Pacific Herring Coded Wire Tagging Study: 2002 Releases and Recoveries

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ABSTRACT

Flostrand, L., and J.F. Schweigert. 2003. Pacific herring coded wire tagging study: 2002 releases and recoveries. Can. Tech. Rep. Fish. Aquat. Sci. 2483: 38 p.

The results from tagging spawning Pacific herring in British Columbia during March and April of 2002 and searching commercial roe herring catches in 2002 to recover tags are presented. A total of 227,928 herring were tagged and released, of which 83,528 were tagged in Area 14 in the Strait of Georgia, 58,658 were tagged in Areas 6,7 and 8 in the Central Coast and 85,742 were tagged in Areas 4 and 5 in the Prince Rupert District. Almost 32% of the total 2002 British Columbia roe herring harvest, equivalent to 8,468 tonnes, was searched for coded wire tags at three fish processing plants. The percentage of regional catches searched for tags among the 5 coastal stock assessment regions varied from 14 to 35%. Approximately 2,581 tagged herring from four release years were recovered. With respect to year of release, there were 68 recoveries from 1999; 298 from 2000; 357 from 2001 and 1,858 from 2002 in-season releases. Four inter-regional strays were observed. One stray was from a 1999 Area 17 Strait of Georgia release recovered in Area 25 in the west coast of Vancouver Island; two strays were from 2001 Area 14 Strait of Georgia releases recovered in Area 7 in the Central Coast; and one stray was a 2001 Area 5 Prince Rupert District release recovered in Area 7 in the Central Coast.

Observed tag recovery data were related to roe herring catches and tag search efforts. Estimates of the total number of tagged fish removed by the 2002 roe herring fisheries, tag recovery rates, tag removal rates and tags recovered per tonne searched were calculated for specific recovery and release events. This was done to determine reference data that may later be used to evaluate study logistics and stock behaviour.

RÉSUMÉ

Flostrand, L., and J.F. Schweigert. 2003. Pacific herring coded wire tagging study: 2002 releases and recoveries. Can. Tech. Rep. Fish. Aquat. Sci. 2483: 38 p.

Nous présentons les résultats du marquage de harengs du Pacifique géniteurs réalisé en mars et en avril 2002 en Colombie-Britannique et de la recherche de poissons marqués parmi les prises commerciales de harengs rogués de 2002. Au total, 227 928 harengs ont été marqués et remis à l'eau, dont 83 528 dans la zone 14 (détroit de Georgia), 58 658 dans les zones 6, 7 et 8 (côte centrale) et 85 742 dans les zones 4 et 5 (district de Prince Rupert). Presque 32 % des prises de harengs rogués effectuées en C.-B. en 2002, soit 8 468 tonnes, ont été vérifiées dans trois usines de transformation du poisson, pour trouver celles qui portaient des micromarques codées. Parmi les cinq régions côtières d'évaluation des stocks, le pourcentage des prises soumises à cette recherche a varié de 14 à 35 %. Au total, environ 2 581 harengs qui ont été marqués en saison au cours de quatre années différentes (68 en 1999, 298 en 2000, 357 en 2001 et 1 858 en 2002) ont été trouvés. Quatre de ces poissons avaient été recapturés dans une région différente de celle où ils ont été marqués : un a été remis à l'eau dans la zone 17 (détroit de Georgia) en 1999, puis recapturé dans la zone 25 (côte ouest de l'île de Vancouver), deux autres ont été remis à l'eau dans la zone 14 (détroit de Georgia) en 2001, puis recapturé dans la zone 7 (côte centrale), et un autre a été remis à l'eau dans la zone 5 (district de Prince Rupert) en 2001, puis recapturé dans la zone 7 (côte centrale).

Nous avons établis le rapport entre les données de harengs marqués-retrouvés versus la quantité de harengs rogués pêchés et l'effort de recherche de poissons marqués. Nous avons ainsi estimé le nombre total de harengs marqués-recapturés dans les pêches aux harengs rogués de 2002 ainsi que les taux de recapture et les taux de récupération de poissons marqués par tonne de harengs vérifiée, selon le lieu et la période de marquage et de pêche. Ceci nous a permis d'obtenir des données de références qui pourrant être utilisées pour évaluer le comportement des stocks de harengs et la logistique d'études futures.

INTRODUCTION

The application of coded wire tags (CWT) in Pacific herring began in 1999 and tag recovery from searching roe herring catches began in 2000. The primary purpose of the multi-year tagging study is to increase understanding of herring stock structure and inter-annual fidelity to spawning sites. Characterizing spatial and temporal patterns of spawning behaviour is critical to the effective management of the resource. This report summarises results of the 2002 Pacific herring CWT release and recovery work.

Pacific Fishery Management Area Regulations of the Canadian Fisheries Act identify 30 management (or statistical) areas along the British Columbia (BC) coast, herein referred to as Areas, Figure 1. These Areas are used for fishery management, enforcement and catch reporting purposes. Specifically for Pacific herring management and stock assessment purposes, there are five herring stock assessment regions and numerous Area subdivisions referred to as herring sections that are used for more detailed analyses (Hamer et al 2002; Schweigert 2002; Midgley 2003). The five herring assessment regions are comprised of: 1) the Queen Charlotte Islands (QCI), south-east portions of Area 2E; 2) the Prince Rupert District (PRD), Areas 3 to 5; 3) the Central Coast (CC), Area 7 and portions of 6 to 8; 4) the Strait of Georgia (SG), Areas 14 to 19 and portions of 13 and 29, and 5) west coast of Vancouver Island (WCVI), Areas 23 to 25 (Hamer et al 2002; Schweigert 2002).

In 2002, the objective was to tag herring in the SG, CC and PRD assessment regions. Another objective was to search a representative portion of each region's roe herring harvest for CWTs by combining search efforts at three Vancouver-Lower Mainland fish processing plants. Prior to 2002, CWT release efforts occurred in the SG (1999 to 2001), the QCI (1999) and the PRD (2001) and searching of roe herring catches for CWTs occurred in 2000 and 2001 (Flostrand and Schweigert 2002). Approximately 450,000 tags were released from 1999 to 2001 and approximately 560 inter-annual and 530 in-season tags were recovered from 2000 and 2001 roe herring fisheries combined. Three regional strays were observed from the 2000 recovery efforts and one regional stray was observed from the 2001 recovery efforts. In 2000, 21.3% of the coast-wide roe herring harvest, equivalent to 6,222 metric tonnes (mt), was searched for tags. In 2001, 28.8% of the coast-wide roe herring harvest, equivalent to 6,922 mt, was searched for tags. More details on the progress of the study can be found in Schweigert and Flostrand (2000) and Flostrand and Schweigert (2002). This report summarises results of the 2002 Pacific herring CWT release and recovery work.

METHODS

TAGGING AND RELEASING HERRING

In 2002, herring were caught, tagged and released in the SG (Area 14, Figure 2), the CC (Areas 6 to 8, Figure 3) and the PRD (Areas 4 and 5, Figure 4). The tagging charter extended from March 4 to11 and March 15 to April 5, including vessel preparation, travel, and weather. Tagging activities occurred on 20 days during this period. The tagging equipment and operational methods were essentially the same as in previous years (Schweigert and Flostrand 2000; Flostrand and Schweigert 2002). The tagging vessel was the Ocean Marauder, a 26.5 m long vessel that used table seining rather than drum seining to capture herring for tagging. The Ocean Marauder and three other test fishing vessels captured herring for tagging. Furthermore, three sizes of purse seine nets were used, the smallest was approximately 180 m long x 17 m deep; an intermediate sized one was approximately 274 m x 33 m and the largest, a commercial sized net, was approximately 410 m x 80 m. All tag insertions were done into the muscle tissue directly behind the skull of the herring (also referred to as the nape site) and fish were not anaesthetised. Binary CWT codes were applied and a unique set of tag codes or code sequences was used for each tagging session. A representative biological sample was collected during each tagging session to assess the age, sex, maturity, length and weight composition of the fish being tagged. Samples for DNA analysis were also taken from some of the sets. Unlike previous years, no recovery pen was deployed to temporarily hold fish after tagging. Instead, seawater was sprayed over and around the release outlet from a power hose to shield tagged herring from predators. The spray was found to be an effective deterrent against sea birds and a good alternative to the recovery pen, which sea lions had a tendency to disturb.

RECOVERING TAGS FROM 2002 ROE HERRING CATCH

Tag recovery refers to the collection of tagged fish by searching the catch during the processing of herring roe at fish plants. Recovery observations were used to calculate tag recovery rates (%). Observed recovery rates were determined by relating the number of tags recovered to the number of tags released from defined fishery and release events. Tag density was defined as the ratio of tags recovered from a specific fishery to the quantity of roe herring searched (mt).

In 2002, roe herring fisheries occurred in all five herring stock assessment regions and the recovery effort focussed on searching a representative portion of each region's catch for CWTs. Further details regarding the 2002 BC roe herring purse seine and gillnet fisheries, occurring in March and April, can be found in Hamer et al (2002). The equipment and methods for tag recovery using R9500 detectors were the same as for the 2000 and 2001 seasons (Schweigert and

Flostrand 2000; Flostrand and Schweigert, 2002). The three fish plants housing the tag recovery equipment in 2002 were also the same as those during the 2001 tag recovery season, being Icicle Seafoods Inc. (Icicle), Canadian Fishing Company (CFC), and Bella Coola Fisheries Ltd. (Bella Coola). A portion of the roe herring seine catch from Sitka, Alaska was also searched.

Tag recovery equipment operated from March 25 to July 8 and J.O. Thomas and Associates were again contracted to: operate recovery units; collect and handle samples; record results of equipment operation; verify catch information related to fish lot processing records and communicate processing schedules and equipment needs with plant staff. Logbooks were kept to document equipment settings and equipment test trials were undertaken approximately every hour using seeded specimens to ensure that recovery units were in working order. Records were also kept of conveyor speeds and loading rates (mt/hour). Field personnel removed the gill tissue and rinsed each carcass of a putative tagged fish with water to remove possible sources of metal contamination prior to re-testing for the presence of a tag. This was done to reduce the number of false positive recoveries brought to the laboratory for CWT dissection.

TAG RECOVERIES AND RATES

Observed tag recovery rates were determined as the number of tags recovered divided by the number of tags released. Recovery rates were determined for all 1999 to 2002 release events:

$$RR_o = R_o / T \quad (1)$$

where

RR_o = observed tag recovery rate;
R_o = observed number of tags recovered by release year, region, and Area and by recovery region, Area and gear;
T = total number of tags released by year, region and Area.

Tag (recovery) densities were determined as:

$$RD = R_o / S \quad (2)$$

where

RD = observed tags recovered per metric tonne searched;
S = total roe herring catch searched (mt) by region, Area and gear.

TAG REMOVALS AND RATES

Tag removal refers to the estimate of the number of tagged herring removed from the population by the roe herring fishery. Removal rate is estimated as the ratio of the tags removed to the the proportion of a fishery's catch searched for tags.

Estimates of tag removals from 2002 roe herring fisheries were determined from an estimate of the proportion of the total catch searched in each Area and the resulting number of tags recovered:

$$R' = R_o\ (C/S) \qquad (3)$$

where

R' = estimated number of tags removed;
C = total roe herring catch (mt) by region, Area and gear.

Estimates of tag removal rate (percentage of the released tags removed by each fishery) were determined by:

$$RR' = R' / T = RR_o / (S/C) \qquad (4)$$

where RR' is the estimated tag removal rate.

RESULTS

TAGGING AND RELEASING HERRING

There were 34 tagging sessions in 2002 and the total number of Pacific herring tagged and released from March 5 to April 2 was 227,928. Of that total, 83,528 were tagged in Area 14 in the SG, and of these, 13,616 were released from sets 1 to 3 prior to any fishery opening in the region (Figure 2). In the CC, 58,658 herring were tagged in Areas 6, 7 and 8, comprised of 18,168, 31,027 and 9,463 releases, respectively (Figure 3). Releases preceded fishery openings in Areas 6 and 7 and no roe herring fisheries occurred in Area 8. In the PRD, 85,742 herring were tagged in Areas 4 and 5, comprised of 48,960 and 36,782 releases, respectively (Figure 4). Releases were concurrent with a gillnet opening in Area 4 and preceded a seine opening in Area 5. The Wilson Inlet tagging session (set 34) in Area 5 was geographically distinct from the Kitkatla Inlet and Willis Bay sessions (sets 29 to 33) and should be considered separately. A total of 11,081 tagged herring were released in Wilson Inlet.

RECOVERING TAGS FROM 2002 ROE HERRING CATCH

The total annual BC catch of roe herring in 2002, including the test fishery, was 26,596 mt (Hamer et al 2002). Roe herring fishery catch and tag recoveries by region, Area, gear,and tonnage searched for tags at fish processing plants is summarized in Table 1. An estimated 8,468 mt of the 26,596 mt total BC roe herring catch was searched for CWTs, representing approximately 31.8% of the total catch. From the total seine catch of 15,391.9 mt, 30.8% was searched for CWTs and from the total gillnet catch of 11,204.5 mt, 33.3% was searched. The tonnages of herring searched at each of the fish plants were approximately 2,452 at Bella Coola, 3,146 at CFC and 2,870 at Icicle. Regionally, 25.8 % of WCVI, 34.9% of SG, 30.9% of CC, 24.6% of PRD and 14.0% of QCI catches were searched for CWTs. Search proportions by gear and fish plant of recovery are also presented in Table 1. Approximately 82% of the combined BC roe herring processed at Icicle, CFC and Bella Coola fish plants was searched for tags and approximately 128 mt of roe herring purse seined in Sitka, Alaska was also searched at CFC (Table 1).

TAG RECOVERIES AND RATES

A total of 2,581 tag recoveries with known release and recovery history were obtained from the 2002 CWT search efforts (Tables 1 and 2). The majority of recoveries (1,858) were from in-season 2002 releases and there were 357 recoveries from 2001 releases, 298 recoveries from 2000 releases and 68 recoveries from 1999 releases. Ten tags were lost in the laboratory prior to being read, so their release information is unknown. A total of 189 herring were incidentally recovered at the three plants due to metal contamination resulting in false positive tag detection (43 CFC, 89 Icicle and 57 Bella Coola).

Out of the 1,858 known in-season recoveries, 1,011 were caught in the SG, 510 were caught in the CC and 337 were caught in the PRD (Tables 1 and 2). Most in-season recoveries from each of the three regions were from seine catches. There were no in-season inter-regional strays but some in-season movements between Areas were detected in the CC. There were 5 gillnet and 2 seine recoveries from East Higgins Pass (Area 7) which had been tagged 5 to 9 days prior in Kitasu Bay (Area 6). There were also 4 tag recoveries with unknown recapture location due to uncertainty in fish plant records at the time the tags were recovered. Two of these were released in the CC and two were released in the SG. Although it is likely that these in-season recoveries were recovered in the region of release, the four recoveries have been removed from summary totals in Table 1.

Out of the 357 known recoveries from one-year at large 2001 releases, 197 were caught in the SG, 3 were caught in the CC and 157 were caught in the PRD (Tables 1 and 2.) There were 3 inter-regional strays from 2001 releases.

Two of these were from Bowser or Cape Lazo, SG (Area 14), recovered in Mosquito Bay, CC (Area 7), and one was from Kitkatla, PRD (Area 5), recovered in East Higgins Pass, CC (Area 7). Most of the one-year at large recoveries were from seine catches and some movements between Areas were detected in the PRD. There were 11 known gillnet recoveries from Area 4 which had been tagged the year before in Area 5 and there were 9 known seine recoveries from Area 5 which had been tagged the year before in Area 4. It is also likely that there was movement between SG Areas 14 and 17 but because of difficulties in resolving 74 gillnet recoveries from either Area 14 or 17, an exact total for each Area cannot be determined.

All of the 298 known recoveries from two-year at large 2000 releases were from the SG and there were no inter-regional strays (Tables 1 and 2). The majority of two-year at large recoveries were from gillnet catches and some movement between Areas 17 and 14 was detected. There were 18 known seine recoveries from Area 14 that had been tagged in Area 17 two years prior. But again, difficulties in resolving gillnet catch between Areas 14 and 17 have prevented further definition of 47 gillnet recoveries from Area 17 releases and 145 gillnet recoveries from Area 14 releases.

Out of the 68 known recoveries from three-year at large 1999 releases, one was caught in the WCVI, 66 were caught in the SG and one was caught in the QCI (Tables 1 and 2). The one WCVI recovery was caught in Rosa Harbour (Area 25) and was a stray from a tagging event near Link Island, SG (Area 17). The majority of three-year at large recoveries were from gillnet catches and some movement between Area 17 and 14 was detected. There were 5 known seine recoveries from Area 14 that had been tagged in Area 17 three years earlier. Difficulties in resolving gillnet catch between Areas 14 and 17 prevented further definition of 16 gillnet recoveries from Area 17 releases and 32 gillnet recoveries from Area 14 releases.

Several of the 2002 tag recoveries possessed discrepant tag codes from either accidental repeated code usage or mislabelling errors during 1999 and 2000 release events (Flostrand and Schweigert 2002). These recoveries were not included with totals in Table 1. There were 14 tag recoveries with codes having 1999 and 2000 between-year discrepancies. In addition, there were 55 tag recoveries with codes having either 1999 or 2000 within-year discrepancies between SG release events, but only 16 of these recoveries affected distinction between Areas 14 and 17 release sites. From the 16 within-year SG release discrepancies, 7 were from 1999 releases and 9 were from 2000 releases (Table 2).

Tag release and recovery data used to estimate the tag recovery rates are presented in Table 3. Only summary rates derived from all fishery sources are described below. In Areas where there were in-season recoveries, recovery rates

from regional release events were 6.44% and 0.19% for the SG (before and after seine fishery releases, respectively); 0.64% and 1.27% for the CC (Areas 6 and 7 releases, respectively) and 0.19% and 0.95% for the PRD (Areas 4 and 5 releases, respectively). The one-year at large recovery rate for SG releases was 0.33% and rates were 0.16% and 0.22% for the PRD (Areas 4 and 5 releases, respectively). Two-year at large recovery rates for SG releases ranged from 0.11% to 0.14% while three-year at large rates for SG releases ranged from 0.12% to 0.16%. The three-year at large recovery rate for QCI releases was 0.02%.

Estimates of the tag densities are presented in Table 4. Several fisheries did not recover tags from a variety of release events. The tag density for in-season recoveries from Area 14 releases, occurring prior to the Area 14 seine fishery, was 0.256 tags/mt. The tag densities for in-season recoveries from Area 14 releases, recovered from combined Areas 14 and 17 gillnet catches, were 0.010 tags/mt and 0.050 tags/mt for before and after seine fishery releases, respectively. The tag densities for in-season recoveries from Area 6 releases were 0.760 tags/mt and 0.002 tags/mt from Areas 6 and 7 seine catches, respectively, and 0.073 tags/mt from Area 7 gillnet catches. The tag density for in-season recoveries from Area 7 releases was 0.489 tags/mt from Area 7 seine catches. The tag density for in-season recoveries from Area 4 releases was 0.103 tags/mt from Area 4 gillnet catches and for Area 5 releases it was 1.184 tags/mt from Area 5 seine catches.

Tag densities for one year at large recoveries from Area 4 releases were 0.109 tags/mt and 0.044 tags/mt from Area 4 gillnet catches and Area 5 seine catches, respectively. Tag densities for one year at large recoveries from Area 5 releases were 0.012, 0.189 and 0.001 tags/mt from Area 4 gillnet catches, Area 5 seine catches and Area 7 seine catches, respectively. Tag densities for one year at large recoveries from Area 14 releases were 0.002, 0.037 and 0.027 tags/mt from Area 7 seine catches, Area 14 seine catches and Areas 14 and 17 gillnet catches, respectively.

Tag densities for two year at large recoveries from Area 14 releases were 0.024 tags/mt and 0.053 tags/mt from Area 14 seine and Areas 14 and 17 gillnet catches, respectively. Tag densities for two year at large recoveries from Area 17 releases were 0.005 tags/mt and 0.017 tags/mt from Area 14 seine and Areas 14 and 17 gillnet catches, respectively. Tag densities for two year at large recoveries from Areas 14 and 17 release discrepancies were 0.001 tags/mt and 0.003 tags/mt from Area 14 seine and Areas 14 and 17 gillnet catches, respectively.

The tag density for three year at large recoveries from Area 2E releases was 0.010 tags/mt from 2E seine catches. Tag densities for three year at large recoveries from Area 14 releases were 0.002 and 0.012 tags/mt from Area 14 seine catches and Areas 14 and 17 gillnet catches, respectively. Tag densities

from three year at large tags from Area 17 releases were 0.001, 0.006 and 0.025 tags/mt from Area 14 seine catches, Areas 14 and 17 gillnet catches and Area 25 gillnet catches, respectively. Tag densities for three year at large recoveries from Areas 14 and 17 release discrepancies were 0.001 tags/mt and 0.001 tags/mt for Area 14 seine catches and Areas 14 and 17 gillnet catches, respectively.

TAG REMOVALS AND RATES

The estimate of the total number of tagged herring removed from the population by the 2002 roe herring fisheries is approximately 9,600 (Table 5). The majority of these tags would likely be from in-season tagging events, estimated at between 7,100 and 7,200. Estimates for one, two and three year at large removals are 1,347, 863 and 209, respectively. Estimates of in-season removals by region are 2,860 for the SG, 1,601 for the CC and 2,690 for the PRD, with the majority of each region's removals likely from seine fisheries. Estimates for one year at large removals are 562 for the SG, 9 for the CC and 776 for the PRD, with the majority likely from seine fisheries. No one year at large removals were estimated for WCVI and QCI. The estimate for the number of two year at large SG removals is 863, with the majority likely from the gillnet fishery. No two year at large removals were estimate for all other regions. Estimates for three year at large removals are 10 for WCVI, 192 for SG, 7 for QCI and zero for the other regions. The majority of removals would likely be from gillnet fisheries, except in the QCI where only a seine fishery occurred.

Estimates for in-season and inter-annual tag removal rates are presented in Table 6. Estimates for in-season tag removal rates from regional release events were 18.06% and 0.57% for the SG (before and after seine fishery releases, respectively); 2.48% and 3.70% for the CC (Areas 6 and 7 releases) and 0.51% and 9.50% for the PRD (Areas 4 and 5 releases). The estimated one year at large removal rate for SG releases was 0.94% and rates were 0.54% and 1.88% for the PRD (Areas 4 and 5 releases). Estimates for two year at large tag removal rates for SG releases ranged from 0.32% to 0.41% while three year at large rates ranged from 0.34% to 0.47%. The estimated removal rate for QCI releases was 0.12%.

DISCUSSION

The geographic distribution for the release of coded wire tagged herring was more extensive in 2002 than in the previous three tagging seasons. In addition, tag recapture opportunities from 2002 roe herring fisheries occurred in all five Pacific herring stock assessment and management regions (Hamer et al 2002, Schweigert 2002). The proportion of coast-wide roe herring searched for tags was 31.8%, which was higher than in previous recovery years (21.3% and 28.8%) but it was unfortunate that the 2002 QCI roe herring catch was relatively

under-represented at 14%. Similar to previous years, the search coverage from quantities of roe herring processed at the fish plants was fairly high (82%), and co-operation from plant staff was excellent. The CWT study again demonstrated a limited extent of reproductive straying, as evidenced by four regional strays and over fifty Area strays.

Recovery rate and tag density estimates are helpful in considering fishery effects on tag recovery. The current format of summarising CWT recoveries differed from two previous publications (Schweigert and Flostrand 2000; Flostrand and Schweigert 2002). In this report, summary release and recovery data are resolved to each Area within herring stock assessment regions (rather than just by region) and recoveries are distinguished by gear type. As a result, the accuracy was improved for describing observations and estimating removals, recovery rates and the number of tags recovered per tonne searched, by enabling effects from fishing gear to be considered. Recovery data from 2000, 2001 and future roe fisheries should also be summarised by fishing gear and Area to further assess fishing effects prior to detailed analysis of these data.

The current tagging data indicated that most of the two and three year recoveries resulted from gillnet catches, which is consistent with effects of gear selectivity. Gillnets catch a higher proportion of larger and thus older herring than the non-selective seine gear. According to historic herring data collected for annual stock assessments, the majority of individual herring on the spawning grounds are usually first and second time spawners (Schweigert 2002). This would also imply that the majority of individual fish caught by seine gear for tagging purposes are also usually first or second time spawners and thus relatively small fish, simply due to their availability. This would partly explain differences in the tag recovery rates and tag search rates between SG seine and gillnet catches whereby more in-season to one year at large recoveries occurred from seine catches and more two and three year at large recoveries resulted from gillnet catches (Tables 1 to 6).

As would be expected, there was considerable variation among tag recovery rates and densities. Principal sources of variation can be attributed to effects of temporal and spatial differences in release and recapture events from multiple years of tagging in a variety of Areas. However, the cumulative effects from other sources of variation on tag recovery also exist of often unknown magnitude. Some of these effects would be the result of reproductive straying; total number of CWT removals by roe and non-roe herring fisheries; fluctuations in stock size and dilution effects from new recruits; fluctuations in natural mortality and tagging mortality. Other less likely effects are possible mortality from spawn on kelp fisheries or incidental mortality due to scaling of small fish during gillnet fisheries. Further study of the magnitude and variation of these factors is recommended.

Unfortunately, many CWT release events in 2002 preceded or were concurrent with the majority of roe fisheries; hence the particularly high number of in-season recoveries. The number of in-season recoveries from tagging sessions 1 to 3 in Area 14 demonstrates how tagging immediately prior to or during a (seine) fishery can potentially result in a substantial removal of tagged fish from the population. In this case, over 6% of the initial 13,616 releases were recovered in-season (Table 3) and it was estimated that approximately 17% of these releases (Table 6) were removed from the population. Similar in-season removal effects should be examined for all tagging sessions beginning in 1999. Eliminating all possible sources of in-season recoveries is not necessarily practical or desirable. However, efforts should be made in future years to minimise tagging herring in Areas where a fishery opening is expected despite the limited opportunity for catching and tagging mature herring. On the positive side, in-season recovery data can provide information on short-term movements on the spawning or holding grounds, such as observed between Areas 6 and 7. In-season recovery data may also be applicable for estimating abundance through mark-recapture analysis.

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REFERENCES

Flostrand, L. and J. F. Schweigert. 2002. Pacific herring coded wire tagging study: releases and recoveries, 1999 – 2001. Can. Tech. Rep. Fish. Aquat. Sci. 2428: 34p.

Hamer, L., P. Midgley and B. Rusch. 2002. A review of 2001 / 2002 British Columbia herring fisheries. Can. Ind. Rep. Fish. Aquat. Sci. 267: vi + 58p.

Midgley, P. 2003. Definitions and codings of localities, herring sections and stock assessment regions for British Columbia herring data. Can. Manuscr. Rep. Fish. Aquat. Sci. 2634: 113p.

Schweigert, J. 2002. Stock assessment for BC herring in 2002 and forecast of the potential catch in 2003. Can. Science Advisory Secr. Res. Doc. 2002/110.

Schweigert, J. and L. Flostrand. 2000. Pacific herring coded wire tagging study: 1999 releases recovered in 2000. Can. Tech. Rep. Fish. Aquat. Sci. 2335: 33p.

Table 1. Summary of roe herring fishery catch (mt) and CWT recoveries from Canadian Fishing Company Ltd. (CFC), Icicle Seafoods Inc. (Icicle) and Bella Coola Fisheries Ltd. (Bella Coola) fish plants in 2002.

		Tonnage		Plant of	Tonnage	Tonnage	% Catch	CWT Recoveries By Release Year				
Region	Gear	Caught	Area	Recovery	Processed	Searched	Searched	1999	2000	2001	2002	All
WCVI	SN	432.8	25	Bella Coola	254.7	171.5	39.6	-	-	-	-	-
	GN	388.3	25	Bella Coola	40.6	40.6	10.5	1[a]	-	-	-	1
	Both	821.1	25	Bella Coola	295.3	212.1	25.8	-	-	-	-	1
SG	SN		14	Bella Coola	1,113.8	616.9	6.6	4	23	23	172	222
	SN		14	CFC	1,358.6	1,329.0	14.3	6	43	52	318	419
	SN		14	Icicle	1,423.6	1,368.1	14.7	4	33	48	359	444
	SN	9,298.9	14	All	3,896.0	3,314.0	35.6	14	99	123	849	1,085
	GN		14, 17	Bella Coola	1,424.3	949.8	11.9	16	69	27	56	168
	GN		14, 17	CFC	1,147.3	1,075.9	13.5	19	76	27	63	185
	GN		14, 17	Icicle	835.1	695.8	8.7	17	54	20	43	134
	GN	7,985.9	14, 17	All	3,406.7	2,721.6	34.1	52	199	74	162	487
	Both	17,284.8	14, 17	All	7,302.7	6,035.6	34.9	66	298	197	1,011	1,572
CC	SN		6, 7	Bella Coola	594.3	344.7	11.9	-	-	1[b]	214	215
	SN		6, 7	CFC	210.4	208.7	7.2	-	-	-	127	127
	SN		6, 7	Icicle	434.7	395.5	13.7	-	-	2[cd]	164	166
	SN	2,893.6	6 7	All	1,239.4	948.9	32.8	-	-	3	505	508
	GN		6, 7	Bella Coola	42.1	27.2	6.8	-	-	-	4	4
	GN		6, 7	CFC	24.0	41.7	10.5	-	-	-	1	1
	GN		6, 7	Icicle	0.0	0.0	0.0	-	-	-	-	-
	GN	398.6	6, 7	All	66.1	68.9	17.3	-	-	-	5	5
	Both	3,292.2	6, 7	All	1,305.5	1,017.9	30.9	-	-	3	510	513
PRD	SN		5	Bella Coola	56.1	53.5	2.6	-	-	12	57	69
	SN		5	CFC	84.0	80.7	3.9	-	-	20	95	115
	SN		5	Icicle	77.1	72.6	3.5	-	-	16	93	109
	SN	2,060.9	5	All	217.2	206.8	10.0	-	-	48	245	293

Table 1 (cont'd)

Region	Gear	Tonnage caught	Area	Plant of Recovery	Tonnage processed	Tonnage searched	% Catch searched	CWT recoveries by release year 1999	2000	2001	2002	All
PRD	GN		4	Bella Coola	200.4	148.8	6.1	-	-	22	11	33
	GN		4	CFC	418.7	410.1	16.9	-	-	48	52	100
	GN		4	Icicle	405.1	338.4	13.9	-	-	39	29	68
	GN	2,431.8	4	All	1,024.2	897.2	36.9	-	-	109	92	201
	Both	4,492.7	4, 5	All	1,241.4	1,104.1	24.6	-	-	157	337	494
QCI	SN	705.7	2E	Bella Coola	111.8	98.9	14.0	1	-	-	-	1
BC	SN	15391.9	All	All	15,391.9	4,740.1	30.8	15	99	174	1,599	1,887
	GN	11204.6	All	All	11,204.6	3,728.4	33.3	53	199	183	259	694
	Both	26,596.4	All	All	26,596.5	8,256.5	31.8	68	298	357	1,858	2581[e]
Sitka	SN		n/a	Bella Coola	924.3	0.0		-	-	-	-	-
	SN		n/a	CFC	161.9	127.9		-	-	-	-	-
	SN		n/a	Icicle	193.6	0.0		-	-	-	-	-
	SN		n/a	All	1,279.8	127.9		-	-	-	-	-
Recoveries by Plant[g]				Bella Coola	3,838.0	2,452.0		22	92	85	514	713
				CFC	3,423.0	3,274.1		25	119	147	656[e]	947
				Icicle	3,175.6	2,870.4		21	87	125	688	921

[a] One stray from SG (Link Is) recaptured in WCVI (Rosa Harbour).
[b, c] Two strays from SG (Bowser and Cape Lazo) recaptured in CC, Mosquito Bay.
[d] One stray from PRD (Kitkatla) recaptured in CC, East Higgins Pass.
[e] An additional ten CWTs were lost during dissection prior to decoding (4 PRD sn, 2 CC sn, 4 SG sn) and fourteen tag recoveries with SG 1999 and 2000 between-year discrepancies were not included in totals.
[f] An additional four tag recoveries from 2002 releases (2 CC, 2 SG) were collected at CFC with uncertainty in recapture sources.
[g] A total of 189 herring eliciting false positive signals due to metal contamination were recovered (43 CFC, 89 Icicle, 57 Bella Coola).

Table 2. Summary of 2002 CWT recoveries by assessment region, Area, and fishing gear relative to releases. Total catch, tonnage of catch searched and the percentage of catch searched are also shown.

Recovery	Region			QCI	PRD	PRD	CC	CC	CC	SG	SG	WCVI	WCVI	UNK	Total
	Area			2E	4	5	6	7	7	14	14,17	25	25		
	Gear			SN	GN	SN	SN	SN	GN	SN	GN	SN	GN		
	Total Catch (mt)			705.8	2,431.9	2,060.9	547.9	2,345.7	398.6	9,299.0	7,985.8	432.8	388.3	-	26,596.7
	Tonnage Searched			98.9	897.2	206.8	143.3	805.6	69.0	3,314.0	2,721.6	171.5	40.7	-	8,468.6
	Catch Searched (%)			14.0	36.9	10.0	26.2	34.3	17.3	35.6	34.1	39.6	10.5	-	31.8
Release			Tags												
Year	Region	Area	Released												
1999	QCI	2E	6,175	1	-	-	-	-	-	-	-	-	-	-	1
	SG	14	23,187	-	-	-	-	-	-	6	32	-	-	-	38
	SG	17	14,266	-	-	-	-	-	-	5	16	-	1	-	22
1999 WYD	SG	14 or 17	5,815	-	-	-	-	-	-	3	4	-	-	-	7
1999 , 2000 BYD	SG	14 or 17	7,141	-	-	-	-	-	-	4	10	-	-	-	14
2000	SG	14	180,229	-	-	-	-	-	-	79	145	-	-	-	224
	SG	17	58,994	-	-	-	-	-	-	18	47	-	-	-	65
2000 WYD	SG	14 or 17	6,471	-	-	-	-	-	-	2	7	-	-	-	9
2001	PRD	4	65,809	-	98	9	-	-	-	-	-	-	-	-	107
	PRD	5	22,387	-	11	39	-	1	-	-	-	-	-	-	51
	SG	14	60,558	-	-	-	-	2	-	123	74	-	-	-	199
2002	PRD	4	48,960	-	92	-	-	-	-	-	-	-	-	-	92
	PRD	5	25,701	-	-	245	-	-	-	-	-	-	-	-	245
	PRD	5 (WI)	11,081	-	-	-	-	-	-	-	-	-	-	-	-
	CC	6	18,168	-	-	-	109	2	5	-	-	-	-	1	117
	CC	7	31,027	-	-	-	-	394	-	-	-	-	-	1	395
	CC	8	9,463	-	-	-	-	-	-	-	-	-	-	-	-
	SG	14 (BSN)	13,616	-	-	-	-	-	-	849	26	-		2	877
	SG	14 (ASN)	69,912	-	-	-	-	-	-	-	136	-	-	-	136
All	All		678,960	1	201	293	109	399	5	1089	497	-	1	4	2599

UNK refers to unknown fishery of recapture; WI refers to Wilson Inlet (PRD) tag releases.
WYD refers to within-year tag code discrepancies and BYD refers to between-year tag code discrepancies.
BSN refers to tags released before the seine fishery; ASN refers to tags released after the seine fishery.

Table 3. Estimates of 2002 CWT recovery rates (percentage of the released tags recovered) by assessment region, Area, and fishing gear. Total catch, catch tonnage searched and the percentage of catch searched are also shown.

Recovery	Region			QCI	PRD	PRD	CC	CC	CC	SG	SG	WCVI	WCVI	UNK	Total
	Area			2E	4	5	6	7	7	14	14,17	25	25		
	Gear			SN	GN	SN	SN	SN	GN	SN	GN	SN	GN		
	Total Catch (mt)			705.8	2,431.9	2,060.9	547.9	2,345.7	398.6	9,299.0	7,985.8	432.8	388.3	-	26,596.7
	Tonnage Searched			98.9	897.2	206.8	143.3	805.6	69.0	3,314.0	2,721.6	171.5	40.7	-	8,468.6
	Catch Searched (%)			14.0	36.9	10.0	26.2	34.3	17.3	35.6	34.1	39.6	10.5	-	31.8
Release			Tags												
Year	Region	Area	Released												
1999	QCI	2E	6,175	0.02	-	-	-	-	-	-	-	-	-	-	0.02
	SG	14	23,187	-	-	-	-	-	-	0.03	0.14	-	-	-	0.16
	SG	17	14,266	-	-	-	-	-	-	0.04	0.11	-	<0.01	-	0.15
1999 WYD	SG	14 or 17	5,815	-	-	-	-	-	-	0.05	0.07	-	-	-	0.12
1999 , 2000 BYD	SG	14 or 17	7,141	-	-	-	-	-	-	0.06	0.14	-	-	-	0.20
2000	SG	14	180,229	-	-	-	-	-	-	0.04	0.08	-	-	-	0.12
	SG	17	58,994	-	-	-	-	-	-	0.03	0.08	-	-	-	0.11
2000 WYD	SG	14 or 17	6,471	-	-	-	-	-	-	0.03	0.11	-	-	-	0.14
2001	PRD	4	65,809	-	0.15	0.01	-	-	-	-	-	-	-	-	0.16
	PRD	5	22,387	-	0.05	0.17	-	<0.01	-	-	-	-	-	-	0.22
	SG	14	60,558	-	-	-	-	<0.01	-	0.20	0.12	-	-	-	0.33
2002	PRD	4	48,960	-	0.19	-	-	-	-	-	-	-	-	-	0.19
	PRD	5	25,701	-	-	0.95	-	-	-	-	-	-	-	-	0.95
	PRD	5 (WI)	11,081	-	-	-	-	-	-	-	-	-	-	-	0.00
	CC	6	18,168	-	-	-	0.60	0.01	0.03	-	-	-	-	0.01	0.64
	CC	7	31,027	-	-	-	-	1.27	-	-	-	-	-	<0.01	1.27
	CC	8	9,463	-	-	-	-	-	-	-	-	-	-	-	-
	SG	14 (BSN)	13,616	-	-	-	-	-	-	6.24	0.19	-	-	0.01	6.44
	SG	14 (ASN)	69,912	-	-	-	-	-	-	-	0.19	-	-	-	0.19

UNK refers to unknown fishery of recapture; WI refers to Wilson Inlet (PRD) tag releases.
WYD refers to within-year tag code discrepancies and BYD refers to between-year tag code discrepancies.
BSN refers to tags released before the seine fishery; ASN refers to tags released after the seine fishery.

Table 4. Estimates of 2002 tag densities (CWTs recovered per tonne of roe herring searched) by assessment region, Area, and fishing gear. Total catch, catch tonnage searched and the percentage of catch searched are also shown.

Recovery	Region			QCI	PRD	PRD	CC	CC	CC	SG	SG	WCVI	WCVI	UNK
	Area			2E	4	5	6	7	7	14	14,17	25	25	
	Gear			SN	GN	SN	SN	SN	GN	SN	GN	SN	GN	
	Total Catch (mt)			705.8	2,431.9	2,060.9	547.9	2,345.7	398.6	9,299.0	7,985.8	432.8	388.3	-
	Tonnage Searched			98.9	897.2	206.8	143.3	805.6	69.0	3,314.0	2,721.6	171.5	40.7	-
	Catch Searched (%)			14.0	36.9	10.0	26.2	34.3	17.3	35.6	34.1	39.6	10.5	-
Release			Tags											
Year	Region	Area	Released											
1999	QCI	2E	6,175	0.010	-	-	-	-	-	-	-	-	-	-
	SG	14	23,187	-	-	-	-	-	-	0.002	0.012	-	-	-
	SG	17	14,266	-	-	-	-	-	-	0.002	0.006	-	0.025	-
1999 WYD	SG	14 or 17	5,815	-	-	-	-	-	-	0.001	0.001	-	-	-
1999,2000 BYD	SG	14 or 17	7,141	-	-	-	-	-	-	0.001	0.004	-	-	-
														-
2000	SG	14	180,229	-	-	-	-	-	-	0.024	0.053	-	-	-
	SG	17	58,994	-	-	-	-	-	-	0.005	0.017	-	-	-
2000 WYD	SG	14 or 17	6,471	-	-	-	-	-	-	0.001	0.003	-	-	-
2001	PRD	4	65,809	-	0.109	0.044	-	-	-	-	-	-	-	-
	PRD	5	22,387	-	0.012	0.189	-	0.001	-	-	-	-	-	-
	SG	14	60,558	-	-	-	-	0.002	-	0.037	0.027	-	-	-
2002	PRD	4	48,960	-	0.103	-	-	-	-	-	-	-	-	-
	PRD	5	25,701	-	-	1.184	-	-	-	-	-	-	-	-
	PRD	5 (WI)	11,081	-	-	-	-	-	-	-	-	-	-	-
	CC	6	18,168	-	-	-	0.760	0.002	0.073	-	-	-	-	UNK
	CC	7	31,027	-	-	-	-	0.489	-	-	-	-	-	UNK
	CC	8	9,463	-	-	-	-	-	-	-	-	-	-	-
	SG	14 (BSN)	13,616	-	-	-	-	-	-	0.256	0.010	-	-	UNK
	SG	14 (ASN)	69,912	-	-	-	-	-	-		0.050	-	-	-
All		All	678,960	0.010	0.224	1.417	0.760	0.495	0.073	0.072	0.123	0.000	0.025	UNK

UNK refers to unknown fishery of recapture; WI refers to Wilson Inlet (PRD) tag releases.
WYD refers to within-year tag code discrepancies and BYD refers to between-year tag code discrepancies.
BSN refers to tags released before the seine fishery; ASN refers to tags released after the seine fishery.

Table 5. Estimates of 2002 CWT removals by assessment region, Area, and fishing gear. Total catch, catch tonnage searched and the percentage of catch searched are also shown.

Recovery	Region			QCI	PRD	PRD	CC	CC	CC	SG	SG	WCVI	WCVI	UNK	Total
	Area			2E	4	5	6	7	7	14	14 , 17	25	25		
	Gear			SN	GN	SN	SN	SN	GN	SN	GN	SN	GN		
	Total Catch (mt)			705.8	2,431.9	2,060.9	547.9	2,345.7	398.6	9,299.0	7,985.8	432.8	388.3	-	26,596.7
	Tonnage Searched			98.9	897.2	206.8	143.3	805.6	69.0	3,314.0	2,721.6	171.5	40.7	-	8,468.6
	Catch Searched (%)			14.0	36.9	10.0	26.2	34.3	17.3	35.6	34.1	39.6	10.5	-	31.8
Release			Tags												
Year	Region	Area	Released												
1999	QCI	2E	6,175	7	-	-	-	-	-	-	-	-	-	-	7
	SG	14	23,187	-	-	-	-	-	-	17	94	-	-	-	111
	SG	17	14,266	-	-	-	-	-	-	14	47	-	10	-	71
1999 WYD	SG	14 or 17	5,815	-	-	-	-	-	-	8	12	-	-	-	20
1999 , 2000 BYD	SG	14 or 17	7,141	-	-	-	-	-	-	11	29	-	-	-	40
2000	SG	14	180,229	-	-	-	-	-	-	222	425	-	-	-	647
	SG	17	58,994	-	-	-	-	-	-	51	138	-	-	-	189
2000 WYD	SG	14 or 17	6,471	-	-	-	-	-	-	6	21	-	-	-	27
2001	PRD	4	65,809	-	266	90	-	-	-	-	-	-	-	-	356
	PRD	5	22,387	-	30	390	-	3	-	-	-	-	-	-	423
	SG	14	60,558	-	-	-	-	6	-	345	217	-	-	-	568
2002	PRD	4	48,960	-	249	-	-	-	-	-	-	-	-	-	249
	PRD	5	25,701	-	-	2,441	-	-	-	-	-	-	-	-	2,441
	PRD	5 (WI)	11,081	-	-	-	-	-	-	-	-	-	-	-	-
	CC	6	18,168	-	-	-	417	6	29	-	-	-	-	UNK	452
	CC	7	31,027	-	-	-	-	1,149	-	-	-	-	-	UNK	1,149
	CC	8	9,463	-	-	-	-	-	-	-	-	-	-	-	-
	SG	14 (BSN)	13,616	-	-	-	-	-	-	2,385	76	-	-	UNK	2,461
	SG	14 (ASN)	69,912	-	-	-	-	-	-	-	399	-	-	-	399
All	All		678,960	7	545	2,921	417	1,164	29	3,059	1,458	-	10	UNK	9,610

UNK refers to unknown fishery of recapture; WI refers to Wilson Inlet (PRD) tag releases.

WYD refers to within-year tag code discrepancies and BYD refers to between-year tag code discrepancies.

BSN refers to tags released before the seine fishery; ASN refers to tags released after the seine fishery.

Table 6. Estimates of 2002 CWT removal rates (percentage of the releases tags removed) from all roe herring catches by assessment region, Area, and fishing gear. Total catch, catch tonnage searched and the percentage of catch searched are also shown.

Recovery	Region			QCI	PRD	PRD	CC	CC	CC	SG	SG	WCVI	WCVI	UNK	Total
	Area			2E	4	5	6	7	7	14	14,17	25	25		
	Gear			SN	GN	SN	SN	SN	GN	SN	GN	SN	GN		
	Total Catch			705.8	2,431.9	2,060.9	547.9	2,345.7	398.6	9,299.0	7,985.8	432.8	388.3	-	26,596.7
	Tonnage Searched			98.9	897.2	206.8	143.3	805.6	69.0	3,314.0	2,721.6	171.5	40.7	-	8,468.6
	Catch Searched (%)			14.0	36.9	10.0	26.2	34.3	17.3	35.6	34.1	39.6	10.5	-	31.8
Release															
Year	Region	Area	Releases												
1999	QCI	2E	6,175	0.12	-	-	-	-	-	-	-	-	-	-	0.12
	SG	14	23,187	-	-	-	-	-	-	0.07	0.40	-	-	-	0.47
	SG	17	14,266	-	-	-	-	-	-	0.10	0.33	-	0.04	-	0.47
1999 WYD	SG	14 or 17	5,815	-	-	-	-	-	-	0.14	0.20	-	-	-	0.34
1999 , 2000 BYD	SG	14 or 17	7,141	-	-	-	-	-	-	0.16	0.41	-	-	-	0.57
2000	SG	14	180,229	-	-	-	-	-	-	0.12	0.24	-	-	-	0.36
	SG	17	58,994	-	-	-	-	-	-	0.09	0.23	-	-	-	0.32
2000 WYD	SG	14 or 17	6,471	-	-	-	-	-	-	0.09	0.32	-	-	-	0.41
2001	PRD	4	65,809	-	0.40	0.14	-	-	-	-	-	-	-	-	0.54
	PRD	5	22,387	-	0.13	1.74	-	0.01	-	-	-	-	-	-	1.88
	SG	14	60,558	-	-	-	-	0.01	-	0.57	0.36	-	-	-	0.94
2002	PRD	4	48,960	-	0.51	-	-	-	-	-	-	-	-	-	0.51
	PRD	5	25,701	-	-	9.50	-	-	-	-	-	-	-	-	9.50
	PRD	5 (WI)	11,081	-	-	-	-	-	-	-	-	-	-	-	0.00
	CC	6	18,168	-	-	-	2.29	0.03	0.16	-	-	-	-	UNK	2.48
	CC	7	31,027	-	-	-	-	3.70	-	-	-	-	-	UNK	3.70
	CC	8	9,463	-	-	-	-	-	-	-	-	-	-	-	0.00
	SG	14 (BSN)	13,616	-	-	-	-	-	-	17.50	0.56	-	-	UNK	18.06
	SG	14 (ASN)	69,912	-	-	-	-	-	-	-	0.57	-	-	-	0.57

UNK refers to unknown fishery of recapture; WI refers to Wilson Inlet (PRD) tag releases.
WYD refers to within-year tag code discrepancies and BYD refers to between-year tag code discrepancies.
BSN refers to tags released before the seine fishery; ASN refers to tags released after the seine fishery.

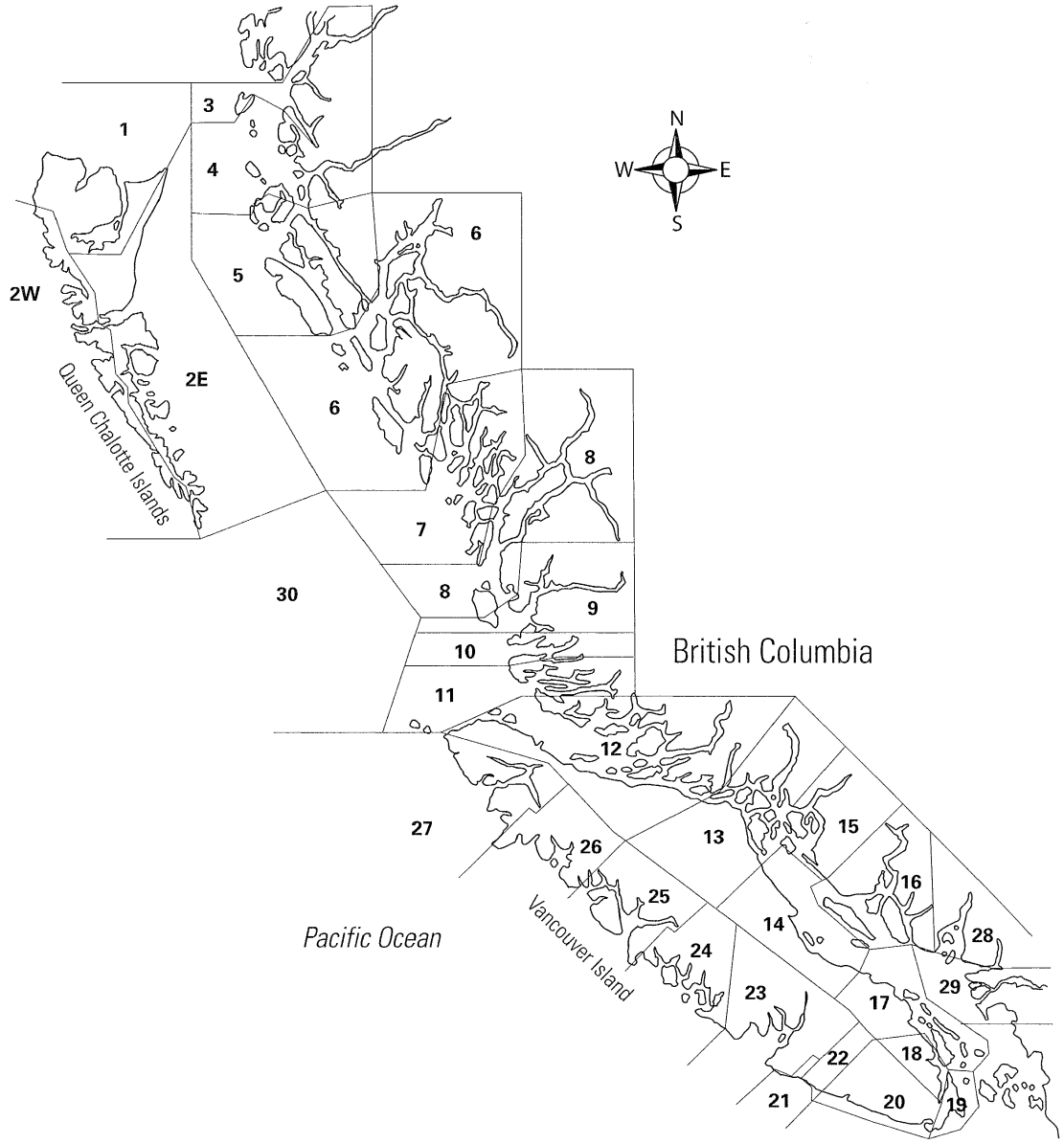

Figure 1. The coast of British Columbia, depicting inshore fishery management (statistical) areas.

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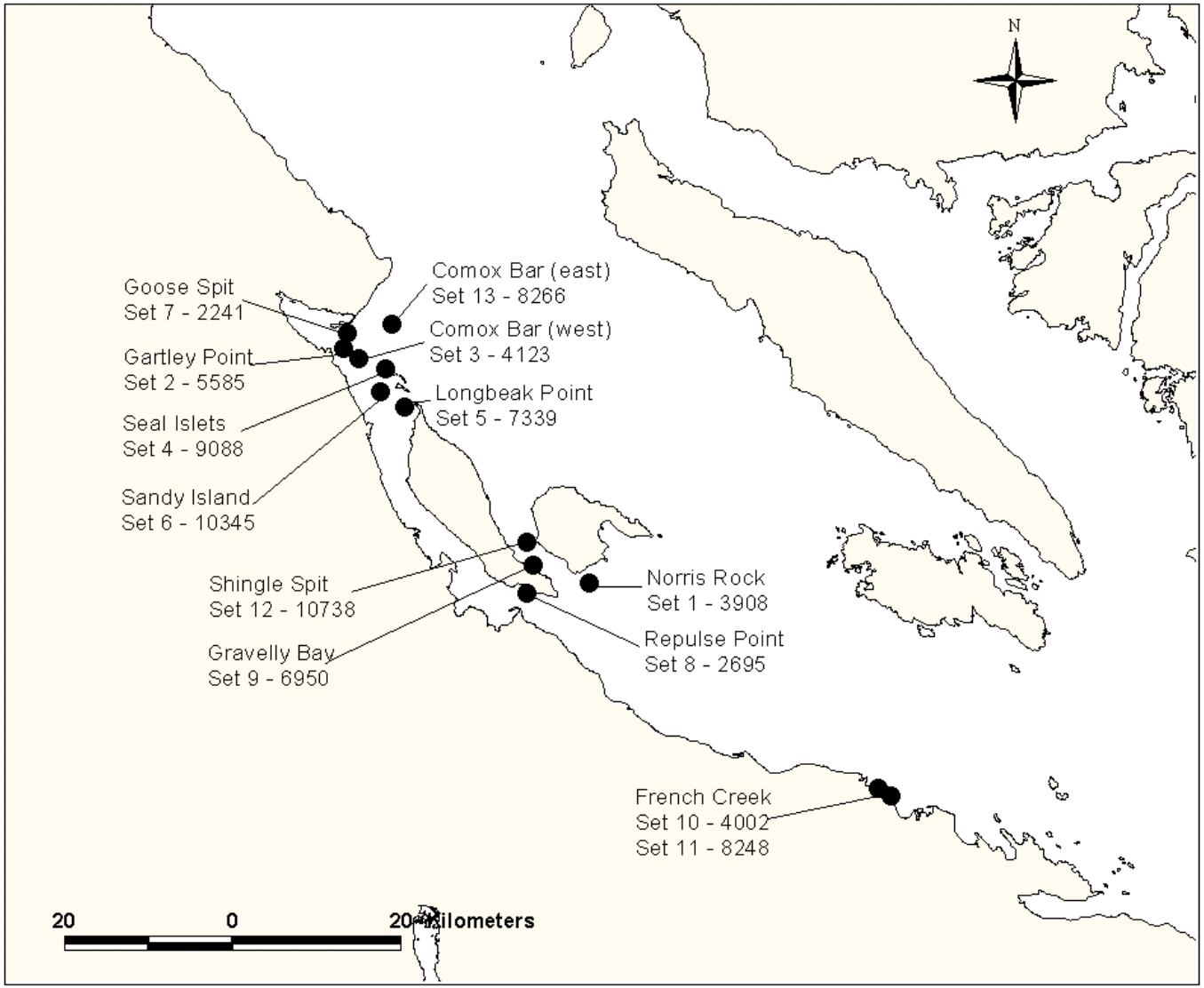

Figure 2. Tag releases by set and location in the Strait of Georgia in 2002.

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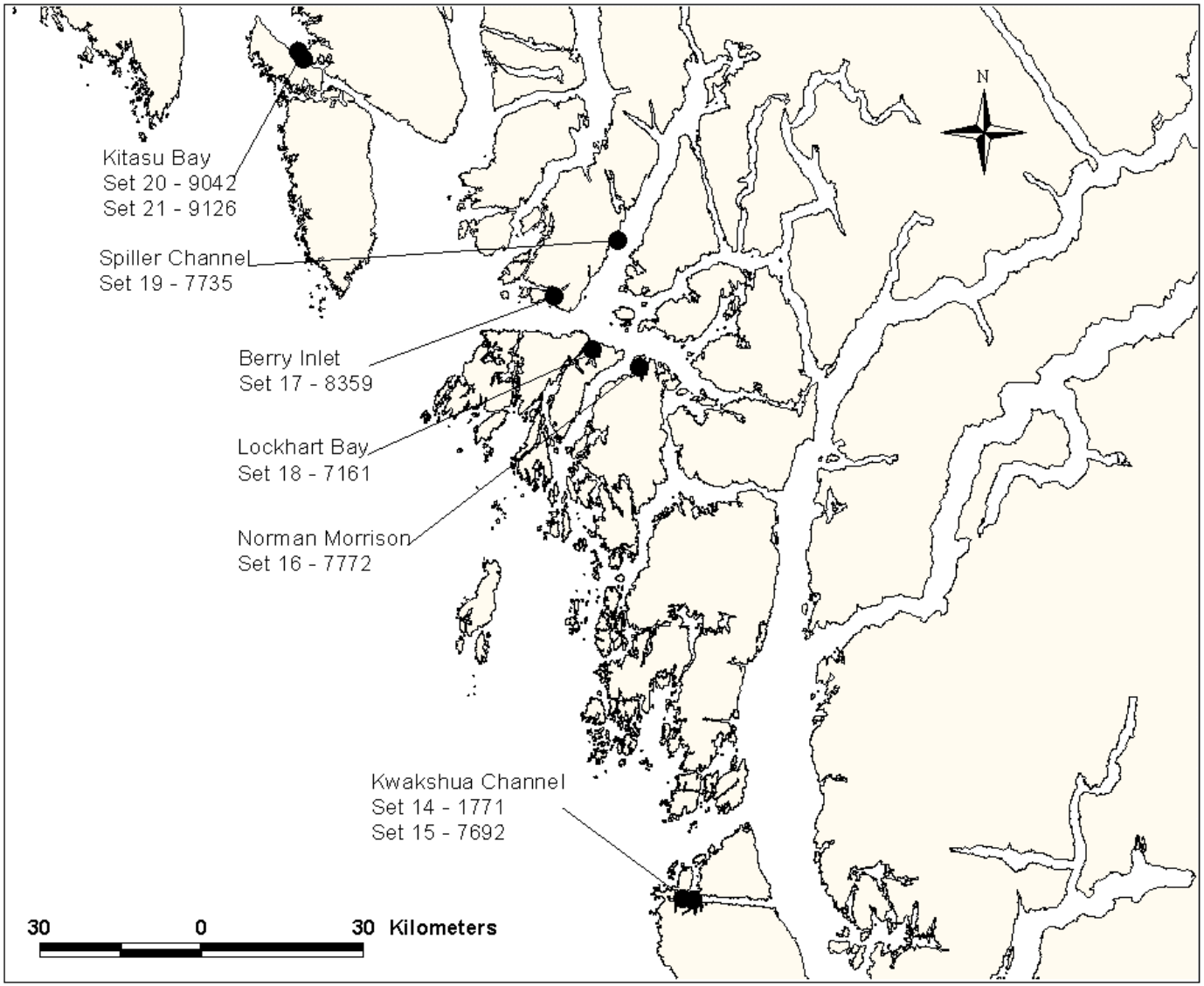

Figure 3. Tag releases by set and location in the Central Coast in 2002.

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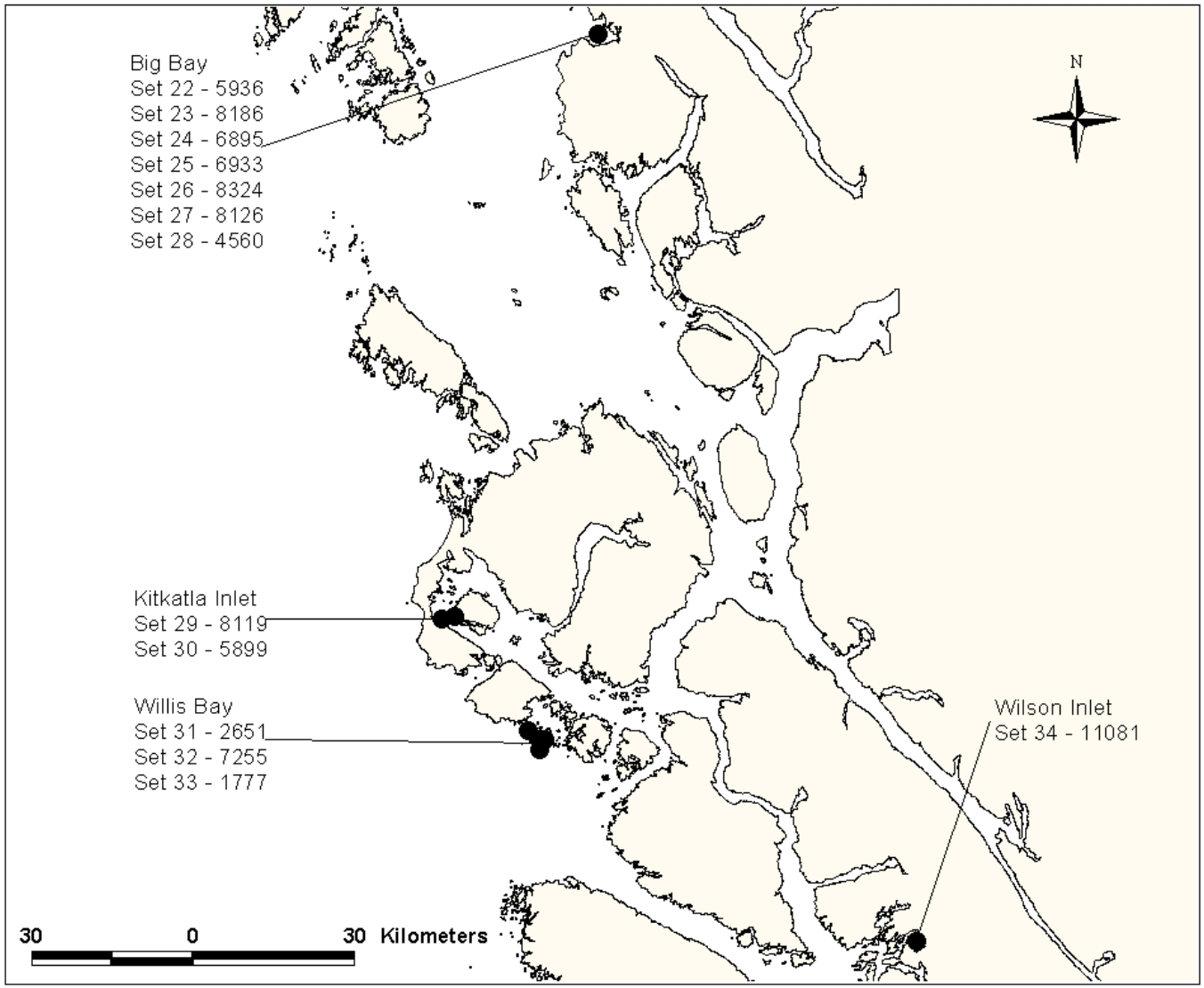

Figure 4. Tag releases by set and location in the Prince Rupert District in 2002.

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Appendix A. Summary of fishing information related to herring tagging sessions conducted in 2002.

Location	Area	Date	Set	Latitude	Longitude	PST	Hours	Conditions	Spawning	Predation	Net size	Fishing vessel
Strait of Georgia												
Norris Rock	14	5-Mar-02	1	49 28.83	124 39.70	20:14	1.5	chop, cold	started March 14	sea lions	large	Bernice C
Gartley Pt	14	6-Mar-02	2	49 38.73	124 54.71	9:45	2.0	chop, cold	started March 14	gulls	large	Royal Mariner
Comox Bar	14	6-Mar-02	3	49 38.56	124 53.48	15:40	1.8	calm, cold	started March 14	gulls	large	Royal Mariner
Seal Islets	14	8-Mar-02	4	49 37.56	124 52.00	16:40	2.5	calm, cold	started March 14	gulls, sea lions	medium	O. Marauder
Longbeak Pt	14	8-Mar-02	5	49 46.47	124 51.00	23:50	2.3	calm, cold	started March 14	gulls, sea lions	medium	O. Marauder
Sandy Is	14	11-Mar-02	6	49 37.05	124 52.71	8:30	1.0	calm, cool	started March 14	gulls, sea lions	large	Royal Mariner
Comox Bar	14	11-Mar-02	7	49 39.35	124 54.38	14:30	3.0	chop, cold	started March 14	gulls	medium	O. Marauder
Repulse Pt	14	15-Mar-02	8	49 28.70	124 42.73	13:10	1.0	calm, cool	started March 14	sea lions	medium	O. Marauder
SE Denman Is	14	15-Mar-02	9	49 29.88	124 42.66	20:40	2.0	chop, cold	started March 15	sea lions	medium	O. Marauder
French Creek	14	16-Mar-02	10	49 20.70	124 21.00	18:15	1.3	swell, cool	active in area	sea lions	small	O. Marauder
French Creek	14	17-Mar-02	11	49 20.10	124 19.18	9:30	2.5	swell, cold	active in area	sea lions	small	O. Marauder
Shingle Spit	14	17-Mar-02	12	49 30.65	124 42.87	16:20	3.0	calm, cool	active in area	no predators	medium	O. Marauder
Comox Buoy	14	19-Mar-02	13	49 39.76	124 51.35	8:15	2.3	chop, cold	active in area	none seen	medium	O. Marauder
Central Coast												
Kwakshua Ch	8	20-Mar-02	14	51 39.24	128 6.20	13:00	1.0	chop, cold	no active spawn	none seen	medium	O. Marauder
Kwakshua Ch	8	21-Mar-02	15	51 39.30	128 6.94	6:15	2.5	calm, cool	no active spawn	none seen	medium	O. Marauder
Norman Morrison	7	21-Mar-02	16	52 12.00	128 11.50	19:20	2.5	calm, cool	no active spawn	none seen	medium	O. Marauder
Spiller Ch	7	22-Mar-02	17	52 16.59	128 18.64	10:15	2.5	calm, mild	no active spawn	some gulls	medium	O. Marauder
Lockhart Bay	7	22-Mar-02	18	52 12.58	128 15.62	18:30	2.2	calm, mild	no active spawn	none seen	medium	O. Marauder
Spiller Ch	7	23-Mar-02	19	52 19.07	128 13.74	7:45	2.5	calm, mild	no active spawn	gulls	medium	O. Marauder
Kitasu Bay	6	24-Mar-02	20	52 31.66	128 45.10	19:00	2.8	calm, mild	no active spawn	gulls	medium	O. Marauder
Kitasu Bay	6	25-Mar-02	21	52 31.10	128 44.81	6:15	2.7	calm, cold	no active spawn	none seen	medium	O. Marauder
Prince Rupert District												
Big Bay	4	26-Mar-02	22	54 27.95	130 25.68	12:45	2.0	chop, cool	active in area	none seen	medium	O. Marauder
Big Bay	4	27-Mar-02	23	54 27.89	130 26.33	8:45	2.0	chop, cool	active in area	none seen	medium	O. Marauder
Big Bay	4	27-Mar-02	24	54 28.14	130 26.05	12:15	2.0	roll, chop	active in area	none seen	medium	O. Marauder
Big Bay	4	27-Mar-02	25	54 28.15	130 25.46	16:15	2.3	roll, chop	active in area	none seen	medium	O. Marauder
Big Bay	4	28-Mar-02	26	54 27.93	130 26.32	8:20	2.3	chop, cool	active in area	none seen	medium	O. Marauder
Big Bay	4	28-Mar-02	27	54 27.61	130 27.21	13:30	2.0	chop, cool	active in area	none seen	medium	O. Marauder
Big Bay	4	28-Mar-02	28	54 28.76	130 26.90	17:15	1.5	chop, cool	active in area	none seen	medium	O. Marauder
Kitkatla Inlet	5	31-Mar-02	29	53 53.24	130 40.48	6:15	2.8	chop, cool	active in area	none seen	medium	O. Marauder
Kitkatla Inlet	5	1-Apr-02	30	53 53.18	130 39.83	6:45	1.3	calm, mild	active in area	none seen	medium	O. Marauder
Willis Bay	5	1-Apr-02	31	53 46.42	130 30.41	16:30	0.8	calm, cool	active in area	none seen	large	O. Venture
Willis Bay	5	1-Apr-02	32	53 46.16	130 31.09	19:15	2.3	calm, cool	active in area	none seen	medium	O. Marauder
Willis Bay	5	2-Apr-02	33	53 46.13	130 31.11	6:10	0.5	calm, cool	active in area	none seen	medium	O. Marauder
Wilson Inlet	5	2-Apr-02	34	53 34.45	129 53.39	13:30	2.3	calm, mild	no active spawn	none seen	medium	O. Marauder

Appendix B. Summary of 1999 to 2001 herring tag releases and recoveries detailing tag code discrepancies.

Discrepancy Type	Release Year	Tagging Set	Statistical Area	Tag Code	Tags Released	Recoveries in 2002
Within-year[a]	1999	13	14	18-12-13	3,310	6
	1999	12	17	18-12-32	2,505	1
	2000	5	14	02-13-12	3,017	0
	2000	25	17	18-14-43	3,454	9
	2000	14, 15	14	18-12-19	2,506	0
	2000	21	14	02-12-12	9,108	14
	2000	11	14	18-03-34	6,356	12
	2000	16, 17	14	18-42-17	7,030	6
	2000	26, 27	17	18-34-42	511	0
	2000	19	14	18-42-23	0	0
	2000	13	14	18-34-35	2,024	0
	2000	13	14	18-34-45	0	3
	2000	27	17	18-31-11	3,312	2
	2000	27	17	18-31-10	3,060	2
		Total		14 codes	46,193	55
Between-years[b]	1999	1	14	18-08-48	2,587	
	2000	30	17		952	
		Subtotal			3,539	8
	1999	3	14	18-15-63	1,857	
	2000	23, 24	17		1,745	
		Subtotal			3,602	6
		Total		2 codes	7,141	14

[a] Tag code mislabelling occurred between codes used within the same year and stock region.
[b] Accidental repeated tag code usage occurred with 1999 and 2000 Strait of Georgia releases.

Appendix C. Summary of herring CWT releases in the Strait of Georgia and Queen Charlotte Islands in 1999 by region, location and set with subsequent recoveries.

Location	Date	Set	Body site	Anaesthetic	Tag rate (per h)	Tags per Set	Tag Code [d]	Tags per Code	Recoveries in 2002
Strait of Georgia									
Fillongley Park	2-Mar-99	1	neck	MS222	310	2,587	18-08-48 [b]	2,587	8
Whalebone Pt	4-Mar-99	2	back	MS222	417	3,751	18-08-56	3,751	6
Phipps Pt	4-Mar-99	3	back	none	348	1,857	18-15-63 [b]	1,857	6
Bowser	5-Mar-99	4	neck	none	376	3,006	02-60-10	3,006	9
Qualicum Bay	6-Mar-99	5	neck	MS222	552	3,590	18-12-33	3,590	5
Qualicum Bay	6-Mar-99	6	back	MS222	612	3,670	18-02-04	3,670	8
Metcalfe Bay	7-Mar-99	7	neck	none	405	675	18-14-34	675	0
Chrome Is	9-Mar-99	8	back	none	617	1,644	18-12-35	1,644	2
Link Is	15-Mar-99	9	neck	MS222	536	1,964	18-12-07	1,964	4 [c]
Jesse Is	15-Mar-99	10	neck	MS222	450	3,597	02-63-44	3,597	4
McKay Pt	16-Mar-99	11	neck	none	460	3,370	18-12-34	3,370	6
Link Is	18-Mar-99	12	neck	none	478	3,418	18-12-32 [a]	2,505	1
Link Is	18-Mar-99	12	neck	none	478		18-38-12	760	1
Link Is	18-Mar-99	12	neck	none	478		08-24-19	153	0
French Creek	18-Mar-99	13	back	clove oil	662	3,310	18-12-13 [a]	3,310	6
French Creek	19-Mar-99	14	back	none	589	3,438	08-16-11	3,438	4
French Creek	19-Mar-99	15	back	MS222	853	3,413	02-19-27	3,413	4
Link Is	20-Mar-99	16	back	MS222	739	4,422	08-16-09	4,422	7
All Strait of Georgia								47,712	81
Total discrepant tags [b]								4,444	14
Total minus discrepant tags								43,268	67
Queen Charlotte Islands									
Wanderer Is	26-Mar-99	17	back	MS222	571	1,141	18-02-25	1,141	0
Wanderer Is	27-Mar-99	18	back	MS222	649	2,002	18-11-50	1,082	0
Wanderer Is	27-Mar-99	18	back	MS222	649		18-11-55	920	1
Wanderer Is	28-Mar-99	19	back	MS222	716	3,032	18-18-34	1,600	0
Wanderer Is	28-Mar-99	19	back	MS222	716		18-14-16	1,432	0
All Queen Charlotte Islands								6,175	1
Total both regions								53,887	82
Total both regions minus discrepant tags								49,443	68

[a] Tag code mislabelling occurred between codes used within the same year and stock region.
[b] Accidental repeated tag code usage occurred with 1999 and 2000 Strait of Georgia releases.
[c] One stray from SG (Link Is) to WCVI (Rosa Harbour).
[d] Total of 23 tag codes were used (SG 18, 5 QCI).

Appendix D. Summary of herring CWT releases in the Strait of Georgia in 2000 by tag code with subsequent recoveries.

Tag Code [c]	Set	Location [d]	Tags per Set	Tags per Code	Recoveries in 2002
02-03-12	6	Boyle Pt	2,478	2,478	2
02-11-16	28	Mudge Is	1,052	1,052	0
02-12-12 [a]	21	Brant Pt	9,108	9,108	14
02-13-12 [a]	5	Boyle Pt	3,017	3,017	0
02-13-56	13	Parksville Bay	2,382	2,382	4
02-15-40	4	Big Qualicum	2,175	2,175	6
02-16-57	4	Big Qualicum	4,171	9,197	6
02-16-57	12	Qualicum Bay	5,026		
02-18-63	7	Repulse Pt	363	6,416	4
02-18-63	8	Repulse Pt	2,539		
02-18-63	9	Tribune Bay	1,961		
02-18-63	10	Tribune Bay	1,553		
02-22-11	6	Boyle Pt	342	342	0
02-22-21	7	Repulse Pt	1,814	6,764	8
02-22-21	8	Repulse Pt	3,156		
02-22-21	9	Tribune Bay	1,794		
02-28-06	14	Parksville Bay	1,142	1,910	4
02-28-06	15	Parksville Bay	768		
02-36-07	19	Longbeak	384	384	0
02-48-43	14	Parksville Bay	2,038	2,725	10
02-48-43	15	Parksville Bay	687		
02-60-34	13	Parksville Bay	1,651	1,651	1
02-62-10	19	Longbeak	1,871	1,871	3
08-16-06	9	Tribune Bay	3,633	16,100	23
08-16-06	10	Tribune Bay	10,142		
08-16-06	11	Helliwell Park	2,325		
08-16-10	1	Fillongley Park	4,705	18,963	38
08-16-10	2	Fillongley Park	10,125		
08-16-10	3	Fillongley Park	4,133		
08-24-17	12	Qualicum Bay	2,286	2,286	3
08-24-18	15	Parksville Bay	1,560	1,560	1
08-24-47	6	Boyle Pt	558	4,945	7
08-24-47	7	Repulse Pt	1,991		
08-24-47	8	Repulse Pt	2,396		
08-25-05	6	Boyle Pt	2,081	2,081	1
08-26-31R	6	Boyle Pt	393	5,643	5
08-26-31R	7	Repulse Pt	1,760		
08-26-31R	8	Repulse Pt	2,549		
08-26-31R	9	Tribune Bay	941		
12-19-50	3	Fillongley Park	4,418	13,472	20
12-19-50	5	Boyle Pt	5,038		
12-19-50	6	Boyle Pt	2,582		
12-19-50	7	Repulse Pt	1,434		
12-22-45	5	Boyle Pt	2,368	4,809	7
12-22-45	6	Boyle Pt	2,441		
18-01-52	20	Longbeak	806	806	2
18-03-32	28	Mudge Is	820	820	0
18-03-34 [a]	11	Helliwell Park	6,356	6,356	12
18-03-44	21	Nanoose	287	287	0

Appendix D (cont'd)

Tag Code [c]	Set	Location [d]	Tags per Set	Tags per Code	Recoveries in 2002
18-03-47	23	Link Is	592	2,287	7
18-03-47	24	Stuart Ch	1,695		
18-03-51	18	French Creek	927	927	1
18-04-35	14	Parksville Bay	1,664	2,130	3
18-04-35	15	Parksville Bay	466		
18-08-46	17	French Creek	1,007	1,007	1
18-08-48 [b]	30	Blunden Pt	952	952	8
18-08-50	22	Yellow Pt	4,393	4,393	3
18-11-51	18	French Creek	1,120	1,120	0
18-11-54	15	Parksville Bay	1,669	1,669	4
18-11-56	18	French Creek	1,060	1,060	0
18-12-19 [a]	14	Parksville Bay	2,138	2,506	0
18-12-19 [a]	15	Parksville Bay	368		
18-12-31	4	Big Qualicum	1,932	1,932	3
18-12-41	23	Link Is	551	1,936	1
18-12-41	24	Stuart Ch	1,385		
18-13-61	18	French Creek	1,203	1,203	0
18-14-21	13	Parksville Bay	1,906	1,906	2
18-14-43 [a]	25	Yellow Pt	3,454	3,454	9
18-15-08	15	Parksville Bay	2,070	2,070	2
18-15-59	16	French Creek	1,586	2,109	0
18-15-59	17	French Creek	523		
18-15-63 [b]	23	Link Is	753	1,745	6
18-15-63 [b]	24	Stuart Ch	992		
18-19-32	18	French Creek	1,582	1,582	0
18-19-33	20	Longbeak	672	672	0
18-28-05	26	Link Is	2,424	2,424	5
18-29-61	17	French Creek	569	569	2
18-30-03	18	French Creek	1,443	1,443	1
18-30-63	27	Hammond Bay	238	238	1
18-31-08	20	Longbeak	3,428	3,428	1
18-31-09	26	Link Is	2,852	2,852	5
18-31-10 [a]	27	Hammond Bay	3,060	3,060	2
18-31-11 [a]	27	Hammond Bay	3,312	3,312	2
18-31-12	29	Richard Pt	1,099	1,099	0
18-31-13	18	French Creek	1,627	1,627	0
18-31-14	18	French Creek	700	700	0
18-32-21	32	Schooner Cove	869	869	1
18-32-33	31	Icarus Pt	1,743	1,743	0
18-32-40	31	Icarus Pt	2,127	2,127	8
18-32-41	32	Schooner Cove	1,960	1,960	0
18-32-42	26	Link Is	424	565	0
18-32-42	27	Hammond Bay	141		
18-32-45	12	Qualicum Bay	2,464	2,464	1
18-34-28	20	Longbeak	3,717	3,717	0
18-34-29	26	Link Is	660	660	2
18-34-30	22	Yellow Pt	3,234	3,234	5
18-34-31	28	Mudge Is	1,025	1,025	0
18-34-35 [a]	13	Parksville Bay	2,024	2,024	0

Appendix D (cont'd)

Tag Code [c]	Set	Location [d]	Tags per set	Tags per Code	Recoveries in 2002
18-34-39	26	Link Is	573	573	0
18-34-41	22	Yellow Pt	631	631	1
18-34-42 [a]	19	Longbeak	511	511	0
18-34-45 [a]	13	Parksville Bay	0	0	3
18-34-47	23	Link Is	411	1428	3
18-34-47	24	Stuart Ch	1,017		
18-35-01	30	Blunden Pt	900	900	0
18-35-02	32	Schooner Cove	1,220	1,220	1
18-35-14	15	Parksville Bay	637	637	1
18-35-20	32	Schooner Cove	785	785	0
18-36-33	28	Mudge Is	1,338	1,338	0
18-37-26	29	Richard Pt	1,870	1,870	3
18-37-27	19	Longbeak	3,356	3,356	8
18-37-28	29	Richard Pt	839	2,746	1
18-37-28	30	Blunden Pt	1,907		
18-37-29	30	Blunden Pt	3,617	3,617	1
18-37-30	25	Yellow Pt	3,426	3,426	9
18-37-34	19	Longbeak	3,555	3,555	1
18-38-24	27	Hammond Bay	3,116	3,116	3
18-39-32	27	Hammond Bay	309	309	0
18-42-01	21	Nanoose	1,372	1,372	2
18-42-04	19	Longbeak	1,192	1,192	1
18-42-06	31	Icarus Pt	560	560	0
18-42-17 [a]	16	French Creek	4,672	7,030	6
18-42-17 [a]	17	French Creek	2,358		
18-42-22	32	Schooner Cove	819	819	1
18-42-23 [a]	19	Longbeak	0	0	0
Total			248,391		312
Total discrepant tags [b]			2,697		14
Total minus discrepant tags			245,694		298

[a] Tag code mislabelling occurred between codes used within the same year and stock region.
[b] Accidental repeated tag code usage occurred with 1999 and 2000 Strait of Georgia releases.
[c] Total of 95 tag codes were used and no stray tag recoveries were observed.

Appendix E. Summary of herring CWT releases in the Strait of Georgia and Prince Rupert District in 2001 by region, tag code with subsequent recoveries.

Assessment Region and Tag Code [a]	Set	Location	Tags per set	Tags per Code	Recoveries in 2002
Strait of Georgia					
02-02-61R	16	French Creek	1,561	1,862	2
02-02-61R	17	French Creek	301		
02-12-63	6	Cape Lazo	1,636	2,923	12
02-12-63	7	Cape Lazo	381		
02-12-63	8	Cape Lazo	906		
02-44-58	3	Bowser	1,107	1,394	1
02-44-58	4	Bowser	287		
02-63-20	1	Bowser	1,088	8,457	34 [b]
02-63-20	2	Bowser	5,446		
02-63-20	3	Bowser	1,923		
08-24-41	7	Cape Lazo	1,782	2,470	8
08-24-41	8	Cape Lazo	688		
08-24-44	4	Bowser	1,382	1,382	0
08-25-14R	16	French Creek	2,713	2,713	3
18-01-40	5	Cape Lazo	2,084	2,574	11
18-01-40	8	Cape Lazo	490		
18-01-53	4	Bowser	1,230	1,230	0
18-02-38	5	Cape Lazo	2,367	2,367	14
18-07-38	12	Little Qualicum R	1,354	4,770	7
18-07-38	13	Qualicum	2,287		
18-07-38	14	Qualicum	52		
18-07-38	15	French Creek	1,077		
18-08-20	4	Bowser	501	501	1
18-08-45	5	Cape Lazo	1,734	2,075	11
18-08-45	8	Cape Lazo	341		
18-09-37	3	Bowser	1,497	2,323	4
18-09-37	4	Bowser	826		
18-16-54	12	Little Qualicum R	716	2,434	6
18-16-54	13	Qualicum	1,718		
18-19-45	9	Lambert Ch	544	3,393	8
18-19-45	10	Lambert Ch	1,757		
18-19-45	11	Lambert Ch	1,092		
18-21-23	6	Cape Lazo	1,611	2,348	10 [c]
18-21-23	7	Cape Lazo	381		
18-21-23	8	Cape Lazo	356		
18-22-60	9	Lambert Ch	345	2,643	20
18-22-60	10	Lambert Ch	1,461		
18-22-60	11	Lambert Ch	837		
18-28-31	7	Cape Lazo	2,877	4,016	11
18-28-31	8	Cape Lazo	1,139		
18-34-46	13	Qualicum	985	2,798	8
18-34-46	14	Qualicum	116		
18-34-46	15	French Creek	1,697		
18-39-02	9	Lambert Ch	451	3,066	13
18-39-02	10	Lambert Ch	1,675		
18-39-02	11	Lambert Ch	940		
18-39-10	6	Cape Lazo	2,286	2,819	15
18-39-10	7	Cape Lazo	533		
All Strait of Georgia			60,558		197

Appendix E (cont'd)

Tag code [a]	Set	Location	Tags per Set	Tags per Code	Recoveries in 2002
Prince Rupert District					
02-02-62R	19	Kitkatla	626	1,946	3 [d]
02-02-62R	20	Kitkatla	1,320		
02-55-42R	20	Kitkatla	1,396	1,396	4
02-56-61R	29	Venn Pass	2,045	2,045	0
02-05-24	18	Kitkatla	176	2,413	6
02-05-24	19	Kitkatla	1,244		
02-05-24	20	Kitkatla	993		
02-10-47	21	Kitkatla	1,597	2,591	7
02-10-47	22	Kitkatla	994		
02-11-40	28	Venn Pass	2,025	2,025	1
02-24-09	28	Venn Pass	4,359	4,359	8
02-30-12	33	Venn Pass	836	5,734	5
02-30-12	34	Metlakatla Bay	2,895		
02-30-12	35	Garden Is	1,646		
02-30-12	36	Garden Is	357		
02-36-09	35	Garden Is	1,536	1,970	1
02-36-09	36	Garden Is	434		
02-41-28	21	Kitkatla	2,036	3,256	11
02-41-28	22	Kitkatla	1,220		
02-41-29	30	Big Bay	2,220	2,220	7
02-41-30	30	Big Bay	1,896	1,896	6
02-41-31	21	Kitkatla	1,393	2,428	4
02-41-31	22	Kitkatla	1,035		
02-50-50	18	Kitkatla	633	2,681	2
02-50-50	19	Kitkatla	2,048		
02-55-54	30	Big Bay	2,013	2,013	10
08-24-40	31	Venn Pass	1,915	3,634	1
08-24-40	32	Venn Pass	1,719		
08-24-61	31	Venn Pass	2,160	4,373	8
08-24-61	32	Venn Pass	2,213		
08-24-62	31	Venn Pass	2,306	4,501	12
08-24-62	32	Venn Pass	2,195		
18-04-05	23	Kitkatla	1,592	1,592	4
18-08-23	23	Kitkatla	1,407	1,407	4
18-08-53	27	Wolf / Garden Is	2,039	2,039	0
18-14-20	26	Wolf / Garden Is	2,491	2,491	4
18-16-11	26	Wolf / Garden Is	2,376	2,376	1
18-20-25	18	Kitkatla	156	156	0
18-20-27	25	Metford Is	1,994	1,994	2
18-20-29	25	Metford Is	2,259	2,259	3
18-28-26	27	Wolf / Garden Is	1,681	1,681	2
18-28-38	24	Casey Cove	1,295	1,295	6
18-28-39	23	Kitkatla	1,301	1,301	3
18-28-59	27	Wolf / Garden Is	1,618	1,618	2
18-33-57	24	Casey Cove	1,618	1,618	5
18-34-16	18	Kitkatla	423	1,220	3
18-34-16	19	Kitkatla	797		
18-34-56	25	Metford Is	2,455	2,455	3
18-38-22	26	Wolf / Garden Is	2,576	2,576	5

Appendix E (cont'd)

Tag Code [a]	Set	Location	Tags per Set	Tags per Code	Recoveries in 2002
18-38-47	33	Venn Pass	370	3,105	4
18-38-47	34	Metlakatla Bay	1,455		
18-38-47	35	Garden Is	1,280		
18-41-26	24	Casey Cove	1,257	1,257	3
28-16-03	29	Venn Pass	4,275	4,275	8
All Prince Rupert District			88,196		151
Total both regions			148,754		357

[a] Total of 59 tag codes were used (SG 22, PRD 37).
[b] One stray from SG (Bowser) to CC (Mosquito Bay).
[c] One stray from SG (Cape Lazo) to CC (Mosquito Bay).
[d] One stray from PRD (Kitkatla) to CC (East Higgins Pass).

Appendix F. Summary of herring CWT releases in the Strait of Georgia, the Central Coast and Prince Rupert District in 2002 by region, location and set with subsequent recoveries.

Location	Date	Set	Tag rate (per h)	Tags per Set	Tag Type [a]	Tag Code [b]	Tag Sequence From	Tag Sequence To	Tags per Code	Recoveries in 2002
Strait of Georgia										
Norris Rock	5-Mar-02	1	651	3,908	BiSq	08-12-01	240	2,403	1,039	0
Norris Rock	5-Mar-02	1			BiSq	08-12-02	217	2,574	1,176	0
Norris Rock	5-Mar-02	1			BiSq	08-12-03	237	2,207	934	1
Norris Rock	5-Mar-02	1			BiSq	08-12-04	235	1,987	759	1
Gartley Pt	6-Mar-02	2	698	5,585	BiSq	08-12-01	2,407	4,694	1,217	113 (1) [c]
Gartley Pt	6-Mar-02	2			BiSq	08-12-02	2,678	5,734	1,660	150
Gartley Pt	6-Mar-02	2			BiSq	08-12-03	2,210	5,152	1,556	136
Gartley Pt	6-Mar-02	2			BiSq	08-12-04	1,995	4,434	1,152	79
Comox Bar	6-Mar-02	3	589	4,123	BiSq	08-12-01	4,848	6,541	901	96
Comox Bar	6-Mar-02	3			BiSq	08-12-02	6,000	9,069	1,192	109
Comox Bar	6-Mar-02	3			BiSq	08-12-03	5,228	7,187	1,045	117 (1) [c]
Comox Bar	6-Mar-02	3			BiSq	08-12-04	4,515	6,372	985	73
Seal Islets	8-Mar-02	4	909	9,088	BiSq	08-12-01	6,548	10,571	2,156	6
Seal Islets	8-Mar-02	4			BiSq	08-12-02	9,078	13,233	2,260	3
Seal Islets	8-Mar-02	4			BiSq	08-12-03	7,192	11,828	2,287	3
Seal Islets	8-Mar-02	4			BiSq	08-12-04	6,383	10,727	2,385	2
Longbeak Pt	8-Mar-02	5	798	7,339	BiSq	08-12-01	10,575	14,000	1,691	5
Longbeak Pt	8-Mar-02	5			BiSq	08-12-03	11,837	13,774	1,073	3
Longbeak Pt	8-Mar-02	5			BiSq	08-12-04	10,729	14,000	1,700	4
Longbeak Pt	8-Mar-02	5			BiSq	08-12-05	208	625	149	0
Longbeak Pt	8-Mar-02	5			BiSq	08-12-06	210	3,566	1,845	10
Longbeak Pt	8-Mar-02	5			BiSq	08-12-07	173	1,456	624	3
Longbeak Pt	8-Mar-02	5			BiSq	08-12-08	222	832	257	0
Sandy Is	11-Mar-02	6	629	2,515	BiSq	08-12-05	636	1,690	544	1
Sandy Is	11-Mar-02	6			BiSq	08-12-06	3,568	5,115	817	5
Sandy Is	11-Mar-02	6			BiSq	08-12-07	1,646	2,690	529	0
Sandy Is	11-Mar-02	6			BiSq	08-12-08	836	2,031	625	3
Goose Spit	11-Mar-02	7	839	10,071	BiSq	08-12-05	1,763	5,799	2,241	4
Sandy Is	11-Mar-02	7			BiSq	08-12-06	5,117	10,194	2,806	5
Sandy Is	11-Mar-02	7			BiSq	08-12-07	2,693	7,156	2,382	3
Sandy Is	11-Mar-02	7			BiSq	08-12-08	2,034	7,260	2,642	5
Repulse Pt	15-Mar-02	8	674	2,695	BiSq	08-12-05	5,808	7,039	639	0
Repulse Pt	15-Mar-02	8			BiSq	08-12-06	10,197	11,673	829	0
Repulse Pt	15-Mar-02	8			BiSq	08-12-07	7,165	8,357	622	0
Repulse Pt	15-Mar-02	8			BiSq	08-12-08	7,263	8,429	605	0
SE Denman Is	15-Mar-02	9	869	6,950	BiSq	08-12-05	7,048	9,903	1,544	0
SE Denman Is	15-Mar-02	9			BiSq	08-12-06	11,759	13,219	772	0
SE Denman Is	15-Mar-02	9			BiSq	08-12-07	8,362	11,446	1,671	1
SE Denman Is	15-Mar-02	9			BiSq	08-12-08	8,437	11,896	1,896	1
SE Denman Is	15-Mar-02	9			BiSq	08-12-09	117	2,265	1,067	0
French Creek	16-Mar-02	10	770	4,002	BiSq	08-12-05	9,907	12,361	1,267	6
French Creek	16-Mar-02	10			BiSq	08-12-07	11,452	13,693	1,204	3
French Creek	16-Mar-02	10			BiSq	08-12-08	11,902	13,571	876	8
French Creek	16-Mar-02	10			BiSq	08-12-09	2,271	4,138	655	1
French Creek	17-Mar-02	11	825	8,248	Bi	08-01-24			1,637	5
French Creek	17-Mar-02	11			BiSq	08-12-05	12,367	13,243	439	2
French Creek	17-Mar-02	11			BiSq	08-12-09	4,139	8,100	2,165	9
French Creek	17-Mar-02	11			BiSq	08-12-10	240	3,815	1,908	10
French Creek	17-Mar-02	11			Bi	18-32-44			2,099	9

Appendix F (cont'd)

Location	Date	Set	Tag rate (per h)	Tags per Set	Tag Type [a]	Tag Code [b]	Tag Sequence From	Tag Sequence To	Tags per Code	Recoveries in 2002
Shingle Spit	17-Mar-02	12	894	10,738	BiSq	08-12-09	8,104	13,591	2,865	0
Shingle Spit	17-Mar-02	12			BiSq	08-12-10	3,816	8,336	2,433	4
Shingle Spit	17-Mar-02	12			Bi	08-25-04R			5,440	1
Comox Buoy	19-Mar-02	13	898	8,266	BiSq	08-12-10	8,342	12,213	2,076	4
Comox Buoy	19-Mar-02	13			Bi	18-22-58			4,845	6
Comox Buoy	19-Mar-02	13			Bi	18-38-23			1,345	1
All Strait of Georgia				83,528						1,011 (2) [c]
Central Coast										
Kwakshua Ch	20-Mar-02	14	443	1,771	Bi	18-37-31			1,771	0
Kwakshua Ch	21-Mar-02	15	769	7,692	Bi	08-24-35			3,612	0
Kwakshua Ch	21-Mar-02	15			Bi	18-37-32			4,080	0
Norman Morrison	21-Mar-02	16	777	7,772	Bi	02-25-46			3,868	52
Norman Morrison	21-Mar-02	16			Bi	18-39-18			3,904	41
Spiller Ch	22-Mar-02	17	834	8,359	Bi	18-38-59			4,201	20
Spiller Ch	22-Mar-02	17			Bi	18-38-61			4,158	9
Lockhart Bay	22-Mar-02	18	814	7,161	Bi	18-02-46			3,464	19
Lockhart Bay	22-Mar-02	18			Bi	18-38-57			3,697	17
Spiller Ch	23-Mar-02	19			Bi	18-15-28			3,680	98 (1) [c]
Spiller Ch	23-Mar-02	19	773	7,735	Bi	18-28-48			3,595	120
Spiller Ch	23-Mar-02	19			Bi	18-42-57			460	18
Kitasu Bay	24-Mar-02	20	822	9,042	Bi	08-01-33			4,572	30
Kitasu Bay	24-Mar-02	20			Bi	18-12-11			3,737	23
Kitasu Bay	24-Mar-02	20			Bi	18-35-22			733	9
Kitasu Bay	25-Mar-02	21	845	9,126	Bi	08-25-02			4,875	29 (1) [c]
Kitasu Bay	25-Mar-02	21			Bi	18-14-14			3,539	21
Kitasu Bay	25-Mar-02	21			Bi	18-39-35			712	4
All Central Coast				58,658						510 (2) [c]
Prince Rupert District										
ig Bay	26-Mar-02	22	742	5,936	Bi	08-24-60			2,920	19
Big Bay	26-Mar-02	22			Bi	18-04-38			3,016	20
Big Bay	27-Mar-02	23	1,023	8,186	Bi	08-25-16R			4,194	10
Big Bay	27-Mar-02	23			Bi	18-07-56			3,992	7
Big Bay	27-Mar-02	24	862	6,895	Bi	18-03-49			3,157	5
Big Bay	27-Mar-02	24			Bi	18-35-03			259	0
Big Bay	27-Mar-02	24			Bi	18-39-03			3,479	5
Big Bay	27-Mar-02	25	754	6,933	Bi	02-19-28			3,033	0
Big Bay	27-Mar-02	25			Bi	08-25-07R			3,393	1
Big Bay	27-Mar-02	25			Bi	18-35-08			507	0
Big Bay	28-Mar-02	26	925	8,324	Bi	02-38-27			4,200	5
Big Bay	28-Mar-02	26			Bi	18-38-58			4,124	8
Big Bay	28-Mar-02	27	1,016	8,126	Bi	18-04-40			7,778	11
Big Bay	28-Mar-02	27			Bi	18-39-34			348	1
Big Bay	28-Mar-02	28	760	4,560	Bi	18-24-63			4,560	0
Kitkatla Inlet	31-Mar-02	29	739	8,119	Bi	02-38-26			4,064	27
Kitkatla Inlet	31-Mar-02	29			Bi	18-28-47			4,055	19
Kitkatla Inlet	1-Apr-02	30	1,180	5,899	Bi	08-25-13R			2,825	19

Appendix F (cont'd)

Location	Date	Set	Tag rate (per h)	Tags per Set	Tag Type [a]	Tag Code [b]	Tag Sequence From	Tag Sequence To	Tags per Code	Recoveries in 2002
Kitkatla Inlet	1-Apr-02	30			Bi	18-35-07			847	9
Kitkatla Inlet	1-Apr-02	30			Bi	18-35-15			1,502	9
Kitkatla Inlet	1-Apr-02	30			Bi	18-35-17			725	7
Willis Bay	1-Apr-02	31	828	2,651	Bi	02-56-62R			1,173	17
Willis Bay	1-Apr-02	31			Bi	18-28-46			1,478	22
Willis Bay	1-Apr-02	32	806	7,255	Bi	02-08-26			3,638	55
Willis Bay	1-Apr-02	32			Bi	18-33-54			3,617	47
Willis Bay	2-Apr-02	33	889	1,777	Bi	18-33-26			448	3
Willis Bay	2-Apr-02	33			Bi	18-35-09			421	5
Willis Bay	2-Apr-02	33			Bi	18-35-18			374	2
Willis Bay	2-Apr-02	33			Bi	18-39-31			534	4
Wilson Inlet	2-Apr-02	34	1,231	11,081	Bi	02-21-16			11,081	0
All Prince Rupert District				85,742						337
Total all regions				227,928						1,858 (4) [c]

[a] All tag insertions were to the nape without anaesthesia; binary sequential (BiSq) and binary batch (Bi) CWT codes were used.

[b] A total of 103 tag codes were used (SG 55, CC 18, PRD 30).

[c] Data in parentheses correspond to four tag recoveries (2 SG, 2 CC) collected at CFC with uncertain recapture location.