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Preliminary Results from EEC Cod Tagging on Flemish Cap

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1.- Introduction.

Spawning biomass level of the Flemish Cap cod stock (Division 3M) has been considered very weak since 1982. So the Scientific Council recommended to close this fishery from 1988 to permit the rebuilding of the genitor components.

An analysis of this fishery (de Cárdenas and Pereiro, 1990) pointed out that the spawning biomass represents historically a small proportion of this population of cod, and concluded by casting some doubts on the assumption of the isolation of this stock.

Until now few tagging experiments have been conducted in this area (Konstantinov, 1970; Templeman; 1976; 1979). The E.E.C. decided in 1990 to tag cod on Flemish Cap for two years, to be able to estimate the degree of isolation of this cod population.

During the first survey, the main objective was to develop a methodology for tagging and to collect biological samples. Only returns from tagging year are now available.

2.- Material and methods.

From the 1st to the 15th of April 1991, the E.E.C. conducted a cod tagging experiment, mainly in Flemish Cap (Division 3M) and in part, on the Nose of the Grand Bank (Division 3L) (Fig. 1). In Flemish Cap all the area was covered, but cod good for tagging was only encountered and tagged in the southwestern part of the bank. The tagged cod were fished at depths between 270 m and 485 m. On the Nose of the Grand Bank only a few trawl hauls were made. The length distributions of tagged cod by areas are presented in Fig. 2 and Table 1.

Two different types of tag were tried. "spaghetti T-bar" type (294 tags placed in Div. 3M), and "L.E.A." type (262 tags placed in Div. 3M and 49 in Div 3L).

Biological sampling was carried out on cod which did not recover from the trauma of being caught. The length/weight relationship was estimated, and maturities at each length have been adjusted to a logistic curve.

3.- Results.

During the cruise, cod appeared to be very dispersed in general. Some concentrations of small fish were found in the northeastern part of the bank, but the specimens were too small for tagging (age classes 1 and 2). Concentrations of cod, whose lengths were larger than those commonly observed in Flemish Cap (average length of 76 cm and range from 37 cm to 139 cm), were found in the southwestern part of the bank, giving an average yield of 200 kg per 20 minutes haul.

In total 605 specimens of cod were tagged, with sizes ranging from 28 cm to 127 cm.

Fish tagged in Division 3M are larger than those tagged in Division 3L (Fig. 2 and Table 1). Almost 20% of the total tagged in Flemish Cap were larger than 90 cm.

The length/weight relationship (Fig. 3) was calculated based on 272 pairs of values and with length ranging from 13 cm to 139 cm. The equation obtained was:

$$W_L = 0.0000609 L^{3.078}.$$

43% of the specimens examined were females (Tab. 2). Males are concentrated in the length class from 40 to 80 cm. From these lengths upwards, the percentage of females increases notably.

Maturity ogives have only been estimated for females (Fig. 4 and Table 3).

All recaptures have been caught in shallower waters, and as they demonstrate (Table 4), the L.E.A. type tag is much more effective, since 7 from 311 of this type have been recovered (2.25%) and only two from 262 T-bar tags have been recaptured (0.68%). This complements the results from Fowler and Stobo (1991) concluding that for gadoids in general, the spaghetti tag was preferable to the Petersen disc tag.

Seven of the nine recaptures communicated before the end of 1991 came from Flemish Cap, while two were recaptured in Grand Bank (Table 4 and Fig. 5). This indicates some rate of emigration from Division 3M to Divisions 3L and 3O.

If we look at the size of the specimens which migrated (50 cm and 68 cm) (Table 4), it can be seen they are within the size range (50 cm to 70 cm) which would correspond to age groups 5 and 6, which has been speculated as the ages in which migration is more probable if it happened (de Cárdenas & Pereiro, 1990), since it coincides with the ages in which the first sexual maturity occurs.

4.- Conclusion.

Concentrations of larger sizes of cod have been observed in Flemish Cap in April, at between 250 and 500 m depth. Successful tagging operations were conducted on cod caught at these depth ranges.

Considering the two types of tag used, the L.E.A. type appears to be more effective than the "spaghetti T-bar".

Up to the present moment, the number of specimens tagged in Division 3M which have been recaptured indicates that there is a certain rate of emigration from Flemish Cap to neighbouring areas.

The 50% maturity length for females of Flemish Cap was estimated to be 52.13 cm for 1991

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| Lt. cm | 3M | 3L | TOTAL |
|--------|------|------|-------|
| 28 | 1 | 0 | 1 |
| 31 | 2 | 1 | 3 |
| 34 | 4 | 2 | 6 |
| 37 | 9 | 7 | 16 |
| 40 | 11 | 3 | 14 |
| 43 | 10 | 2 | 12 |
| 46 | 14 | 7 | 21 |
| 49 | 28 | 3 | 31 |
| 52 | 36 | 7 | 43 |
| 55 | 38 | 2 | 40 |
| 58 | 31 | 1 | 32 |
| 61 | 36 | 1 | 37 |
| 64 | 30 | 3 | 33 |
| 67 | 33 | 4 | 37 |
| 70 | 26 | 3 | 29 |
| 73 | 49 | 1 | 50 |
| 76 | 24 | 5 | 29 |
| 79 | 24 | 0 | 24 |
| 82 | 16 | 0 | 16 |
| 85 | 20 | 0 | 20 |
| 88 | 18 | 0 | 18 |
| 91 | 7 | 0 | 7 |
| 94 | 21 | 0 | 21 |
| 97 | 13 | 0 | 13 |
| 100 | 15 | 0 | 15 |
| 103 | 16 | 0 | 16 |
| 106 | 11 | 0 | 11 |
| 109 | 9 | 0 | 9 |
| 112 | 3 | 0 | 3 |
| 115 | 3 | 0 | 3 |
| 118 | 2 | 0 | 2 |
| 121 | 0 | 0 | 0 |
| 124 | 0 | 0 | 0 |
| 127 | 3 | 0 | 3 |
| >90 | 103 | 0 | 103 |
| TOTAL | 556 | 49 | 605 |
| % >90 | 0,19 | 0,00 | 0,17 |

Table 1.- Length composition of tagged cod split by NAFO Divisions.

| Lt cm | males | females | % |
|--------------|-----------|-----------|-------------|
| 19 | 0 | 1 | 1,00 |
| 22 | 0 | 2 | 1,00 |
| 25 | 0 | 6 | 1,00 |
| 28 | 6 | 4 | 0,40 |
| 31 | 4 | 4 | 0,50 |
| 34 | 3 | 4 | 0,57 |
| 37 | 1 | 4 | 0,80 |
| 40 | 2 | 5 | 0,71 |
| 43 | 1 | 0 | 0,00 |
| 46 | 4 | 0 | 0,00 |
| 49 | 6 | 2 | 0,25 |
| 52 | 5 | 3 | 0,38 |
| 55 | 13 | 2 | 0,13 |
| 58 | 7 | 1 | 0,13 |
| 61 | 5 | 2 | 0,29 |
| 64 | 3 | 0 | 0,00 |
| 67 | 2 | 1 | 0,33 |
| 70 | 3 | 2 | 0,40 |
| 73 | 1 | 0 | 0,00 |
| 76 | 2 | 0 | 0,00 |
| 79 | 1 | 0 | 0,00 |
| 82 | 0 | 2 | 1,00 |
| 85 | 0 | 2 | 1,00 |
| 88 | 7 | 2 | 0,22 |
| 91 | 1 | 1 | 0,50 |
| 94 | 0 | 1 | 1,00 |
| 97 | 4 | 6 | 0,60 |
| 100 | 4 | 3 | 0,43 |
| 103 | 2 | 4 | 0,67 |
| 106 | 2 | 2 | 0,50 |
| 109 | 2 | 1 | 0,33 |
| 112 | 0 | 1 | 1,00 |
| 115 | 0 | 0 | - |
| 118 | 0 | 1 | 1,00 |
| 121 | 0 | 0 | - |
| 124 | 0 | 0 | - |
| 127 | 0 | 0 | - |
| 130 | 0 | 0 | - |
| 133 | 0 | 0 | - |
| 136 | 0 | 0 | - |
| 139 | 0 | 1 | 1,00 |
| TOTAL | 91 | 70 | 0,43 |

Table 2.- Sex-ratio of 3M Cod.

| Lt cm. | Immature | Mature | % Maturity | Theoretical |
|--------|----------|--------|------------|-------------|
| 21 | 3 | 0 | 0,00 | 0,04 |
| 27 | 10 | 0 | 0,00 | 0,07 |
| 33 | 8 | 0 | 0,00 | 0,12 |
| 39 | 7 | 2 | 0,22 | 0,21 |
| 45 | 0 | 0 | - | 0,32 |
| 51 | 3 | 2 | 0,40 | 0,47 |
| 57 | 1 | 2 | 0,67 | 0,62 |
| 63 | 2 | 0 | 0,00 | 0,75 |
| 69 | 0 | 2 | 1,00 | 0,85 |
| 75 | 0 | 0 | - | 0,91 |
| 81 | 0 | 2 | 1,00 | 0,95 |
| 87 | 0 | 4 | 1,00 | 0,97 |
| 93 | 0 | 2 | 1,00 | 0,99 |
| 99 | 0 | 9 | 1,00 | 0,99 |
| 105 | 0 | 6 | 1,00 | 1,00 |
| 111 | 0 | 2 | 1,00 | 1,00 |
| 117 | 0 | 1 | 1,00 | 1,00 |
| 123 | 0 | 0 | - | 1,00 |
| 129 | 0 | 0 | - | 1,00 |
| 135 | 0 | 0 | - | 1,00 |
| 141 | 0 | 1 | 1,00 | 1,00 |

Number of females by maturity range = 19

L₅₀ = 52.13

Table 3.- Females maturity of 3M cod.

| tag code | length | Tagging | | | | | Recapture | | | | | days* |
|----------|--------|----------|----------|----------|-------|------|-----------|----------|----------|-------|------|-------|
| | | date | long. | lat. | depth | Div. | date | long. | lat. | depth | Div. | |
| A0279 | 77 | 10-04-91 | 46° 09 W | 46° 42 N | 353 | 3M | 25-04-91 | 46° 00 W | 47° 00 N | 310 | 3M | 15 |
| A0226 | 58 | 12-04-91 | 46° 00 W | 46° 40 N | 345 | 3M | 27-05-91 | 44° 34 W | 47° 13 N | 160 | 3M | 45 |
| A2580 | 67 | 10-04-91 | 46° 08 W | 46° 40 N | 360 | 3M | 26-05-91 | 44° 25 W | 47° 15 N | 180 | 3M | 46 |
| A2210 | 50 | 10-04-91 | 46° 08 W | 46° 40 N | 360 | 3M | 25-06-91 | 47° 10 W | 47° 31 N | 240 | 3L | 75 |
| B4909 | 52 | 10-04-91 | 46° 07 W | 46° 40 N | 360 | 3M | 03-07-91 | 44° 41 W | 46° 53 N | - | 3M | 83 |
| A0299 | 65 | 10-04-91 | 46° 09 W | 46° 43 N | 350 | 3M | 09-07-91 | 44° 30 W | 47° 02 N | 145 | 3M | 89 |
| A2268 | - | 10-04-91 | 46° 10 W | 46° 42 N | 353 | 3M | 25-07-91 | 44° 23 W | 47° 15 N | 140 | 3M | 105 |
| A2214 | 102 | 10-04-91 | 46° 08 W | 46° 40 N | 360 | 3M | 26-07-91 | 46° 13 W | 47° 01 N | 215 | 3M | 106 |
| B4893 | 68 | 10-04-91 | 46° 07 W | 46° 40 N | 360 | 3M | 06-12-91 | 52° 35 W | 44° 00 N | 170 | 30 | 240 |

* Days before recapture

Table 4.- Data of the recaptured cod. Tags whose code starts with "A" are LEA type; tags whose code starts with "B" are spaghetti T-bar type.

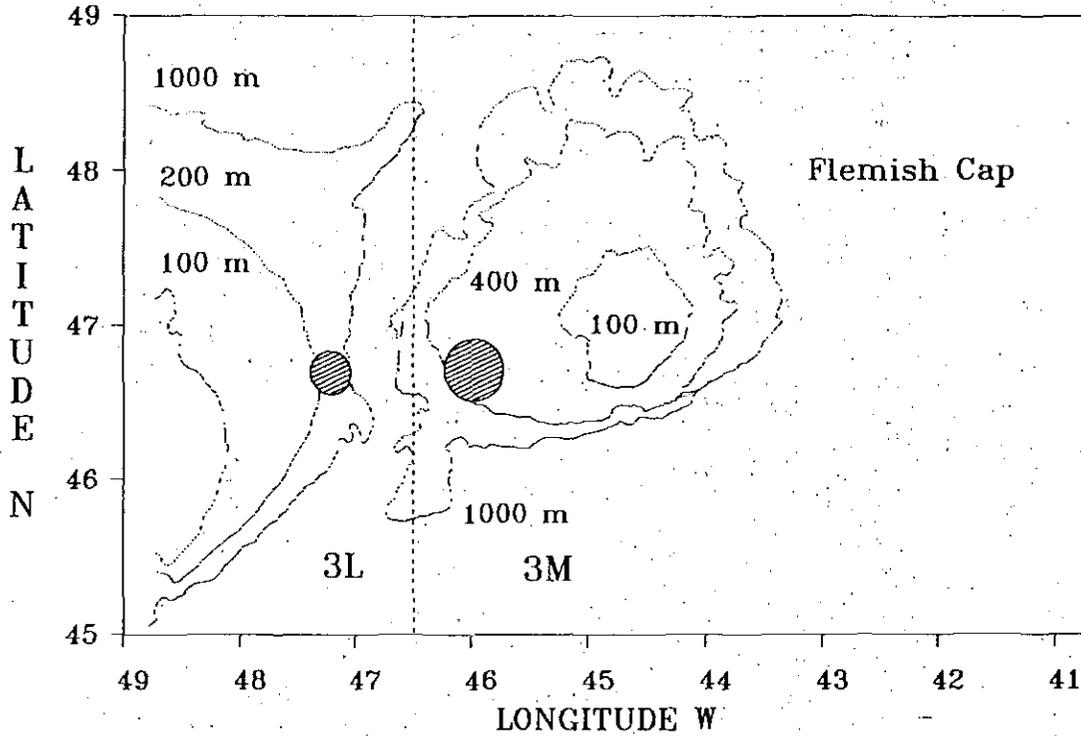
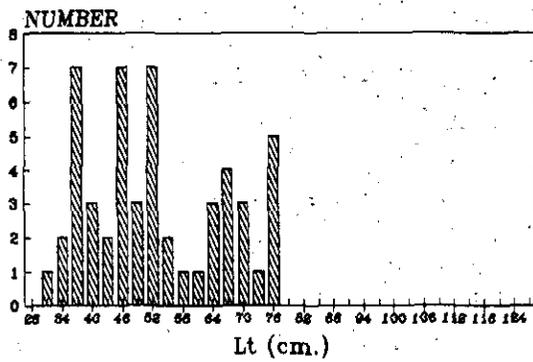
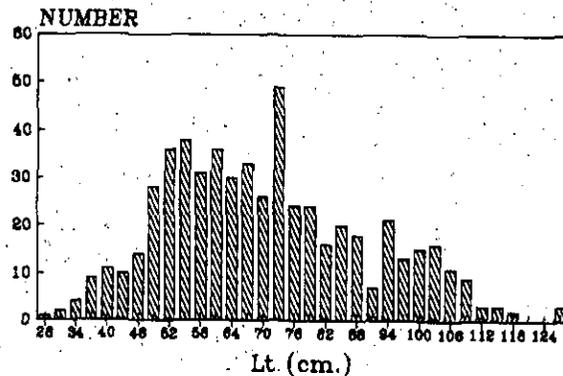


Fig. 1.- Maps showing the tagging region



a.- 3L NAFO Division.



b.- 3M NAFO Division.

Fig. 2.- Length distribution of tagged cod.

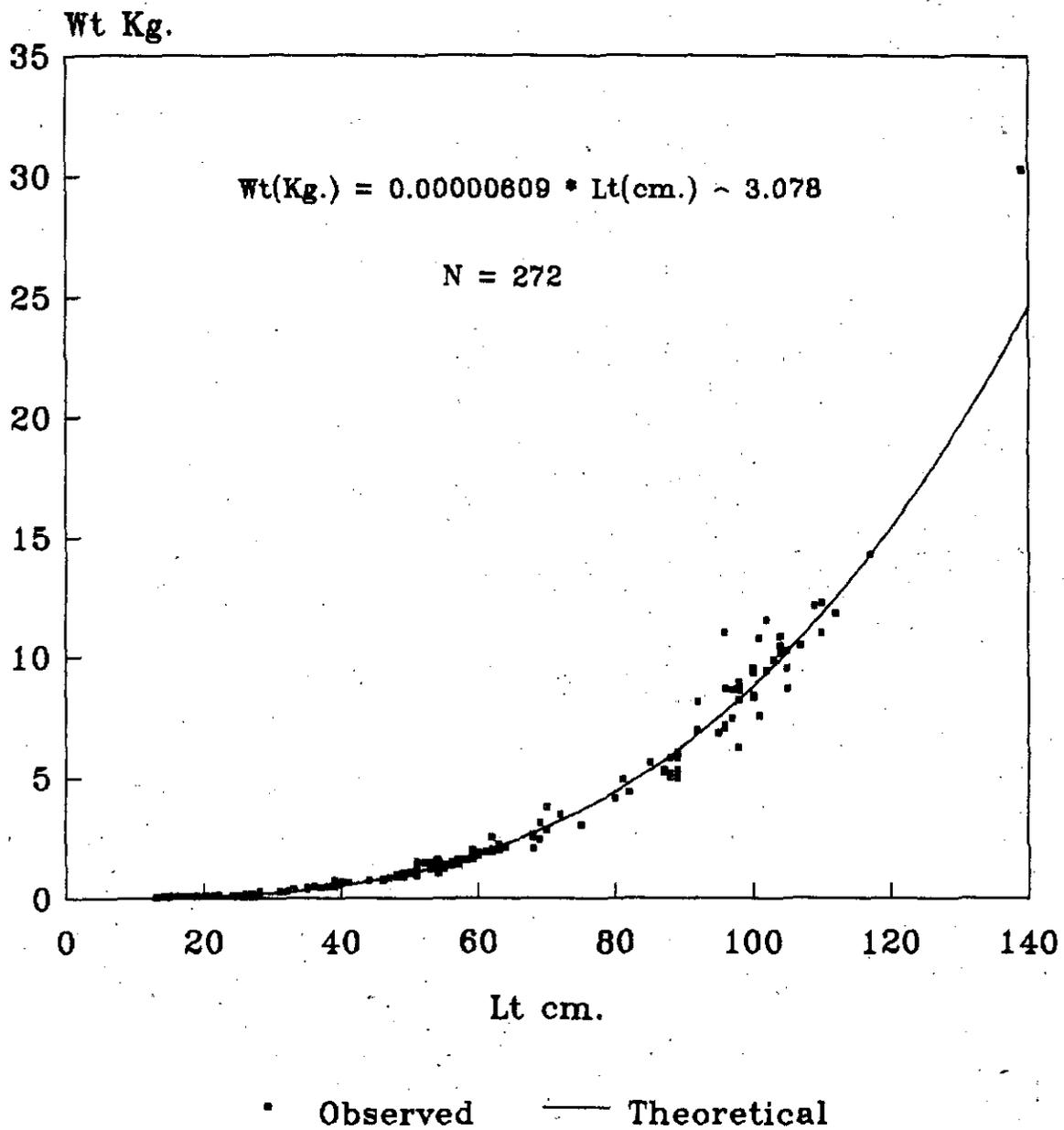


Fig. 3.- Length-weight relationship for 3M NAFO Division cod.

3M cod (females).

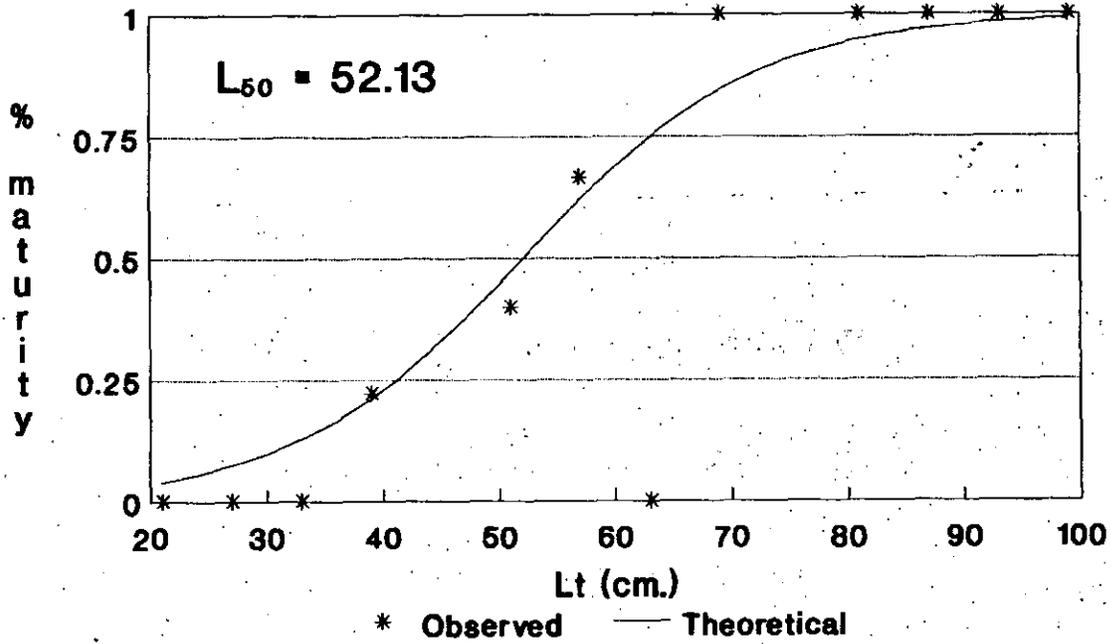


Fig. 4.- maturity percentage fitted to a logistic curve.

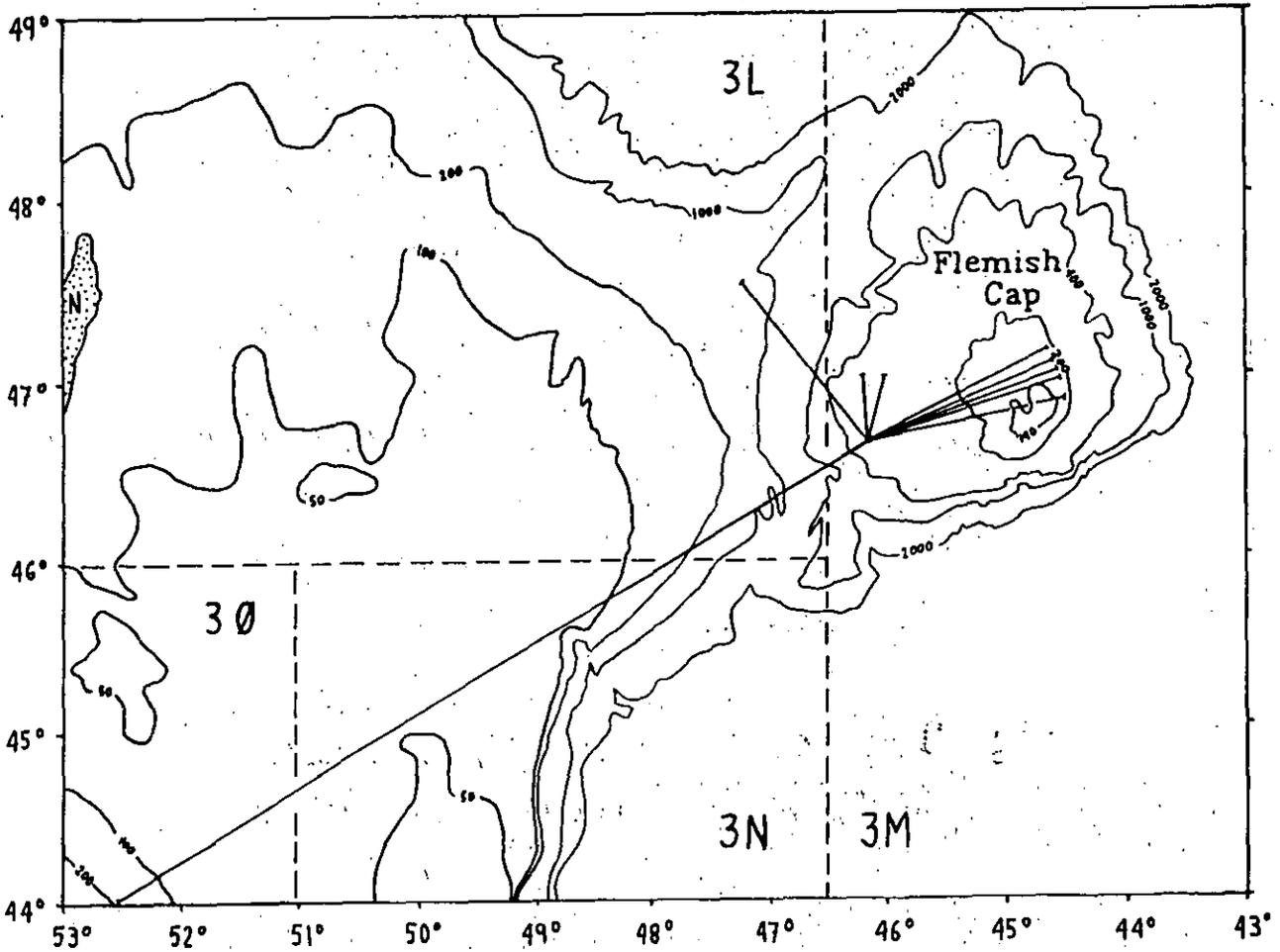


Figure 5.- Map showing the routes of the recaptured cod.