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Tagging Studies on Squid (*Illex illecebrosus*) in the Newfoundland Area

by

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Introduction

Tagging studies have proven very useful in elucidating migration patterns of the Japanese squid (*Todarodes pacificus*) in Japanese coastal waters (Soeda 1950, Soeda et al. 1953, Hambe et al. 1966, Shevtsov 1973). In a special meeting on squid (*Illex*) of the Standing Committee on Research and Statistics (STACRES) of the International Commission for the Northwest Atlantic Fisheries (ICNAF) held in Havana, February 1978, it was recommended that studies aimed at stock discrimination be intensified through the use of tagging experiments. . . (ICNAF Sum. Doc. 78/VI/3). At another special meeting of STACRES held in Tokyo, February 1979, the need for improved tagging techniques was emphasized (ICNAF Sum. Doc. 79/VI/5).

The purpose of this paper is to review the historical records of the squid tagging operations in the Newfoundland area which were initiated in 1965, and to present the results of an extensive tagging program undertaken in 1979.

Tagging information is summarized as to the number of squid tagged, dates and location of tagging, types of tags used and areas of the body used for tag attachment. Tag returns provide information on the length of time at large and the percent recaptured. Further, they may offer an opportunity to speculate on the migration patterns of squid in Newfoundland coastal waters.

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Materials and Methods

Data presented in this paper are the result of the operations of research vessels of the Department of Fisheries and Oceans, St. John's, Newfoundland and charter vessels. Vessels involved were the RITA MAXWELL (1966), MARINUS and NEWFOUNDLAND HAWK (1978), ZAGREB, SHAMOOK and MARINUS (1979). In some instances, small 2-man fishing boats were used in inshore areas. Squid while inshore, were captured for tagging using jigging devices, most commonly the Japanese drum jigger. During 1979 in Newfoundland offshore areas (ICNAF divisions 3N, 3O and subdivision 3Ps) squid were captured for tagging by the ZAGREB using an Engels bottom trawl with the cod end untied. Most squid for tagging were removed from the wings as these animals were in better condition. In most cases the freshly-caught squid were transferred to a tub of circulating seawater. An effort was made to choose only squid which had not suffered any obvious skin damage and appeared quite active.

Various types of tags were used. Preliminary attempts at tagging, commencing in 1965, were made using monofilament line of various colours, without numbers. These were attached to the caudal fin. Other tag types which were used prior to 1978 included a numbered metal clip tag and a spaghetti tag with a numbered disc attached to it. These were all placed in the caudal fin region (Fig. 1). In 1978 and 1979 the various types of tags used (metal clip, anchor, and ribbon) were placed in the collar region of the mantle (Fig. 2). The anchor tags were applied easily with the aid of a special gun. The metal clip tags were similarly quite easy to attach. More difficult to attach were the ribbon tags, as needles used to attach these often separated from the tags.

Since the inception of the tagging program the general public, in particular fishermen, have been encouraged to return tags by means of monetary rewards. The reward was valued at \$1.00 per tag for the years 1965-78 (Fig. 1). In 1979 rewards were \$3.00 per tag for squid tagged inshore and \$10.00 each for tags from squid tagged in offshore areas (Fig 2). Reward posters along with tag return envelopes were sent to every bonafide fisherman in 1979 and were placed in strategic locations such as post

offices and fish plants. Each tag carried a code number and a return address to facilitate the identification and return of the tags.

Foreign fishing nations were alerted to the tagging programs by means of the ICNAF/NAFO Circular Letter series in 1978 (Circ. Letter 79/3) and 1979 (Circ. Letters 79/43, 79/47 and 79/54) and by the placement of reward posters on some foreign fishing vessels by Canadian observers.

Results

Review of historical information on tagging

Tagging trials on Illex illecebrosus were initiated in Newfoundland inshore areas in 1965 when approximately 400 squid were tagged in Conception Bay and Trinity Bay (unpublished data). No tags were recovered.

In 1966 there were 116 squid tagged along the south coast of Newfoundland aboard the RITA MAXWELL during the months of August to October. These squid ranged in mantle length from 18 to 25 cm. There were no tag returns.

Only 7 squid were tagged in 1967. These were tagged during August in Conception Bay near Holyrood (Fig. 3). Again no tags were recovered.

In 1971, 402 squid were tagged at Holyrood from August 12 to 26. Of these, 77 tags (18.7%) were later recovered. At tagging, the squid ranged in mantle length from 18 to 26 cm. Most of the returns were made within 2 days, but some squid were caught up to 86 days after tagging (unpublished data).

In June-July 1978, squid were tagged offshore from the NEWFOUNDLAND HAWK. Using metal clips, 49 squid were tagged on the southern edge of the Grand Bank (ICNAF divisions 3N, 30 and subdivision 3Ps). There were no returns. Squid were captured using a Diamond-XI midwater trawl and appeared to suffer less damage than squid recaptured by bottom trawl.

Of the 3184 squid tagged during October 1978 in lower Conception Bay (Fig. 3), there were 1011 tags (32%) recovered from the commercial fishery (Hurley and Beck 1979). The maximum number of days at large was 30. Of the 3184 squid tagged, there were 2463 with anchor tags, 588 with metal clip tags, and 133 with ribbon tags. The percent return for each of

these tag types was 32.8, 26.4, and 20.1, respectively. Most returns came within a few days of tagging. Undoubtedly, there would have been more returns if the commercial fishery had not terminated in late November when the squid abandoned the inshore areas.

There was some evidence of local migrations during 1978 in lower Conception Bay (Fig. 3). There were 16 squid tagged at Harbour Main and recaptured at Holyrood, a distance of 4 miles away. Only one of the squid tagged in Holyrood was recaptured in Harbour Main. This difference is probably due to the greater fishing effort in Holyrood rather than a net immigration into the Holyrood area. The elapsed time between tagging and recapture ranged from 2 to 29 days.

1979 Tagging program

Offshore

There were 3051 squid tagged in Newfoundland offshore areas (ICNAF divisions 3N, 30, and subdivision 3Ps - Fig. 4) in June 1979 (ICNAF Circ. Letter 79/43). There have been no returns to date from these squid.

Inshore

Tagging operations along the Northeast coast of Newfoundland were carried out July 11 near St. John's, July 17 and 18 in Bonavista Bay, and during August in the Twillingate area (ICNAF Circ. Letter 79/47). Figure 4 gives the number of squid tagged and the number of returns from squid tagged at each location. Of the 3386 squid tagged along the Northeast coast, 136 (4%) were reported as recaptured. The percent of returns at each tagging locality was 0.3, 7.0, and 10.0 for St. John's, Bonavista Bay, and Twillingate, respectively. The number of days at large ranged from 1 to 62.

The highest number of squid tagged in any of the inshore localities was on the South coast in Fortune Bay (10,554, Fig. 4). There have been 1742 returns (17%) from this operation. The number of days at large ranged from 1 to 36 days.

Most tags were recovered locally. However, some were recovered at localities considerably distant from the tagging site (Table 1, Fig. 5).

Northward movement was more common for squid tagged at the most northern localities. The longest distances travelled were 147 miles from Plate Cove to La Scie and 140 miles from Plate Cove to Cape St. John.

Southward movement was predominant from the two most southern localities. The longest movement was 225 miles from Fortune Bay to Cape Egmont, Cape Breton Island, Nova Scotia. A second squid tagged at Fortune Bay and recovered in Cape Breton Island displayed the fastest overall rate of travel, covering 198 miles in 10 days.

Summary

Squid-tagging in Newfoundland inshore waters in 1978-79 has demonstrated that such studies can be successful in revealing squid migration patterns.

Using new types of tags and different locations on the body for attachment, retention time is increased. This, along with widely distributed information on tag recoveries, more valuable rewards and larger numbers of animals tagged resulted in a higher number of tag returns in 1979.

Preliminary results indicate that movements, while inshore, are generally small-scale, but that long-distance movements also occur.

Increased effort in offshore tagging is most needed to understand the inshore squid migration. Also, better methods of capturing squid offshore is required, as animals captured using present methods are in poor condition and tagging mortality may be high.

Literature Cited

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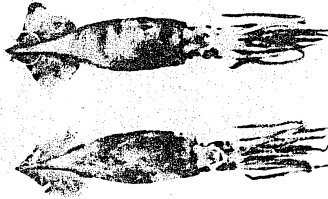
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Table 1. Description of long-distance migrations of squid (Illex illecebrosus) as shown in Figure 5.

Map Reference	Tagging Locality	Date Tagged	Place of Recovery	Days Elapsed	Approximate Miles Travelled
1	Twillingate	Aug. 22	Englee	22	85
2	Twillingate	Aug. 22	Englee	22	85
3	Plate Cove	July 17	La Scie	27	147
4	Plate Cove	July 18	Cape St. John	42	140
5	Plate Cove	July 17	Chance Cove	62	93
6	Plate Cove	July 18	Dildo	62	98
7	Plate Cove	July 18	Cape Broyle	44	131
8	Freshwater Bay	July 7	North Harbour	54	195
9	Freshwater Bay	July 7	Garden Cove	53	197
10	Freshwater Bay	July 7	Burin	18	167
11	Freshwater Bay	July 11	St. Pierre	22	190
12	Freshwater Bay	July 11	St. Pierre	41	190
13	East Bay	Sept. 22	Fair Haven	36	183
14	East Bay	Sept. 23	Cape Egmont, Nova Scotia	32	225
15	Salmonier Cove	Sept. 24	Port-aux-Basques	33	142
16	Salmonier Cove	Sept. 25	Glace Bay-Sydney Bight area, Nova Scotia	10	198

REWARD FOR RETURN OF SQUID TAGS

Two types of tags are used in our study of squid migration. These are shown in the figure below. One is a yellow spaghetti type with a red disc; the other is a small metal clip.



A reward of \$1.00 will be paid for the return of these tags. State when, where, depth and how caught. Return to:

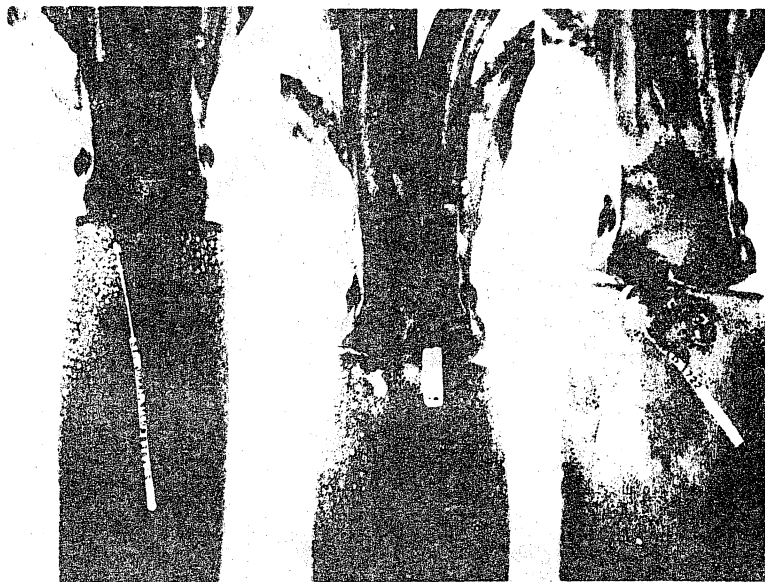
**FISHERIES RESEARCH BOARD OF CANADA,
BIOLOGICAL STATION,
WATER STREET, EAST,
ST. JOHN'S, NEWFOUNDLAND.**

Fig. 1. Reward poster circulated from 1965 to 1977 showing tag types, location on the body, and tag-return information.

REWARD

SQUID TAGS

The various types of tags used in our study of squid are shown below. The photographs indicate the type of tag and location of attachment on the animal.



A

B

C

A reward of \$10.00 each will be paid for the return of anchor tags illustrated in Photo A, Serial Number A 0001 to A 5000.

A reward of \$3.00 each will be paid for the return of all other tags.

Information required for each tag returned:

date caught, place of capture, depth and how caught.

Return to: Fisheries & Environment Canada
P. O. Box 5667
St. John's, Nfld., Canada A1C 5X1

Fig. 2. Reward poster circulated in 1979 showing tag types and location on the body (1978-79) and 1979 tag-return information.

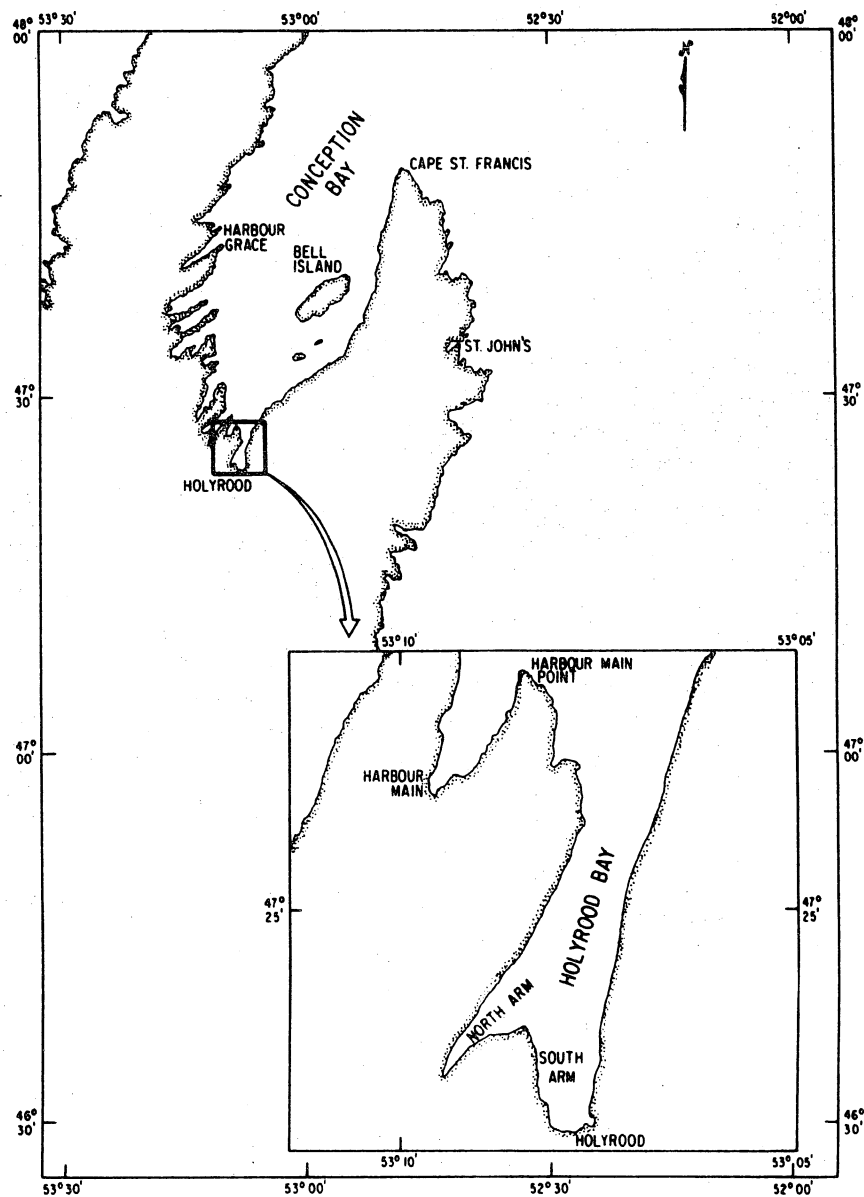


Fig. 3. Map of Conception Bay, Newfoundland showing locations of tagging in 1967, 1971, and 1978.

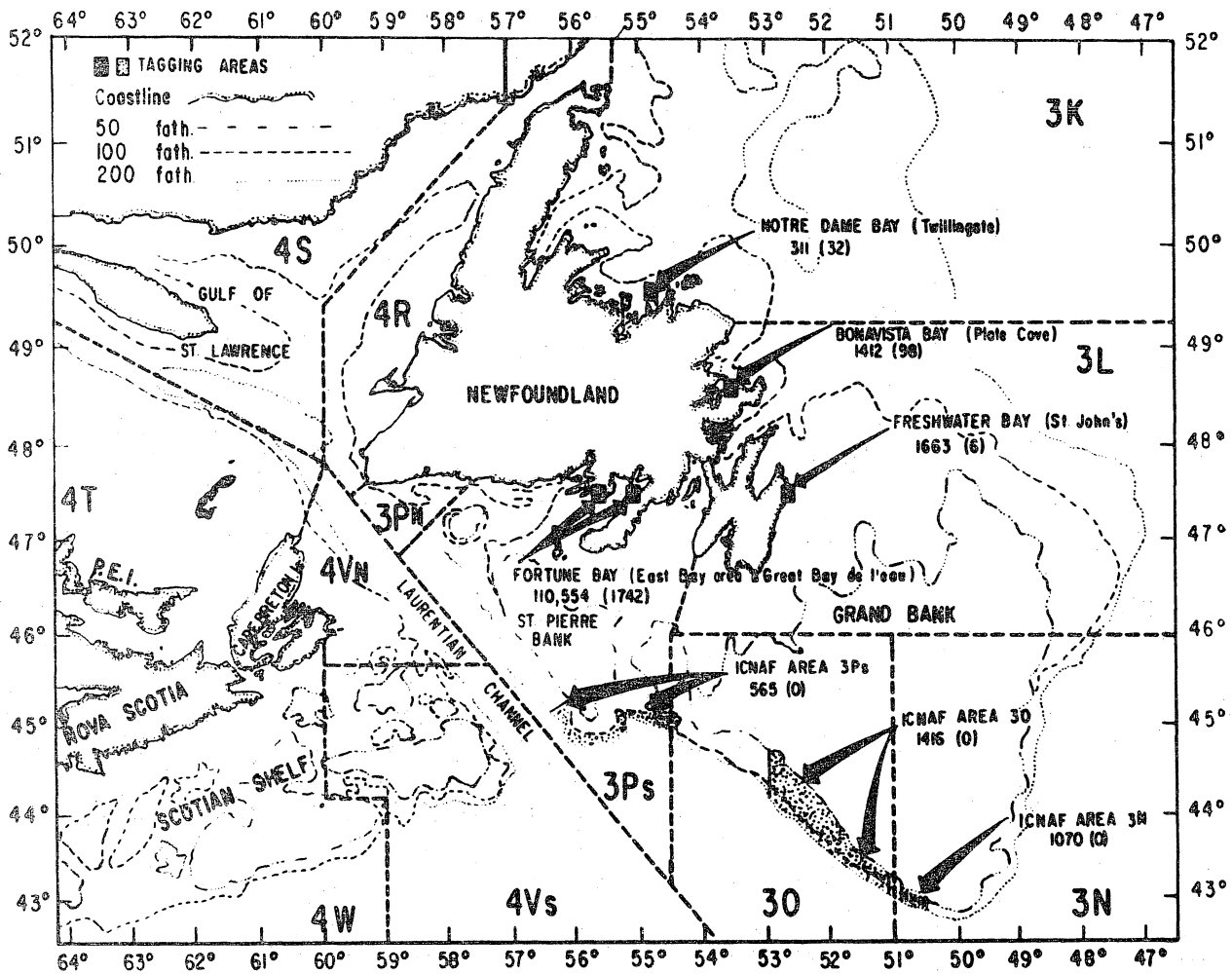


Fig. 4. Tagging areas for inshore and offshore areas in 1979. Number of returns in parenthesis.

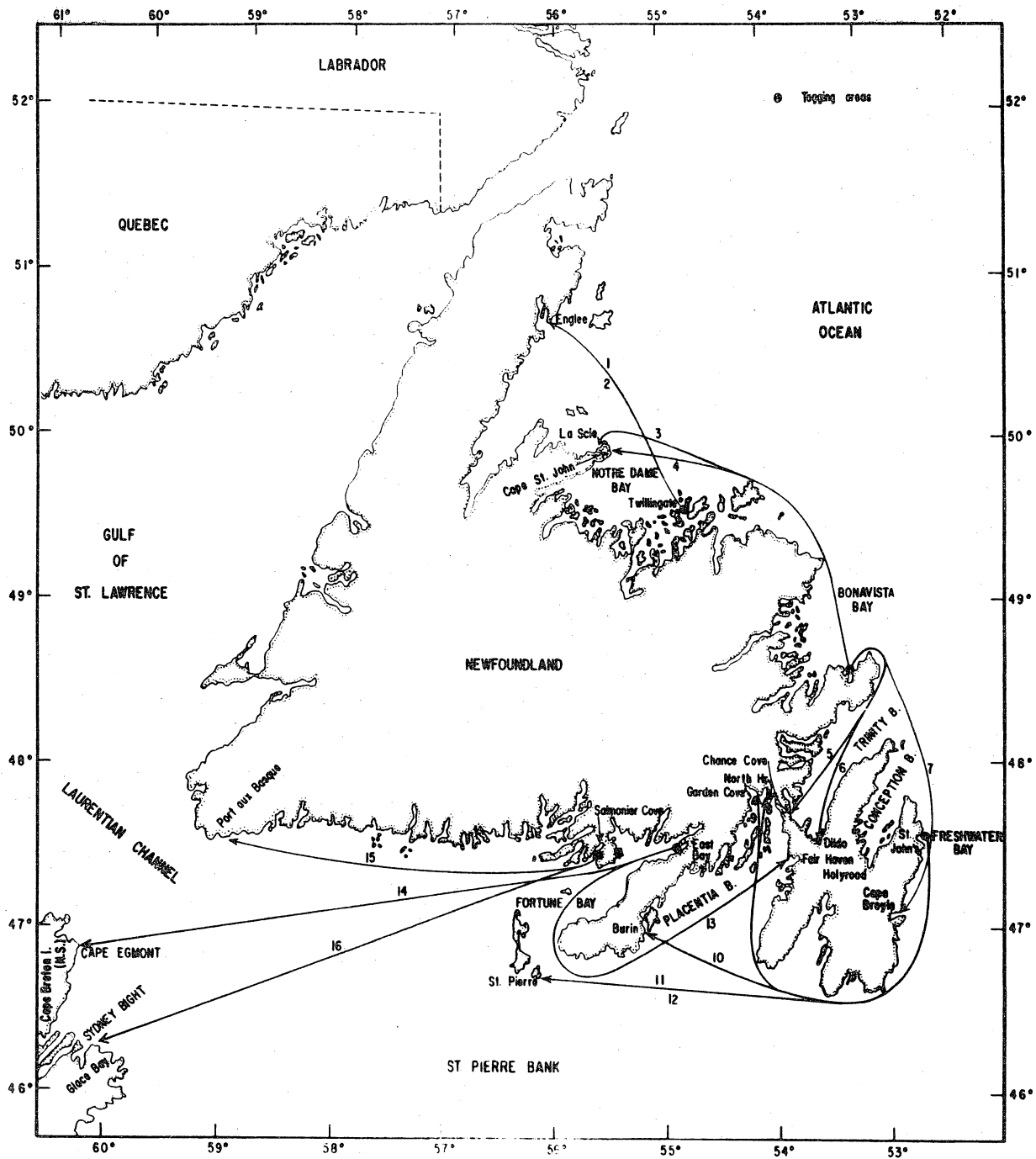


Fig. 5. Long distance tag returns for 1979.