THIS PAPER NOT TO BE CITED WITHOUT PRIOR REFERENCE TO THE AUTHORS

THE RESULTS OF THE INTERNATIONAL O-GROUP GADOID SURVEY IN THE NORTH SEA, 1976

by

N Daan, Netherlands, Institute for Fishery Investigations, Ijmuiden
J R G Hislop, Marine Laboratory, Aberdeen
M J Holden, Fisheries Laboratory, Lowestoft
W G Parnell, Fisheries Laboratory, Lowestoft
H Knudsen, Danish Institute of Fisheries and Marine Investigations, Charlottenlund
J Lahn-Johanesson, Institute of Marine Research, Bergen.

INTRODUCTION

The 1976 survey was carried out in the period 13-30 June by 5 vessels.
CORELLA (England), DANA (Denmark), EXPLORER (Scotland), JOHAN HJORT (Norway) and
TRIDENS (Netherlands). All vessels fished· the Dutch version of the international
young gadoid pelagic trawl (IYGPT) except the EXPLORER, which fished the Scottish
version. The survey was designed so that each of the statistical squares within
the heavy broken line shown in Figure 1 was sampled twice, insofar as possible
by different vessels, at as great a time interval as possible and in general more
than 7 days. Each sample haul was of 1 hour's duration made in the manner described
by Daan et al., (1975), except that in water deeper than 150 m this depth was taken
as the bottom and the mid-water haul made at 75 m or at the thermocline if one
existed. In some parts of the northern North Sea two thermoclines were found,
one close to the surface and one at a lower depth, in which case the latter was
fished.

RESULTS

Area fished

The statistical squares fished by each vessel are shown in Figures 1 and 2.
The survey was carried out as planned except that statistical rectangles 48 E7,
47 E7 and 46 F2 were sampled only once and that most of the samples from
statistical rectangles 41 F4-7 and 42 F4-7 were taken within 4 days. The hauls
shown in Figure 1 are referred to as the first survey and those in Figure 2 as
the second survey. Mean numbers of O-group cod, haddock and whiting per 1h haul
for the three areas described by Daan et al., (1975) are shown in Table 1 and
average numbers per haul, mean length, standard deviation and range for all species
by groups of 4 statistical rectangles in Tables 2 and 3.

## Distribution

The mean numbers of each species of O-group gadoid caught in each survey by statistical rectangle are shown in Figures 3-8.

Cod were very widely distributed and, for the first year since the present coverage was achieved, were much more abundant off the Danish coast than elsewhere. They were also more abundant off the east coast of Britain than in previous years, particularly during the second survey.

Haddock were, as usual, most abundant to the east of Shetland, on both surveys. Few were caught off the Danish coast. They were widely distributed, although not very abundant, along the east coast of Britain. In this area catches of haddock were noticeably greater during the second survey than in the first.

The distribution of whiting was different in the two surveys. In the first survey the largest catches were taken round the Orkneys and to the east of Shetland, with small numbers occurring off the Danish coast; few whiting were found along the east coast of Britain. However, during the second survey the main area of abundance was along the British east coast. The numbers caught off the Danish coast and to the east of Shetland were also higher than in the first survey.

In both surveys saithe were scarce off the coasts of Britain and Denmark (ie south of latitude $57^{\circ}N$). To the north of this latitude their distribution was widespread, with no real centre of abundance.

The distribution of Norway pout followed its usual pattern, large numbers being caught mid-way between Norway and Shetland and relatively few elsewhere. In the second survey the main area of concentration was farther to the north than in the first.

Small catches of blue whiting were made in four rectangles only, all in the northern part of the survey area.

For all species, except saithe and Norway pout, there was an increase in average numbers per haul between the first and second surveys (Figures 2-8 and Table 1).

## Length distributions

In both surveys both the mean length and the size of the largest cod caught were smaller off the British east coast than elsewhere and the same was true for haddock. (Tables 2 and 3). The mean length of whiting in the second survey was lower off the British east coast than to the north and east of Scotland (Table 3).

Growth

Mean lengths of the different species varied widely over the North Sea.
Because of the effects to be expected from the exact timing of the hauls in each
particular group of rectangles the strictly regional differences cannot be easily
extracted from the data and a detailed analysis had to be postponed.

However, to present a general idea of the situation in 1976 weighted length
data in 4 major areas are given in Tables 2 and 3. In interpreting the results it
should be noted that the Danish coast was sampled for the second time only three
days after the first. Any difference for this region should therefore be explained
in terms of random variability of trawl catches rather than of apparent growth.

Figure 9 gives the mean lengths of the total population caught during each
of the surveys plotted at the midpoints of the survey periods, together with the
data for 1975 and 1974. Nearly all species were slightly larger than in 1975,
at a comparable time period, but considerably smaller than in 1974. The apparent
negative growth of the cod in 1976 can be attributed to smaller sized fish being
caught in the northeastern area in the second survey. The Norway pout shoals are
known to consist of different sized fish even within a statistical square
(stratification experiment 1975, Daan et al., 1975) and, because of the very large
catches involved in particular hauls, the overall mean lengths for this species
are likely to show large random variability. The blue whiting data are based on
very limited numbers only. The other species do indicate some growth over the
time interval between the two surveys, but their higher vulnerability during the
second survey, as indicated by the increased catch rates, may to some extent bias
the observed growth rates.

Prediction of year-class strengths

The geometric mean of the numbers of cod, haddock and whiting were calculated
for the areas in which the average abundance of each species was highest for
the period 1969-75; these areas, which are shown in Figures 2, 3 and 4 for cod
haddock and whiting respectively, were based on Figures 9-11 in Daan et al., (1975).
The results are shown in Table 4; for the period 1969-71 the surveys were
carried out by Scotland only and the group considered that the data for those
years gave a reliable estimate of 0-group abundance only for haddock. Also
shown in Table 4 are the results from the International Young Herring Survey (IYHS)
and the VPA estimates of year-class size from the North Sea Roundfish Working
Group (Anon., 1976a).

One of the problems that the group had in correlating any two estimates
of year-class size for both cod and whiting were the limited number of data sets,

3 years for VPA data and 4 years for IYHS data, which are effectively reduced to 3 sets for cod because the 1975 data are for the whole of sub-area IV and are not comparable with previous years when data for division IVa was given separately from those for IVb, c. For cod and whiting it is too early to state whether the 0-group surveys provide an early indication of year-class size and in view of the relatively late and prolonged spawning period of whiting it is doubtful whether estimates of the year-class size of this species can be calculated from surveys made at the appropriate time for cod and haddock. For haddock the correlation between the results from the 0-group surveys and the VPA estimates is better than that between the former and the results from the IYHS ($r = 0.35$ for 4df compared with 0.17 for 5 df), although both are non-significant. This was because the 1973 year-class of haddock was estimated as being large by the IYHS. However, the correlation between the results of the IYHS and the results from the VPA for this limited data series is also non-significant ($r = 0.15$), although the North Sea Roundfish Working Group found a highly significant relationship when 10 years data were considered (Anon, 1976a). (This group used the data for IVb, c even though it is given as for sub-area IV in its Table 35). More data points are therefore required before it can be stated whether the surveys can be used to predict year-class size for haddock.

PLANNING OF THE 1977 SURVEYS

The group discussed the planning of the 1977 survey in the light of the results obtained in 1976. The higher catches of cod, haddock and whiting during the second survey showed that a proportion of the population of each of these species was not available to the trawl during the first survey but, because both spawning times and growth rates are likely to vary from year to year, it was felt that there would be little point in changing the survey dates for 1977. It was agreed that the system adopted in 1976, when almost the whole survey was covered twice and most rectangles were sampled by different vessels should be used in 1977. However, if ships' time allowed, a partial third survey should be carried out. All the present participants agreed to continue the work during 1977 but additional participants would be welcome and should contact the co-ordinator (Holden).

REFERENCES

ANON, 1976a. Report of the North Sea Roundfish Working Group, ICES C.M. 1976/F:19 pp 52 (mimeo).

ANON, 1976b. Report of the meeting on abundance estimates of juvenile cod, haddock and whiting from the 'International Young Herring Surveys' in the North Sea. ICES CM 1976/F:5.

Table 1. Mean numbers, based on geometric means, and 95% confidence limits, of 0-group cod, haddock and whiting caught in 1h hauls; areas are shown in Figure 2. 1975 excludes Danish results. Year-class size are millions of 1 year old fish from virtual population analyses*, taken from Table 35, Anon. (1976)

| | | 1972 | 1973 | 1974 | 1975 | 1976 (first survey) | 1976 (second survey) |
|---|---|---|---|---|---|---|---|
| **COD** | | | | | | | |
| Northern North Sea | n̄ | 11.2 | 2.7 | 74.4 | 5.7 | 23.5 | 60.3 |
| | 95% | 6.5– 18.8 | 1.6– 4.1 | 40.6– 135.9 | 3.1– 9.8 | 13.7– 40.0 | 32.2–112.9 |
| British east coast | n̄ | 9.6 | 4.7 | 1.3 | 0.7 | 7.1 | 47.8 |
| | 95% | 5.1– 17.4 | 1.8– 10.6 | 0.5– 2.5 | 0.1– 1.7 | 3.6– 14.0 | 17.8–128.8 |
| Danish coast | n̄ | 20.1 | 12.9 | 229.9 | 4.7 | 168.5 | 519.4 |
| | 95% | 7.6– 53.1 | 5.0– 33.5 | 31.8–1662.5 | 1.7– 13.2 | 51.5–550.7 | 74.7–3610.6 |
| Year-class size | | 182 | 138 | (196) | – | – | – |
| **HADDOCK** | | | | | | | |
| Northern North Sea | n̄ | 34.0 | 56.5 | 1625.2 | 147.5 | 168.8 | 381.5 |
| | 95% | 20.7– 55.5 | 28.7–110.6 | 683.6–3861.8 | 60.5–357.6 | 81.3–350.7 | 171.2–850.3 |
| British east coast | n̄ | 1.7 | 1.0 | 0.3 | 0.3 | 1.8 | 7.4 |
| | 95% | 0.7– 3.1 | 0.4– 1.8 | 0.1– 0.5 | 0.1– 0.5 | 1.2– 2.8 | 3.5– 15.7 |
| Danish coast | n̄ | 0.4 | 3.6 | 34.7 | 32.5 | 0.7 | 3.4 |
| | 95% | 0.2– 0.5 | 1.6– 8.2 | 7.7– 155.6 | 7.1–149.5 | 0.5– 1.1 | 1.5– 7.8 |
| Year-class size | | 279 | 939 | (2718) | – | – | – |
| **WHITING** | | | | | | | |
| Northern North Sea | n̄ | 124.6 | 10.7 | 302.8 | 43.8 | 6.4 | 8.3 |
| | 95% | 71.8–215.9 | 6.2– 18.0 | 138.2– 662.5 | 21.0– 90.1 | 4.0– 10.3 | 5.1– 13.8 |
| British east coast | n̄ | 16.6 | 17.3 | 0.1 | 1.2 | 0.6 | 24.1 |
| | 95% | 6.9– 37.9 | 6.2– 44.8 | 0.0– 0.3 | 0.4– 2.5 | 0.4– 0.9 | 9.9– 58.6 |
| Danish coast | n̄ | 69.1 | 190.5 | 4.1 | 76.4 | 2.5 | 19.6 |
| | 95% | 13.7–347.7 | 40.3–899.4 | 1.5– 11.2 | 32.4–180.6 | 1.0– 6.1 | 5.7– 67.6 |
| Year class size | | 2316 | 2550 | (3015) | – | – | – |

*Assuming a value for M of 0.2

Table 2.  Catch rates, mean length (cm), standard deviations and ranges of lengths by species and blocks of 4 statistical rectangles:  1st survey

| Block | Dates (June) | Ship | Cod | | | | Haddock | | | | Whiting | | | | Saithe | | | | Norway Pout | | | | Blue Whiting | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | N | L̄ | Sd | Range | N | L̄ | Sd | Range | N | L̄ | Sd | Range | N | L̄ | Sd | Range | N | L̄ | Sd | Range | N | L̄ | Sd | Range |
| 52-51 F0-1 | 17, 21 | JH/E | <1 | 5.25 | - | 5.0-5.4 | 23 | 2.32 | 0.80 | 1.0-5.4 | 7 | 1.56 | 0.33 | 1.0-2.9 | 2 | 4.25 | 0.50 | 3.5-5.4 | 6 | 3.02 | 0.36 | 2.0-4.9 | | | | |
| 52-51 F2-3 | 17 | JH | - | | | | - | | | | - | | | | - | | | | - | | | | | | | |
| 50-49 F0-1 | 16, 21 | JH/E | 101 | 5.07 | 0.61 | 2.0-7.4 | 142 | 4.16 | 1.14 | 1.0-9.4 | 31 | 2.47 | 0.81 | 1.0-6.4 | 36 | 5.31 | 1.44 | 3.0-9.4 | 12891 | 3.67 | 0.70 | 2.0-6.9 | | | | |
| 50-49 F2-3 | 17 | JH | 16 | 3.38 | 0.49 | 2.5-3.9 | 467 | 3.46 | 0.85 | 1.5-6.9 | - | | | | 18 | 2.92 | 0.24 | 2.5-3.9 | 2528 | 3.51 | 0.54 | 1.5-5.4 | | | | |
| 48-47 F0-1 | 16, 20 | JH/E | 60 | 4.66 | 0.96 | 2.5-7.9 | 283 | 5.48 | 1.39 | 2.5-10.9 | - | | | | 16 | 4.68 | 1.91 | 1.5-9.4 | 8635 | 4.00 | 0.46 | 2.5-6.4 | 1 | 8.75 | - | 8.5-9.4 |
| 48-47 F2-3 | 16 | JH | 35 | 4.10 | 0.53 | 3.0-5.4 | 273 | 4.28 | 0.66 | 2.5-7.9 | - | | | | 2 | 4.25 | - | 4.0-4.9 | 3739 | 3.58 | 0.39 | 2.5-4.9 | | | | |
| 46-45 F0-1 | 14, 19 | JH/E/T | 11 | 3.62 | 0.51 | 2.5-5.4 | 4 | 2.85 | 0.60 | 1.5-4.4 | - | | | | 124 | 4.54 | 1.10 | 2.0-7.4 | 7621 | 4.61 | 0.30 | 2.5-6.4 | | | | |
| 46-45 F2-3 | 15 | JH | 192 | 4.43 | 0.97 | 3.0-6.4 | 216 | 4.42 | 0.92 | 2.5-7.4 | - | | | | 78 | 4.79 | 1.14 | 2.5-6.9 | 37095 | 4.19 | 0.56 | 2.5-5.9 | | | | |
| 44-43 F0-1 | 13, 17 | JH/T | 1 | 2.75 | 0.50 | 2.0-3.4 | <1 | 2.25 | - | 2.0-2.9 | - | | | | 2 | 2.61 | 0.56 | 1.5-3.9 | 6 | 4.06 | 0.96 | 2.0-5.9 | | | | |
| 44-43 F2-3 | 15 | JH | <1 | 3.50 | 0.35 | 3.0-3.9 | 1 | 3.50 | 0.35 | 3.0-4.4 | - | | | | 45 | 3.20 | 0.56 | 1.5-5.4 | 25 | 3.32 | 0.98 | 1.5-5.9 | | | | |
| Mean | | | 418 | 4.52 | 0.93 | 2.0-7.9 | 1410 | 4.22 | 1.25 | 1.0-10.9 | 38 | 2.30 | 0.82 | 1.0-6.0 | 323 | 4.40 | 1.30 | 1.5-9.4 | 72546 | 4.06 | 0.63 | 1.5-6.9 | 8 | 3.50 | 0.53 | 2.5-4.9 |
| 50-49 E8-9 | 21 | E | 23 | 3.38 | 0.80 | 2.5-5.4 | 67 | 3.29 | 1.03 | 1.5-8.4 | 152 | 2.43 | 0.49 | 1.0-4.4 | 6 | 6.00 | 1.13 | 4.0-7.9 | 608 | 2.21 | 0.31 | 1.5-3.9 | 8 | 3.50 | 0.53 | 2.5-4.9 |
| 48-47 E4-5 | 16 | E | - | | | | - | | | | 7 | 1.75 | - | 1.5-2.4 | - | | | | 8 | 1.81 | 0.32 | 1.0-2.4 | | | | |
| 48-47 E6-7 | 16, 18 | E | 1 | 4.00 | 0.35 | 3.5-4.4 | 5 | 3.50 | 1.42 | 1.5-6.9 | 25 | 3.12 | 0.81 | 1.0-5.4 | - | | | | 1 | 2.08 | 0.29 | 1.5-2.9 | | | | |
| 48-47 E8-9 | 18, 19 | E | 3 | 4.93 | 1.19 | 3.0-6.9 | 31 | 3.84 | 0.52 | 2.5-5.9 | 7 | 2.51 | 0.53 | 1.0-3.9 | 4 | 4.19 | 1.32 | 2.5-7.9 | 1 | 3.00 | 0.29 | 2.5-3.9 | | | | |
| 46-45 E4-5 | 17 | E | 6 | 3.83 | 1.24 | 2.0-6.4 | 5 | 3.44 | 0.48 | 2.5-4.9 | 17 | 2.60 | 0.83 | 1.0-4.9 | - | | | | - | | | | | | | |
| 46-45 E6-7 | 17, 20 | C/E | 7 | 3.02 | 0.51 | 2.0-3.9 | 28 | 3.77 | 0.74 | 2.0-5.9 | 349 | 2.63 | 0.51 | 1.0-5.4 | 1 | 5.62 | 0.95 | 4.0-6.9 | <1 | 2.25 | - | 2.0-2.9 | | | | |
| 46-45 E8-9 | 18, 19 | E/T | 2 | 3.13 | 0.52 | 2.0-3.9 | 6 | 4.63 | 0.98 | 3.0-6.4 | 27 | 1.96 | 0.30 | 1.0-3.4 | 5 | 4.47 | 1.51 | 2.5-7.9 | 7 | 3.40 | 0.80 | 1.0-5.4 | | | | |
| 44-43 E6-7 | 20 | C | 17 | 3.90 | 0.48 | 2.5-4.9 | | | | | 6 | 3.25 | 0.44 | 2.0-4.4 | 1 | 5.25 | - | 5.0-5.9 | - | | | | | | | |
| 44-43 E8-9 | 18, 19 | C/T | 1 | 3.65 | 0.55 | 2.5-4.4 | 2 | 2.81 | 0.31 | 1.5-4.4 | 8 | 2.07 | 0.33 | 1.5-3.4 | 4 | 5.72 | 0.93 | 4.5-7.9 | 2 | 3.31 | 1.10 | 2.0-5.9 | | | | |
| Mean | | | 60 | 3.61 | 0.84 | 2.0-6.9 | 144 | 3.56 | 0.93 | 1.5-8.4 | 598 | 2.56 | 0.56 | 1.0-5.4 | 21 | 5.18 | 1.33 | 2.5-7.9 | 628 | 2.22 | 0.35 | 1.0-5.9 | | | | |
| 42-41 E6-7 | 17, 19 | C | 7 | 2.82 | 0.55 | 2.0-3.9 | 1 | 1.75 | - | 1.5-2.4 | 15 | 5.56 | 0.54 | 4.5-7.4 | 22 | 5.01 | 0.68 | 3.5-8.4 | - | | | | | | | |
| 42-41 E8-9 | 18, 19 | C | 2 | 2.75 | 0.60 | 1.5-3.4 | 1 | 3.25 | 0.50 | 2.5-4.4 | - | | | | 2 | 5.25 | 1.34 | 4.0-8.4 | - | | | | | | | |
| 42-41 F0-1 | 17, 18 | C/T | 2 | 2.42 | 0.58 | 1.5-2.9 | 1 | 2.25 | - | 2.0-2.9 | - | | | | - | | | | - | | | | | | | |
| 40-59 E8-9 | 16, 17 | C | 3 | 2.90 | 0.34 | 2.0-3.4 | 7 | 2.84 | 0.24 | 1.5-4.9 | - | | | | - | | | | - | | | | | | | |
| 40-59 F0-1 | 16, 17 | C | 29 | 2.79 | 0.33 | 2.0-3.4 | 2 | 2.08 | 0.29 | 1.5-2.9 | - | | | | - | | | | - | | | | | | | |
| 38-37 E8-9 | 15 | C | 26 | 1.98 | 0.37 | 1.0-2.9 | - | | | | - | | | | - | | | | - | | | | | | | |
| 38-37 F0-1 | 15 | C | 1 | 3.00 | 0.25 | 2.5-3.4 | - | | | | - | | | | - | | | | - | | | | | | | |
| Mean | | | 70 | 2.49 | 0.54 | 1.0-3.9 | 12 | 2.61 | 0.49 | 1.5-4.9 | 15 | 5.56 | 0.54 | 4.5-7.4 | 24 | 5.03 | 0.71 | 3.5-8.4 | | | | | | | | |
| 42-41 F4-5 | 15, 16 | T | 471 | 3.13 | 0.63 | 1.5-6.9 | 1 | 2.75 | - | 2.5-3.4 | 4 | 3.34 | 0.51 | 2.0-4.4 | 1 | 2.75 | - | 2.5-3.4 | - | | | | | | | |
| 42-41 F6-7 | 15, 16 | T | 36 | 3.30 | 0.65 | 1.5-5.4 | 1 | 3.25 | 0.65 | 2.5-4.9 | 2 | 3.54 | 1.15 | 1.5-5.4 | <1 | 4.25 | - | 4.0-4.9 | - | | | | | | | |
| Mean | | | 507 | 3.14 | 0.63 | 1.5-6.9 | 2 | 3.00 | 0.35 | 2.5-4.9 | 6 | 3.41 | 0.66 | 1.5-5.4 | 2 | 3.50 | 1.06 | 2.5-4.9 | | | | | | | | |
| Mean (all survey) | | | 1055 | 3.67 | 1.05 | 1.0-7.9 | 1568 | 4.15 | 1.24 | 1.0-10.9 | 657 | 2.62 | 0.74 | 1.0-7.4 | 370 | 4.48 | 1.29 | 1.5-9.4 | 73174 | 4.04 | 0.65 | 1.0-6.9 | 9 | 4.08 | 1.82 | 2.5-9.4 |

Table 3. Catch rates, mean length (cm), standard deviations and ranges of lengths by species and blocks of 4 statistical rectangles: 2nd survey

| Block | Dates (June) | Ships | Cod N | Cod L̄ | Cod Sd | Cod Range | Haddock N | Haddock L̄ | Haddock Sd | Haddock Range | Whiting N | Whiting L̄ | Whiting Sd | Whiting Range | Saithe N | Saithe L̄ | Saithe Sd | Saithe Range | Norway Pout N | Norway Pout L̄ | Norway Pout Sd | Norway Pout Range | Blue Whiting N | Blue Whiting L̄ | Blue Whiting Sd | Blue Whiting Range |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52-51 FO-1 | 22,23 | JH | 0 | | | | 0 | | | | 0 | | | | 0 | | | | 0 | | | | 0 | | | |
| 52-51 F2-3 | 22 | JH | 0 | | | | 0 | | | | 0 | | | | 0 | | | | 0 | | | | 0 | | | |
| 50-49 FO-1 | 21-23 | D/JH | 96 | 4.80 | 0.62 | 3.0-6.9 | 661 | 5.49 | 1.29 | 2.0-9.4 | 109 | 3.47 | 1.31 | 2.0-7.4 | 3 | 5.10 | 1.56 | 3.5-7.9 | 3805 | 3.37 | 0.76 | 1.5-5.4 | 5 | 3.62 | 0.28 | 3.0-4.4 |
| 50-49 F2-5 | 19,21,22 | D/JH | 52 | 3.73 | 0.49 | 3.0-6.4 | 291 | 4.97 | 1.22 | 1.5-7.9 | 0 | | | | <1 | | | | 13930 | 4.12 | 4.8 | 1.0-5.4 | 0 | | | |
| 48-47 FO-1 | 21,24,25 | D/JH/T | 55 | 4.58 | 0.83 | 3.0-6.9 | 293 | 5.74 | 1.13 | 2.5-9.9 | 0 | | | | 9 | 5.24 | 0.94 | 4.5-8.9 | 23551 | 4.28 | 0.71 | 2.5-5.9 | 0 | | | |
| 48-47 F2-3 | 20,21,25 | D/JH | 112 | 4.39 | 0.72 | 3.0-7.9 | 412 | 5.28 | 1.34 | 2.0-5.9 | 2 | 3.25 | 0 | 3.0-3.4 | 7 | 3.56 | 0.68 | 2.0-5.4 | 44655 | 3.53 | 0.49 | 1.0-5.4 | 0 | | | |
| 46-45 FO-1 | 22,24,26 | C/E/T | 1 | 2.25 | - | 2.0-2.4 | 1 | 3.58 | 1.53 | 2.0-5.4 | 1 | 3.25 | - | 3.0-3.4 | 1 | 4.75 | 0.71 | 4.0-5.9 | 4 | 4.42 | 0.87 | 1.5-5.9 | 0 | | | |
| 46-45 F2-3 | 25,26,28 | D/E/T | 12 | 2.63 | 0.72 | 1.5-5.9 | 41 | 3.79 | 0.93 | 1.0-7.4 | 1 | 3.75 | - | 3.5-3.9 | <1 | | | | 69 | 3.29 | 0.80 | 1.0-5.9 | 0 | | | |
| 44-43 FO-1 | 20,22,26 | C/D/E | 112 | 2.20 | 0.57 | 1.0-5.5 | 1 | 2.25 | - | 2.0-2.4 | 0 | | | | | | | | 7 | 4.04 | 1.16 | 2.0-5.9 | 0 | | | |
| 44-43 F2-3 | 20,26,28 | D/E/T | 30 | 1.93 | 0.31 | 1.0-3.0 | 3 | 1.70 | 0.44 | 1.0-2.9 | 0 | | | | | | | | 1 | 3.00 | 1.78 | 1.0-4.9 | 0 | | | |
| Mean | - | - | 470 | 3.69 | 1.27 | 1.0-7.9 | 1703 | 5.34 | 1.31 | 1.0-9.9 | 113 | 3.46 | 1.29 | 2.0-7.4 | 20 | 4.61 | 1.19 | 2.0-8.9 | 86022 | 3.82 | 0.67 | 1.0-5.9 | | | | |
| 50-49 E8-9 | 23,25 | JH/T | 15 | 4.83 | 1.19 | 2.0-6.9 | 62 | 3.70 | 0.72 | 1.5-7.4 | 38 | 3.05 | 0.53 | 1.5-4.4 | 4 | 5.10 | 1.69 | 3.5-8.9 | 16 | 2.49 | 0.28 | 1.5-3.4 | 3 | 3.97 | 0.56 | 2.5-4.9 |
| 48-47 E4-5 | 22 | T | 0 | | | | 0 | | | | 0 | | | | 0 | | | | 0 | | | | 0 | | | |
| 48-47 E6-7 | 22 | T | 0 | | | | 0 | | | | 2 | 2.15 | 0.82 | 1.0-3.4 | 0 | | | | 0 | | | | 0 | | | |
| 48-47 E8-9 | 23,24 | JH/T | 12 | 4.07 | 0.85 | 2.5-7.4 | 43 | 4.38 | 1.18 | 2.0-9.4 | 3 | 2.85 | 0.46 | 2.0-3.4 | 2 | 5.14 | 2.03 | 3.0-8.4 | 45 | 4.78 | 0.59 | 3.0-5.9 | 0 | | | |
| 46-45 E4-5 | 21 | T | 9 | 3.63 | 0.37 | 3.0-4.4 | 4 | 5.25 | 0.57 | 4.5-5.9 | 4 | 4.75 | 0 | 4.5-4.9 | 5 | 7.25 | 0 | 7.0-7.5 | 0 | | | | 0 | | | |
| 46-45 E6-7 | 21,30 | E/T | 2 | 3.69 | 0.39 | 3.0-4.4 | 30 | 3.34 | 0.82 | 2.0-6.9 | 292 | 3.60 | 0.71 | 1.0-6.9 | 62 | 6.37 | 0.88 | 3.0-8.4 | 0 | | | | 0 | | | |
| 46-45 E8-9 | 21,23 | C/T | 0 | | | | 22 | 4.53 | 0.73 | 2.5-6.4 | 3 | 2.71 | 0.42 | 1.5-3.4 | 0 | | | | 34 | 3.87 | 0.59 | 2.5-5.4 | 0 | | | |
| 44-43 E6-7 | 29,30 | E | 11 | 3.50 | 0.75 | 2.0-7.9 | 11 | 4.95 | 1.83 | 2.5-8.9 | 46 | 3.59 | 1.02 | 2.0-8.9 | 0 | | | | 0 | | | | 0 | | | |
| 44-43 E8-9 | 21,27 | C/E | 4 | 3.57 | 0.30 | 2.5-4.4 | 6 | 3.59 | 0.75 | 2.5-6.4 | 2 | 3.17 | 0.49 | 2.5-6.4 | 20 | 5.55 | 0.60 | 4.0-7.4 | 1 | 5.00 | 0.27 | 4.5-5.4 | 0 | | | |
| Mean | - | - | 53 | 4.04 | 0.98 | 2.0-7.4 | 174 | 3.99 | 1.07 | 2.0-9.4 | 386 | 3.52 | 0.76 | 1.0-6.9 | 93 | 6.16 | 0.99 | 3.0-8.9 | 96 | 4.08 | 0.99 | 1.5-5.9 | 0 | | | |
| 42-41 E6-7 | 29 | E | 156 | 2.98 | 0.57 | 1.5-4.9 | 28 | 3.21 | 0.73 | 2.0-5.4 | 105 | 2.31 | 0.47 | 2.0-5.4 | 2 | 5.63 | 0.48 | 5.0-6.4 | 1 | 2.25 | - | 2.0-2.4 | 0 | | | |
| 42-41 E8-9 | 27,28 | E | 36 | 2.73 | 1.10 | 1.5-4.9 | 13 | 3.17 | 1.12 | 1.0-5.9 | 10 | 1.93 | 0.54 | 1.0-5.9 | 0 | | | | 2 | 2.25 | 0.66 | 1.0-3.4 | 0 | | | |
| 42-41 FO-1 | 28 | E | 0 | | | | 2 | 2.50 | 0.35 | 2.0-2.9 | 0 | | | | 0 | | | | 0 | | | | 0 | | | |
| 42-41 F2-3 | 28 | T | 36 | 5.49 | 1.11 | 1.5-6.9 | 2 | 3.00 | 0.36 | 2.5-3.4 | 4 | 3.50 | 0.28 | 3.0-3.9 | 0 | | | | 0 | | | | 0 | | | |
| 40-39 E8-9 | 23-25 | C | 45 | 3.08 | 0.46 | 2.0-4.4 | 10 | 3.59 | 0.88 | 2.0-5.9 | 16 | 2.35 | 0.45 | 1.0-3.9 | 0 | | | | 0 | | | | 0 | | | |
| 40-39 FO-1 | 24 | C | 1 | 2.75 | - | 2.5-2.9 | 0 | | | | 1 | 2.75 | - | 2.5-2.9 | 0 | | | | 0 | | | | 0 | | | |
| 38-37 E8-9 | 25,26 | C | 3 | 2.70 | 0.28 | 2.0-3.4 | 0 | | | | 5 | 2.66 | 0.27 | 2.0-3.4 | 0 | | | | 0 | | | | 0 | | | |
| 38-37 FO-1 | 26 | C | 1 | 2.75 | - | 2.5-2.9 | 0 | | | | 3 | 2.65 | 0.42 | 2.0-3.4 | 0 | | | | 0 | | | | 0 | | | |
| Mean | - | - | 278 | 3.28 | 1.12 | 1.5-6.9 | 55 | 3.24 | 0.85 | 1.0-5.9 | 144 | 2.34 | 0.51 | 1.0-4.4 | 2 | 5.63 | 0.48 | 5.0-6.4 | 3 | 2.25 | 0.47 | 1.0-3.4 | 0 | | | |
| 42-41 F4-5 | 28 | T | 348 | 2.87 | 0.53 | 1.5-6.9 | 10 | 4.67 | 1.50 | 2.5-9.9 | 15 | 3.81 | 1.27 | 1.5-6.9 | 0 | | | | 0 | | | | 0 | | | |
| 42-41 F6-7 | 18,19,26 | D | 44 | 2.77 | 0.45 | 1.5-5.9 | 5 | 3.30 | 0.79 | 1.5-4.9 | 8 | 2.69 | 0.91 | 1.0-5.4 | 0 | | | | 0 | | | | 0 | | | |
| Mean | | | 392 | 2.86 | 0.52 | 1.5-6.9 | 15 | 4.21 | 1.44 | 1.5-9.4 | 23 | 3.42 | 1.26 | 1.0-9.4 | 0 | | | | 0 | | | | 0 | | | |
| Mean (all survey) | | | 1193 | 3.34 | 1.10 | 1.0-7.9 | 1947 | 5.15 | 1.38 | 1.0-9.9 | 666 | 3.25 | 0.98 | 1.0-9.9 | 115 | 5.88 | 1.17 | 2.0-8.9 | 86121 | 3.82 | 0.67 | 1.0-5.9 | 8 | 3.75 | 0.41 | 2.5-4.9 |

Table 4. Estimates of year-class size from 0-group surveys and as 1 year olds from the International Young Herring Surveys (IYHS) (Anon. 1976b) and from VPA estimates (Anon. 1976a). For 1975 only value for cod available is that for sub-area IV

| Area | Cod | | | | Haddock | | | Whiting | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year Class | IV 0-gp | IVa IYHS | IVb,c IYHS | IV VPA | IVa 0-gp | IV IYHS | IV VPA | IV 0-gp | IV IYHS | IV VPA |
| 1969 | – | 3.2 | 61 | 377 | 248 | 45 | 111 | – | 86 | 686 |
| 1970 | – | 75.0 | 142 | 501 | 34 | 2114 | 907 | – | 296 | 688 |
| 1971 | – | 1.1 | 3 | 89 | 4068 | 3044 | 1363 | – | 710 | 1656 |
| 1972 | 26 | 1.9 | 46 | 182 | 93 | 461 | 279 | 138 | 4272 | 2316 |
| 1973 | 8 | 11.0 | 10 | 138 | 301 | 3685 | 939 | 40 | 703 | 2550 |
| 1974 | 157 | 0.2 | 121 | (196) | 2173 | 1663 | (2718) | 276 | 1292 | (3015) |
| 1975 | 17 | | 131 | | 622 | 312 | – | 70 | 1306 | – |
| 1976(1+2) | 188 | | | | 579 | – | – | 16 | – | – |
| Average | 79.2 | | | 247.2 | 1014.6 | 1617.7 | 1052.8 | 108.0 | 688.6 | 1818.5 |

DAAN, N., HISLOP, J. R. G., HOLDEN, M. J. and LAHN-JOHANESSON, J., 1975. Report of the pelagic O-group gadoid survey in the North Sea in 1975. ICES C.M. 1975/F:33 pp 7 (mimeo).

HISLOP, J. R. G., HOLDEN, M. J. and DAAN, N., 1974. A combined report on the pelagic O-group gadoid surveys undertaken by Scotland, England and the Netherlands in the North Sea in 1974. ICES CM 1974/F:15.
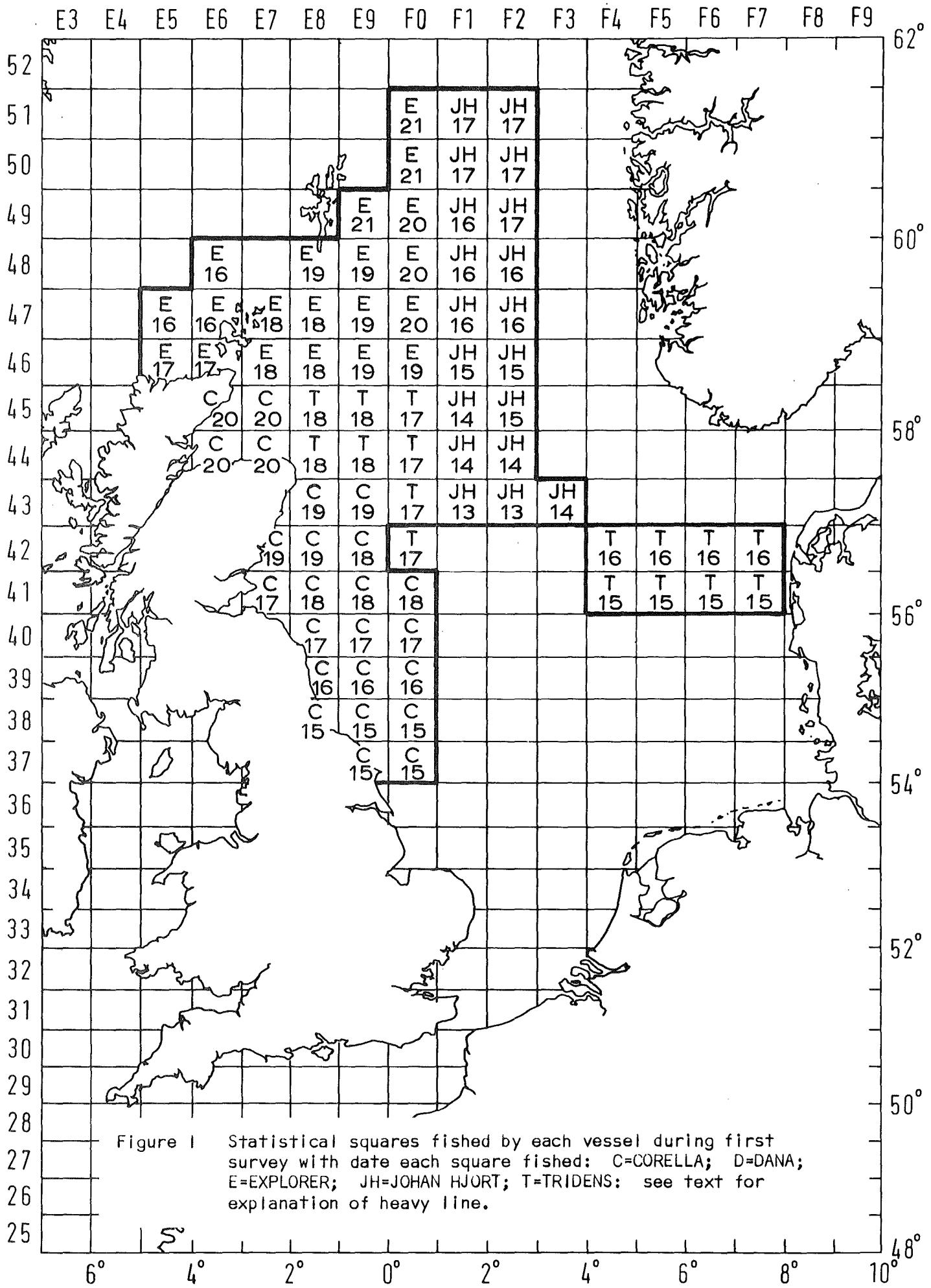
Figure I    Statistical squares fished by each vessel during first
survey with date each square fished:  C=CORELLA;   D=DANA;
E=EXPLORER;   JH=JOHAN HJORT;  T=TRIDENS:   see text for
explanation of heavy line.
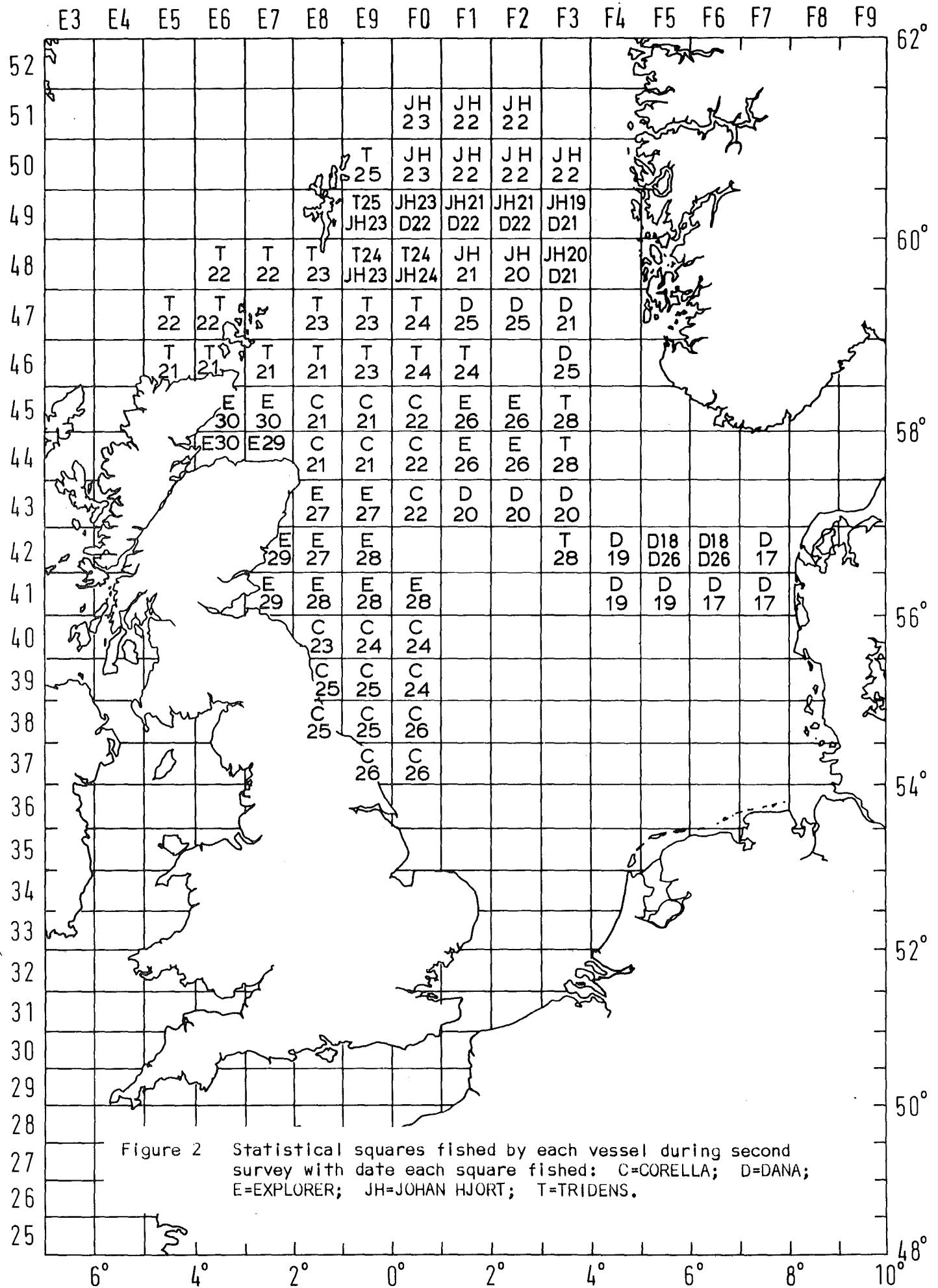
Figure 2    Statistical squares fished by each vessel during second survey with date each square fished: C=CORELLA;   D=DANA; E=EXPLORER;   JH=JOHAN HJORT;   T=TRIDENS.

E3  E4  E5  E6  E7  E8  E9  F0  F1  F2  F3  F4  F5  F6  F7  F8  F9   62°

52

51                              O    1    O
                                 0    0    0

50                              7    4    24
                           0      2   225   50   0

49                      23   34   360  8
                          15   16   141  160   0                    60°

48        O         O    9    11   42   O
            0    0    0    2    4    58   270   0

47    O    O    2    O    2    90   98   70
       0    0        0    47   23   133  150   27

46    6    18   1    O    6    1    14   360
            0    35   0    0    5    0    0        16

45         1    O    O    2    3    25   24
            0    1    0    4    1    3    25   5                     58°

44        28   5    2    O    1    O    2
            4    18   12   0    0    71   114   0

43                  2    1    4    O    O    O
                     1    1    0    376  5    2

42        11   2    2    3                   129  1663 24  72
           110  20   1                  36   18   418  174   3

41        3    4    O    O                   44   62   28   18
           201  117   5    0                  808  147   0    0       56°

40        9    O    4
           112  0    0

39        1    O    53
           62   6    2

38        OI   O    2
            0    3    0

37        87   O
            7    1                                                  54°

36

35

34

33                                                                 52°

32

31

30

29                                                                 50°

28
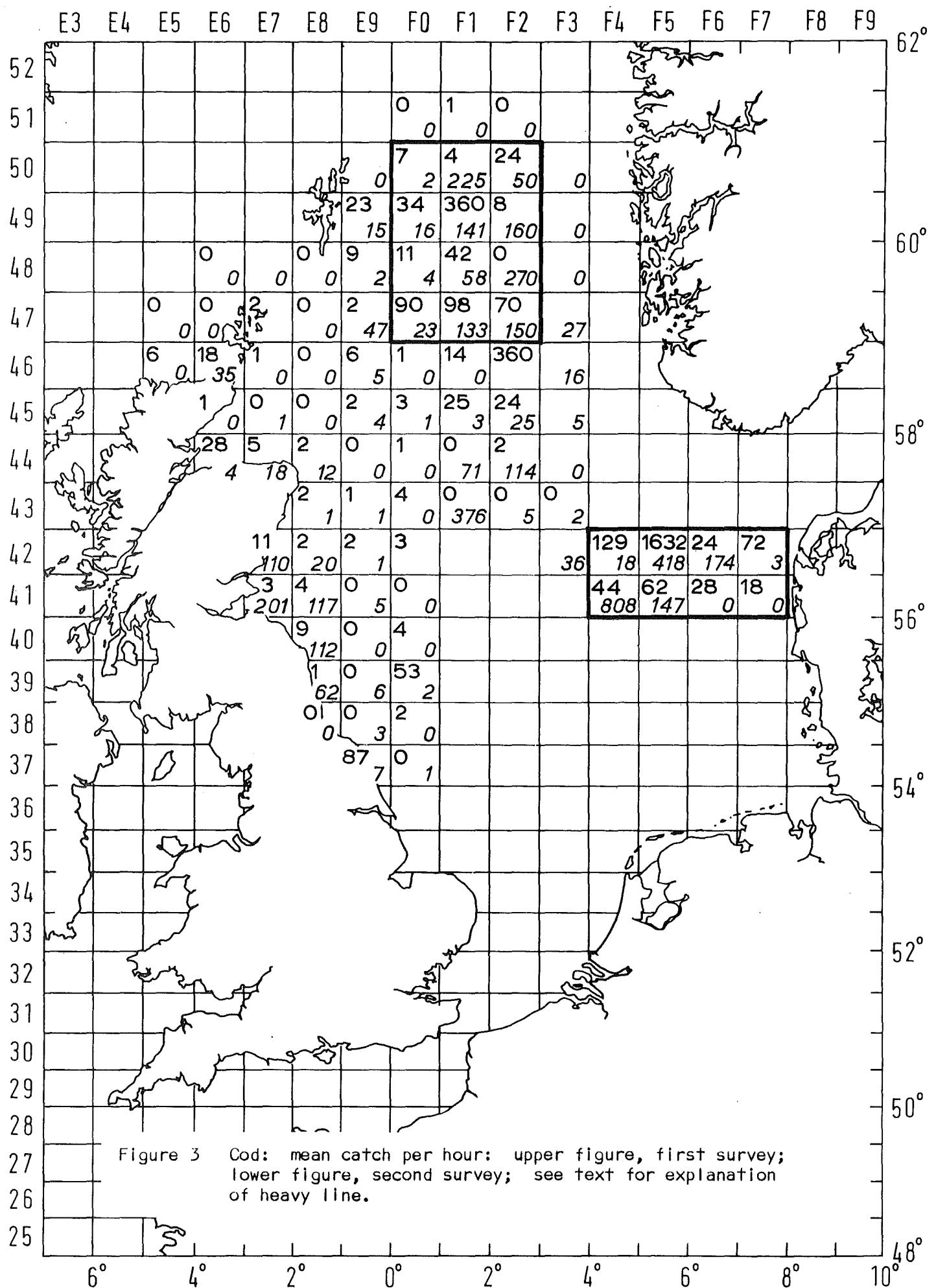
27   Figure 3   Cod:  mean catch per hour:  upper figure, first survey;
                 lower figure, second survey;  see text for explanation
26               of heavy line.

25                                                                 48°

     6°      4°       2°       0°       2°       4°       6°       8°     10°
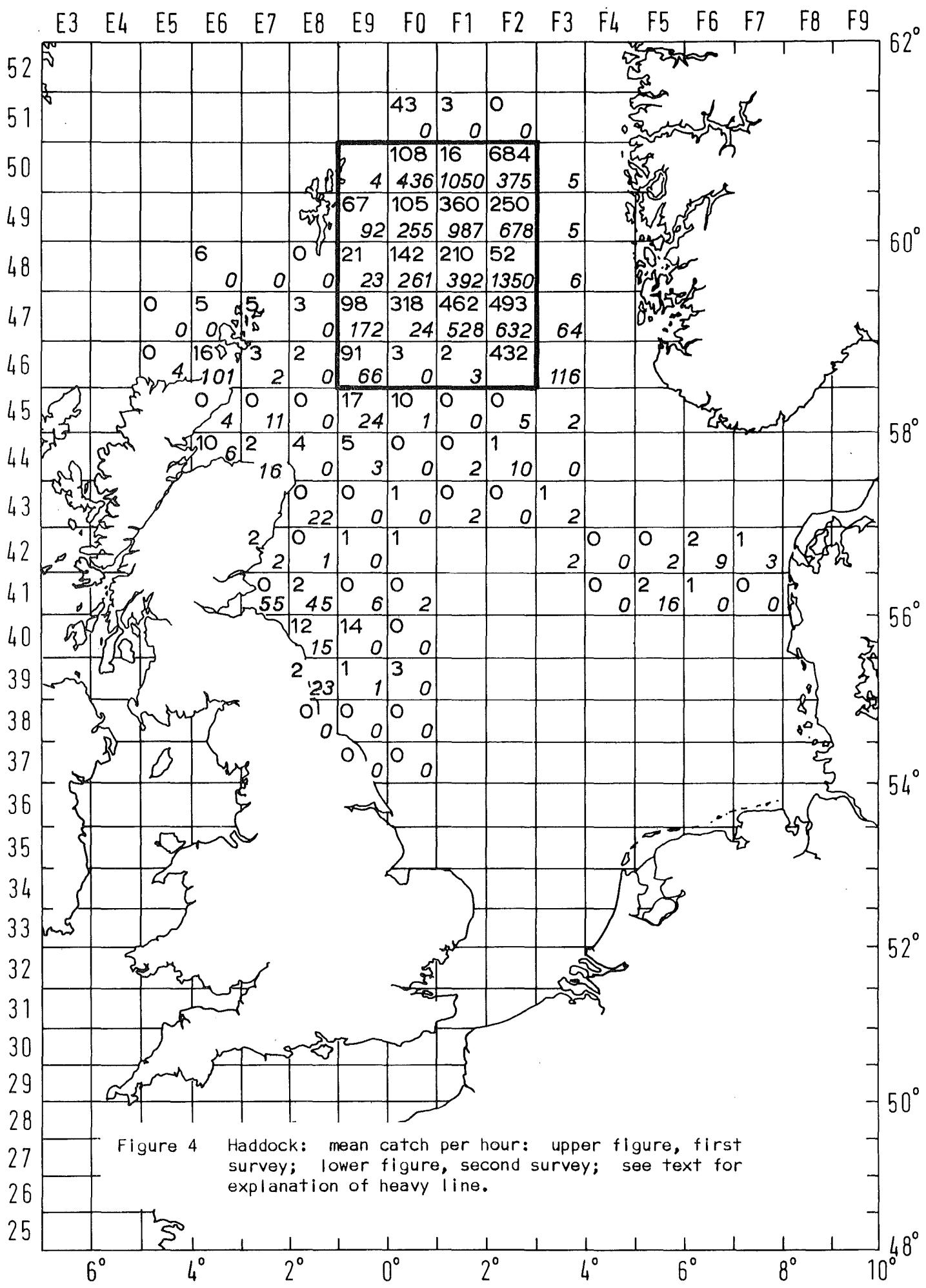
Figure 4   Haddock:   mean catch per hour:   upper figure, first
survey;   lower figure, second survey;   see text for
explanation of heavy line.
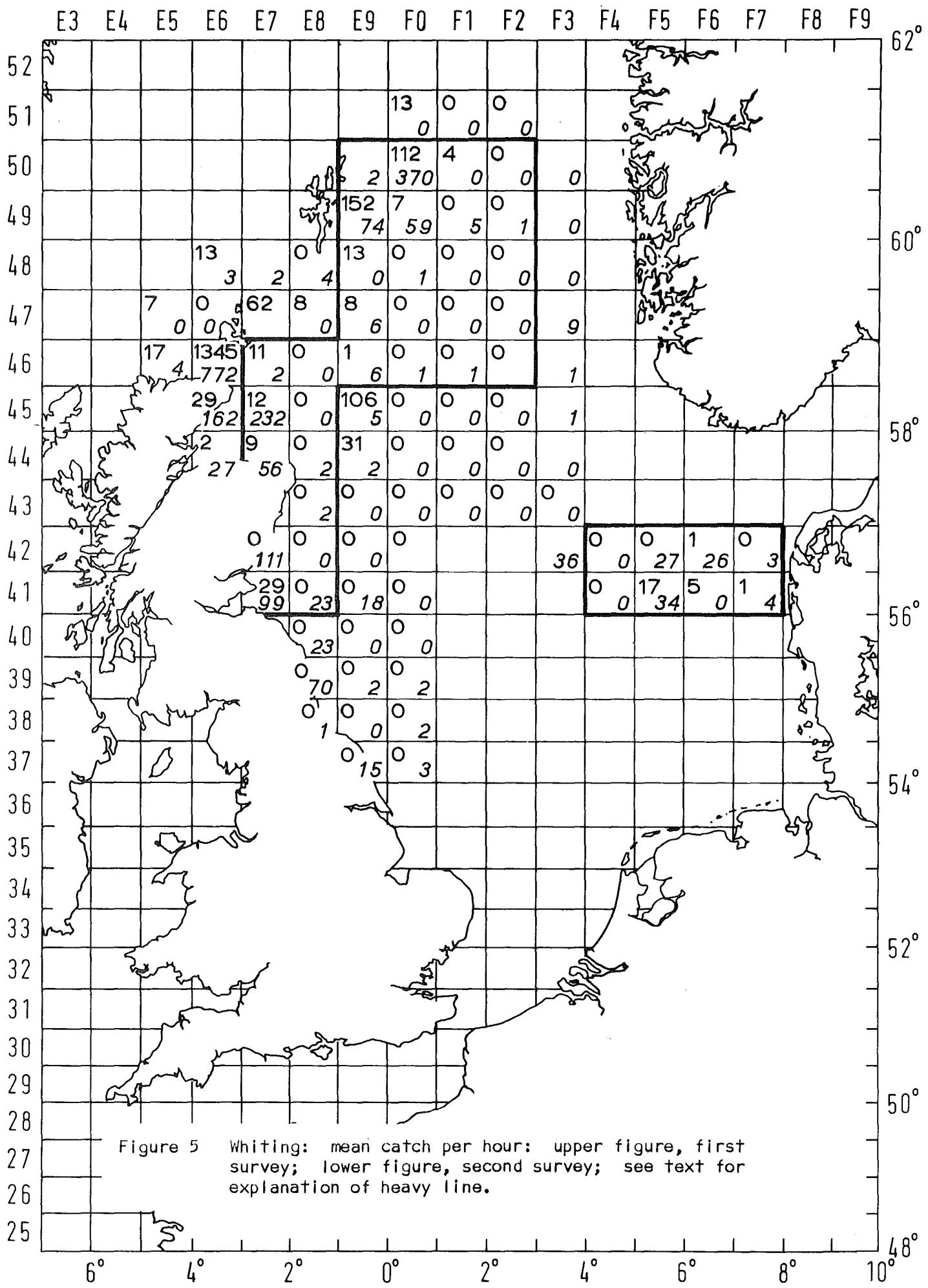
Figure 5    Whiting:   mean catch per hour:   upper figure, first
            survey;   lower figure, second survey;   see text for
            explanation of heavy line.
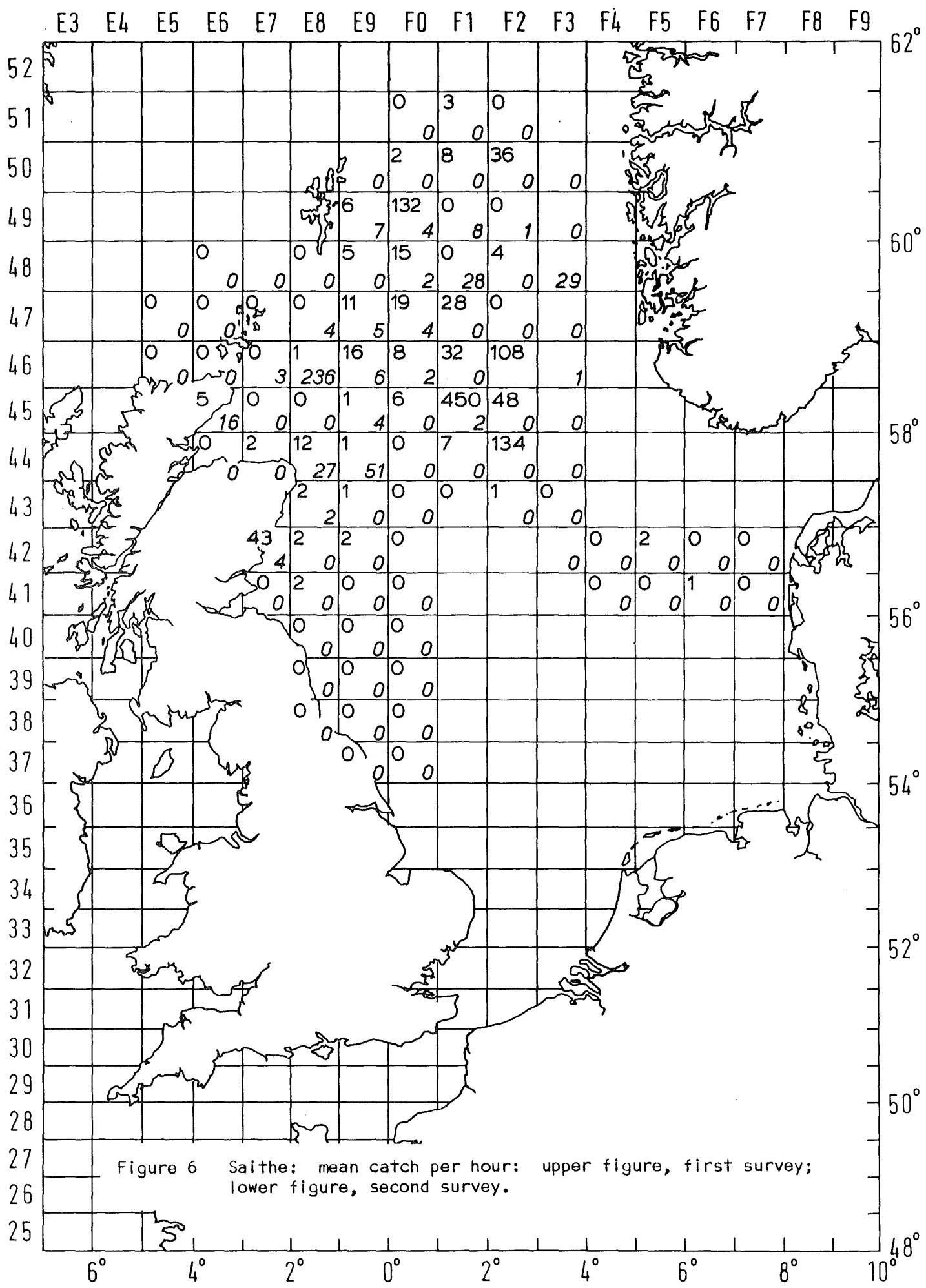
Figure 6    Saithe:  mean catch per hour:   upper figure, first survey;
lower figure, second survey.
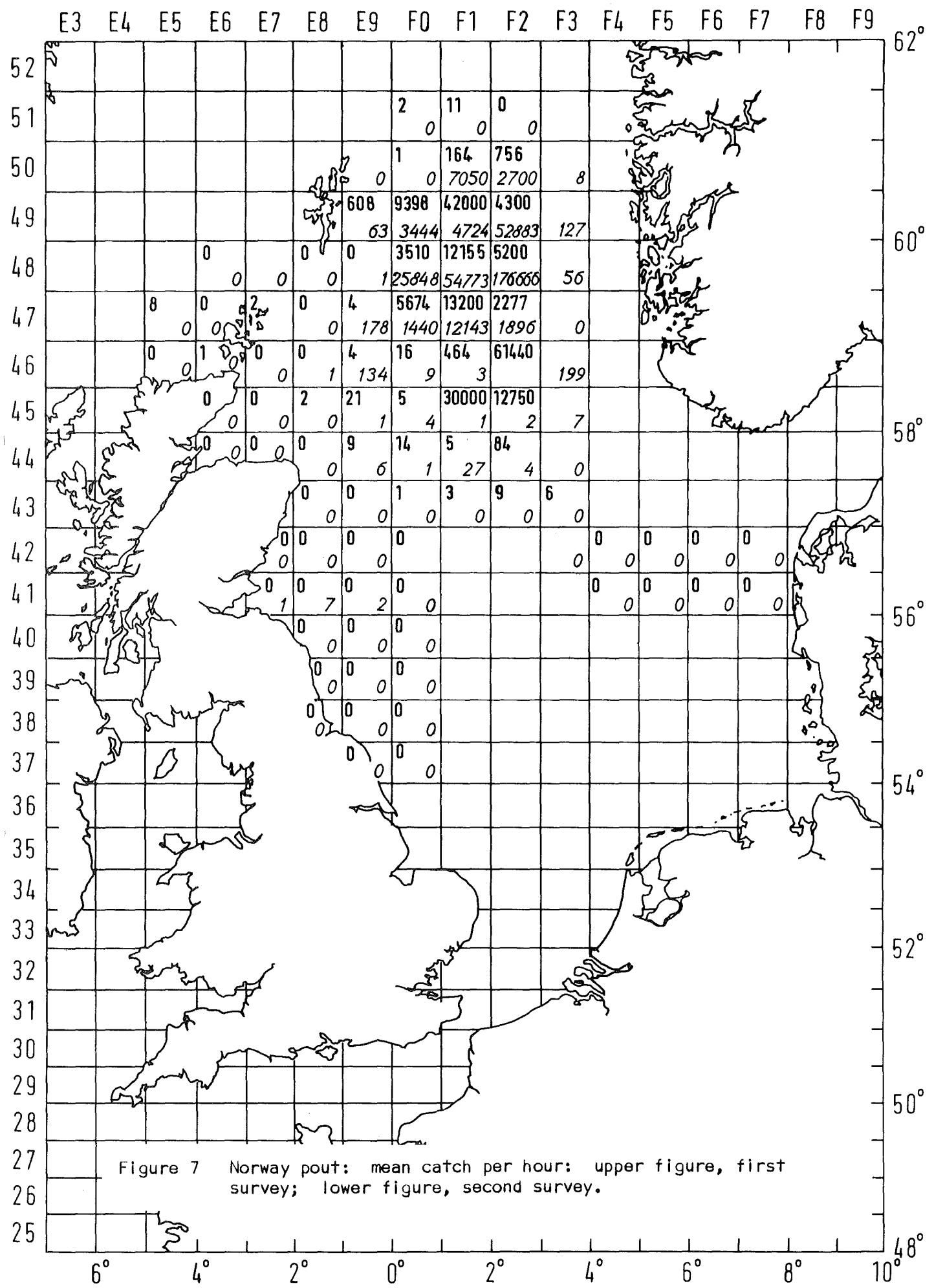
Figure 7    Norway pout: mean catch per hour: upper figure, first survey; lower figure, second survey.

Grid columns (top): E3 E4 E5 E6 E7 E8 E9 F0 F1 F2 F3 F4 F5 F6 F7 F8 F9

Latitude labels (right): 62° 60° 58° 56° 54° 52° 50° 48°

Longitude labels (bottom): 6° 4° 2° 0° 2° 4° 6° 8° 10°

Row labels (left): 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25

Data values by row (upper figure = first survey, lower figure = second survey):

Row 51: F0 = 2 (0), F1 = 11 (0), F2 = 0 (0)

Row 50: F0 = 1 (0), F1 = 164 (7050), F2 = 756 (2700), F3 = (8)

Row 49: E9 = 608 (63), F0 = 9398 (3444), F1 = 42000 (4724), F2 = 4300 (52883), F3 = (127)

Row 48: E5 = 0 (0), E7 = 0 (0), E8 = 0 (0), F0 = 3510 (125848), F1 = 12155 (54773), F2 = 5200 (176666), F3 = (56)

Row 47: E4 = 8 (0), E5 = 0 (0), E6 = 2 (0), E7 = 0 (0), E8 = 4 (0), E9 = (178), F0 = 5674 (1440), F1 = 13200 (12143), F2 = 2277 (1896), F3 = (0)

Row 46: E4 = 0 (0), E5 = 1 (0), E6 = 0, E7 = 0 (1), E8 = 4 (134), E9 = 16 (9), F0 = 464 (3), F1 = 61440, F3 = (199)

Row 45: E5 = 0 (0), E6 = 0 (0), E7 = 2 (0), E8 = 21 (1), E9 = 5 (4), F0 = 30000 (1), F1 = 12750 (2), F2 = (7)

Row 44: E5 = 0, E6 = 0 (0), E7 = 0 (0), E8 = 9 (6), E9 = 14 (1), F0 = 5 (27), F1 = 84 (4), F2 = (0)

Row 43: E7 = 0 (0), E8 = 0 (0), E9 = 1 (0), F0 = 3 (0), F1 = 9 (0), F2 = 6 (0)

Row 42: E6 = 0 (0), E7 = 0 (0), E8 = 0 (0), E9 = 0 (0), F4 = 0 (0), F5 = 0 (0), F6 = 0 (0), F7 = 0 (0), F8 = (0)

Row 41: E6 = 0 (1), E7 = 0 (7), E8 = 0 (2), E9 = 0 (0), F4 = 0 (0), F5 = 0 (0), F6 = 0 (0), F7 = 0 (0)

Row 40: E7 = 0 (0), E8 = 0 (0), E9 = 0 (0)

Row 39: E7 = 0 (0), E8 = 0 (0), E9 = 0 (0)

Row 38: E7 = 0 (0), E8 = 0 (0)

Row 37: E7 = 0 (0), E8 = 0 (0)

Figure 8    Blue whiting:   mean catch per hour:   upper figure,
            first survey;   lower figure, second survey.
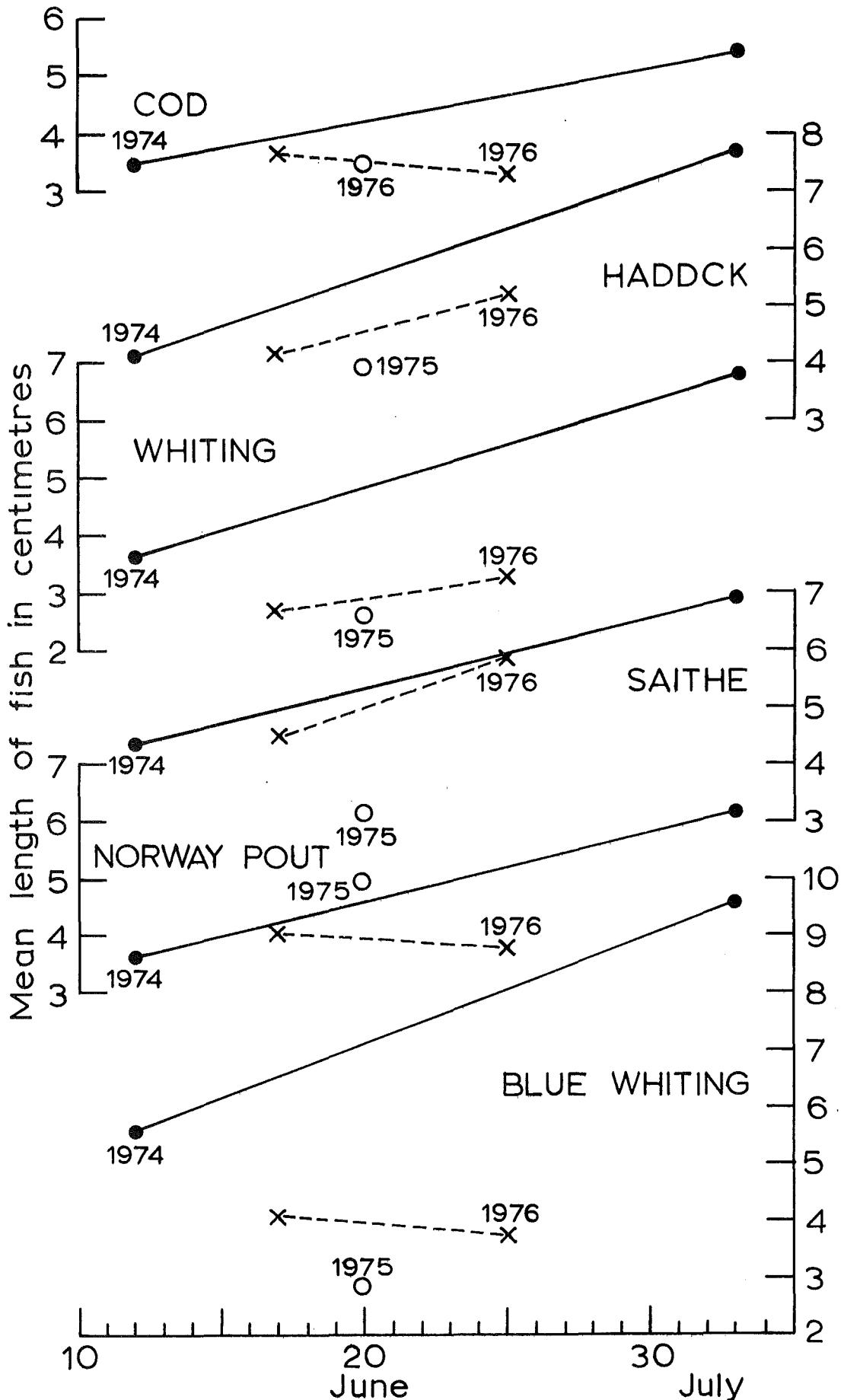
Figure 9    Mean lengths of each species 1974-6;    data for 1974 are
            taken from Table II (Hislop, 1974);    two data points
            for 1976 are first and second surveys.