impacted by the trawl (mean estimated escapes in the wing and the belly exceeded the catch in the blinded codend (Fig 4)).
- Harbor crab and spiny mudlark live buried 2-5 cm in the mud. Catches of high numbers of these species indicate that penetration depth of the ground gear reach this depth.

Application of the collecting bags

The collecting bags are easy to handle and in June 2014 they were tested in full scale on board a commercial trawler (see band of pictures below).

- The paired collecting bag system allows quantification of the effect of small changes in the gear thus facilitating the development of low impact gears.
- The paired design of the collecting bags allows use of traditional selectivity analysis of the collected species in different parts of the trawl.
- The collecting bag system can be used for large scale cheap benthic data collecting e.g. in existing observer programs.
- The collecting bag system catches several species of juvenile commercial fish and crustaceans. Such catch information can be used for modeling e.g. full gear selectivity in trawls or length based behavior in relation to different parts of a trawl.

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