



**CSAS**

**Canadian Science Advisory Secretariat**

**SCCS**

**Secrétariat canadien de consultation scientifique**

**Research Document 2001/072**

**Document de recherche 2001/072**

Not to be cited without  
permission of the authors \*

Ne pas citer sans  
autorisation des auteurs \*

**Stock structure, movements, and exploitation of Atlantic cod (*Gadus morhua*)  
in NAFO Divs. 2J+3KL based on tagging experiments conducted during 1999-  
2000**

John Bratley, D. Porter, and C. George

Science, Oceans and Environment Branch,  
Department of Fisheries and Oceans,  
Box 5667, St. John's, Newfoundland, Canada A1C 5X1

\* This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

\* La présente série documente les bases scientifiques des évaluations des ressources halieutiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Research documents are produced in the official language in which they are provided to the Secretariat.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au Secrétariat.

This document is available on the Internet at:

Ce document est disponible sur l'Internet à:

<http://www.dfo-mpo.gc.ca/csas/>



### Abstract

A tagging study of adult (>45 cm) Atlantic cod (*Gadus morhua*) in 2J+3KL, initiated in spring 1999, was continued. During 2000 a total 3,417 cod were tagged with single, double, or high-reward t-bar anchor tags and released at various inshore locations off the east and northeast coasts of insular Newfoundland and southern Labrador. A total of 205 cod (5.9%) tagged in 2000 and 344 tagged in 1999 were reported as recaptured during 2000 from recreational, sentinel, directed commercial and by-catch fisheries. Tag returns were adjusted to account for reporting rate and the number of tagged cod released was adjusted to account for tagging mortality, tag loss and assumed natural mortality; these data were used to estimate exploitation rates. These analyses gave exploitation rates in 2000 of 0.10 for fish tagged in 3K, 0.11 for fish tagged in northern 3L, and 0.22 for those tagged in southern 3L. The spatial distribution of recaptures from 2000 was consistent with other post-moratorium northern cod tagging studies and indicates that the inshore of 3KL is inhabited by (1) a northern resident coastal group of cod that occupies an area from western Trinity Bay northward through Bonavista Bay, the Fogo-Twillingate area, to western Notre Dame Bay, and (2) a migrant group from inshore and offshore areas of 3Ps that moves into southern 3L and more rarely northern 3L and 3K during late spring and summer and returns to 3Ps during fall. The contribution of offshore northern cod to the inshore fishery in 3KL during 2000 remains unknown.

### Résumé

L'étude par échantillonnage de la morue (*Gadus morhua*) adulte (> 45 cm) de 2J+3KL, lancée au printemps 1999, a continué en 2000. Les 3 417 morues capturées en 2000 ont été munies soit d'une ou de deux étiquettes à ancrage en T ou d'une étiquette-récompense de même type, puis relâchées à divers endroits des côtes est et nord-est de l'île de Terre-Neuve et de la côte sud du Labrador. Un total de 205 morues (5,9 %) étiquetées en 2000 et de 344 autres étiquetées en 1999 ont été recapturées en 2000 dans le cadre de pêches récréatives, sentinelles et commerciales dirigées, ainsi que comme prises accessoires. Le nombre d'étiquettes retournées a été corrigé du taux de compte rendu et le nombre de morues étiquetées remises à l'eau, de la mortalité due à l'étiquetage, de la perte d'étiquettes et du taux de mortalité naturelle hypothétique. Les résultats ainsi obtenus ont servi à estimer les taux d'exploitation en 2000; ceux-ci se chiffraient à 0,10 pour les morues étiquetées dans 3K, 0,11 pour celles étiquetées dans le secteur nord de 3L et 0,22 pour celles étiquetées dans le secteur sud de 3L. La distribution spatiale des morues reprises en 2000, qui correspond aux résultats d'autres études d'étiquetage post-moratoire de la morue, indique que les eaux côtières de 3KL sont habitées par (1) un groupe résident des eaux côtières nordiques, qui peuple une région s'étendant de l'ouest de la baie de la Trinité vers le nord jusqu'à l'ouest de la baie de Notre Dame, en passant par la baie de Bonavista et la région Fogo-Twillingate et (2) un groupe migrant issu des eaux côtières et hauturières de 3Ps qui pénètre dans le secteur sud de 3L et plus rarement les secteurs nord de 3L et 3K vers la fin du printemps et en été et qui retourne dans 3Ps en automne. La contribution de la morue hauturière à la pêche côtière dans 3KL en 2000 demeure inconnue.

## Introduction

A tagging study of northern cod initiated in 1999 was continued in 2000. The purpose of the study was to provide information on movement patterns of inshore cod among different regions of NAFO Divs. 2J+3KL and Subdiv. 3Ps as well as obtain estimates of exploitation rates and population size. The tagging program was conducted partly in response to a recommendation by the Fisheries Resource Conservation Council (Anon, 1999) that an extensive tagging program be carried out off the northeast coast of Newfoundland to provide better scientific information on the status of the resource in these areas.

This document updates results from the first year of the study (Bratley 2000) and gives a synopsis of the spatial and temporal distribution of recaptures of tagged cod released in the inshore of 2J3KL during 1999 and 2000 and reported as recaptured up to the end of January 2001; some information from cod tagged during 1995-1998 is also included. The numbers of releases and recaptures from tagging experiments conducted in 1999 and 2000 were adjusted to account for various sources of loss (see Cadigan and Bratley 1999a, b, 2000a) and annual estimates of exploitation are given for each tagging experiment. Reported landings of cod during 1998-2000 are given by month and statistical area to aid in the interpretation of recaptures. Information on stock structure and seasonal movement patterns from other post-moratorium cod tagging studies is reported in previous documents (Lawson et al. 1998; Bratley 1999, 2000; Bratley et al. 1999). Historical cod tagging studies (prior to 1994) in the Newfoundland Region are summarized in Taggart et al. (1995) and Myers et al. (1996, 1997). Further quantitative analyses of the recapture data from the current experiments, including estimates of tag loss, reporting rates, exploitation rates and growth are presented elsewhere (Cadigan and Bratley 1999a, b; 2000a, b; Lilly et al. 2001; Pope and Bratley 2001).

## Materials and Methods

Between 4 May and 8 December 2000 a total of 3,417 cod were captured with various gears, measured (nearest cm) and tagged with one or two t-bar anchor tags inserted at the base of the first dorsal fin, and released. Only cod  $\geq 45$  cm (fork length) that appeared healthy were tagged and each batch of cod typically consisted of individuals tagged with either single, double or high-reward tags in approximate proportion 2:2:1. The tags were uniquely numbered and bore a return address as well as the value of the reward (\$10 for single, \$20 for double, or \$100 for high-reward). The tagging program was advertised extensively among those participating in the fishery. Details of the tagging experiments are summarized in Table 1. The number of cod tagged in 2000 was substantially smaller than in the preceding year (8,347 cod tagged) in spite of a considerable increase in effort; in many areas no aggregations of cod were located, notably in 3K during June and July, in Conception Bay (3Lf) during June, and throughout the summer off the eastern Avalon Peninsula (3Lj). An attempt was also made to tag offshore cod during an offshore acoustic survey directed at species other than cod and during the fall multi-species trawl survey, but

neither trip was successful in tagging adult cod in the offshore; only one offshore cod was tagged.

Reported landings of cod from the inshore of Divs. 3K and 3L were extracted from the Statistics Branch catch database; offshore landings and total landings for 2J were negligible and were excluded. The commercial “index” fishery opened on 26 June 2000 and consisted of two fishing periods: 26 June-29 July and 11 September-30 November. Monthly catches from the sentinel fishery were collated from records provided by sentinel fishers. Estimated catches from recreational cod fisheries held during August, and September 2000 were provided by Conservation and Protection Branch; these estimates were only available by month and NAFO Division and totalled only 498 t for Divs 2J+3KL combined. It was assumed that the recreational catches were split equally between August and September and the catch was partitioned among statistical areas using the corresponding breakdown of commercial catches for those months.

### **Estimation of exploitation rates**

The number of reported recaptures from individual cod tagging experiments gives minimum estimates of the exploitation rates on the aggregations of cod that were tagged; however, in practice, not all fish survive tagging, some tags fall off the fish, particularly in the first year, and not all recaptures of tagged fish are reported. Tagged cod also suffer natural mortality due to factors such as predation and disease. Accounting for these losses leads to a reduction in the number of tagged animals available to the fishery. We used information from companion studies to estimate these losses and produce more realistic annual estimates of exploitation. In this analysis we produce estimates of exploitation for cod tagged in a specific area at a specific time (i. e. individual tagging experiments), irrespective of where recaptures came from. Only tag releases in 1999 and 2000 were used in this analysis. We did not attempt to estimate population sizes using tag returns and commercial catches in this analyses, because typically some harvesting occurs in an area different from where fish were tagged; this makes it difficult to convert local catches to local population biomass. Also, this analyses does not take into account the size selectivity of the fishery; exploitation rates may differ markedly across size groups because of the size selectivity of the various gears used in the fishery. More complex analyses of the tagging data that include methods to estimate inshore cod biomass are presented elsewhere (Lilly et al. 2001; Pope and Bratley 2001).

We estimated tag-induced mortality ( $J$ ) by retaining tagged cod in submersible cages for periods of 5-10 days and monitoring their survival (see Cadigan and Bratley 2000a). An estimate of 0.13 was used for all experiments (i.e.  $1-J=0.87$  survived tagging).

Our method of estimating reporting rate ( $\theta$ ) is based on a high-reward tagging study, described in detail in Cadigan and Bratley (1999a, 2000a) and updated using recaptures up to the end of 2000. We used pooled estimates (all years combined) of reporting rate

for 3KL of 0.66 for single tags ( $k=1$ ) and 0.77 for double tags ( $k=2$ ); high-reward tags ( $k=3$ ) were assumed to have a reporting rate of 1.0.

Tag loss rates were estimated from a double-tagging study, which showed that tag loss was low and mostly occurs in the first 3-4 months after release with only negligible losses thereafter (Cadigan and Bratley 1999a, b). In this analysis we used a simplified estimate of tag loss rate, based on Cadigan and Bratley (1999a), and assumed that tag loss only occurred in the year of release; the loss rate for single and high reward tags used here was  $\leq 0.8^{(diff/52)}$  and for double tags  $\leq 0.96^{(diff/52)}$ , where *diff* = the number of weeks between the median date of release of tagged fish and the median recapture date of tagged individuals in the year of recapture.

The instantaneous rate of natural mortality was assumed to be 0.2 per yr, and occurred over a short period of time that coincided with the median date of recapture of tagged individuals, or at the end of the year if no recaptures occurred in the first year. For annual exploitation estimates for 1999 and for 2000, we only used data for cod tagged and released prior to the opening of the fisheries in those years; the fishery in 2000 opened June 26. Assuming that  $M$  tags of type  $k$  are put on prior to the opening of the fishery and  $R$  tags are returned and that tag loss and natural mortality took place between the median date of release and recapture, the exploitation rate ( $\mu$ ) in the year of release ( $y_0$ ) is:

$$\mu_0 = \sum_k ((R_{y_0k}/\lambda_k)/(1 - \tau) M_k e^{-m/(52/diff)} v_k)$$

where  $R_{0k}$  is the number of reported recaptures of tag type  $k$  in the year of release. In the first year after release ( $y_1$ ) the exploitation rate is:

$$\mu_1 = \sum_k ((R_{y_1k}/\lambda_k)/(1 - \mu_0) M_k e^{-m/(52/diff)})$$

For most areas several tagging experiments were conducted (Table 1) and we also computed pooled estimates of exploitation (typically by unit area, e.g. 3La, 3Lb, etc.) simply by calculating the arithmetic mean of the individual estimates.

## Results

### Spatial and temporal distribution of cod landings

Reported monthly landings of cod are summarized by unit area for 1998-2000 (Table 2). The total allowable catches (TAC's) in each year were 5,000 t, 9,000 t, and 7,000 t. In 2000 reported landings (5,324 t) were substantially less than the TAC. The spatial patterns in landings in 2000 were broadly similar to those observed in 1998 and 1999 with highest landings from adjacent areas in southern 3K and northern 3L, particularly Fogo-Twilligate (3Ki, 1175 t), Bonavista Bay (3La, 1440 t) and Trinity Bay (3Lb, 1410 t). Landings declined rapidly further northward with a total of only 273 t reported from the Notre Dame Bay and the White Bay-Northern Peninsula areas combined (3Kh, 3Kd,

3Ka). Landings from southern 3L (i.e. Conception Bay southward; areas 3Lf, 3Lj, and 3Lq) totaled 1026 t.

The distribution of total landings each year across unit areas is shown in Fig. 2. The most notable spatial change in landings over the three years was the decreasing proportion of landings in all unit areas in 3K and corresponding increase in 3Lb (Trinity Bay).

As in 1998 and 1999, there was little or no reported catch between January and the end of May during 2000. Small landings totaling < 110 t during June were mostly from the sentinel fishery (Table 2). The directed cod fishery opened on 26 June 2000 and in most areas a substantial portion of the total was taken in the following month. The fishery was closed from July 30 until September 10th and the small landings during this period came from sentinel and recreational fisheries. Reported landings during the second period of the directed cod fishery were generally highest in the latter half of September and declined through October and November and the fishery was closed on November 30<sup>th</sup>. Minor landings during the latter part of November and during December were from sentinel fishers. There were no major differences in the temporal pattern of landings between 1999 and 2000; the months of July and the latter half of September accounted for most of the landings, about 80% of the total in 2000, compared to 61-68% in 1999.

### **Numbers of releases and recaptures**

Details of the numbers of cod tagged and reported as recaptured up to the end of 2000 are summarized in Table 3. In 2000, most tagged cod were released in April-June in Bonavista Bay and Trinity Bay; in other areas no significant aggregations of cod could be located early in the year prior to the fishery opening. In spite of extensive consultations with local fishers and requests for fishers to contact research staff when cod appeared, there were no reports of significant cod aggregations in the Fogo-Twillingate area in June 2000, in contrast to the situation in this area in June 1999 (see Bratney 2000). In addition, a thorough search of Conception Bay using the research vessel Shamook in June did not locate any cod. Small numbers of cod were tagged in many of these areas later in the season (July-September) when the fishery was underway. The only areas where cod were reasonably abundant were in southern Bonavista Bay, around the Bonavista Peninsula, and in Trinity Bay from Northwest Arm and Smith Sound northward. As in previous years there were reports of an extensive aggregation of cod in Smith Sound in early spring and during late fall.

Overall, 5.9% of the 3417 cod tagged in 3KL during 2000 were reported as recaptured. For experiments conducted prior to the opening of the fishery, 6.3% of tagged cod were reported as recaptured. There were some differences in percentage returns among regions, although comparisons are in some cases complicated by differences in the timing of release. Among cod tagged in Bonavista Bay prior to the start of the fishery, 7.9% were reported as recaptured. The corresponding figure for Smith Sound was 4.6% for 2000 releases and 6.3% for releases in the fall of 1999. Cod tagged in the most southerly regions of 3L (3Lq) gave substantial numbers of recoveries, mainly due to recaptures

from neighboring Placentia Bay during late fall; similar findings were evident for 1999 releases. There were no reported recoveries in 2000 from cod tagged in Gilbert Bay, Labrador; however, several local fishers are known to have tags that have not been sent in and the tagging data for the local cod population in this area are not considered further in the current analysis.

Although percentage returns from most tagging experiments are not particularly high (Table 3), we emphasize that these figures reflect only the numbers of tags sent in by fishers; factors such as tagging mortality, tag loss, and natural mortality can reduce the number of tagged fish available to the fishery. The influence of these factors, as well as reporting rate, in estimating exploitation rates are considered below and in more complex analyses that are reported elsewhere (see Cadigan and Bratley 1999a, b, 2000a, b; Lilly et al 2001; Pope and Bratley 2001).

### **Exploitation rates**

Annual estimates of exploitation rate for each tagging experiment are summarized in Table 4. The estimates clearly varied between regions and in some areas between years; however, there was reasonable consistency among estimates within the same region. Estimates were particularly high for cod tagged in 3K in 1999 and ranged from 0.29 to 0.61 (mean 0.43). For cod tagged in northern 3L (3La and 3Lb) the estimates for experiments that began before the fishery opened were much lower than those for 3K and ranged from 0.04 to 0.22 (mean 0.13). Most of the experiments conducted in southern 3L (3Lf, 3Lj and 3Lq) were started after the fishery was well underway and reflect only a portion of the exploitation in those regions; however, a single batch of cod (n=734) tagged in 3Lq prior to the opening of the fishery was heavily exploited (0.24). Most of the tagged cod in the most southern region (3Lq) were quite heavily exploited, irrespective of the timing of release (mean 0.17, range 0.05 to 0.25).

Exploitation estimates for cod tagged in 3K were substantially lower in 2000 (range 0.02 to 0.22, mean 0.10) compared to 1999. For cod tagged in other regions the estimates were broadly similar between years and in 2000 ranged from 0.01 to 0.22 (mean 0.11) for cod tagged in northern 3L (3La, 3Lb), and from 0.07 to 0.60 (mean 0.22) for cod tagged in southern 3L.

### **Spatial distribution of recaptures**

Annual summaries of the distribution of tagged cod, grouped by year and area of release, are given in Table 5. In 1999 and 2000, many tagged cod were recaptured in the same unit area where they were released; however, some tagged cod moved considerable distances. Most cod tagged in southern 3K, 3La, and 3Lb tended to stay within those regions, but there was extensive movement among them. In contrast, cod tagged in southern 3L (3Lf, 3Lj and 3Lq) were often recaptured further south and a substantial proportion of the recoveries came from Placentia Bay (3Psc). Cod tagged in the inshore



(3Psc) and offshore (3Psg,h) of 3Ps also gave recoveries in southern 3L and more rarely northern 3L and southern 3K. There were no major difference in the distributions of recoveries between 1999 and 2000, although all areas where tagging took place in 1999 generated some recoveries in Placentia Bay during 2000.

Plots showing the distribution of recaptures for experiments with reasonable numbers of releases conducted in late 1999 and 2000 are shown in Figs. 3-7. The distributions of recaptures for cod tagged in each unit area in 2000 are generally similar to those described for the other post-moratorium cod tagging experiments (Bratley 1999, 2000; Bratley et al. 1999).

In a previous document (Bratley 2000) a series of plots illustrating recapture locations of cod tagged during December 1995-1998 were shown to illustrate more long-term movements of cod tagged inshore during the post-moratorium period. These plots are updated here (Figs. 8-13) with recaptures received up to the end of December 2000. The findings are essentially as described in Bratley (2000) and give no indication of any progressive dispersal away from the tagging site in successive years after release.

## **Conclusions**

The spatial and temporal distributions of recaptures from these tagging experiments are consistent with those observed in 1999. The inshore of 3KL is inhabited by at least two groups of adult cod: (1) a northern coastal group that occupies the area from approximately western Trinity Bay northward through Bonavista Bay, the Fogo-Twillingate area and Notre Dame Bay, and (2) a seasonal migrant group that includes both inshore (Placentia Bay) and offshore (Halibut Channel) cod from neighbouring NAFO Subdiv. 3Ps. As in 1999, the lack of fishing activity in spring (January-June) in 3KL makes it difficult to determine precisely when the northward seasonal migration of 3Ps cod into 3L begins; but these cod appear to be well dispersed into southern 3L when the commercial fishery was active in July.

The northern coastal population inhabiting the inshore of 3K and northern 3L appears to be a resident coastal population that is supplemented with seasonal migrants from 3Ps during summer. The post-moratorium tagging studies also show that many cod found in Smith Sound in late fall, winter and early spring appear to move out of the fjord in early summer and disperse mostly in a northward direction, around the Bonavista Peninsula into southern Bonavista Bay with some reaching as far north as 3K.

The most notable finding in the tag returns from the 1999 releases was the dramatic reduction in recoveries from 3Ki during 2000. Reported landings in 3Ki also dropped by approximately 42% between 1999 and 2000 from 2355 t to 1375 (Table 2, Fig. 2. As reported herein and in Cadigan and Bratley (2000b) the cod in 3Ki were heavily exploited during 1999 and there would have been substantially fewer tagged cod available for capture during the 2000 fishery. The remaining tagged cod were not as heavily exploited in 2000 and many of the recaptures came from Bonavista Bay (Table 5). Overall these

results suggest that fewer cod were available to the fishery in the Fogo-Twillingate area but exploitation rates were much lower in 2000 compared to 1999

Estimates of exploitation rate in 2000 based on tag returns were approximately 0.1 for cod tagged in 3K and northern 3L and approximately 0.2 for cod tagged in southern 3L, with much of the exploitation of the latter occurring in neighbouring 3Ps. These analyses suggest that even with a small TAC and reported landings of only around 5,000 t, a considerable fraction of the adult cod population present in the inshore of 3KL at the time of the fishery was removed in 2000.

Currently, the offshore northern cod populations remain at an extremely low level (Lilly et al. 2000) and how much they contribute to inshore populations and the fishery during summer is not known. We were unable to locate any significant aggregations of adult cod in the offshore and there have been no offshore recoveries of cod tagged inshore during the post-moratorium period in spite of extensive fisheries for other species such as Greenland halibut.

### **Acknowledgements**

We thank the sentinel and commercial fishers and staff of the Fisheries Evaluation, Gadoids, and Commercial Sampling Sections of DFO Newfoundland Region for conducting the tagging experiments; Dr. J. Green and co-workers, Biology Dept., Memorial University, tagged the cod in 2J; C. George, D. Porter, and P. Upward collated the release and recapture information. We also gratefully acknowledge the assistance of Fisheries Officers and Observers in implementing the tagging program, and thank the numerous fishers and plant workers for returning tags and recapture information. This study was funded by the DFO under the Strategic Science Fund program.

**References:**

- Anon. 1999. Conservation Requirements for 2J3KL cod. Fisheries Resource Conservation Council Report to the Minister of Fisheries and Oceans. FRCC.99.R.3. May 1999.
- Bratley, J. 1999. Stock structure and seasonal migration patterns of Atlantic cod (*Gadus morhua*) based on inshore tagging experiments in Divs. 3KL during 1995-97. DFO Canadian Stock Assessment Secretariat Research Document 99/103.
- Bratley, J. 2000. Stock structure and seasonal movements of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL inferred from recent tagging experiments. Canadian Stock Assessment Secretariat Res. Doc. 2000/084.
- Bratley, J., G. Lawson, and G. Rose. 1999. Seasonal migration patterns of Atlantic cod (*Gadus morhua*) in Subdivision 3Ps based on tagging experiments during 1997-1998. Canadian Stock Assessment Secretariat Res. Doc. 99/37.
- Cadigan, N. G. and J. Bratley. 1999a. Tag loss and reporting rates for 1997 and 1998 cod tagging experiments in 3Psc and 3KL. Canadian Stock Assessment Secretariat Research. Document 99/65.
- Cadigan, N. G. and J. Bratley. 1999b. Estimation of exploitation and migration rates of Atlantic cod (*Gadus morhua*) in Subdiv. 3Ps and Divs. 3KL during 1997 and 1998 based on tagging experiments. Canadian Stock Assessment Secretariat Research. Document 99/38.
- Cadigan, N. G. and J. Bratley. 2000a. Lower bounds on the exploitation of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL and Subdiv. 3Ps in 1997-1999 from tagging experiments. DFO Canadian Stock Assessment Secretariat Research Document 2000/073.
- Cadigan, N. G. and J. Bratley. 2000b. Estimation of cod growth in Subdiv. 3Ps and Divs. 3KL in 1997-1999 from tagging experiments. Canadian Stock Assessment Secretariat Research. Document 2000/074.
- Lawson, G. L., G. A. Rose, and J. Bratley. 1998. Movement patterns of inshore cod in Subdivision 3Ps (southern Newfoundland) based on mark-recapture studies during 1996/97. DFO Canadian Stock Assessment Secretariat Research Document 98/24.
- Lilly, G. R., P. A. Shelton, J. Bratley, N. Cadigan, E. F. Murphy, D. E. Stansbury. 2000. An assessment of the cod stock in NAFO Divisions 2J+3KL. Canadian Stock Assessment Secretariat Res. Doc. 2000/063.
- Lilly, G. R., P. A. Shelton, J. Bratley, N. Cadigan, B. P. Healey, E. F. Murphy, D. E. Stansbury. 2001. An assessment of the cod stock in NAFO Divisions 2J+3KL. Canadian Stock Assessment Secretariat Res. Doc. 2001/044.
- Myers, R. A., N. J. Barrowman, J. M. Hoenig, and Z. Qu. 1996. The collapse of cod in eastern Canada: the evidence from tagging data. ICES J. Mar. Sci. 53: 629-640.

- Myers, R. A., N. J. Barrowman, and J. A. Hutchings. 1997. Inshore exploitation of Newfoundland Atlantic cod (*Gadus morhua*) since 1948 as estimated from mark-recapture data. *Can. J. Fish. Aquat. Sci.* 54: 224-235.
- Pope, J. and J. Brattey 2001. A simple matrix based analysis of multiple area tagging data applied to the northern cod stock of Newfoundland. *Canadian Stock Assessment Secretariat Res. Doc.* 2001/082.
- Taggart, C. T., P. Penney, N. Barrowman, and C. George. 1995. The 1954-1993 Newfoundland cod-tagging database: statistical summaries and spatial-temporal distributions. *Canadian Technical Report of Fisheries and Aquatic Sciences* 2042: 441p.

Table 1. Summary of details for cod tagging experiments conducted in NAFO Divs. 2J+3KL and Subdiv. 3Ps (Placentia Bay) during 2000 (BB=Bonavista Bay, CB=Conception Bay, TB=Trinity Bay, SMB=St. Mary's Bay, PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay).

DFO Stat. area	Year & expt no.	Area of release	Dates	Gear	Depth (m)	Number tagged	Mean length (cm)
3Psc	2000-007	inner Placentia Bay	26 Apr.- 6 May	handline	16-50	2494	60.5
3Psc	2000-008	inner Placentia Bay	27 Apr. - 4 May	otter trawl	30-107	378	59.2
3Psc	2000-009	inner Placentia Bay	27 Apr.	handline (cage exp)	93	101	58.5
3Psc	2000-010	inner Placentia Bay	4 May	otter trawl (cage exp)	93	46	55.5
3La	2000-011	Plate Cove, BB	April 20	beach seine	4	29	62.0
3Lb	2000-012	Smith Sound, TB	May 4	handline	11	69	69.0
3Lb	2000-013	Smith Sound, TB	May 11	handline	20	45	82.0
3Lb	2000-014	Smith Sound, TB	May 18	handline	14	333	71.0

Table 1. Cont'd.

DFO Stat. area	Year & expt no.	Area of release	Dates	Gear	Depth (m)	Number tagged	Mean length(cm)
3Lb	2000-015	Smith Sound, TB	May 25	trap/handline	14	273	67.0
3La	2000-016	Red Cove, BB	May 26	rod & reel/lures	4	24	76.0
3L	2000-017	Offshore	May 27	otter trawl	159	1	55.0
3Lb	2000-018	Smith Sound, TB	May 30	handline	15-31	315	69.0
3La	2000-019	Southern Bonavista Bay	June 6-12	handline	14-34	1032	64.0
3Lq	2000-020	St. Mary's Bay	June 23	handline	40-43	194	66.9
3La	2000-021	Bonaventure Head, BB	June 27	trap (grow-out)	10	213	88.0
3Lj	2000-022	Petty Harbour	July 5	handline	22	28	60.3
3Ki	2000-023	Too Good Arm	10-11 Aug	handline	40	252	57.3
3Lq	2000-024	St. Shott's, SA	11 Aug.	handline	33	122	61.5
3Lj	2000-025	Petty Harbour	15 Aug.	handline	22	20	52.5

Table 1. Cont'd.

DFO Stat. area	Year & expt no.	Area of release	Dates	Gear	Depth (m)	Number tagged	Mean length(cm)
3Lb	2000-026	Hopeall, TB	16 Aug.	handline	22	16	51.4
3Lf	2000-027	Foxtrap, CB	17 Aug.	handline	22	172	52.6
3Ki	2000-028	Too Good Arm	17-18 Aug.	handline	39	145	55.0
3Lf	2000-029	Foxtrap, CB	23 Aug.	handline	23-40	50	55.4
3Lb	2000-030	Hopeall, TB	24 Aug.	handline	23	32	51.9
3Lf	2000-031	Bay de Verde, CB	28 Aug.	handline	27-32	41	53.6
3La	2000-032	Happy Adventure, BB	7-8 Sept.	handline	27	8	48.8

Table 2. Monthly reported landings (t) of cod from the inshore of NAFO Divs. 3KL during 1998-2000 including sentinel and recreational fishery catches.

<b>Year</b>	<b>Month</b>	<b>3Ka</b>	<b>3Kd</b>	<b>3Kh</b>	<b>3Ki</b>	<b>Total</b>
<b>1998</b>	<b>Jan</b>	0.0	0.0	0.0	0.0	0.0
	<b>Feb</b>	0.0	0.0	0.0	0.0	0.0
	<b>Mar</b>	0.0	0.0	0.0	0.0	0.0
	<b>Apr</b>	0.0	0.0	0.0	0.0	0.0
	<b>May</b>	0.0	0.0	0.4	4.1	4.5
	<b>Jun</b>	0.2	0.4	7.4	48.2	56.1
	<b>Jul</b>	0.4	4.5	30.8	43.1	78.8
	<b>Aug</b>	0.9	4.7	31.6	299.3	336.5
	<b>Sep</b>	3.0	57.3	392.5	645.3	1098.1
	<b>Oct</b>	0.8	55.1	194.8	283.0	533.7
	<b>Nov</b>	0.0	0.0	2.9	7.5	10.4
	<b>Dec</b>	0.0	0.0	0.5	0.5	1.0
	<b>Totals</b>	5.4	121.8	660.9	1331.0	2119.1

<b>Year</b>	<b>Month</b>	<b>3La</b>	<b>3Lb</b>	<b>3Lf</b>	<b>3Lj</b>	<b>3Lq</b>	<b>Total</b>
<b>1998</b>	<b>Jan</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Feb</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Mar</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Apr</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>May</b>	5.6	0.0	0.0	0.0	0.0	5.6
	<b>Jun</b>	23.0	17.0	1.9	5.6	2.6	50.1
	<b>Jul</b>	42.4	29.7	24.1	49.4	29.3	174.8
	<b>Aug</b>	436.8	148.5	69.6	81.9	30.3	767.0
	<b>Sep</b>	460.9	311.2	212.6	129.1	39.1	1152.8
	<b>Oct</b>	139.3	139.3	101.6	133.6	45.1	558.8
	<b>Nov</b>	4.1	0.9	0.9	2.5	0.5	8.8
	<b>Dec</b>	0.6	2.3	0.0	0.0	0.0	2.9
	<b>Totals</b>	1112.6	648.9	410.6	402.0	146.7	2721.0



Table 2. Cont'd.

<b>Year</b>	<b>Month</b>	<b>3Ka</b>	<b>3Kd</b>	<b>3Kh</b>	<b>3Ki</b>	<b>Totals</b>	
<b>1999</b>	<b>Jan</b>	0.0	0.0	0.0	0.0	0.0	
	<b>Feb</b>	0.0	0.0	0.0	0.0	0.0	
	<b>Mar</b>	0.0	0.0	0.0	0.0	0.0	
	<b>Apr</b>	0.0	0.0	0.0	0.0	0.0	
	<b>May</b>	0.0	0.0	0.1	3.4	3.5	
	<b>Jun</b>	0.1	0.6	5.0	24.2	29.9	
	<b>Jul</b>	9.9	85.2	667.9	1003.6	1766.5	
	<b>Aug</b>	5.7	11.4	30.7	85.6	133.4	
	<b>Sep</b>	11.5	80.8	223.8	930.6	1246.6	
	<b>Oct</b>	4.5	26.3	129.9	235.8	396.5	
	<b>Nov</b>	0.0	8.2	59.5	71.9	139.6	
	<b>Dec</b>	0.0	0.0	0.0	0.5	0.5	
	<b>Totals</b>	31.7	212.5	1117.0	2355.4	3716.6	
<b>Year</b>	<b>Month</b>	<b>3La</b>	<b>3Lb</b>	<b>3Lf</b>	<b>3Lj</b>	<b>3Lq</b>	<b>Totals</b>
<b>1999</b>	<b>Jan</b>	0.0	0.5	0.0	0.0	0.0	0.5
	<b>Feb</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Mar</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Apr</b>	0.0	8.0	0.0	0.0	0.0	8.0
	<b>May</b>	6.2	2.7	0.0	0.0	0.0	8.9
	<b>Jun</b>	9.7	11.6	6.4	24.5	2.3	54.5
	<b>Jul</b>	463.5	709.2	490.0	189.2	89.7	1941.5
	<b>Aug</b>	50.6	56.3	15.6	30.8	17.7	171.0
	<b>Sep</b>	807.0	575.4	122.8	337.8	102.4	1945.4
	<b>Oct</b>	142.3	355.7	78.3	121.3	67.5	765.1
	<b>Nov</b>	18.9	38.6	10.4	17.1	14.5	99.4
	<b>Dec</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Totals</b>	1498.1	1758.0	723.6	720.7	294.1	4994.4

Table 2. Cont'd.

<b>Year</b>	<b>Month</b>	<b>3Ka</b>	<b>3Kd</b>	<b>3Kh</b>	<b>3Ki</b>	<b>Totals</b>	
<b>2000</b>	<b>Jan</b>	0.0	0.0	0.0	0.0	0.0	
	<b>Feb</b>	0.0	0.0	0.0	0.1	0.1	
	<b>Mar</b>	0.0	0.0	0.0	0.1	0.1	
	<b>Apr</b>	0.0	0.0	0.0	0.1	0.1	
	<b>May</b>	0.0	0.0	0.0	0.0	0.0	
	<b>Jun</b>	0.0	0.1	0.6	18.7	19.4	
	<b>Jul</b>	2.2	8.7	18.6	407.4	437.0	
	<b>Aug</b>	2.9	8.8	17.2	76.1	104.9	
	<b>Sep</b>	8.2	26.9	74.9	347.5	457.4	
	<b>Oct</b>	2.5	7.8	54.2	138.5	203.0	
	<b>Nov</b>	1.8	1.1	36.8	185.8	225.5	
	<b>Dec</b>	0.0	0.0	0.0	0.4	0.4	
		<b>Totals</b>	17.7	53.4	202.2	1174.5	1447.8
<b>Year</b>	<b>Month</b>	<b>3La</b>	<b>3Lb</b>	<b>3Lf</b>	<b>3Lj</b>	<b>3Lq</b>	<b>Totals</b>
<b>2000</b>	<b>Jan</b>	0.0	1.5	0.0	0.0	0.0	1.5
	<b>Feb</b>	0.0	1.1	0.0	0.3	0.0	1.4
	<b>Mar</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>Apr</b>	0.0	0.0	0.0	0.0	0.0	0.0
	<b>May</b>	0.0	3.5	0.0	0.0	1.3	4.8
	<b>Jun</b>	10.0	66.9	4.2	1.1	9.3	91.5
	<b>Jul</b>	375.5	298.9	164.5	109.2	102.0	1050.1
	<b>Aug</b>	120.8	148.9	15.9	38.0	19.9	343.6
	<b>Sep</b>	545.2	701.3	145.1	168.2	28.9	1588.6
	<b>Oct</b>	264.4	159.8	54.9	99.8	32.4	611.3
	<b>Nov</b>	123.7	28.4	11.9	18.8	0.6	183.5
	<b>Dec</b>	0.4	0.0	0.0	0.0	0.0	0.4
		<b>Totals</b>	1439.8	1410.3	396.5	435.4	194.5

Table 3 . Summary of reported recaptures (all tag types combined) for cod tagged and released in the inshore of NAFO Divs. 2J3KL during 1998, 1999 and 2000 (see Fig. 1 for locations of unit areas and tagging sites).

Expt. number	Unit area	Release date		Tagging site	Number tagged	Reported recaptures		
		First	Last			1998	1999	2000
9811	2JM	3-Jun-98	28-Jun-98	GILBERTS BAY LAB	797	8	15	0
9807	3KI	18-Jun-98	18_jun-98	SE FOGO	118	14	9	2
9932	2JM	20-May-99	1-Jun-99	GILBERTS BAY LAB	556	.	20	0
9922	3KH	22-Jun-99	22-Jun-99	JACKSONS CV NDB	3	.	0	0
9911	3KI	3-Jun-99	3-Jun-99	FOGO	122	.	21	3
9912	3KI	9-Jun-99	11-Jun-99	TOO GOOD ARM	639	.	163	18
9920	3KI	15-Jun-99	15-Jun-99	LUMSDEN FOGO	10	.	3	0
9921	3KI	16-Jun-99	16-Jun-99	SUMMERFORD TW	3	.	1	0
9925	3KI	22-Jun-99	25-Jun-99	TOO GOOD ARM	571	.	143	18
9926	3KI	6-Jul-99	7-Jul-99	TWILLINGATE	197	.	80	6
9934	3KI	22-Sep-99	22-Sep-99	LUMSDEN FOGO	101	.	0	1
9937	3KI	29-Sep-99	29-Sep-99	LADLE COVE	60	.	0	4
9908	3LA	4-May-99	5-May-99	PLATE COVE BB	309	.	26	9
9909	3LA	11-May-99	12-May-99	S. BONAVIDA BAY	80	.	10	5
9918	3LA	9-Jun-99	10-Jun-99	GREENSPOND BBN	242	.	21	7
9915	3LA	10-Jun-99	13-Jun-99	SANDY COVE BB	164	.	13	7
9916	3LA	10-Jun-99	13-Jun-99	SWALE ISLAND BB	372	.	33	7
9919	3LA	11-Jun-99	11-Jun-99	SILVER FOX ISLAND BBN	157	.	13	6
9917	3LA	11-Jun-99	12-Jun-99	BROOM CLOSE HEAD BB	305	.	31	15
9924	3LA	24-Jun-99	24-Jun-99	BONAVIDA BB	210	.	7	13
9933	3LA	21-Sep-99	21-Sep-99	WESLEYVILLE BBN	107	.	0	0
9941	3LA	22-Nov-99	22-Nov-99	HAPPY ADVENTURE BB	49	.	0	2
9907	3LB	27-Apr-99	4-May-99	SMITH SD TB	376	.	22	12
9910	3LB	28-May-99	28-May-99	SMITH SD TB	224	.	11	8
9913	3LB	7-Jun-99	8-Jun-99	NW ARM TB	224	.	16	6
9914	3LB	9-Jun-99	9-Jun-99	TRINITY TB	222	.	4	6
9928	3LB	6-Aug-99	6-Aug-99	NEW HARBOUR TB	486	.	38	19
9930	3LB	1-Sep-99	2-Sep-99	L. CATALINA TB	456	.	16	13
9935	3LB	21-Sep-99	21-Sep-99	L. CATALINA TB	203	.	5	1
9936	3LB	28-Sep-99	28-Sep-99	SMITH SND TB	16	.	0	1
9938	3LB	7-Oct-99	8-Oct-99	SMITH SND TB	142	.	0	11
9942	3LB	23-Nov-99	26-Nov-99	SMITH SND TB	514	.	0	27
9944	3LB	1-Dec-99	3-Dec-99	SMITH SND TB	476	.	0	33
9927	3LF	19-Jul-99	19-Jul-99	FOXTRAP CB	17	.	2	0
9929	3LF	25-Aug-99	25-Aug-99	KELLY'S ISLAND CB	177	.	12	6
9923	3LJ	28-Jun-99	28-Jun-99	FERRYLAND S. AV	21	.	7	1
9906	3LQ	7-May-99	10-May-99	ST. MARYS BAY	734	.	85	58
9931	3LQ	2-Sep-99	13-Sep-99	ST SHOTTS S. AV	280	.	38	19
Total					8825	22	865	344

Table 3. Cont'd.

Expt. number	Unit area	Release date		Tagging site	Number tagged	Reported recaptures
		First	Last			2000
2036	2J	13-Jun-00	7-Aug-00	GILBERT BAY LAB	582	0
2023	3KI	10-Aug-00	11-Aug-00	TOO GOOD ARM	252	9
2028	3KI	17-Aug-00	18-Aug-00	TOO GOOD ARM	145	9
2011	3LA	20-Apr-00	20-Apr-00	PLATE COVE BB	29	2
2016	3LA	26-May-00	26-May-00	RED COVE BB	24	2
2019	3LA	7-Jun-00	11-Jun-00	SOUTHERN BB	1032	82
2032	3LA	7-Sep-00	8-Sep-00	HAPPY ADVENTURE BB	8	0
2012	3LB	4-May-00	4-May-00	SMITH SND TB	69	4
2013	3LB	11-May-00	11-May-00	SMITH SND TB	45	3
2014	3LB	18-May-00	19-May-00	SMITH SND TB	333	21
2015	3LB	25-May-00	25-May-00	SMITH SND TB	273	11
2018	3LB	30-May-00	30-May-00	SMITH SND TB	315	9
2021	3LB	27-Jun-00	27-Jun-00	BONAVENTURE HD BB	213	10
2026	3LB	16-Aug-00	16-Aug-00	HOPEALL TB	16	0
2030	3LB	24-Aug-00	24-Aug-00	HOPEALL TB	32	0
2027	3LF	17-Aug-00	17-Aug-00	FOXTRAP CB	172	7
2029	3LF	23-Aug-00	23-Aug-00	FOXTRAP CB	50	1
2031	3LF	28-Aug-00	28-Aug-00	BAY DE VERDE CB	41	2
2017	3LG	27-May-00	27-May-00	OFFSHORE 3L	1	0
2022	3LJ	5-Jul-00	5-Jul-00	PETTY HARBOUR	28	1
2025	3LJ	15-Aug-00	15-Aug-00	PETTY HARBOUR	20	0
2020	3LQ	22-Jun-00	22-Jun-00	ST MARYS BAY	194	17
2024	3LQ	11-Aug-00	11-Aug-00	ST SHOTTS	122	15
Total					3996	205

Table 4. Annual estimates of exploitation by experiment for cod tagged in the inshore of NAFO Divs. 3KL during 1999-2000. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss, and natural mortality. See text for details and Table 3 for numbers of releases and recaptures.

Expt number	Release area	Release date		Exploitation rate in 1999	Exploitation rate in 2000
		First	Last		
9911	3Ki	3-Jun-99	3-Jun-99	0.293	0.075
9912	3Ki	9-Jun-99	11-Jun-99	0.440	0.098
9920	3Ki	15-Jun-99	15-Jun-99	0.571	0.000
9925	3Ki	22-Jun-99	25-Jun-99	0.426	0.104
9926	3Ki	6-Jul-99	7-Jul-99	0.651	0.222
9934	3Ki	22-Sep-99	22-Sep-99	0.000	0.021
9937	3Ki	29-Sep-99	29-Sep-99	0.000	0.100
2023	3Ki	10-Aug-00	11-Aug-00	.	0.063
2028	3Ki	17-Aug-00	18-Aug-00	.	0.093
9908	3La	4-May-99	5-May-99	0.148	0.070
9909	3La	11-May-99	12-May-99	0.220	0.188
9915	3La	10-Jun-99	13-Jun-99	0.140	0.106
9916	3La	10-Jun-99	13-Jun-99	0.160	0.052
9917	3La	11-Jun-99	12-Jun-99	0.186	0.123
9918	3La	9-Jun-99	10-Jun-99	0.152	0.079
9919	3La	11-Jun-99	11-Jun-99	0.149	0.083
9924	3La	24-Jun-99	24-Jun-99	0.062	0.130
9933	3La	21-Sep-99	21-Sep-99	0.000	0.000
9941	3La	22-Nov-99	22-Nov-99	0.000	0.067
2011	3La	20-Apr-00	20-Apr-00	.	0.150
2016	3La	26-May-00	26-May-00	.	0.118
2019	3La	7-Jun-00	11-Jun-00	.	0.142
2032	3La	7-Sep-00	8-Sep-00	.	0.000
9907	3Lb	27-Apr-99	4-May-99	0.105	0.067
9910	3Lb	28-May-99	28-May-99	0.089	0.074
9913	3Lb	7-Jun-99	8-Jun-99	0.133	0.062
9914	3Lb	9-Jun-99	9-Jun-99	0.036	0.058
9928	3Lb	6-Aug-99	6-Aug-99	0.134	0.088
9930	3Lb	1-Sep-99	2-Sep-99	0.058	0.052
9935	3Lb	21-Sep-99	21-Sep-99	0.040	0.008
9936	3Lb	28-Sep-99	28-Sep-99	0.000	0.083
9938	3Lb	7-Oct-99	8-Oct-99	0.000	0.153
9942	3Lb	23-Nov-99	26-Nov-99	0.000	0.104
9944	3Lb	1-Dec-99	3-Dec-99	0.000	0.132
2012	3Lb	4-May-00	4-May-00	.	0.094
2013	3Lb	11-May-00	11-May-00	.	0.071
2014	3Lb	18-May-00	19-May-00	.	0.116
2015	3Lb	25-May-00	25-May-00	.	0.070
2018	3Lb	30-May-00	30-May-00	.	0.050
2021	3Lb	27-Jun-00	27-Jun-00	.	0.077
2026	3Lb	16-Aug-00	16-Aug-00	.	0.000
2030	3Lb	24-Aug-00	24-Aug-00	.	0.000
9927	3Lf	19-Jul-99	19-Jul-99	0.091	0.000
9929	3Lf	25-Aug-99	25-Aug-99	0.107	0.070
2027	3Lf	17-Aug-00	17-Aug-00	.	0.063
2029	3Lf	23-Aug-00	23-Aug-00	.	0.026
2031	3Lf	28-Aug-00	28-Aug-00	.	0.091
9923	3Lj	28-Jun-99	28-Jun-99	0.600	0.200
2022	3Lj	5-Jul-00	5-Jul-00	.	0.050
2025	3Lj	15-Aug-00	15-Aug-00	.	0.000
9906	3Lq	7-May-99	10-May-99	0.236	0.246
9931	3Lq	2-Sep-99	13-Sep-99	0.237	0.160
2020	3Lq	22-Jun-00	22-Jun-00	.	0.159
2024	3Lq	11-Aug-00	11-Aug-00	.	0.211

Table 5. Distribution of recaptures of cod tagged and released in various inshore areas of NAFO Divs. 3KL and eastern Subdiv. 3Ps during 1999 and 2000. Shaded cells are annual percentages recovered in the area of release.

Release Area	Year	Number tagged	Reported recaptures	% of total recaptured by area												
				3Kh (Notre Dame)	3Ki (Fogo)	3La (Bonavista)	3Lb (Trinity)	3Lf (Conception)	3Lj (E. Avalon)	3Lq (S. Avalon)	3Psc (Placentia)	3Psb (Fortune)	3Psd (Burgee)	3Psfgh (Halibut Ch.)	4R (N. Gulf)	3NO (G. Banks)
3Ki	1999	1703	401	5.0	90.5	4.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000		50	0.0	70.0	22.0	4.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0
3La	1999	1995	152	0.7	19.1	75.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000		68	2.9	23.5	64.7	7.4	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
3Lb	1999	3339	106	0.0	1.9	14.2	84.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000		134	3.0	6.0	32.1	53.7	0.8	3.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
3Lf	1999	194	14	0.0	0.0	0.0	0.0	78.6	7.1	0.0	14.3	0.0	0.0	0.0	0.0	0.0
	2000		6	0.0	16.7	0.0	0.0	50.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	0.0
3Lj	1999	21	7	0.0	0.0	0.0	14.3	0.0	42.9	0.0	42.9	0.0	0.0	0.0	0.0	0.0
	2000		1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
3Lq	1999	1014	121	0.0	0.0	0.8	2.5	0.0	3.3	4.1	86.0	2.5	1.0	0.0	0.0	0.0
	2000		77	0.0	0.0	0.0	2.6	0.0	3.9	7.8	84.4	1.3	0.0	0.0	0.0	0.0
3Psc	1999	2597*	430	0.0	0.0	0.0	0.9	0.5	0.9	0.7	96.1	0.9	0.0	0.0	0.0	0.0
	2000		269	0.0	0.0	0.0	0.4	0.4	0.4	0.7	93.3	4.1	0.0	0.7	0.0	0.0
3Psh	1999	1808	35	0.0	2.9	0.0	2.9	2.9	8.6	2.9	40.0	0.0	0.0	34.2	0.0	5.6
	2000		32	0.0	0.0	0.0	0.0	3.1	0.0	3.1	18.8	0.0	6.3	65.6	0.0	3.1

\* spring releases only

Release Area	Year	Number tagged	Reported recaptures	% of total recaptured by area												
				3Kh (Notre Dame)	3Ki (Fogo)	3La (Bonavista)	3Lb (Trinity)	3Lf (Conception)	3Lj (E. Avalon)	3Lq (S. Avalon)	3Psc (Placentia)	3Psb (Fortune)	3Psd (Burgee)	3Psfgh (Halibut Ch.)	4R (N. Gulf)	3NO (G. Banks)
3Ki	2000	397	18	0.0	94.4	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3La	2000	1093	83	0.0	18.1	74.7	6.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
3Lb	2000	1296	54	0.0	2.0	14.7	83.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3Lf	2000	263	10	0.0	0.0	0.0	0.0	78.6	7.1	0.0	14.3	0.0	0.0	0.0	0.0	0.0
3Lj	2000	48	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
3Lq	2000	316	30	0.0	0.0	0.0	0.0	0.0	0.0	10.0	76.7	6.7	0.0	6.7	0.0	0.0
3Psc	2000	3168*	311	0.0	0.0	0.0	0.0	0.0	0.3	1.9	94.9	2.6	0.3	0.0	0.0	0.0
3Psh	2000	1044	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0

\* spring releases only

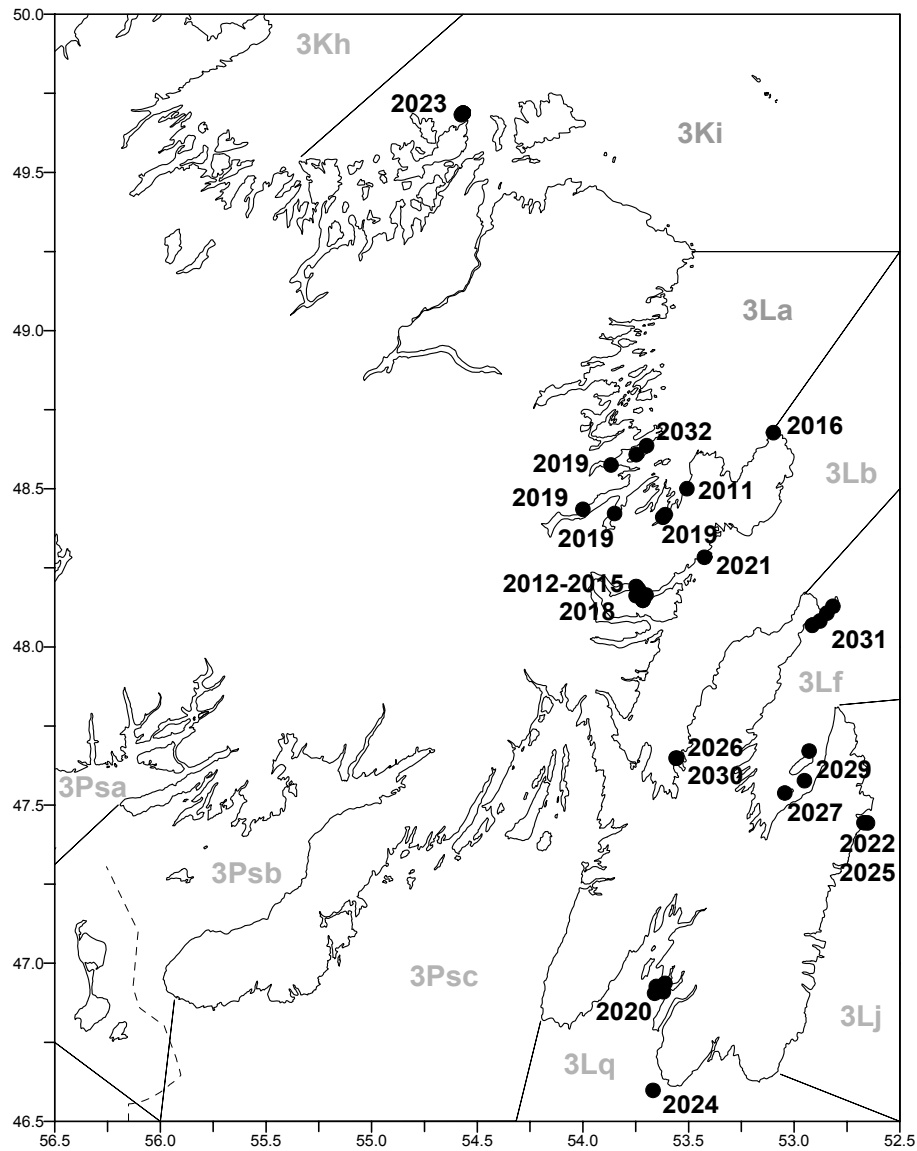


Fig. 1. Locations where cod were tagged and released in NAFO Divs. 3KL during 2000. Numbers indicate tagging experiment numbers. Solid lines are boundaries of unit areas (labelled in grey). An additional 582 tagged cod were released inshore in Gilbert Bay, southern Labrador (2Jm, not shown) but no recaptures were reported. See Table 1 for further details.

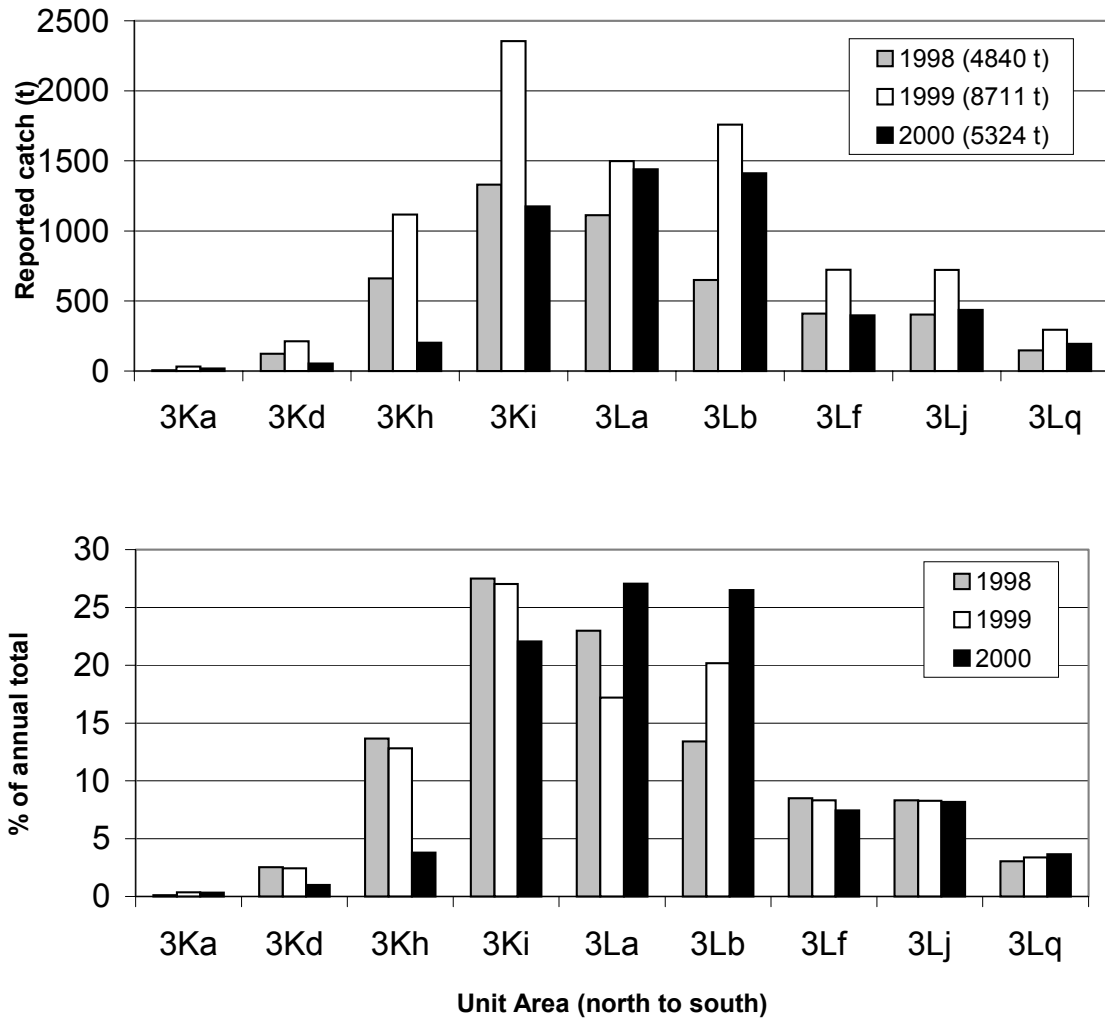


Fig. 2. Distribution of cod landings along the inshore of NAFO Divs. 3KL during 1998-2000  
Total reported landings are shown in the legend in the upper panel



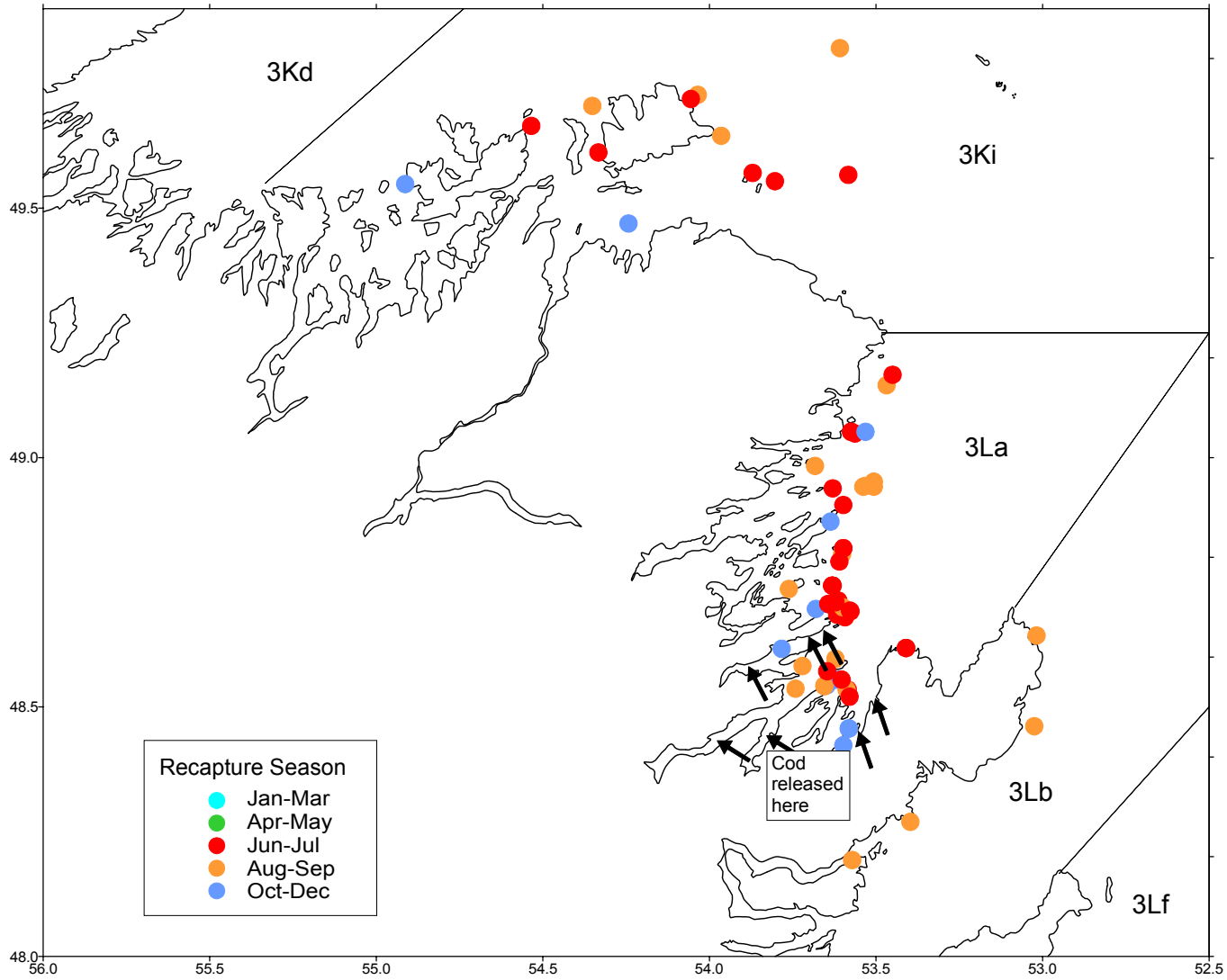


Fig. 3. Reported recapture positions for cod tagged and released in southern Bonavista Bay during 7-11 June 2000 (N=1032).

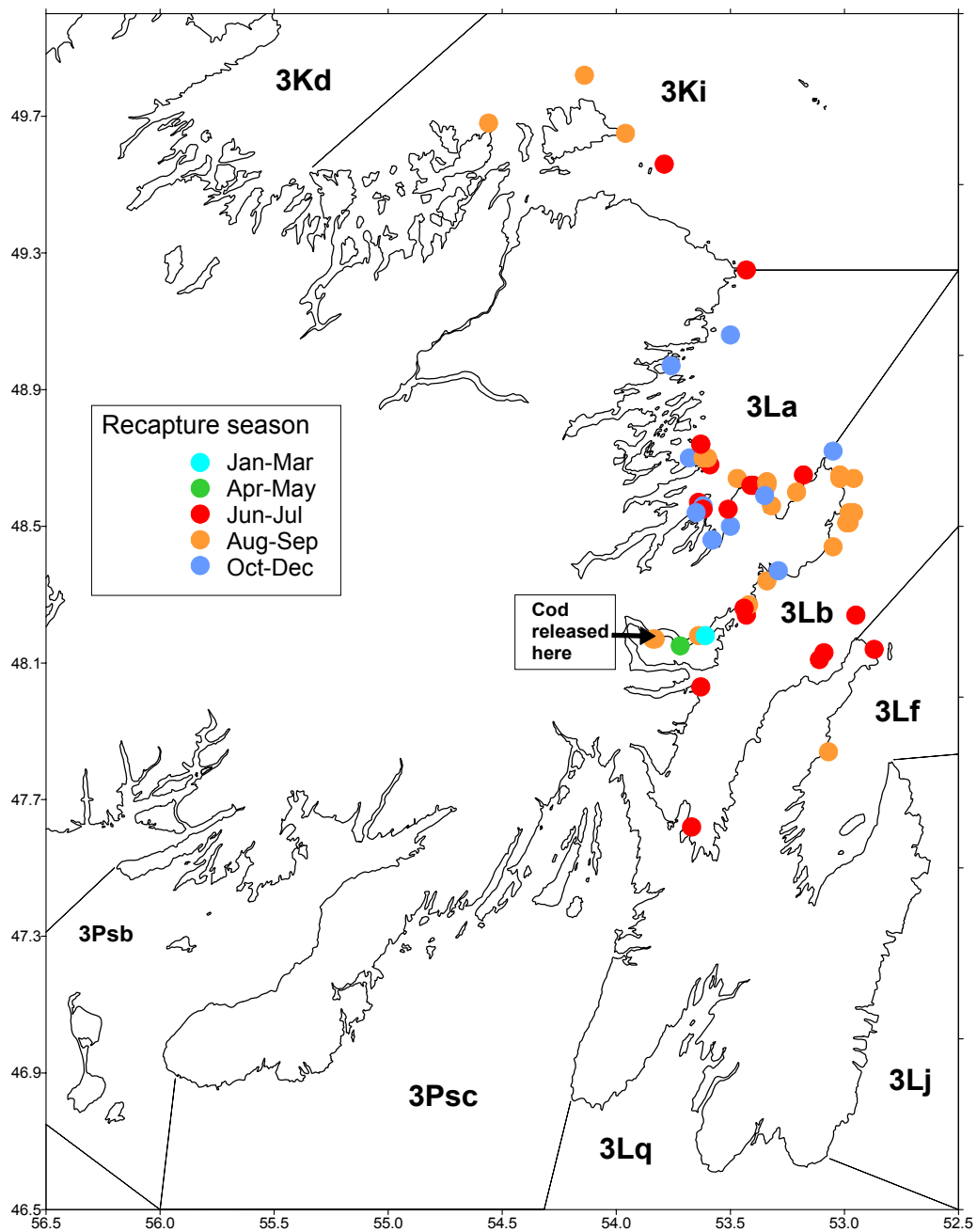


Fig. 4. Reported recapture positions for cod tagged in Smith Sound, Trinity Bay, during 28 Sept. - 1 Dec. 1999 (N=1148).

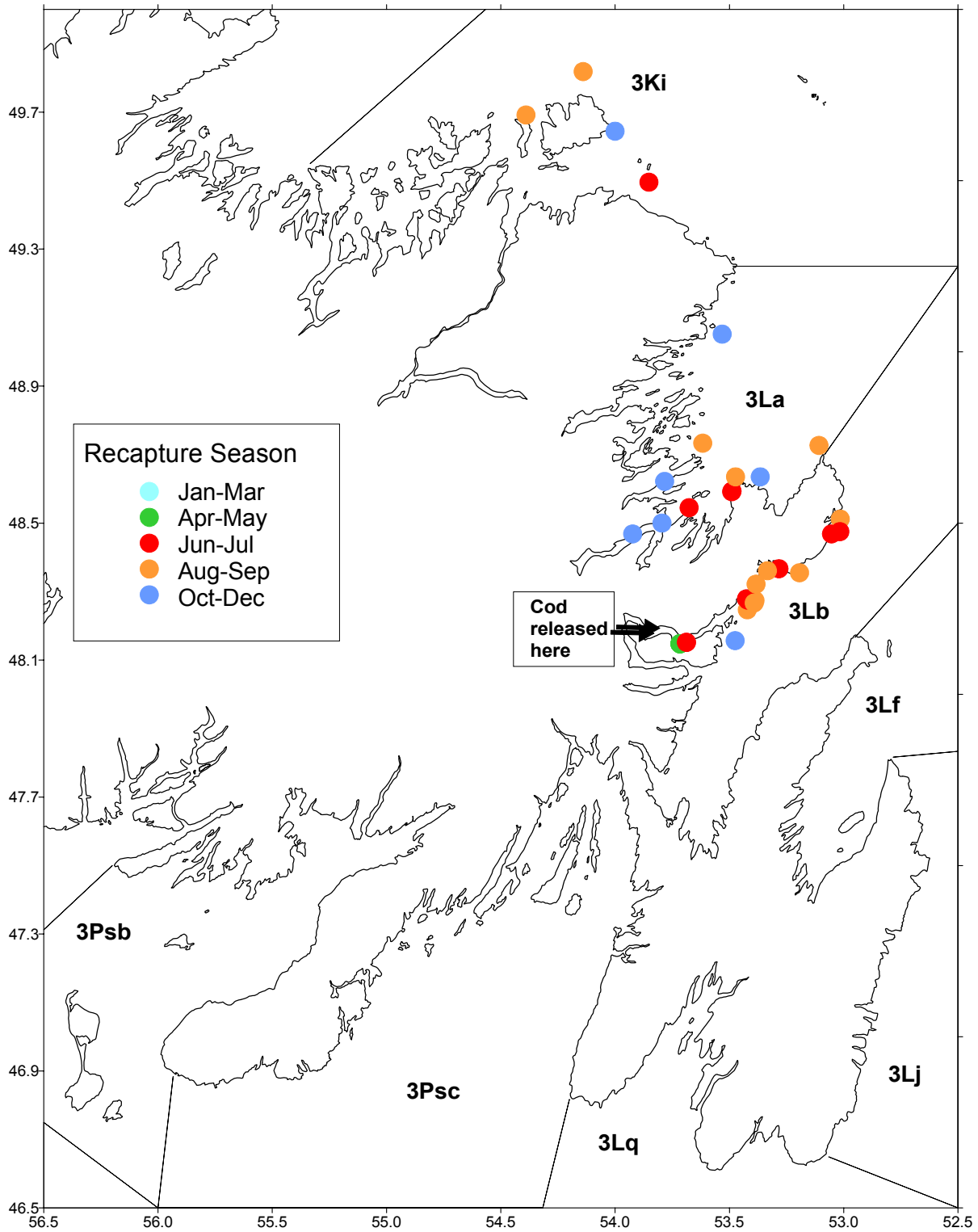


Fig. 5. Reported recapture positions for cod tagged in Smith Sound, Trinity Bay, during 4-30 May 2000 (N=1035).

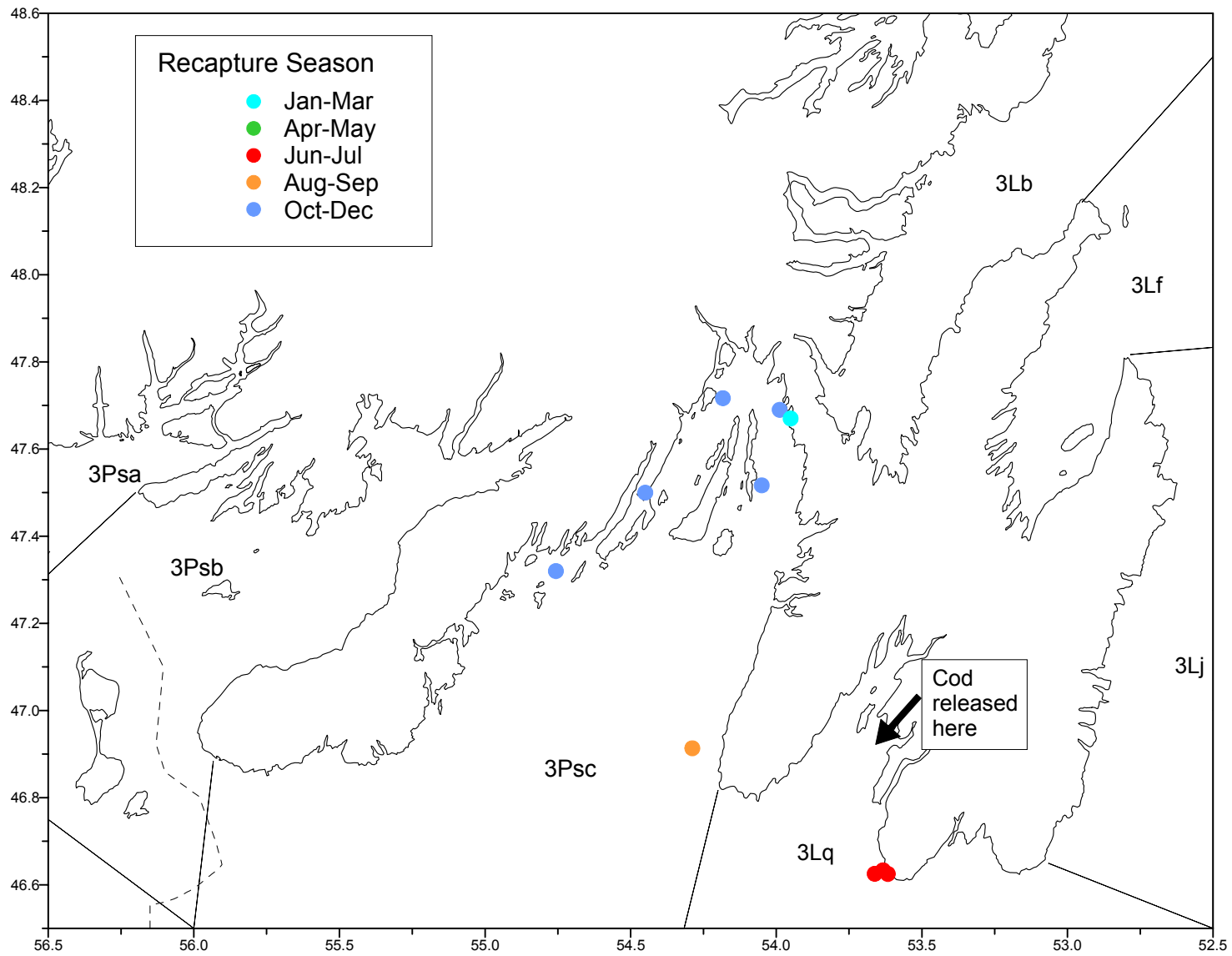


Fig. 6. Reported recapture positions for cod tagged in St. Mary's Bay during 23 June 2000 (N=194).

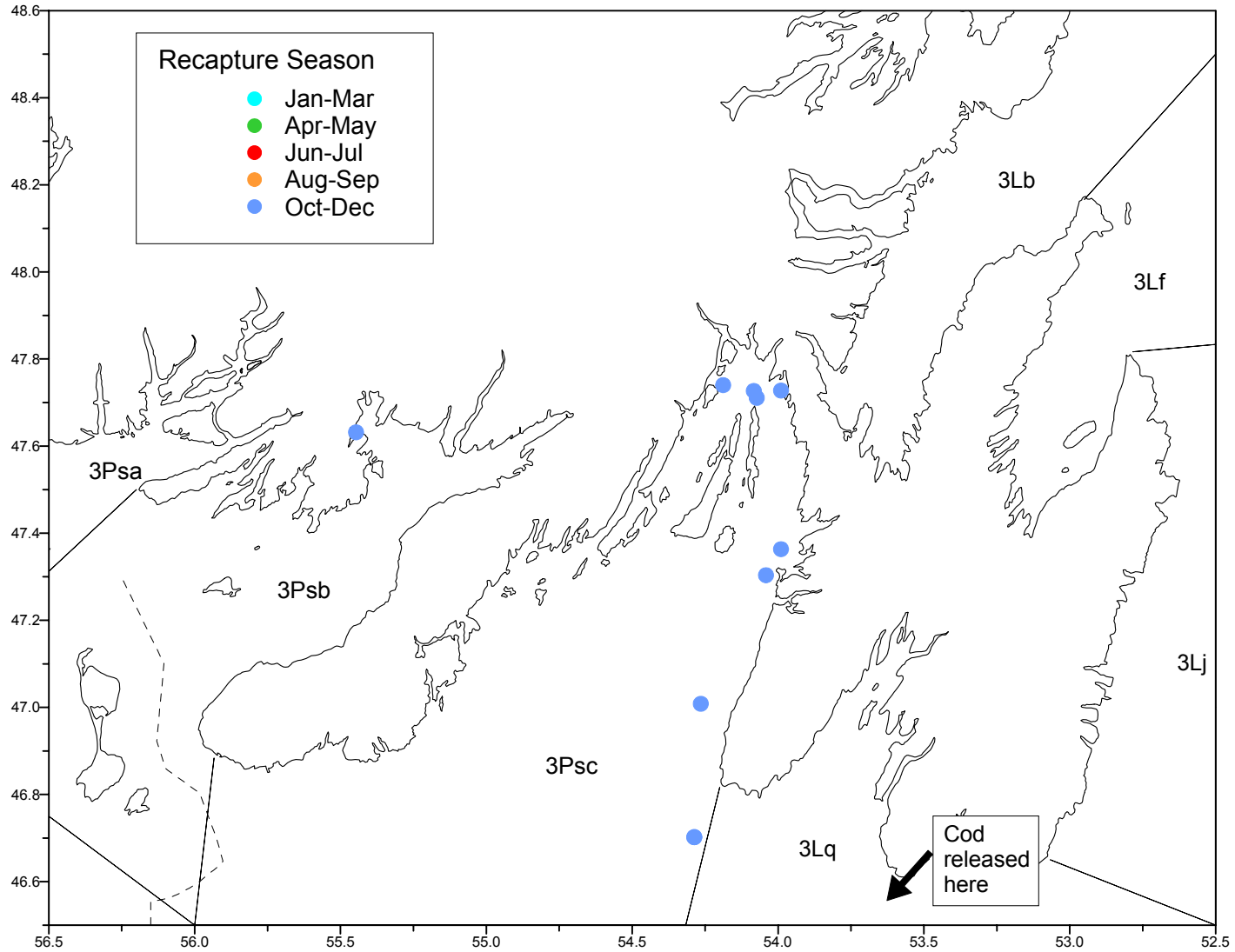


Fig. 7. Reported recapture positions for cod tagged off St. Shott's during 11 Aug 2000 (N=122).

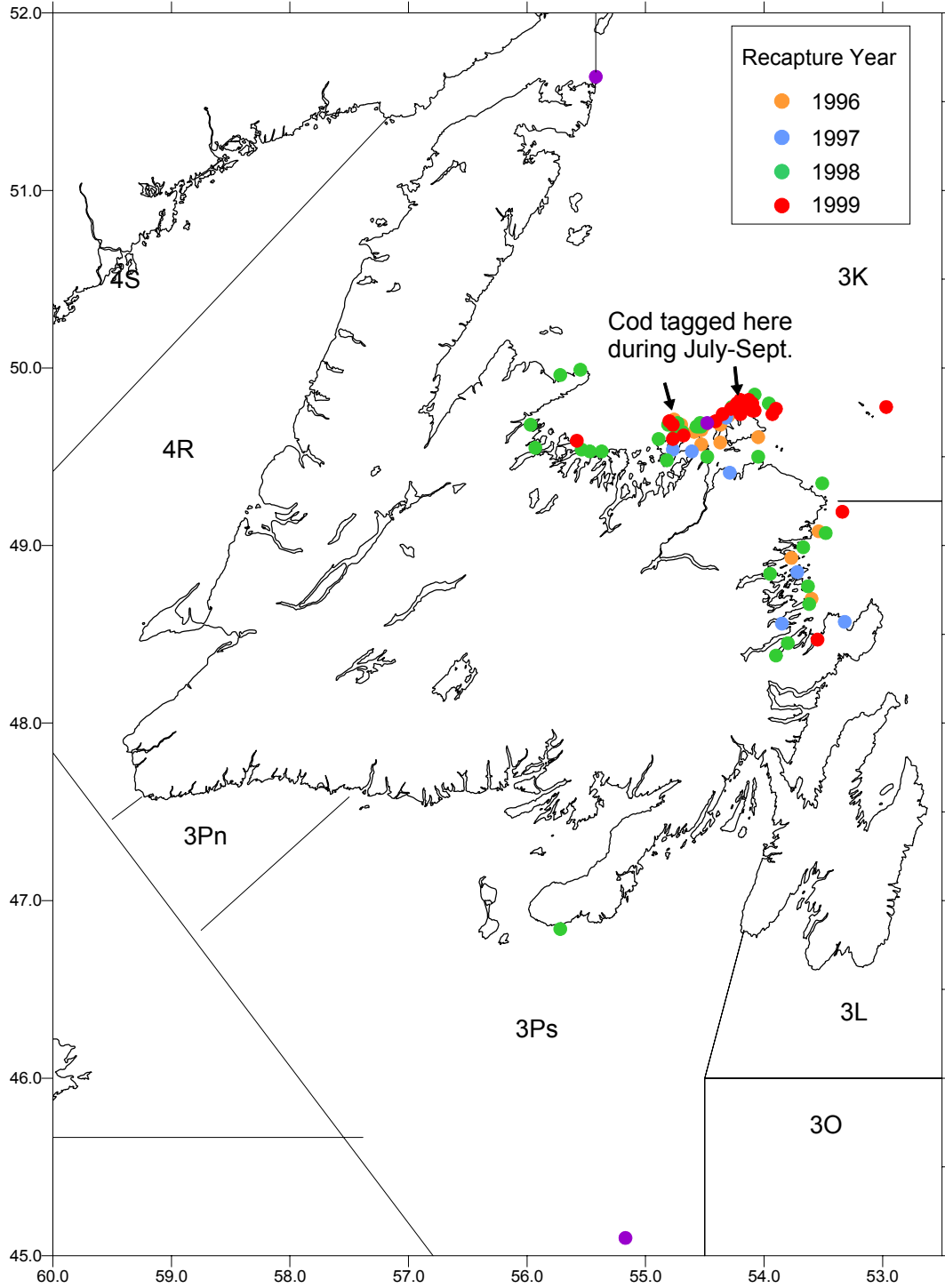


Fig. 8. Reported recapture positions for cod tagged in 3Ki during July-Sept. 1996-1998 (N=1169; approximately 88 recaptures have been reported to the end of Dec 2000).

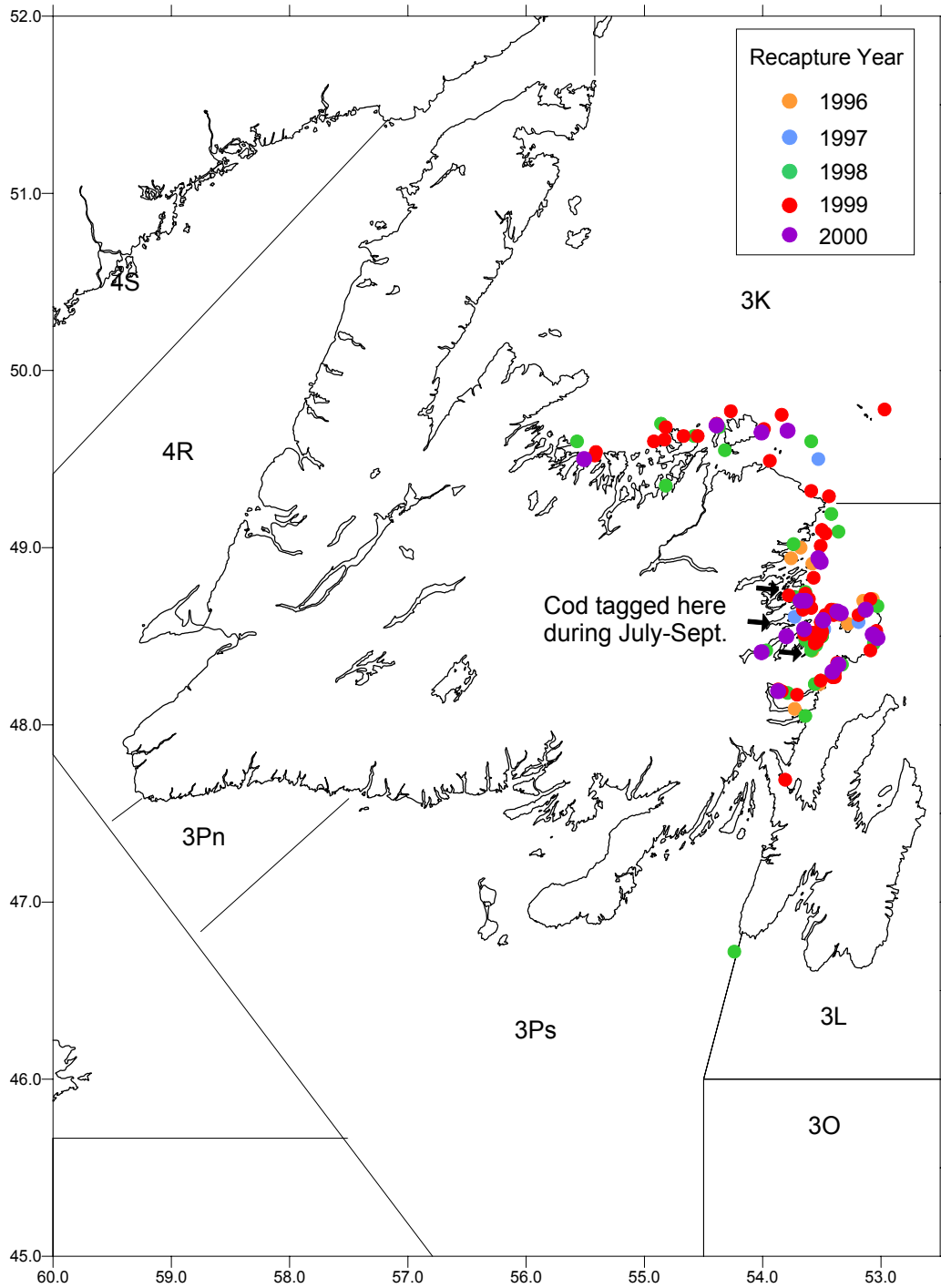


Fig. 9. Reported recapture positions for cod tagged in southern Bonavista Bay during July-Sept. 1996-1997 (N=1257 and N=778). Approximately 143 recaptures have been reported to the end of December 2000.

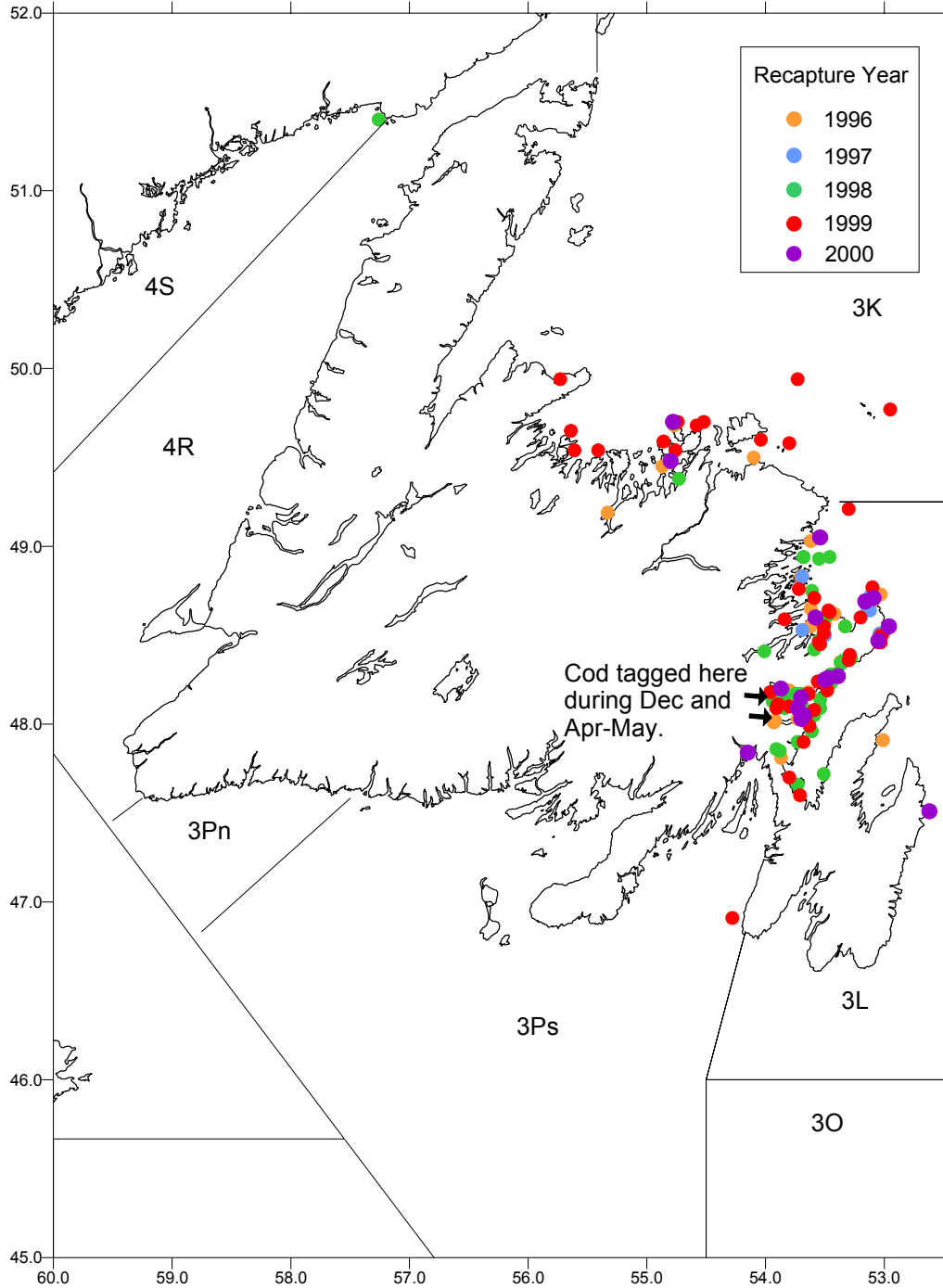


Fig. 10. Reported recapture positions for cod tagged in Trinity Bay during December 1995 (N=2046) and April-May 1997 (N=788). Approximately 191 recaptures have been reported to the end of Dec 2000.



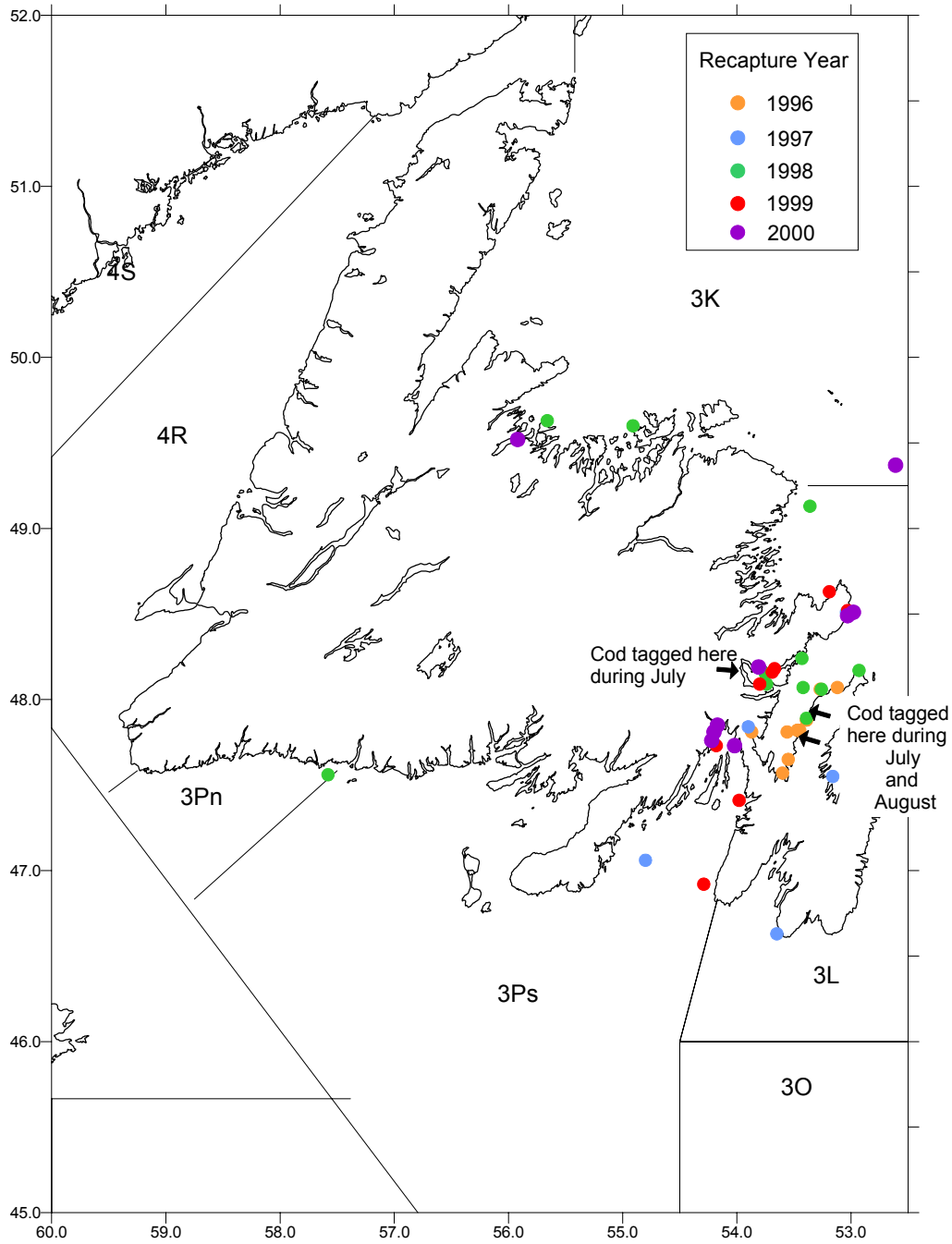


Fig. 11. Reported recapture positions for cod tagged in eastern and western Trinity Bay during July and August 1996 (N=977). Approximately 44 recaptures have been reported to the end of Dec 2000.

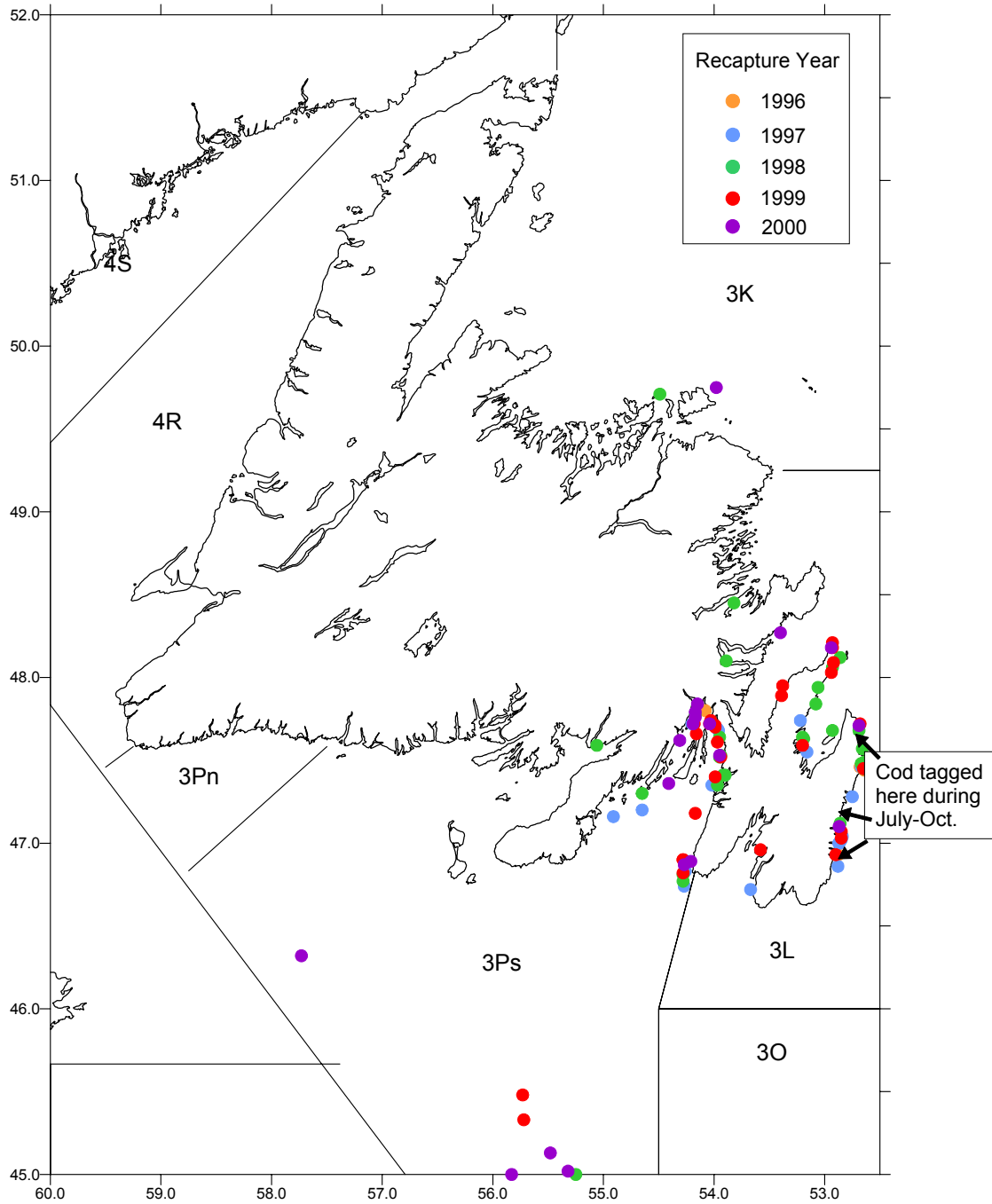


Fig. 12. Reported recapture positions for cod tagged off eastern Avalon during July-Oct 1996 (N=1936) and July-Aug.1997 (N=306). Approximately 103 recaptures have been reported to the end of Dec 2000.

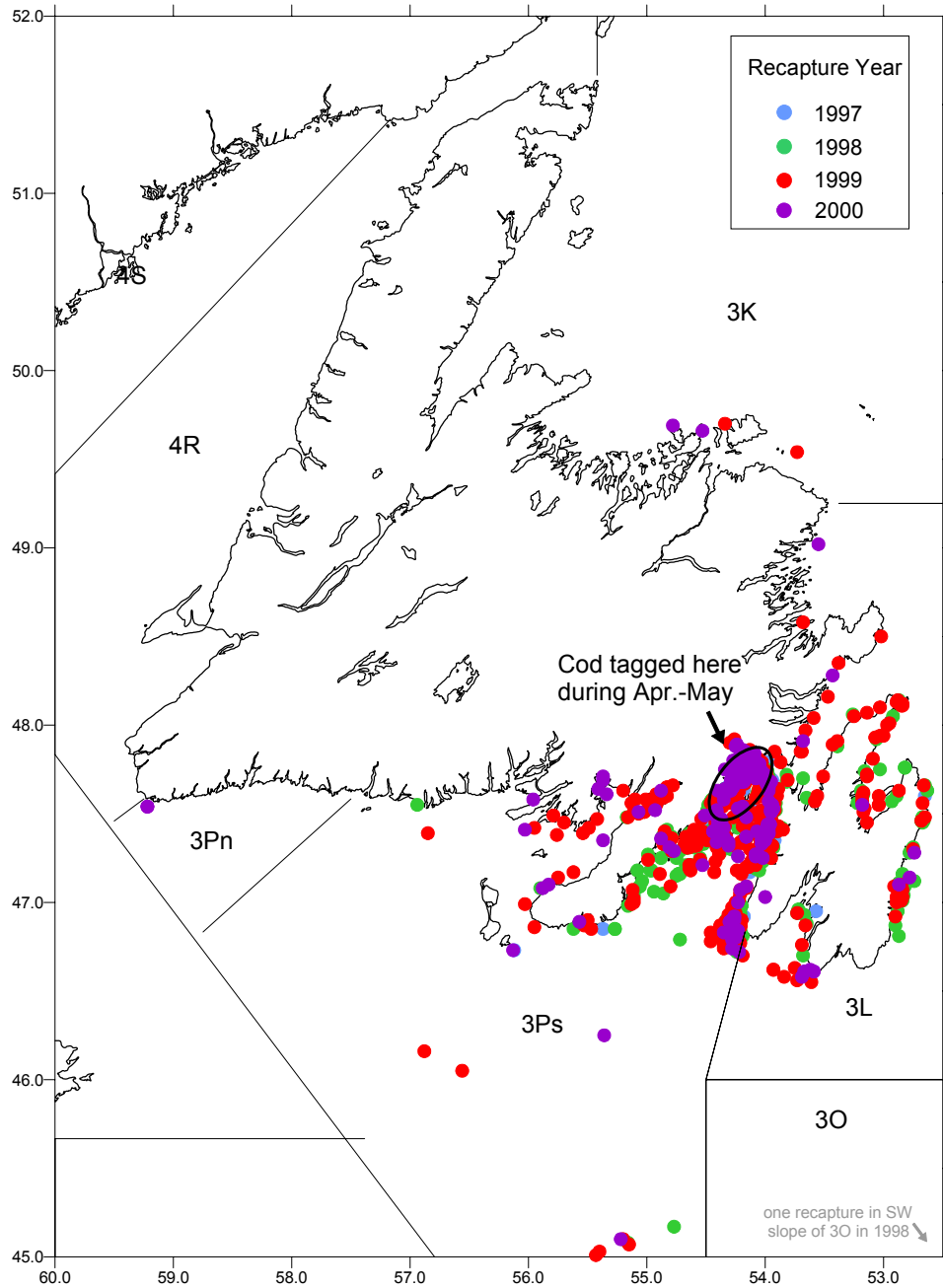


Fig. 13. Reported recapture positions for cod tagged at the head of Placentia Bay during April - May 1997 (N=2779) and 1998 (N=5261). Approximately 1707 recaptures have been reported to the end of Dec 2000.