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Preliminary studies on the influence of bottom obstructions and topography on the availability of demersal fish for gillnet fishing in the North Sea

by

Fernø, A. [x] and Valdemarsen, J.W. [xx]

ABSTRACT

Gillnet fishing experiments were carried out in the Little Fisher Bank area in the North Sea. Saithe and pollack and to some extent cod showed a patchy distribution along a gillnet string. The abundance of fish was positively correlated with hard bottom and depth changes. Good catches were obtained on wrecks provided the gillnet string was set accurately across the wreck.

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x) Department of Fisheries Biology
University of Bergen,
Box 1839, N-5011 Bergen-Nordnes, Norway

xx) Institute of Fishery Technology Research,
Box 1964, N-5011 Bergen-Nordnes, Norway

INTRODUCTION

Gillnet fishing for demersal species as cod and saithe has increased markedly in recent years in the North Sea, especially by Norwegian vessels. The distribution and migration of fish in relation to different habitats are important factors when choosing the optimal fishing strategy, i.e. the setting of gillnet strings relative to bottom conditions and current direction. The North Sea is generally characterized by sandy/muddy bottom interrupted by areas with stones, often known to be good fishing grounds.

This report is based on gillnet fishing experiments from two cruises in the North Sea. The objectives of this preliminary investigation are to describe the distribution of demersal fish in relation to bottom topography and structures and to evaluate the fishing potential around wrecks. Future aims of the project are to study the migration of fish between preferred areas and the behavioural mechanisms behind the observed distributions.

MATERIALS AND METHODS

The experiments were made in the Little Fisher Bank area during two cruises in August 1978 and April/May 1979. Commercial Norwegian gillnet fishing vessels of 75 and 80 feet were used.

The study area is characterized by sandy as well as by rough, stony bottom with depth ranging from 40 to 60 meters. Ridges of up to 10 meters height are also typical for the area. The wreck, at which experiments were carried out during both cruises, was situated on sandy bottom 1-2 nautical miles away from an area with stones (Figure 1).

Gillnet strings varying in length from 250 to 1500 meters were set across areas of stones, ridges and wreck. Catches per unit of gillnet were recorded and analyzed with reference to the bottom conditions. Before setting a gillnet string, the area was normally inspected for fish consentrations as well as for bottom conditions with the vessels' echo sounders.

For location of wrecks a sonar (Simrad SB2) was operated on the 1979 cruise. When knowing the Decca position of the wreck,

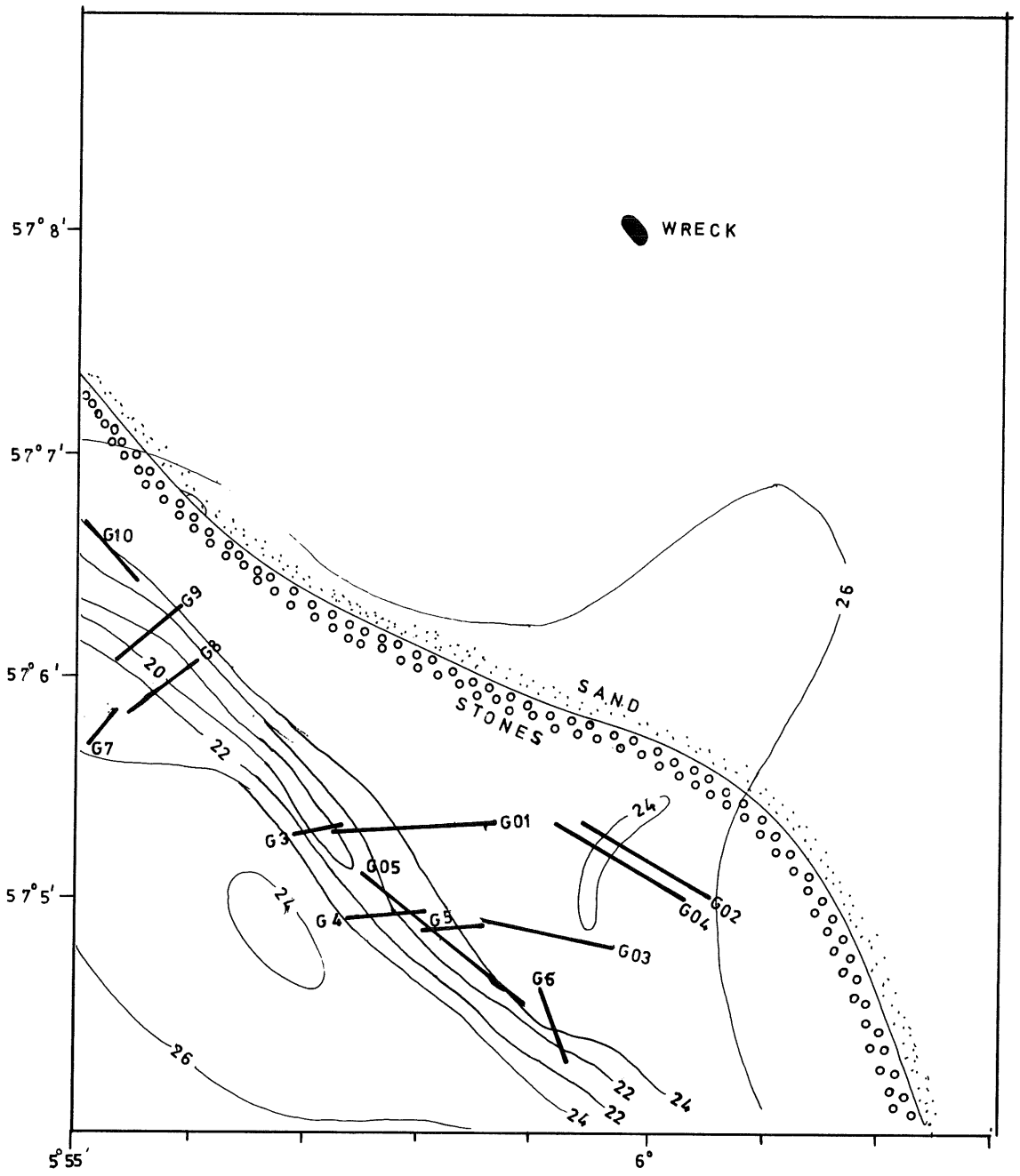

Figure 1. Part of the investigation area with positions of gillnet settings and the wreck indicated. GO represents the 1978 trials and G the 1979 trials. The depth is given in fathoms.

exact localisation was then simple. The sonar was also successfully used to locate small areas of stone surrounded by sandy bottom.

The gillnets were made of monotwine or monofilament nylon with a mesh size of 150 and 180 mm. Larger meshes (up to 220 mm) were used in some nets during the 1979 cruise. All the 150 mm nets were of about 6 meters height, with leadcable as sinking line and a special Norwegian floating line for flotation. Hanging ratio was normally 0.5 for both lines. The height of the 180 mm nets used on the 1978 cruise was about 3.5 meters and the floating line (hanging ratio = 0.33) was about 10% shorter than the sinking line. On the 1979 cruise these large-meshed nets were about 6 meters high, and with the same difference in hanging ratio between the floating and sinking lines. All the 180 mm net had rings for flotation. The fishing time varied from 12 to 24 hours and did always include one night.

Samples of fish caught in different areas and with different nets were length-measured, and the stomach contents of some fishes were analysed.

During the 1979 cruise an instrument buoy recording the direction and velocity of the current and temperature data each 5 minutes was anchored 5 m above the bottom in the study area. The instrument was a three axis ultrasonic current meter described by GYTRE (1979).

RESULTS

Hydrography

The data will not be presented here in detail, but only a general description of the conditions during the 1979 cruise will be given. The first part of the cruise was characterized by a stabile, medium strong (18-22 cm/s) S-SE current. In the second part of the cruise, the current was weaker (12-14 cm/s) and with more varied directions, but the dominating direction was SW-NW. The temperature varied between 3.95°C and 4.20°C during the cruise.

Catch data

Cod and saithe dominated the catches in 1978 and cod and pollack in 1979 (Table 1) Wreck fishing resulted generally in greater catches of cod and pollack per unit gillnet than fishing on hard stony bottom, provided the gillnet string accurately hit the wreck. Saithe was caught at wrecks only in small quantities compared to hard bottom. This is considered to be due to the limited availability of saithe to gillnet fishing because of a more pelagic distribution of the fish above the wreck, as the presence of large amounts of saithe around wrecks was demonstrated with jipping.

Table 1. Catch data related to bottom conditions, mesh size and effort (total gillnet length). Catches are given as mean numbers of fish caught per 100 m of gillnet string.

Cruise	Locality	Mesh size (mm)	Effort (meters)	Catch			
				Cod	Saithe	Pollack	Others
1978	Wreck	150	550	26.4	1.3	0.4	1.3
"	"	180	400	16.0	0.5		7.3 (1)
"	Stone	150	550	6.2	31.8	0.5	1.3
"	"	180	6500	5.8	1.5		0.7
1979	Wreck	150	85 (2)	7.0		24.7	1.1
"	"	≥180	250 (2)	8.4		6.4	2.4
"	Stone	150	4300	7.5	1.6	10.9	1.1
"	"	180	3150	2.9	0.3	2.2	0.8
"	"	>180	1000	4.6	4.2	2.1	1.1

Notes (1) Mostly plaice, (2) 3 settings not hitting the wreck excluded from these figures.

The mesh size in gillnets influences to a great extent the length distribution of captured fish. A mean difference in middle length of 10 cm could be expected between nets of 150 and 180 mm mesh size.

During the 1978 experiments cod was caught in about equal numbers per unit length with both mesh sizes, indicating presence of a wide range of length intervals (65-85 cm). Saithe, however, was seldom caught in nets with 180 mm meshes, but fish of 65-75 cm length were numerous in the 150 mm nets. The cod caught in the same area in 1979 was somewhat smaller, as relatively few fish were caught in the 180 mm nets. Only few saithe of the 65-75 cm size groups were recorded this year. The saithe present was large fish of 105-110 cm length taken in nets of larger meshes than 180 mm. Pollack (60-65 cm) was mostly caught in 150 mm nets.

Fish distribution along a gillnet string

The catch was generally not evenly distributed along a gillnet setting, but there were strong tendencies to patchiness. In Figures 2 and 3, the catch distribution from some of the fishing experiments on stony bottom is given. The patchy distribution of cod and saithe (Figure 2) and cod and pollack (Figure 3) is clearly demonstrated. Saithe and pollack seem generally to be more concentrated than cod. There is also a general tendency for the distribution of two species to be correlated, although in GO3 the greatest number of saithe occurred together with the smallest number of cod along the string.

Three examples of the catch distribution from gillnet settings at wrecks are given in Fig.4. The fish apparently aggregated around the wreck, as is apparent from the strong decline in the catch on sandy bottom outside the position of the wreck. This strong tendency to patchiness was also demonstrated through the great difference between three settings obviously not hitting the wreck (mean catch = 10 fish) and four settings hitting the wreck (mean catch = 83 fish).

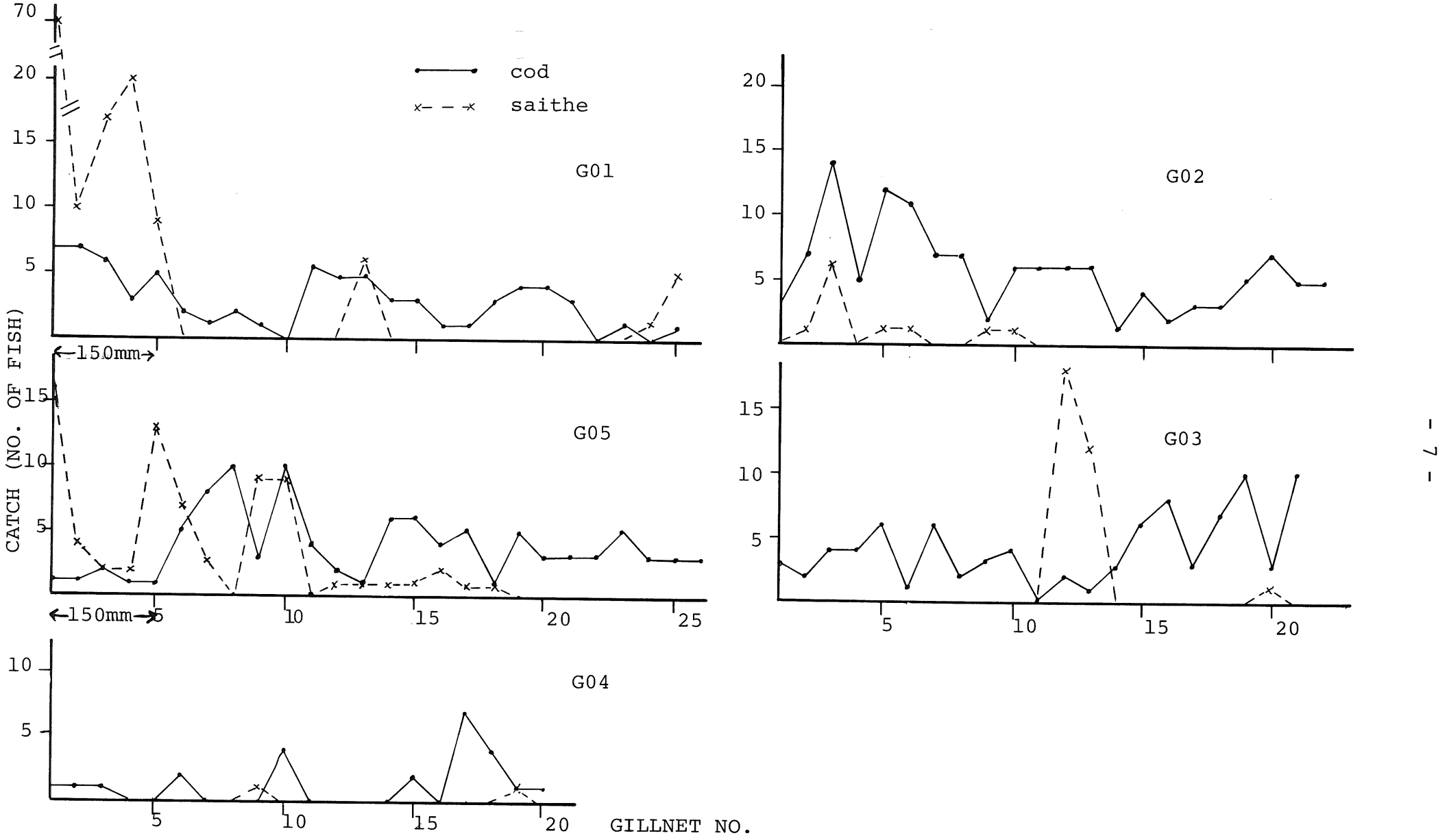

Figure 2. Catch per gillnet from 5 settings on stony bottom during the 1978 experiments. Origo represents the western net in each setting. Mesh size of the gillnets is 180 mm and their length 62 m, except for 10 nets in the settings G01 og G05 with 150 mm mesh size and about 30 m length. In the figures, the catches from two such 150 mm nets are presented together.

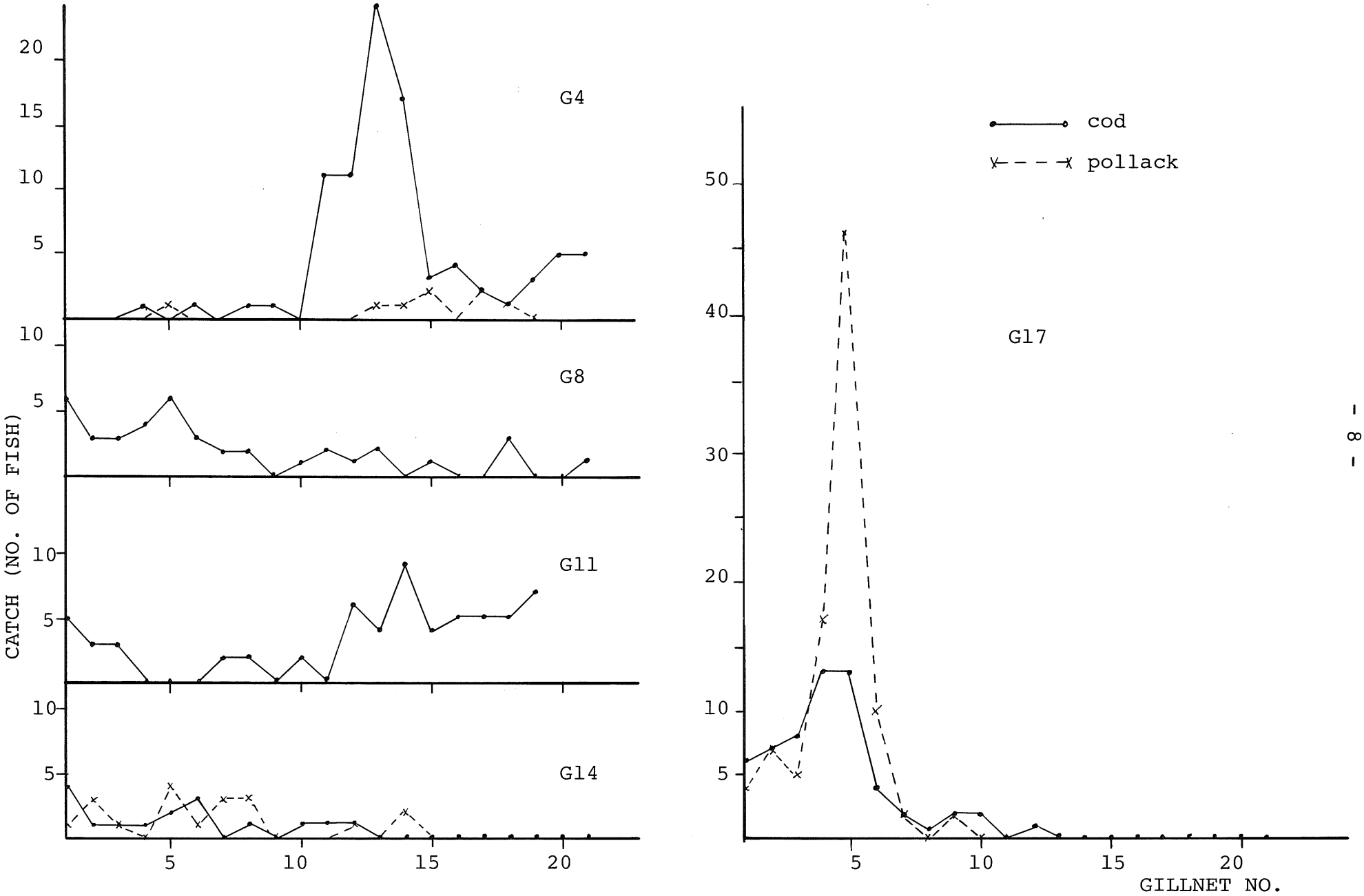

Figure 3. Catch per gillnet from 5 settings on stony bottom during the 1979 experiments. Origo represents the western net in each setting. Mesh size in the gillnets is 150 mm and their length about 30 meters.

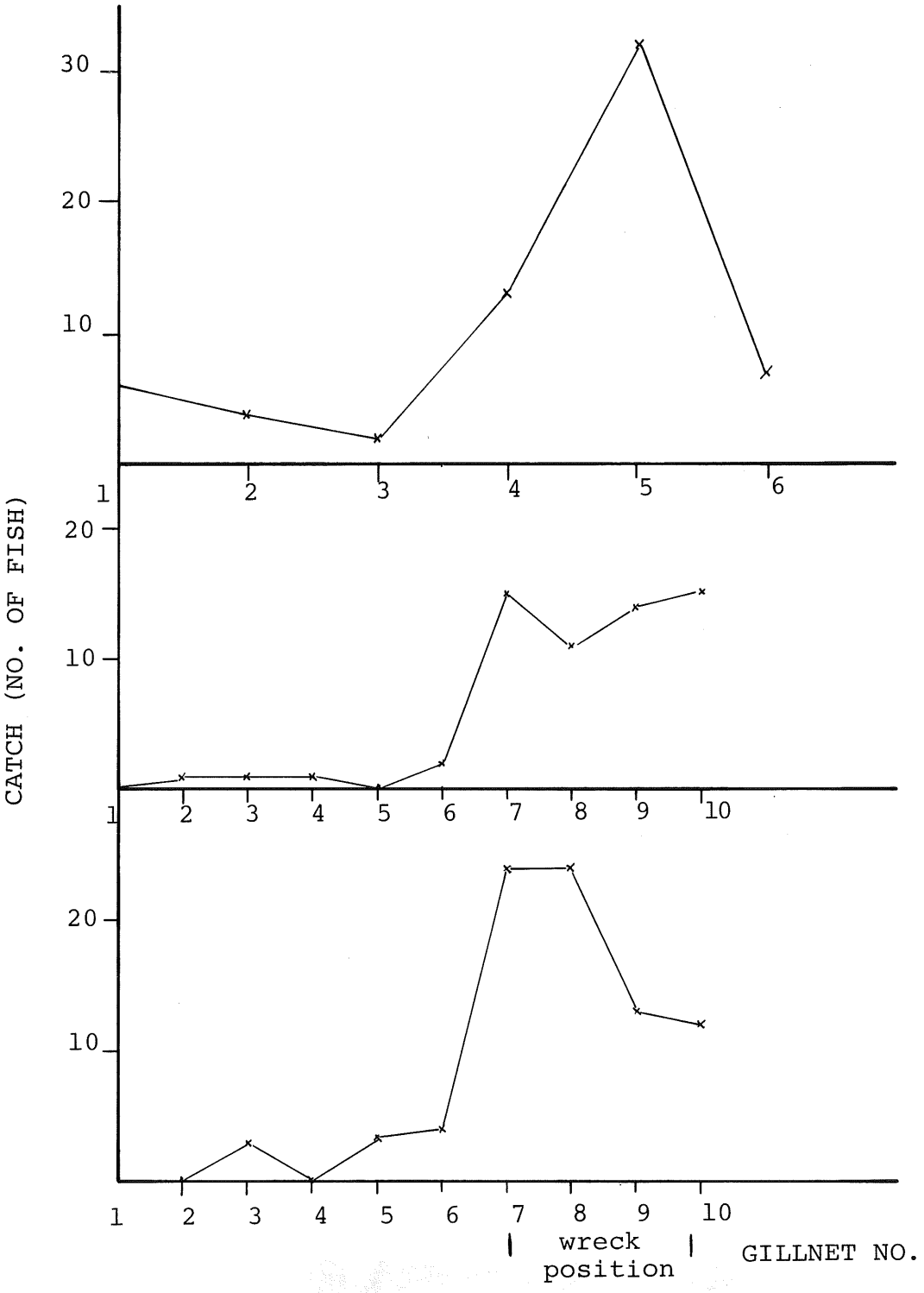

Figure 4. Catch per gillnet of cod from 3 parallel settings across the wreck in the 1978 experiments. The position of the wreck is indicated. The mesh size from the fishing experiment on top is 180 mm and from the other two 150 mm.

A gillnet string was generally not set until clear indications of fishable concentrations were observed on the echo sounder. Such indications of fish were in fact never observed on sandy bottom in connection with searching before setting the nets. This strongly suggests a general correlation between bottom hardness and abundance of demersal fish. On one occasion, two short gillnet strings (11 nets) set at close distance across a small area of stone gave completely different catches (24 and 284 fishes). The gillnet string with the small catch was set on relatively soft bottom not hitting the area with stones. In the experiment G17 (Figure 3), the peak of fish coincided with an area of stony bottom producing another evidence of the correlation between hard stony bottom and fish concentrations.

The relationship between bottom topography and fish abundance is apparent when comparing the topography of a thoroughly investigated area (Figure 4) with the catch distribution from the fishing experiments (Figures 1 and 2). Figure 1 shows that there is a 10 m high ridge in the direction northwest-southeast in an area with predominately stony bottom. In GO2, GO5, G4 and G8 great catches of cod are taken in connection with a raise of the bottom, while GO1, GO2 and GO5 show that saithe tends to be concentrated on the peak. Figure 5 shows an echogram from the setting of GO2, indicating aggregations of fish in connection with uneven bottom.

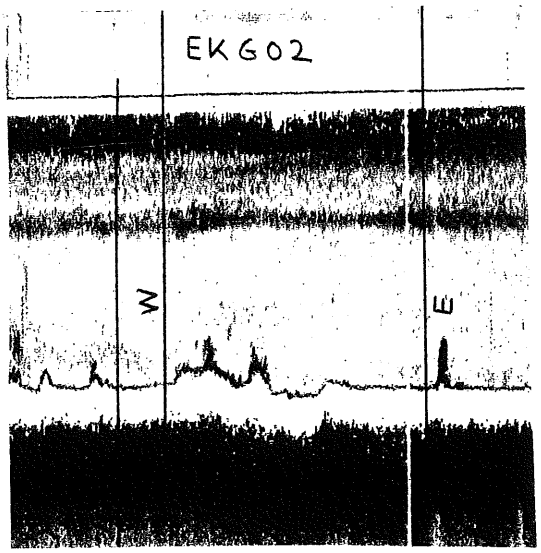

Figure 5. Echogram from fishing experiment GO2.

DISCUSSION

This investigation clearly shows that, within the length of a gillnet string, demersal fish in the North Sea has a patchy distribution. Aggregations of fish are most often found in areas with stones surrounded by flat sandy or muddy bottom, in connection with depth differences and around bottom structures like wrecks and oil platforms.

Pollack and saithe were obviously more concentrated than cod in our experiments. This difference may be explained by species-specific habitat preferences but also by a more or less strong schooling tendency. It is known that saithe and pollack form denser schools than cod. A corresponding difference in aggregations of cod and saithe in the vicinity of oil platforms was found by VALDEMARSEN (1979).

Although the fishing results suggest correlations between good catches and certain bottom conditions, the question remains whether fish is stationary over long periods at such places. To study this problem, one attempt was made to follow an acustically tagged fish caught on the wreck. More investigations of that kind have to be made in order to understand more of the dynamics of the system.

The tendency of fish to aggregate around wrecks is in accordance with similar findings of many different species of fish concentrating around artificial reefs and structures (CARLISLE et al. 1964, UNGER 1966). A special gillnet fishery for fish concentrations around wrecks has since some years been practised in the North Sea, especially by Danish vessels. Such fishing is apparently depending on an accurate localization of the wreck and setting of the gillnet string.

Knowledge of how and where fish tend to aggregate and their migration route within a fishing area is of course of vital importance for successful fishing, especially with stationary fishing gears like gillnets. Our findings thus indicate that a detailed mapping of the bottom type and topography prior to fishing in an unknown area is worth-while.

REFERENCES

CARLISLE, J.G. Jr., TURNER, C.H.. & EBERT, E.E. 1964. Artificial habitat in the marine environment. Calif.Dep. of Fish and Game. Fish.Bull. 124.

GYTRE, T. 1979. The performance of a three axis ultrasonic current sensor when integrated into an oceanographic data acquisition system. Coun.Meet.int.Coun.Explor.Sea, 1979 (C:52).

UNGER, I. 1966. Artificial reefs. A review. Ann.Littoral. Soc.Spec. Publ. 4: 1-24.

VALDEMARSEN, J.W. 1979. Behaviour aspects of fish in relation to oil platforms in the North Sea. Coun.Meet.int.Coun. Explor.Sea, 1979 (B:27).