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Some experiments on the influence of the beam trawl on the bottomfauna.

by

S.J. de Groot and J. Apeldoorn
(Netherlands Institute for Fishery Investigations, IJmuiden, The Netherlands)

Introduction:

The Dutch most important commercial species of today, as sole, plaice and shrimp are caught by beam trawls. In recent years the number and weight of tickler chains has increased rapidly. The number of chains up to 15 and the total weight of the chains up tp 2000 kg for the sole beam trawl. The sole and shrimp fisheries are entirely dependent on the use of the beam trawl. In international bodies as ICES and NEAFC concern has arisen as to the effect of the use of heavy chains on the seabed. Preliminary results of the Dutch investigations are reported in this paper. (Resolution of the last Meeting, C.Res. 1970/5:1).

Material and Methods:

The experiments were carried out (1) with R.V. "Tridens" from 13 - 23 April 1971 in an area due north of the Frisian Islands and (2) with R.V. "Willem Beukelsz" from 17 - 28 May 1971 in an area off the coast of Scheveningen.

(1) "Tridens"-data: A 6 m shrimp beam trawl, 2 cm mesh, was used. The method of fishing was as follows. On each ground in the area blocks of 3 x 3 hauls were performed, in which combinations of three towing speeds (2, 3, 4 knots) and three classes of tickler chain numbers (0, 2, 4) were randomized according to the Latin Square method. The duration of haul was 15 minutes. The number of hauls was 90 (10 blocks).

(2) "Willem Beukelsz"-data: A 6 m shrimp beam trawl, 2 cm mesh, with 0 and 5 ticklers and a 6 m sole beam trawl, 7.5 cm mesh, with 0 and 5 ticklers were used. The duration of haul was 15 minutes. The number of hauls were respectively 5, 32, 5 and 2. The low number of hauls with the sole beam trawl with 5 ticklers is due to the heavy damage to and loss of the available gear. On this trip we also used bottom samplers to investigate the burrowing habits of some invertebrates and to identify those animals which are nearly completely destroyed by the trawl.

Results:

A. INVERTEBRATA.

Coelenterata - Hydrozoa (Sea-firs).

The damage to the Tubularia species (mainly T. indivisa) is great, however, this effect is mainly caused by the drag of the belly of the net along the bottom. The meshes of the belly were filled with the pulp of Tubularia, and a red liquid of mashed individuals oozed very frequently out of the codend during the hauling process. The meshes of the trawl were equally filled with or without the use of tickler chains. We must assume that nearly all Tubularia in the trawl path will be destroyed by any towmet used.

- Ctenophora (Comb-jellies).

Nearly all individuals will be destroyed due to the pressure in the net. There is no effect of the ticklers on the amount caught - group C.

- Scyphozoa (Jelly fish).

All individuals are completely destroyed due to the pressure in the net. There is no effect of the ticklers on the amount caught - group C.

Bryozoa (Sea-mats).

Notwithstanding considerable quantities are caught in the trawl, the damage to the individuals is insignificant. Almost intact they will be shovelled into the sea again. Nearly three times the amount is caught with 4 ticklers instead of none - group B.

- Nemertea -

Nemertea (Ribbon worms).

There is some damage to this group caused mainly by the ticklers, through the ploughing effect. The amount of the damage is hardly to be estimated as these worms are easily swept through the meshes, the number caught therefore is very low. However, in a bottom sample of 1 m^2 we collected about 30 of these worms.

Annelida (Bristle worms).

Several species were collected (Nereis-, Arenicola-, Pectinaria-, and Lanice species). The damage to these worms done may be considerably, especially Pectinaria and Lanice. On one of our hauls the whole net was filled with crushed Pectinaria and sand.

Crustacea - Decapoda.

Eupagurus species were caught in large numbers. However, nearly all hermit crabs survive their stay in the net and on the deck. There is an increase in the catch when 4 ticklers are used of about 1.6 times - group B.

Portunus species, swimming crabs, are partly damaged. The number caught increases five times when 5 ticklers are used instead of none - group A. There is only a slight increase in the catch of Crangon, shrimp, when the number of tickler chains is increased to four of about 1.2 times - group D.

Mollusca.

Cephalopoda. All cephalopods, Sepia, Sepiola, Loligo, are killed or badly damaged during the fishing process. There is, however, no relation between the number of ticklers used and the amount of damage done. There is a strong influence of the towing speed on the numbers caught.

Bivalva. Of the bivalves investigated only the Ensis and Solen species (razorshells) are badly damaged owing to the ploughing effect of the ticklers. The long thin shells are wipped out of the sand. Most other bivalves sustain the ticklers very well as Spisula-, Mactra-, Venus and Cardium species. The number of living bivalves caught by the trawl is very low compared with the amount of dead sea-shells. The amount of dead shells increases in the catch, when 4 tickler chains are used instead of none, to about 1.7 times - group B.

Echinodermata.

Echinoidea. Especially Echinocardium (Sea potato) is heavily damaged through the action of the tickler chains. The number of damaged sea potatoes increases with the number of ticklers used. From the bottom samples we know that they lie burrowed nearly 10 cm deep in the sand. There is an increase in the catch when the number of tickler chains is increased to four of about 3.4 times - group A.

Asteroidea. The number of starfishes caught (Asterias and Astropecten) increases rapidly when using ticklers. The percentage of damaged starfishes was about 3%. There is an increase in the catch when the number of tickler chains is increased to four about 3 times - group A.

Ophiuroida. Brittle stars behave in a different way compared with the star-fishes. The ticklers have a reduced effect on the number caught. There is only an increase in the catch when the number of tickler chains is increased to four of about 1.3 times - group C. However, owing to pressure about 3/4 of the numbers caught are badly damaged. We never found regenerated brittle stars, as we often observed in starfishes. Therefore we have to assume that the damaged brittle stars do not survive their stay in the net.

B. VERTEBRATA - PISCES.

There is no shift in the average size of the fishes, indicated below with an asterisk, when the towing speeds and/or the number of chains is altered. These data are mainly collected with R.V. "Tridens", but additional data collected with R.V. "Willem Beukelsz" are also given. These data are collected with the shrimp beam trawl.

1*. Cod - Gadus morhua.

There is only a slight increase in the catch when the number of tickler chains is increased to four of about 1.3 times - group C.

2*. Whiting - Odontogadus merlangus.

There is hardly any increase in the catch when the number of tickler chains is increased to four of about 1.1 times - group C.

3*. Bib - Trisopterus luscus.
There is a decrease in the catch when the number of tickler chains is increased to four of about 0.75 times - group D.

4*. Greater sand-eel - Hyperoplus lanceolatus.
There is an increase in the catch when the number of tickler chains is increased to four of about 2 times - group B.

5*. Lesser sand-eel - Ammodytes lancea.
There is an increase in the catch when the number of tickler chains is increased to four of about 1.9 times - group B.

6. Common dragonet - Callionymus lyra.
There is an increase in the catch when the number of tickler chains is increased to four of about 1.8 times - group B. However, when only 2 ticklers are used there is a rise of abour 1.9 times.

7. Reticulated dragonet - Callionymus reticulatus.
There is an increase in the catch when the number of tickler chains is increased to four of about 3.4 times - group A.

8. Goboid species - Gobius spec.
There is a slight increase in the catch when the number of tickler chains is increased to four of about 1.2 times - group C.

9*. Sole - Solea solea.
There is an increase in the catch when the number of tickler chains is increased to two of about 2.3 times - group B. However, the number of soles caught when using 4 ticklers was too low to draw any conclusions from. From data collected with R.V. "Willem Beukelsz" when using 5 ticklers we know that there is an increase of 4 times compared with when no ticklers were used at all. When using a sole beam trawl with 5 ticklers this may be about 10 times.

10*. Solenette - Buglossidium luteum.
There is an increase in the catch when the number of ticklers is increased to four of about 1.5 times - group B.

11*. Plaice - Pleuronectes platessa.
There is an increase in the catch when using 2 ticklers instead of none of about 1.3 times. However, when 4 ticklers are used there is, relatively a decrease, an increase of only 1.2 times - group C. Data of R.V. "Willem Beukelsz" confirm this trend, when 5 ticklers are used the catch is about 0.8 times.

12*. Dab - Limanda limanda.
There is only a slight increase in the catch when using 2 ticklers instead of none of about 1.2 times. However, when 4 ticklers are used there is, relatively a decrease, an increase of only 1.1 times - group C. This trend is again confirmed by the "Willem Beukelsz" data, when 5 ticklers are used the catch is about the same as no ticklers are used at all.

C. LIFELESS MATTER.

Peat lumps. There is a great increase in the catch when using 2 ticklers instead of none of about 4.8 times. There is again a great increase in the catch when 4 instead of 2 ticklers are used of about 6 times - group A, compared with none.

Discussion (see Fig.1):

From the first data gathered at this initial stage we are already able to draw some conclusions and see the shortcomings. For brevity's sake the data are divided into four groups. Group A, an increase of the catch when using for ticklers of more than 300% compared with the catch with no ticklers; group B: 150 - 299%; group C: 100 - 149% and group D: less than 100%.

The items of group A behave more or less as we may expect from passive objects. A doubling of the number of ticklers gives a doubling in the amount caught. The fact that peat lumps, Echinocardium and Asterias behave in this way is understandable as these items do not move or just very slowly. The reticulated dragonet is a very small bottom fish, and most of them will escape through the meshes during the fishing process. It is, however, embarrassing that Portunus, the swimming crab, behaves in the same way. The items of this group, as a whole are unable to escape the approaching trawl owing to their passivity. The items of group B possess the ability to be caught less than we should expect if they were

completely passive. The damage done by the ticklers to this group is comparatively small, as Astropecten, Eupagurus and Bryozoa are hardly affected by the fishing process. However, we have to consider that on board of commercial vessels this group will be badly effected by exposure. Group C, to this group belong all the commercial species encountered, and very embarrassing also the brittle stars (Ophiuroidea). They are able to a remarkable extent to minimize the effect of the tickler chains. That the sole is also grouped under this heading may be a distorted image as ticklers are used especially to chase soles out of the sand. From our data collected with R.V. "Willem Beukelsz" we have to assume that this species really belongs to group A. The marketable quality of plaice, however, is reduced owing to the ticklers. During our 15 minutes hauls we hardly observed any damage done by the ticklers or the trawl to plaice. Therefore, in the near future we shall have to investigate the relation between the duration of haul and the number of tickler chains. As we have to compare our data with the commercial fishery we shall also investigate in near future the effect of 8 and 15 ticklers. Group D, to this group belong the bib and the common squid. There is a negative effect of the use of ticklers on the amount caught. When we compare the amount of squids caught, we observe an increase when fishing with a towing speed of 3 knots instead of 2 of about 4.8 times. This is understandable as squid live pelagically and do not belong to the bottomfauna and escape easily a slow moving trawl. However, we caught frequently clusters of squid eggs, which were effected by the pressure of the mass of items caught in the net. Also we observed that clusters of eggs were hanging in the meshes of the belly.

Apart from the groups mentioned above we observed that a heavy damage was done to some groups of invertebrates as Tubularia (Coelenterata) and Pectinaria and Lanice (Annelida). The Tubularia in the path of the trawl will be destroyed completely through the chafing of the belly of the net along the bottom. This heavy damage is not caused by the tickler chains. On the other hand Pectinaria and Lanice will pay a heavy toll to the ploughing of the tickler chains.

We used in this initial stage especially the shrimp beam trawl as this gear catches more of the bottomfauna compared with the sole beam trawl. We know, however, that there are distinct differences between the catch compositions of both gears. Owing to the wider meshes sand-eel species are hardly caught with the sole beam trawl. This trawl with 5 tickler chains catches about 2.5 times more plaice and dab. To evaluate these differences of the 2 gears will be another field of investigation in near future.

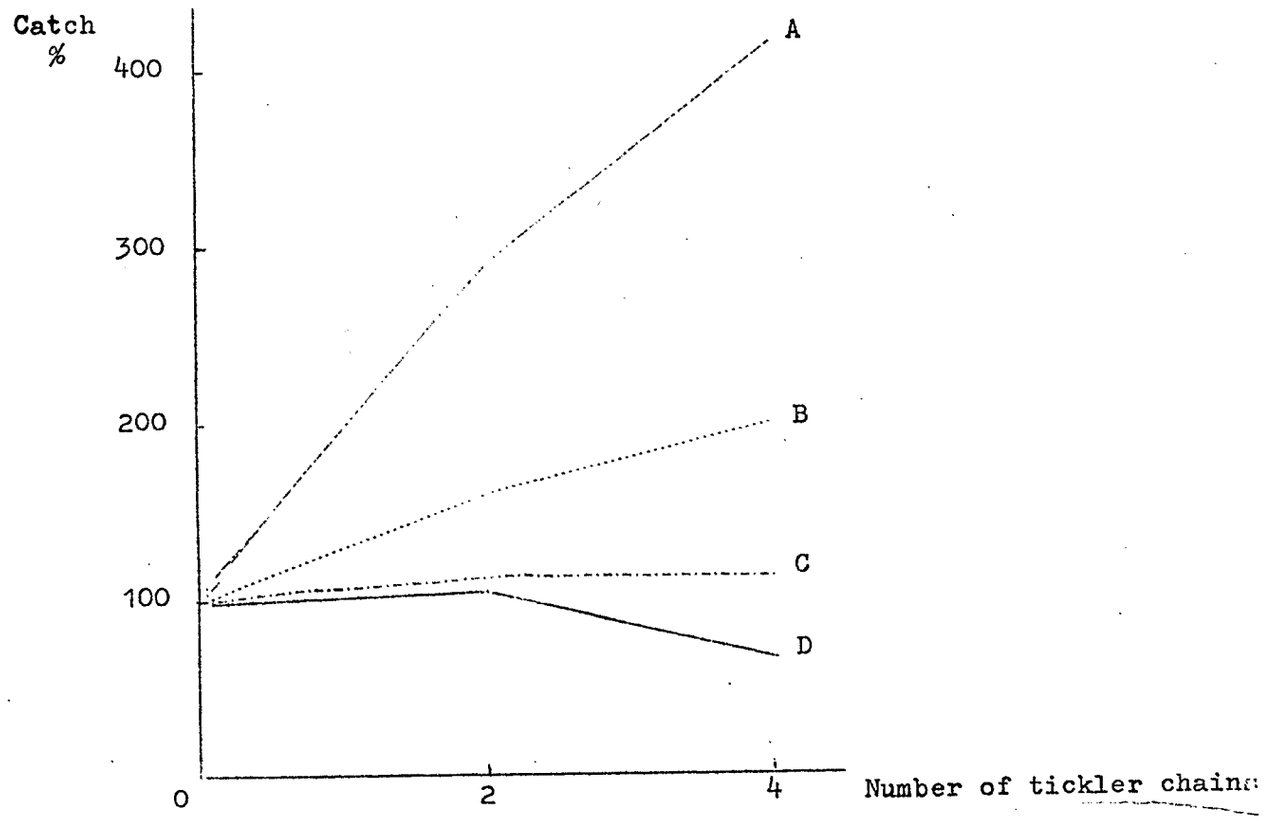

Fig. 1. Influence of the number of tickler chains on the catch.

Group A: >300%
- Peat lumps
- Portunus
- Echinocardium
- Asterias
- Callionymus reticulatus

Group B: 150-299%
- Dead shells
- Bryozoa
- Eupagurus
- Astropecten
- Hyperoplus lanceolatus
- Ammodytes lancea
- Callionymus lyra
- Buglossidium luteum

Group C: 100-149%
- Scyphozoa
- Crangon
- Ophiura
- Solea solea
- Gobius spec.
- Gadus morhua
- Odontogadus merlangus
- Limanda limanda
- Pleuronectes platessa

Group D: <100%
- Loligo forbesi
- Trisopterus luscus