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Exploitation of Atlantic *cod (Gadus morhua*) in NAFO Subdiv. 3Ps: further updates based on tag returns during 1997-2004.

Taux d'exploitation de la morue franche (*Gadus morhua*) dans la sous division 3Ps de l'OPANO : bilan d'après les étiquettes récupérées de 1997 à 2004

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ABSTRACT

This document updates the results of a multi-year tagging study of Atlantic cod (*Gadus morhua*) in NAFO Subdiv. 3Ps, initiated during spring 1997. Since inception, a total of over 63,700 cod have been tagged with single, double, or high-reward t-bar anchor tags and released at various inshore and offshore sites off southern Newfoundland (3Ps) and 18.5% have been reported as recaptured to 10 September 2004. Estimates of exploitation for cod tagged in each region in each year were computed using methods similar to those reported in previously, but with minor modifications; values for 2004 are preliminary as the fishery was still in progress. Estimates of short-term tagging mortality, tag loss, and reporting rate were obtained and are incorporated into the estimation. Among cod tagged in Placentia Bay mean annual estimates of exploitation have declined from 34% in 1999 to 22% in 2003; however, some individual estimates remain quite high with four of seven estimates exceeding 25% in 2003. Mean annual estimates for cod tagged in Fortune Bay have been similar (10-11%) over the past four years, although cod tagged in the inner reaches of Fortune Bay at Poole's Cove have been more heavily exploited (20-31%) than those tagged in the outer reaches off Pass Island (4 to 6%). Tag returns indicate considerable movement of cod between Fortune Bay and Placentia Bay. Exploitation of cod tagged in 3Psd (Burgeo Bank) appears to have declined to only 2% in 2003 (compared to 4%-9% during 1998-2002); this decline may be due to closure of the directed cod fishery in the neighbouring northern Gulf management area (3Pn4RS) during 2003 as well as seasonal closures and restrictions to the directed cod fishery in western 3Ps (3Psa, 3Psd, and more recently 3Pse/g). Reported commercial landings from 3Psa/d during November-April 2002/2003 were only 260 t and for 2003/2004 totaled 507.7 t. These data suggest that potential removals of 3Pn4RS cod from winter fisheries in western 3Ps in the past two management years are relatively small and likely to have little influence on the dynamics of that stock. Mean annual estimates of exploitation during 2003 for cod tagged in offshore areas of 3Ps (3Psh) remain consistently low (1-2%) in spite of offshore landings of >6,000 t. Offshore tagging coverage was expanded during 2003 with the assistance of industry, and approximately 1,000 tagged cod were released in southern 3Psg and 3Psh during December. To date, only 10 of the cod tagged offshore in December have been reported as recaptured, one from Placentia Bay, six from offshore 3Ps and three from unknown locations in 3Ps.

RÉSUMÉ

Un bilan est fait des résultats d'une étude de marquage-recapture pluriannuelle de la morue franche (*Gadus morhua*) dans la sous-division 3Ps de l'OPANO, lancée au printemps de 1997. Depuis le lancement de cette étude, quelque 63 700 morues ont été marquées au moyen d'étiquettes à ancrage en T à récompenses simples, doubles ou élevées avant d'être remises à l'eau à divers endroits dans les eaux côtières et hauturières au sud de Terre-Neuve (3Ps). Au 10 septembre 2004, 18,5 % de ces morues étiquetées avaient été recapturées. Pour 2004, des méthodes semblables à celles utilisées par le passé ont été utilisées pour estimer le taux d'exploitation dans chaque région et durant chaque année, sauf que les valeurs pour 2004 sont préliminaires étant donné que la pêche était en cours. L'estimation du taux d'exploitation tient compte des estimations de la mortalité à court terme due au marquage, du nombre d'étiquettes perdues et du taux de déclaration propre à la région. Dans le cas des morues étiquetées dans la baie de Plaisance, le taux annuel moyen d'exploitation a chuté, passant de 34 % en 1999 à 22 % en 2003; par contre, quelques taux estimatifs demeurent assez élevés, quatre des sept dépassant 25 % en 2003. Pour les morues étiquetées dans la baie de Fortune, les taux annuels moyens estimatifs étaient semblables (10-11 %) pour les quatre dernières années, quoique celles étiquetées dans l'arrière-baie, à Pool's Cove, ont été plus fortement exploitées (20-31 %) que celles étiquetées dans l'avant-baie, au large de Pass Island (4-6 %). D'après les étiquettes récupérées, la morue se déplace beaucoup entre la baie de Fortune et la baie de Plaisance. Le taux d'exploitation de la morue étiquetée dans 3Psd (banc Burgeo) semble avoir diminué, pour n'atteindre que 2 % en 2003 en comparaison de 4-9 % de 1998 à 2002; ce déclin peut être imputable à la fermeture, en 2003, de la pêche dirigée de la morue dans la zone de gestion voisine du nord du Golfe (3Pn4RS), ainsi qu'à des fermetures saisonnières et des restrictions touchant la pêche dirigée de la morue dans le secteur ouest de 3Ps (3Psa, 3Psd et, plus récemment, 3Pse/g). Les prises commerciales déclarées récoltées dans 3Psa/d de novembre 2002 à avril 2003 n'atteignaient que 260 t et, pour 2003-2004, ne totalisaient que 507,7 t. Ces données suggèrent que les ponctions potentielles de morue de 3Pn4RS imputables aux pêches d'hiver dans le secteur ouest de 3Ps au cours des deux dernières années de gestion sont relativement faibles et ont probablement peu d'incidence sur la dynamique de ce stock. Les estimations du taux d'exploitation annuel moyen en 2003 des morues étiquetées dans les eaux hauturières de 3Ps (3Psh) demeurent toujours faibles (1-2 %) malgré des prises hauturières de plus de 6 000 t. La couverture du programme d'étiquetage en haute mer a été élargie en 2003 avec l'aide de l'industrie, ce qui a permis de relâcher quelque 1 000 morues étiquetées dans le secteur sud de 3Psg et 3Psh en décembre. Jusqu'à maintenant, seules10 de ces morues ont été recapturées : une dans la baie de Plaisance, six dans les eaux hauturières de 3Ps et trois à des endroits inconnus dans 3Ps.

Introduction

A mark-recapture study of Atlantic cod (*Gadus morhua*), initiated in NAFO Subdiv. 3Ps during 1997, was updated with recaptures received up to 10 September 2004 from tagged cod released in previous years. The purpose of the study was to provide information on movement patterns of 3Ps cod as well as obtain ongoing estimates of exploitation rates on different components of the stock.

Annual estimates of exploitation are given for each tagging experiment conducted in 3Ps during 1997-2003 using the methods described in Brattey and Healey (2003a) with some minor modifications. This document also gives a summary of the spatial and temporal distribution of recaptures of tagged cod released in various regions of Subdiv. 3Ps during April 1997-December 2003. Previous results from post-moratorium cod tagging studies in 3Ps and adjacent areas are reported in Brattey (1999, 2000), Brattey and Healey (2003b), Brattey et al. (1999, 2002a), Lawson et al. (1998), Robichaud and Rose (2001, 2002). Historical cod tagging studies (prior to 1994) in the Newfoundland Region are summarized in Taggart et al. (1995), Myers et al. (1996, 1997), Brattey (1996). Further analyses of the data from the post-moratorium cod tagging experiments are presented elsewhere (Brattey and Cadigan, 2004; Cadigan and Brattey 1999a, b; 2000a, b; 2001, 2002, 2003a, 2003b; Lawson and Rose 2000; Lilly et al. 2001; Pope and Brattey 2001). Methods to estimate tagging mortality, and tag loss and reporting rates from the data reported herein are described in Brattey and Cadigan (2004) and Cadigan and Brattey (2003b, 2004).

Materials and Methods

Cod for tagging were captured with various gears (mostly hand-line and otter-trawl), measured (nearest cm) and tagged with one or two t-bar anchor tags inserted at the base of the first dorsal fin, and released. Experienced technicians conducted the tagging. Only cod ≥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. The tags were uniquely numbered and bore a return address as well as the value of the reward ($10 for one single, $20 for two singles, or $100 for high-reward). The tagging program was advertised extensively among those participating in the fishery. Details of the tagging experiments are summarised in Table 1. The number of cod tagged annually ranged from about 6,000 to 11,200. The sizes of tagged cod ranged from 45 to about 115 cm with mean lengths mostly in the 55-65 cm range. A total of 59 tagging experiments has been conducted at various sites in 3Ps; most tagging has been conducted on spawning and pre-spawning aggregations at the head of Placentia Bay (3Psc), the head of Fortune Bay (3Psb), off Pass Island in the outer reaches of Fortune Bay, in the Burgeo Bank-Hermitage Channel area (3Psa/d), in the Halibut Channel area (3Psh), and on one occasion off the north-western corner of St. Pierre Bank (3Psd)(Fig. 1). In 2003, an additional 999 cod were tagged in relatively shallow water (123-161 m) in the offshore (3Psg/h) during an industry trawl survey conducted in December; these cod were tagged by experienced retired DFO technicians who followed the same protocols used elsewhere in the current study.

Reported landings of cod from 3Ps (up to September 2004) and from neighbouring management areas in the northern Gulf (3Pn4RS) and eastern Newfoundland (3KL) during recent years were extracted from the Statistics Branch catch database and are summarized to aid in the interpretation of tag returns.

Estimation of exploitation rates

Development of the methods used to estimate exploitation rates is ongoing and the methods used here are similar to those described in Brattey and Healey (2003a). Data from tag releases in 1997-2003 and recaptures obtained during 1997-10 September 2004 were used herein. As in previous analyses (Brattey and Healey 2003a, b), we did not attempt to estimate population sizes using tag returns and commercial catches in this analysis, 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. Methods to estimate cod biomass from tagging data and catches are presented elsewhere (Lilly et al. 2001; Pope and Brattey 2001; Cadigan and Brattey 2001, 2002, 2003a).

Tag-induced mortality (τ) was estimated from experimental studies (Brattey and Cadigan 2004). Our method of estimating reporting rate (λ) is based on a high-reward tagging study, described in detail in Cadigan and Brattey (2003b) and modified slightly in Cadigan and Brattey (2004) and updated with recent recaptures. We used annual, region-specific estimates of reporting rate calculated from the high-reward tagging study; high-reward tags were assumed to have a reporting rate of 1.0.

Tag loss rates (ϕ) were estimated from a double-tagging study (see Cadigan and Brattey 2003b), which showed that tag loss mostly occurred in the first 3-4 months after release with only minimal losses thereafter. We used the model proposed by Kirkwood (1981) to estimate tag loss rates

$$\phi_t = ((\beta_0 / (\beta_0 + \beta_1 t))^{\beta_0} ; \ \beta_0, \beta_1 \geq 0$$

where t is the time at liberty. This model is more suitable than the proportional tag loss model proposed by Barrowman and Myers (1996). For each recapture year, we computed a time at liberty, which in the first year corresponds to 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 release. For subsequent years, time at liberty is calculated by incrementing the number of weeks between the annual median dates of recapture.

Our analyses has shown that the rate of loss of tags depends on position and that the front tag of a double tagged fish is lost at a faster rate than the back tag; thus, there are three types of recapture from a double tagged fish: (the front tag only, the back tag only, or both tags). The tag loss model was used to compute the proportion of initial number of tags applied that were retained at the median date of recapture for each recapture year. This was done separately for each type of tag return. Estimates of parameters β_0 and β_1 for the Kirkwood model were 0.0688 and 0.0476 for tags in position 1 and 0.0407 and 0.0203 for tags in position 2.

To estimate exploitation annually, we tracked the numbers of fish available for capture in each year, accounting for tag loss and assumed natural mortality. The instantaneous rate of natural mortality (m) assumed to be 0.2 per yr (i.e. 82% annual survival rate). The recaptures from each region (R) were adjusted by the reporting rate (R^*). In the initial year, we immediately removed those cod that die "instantly" due to tagging mortality. The estimates of loss are actually retention rates (ϕ) using

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Kirkwood's model and apportioned by the time at liberty. Natural mortality (m) was also apportioned by the time-at-liberty, i.e. $e^{-m(t/52)}$

Let $M(t)_{eff}$ denote the "effective" number of tagged fish available in year t prior to the fishery. After the fishery in year t, let $next_t$ denote the number of tagged fish remaining. For fish having a single tag, in the year of release, if T_0 is the number of fish tagged and released,

$$M(0)_{eff} = T_0(1-\tau)\phi_0 m_0,$$

and

$$next_0 = M(0)_{eff} - R^*_0.$$

In subsequent years,

$$M(t)_{eff} = next_{t-1}\delta_{L_t}\delta_{m_t}$$

where

$$\delta_{L_t} = \phi_t/\phi_{t-1} \quad \text{and} \quad \delta_{m_t} = m_t/m_{t-1},$$

and

$$next_t = M(t)_{eff} - R^*_t$$

Note that δ_{Lt} and δ_{mt} are the proportion of additional tag loss and natural mortality to be removed from the available population. We use such ratios because the values of N and m are relative to the initial numbers of tagged cod.

For fish that are double-tagged and released, additional attention is required when adjusting the annual loss rates and computing the effective number of tagged fish remaining. For example, in any given year, a double-tagged fish may lose neither or both tags, or, could lose only the anterior or posterior tag. First, consider those fish that have retained both of the tags:

$$M(0)_{eff} = T_{D0}(1-\tau)\phi_{A\_0}\phi_{B\_0}m_0$$

where ϕ_{A_0} and ϕ_{B_0} represent the tag retention of the anterior and posterior tags, and T_{D0} is the number of double-tagged fish released. After the fishery in the initial year,

$$next_0 = M(0)_{eff} - R^*_0.$$

In subsequent years,

$$M(t)_{eff} = next_{t-1}\delta_{L_t}\delta_{m_t}$$

where

$$\delta_{L_t} = \phi_{A\_t}\phi_{B\_t}/\phi_{A\_(t-1)}\phi_{B\_(t-1)} \quad \text{and} \quad \delta_{m_t} = m_t/m_{t-1},$$

so the loss adjustment is made for both tags. After the fishery, we again have

$$next_t = M(t)_{eff} - R^*_t.$$

Double-tagged fish that lose one of their tags create two additional types of return to track: those that have the anterior tag only, and those that have the posterior tag only. In the first year, such individuals can only come from the double-tagged fish. However, in subsequent years, individuals with only the anterior tag come from two sources: those that had both tags in the previous year or those with only the anterior tag (which was retained) in the previous year. Thus, the number of individuals available to the fishery with the anterior tag only can increase over time. The identical situation exists for the individuals retaining the posterior tag. The expressions below indicate how we track fish that have the anterior tag (only) in place. In the year of release,

$$M(0)_{eff} = T_{D0}(1-\tau)\phi_{A\_0}(1-\phi_{B\_0})m_0, \text{ and}$$

$$next_0 = M(0)_{eff} - R^*_0.$$

In subsequent years, (keeping in mind that individuals with the anterior tag come from two sources as described above),

$$M(t)_{eff} = next_{t-1}\delta_{L_{A\_t}}\delta_{m_t} + next_{D(t-1)}\delta_{L\_D_t}\delta_{m_t},$$

where

$$\delta_{L_{A\_t}} = \frac{\phi_{A\_t}}{\phi_{A\_(t-1)}}, \quad \delta_{L\_D_t} = \frac{\phi_{A\_t}}{\phi_{A\_(t-1)}}\left(1 - \frac{\phi_{B\_t}}{\phi_{B\_(t-1)}}\right) \text{ and } \delta_{m_t} = \frac{m_t}{m_{t-1}}.$$

Here, $next_{D(t-1)}$ refers to the numbers of fish with both tags remaining available, δ_{A_t} is the tag-loss adjustment for individuals having the anterior tag only in the previous year, and $\delta_{L\_D_t}$ is the tag-loss adjustment for double tagged fish in the previous year which have lost the posterior tag since the previous years fishery. Again we have

$$next_t = M(t)_{eff} - R^*_t.$$

Similar expressions are used to account for the numbers of fish available having the posterior tag only.

The exploitation rate $\mu(t)$ in year t for each experiment is estimated by summing the adjusted number of recaptures across tag types and dividing by the summed numbers of each tag type available to the fishery, i.e.:

$$\mu(t) = \frac{\sum_k R^*_{t(k)}}{\sum_k M(t)_{eff(k)}}.$$

The subscript k represents available tag types at time t. $M_{eff(k)}$ is the number of type k tags available at the time of the fishery in each year. Note that the annual median time at liberty is common across tag types within an experiment. Tagging experiments were conducted in consecutive years in many locations; thus multiple annual estimates of exploitation are given for some locations. Note that in some years tagged fish were released during the fishery and the first estimate of exploitation for these releases accounts for only a portion of the total exploitation in that year.

We also computed mean annual estimates of exploitation for each of the unit areas where fish were tagged. We used recaptures from the year of estimation and two preceding years in calculating these means, which were weighted by the numbers of tagged cod released (i.e. annual means for 2003 were based on recaptures from 2003, 2002 and 2001. Note that for some of the cod tagged early in the study (1997 and 1998) no more recaptures have been received and the tagged population is estimated to have declined to zero or very low numbers.

Results

Spatial and temporal distribution of cod landings

Reported landings of cod by unit area for NAFO Subdiv. 3Ps from 1997-unitil 1 Ocober 2004 are summarized in Table 2A and Fig. 2. There were substantial landings (>1,000 t) in most unit areas in most years, except 3Psg and 3Psd; that latter unit area is closed to directed cod fishing for much of the year. There have been no major changes in the distribution of landings over the past 3-4 years. Highest landings (33-51% of the entire TAC) have come from Placentia Bay (3Psc) (Fig. 2) and reported landings from Placentia Bay in 2003 are similar to those observed in 2002. In the offshore, landings have mostly been highest in 3Psf/h, which includes the southern Halibut Channel and the eastern portions of St. Pierre Bank. Note that the total annual catches reported herein for some years exclude catches where unit area was not reported and are therefore slightly lower than the totals reported in Brattey et al. (2004).

Reported annual landings by unit area for adjacent management areas are reported in Table 2B (NAFO Divs. 2J3KL) and Table 2C (Subdiv. 3Pn and Divs. 4RS). The TAC's in these adjacent management units have been smaller than those in 3Ps (typically 3,000-9,000 t). The highest landings per unit area from the northern Gulf stock have come from Subdiv. 3Pn, and unit areas 4Ra and 4Rb. From the northern cod stock area, highest landings have come well to the north of 3Ps from unit areas 3Ki, 3La and 3Lb; annual landings in southern 3L (3Lf/j/q) have typically been low (<700 t). A moratorium on directed cod fishing in both of these adjacent management areas was re-introduced during 2003 and is clearly reflected in the lower landings.

Numbers of recaptures

A matrix of the numbers of tagged cod reported as recaptured annually (for all tag types combined) up to 10 September 2004 is given by tagging experiment in Table 3. As in previous years, there have been substantial numbers of recaptures from most inshore tagging experiments, particularly those conducted in Placentia Bay during spring. Offshore tagging (Halibut Channel, Hermitage Channel, Burgeo Bank, NW St. Pierre Bank) has tended to generate substantially fewer recaptures. Tags have been returned from some experiments 6 years after release, although the numbers of returns have declined to zero in some of the earliest experiments conducted in 1997 and 1998.

Exploitation estimates

Annual estimates of exploitation (expressed as % of available numbers harvested) for each tagging experiment are summarized and grouped by unit area of release in Table 4. Note that the values for years prior to 2003 have been revised slightly from those reported in Brattey et al (2002a) and Brattey and Healey (2003); these differences reflect slight changes in the estimates of reporting rate (see Table 6), and recovery of a few additional tags from previous years. Values for 2004 for all experiments are preliminary as the fishery was still in progress.

The number of cod tagged has been too low in the western portion of the inshore (i.e. 3Psa) to draw firm conclusions about exploitation of cod tagged in that region. Among cod tagged in Fortune Bay, annual estimates for 2003 have tended to be low for cod tagged at Pass Island (4.0 – 6.0%) compared to those tagged at Poole's Cove (20.2 – 30.8%). Overall, the results indicate high exploitation during 2003 for cod in the Poole's Cove area, with 3 of 6 estimates exceeding 25.0%. The overall annual means for 3Psb as a whole have been similar over the past three years at 10-11%.

Among cod tagged in Placentia Bay, annual estimates of exploitation have been much higher than those for cod tagged in other regions of 3Ps, particularly during 1999 and 2000 when both the overall TAC and landings in Placentia Bay were highest (see Fig. 2). Annual estimates increased from 14-15% during 1997-1998 to a maximum of 34.0% during 1999 followed by a decline during the subsequent three years. The mean annual estimate of exploitation in 2003 for cod tagged in Placentia Bay (22.4%) is comparable to that estimated for 2002 (21.0%) and landings were similar in both years. Exploitation estimated from tagging in Placentia Bay appears to be tracking annual changes in landings observed since the fishery re-opened in 1997 (see Fig. 2).

Note that not all of the exploitation of these cod occurs in Placentia Bay itself (see Table 5). Reductions in catch from the cod fishery in adjacent 3KL during 2000 to 2003 may also have lowered the estimates because some of the cod tagged in Placentia Bay are known to migrate across the stock boundary into southern 3L. Interestingly, the closure of the directed cod fishery in 3KL during 2003 has not resulted in further decline in the estimate of exploitation for cod tagged in Placentia Bay during 2003. Also, the 2003 exploitation estimates from cod tagged in 3Psc prior to the spring of 1999 are based on very few recaptures (<5) and are consistently low; this may reflect growth and reduced selection of the available tagged fish from these experiments; most of these fish may have grown beyond the optimum selection size of gillnets which account for most of the catch. These recaptures were therefore not included when calculating annual means. There are no

recaptures from some of the oldest tagging experiments (1997 and 1998), suggesting that the tagged population from these experiments has now declined to very low numbers; this is not surprising given that any survivors would mostly be at least 12 years old and they have been fished quite heavily for at least five of the past seven years.

Among cod tagged in 3Psd since 1998, estimates of exploitation have been consistently low and notably lower than those observed in 3Psc and 3Psb, with annual means ranging from 8.8% in 1999 to only 1.7% in 2003. The individual estimates for 2003 were all low (1.3% to 1.9%) and the mean annual estimate for 2003 is the lowest in the time series. Many of the cod tagged in this region in recent years have subsequently been recaptured in western 3Ps or in 3Pn4RS. The low estimate for 2003 may reflect management measures that have reduced the cod landings from these regions in 2003 (see Table 2). Several measures have been introduced, beginning in late fall 2000 when unit area 3Psd was closed to directed cod fishing from 15 November to 15 April 2001. In the 2001/02 fishing season the closure in 3Psd was extended and applied from 15 November to June 30th following an FRCC recommendation related to protecting spawning aggregations. In the 2002/03 season this closure of 3Psd was continued and the area was expanded to include 3Pse/g; in addition, unit area 3Psa (as well as 3Psb/c) was closed from 1 March – April 30th to protecting spawning aggregations. In the 2003/04 season, the closure of 3Psd extended from 15 November to June 1st for vessels <65 ft (but remained at June 30th for vessels $\geq$65 ft); a further measure was introduced that restricted direct harvesting of cod in 3Psa during 15 November – 15 May to resident fishers only. The closures imposed in 2003/04 were rolled over for the 2004/05 fishing season. Furthermore, the directed cod fishery in the neighbouring northern Gulf management area (3Pn4RS) was closed completely in 2003/04, but reopened in 2004/05 with a TAC of 3,500 t.

Mean annual estimates of exploitation have consistently been lowest among cod tagged in Halibut Channel (3Psh) during April, with values ranging from 1.3-3.4% and little variation among individual experiments in spite of substantial landings, particularly in 2000 (see Fig. 2). The estimates for 2003 are again low in spite of substantial offshore landings of over 6,000 t. In 2003, tagging was also conducted in 3Psh and 3Psg in December to improve the coverage of this offshore region; however, only 10 of a total of 999 (1%) of cod tagged in December have been reported as recaptured as of 10 September 2004. Early indications are that both the numbers (Table 3) and locations of recapture (Table 5) are similar to those observed for cod tagged in this region in April.

Spatial and temporal distribution of recaptures

Annual summaries of the distribution of recaptures, grouped by unit area and year of release and adjusted by reporting rates, are given in Table 5; in addition, plots showing the annual distribution of recaptures (only for tags where exact recapture positions were reported) by unit area of release are shown in Figs. 3.1 to 7.21. These data indicate in a general sense where the exploitation of cod tagged in each region subsequently takes place; we emphasized that the distribution of recaptures is strongly influenced by changes in landings (Tables 2A, 2B, 2C).

Data are limited for 3Psa, but two small experiments involving a total of only 64 cod tagged have generated a small number of inshore recaptures in 3Ps west of the Burin Peninsula, with one offshore recapture in Halibut Channel (Fig. 3.1).

Most cod tagged near Pass Island, Poole's Cove, and other locations in Fortune Bay, show strong inshore residency even among recaptures taken 4-5 years later, with most recoveries coming from within Fortune Bay or eastward into neighbouring Placentia Bay (Figs. 4.1-4.13). There is little evidence of westward movement of these cod with only a few recaptures from 3Pn4RS especially from experiments conducted later in spring (late May). These experiments may have included some migrant fish from areas to the west. Small proportions of cod tagged in Fortune Bay have also been recovered from more distant regions such as southern 3L, offshore 3Ps, and 3Pn4RS, but in general there are no strong indications of any progressive dispersal away from the tagging region over time. The recaptures indicate that a substantial portion of the exploitation of cod tagged in Fortune Bay takes place in neighbouring Placentia Bay.

Cod have been tagged offshore in 3Psd (Hermitage Channel and the southern edge of Burgeo Bank) in April in five of the previous six years (Figs. 6.1-6.3 and Figs. 6.5-6.6); the exception was 2000 when no significant aggregations were located. The overall numbers recaptured have tended to be low except from the 1998 and 2001 releases; consequently, many of the percentages are based on small sample sizes, particularly in 2002 and 2003. Nonetheless, many of the tagged cod dispersed widely from the tagging area and these cod are therefore exploited in several regions. The distribution of recaptures extended west and northward into 3Pn4RS as far north as the Strait of Belle Isle (4Ra) often within 3 months of release (see Figs 6.1 and 6.2). Others migrated inshore and eastward along the south coast of Newfoundland into unit areas 3Psa, 3Psb, and 3Psc, and more rarely into southern 3L (Fig. 6.1). The proportion of recaptures from 3Pn4RS relative to 3Ps has varied annually. For example, there are no recaptures in 3Pn from cod tagged in 3Psd during 1999 (Fig 6.2), but several in 3Pn from cod tagged in 3Psd during 2001 (Fig. 6.3). Closure of the directed cod fishery in 3Pn4RS during 2003 makes comparison among years more difficult and most recaptures in recent years have come from within 3Ps. Few of the cod tagged in the Burgeo Bank-Hermitage Channel area have been recaptured on the southeast corner of St. Pierre Bank, or in Halibut Channel, in spite of substantial landings, suggesting little inter-mixing between cod tagged in these two offshore regions during April. The lack of recaptures close to the tagging site in 3Psd can be attributed at least partly to various seasonal closures of this region to directed cod fishing.

Cod tagged in 3Psd on the NW edge of St. Pierre Bank (i.e. eastward of the Hermitage Channel) show a marked difference in the distribution of recaptures compared to those tagged in 3Psd on the western side of the Hermitage Channel. To date, most of these cod have been exploited only short distances away eastward on St. Pierre Bank, or further afield inshore in Placentia Bay (Fig. 6.4). There are no recoveries of these cod from 3Pn4RS, in contrast to those tagged in the Burgeo Bank-Hermitage Channel area about 25 miles to the northwest (see Figs. 6.1-6.3, Figs. 6.5-6.6, and Table 5).

Cod have been tagged offshore in Halibut Channel (3Psh) during April in five consecutive years. (see Figs. 7.1-7.7 and Table 5). Exploitation of these cod has taken place mainly in three areas: (1) the slope edge at the bottom of Halibut Channel close to the area of release (3Psh), (2) shallow water on the south-east corner of St. Pierre Bank in unit areas (3Psf and 3Psh), or (3) inshore in Placentia Bay and around the Avalon Peninsula (3Psc and 3Lj/q/f). A few cod tagged in this region have also been reported from other regions (i.e. single recoveries from 3K and 4R). Overall, the distribution of recaptures has been consistent for 5 years, although substantially fewer recaptures have been obtained from the 2000 and 2001 releases in Halibut Channel relative to those released in 1998 and 1999. There have consistently been few recaptures from the western portion of the

inshore of 3Ps (i.e. 3Psa and 3Psb) in spite of substantial landings (see Table 2A, Fig. 2). Furthermore, there has been only a single recapture from the northern Gulf of St. Lawrence stock area (3Pn4RS) from >8,000 releases in 3Psg/h over the past 6 years.

Cod tagged in Placentia Bay (Fig. 3C) have mostly been exploited inshore within Placentia Bay or in neighbouring Fortune Bay. Typically over 80% of the recoveries have come from within Placentia Bay itself, even several years after tagging (Table 5). In each year, small proportions of recaptures have come from southern 3L, particularly in 1999, and more rarely northern 3L (i.e. 3La, 3Lb) or 3K. Most tagging experiments in Placentia Bay in spring have also resulted in a small number of recaptures clustered at the slope edge at the bottom of the Halibut Channel, or scattered across St. Pierre Bank. However, the number of reported offshore recaptures from Placentia Bay tagging has been small in spite of substantial offshore landings (see Table 2A, Fig. 2).

Discussion

The updated results described herein are generally similar to those given in our previous analyses (Brattey et al. 2002a, Brattey and Healey 2003a), and again show limited mixing of cod from different portions of the 3Ps stock area as well as higher exploitation of adult cod in the inshore. Our findings indicate strong inshore residency among fish tagged in spring in Fortune Bay and Placentia Bay. These fish appear to disperse along the inshore during summer, particularly in an easterly direction, with their distribution extending into 3L in some years. There appears to be limited offshore movement of these cod with only a few offshore recaptures even several years after release. These inshore sub-components, particularly in Placentia Bay, are supplemented during late spring, summer, and fall by seasonal migrants from offshore areas. The tagging shows that the inshore catch comprises a mixture of cod that includes inshore fish as well as migratory offshore cod from Burgeo Bank, St. Pierre Bank, and the Halibut Channel. In contrast, the offshore catch (3Ps/e/f/g/h) appears to be comprised mainly of fish that reside on St. Pierre Bank and in Halibut Channel throughout the year.

Although the tagging in the Burgeo Bank-Hermitage Channel area in recent years suggests that there may be mixing with Gulf cod even as late as mid-April in some years, our estimates of overall exploitation for cod tagged in this region are low and suggest cod present in this area at that time, irrespective of their stock affinity, have not been heavily exploited. The results for 2003 in particular indicate very low exploitation of these cod and are consistent with the decline in landings in western 3Ps and 3Pn4RS. Reported catches from these areas have been declining in recent years, probably due to a combination of seasonal restrictions in the cod fishery (described in the Results), closure of the directed cod fishery in 3Pn4RS during 2003/04, and the switch from a competitive fishery to individual quotas in western 3Ps. Reported commercial landings from 3Psa/d combined during November-April 2002/2003 were only 260 t and from November-April 2003/2004 totalled 507.7 t (see Brattey et al. 2004). These data suggest that potential removals of 3Pn4RS cod from this area in the past two management years are relatively small and likely to have little influence on the dynamics of that stock.

Our findings indicate that cod tagged in Placentia Bay continue to be more heavily exploited than those in most other regions, although cod tagged at the head of Fortune Bay are showing comparable

exploitation rates. Catch rates in Placentia Bay declined after the fishery reopened in 1997, but have remained similar over the past 3-4 years (Brattey et al. 2004), suggesting that current exploitation rates are continuing to prevent local rebuilding of this component of the stock. Our estimates of exploitation for cod in Placentia Bay during 2003 (20%) are similar to those estimated for 2002 and correlate well with the stable landings both overall and from within Placentia Bay. However, catch rate indices from sentinel and logbooks for the <35' sector have remained low but largely unchanged for the past three years. For this local stock to rebuild it appears that further reductions in exploitation (and/or better recruitment) would be required. In contrast, catch rate indices (sentinel line-trawl and under 35" line-trawl) for Fortune Bay (3Psb) as a whole have been quite stable in recent years (see Brattey et al 2003, 2004).

The estimates of exploitation for the offshore areas in 3Ps continue to be much lower than those for other regions, in spite of substantial offshore landings of over 6,000 t per annum in the past 3 years (Fig 2). As in the previous analyses (Brattey et al. 2002a, Brattey and Healey 2003b) there are concerns that the previous estimates for the offshore may be more uncertain because of the sparseness of the tagging coverage, depth of capture of cod for tagging, and limited spatial extent of activity in the offshore fishery. We have attempted to address these concerns by conducting tagging offshore during December as part of the industry trawl survey (see McClintock 2003). Results to date are preliminary, but agree with findings from spring tagging, with only a small percentage recaptured and these taken offshore near the tagging site or inshore in Placentia Bay.

Acknowledgements

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Table 1. Summary of details for cod tagging experiments conducted in NAFO Subdiv. 3Ps during 1997-2003 (PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay).

Year & expt no.	DFO Stat. area	Area of release	Dates	Gear	Depth (m)	Number tagged	Mean length (cm)
1997-001	3Psc	Bar Haven, NW PB	9-12 Apr.	handline	48-60	996	62.1
1997-002	3Psc	Clattice Hbr., NW PB	10 Apr.	handline	58-60	966	52.3
1997-004	3Psc	Bar Haven, NW PB	17-18 May	handline	50	817	65.0
1997-005	3Psc	St. Bride's, SE PB	25-28 May	handline	40	709	66.4
1997-006	3Psc	Oderin Bank, W PB	24-26 Jun.	handline	40	963	58.9
1997-008	3Psc	Lord's Cove, SW PB	25 Jun.-18 Jul.	trap/handline	18-40	793	53.5
1997-015	3Psc	Iona Islands, E PB	6-8 Nov.	handline	30-50	778	61.3
1998-001	3Psh	Halibut Channel	2-5 Apr.	otter trawl	181-307	1842	63.9
1998-002	3Psd	Hermitage Channel	5-7 Apr.	otter trawl	231-344	1352	53.9
1998-003	3Psc	Bar Haven, NW PB	22-25 April	handline	21-50	2073	61.0
1998-004	3Psc	Paradise Sound, W PB	27-29 April	otter trawl	151-206	1212	60.8
1998-005	3Psc	Wareham Rock, NW PB	May 1-3	handline	41-53	1037	61.9
1998-006	3Psb	Pool's Cove, FB	May 20-29	handline	67	938	57.5
1998-007	3Psc	Bar Haven, NW PB	19-24 Oct.	h'line/otter trl.	41-60	511	60.3
1998-008	3Psc	Eastern Channel, PB	17-22 Oct.	handline	52-80	883	58.8
1999-003	3Psb	South of Pass Island, FB	8 Apr.	otter trawl	211-217	1293	57.0
1999-004	3Psc	head of Placentia Bay	29 Apr.-7 May	handline	20-70	2422	63.2
1999-002	3Psd	Hermitage Channel	4-7 Apr.	otter trawl	192-322	464	59.8
1999-001	3Psh	Halibut Channel	1-3 Apr.	otter trawl	149-239	1808	68.0
1999-039	3Psc	head of Placentia Bay	8-17 Nov	h'line/otter tr'l	50	2152	63.0
1999-043	3Psa	Hermitage Bay	30 Nov-1 Dec	handline	50	57	52.9
2000-001	3Psh	Halibut Channel	1-7 Apr	otter trawl	203-259	1044	85.8
2000-003	3Psd	Burgeo Bank	4-Apr	otter trawl	212-318	5	77.0
2000-004	3Psb	Pass Island	5-7 Apr	otter trawl	136-220	1665	53.1
2000-006	3Psb	Pool's Cove, FB	17-19 Apr	line-trawl	60-112	752	55.0
2000-007	3Psc	inner Placentia Bay	26 Apr - 6 May	handline	16-50	2494	60.5
2000-008	3Psc	inner Placentia Bay	27 Apr - 4 May	otter trawl	30-107	528	59.2
2000-033	3Psc	Bar Haven, PB	5-12 Nov.	handline	33-55	1165	59.0
2000-034	3Psc	Saturday Ledge, PB	10-12 Nov.	otter trawl	35-55	792	58.7
2000-035	3Psc	Eastern Channel, PB	13-15 Nov.	handline	35-63	1212	58.7
2001-001	3Psb	Pool's Cove, FB	9-11 Jan.	handline	55-92	200	57.5
2001-002	3Psb	Pool's Cove, FB	9-11 Jan.	linetrawl	73-92	388	56.1
2001-003	3Psh	Halibut Channel	12-14 Apr.	otter trawl	170-248	1144	80.8
2001-006	3Psd/a	Burgeo Bank	15-17 Apr.	otter trawl	179	999	53.8
2001-007	3Psd	NW St. Pierre Bank	16-17 Apr.	otter trawl	186-193	666	89.0
2001-008	3Psb	Pass Island, FB	18 Apr.	otter trawl	178-224	477	54.8
2001-009	3Psb	Fortune Bay	25-26 Apr.	handline	50-185	60	52.8
2001-010	3Psc	inner Placentia Bay	28 Apr.-6 May	otter trawl	35-230	1704	57.1
2001-011	3Psc	inner Placentia Bay	28 Apr.-7 May	handline	30-60	2273	58.7
2002-001	3Psb	Pool's Cove, FB	8-10 Jan.	handline	31-69	408	54.2
2002-002	3Psb	Pool's Cove, FB	8-10 Jan.	linetrawl	60-76	223	55.4
2002-003	3Psh	Halibut Channel	11-18 Apr.	otter trawl	150-279	1509	56.5
2002-004	3Psb	Pass Island, FB	13-14 Apr.	otter trawl	219-239	1792	54.0
2002-006	3Psd	SE Burgeo Bank	14-15 Apr.	otter trawl	136-369	963	64.8
2002-007	3Psc	inner Placentia Bay	27 Apr.-7 May	handline	20-45	1832	55.5
2002-008	3Psc	inner Placentia Bay	28 Apr.-7 May	otter trawl	17-48	1399	56.4
2002-012	3Psb	Grand Bank, FB	18 Jun.	handline	67	138	52.0
2002-024	3Psc	inner Placentia Bay	12-18 Nov.	handline	29-51	1676	55.6
2003-002	3Psh	Halibut Channel	12-13 Apr.	otter trawl	184-295	133	53.4
2003-003	3Psb	Pass Island, FB	14-15 Apr.	otter trawl	208-231	1481	52.2
2003-004	3Psd	Burgeo Bank	15-16 Apr	otter trawl	277-347	878	63.0
2003-005	3Psc	Placentia Bay	28 Apr.-11 May	handline	14-70	3427	55.5
2003-006	3Psb	Fortune Bay	16-22 Jun.	hand-line	39-80	1384	54.0
2003-007	3Psb	Fortune Bay	16-22 Jun.	h'line/otter trawl	34-160	630	54.4
2003-008	3Psc	Placentia Bay	11-18 Nov	handline	39-65	1645	55.4
2003-009	3Psc	Placentia Bay	18-19 Nov	otter trawl	74-145	634	53.6
2003-010	3Psh	Halibut Channel	9-10 Dec.	otter trawl	150-161	488	60.4
2003-011	3Psg	South St. Pierre Bank	10-Dec.	otter trawl	123-138	511	59.8

Table 2A. Reported landings of cod from unit areas in NAFO Subdiv. 3Ps during 1997-2004. (landings for 2004 are to 1 October as the fishery was still in progress).

Year	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh	Totals
1997	1,191	1,791	4,956	256	110	90	0	1,314	9,708
1998	1,573	2,428	7,102	1,274	698	1,108	377	4,713	19,274
1999	2,697	3,206	11,654	873	360	2,856	804	2,109	24,558
2000	1,718	2,263	8,774	249	1,003	3,183	156	7,742	25,087
2001	1,273	2,398	5,853	343	262	1,404	120	3,349	15,002
2002	1,353	2,302	4,892	356	1,389	1,144	92	3,292	14,819
2003	1,328	2,536	4,825	234	1,401	1,358	171	3,408	15,261
2004	712	1,529	3,135	223	2	4	16	2,281	7,901

Table 2B. Reported landings of cod from inshore unit areas in NAFO Divs. 3KL during 1998-2003. Most of the landings in 3Lb during 2003 were from a fish kill in Smith Sound, Trinity Bay during April. Total reported offshore landings have been < 50 t per annum.

Year	3Ka	3Kd	3Kh	3Ki	3La	3Lb	3Lf	3Lj	3Lq	Totals
1998	5	122	661	1,331	1,113	649	411	402	147	4,840
1999	24	205	1,100	2,299	1,462	1,686	702	698	268	8,444
2000	13	57	204	1,188	1,477	1,442	398	451	211	5,441
2001	27	184	440	1,117	1,546	2,042	592	486	434	6,868
2002	8	37	133	444	1,150	1,503	304	288	285	4,153
2003	4	6	14	32	87	862	22	13	28	1,069

Table 2C. Reported landings of cod from unit areas in NAFO Subdiv. 3Pn and Divs. 4RS during 1997-2003.

Year	3PN	4Rd	4Rc	4Rb	4Ra	4Sv	4Sw	4Sxyz	Totals
1997	2,006	299	593	600	806	141	327	20	4,792
1998	870	636	281	367	387	61	476	33	3,111
1999	1,165	944	908	1,478	1,551	124	632	88	6,890
2000	1,478	800	728	1,439	1,215	180	660	140	6,640
2001	1,740	717	995	1,269	1,310	252	570	81	6,934
2002	1,713	591	795	1,377	1,172	123	686	69	6,526
2003	35	59	14	55	20	19	60	13	276

Table 3. Annual summary of reported recaptures (all tag types combined) for cod tagged and released in NAFO Subdiv. 3Ps during 1997-2003 (PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay) and recaptured during 1997-2004.

Year & expt no.	DFO Stat. area	Area of release	Dates of release	Number tagged	Reported recaptures								
					1997	1998	1999	2000	2001	2002	2003	2004	unk'n
1997-001	3Psc	Bar Haven, NW PB	9-12 Apr.	996	78	69	72	35	8	3	1	0	8
1997-002	3Psc	Clattice Hbr., NW PB	10 Apr.	966	91	42	54	26	7	5	2	0	6
1997-004	3Psc	Bar Haven, NW PB	17-18 May	817	103	43	84	49	5	5	0	0	6
1997-005	3Psc	St. Bride's, SE PB	25-28 May	709	27	46	86	41	8	1	1	0	5
1997-006	3Psc	Oderin Bank, W PB	24-26 Jun.	963	16	57	36	16	10	0	1	0	5
1997-008	3Psc	Lord's Cove, SW PB	25 Jun.-18 Jul.	794	28	69	50	26	13	3	2	0	3
1997-015	3Psc	Iona Islands, E PB	6-8 Nov.	784	0	39	89	32	9	2	0	0	5
			Total	6029	343	365	471	225	60	19	7	0	0
1998-001	3Psh	Halibut Channel	2-5 Apr.	1842	.	24	23	16	7	4	2	0	3
1998-002	3Psd	Hermitage Channel	5-7 Apr.	1352	.	39	50	20	10	3	0	0	2
1998-003	3Psc	Bar Haven, NW PB	22-25 April	2073	.	124	313	141	34	9	4	0	16
1998-004	3Psc	Paradise Sound, W PB	27-29 April	1212	.	152	192	100	20	4	6	1	14
1998-005	3Psc	Wareham Rock, NW PB	May 1-3	1037	.	81	208	91	25	6	5	1	13
1998-006	3Psb	Pool's Cove, FB	May 20-29	938	.	87	91	43	25	13	3	1	1
1998-008	3Psc	Bar Haven, NW PB	19-24 Oct.	511	.	6	80	38	22	9	3	1	1
1998-009	3Psc	Eastern Channel, PB	17-22 Oct.	883	.	29	103	84	38	19	3	1	8
			Total	9848		542	1060	533	181	67	26	5	58
1999-001	3Psh	Halibut Channel	1-3 Apr.	1808	.	.	39	45	20	14	6	3	2
1999-002	3Psd	Hermitage Channel	4-7 Apr.	464	.	.	29	12	2	6	1	0	0
1999-003	3Psb	South of Pass Island, FB	8 Apr.	1293	.	.	76	59	31	18	4	2	2
1999-004	3Psc	head of Placentia Bay	29 Apr.-4 May	2422	.	.	402	275	110	34	13	2	30
1999-039	3Psc	head of Placentia Bay	8-17 Nov	2152	.	.	68	370	124	44	9	3	24
1999-043	3Psa	Hermitage Bay	30 Nov-1 Dec	57	.	.	1	6	2	1	0	0	0
			Total	8196			615	767	289	117	33	10	58
2000-001	3Psh	Halibut Channel	1-7 Apr	1044	.	.	.	2	12	2	2	2	0
2000-003	3Psd	Burgeo Bank	4-Apr	5	.	.	.	0	0	0	0	0	0
2000-004	3Psb	Pass Island	5-7 Apr	1665	.	.	.	92	45	46	26	5	2
2000-006	3Psb	Pool's Cove, FB	17-19 Apr	752	.	.	.	60	63	34	18	1	5
2000-007	3Psc	inner Placentia Bay	26 Apr - 6 May	2494	.	.	.	312	272	107	20	3	22
2000-008	3Psc	inner Placentia Bay	27 Apr - 4 May	528	.	.	.	65	42	26	14	1	5
2000-033	3Psc	Bar Haven, PB	5-12 Nov.	1165	.	.	.	43	153	40	15	6	7
2000-034	3Psc	Saturday Ledge, PB	10-12 Nov.	792	.	.	.	40	79	45	16	2	9
2000-035	3Psc	Eastern Channel, PB	13-15 Nov.	1212	.	.	.	50	129	40	26	1	10
			Total	9657				664	795	340	137	21	60
2001-001	3Psb	Pool's Cove, FB	9-11 Jan.	200	.	.	.	.	25	13	8	2	0
2001-002	3Psb	Pool's Cove, FB	9-11 Jan.	388	.	.	.	.	52	27	12	1	3
2001-003	3Psh	Halibut Channel	12-14 Apr.	1144	.	.	.	.	10	13	7	2	1
2001-006	3Psd/a	Burgeo Bank	15-17 Apr.	999	.	.	.	.	55	32	7	3	1
2001-007	3Psd	NW St. Pierre Bank	16-17 Apr.	666	.	.	.	.	25	9	3	0	1
2001-008	3Psb	Pass Island, FB	18 Apr.	477	.	.	.	.	14	15	10	0	0
2001-009	3Psb	Fortune Bay	25-26 Apr.	60	.	.	.	.	4	5	2	1	0
2001-010	3Psc	inner Placentia Bay	28 Apr.-6 May	1704	.	.	.	.	216	175	74	7	22
2001-011	3Psc	inner Placentia Bay	28 Apr.-7 May	2273	.	.	.	.	326	189	65	6	18
2001-025	3Psa	Ramea	1 Aug.	7	.	.	.	.	0	1	0	0	0
2001-027	3Psc	inner Placentia Bay	22 Nov.	350	.	.	.	.	5	48	19	1	2
			Total	8268					732	527	207	23	48
2002-001	3Psb	Pool's Cove, FB	8-10 Jan.	408	.	.	.	.	.	35	37	3	1
2002-002	3Psb	Pool's Cove, FB	8-10 Jan.	223	.	.	.	.	.	31	18	0	1
2002-003	3Psh	Halibut Channel	11-18 Apr.	1509	.	.	.	.	.	13	14	4	0
2002-004	3Psb	Pass Island, FB	13-14 Apr.	1792	.	.	.	.	.	47	35	13	0
2002-006	3Psd	SE Burgeo Bank	14-15 Apr.	963	.	.	.	.	.	13	7	2	0
2002-007	3Psc	inner Placentia Bay	27 Apr.-7 May	1832	.	.	.	.	.	219	190	19	3
2002-008	3Psc	inner Placentia Bay	28 Apr.-7 May	1399	.	.	.	.	.	188	154	18	4
2003-010	3Psh	Halibut Channel	9-10 Dec.	488	.	.	.	.	.	.	1	3	0
2003-011	3Psg	South St. Pierre Bank	10-Dec.	511	.	.	.	.	.	.	0	6	0
			Total	11211							652	191	10

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Table 4. Annual estimates of exploitation (harvest rates) by experiment for cod tagged in NAFO Subdiv. 3Ps during 1997-2004 Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss and assumed natural mortality. Dark shaded cells represent estimates for experiments conducted during the fishing season and account for only a portion of exploitation in the year of release. Boxed cells (light shading) indicate values used to compute annual means for each area of release. See text for further details.

					Reported annual landings (t)							
					9,045	19,694	28,111	25,100	15,460	14,819	15,260	7,900
DFO Stat.	Year &			Number	Exploitation rates (% harvested)							
area	expt no.	Area of release	Dates	tagged	1997	1998	1999	2000	2001	2002	2003	*2004
3Psa	1999-043	Hermitage Bay	30 Nov-1 Dec	57	.	.	4.0	22.1	18.9	12.6	0.0	0.0
"	2001-025	Ramea	1-Aug	7	.	.	.	.	0.0	41.1	0.0	0.0
		Annual mean exploitation						22.1	16.9	15.7	0.0	0.0
3Psb	1998-006	Poole's Cove, FB	20-29 May	938	.	11.8	24.6	15.2	17.8	13.0	1.8	2.5
"	1999-003	Pass Island, FB	8-Apr	1293	.	.	10.9	10.6	7.7	6.3	1.9	1.0
"	2000-004	Pass Island	5-7 Apr	1665	.	.	.	8.0	5.9	8.5	6.0	2.0
"	2000-006	Poole's Cove, FB	17-19 Apr	752	.	.	.	13.3	18.9	18.0	12.1	1.3
"	2001-001	Poole's Cove, FB	9-11 Jan	200	.	.	.	.	26.3	23.8	25.5	10.3
"	2001-002	Poole's Cove, FB	9-11 Jan	388	.	.	.	.	29.0	27.2	20.2	2.7
"	2001-008	Pass Island, FB	18-Apr	477	.	.	.	.	4.6	6.0	5.9	0.0
"	2001-009	Fortune Bay	25-26 Apr	60	.	.	.	.	10.5	16.6	10.3	8.0
"	2002-001	Poole's Cove, FB	8-10 Jan	408	.	.	.	.	.	16.6	29.0	4.2
"	2002-002	Poole's Cove, FB	8-10 Jan	222	.	.	.	.	.	28.5	30.8	0.0
"	2002-004	Pass Island, FB	13-14 Apr	1792	.	.	.	.	.	3.8	4.0	1.7
"	2002-012	Grand Bank, FB	18-Jun	138	.	.	.	.	.	7.4	6.0	4.2
"	2003-003	Pass Island, FB	14-15 Apr	1481	.	.	.	.	.	.	5.8	2.5
"	2003-006	Fortune Bay	16-22 Jun	1384	.	.	.	.	.	.	8.0	5.6
"	2003-007	Fortune Bay	16-22 Jun	630	.	.	.	.	.	.	3.9	1.3
		Annual mean exploitation				11.8	16.7	11.0	11.0	11.2	10.0	2.9
3Psc	1997-001	Bar Haven, NW PB	9-12 Apr	996	14.6	19.3	31.1	16.4	11.7	6.7	0.0	0.0
"	1997-002	Clattice Hbr., NW PB	10-Apr	966	11.7	9.8	21.6	15.9	7.1	5.6	0.0	0.0
"	1997-004	Bar Haven, NW PB	17-18 May	817	17.4	13.3	33.9	35.2	0.0	4.2	0.0	0.0
"	1997-005	St. Bride's, SE PB	25-28 May	709	5.8	19.4	55.3	59.6	12.6	25.7	0.0	0.0
"	1997-006	Oderin Bank, W PB	24-26 Jun	963	2.6	12.0	11.2	6.8	7.3	0.0	0.0	0.0
"	1997-008	Lord's Cove, SW PB	25 Jun-18 Jul	793	6.7	22.9	31.0	22.1	9.0	11.4	0.0	0.0
"	1997-015	Iona Islands, E PB	6-8 Nov	778	0.0	11.8	39.7	18.8	10.9	6.1	0.0	0.0
"	1998-003	Bar Haven, NW PB	22-25 Apr	2073	.	9.9	36.6	25.0	9.0	2.7	2.2	0.0
"	1998-004	Paradise Sound, W PB	27-29 Apr	1212	.	21.5	39.1	39.9	16.2	2.4	14.1	0.0
"	1998-005	Wareham Rock, NW PB	1-3 May	1037	.	13.8	46.5	42.6	17.0	3.2	7.2	4.6
"	1998-008	Bar Haven, NW PB	19-24 Oct	511	.	2.4	37.7	25.0	41.3	18.7	7.7	11.3
"	1998-009	Eastern Channel, PB	17-22 Oct	883	.	4.6	27.6	30.2	24.7	24.6	4.0	0.0
"	1999-004	inner Placentia Bay	29 Apr.-7 May	2422	.	.	33.6	32.7	25.9	13.6	7.4	1.4
"	1999-039	inner Placentia Bay	8-17 Nov	2152	.	.	6.3	37.7	26.5	16.4	4.5	2.6
"	2000-007	inner Placentia Bay	26 Apr - 6 May	2494	.	.	.	20.4	28.6	16.7	3.7	1.5
"	2000-008	inner Placentia Bay	27 Apr - 4 May	528	.	.	.	17.9	21.1	20.7	18.2	2.5
"	2000-033	Bar Haven, PB	5-12 Nov	1165	.	.	.	5.4	30.6	15.9	8.4	3.8
"	2000-034	Saturday Ledge, PB	10-12 Nov	792	.	.	.	8.9	26.1	25.3	15.0	2.9
"	2000-035	Eastern Channel, PB	13-15 Nov	1212	.	.	.	6.8	26.0	15.3	13.3	0.8
"	2001-010	inner Placentia Bay	28 Apr.-6 May	1704	.	.	.	.	22.0	28.3	20.6	3.0
"	2001-011	inner Placentia Bay	28 Apr.-7 May	2273	.	.	.	.	23.9	22.8	13.5	1.6
"	2001-027	western Channel, PB	22-23 Nov	350	.	.	.	.	1.8	31.6	24.6	2.0
"	2002-007	inner Placentia Bay	27 Apr - 7 May	1832	.	.	.	.	.	19.5	27.6	4.1
"	2002-008	inner Placentia Bay	28 Apr - 7 May	1399	.	.	.	.	.	22.8	30.8	6.5
"	2002-024	inner Placentia Bay	12-18 Nov	1676	.	.	.	.	.	6.8	26.6	6.3
"	2003-005	inner Placentia Bay	28 Apr.-11 May	3427	.	.	.	.	.	.	20.7	5.9
"	2003-008	inner Placentia Bay	11-18 Nov	1645	.	.	.	.	.	.	4.0	3.7
"	2003-009	inner Placentia Bay	18-19 Nov	634	.	.	.	.	.	.	1.3	1.8
		Annual mean exploitation			14.4	14.8	34.0	30.4	25.9	21.0	22.4	5.1

Table 4. Cont'd.

					Reported annual landings (t)							
					9,045	19,694	28,111	25,100	15,460	14,819	15,260	7,900
DFO Stat.	Year &			Number	Exploitation rates (% harvested)							
area	expt no.	Area of release	Dates	tagged	1997	1998	1999	2000	2001	2002	2003	*2004
3Psd	1998-002	Hermitage Channel	5-7 Apr	1352	.	5.1	8.3	3.3	3.5	1.1	0.0	0.0
"	1999-002	Hermitage Channel	4-7 Apr	464	.	.	10.4	6.5	1.4	4.8	1.1	0.0
"	2001-006	Burgeo Bank	15-17 Apr	999	.	.	.	.	9.9	9.4	1.9	1.2
"	2001-007	NW St. Pierre Bank	16-17 Apr	666	.	.	.	.	5.8	3.1	1.3	0.0
"	2002-006	SE Burgeo Bank	14-15 Apr	963	.	.	.	.	.	2.5	1.9	0.5
"	2003-004	Burgeo Bank	15-16 Apr	878	.	.	.	.	.	.	1.8	1.1
		Annual mean exploitation				5.1	8.8	4.1	6.8	5.3	1.7	0.8
3Psh	1998-001	Halibut Channel	2-5 Apr	1842	.	2.1	3.1	2.5	1.0	0.0	0.0	0.0
"	1999-001	Halibut Channel	1-3 Apr	1808	.	.	3.8	5.1	3.1	2.8	1.2	0.0
"	2000-001	Halibut Channel	1-7 Apr	1044	.	.	.	0.4	2.0	0.4	0.4	1.1
"	2001-003	Halibut Channel	12-14 Apr	1144	.	.	.	.	1.4	1.9	1.3	0.6
"	2002-003	Halibut Channel	11-18 Apr	1509	.	.	.	.	.	1.5	1.6	0.5
"	2003-002	Halibut Channel	12-13 Apr	133	.	.	.	.	.	.	2.3	0.0
"	2003-010	Halibut Channel	9-10 Dec.	488	.	.	.	.	.	.	0.3	1.0
3Psg	2003-011	South St. Pierre Bank	10-Dec.	511	.	.	.	.	.	.	0.0	1.8
		Annual mean exploitation				2.1	3.4	3.0	2.3	1.3	1.5	0.8

* partial landings and exploitation, based on recorded catch and tags received up to 10 September 2004

Table 5. Annual distribution of recaptures of cod tagged and released in various regions of NAFO Subdiv. 3Ps during 1997-2003. Recaptures were adjusted by region-specific reporting rates estimated from a high-reward tagging study. Shaed cells give the percentage recaptured in the area of release. Values for 2004 are based on tags received to 10 September 2004.

Release Area	Release year	Number tagged	Recapture year	Adj. Nos. recap'd	% of annual recaptures													
					3K	3LA	3LB	3LF	3LJ	3LQ	3NO	3PSA	3PSB	3PSC	3PSD	3PSOFF	4RS3PN	UNK
3PSA	1999	57	1999	1	0.0	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
			2000	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.7	14.3	0.0	0.0	0.0	0.0	0.0
			2001	3	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	0.0
			2002	1	0.0	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
	2001	7	2002	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	0.0
3PSB	1998	939	1998	109	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	70.6	17.4	0.0	0.0	4.6	0.0
			1999	115	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	65.2	20.9	0.0	0.0	5.2	1.7
			2000	50	0.0	0.0	0.0	0.0	2.0	0.0	0.0	6.0	70.0	20.0	0.0	2.0	0.0	0.0
			2001	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	51.7	27.6	0.0	0.0	3.4	0.0
			2002	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.3	6.7	0.0	0.0	0.0	0.0
			2003	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	33.3	0.0	0.0	0.0	0.0
			2004	1	0.0	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
	1999	1293	1999	99	0.0	0.0	0.0	0.0	1.0	1.0	0.0	4.0	28.3	64.6	0.0	1.0	0.0	0.0
			2000	70	0.0	0.0	0.0	4.3	1.4	1.4	0.0	7.1	38.6	40.0	0.0	4.3	2.9	0.0
			2001	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	19.4	66.7	0.0	2.8	0.0	2.8
			2002	21	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	14.3	66.7	0.0	4.8	9.5	0.0
			2003	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0
	2000	2417	2000	181	0.0	0.0	0.0	0.0	0.6	0.0	0.0	3.3	55.2	34.8	0.0	0.6	1.7	3.9
			2001	128	0.0	0.0	0.0	0.0	0.8	2.3	0.0	3.1	62.5	25.8	0.8	0.8	3.1	0.8
			2002	94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	48.9	40.4	0.0	1.1	0.0	1.1
			2003	52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.5	34.6	0.0	1.9	0.0	1.9
			2004	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	25.0	0.0	0.0	0.0	0.0
	2001	1125	2001	109	0.0	0.0	0.0	0.0	0.9	3.7	0.0	2.8	59.6	31.2	0.0	0.0	0.0	1.8
			2002	70	0.0	0.0	0.0	0.0	0.0	1.4	0.0	5.7	65.7	24.3	0.0	0.0	0.0	2.9
			2003	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	47.4	44.7	0.0	0.0	2.6	2.6
			2004	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	20.0	0.0	0.0	0.0	0.0
	2002	2560	2002	144	0.0	0.0	0.0	0.0	0.7	0.0	0.0	2.8	54.2	33.3	0.0	0.0	1.4	7.6
			2003	109	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	61.5	33.0	0.0	3.7	0.0	0.9
			2004	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	55.0	0.0	0.0	0.0	5.0
	2003	3495	2003	178	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	74.2	19.7	0.0	0.6	0.0	0.0
			2004	78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	55.1	35.9	0.0	0.0	0.0	3.8

cont'd

Table 5. Cont'd.

Release Area	Release year	Number tagged	Recapture year	Adj. Nos. recap'd	3K	3LA	3LB	3LF	3LJ	3LQ	3NO	3PSA	3PSB	3PSC	3PSD	3PSOFF	4RS3PN	UNK
													% of annual recaptures					
3PSC	1997	6029	1997	446	0.0	0.0	0.0	0.2	0.2	0.7	0.0	0.0	4.3	94.4	0.0	0.2	0.0	0.0
			1998	472	0.0	0.0	0.0	1.3	4.2	1.1	0.6	0.2	12.9	75.6	0.6	1.5	0.4	1.5
			1999	603	0.3	0.5	0.0	3.2	1.7	1.7	0.0	1.0	6.8	82.6	0.0	1.0	0.0	1.3
			2000	263	0.4	1.1	0.0	0.0	0.8	1.1	0.0	1.5	6.5	81.4	0.0	5.3	0.4	1.5
			2001	69	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.4	11.6	79.7	0.0	5.8	0.0	0.0
			2002	23	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	21.7	52.2	0.0	17.4	0.0	4.3
			2003	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	75.0	0.0	12.5	0.0	0.0
	1998	5716	1998	488	0.0	0.0	0.0	2.0	4.5	1.2	0.0	0.2	1.0	90.2	0.0	0.0	0.0	0.8
			1999	1091	0.4	0.5	0.0	2.5	1.8	1.4	0.0	0.2	4.3	86.6	0.0	0.8	0.0	1.6
			2000	519	0.6	0.2	0.0	0.4	0.4	2.5	0.0	0.8	4.6	88.2	0.0	1.5	0.0	0.8
			2001	157	1.3	0.6	0.0	0.6	1.3	3.8	0.0	0.0	3.8	84.7	0.0	3.2	0.0	0.6
			2002	54	0.0	1.9	0.0	0.0	0.0	9.3	0.0	0.0	0.0	83.3	0.0	1.9	0.0	3.7
			2003	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	75.0	0.0	0.0	0.0	4.2
			2004	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	20.0
	1999	4574	1999	648	0.0	0.0	0.0	0.5	0.8	0.6	0.0	0.0	0.8	97.2	0.0	0.0	0.0	0.2
			2000	754	0.0	0.0	0.0	0.1	0.5	1.2	0.0	0.0	2.9	94.8	0.0	0.1	0.0	0.3
			2001	273	0.0	0.4	0.0	0.7	0.7	2.9	0.0	0.0	2.2	89.0	0.0	2.6	0.0	1.5
			2002	91	0.0	0.0	0.0	0.0	1.1	4.4	0.0	0.0	6.6	84.6	0.0	1.1	0.0	2.2
			2003	26	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	92.3	0.0	3.8	0.0	0.0
			2004	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	60.0	0.0	20.0	0.0	0.0
	2000	6191	2000	608	0.0	0.0	0.0	0.0	0.5	1.3	0.0	0.0	1.5	95.4	0.2	0.0	0.0	1.2
			2001	793	0.0	0.0	0.0	0.6	0.8	3.8	0.0	0.1	1.4	91.7	0.0	1.0	0.0	0.6
			2002	310	0.0	0.0	0.0	0.3	0.0	2.9	0.0	0.3	3.5	87.1	0.3	4.2	0.0	1.3
			2003	108	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	1.9	92.6	0.0	3.7	0.0	0.9
			2004	16	0.0	0.0	0.0	6.3	6.3	0.0	0.0	6.3	0.0	43.8	18.8	18.8	0.0	0.0
	2001	4326	2001	646	0.2	0.2	0.0	1.2	0.6	4.6	0.0	0.0	1.1	89.0	0.0	0.9	0.0	2.2
			2002	495	0.2	0.2	0.0	0.6	0.6	0.8	0.0	0.6	1.0	92.9	0.0	1.4	0.0	1.6
			2003	189	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.1	92.1	0.0	4.8	0.0	0.5
			2004	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	88.9	0.0	5.6	0.0	0.0
	2002	4907	2002	566	0.0	0.0	0.0	0.2	0.0	1.2	0.0	0.2	0.0	98.2	0.0	0.0	0.0	0.2
			2003	618	0.0	0.0	0.0	0.2	0.0	0.5	0.0	0.0	2.1	95.6	0.0	1.1	0.0	0.5
			2004	74	1.4	0.0	0.0	0.0	0.0	1.4	0.0	1.4	1.4	89.2	0.0	1.4	0.0	4.1
	2003	5706	2003	561	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.4	98.9	0.0	0.2	0.0	0.2
			2004	144	0.0	0.0	0.0	0.7	0.7	0.7	0.0	0.7	2.8	93.1	0.0	1.4	0.0	0.0

cont'd

Table 5. Cont'd.

Release Area	Release year	Number tagged	Recapture year	Adj. Nos. recap'd	3K	3LA	3LB	3LF	3LJ	3LQ	3NO	3PSA	3PSB	3PSC	3PSD	3PSOFF	4RS3PN	UNK
																% of annual recaptures		
3PSD	1998	1352	1998	48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	10.4	27.1	2.1	2.1	45.8	2.1
			1999	63	1.6	0.0	0.0	0.0	0.0	0.0	0.0	12.7	4.8	14.3	0.0	1.6	60.3	4.8
			2000	25	4.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	4.0	8.0	0.0	4.0	60.0	4.0
			2001	13	0.0	0.0	0.0	7.7	0.0	7.7	0.0	0.0	0.0	7.7	0.0	7.7	69.2	0.0
			2002	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
	1999	464	1999	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.1	10.5	23.7	2.6	10.5	7.9	2.6
			2000	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	31.3	31.3	0.0	25.0	0.0
			2001	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2002	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3	28.6	28.6	14.3
			2003	1	0.0	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
	2001	1665	2001	117	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	1.7	6.0	14.5	9.4	44.4	12.8
			2002	59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	11.9	10.2	1.7	8.5	57.6	1.7
			2003	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.2	36.4	0.0	0.0	36.4	9.1
			2004	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	33.3	0.0	33.3	0.0
	2002	963	2002	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	22.2	11.1	5.6	0.0	55.6	0.0
			2003	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.4	11.1	0.0	22.2	0.0	22.2	0.0
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0
	2003	878	2003	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	8.3	8.3	0.0	8.3	50.0	16.7
			2004	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	16.7	33.3	0.0	0.0	16.7
3PSG	2003	511	2003	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2004	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.4	0.0	28.6
3PSH	1998	1842	1998	29	0.0	0.0	0.0	3.4	0.0	0.0	3.4	0.0	0.0	24.1	0.0	69.0	0.0	0.0
			1999	29	0.0	0.0	0.0	3.4	3.4	0.0	0.0	0.0	0.0	34.5	0.0	51.7	3.4	3.4
			2000	19	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	5.3	26.3	0.0	57.9	0.0	5.3
			2001	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.9	0.0	42.9	0.0	14.3
			2002	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	60.0	0.0	20.0
			2003	3	0.0	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
	1999	1808	1999	47	2.1	0.0	0.0	0.0	8.5	2.1	4.3	0.0	0.0	42.6	0.0	31.9	0.0	8.5
			2000	58	0.0	0.0	0.0	5.2	0.0	1.7	1.7	0.0	0.0	22.4	5.2	44.8	0.0	19.0
			2001	24	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	4.2	29.2	0.0	54.2	0.0	8.3
			2002	16	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	43.8	0.0	31.3	0.0	18.8
			2003	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	0.0	42.9	0.0	28.6
			2004	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	66.7
	2000	1044	2000	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	0.0	0.0
			2001	16	0.0	0.0	0.0	0.0	0.0	6.3	18.8	0.0	0.0	6.3	0.0	50.0	0.0	18.8
			2002	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
			2003	3	0.0	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
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0
	2001	1145	2001	12	0.0	0.0	0.0	0.0	0.0	8.3	8.3	0.0	0.0	16.7	0.0	58.3	0.0	8.3
			2002	16	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	18.8	0.0	50.0	0.0	25.0
			2003	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	50.0	0.0	25.0
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
	2002	1509	2002	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.5	0.0	64.7	0.0	11.8
			2003	16	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	37.5	0.0	31.3	0.0	25.0
			2004	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	60.0	0.0	20.0
	2003	621	2003	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	33.3	0.0	33.3
			2004	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	25.0	0.0	25.0

Table 6. The proportion of tags returned by year and region based on a high-reward tagging study and estimated using odds ratio method described by Cadigan and Brattey (2004). 3K_IN=NAFO unit areas 3Kd/h/i; 3L_INN=3La/b; 3L_INS=3Lf/j/q; 3Ps_PB=3Psc; 3Ps_FB=3Psb; 3Ps_BB=3Psa/d; OFF_SH=3Pse/f/g/h; 3PN_4RS=subdiv. 3Pn and Divs. 4R and 4S.

Region	Single tag reporting rates								Double tag reporting rates						
	1997	1998	1999	2000	2001	2002	2003		1997	1998	1999	2000	2001	2002	2003
3K_IN	0.755	0.755	0.755	0.755	1.000	0.755	0.755		0.815	0.815	0.815	0.815	1.000	0.815	0.815
3L_INN	0.755	0.755	0.755	0.755	1.000	0.755	0.755		0.815	0.815	0.815	0.815	1.000	0.815	0.815
3L_INS	0.755	0.755	0.755	0.755	1.000	0.755	0.755		0.815	0.815	0.815	0.815	1.000	0.815	0.815
3Ps_PB	0.698	0.698	0.698	0.837	0.837	0.837	0.837		0.789	0.789	0.789	0.864	0.864	0.864	0.864
3Ps_FB	0.698	0.698	0.698	0.837	0.837	0.837	0.837		0.789	0.789	0.789	0.864	0.864	0.864	0.864
3Ps_BB	0.708	0.708	0.708	0.708	0.708	0.708	0.708		0.793	0.793	0.793	0.793	0.793	0.793	0.793
OFF_SH	0.708	0.708	0.708	0.708	0.708	0.708	0.708		0.793	0.793	0.793	0.793	0.793	0.793	0.793
3PN_4RS	0.526	0.526	0.526	0.526	0.526	0.526	0.526		0.751	0.751	0.751	0.751	0.751	0.751	0.751