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The migration of plaice on the spawning grounds "Noord-Hinder"

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At the meetings of the North Sea Flatfish Working Group (Anon. 1974, Anon. 1975) it was repeatedly pointed out that more information was needed on the migration pattern of plaice in the North Sea. A Belgian tagging program was set up in 1975 in order to collect more information of the migration routes of the spawning stock on the Noord-Hinder grounds in the Southern Bight.

MATERIAL AND METHODS

The tagging experiments on the Noord-Hinder Grounds were carried out in January and February 1975 on board the commercial vessel N 720 (position 51°35'N/2°35'E). Petersen discs were used for the 702 tagged plaice. The sex ratio was 17 % females and 73 % males. The length frequency distribution of the released plaice is shown on figure 1, indicating a mean length of 31.7 cm.

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

- ψ : mean direction of dislocation
- a^2 : mean square dispersion coefficient

- V : mean velocity in the mean direction of dislocation
- $tn.V$: mean distance

These parameters were grouped per months or per seasons depending of the number or migration behaviour of the recaptures.

The results are given in table 1. The positions of the recaptures with the mean direction and distance are shown on figure 2.

RESULTS.

Five spawning areas of plaice have been defined in the North Sea (De Veen en Boerema, 1959 ; Anon., 1975). The most important area however is the Southern Bight (Heincke, 1913 ; Simpson, 1959).

Plaice eggs are most abundant in the Flemish Bight and a gradual decline in number of plaice eggs was ascertained from South to North in the North Sea (Oray, 1965). The spawning season in the Southern Bight seems to occur between 7. and 29 January, the maximum egg production being on 19. January with a standard deviation of seven days and a standard error of 2.5 days (Cushing, 1969).

The recovery rate was rather high, viz. 43 %.

Most of the released plaice remained on the spawning ground in January (figure 2). Thirteen recaptures were recorded in the release area (A - table 1) while only three recaptures (B) indicated a migration to a distance of 59 miles, corresponding to a mean daily velocity of 3.1 miles.

From February onwards the numbers of plaice on the spawning area decreased gradually and a general migration outside the area started in a predominantly northerly and northeasterly direction.

As in some following periods different distances have been covered within a major migration direction a split up was made for the returns of the NE migration into directions B1, B2 and B3 and of the N migration into directions C1 and C2 (table 1).

In the period February-April the highest number of returns was reported in the NE direction (B1) with a mean distance of about 68 miles. Regarding the NNE direction (B2) a distance of 185 miles was reached. The plaice migrating into the N direction travelled a mean distance of 124 miles from the release ground.

In the following summer and autumn period no relevant further migration seemed to occur. Again most of the returns came from the NE direction. The mean distance from the release point was also rather similar : 72 miles for direction B1, 206 miles for direction B2 and 130 miles for direction C. The only migration of a very small number was covered into the most pronounced NNE direction (B3) reaching a maximum of 320 miles from the release point in the first autumn. The area of distribution during this period was so extensive that mixing must occur with other sub-populations, viz. the German Bight population and the Flamborough population (De Veen, 1962).

The second winter recaptures indicated a return to the spawning place. During this period twenty-one recoveries were reported from which seven were on the spawning ground Noord-Hinder (3 of them reported in January, 1 in March and 3 in April). The other fourteen were at a distance from the spawning area of 64 miles for direction B1, 148 miles for direction B2 and 49 miles for direction C, which led to the supposition that the plaice was also migrating to the Noord-Hinder for spawning.

The results of the second summer and second autumn although based on a limited number of observations, could be considered as being rather similar to the results of the first summer and autumn migrations. Returns of the directions A, B en C were again reported. Two recoveries however were recorded during the second summer in the spawning area, which was not

the case during the first summer period of investigation.

A very small number of plaice was reported in a SE (Belgian coast) and a SW direction (English Channel). The migration to the English Channel after spawning emphasizes the very complex mixing between North Sea and English Channel sub-stocks. A contrary phenomenon has been observed of a sub-stock spawning in the Channel and feeding in the North Sea (Houghton, 1976).

The total area of distribution for this tagging experiment was about 250,000 km² (figure 3).

SUMMARY

Adult plaice tagged on the spawning ground Noord-Hinder in the Southern Bight migrated during the summer period mostly into a North to Northeast direction. A very small part of the population chose the English Channel as a feeding area. A return for spawning to the release area was observed.

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Table 1 - Migration parameters.

Season - month of recapture		V miles/day	a ²	ψ.	tn.V miles	n
First winter January	A	1.29	20.88	81	12	13
	B1	3.10	14.20	30	59	3
February	A	0.24	3.91	88	8	6
	B1	1.70	13.60	33	69	9
	B2	3.9	0	25	185	1
	C	2.70	0	3	105	1
	D	0.60	0	210	16	1
March	A	0.04	0.41	42	2	5
	B1	1.20	18.70	36	70	45
	C	2.5	28.2	0	128	3
	D	0.6	0	227	51	1
	E	0.58	3.08	127	21	3
April	A	0.06	0.69	90	5	3
	B1	0.87	21.6	43	73	43
	C	1.5	3.8	2	139	2
	D	0.6	0	227	51	1
First summer May	B1	0.60	7.85	48	70	35
	C	0.62	0.31	3	76	2
	D	2.57	0	240	280	1
June	B1	0.37	3.97	59	54	11
	B2	1.27	2.03	43	182	2
	C	0.77	0.98	3	117	5
	E	0.23	0	105	27	1
July	B1	0.43	5.78	43	75	8
	B2	1.31	12.39	40	223	2
	C	0.61	0.08	9	118	2
	F	0.13	0	292	25	1
August	B1	0.42	6.71	37	91	12
	C	0.61	1.65	358	122	3
	E	0.08	0	125	18	1
First autumn September- December	B1	0.26	5.43	40	70	22
	B2	0.71	0	38	212	1
	B3	1.40	0	14	320	1
	C	0.48	2.66	3	117	4
	D	0.2	0	225	70	1
Second winter January- April	A	0.03	0.23	78	12	7
	B1	0.16	0.66	40	64	9
	B2	0.35	0	125	148	1
	C	0.13	0.21	4	49	2
	D	0.13	0.41	219	56	2

Second summer						
May -	A	0.03	0.01	100	15	2
August	B1	0.18	2.00	43	91	5
	B2	0.81	0	32	420	1
	C	0.14	0	5	78	1
Second autumn						
September-	B1	0.18	2.12	29	114	3
December	C1	0.07	0	10	42	1
	C2	0.32	0	4	215	1

A : remains or is back again on the spawning ground

B : migration in NE. direction

C.: migration in N. direction

D : migration in SW. direction (English Channel)

E : migration in SE. direction (Belgian coast)

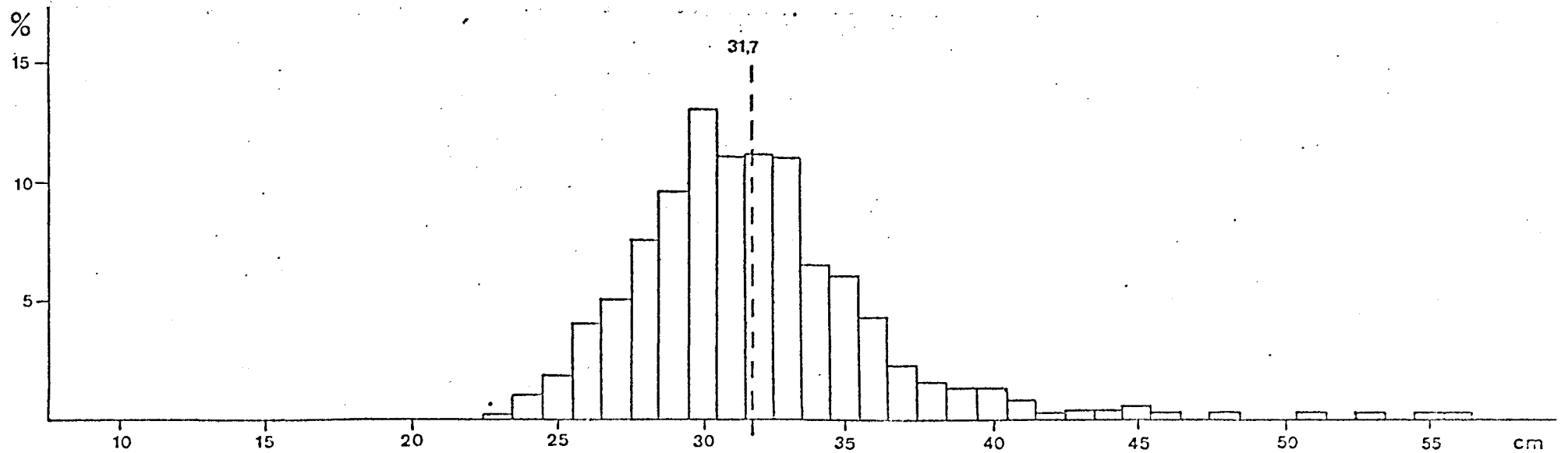


Figure 1.- Length frequency distribution of the released plaice

length

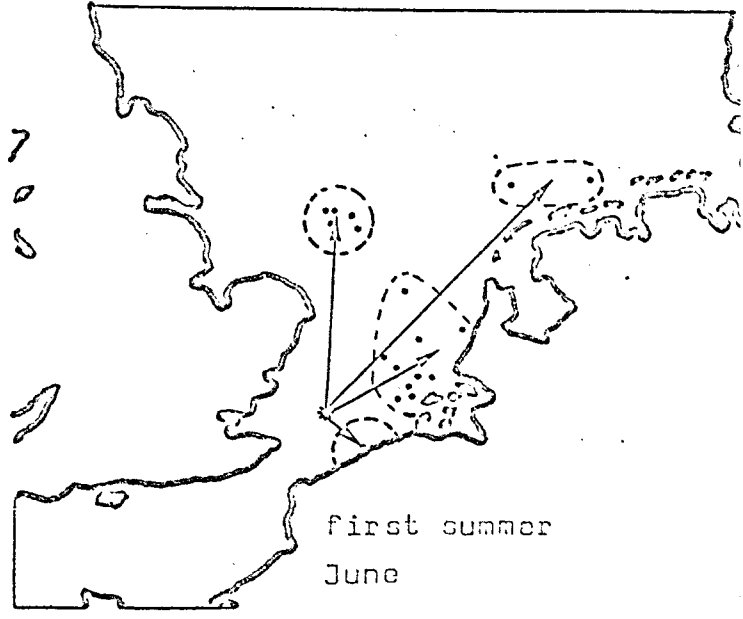
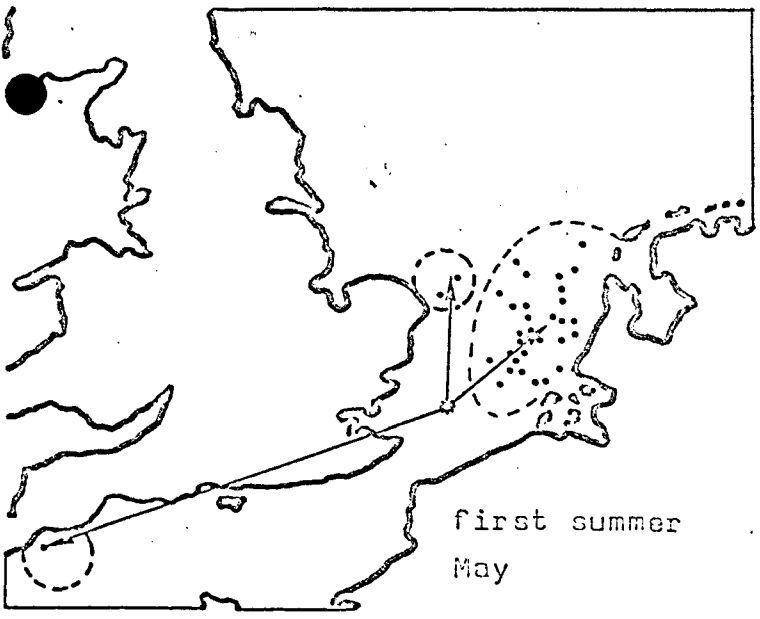
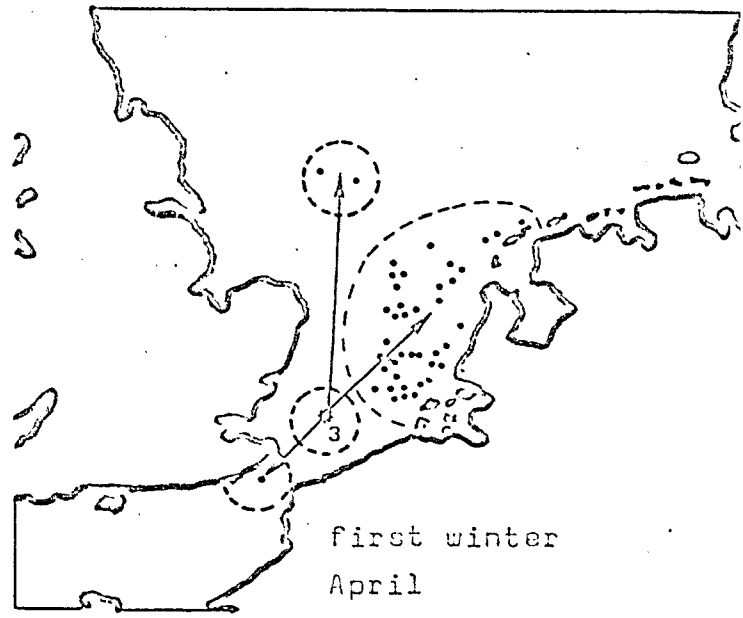
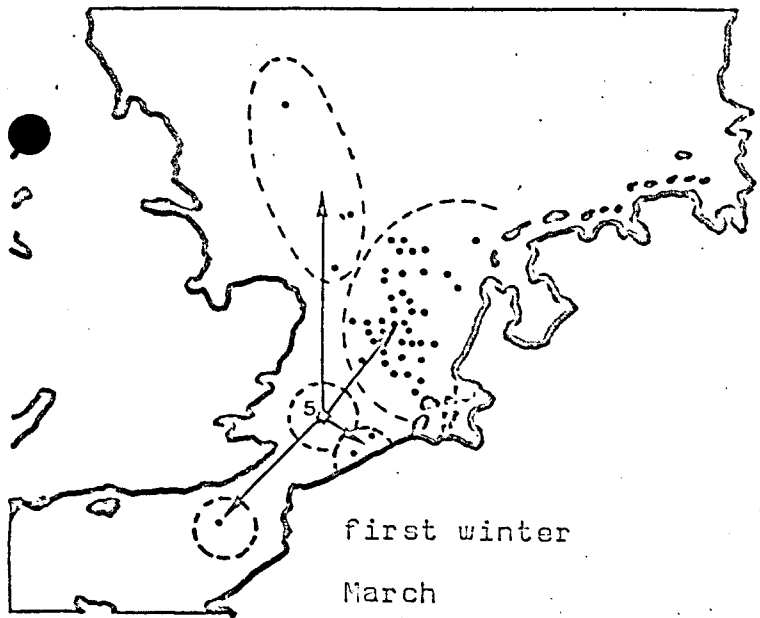
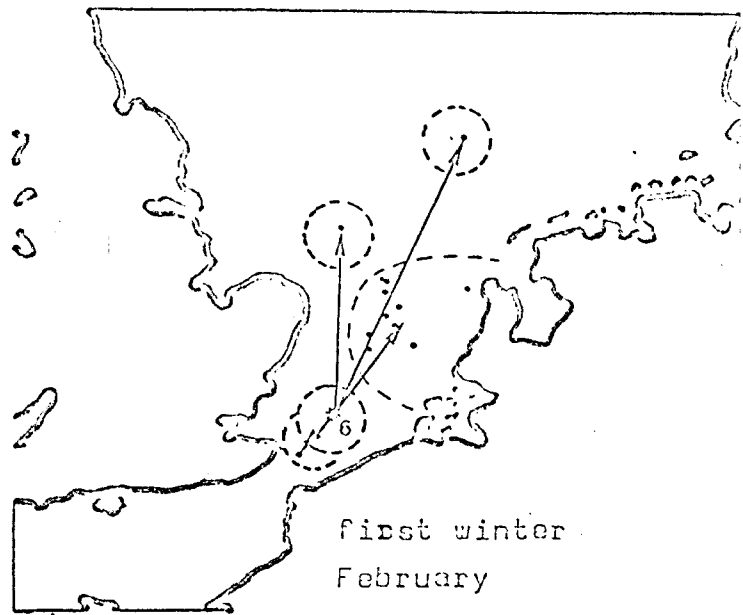
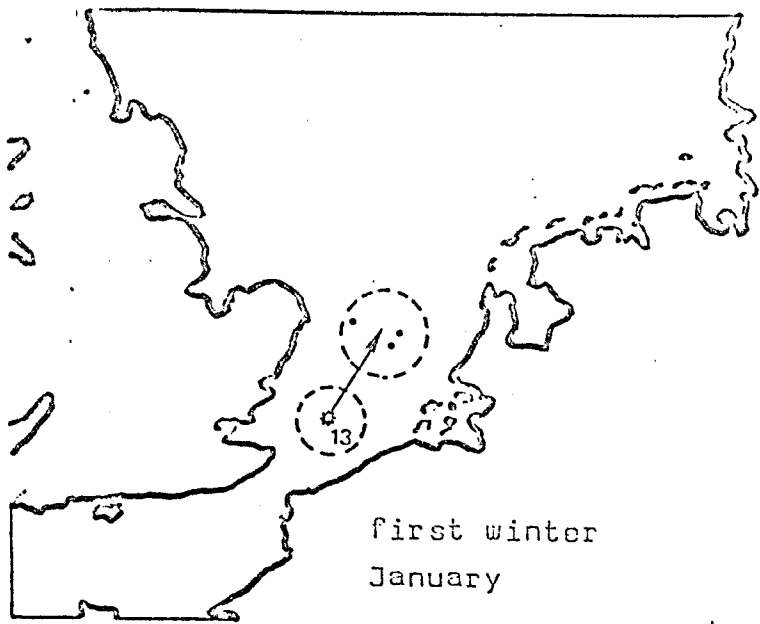


Figure 2.- Results of the tagging experiment

- * Release position
- Recapture position

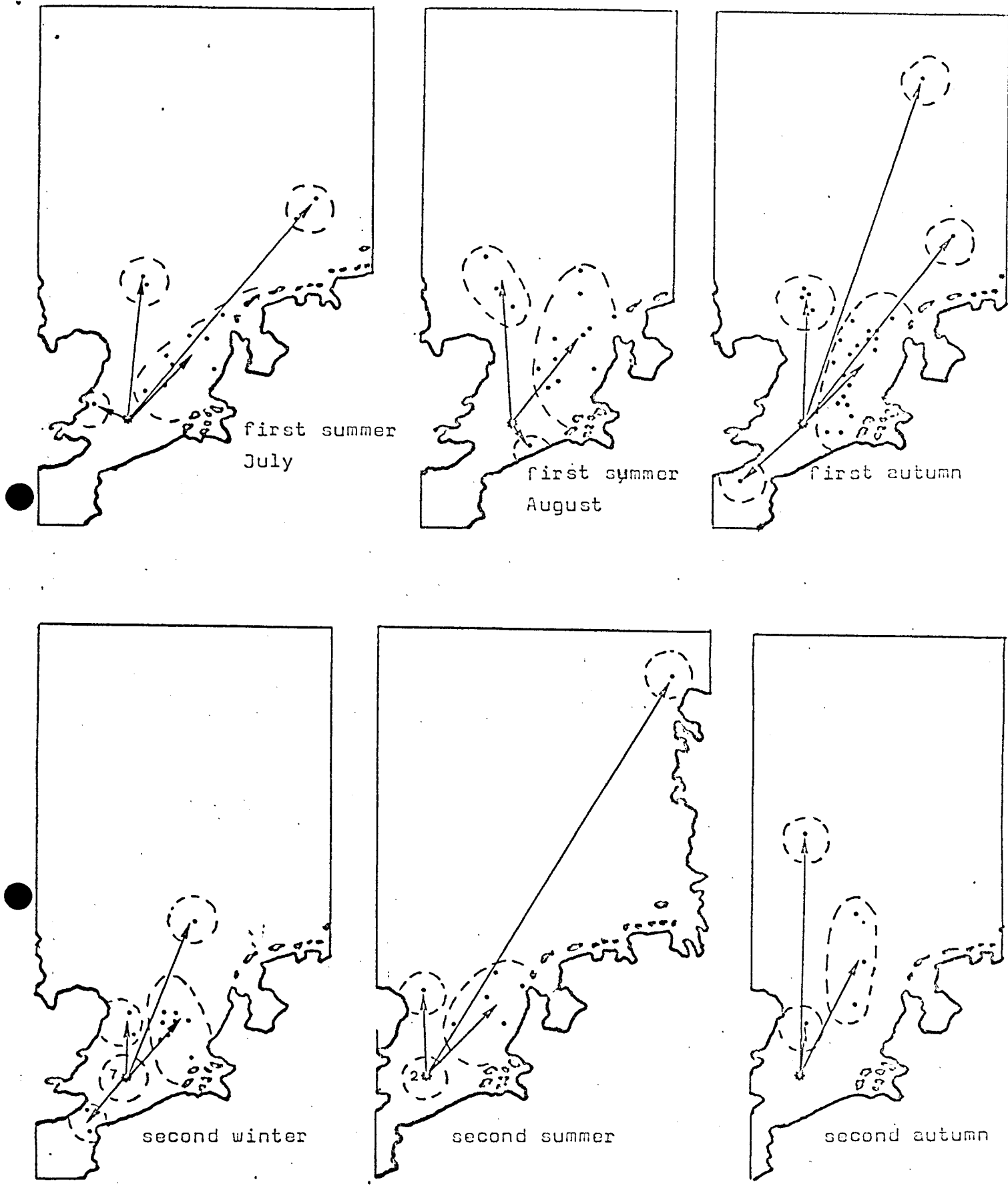


Figure 2.- continued.

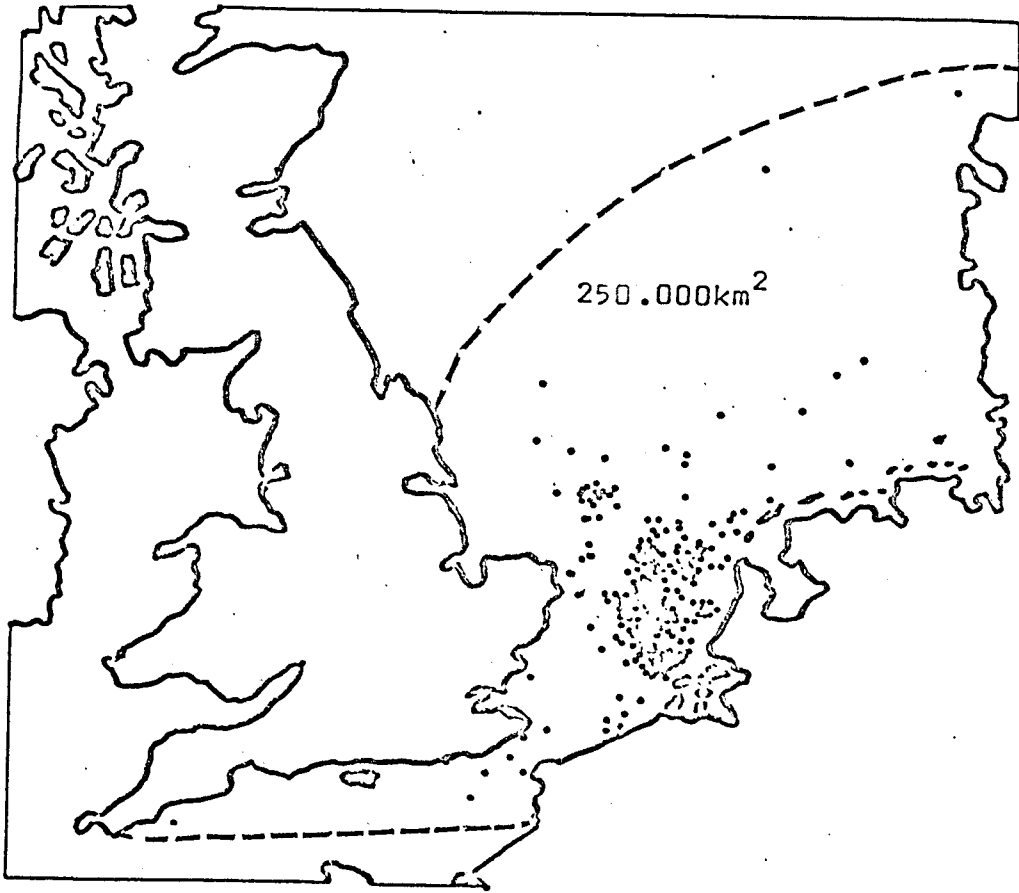


Figure 3.- Area of distribution of the tagged plaice