International Council for the Exploration of the Sea.

C. M. 1975 / F : 25
Demersal Fish (Northern) Committe

# Tagging experiments on juvenile plaice off the Belgian coast.

by R. De Clerck and N. Cloet
Fisheries Research Station, Ostend, Belgium.

## INTRODUCTION.

During its recent meetings the North Sea Flatfish Working Group (Anon. 1974, Anon. 1975) has expressed its concern about the lack of information on the migration pattern of plaice in the North Sea. The main problems concerning the migration pattern are the seasonal intermixing behaviour of the different spawning stocks and the identification of the different juvenile stocks. The aim of this study is to determine the migration routes of one of these juvenile plaice stocks having their nursery ground off the Belgian coast.

## MATERIAL AND METHODS.

Three tagging experiments were carried out off the Belgian coast partly on board of the R. V. "Hinders" and partly on a commercial vessel. The experiments covered three seasonal periods, i. e. January-April (winter 1972), May-August (summer 1971) and September-December (autumn 1970). The numbers released and recaptured for the three experiments are given in table 1.

The plaice was tagged with the orange coloured Floy-tag.

The length frequency distribution of the tagged plaice during the three experiments is shown in figure 1. All the taggings were carried out on juvenile plaice.

The following migration parameters were calculated (Jones, 1965) :

- $\Psi$ : mean direction of dislocation,
- $a^2$ : mean square dispersion coefficient,
- V : mean velocity in this direction
- tn. $\gamma$ : mean distance.

The resulting parameters of the three seasonal periods are given in table 2. The position of the recaptures as well as the mean direction and the mean distance are illustrated in figures 2, 3 and 4.

RESULTS.

A permanent plaice population has been observed along the Belgian coast (De Clerck 1975, 1976). The majority of this plaice stock consists of 0-, I- and II- groups. Except in very restricted areas no permanent dense adult stock is present and no important commercial fishery on plaice takes place. Therefore the shallow waters of the Belgian coast might be considered as a plaice nursery ground of the Southern Bight.

The general lower density of adult plaice compared to the density of the 0-, I- and II-groups indicate a migration out of the nursery ground at a certain length or age. This phenomenon had already been observed in the other nursery areas (Heincke 1913, De Veen 1965).

The migration pattern of the tagged juvenile plaice can be described as follows :

a/ Experiment. 1. (table 2 and figure 2).

During the first months after tagging most of the recaptures were still present around the release point. When considering the first summer period as a whole it became apparent that a further splitting up

of the data on a monthly basis could result in a better picture of the migration pattern. As a matter of fact about 70 % of the total recaptures were recorded during this period. Moreover the first summer period coincided with the most pronounced migration of the juveniles from their nursery ground. The number of the recoveries in the release area were steadily decreasing from May till August. The general migration route was in a NE direction to the Dutch coast. From June onwards the plaice on the Dutch coast tended to move in western direction to the English coast. During the second and third year the recaptures were mostly concentrated in the Flamborough spawning area as described by De Veen (1962).

The migration to the English Channel seems to be less important which is reflected by the scarse recaptures in this area.

b/Experiment 2. (table 2 and figure 3).

The recaptures of experiment 2 were unfortunately rather small. Nevertheless, as in the first experiment, the same migration routes, i. e. Dutch coast, Flamborough area and English Channel were again observed.

c/ Experiment 3. (table 2 and figure 4).

The third experiment showed a more pronounced migration to the English Channel. The migration to the Dutch coast and Flamborough area seemed to be less important. After one year no recoveries were reported in the release area.

All the experiments presented an identical picture. Firstly the recoveries around the release point decreased steadily in time. Secondly three migration routes became apparent : NE (Dutch coast), NW (Flamborough area) and SW (English Channel). From the recoveries it became clear that only a small part of the tagged plaice moved into the Channel whereas the majority took a northeastern and northwestern direction.

Compared to the migration pattern of adult plaice (Garstang 1909, Hickling 1937, De Veen 1962) there seems not to be a particular seasonal migration of the juvenile stock. The period the juvenile plaice tended to recruit the adult stocks covers the whole year cycle. For this reason further investigations were made in order to point out the treshold value at which the migration from shallow waters to deeper waters starts. As no significant differences in migration pattern could be found between the age or the sex of the tagged plaice, the length of the recoveries was further studied in detail. For the three experiments the mean length of the remaining population as well as of the migrating population was calculated. The results given in table 3, show a clear difference according to the migratory behaviour of the two stocks. The plaice which were recovered in the nursery area had a mean length of about 26 cm. The plaice recruiting to the adult stock had however a mean length of over 30 cm. Although belonging to the same year-class (mainly the III-group) only the largest plaice migrated out of the nursery ground. The remainder of the juvenile stock consisted of the smaller ones of the III-group. For this reason a length value of about 30 cm coinciding probably with the first maturing seems to be critical for leaving the nursery ground. This phenomenon was already ascertained in earlier experiments (Garstang, 1909, Heincke 1913, De Veen 1962).

SUMMARY.

The juvenile plaice stock along the Belgian coast starts migrating at a length of about 30 cm. Three migration routes became apparent : NE (Dutch coast), NW (Flamborough area) and SW (English Channel).

REFERENCES.

Anon. (1974), Report of the North Sea Flatfish Working Group, I.C.E.S. F : 6.

Anon. (1975), Report of the North Sea Flatfish Working Group, I.C.E.S. F : 4.

De Clerck, R. (1975), Densities of flatfishes off the Belgian coast during 1970-1973, An. Biol. XXX 1973.

De Clerck, R. (1976), Contribution on the densities of flatfishes off the Belgian coast during 1974, An. Biol. XXXI 1974.

De Veen, J. (1962), On the subpopulations of plaice in the Southern North Sea, I.C.E.S. Near Northern Committee no. 94.

De Veen, J. (1965), Schollen op stap, Visserij-Nieuws 2.

Garstang, W. (1909), The distribution of the plaice in the North Sea Skagerak and Kattegat, according to size, age, and frequency. Rapp. P. - v. Réun. Cons. perm. int. Explor. Mer, XI, appendix E.

Heincke, F. (1913), Investigations on the plaice. General report, Rapp. P.-v. Réun. Con. perm. int. Explor. Mer, XVII.

Hickling, C.F. (1937), The English plaice-marking experiments 1929-1932, Fish. Invest. Ser. II, vol. XVI, 1.

Jones, R. (1965), FAO/UN seminar on sardine tagging, Split, Yugoslavia, 2-14 November 1964, Report and lectures, FAO Fish. EPTA Rep.

Table 1 - Numbers released and recaptured.

| Experiment | Period | Numbers released | Recaptures |
|---|---|---|---|
| 1 | winter 1972 | 1470 | 302 |
| 2 | summer 1971 | 1620 | 67 |
| 3 | autumn 1970 | 315 | 28 |

Table 2 - Migration parameters (a).

| Experiment | Season of recapture | V | $a^2$ | $\Psi$ | tn.V | n |
|---|---|---|---|---|---|---|
| 1 | first winter A | 0.02 | 12.36 | 128 | 5 | 37 |
| | first winter B | 1.17 | 42.60 | 40 | 56 | 8 |
| | first winter D | 1.05 | 21.44 | 274 | 16 | 8 |
| | first summer A (May) | 0.08 | 2.67 | 100 | 5 | 81 |
| | first summer B (May) | 0.67 | 5.84 | 45 | 39 | 13 |
| | first summer D (May) | 1.19 | 0.00 | 218 | 69 | 1 |
| | first summer A (June) | 0.10 | 1.69 | 81 | 9 | 21 |
| | first summer B (June) | 0.97 | 34.77 | 37 | 89 | 25 |
| | first summer A (July) | 0.09 | 1.18 | 61 | 11 | 8 |
| | first summer B (July) | 0.83 | 18.86 | 28 | 101 | 16 |
| | first summer A (August) | 0.13 | 0.88 | 65 | 20 | 7 |
| | first summer B (August) | 0.44 | 17.62 | 26 | 69 | 7 |
| | first summer C (August) | 0.83 | 3.38 | 50 | 130 | 3 |
| | first autumn A | 0.02 | 0.06 | 17 | 5 | 3 |
| | first autumn B | 0.35 | 3.50 | 23 | 74 | 14 |
| | first autumn C | 0.89 | 6.14 | 348 | 150 | 4 |
| | first autumn D | 0.60 | 38.70 | 240 | 148 | 2 |
| | second winter A | 0.01 | 0.00 | 62 | 3 | 2 |
| | second winter B | 0.29 | 1.25 | 39 | 111 | 5 |
| | second winter C | 0.28 | 4.42 | 345 | 84 | 3 |
| | second summer A | 0.01 | 0.02 | 22 | 4 | 2 |
| | second summer B | 0.14 | 3.55 | 32 | 66 | 4 |
| | second summer C | 0.14 | 0.10 | 343 | 64 | 2 |
| | second autumn A | 0.05 | 0.00 | 76 | 27 | 2 |
| | second autumn C | 0.17 | 0.00 | 332 | 101 | 1 |
| | third winter A | 0.03 | 0.00 | 249 | 20 | 1 |
| | third winter C | 0.13 | 0.00 | 355 | 95 | 3 |
| | fourth winter C | 0.23 | 0.00 | 331 | 260 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | first summer A | 0.05 | 1.27 | 324 | 1 | 38 |
| | first summer B | 1.02 | 5.60 | 27 | 71 | 4 |
| | first autumn A | 0.02 | 1.76 | 140 | 3 | 4 |
| | first autumn B | 0.98 | 96.80 | 32 | 107 | 2 |
| | first winter A | 0.02 | 0.00 | 190 | 5 | 1 |
| | first winter B | 1.47 | 0.00 | 35 | 317 | 1 |
| | second summer A | 0.03 | 0.24 | 203 | 10 | 6 |
| | second summer B | 0.06 | 0.09 | 41 | 24 | 4 |
| | second autumn A | 0.02 | 0.00 | 328 | 10 | 1 |
| | second autumn D | 0.31 | 27.02 | 265 | 150 | 2 |
| | second winter A | 0.01 | 0.00 | 17 | 9 | 1 |
| | third autumn B | 0.09 | 0.00 | 1 | 100 | 1 |
| 3 | first autumn A | 1.47 | 0.00 | 71 | 28 | 1 |
| | first winter A | 0.05 | 0.31 | 245 | 7 | 5 |
| | first winter D | 0.56 | 0.28 | 251 | 71 | 2 |
| | first summer A | 0.04 | 0.39 | 188 | 9 | 5 |
| | first summer B | 0.45 | 0.00 | 2 | 116 | 1 |
| | first summer D | 0.37 | 26.09 | 255 | 75 | 4 |
| | second autumn D | 0.77 | 0.00 | 250 | 235 | 1 |
| | second winter B | 0.42 | 0.00 | 0 | 200 | 1 |
| | second winter D | 0.12 | 0.00 | 230 | 55 | 1 |
| | third autumn B | 0.05 | 0.21 | 44 | 33 | 2 |

(a) When clear differences in the direction were noticed a separation has been made in the calculations as follows :

A : recaptures around the release point
B : migration into NE-direction
C : migration into NW-direction
D : migration into the English Channel

Table 3 - The mean length of the recoveries from the remaining part of the stock and from the migrating part.

| Experiment | Mean length at recapture | |
|---|---|---|
| | remaining part | migrating part |
| 1 | 26.6 cm (s.d. 3.6) | 30.6 cm (s.d. 3.4) |
| 2 | 26.4 cm (s.d. 3.8) | 33.9 cm (s.d. 4.8) |
| 3 | 26.4 cm (s.d. 4.5) | 30.6 cm (s.d. 3.2) |

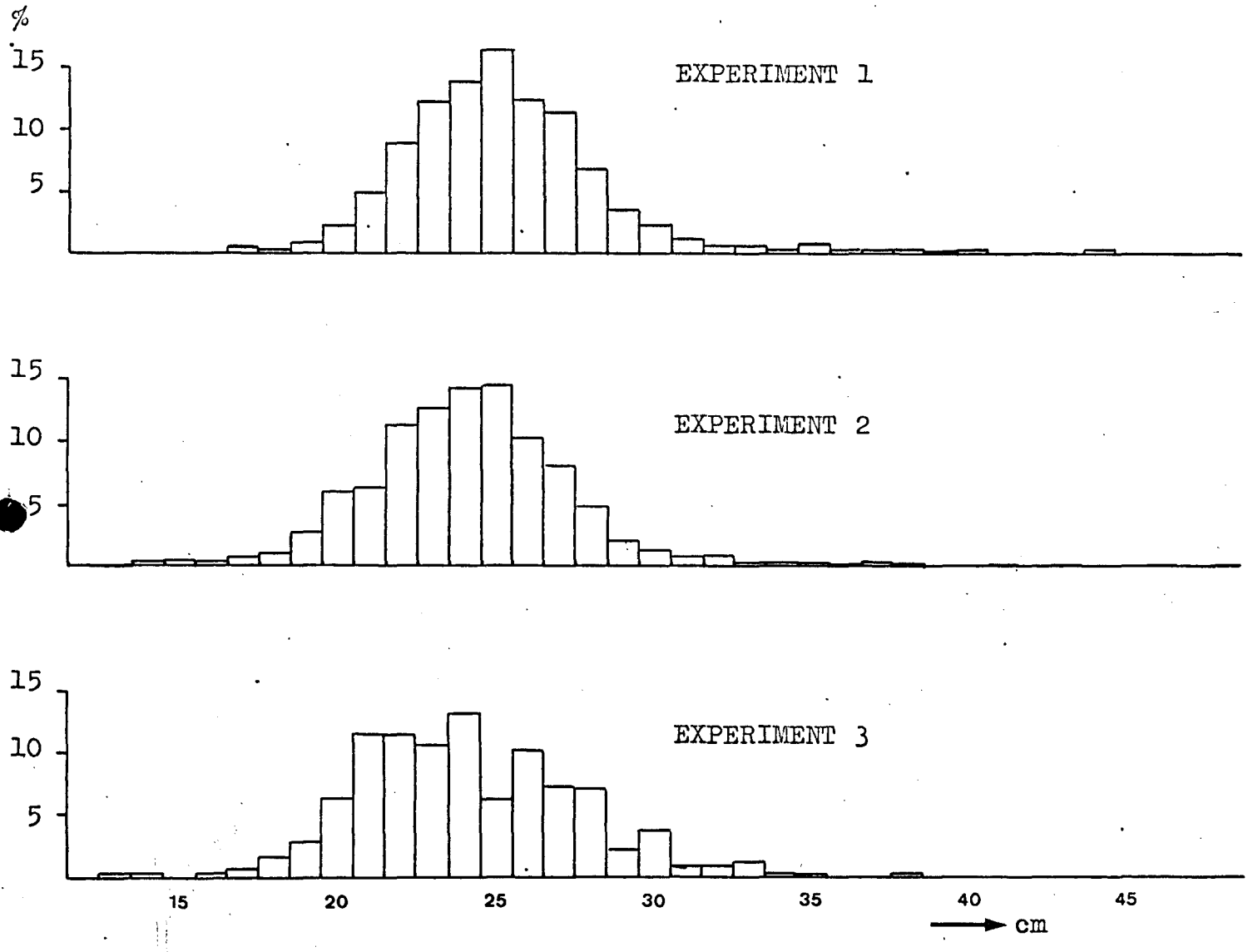


Figure 1 - The length frequency distribution of the three experiments

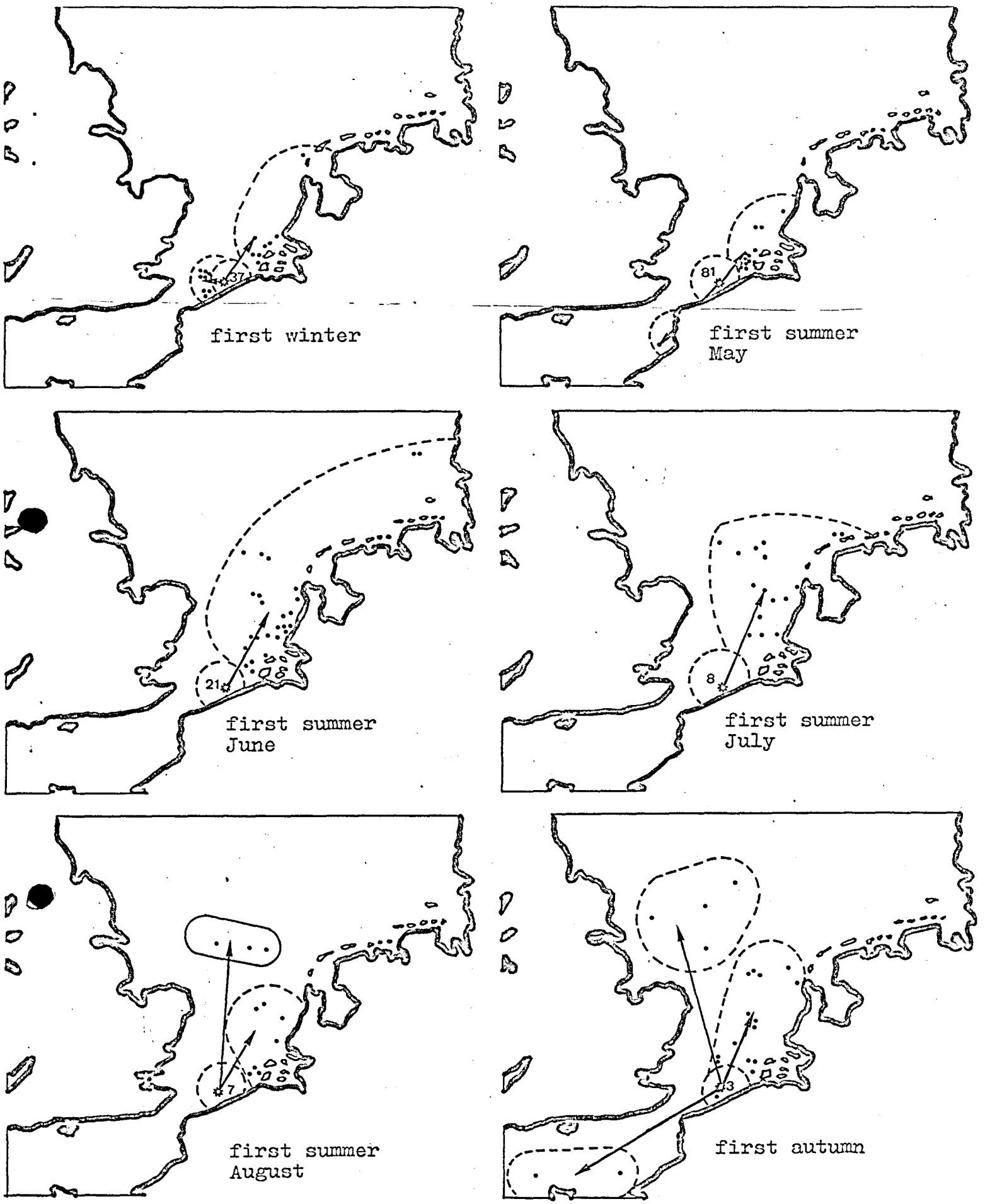


Figure 2 - Experiment 1.

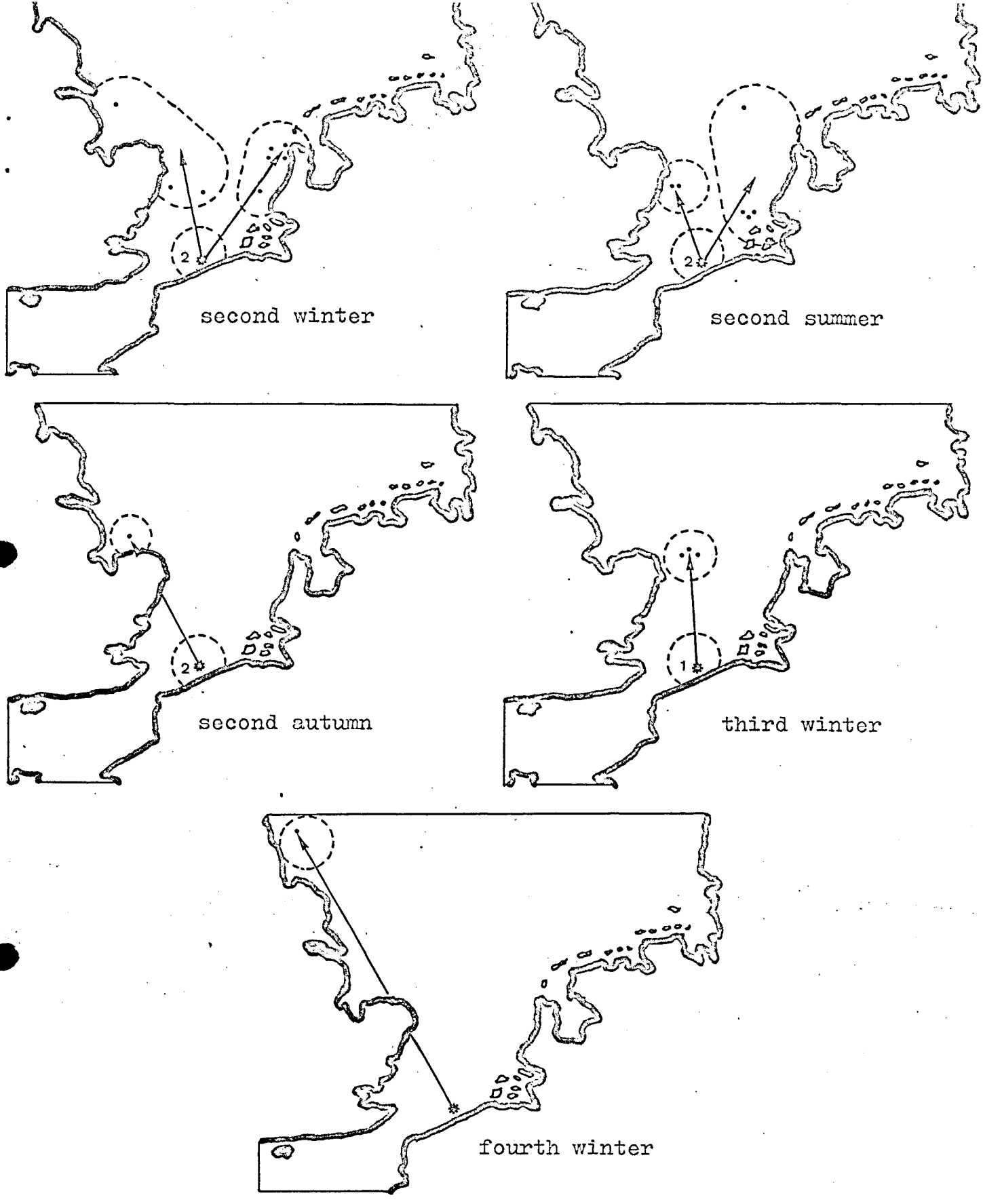


Figure 2 - continued.

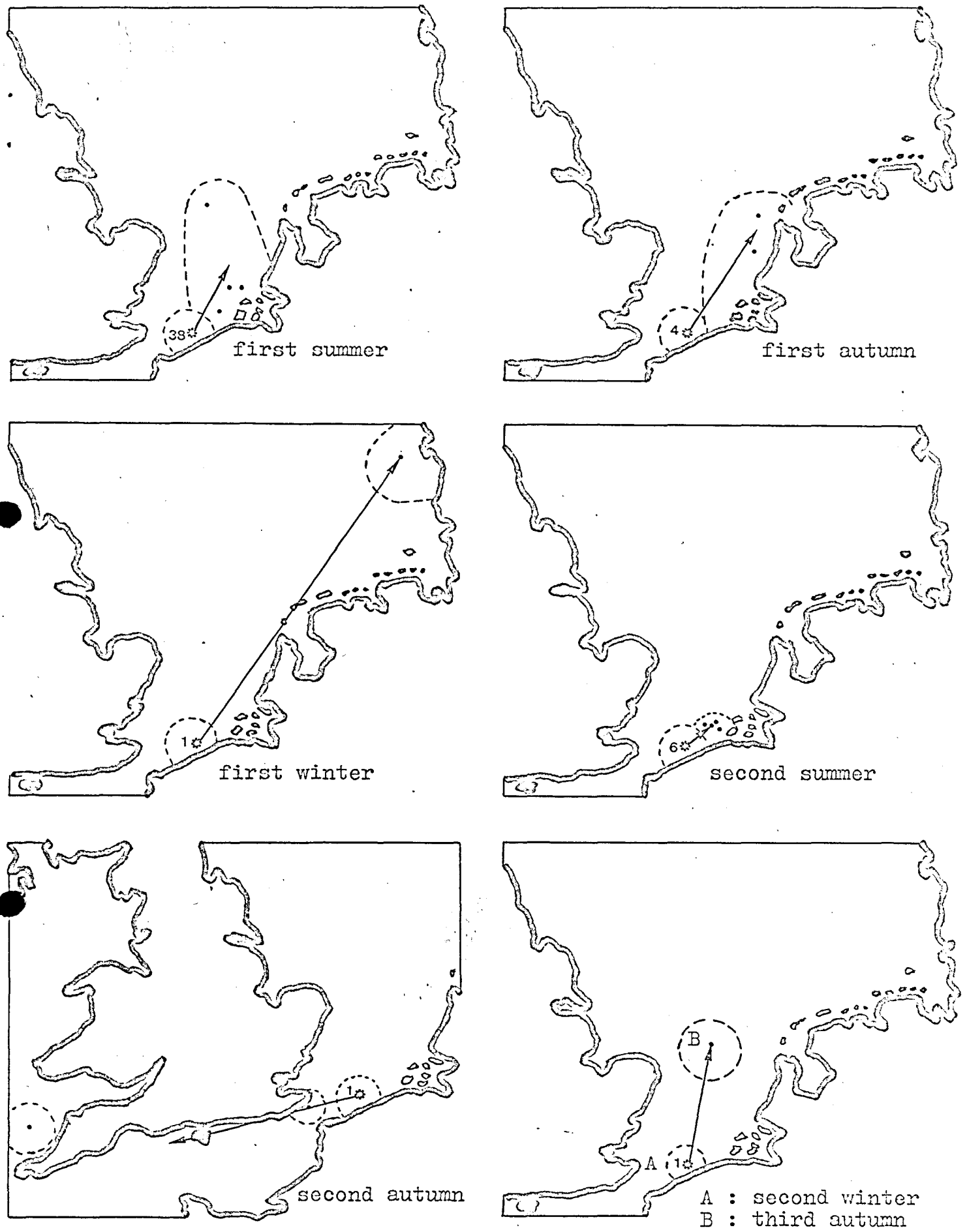


Figure 3 - Experiment 2.

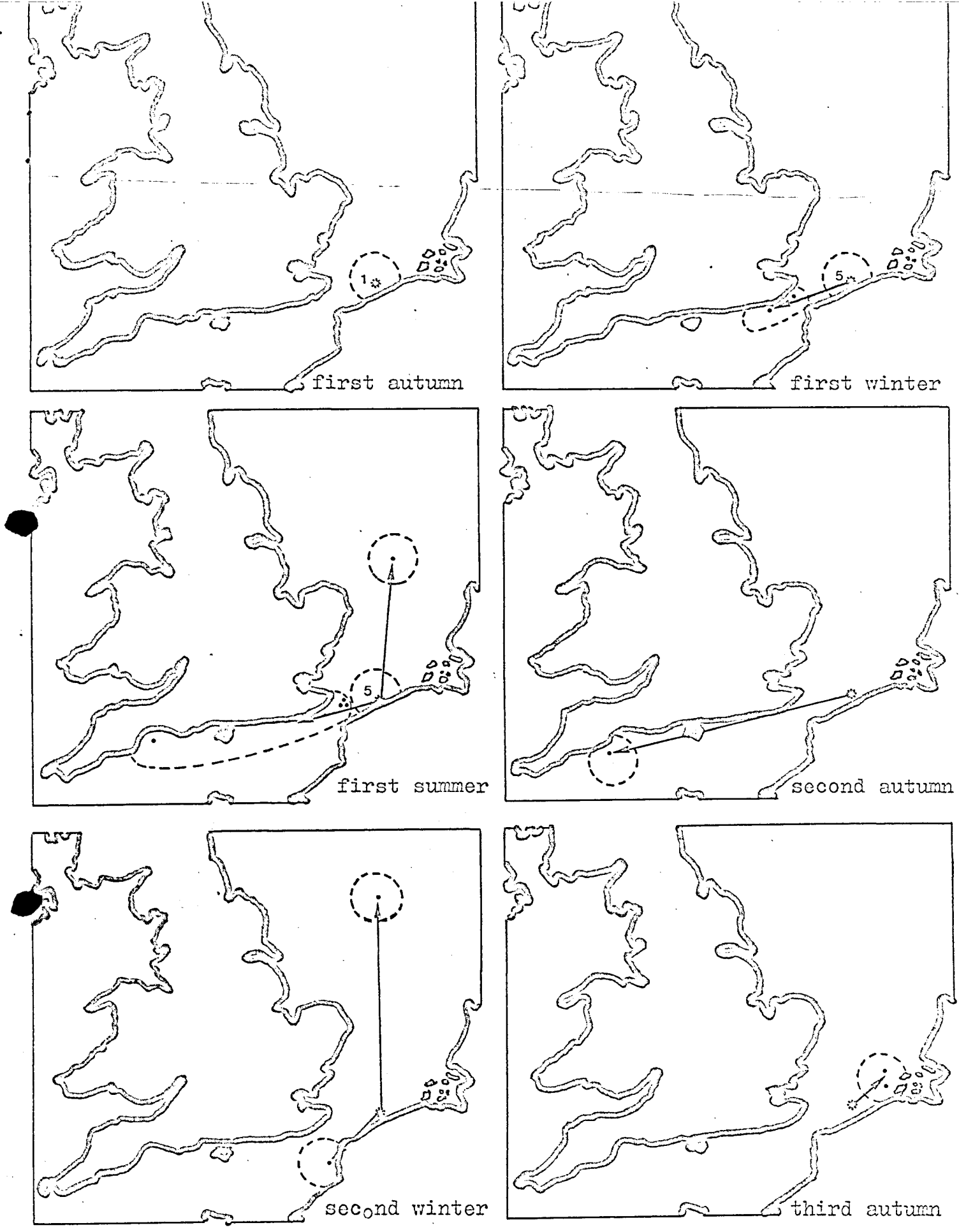


Figure 4 - Experiment 3.