Canadian Mark Recovery Program CWT Sampling, Lab Operations and Reporting – Year 2

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Canadian Mark Recovery Program CWT Sampling, Dissection, and Reporting

Glossary

All terms that are specific to PSC management are indicated as (PSC)

AABM	Aggregate Abundance Based Management (PSC)
CoTC	Coho Technical Committee (PSC)
CC	Central Coast – portion of NC (Areas 6-10)
CGSB	Canadian General Standards Board
CTC	Chinook Technical Committee (PSC)
CWT	Coded Wire Tag
CWTIP	CWT Improvement Program (PSC)
CWTIT	Joint CWT Implementation Team (PSC)
DFO / The Department	Department of Fisheries and Oceans Canada
DIT	Double Index Tagging
DSWG	Technical Committee Data Sharing – Data Standards Working Group (PSC)
ISBM	Individual Stock Based Management (PSC)
ETD	Electronic tag detection
FSC	First Nations Food Social and Ceremonial fisheries
FOS	DFO Fisheries Operations Database
MRP	Mark Recovery Program
MRPIS	DFO Mark Recovery Program Information System
MM	Mass Marking
MSF	Mark Selective Fishing
MOU	PST Memorandum of Understanding (PSC)
NBC	Northern British Columbia
NC	North Coast – portion of NBC including Areas 1-5
PFMA	Pacific Fishery Management Area
PSC	Pacific Salmon Commission
PSMFC	Pacific States Marine Fisheries Commission
PST	Pacific Salmon Treaty (PSC)
RMIS	PSMFC CWT database – Regional Mark Information System
SBC	Southern British Columbia
TCDS	Technical Committee on Data Sharing (PSC)
TR18	PSC Technical Report 18 – Report of the Expert Panel on the Future of the CWT Program (PSC)
TR25	PSC Technical Report 25 – An Action Plan in Response to CWT Expert Panel Recommendations (PSC)
TR33	PSC Technical Report 33 – 5-year Synthesis Report of the CWTIP (PSC)
WCVI	West Coast Vancouver Island

Table of Contents

List of Tables

List of Figures

1. Introduction

This report documents the results of the Canadian Mark Recovery Program (MRP) conducted in British Columbia from April 1, 2016 to March 31, 2017 to conduct a coded-wire tag (CWT) sampling and recovery program to support domestic stock assessment and sustainable fisheries management, and to implement Chapter 3 of the Pacific Salmon Treaty (PST).

In 2014, the Pacific Salmon Commission (PSC) recognized that management agencies in Canada and the U.S. preparing for the 2015-2019 fishing seasons were facing financial challenges to maintain their existing PSC Coded Wire Tag recovery and lab operations under projected agency budgets. Fisheries and Oceans Canada (DFO) had faced increasing budget pressures since the introduction of U.S. mass marking and alternative funding sources such as the CWT Improvement Program (CWTIP) were used increasingly to maintain catch monitoring, CWT sampling, and the Chinook indicator stock program. Looking forward, anticipated cuts were expected to reduce the extent of fishery monitoring and CTC indicator stocks to levels much less than those that led the PSC to convene the CWT Expert Panel in 2004. With the CWTIP ending in 2013 in Canada and in 2014 in the U.S., the PSC Joint Technical Committees, supported by the PSC, identified this project as a "very high priority chinook project" to address PST Chapter 3 data needs.

The Mark Recovery Program completed its forty-fourth year of operation in 2016. This is year two of a collaborative project to maintain the MRP to sample, dissect, read, analyze and report statistically-reliable and timely CWT data from British Columbia (BC) fisheries, hatcheries and spawning grounds.

1.1 Background

The PST, signed by Canada and the United States in 1985, provides the framework through which the two countries work together to manage and conserve Pacific salmon.

Pacific salmon are highly migratory and, over the course of their lifecycle, fish originating in the rivers of one country are often subject to the fisheries of the other. With the development of comprehensive evaluations of science-based management regimes on interception fisheries and on the stocks which contribute to those fisheries under the PST, Canada and the U.S. considered it necessary to maintain a CWT tagging and recapture program designed to provide statistically reliable data (PST MOU 1985). Over the last 30 years, a high level of cooperation has occurred between Canada and the U.S. to develop coast wide standards for use of CWTs in tagging projects, for sampling fisheries, lab operations for tag recovery, data collection and data exchange.

DFO relies on the CWT Program to provide stock and fishery specific information for chinook and coho salmon, to evaluate salmon enhancement activities, and to support international fisheries management (PSC Reports TCCOHO (13)-1, TCCHINOOK (15)-1, TCCHINOOK (15)-2). The Department also uses the data to determine stock status (Wild Salmon Policy), forecast stock abundance, and monitor trends in regional survival and harvest patterns for ecosystem-based assessment to support domestic fisheries management and salmon enhancement assessment.

Since the early 2000s, DFO and U.S. agencies have been challenged to maintain the CWT Program given declining resources, increasing fisheries management complexity including the introduction of mass marking (MM) and mark selective fisheries (MSFs).

- In 2004, as a result of growing concern over the statistical reliability of the CWT Program, the PSC convened an Expert Panel to review the CWT Program (PSC TR18)
- In 2008, a bilateral Working Group was formed to develop an Action Plan in response to the review. (PSC TR25)
- In 2009, the comprehensive renewal of Chapter 3 (Chinook) of the PST established a $15,000,000 5-year CWT Improvement Fund to support the CWT Program. (PSC PST)
- In 2014, with the sun setting of the CWT Improvement Fund, the PSC Commissioners identified this project as a "very-high-priority" project in response to bilateral concerns over the maintenance of CWT Program improvements that were achieved. (PSC TR32)

1.2 Objectives

The specific objectives of this project were:

1) Complete CWT sampling of commercial fisheries at sufficient levels (weighted average of 20%) and data entry of commercial, recreational and First Nations fisheries by January 15, 2017.
2) Complete CWT lab and data entry activities for commercial, recreational and First Nations fisheries, and escapement data by January 15, 2017.
3) Complete integration of data sources and computer analyses associated with the calculation of stratified CWT estimates by Jan 31, 2017.
4) Publish data to Pacific States Marine Fisheries Commission (PSMFC) for validation against PSC exchange specifications and upload into the U.S. Regional Mark Information System (RMIS) to meet PST data sharing commitments and make data widely available to the PSC Chinook Technical Committee for analysis by Feb 15, 2017
5) Complete final project report to PSC for project activities and budget expenditures by Apr 30, 2017.

2. Study Area

The study area was the province of British Columbia, Canada. The North Coast Area (NBC) includes tidal waters stretching from the Alaskan boundary in the north to Cape Caution in the south and incorporates the non-tidal waters that flow into this area. This includes Pacific Fishery Management Areas (PFMAs) 1 to 10 and offshore waters as well as adjacent freshwater watersheds. The South Coast Area (SBC) includes tidal waters stretching Cape Caution in the north to the Washington boundary in the south and incorporates the non-tidal waters that flow into this area. This includes PFMAs 11-29 and offshore waters as well as adjacent freshwater watersheds. Commercial fisheries are also described by License Area as described in Table 1.

Pacific Salmon License Area	Gear	Corresponding Pacific Fisheries Management Areas (PFMA)
Salmon Area A	Seine	Areas 1 to 10, Subarea 101-7
Salmon Area B	Seine	Areas 11 to 29 and 121
Salmon Area C	Gill net	Areas 1 to 10, Subarea 101-7
Salmon Area D	Gill net	Areas 11 to 15 and 23 – 27
Salmon Area E	Gill net	Areas 16 to 22, 28, 29 and 121
Salmon Area F	Troll	Areas 1 to 10, 101 to 110, 130 and 142
Salmon Area G	Troll	Areas 11, 20 to 28, 111, 121, 123 to 127 and Subareas 12-5 and 12-6
Salmon Area H	Troll	Areas 12 to 19, 28 and 29

Table 1 - Pacific Salmon License Areas

Maps of DFO Commercial Salmon License Areas (Areas A-F) and Pacific Fishery Management Areas (Areas) are provided in Appendices 1 and 2.

3. Methods

3.1 Sampling Design and Procedures

The DFO Mark Recovery Unit conducted this project from April 2016 – Mar 2017. In addition to commercial, First Nations economic, and recreational fisheries sampling conducted under this project, area-based DFO personnel were engaged in CWT sampling in Test Fisheries, with First Nations Food, Social and Ceremonial (FSC) fisheries, and escapement sampling under different funding envelopes.

Because fisheries sampling is required throughout year in remote geographic areas and priorities can change quickly to respond to fishery dynamics, often on short notice, DFO conducted this this project using a contracted service provider. The service provider, J.O. Thomas and Associates, was selected through a Public Works and Service Canada open competition, was listed with the Canadian General Standards Board (CGSB 2015b), met ISO 9001 quality management standards (CGSB 2015e), and was designated by Fisheries and Oceans Canada as a certified provider of dockside monitoring services.

A bi-laterally accepted sample target of 20% has been established to provide an adequate number of CWT recoveries to meet statistical criteria to estimate fishery and stock parameters. (PSC TR25). In 2016, sampling for CWTs was designed to sample 20% of the catch for all Canadian commercial fisheries which allowed legal retention of chinook or coho in BC waters in which salmon with CWT indicator stocks would be intercepted. BC fisheries were CWT sampled using a stratified sampling design by dividing the fisheries into non-overlapping subpopulations by fishery geographic regions (catch regions) and period fished (weeks, months) that are similar in the stock composition of the population present. Under this assumption, estimates of the number of tagged fish harvested in the strata are unbiased for each tag code (TR 25 2008).

Sample design and methods for Canadian CWT programs varied across fishery types as a result of different DFO catch monitoring programs and different conduct of the fisheries. The definition of the spatial-gear-time strata for sampling was also determined by the conduct of the fisheries and the associated DFO catch monitoring program.

3.1.1 Commercial and First Nations Economic Fisheries

For all commercial and First Nations economic fisheries, representative samples were taken at fishery landing stations or processing sites, aligning to the fishery temporal and spatial dynamics with a target sample of 20% of the total landed catch in the fishery within each gear type (troll, seine, and gillnet), Pacific Fishery Management Area and statistical week (beginning Sunday). The sample unit was the entire catch of a selected vessel to reduce the risk of bias by sampling partial offloads. Pacific Fishery Management Areas and statistical week calendars are provided in Appendix 2 and 3. See Appendix 4 for a listing of sampled commercial fishery openings.

Southern B.C. Fraser River (area 29) fisheries, primarily targeting chum during fall fisheries, had a sample target of 30% to increase the likelihood to acquire tags from Fraser River indicator stocks.

Historic fishery catch and effort by area, day, and week was modelled and used as a tool to develop sample plans and set weekly sample or daily quotas to adjust for in-season fishery dynamics. Sample opportunities were identified using fishery notices, daily phone-ins, electronic catch and offload reports from vessels, and direct contact with DFO fishery managers and primary buyers to confirm times and locations for sample events. In some fisheries, conditions of license provided designated offload locations.

Samplers were deployed to primary offload sites but occasionally operate in secondary processors in Nanaimo or Vancouver for cost effective program delivery in net fisheries. At primary offload sites, the sample unit is the catch of an entire vessel to reduce the risk of bias by sampling partial offloads. At secondary processors, if the catch from individual vessels has been mixed, the sample unit is the truck.

Access to fish in commercial and First Nations economic fisheries is ensured by the Fishery (General) Regulations (DFO 1993) which state:

> When requested, the master or owner of fishing vessels and the owner or any person who has the care, charge or control or a fish landing station must permit access to the catch and provide CWT samplers with assistance that is reasonably necessary to enable them to perform their duties according to DFO-approved sampling protocols including:
> (i) Making the fish readily accessible to the CWT samplers,
> (ii) Providing samplers with a suitable work area, and
> (iii) Permitting CWT samplers to remove the head from the fish free of charge.

For commercial landings selected for CWT sampling, the sampling event included a vessel operator interview designed to collect vessel identification information, fishing period, and fishing location. Samplers enumerated all of the landed fish by clip status, and collected all heads using screening

methods to identify samples likely to contain CWTs following DFO protocols for visual sampling or full electronic sampling. Heads of CWT-tagged fish were recovered, labelled with durable bar-coded and numbered waterproof tags. Each tag recovery was measured for length. All data associated the landing and head recoveries were recorded on uniquely numbered waterproof Mark Recovery Sample Forms which were delivered to the Project office within one week of field sampling. Samples were packaged and labelled with waterproof container labels and shipped or delivered to the CWT Head Lab for processing within one week of field sampling. Mark Recovery Sample forms and Commercial head labels and container labels can be found in Appendix 5 and 6.

Screening for CWTs - Detection Method

In all commercial and First Nations economic fisheries, the required method for CWT detection is dependent upon the presence of mass marked or double index tagged fish in the fishery. A requirement for all sampling was that each fish in a sample was inspected and that all heads identified as potentially containing a CWT are collected for lab processing.

Visual sampling requires a fish to be inspected for a missing adipose fin to indicate that there is a CWT. Electronic sampling requires all fish in the sample to be inspected, regardless of adipose clip status, with electronic tag detection (ETD) by passing the fish through a tube detector or using a handheld wand. Visual sampling is the most cost effective method to CWT sample for fisheries which do not encounter mass-marked fish because the adipose-clip is a cue to recognize that a fish contains a CWT.

Full electronic sampling is required in all fisheries that encounter large proportions of mass-marked (MM) Chinook or Coho and intercept doubled index tag (DIT) stocks to screen the catch to ensure all tags in the sample are acquired because the is no visual cue to indicate a fish contains a tag. Electronic sampling is effective in reducing the effort to sample, the impact on the harvester or buyer, and the cost to ship heads in fisheries that encounter large proportions mass-marked fish, and the number of samples to be processed in the lab. Detection methods by geographic fishing area are provided in Table 2.

	Chinook		
	MM fish present	DIT fish present	Detection Method
NC & SC marine mixed stock fisheries	Y	Y	E
NC & SC inshore terminal fisheries	N	N	V
WCVI marine mixed stock fisheries	Y	Y	E
WCVI inshore terminal fisheries (Areas 21, 24-27 Nitinat, Clayquot Sound, Nootka/Esperanza, Kyuquot Soutnd, Quatsino)	N	N	V
WCVI inshore and terminal Robertson Creek fisheries (Area 23 Barkley Sound and Alberni Inlet)	N	N	V
SC Inside Areas (Johnstone Strait, Strait of Georgia), Juan de Fuca Strait)	Y	Y	E
Fraser River terminal fisheries	N	N	V

Table 2 - Protocols for CWT Detection Method in Canadian Commercial and First Nations Economic Fisheries

Custom sampling infrastructure such as sorting tables, stands and receiving tables that can accommodate electronic tube detectors have been integrated into many fish offload sites or processing operations to facilitate positive relationships with industry to minimize disruption to the industry's offloading and grading processes.

Freezer Trollers

To ensure freezer troll caught heads are available to sample, the Department has established a condition of license for all troll vessels that remove and dispose heads at sea prior to freezing to retain and land heads with their catch. With this condition of license, the legal mechanism to select a random sample of vessels to retain heads is put in place through a fishery notice that exempts randomly selected vessels from this condition of license (thus designating the remainder of license holders to keep all heads).

For the Northern BC Area F troll fishery, a sample target rate of 30% was established in 2015 in recognition that the historical compliance rate to provide samples that meet MRP quality assurance standards has been about 70%, resulting in an adjusted post-compliance sample target of 21%. With higher abundance in 2016 and a fixed budget, the sample target rate was reduced to 20% and additional efforts to increase compliance were implemented. An additional 6 vessels were reselected to provide a penalty for non-compliance and a targeting opportunity to intercept and enforce ongoing non-compliance by these specific vessels. Assuming 100% of all vessels selected, the effective target sample rate for 2016 was 22.5%.

Recognizing that vessels may have space limitations for retaining heads, the Department allowed the alternative of retaining only the portion of the head likely to contain the CWT, referred to as the 'snout' and provided instructions that, at a minimum, the portion of each head retained must include the upper portion of the head extending from the tip of the snout to a cut travelling from the top of the head, passing 1 centimeter behind the eye, and ending at the back corner of the mouth.

The 2016 conditions of license required the following protocols for head storage:

- Heads must be stored in DFO-supplied heavy weight Salmon Head Recovery Program.
- Heads must be kept frozen until delivery and each bag must contain only the heads from a single week of fishing (where weeks run from Sunday to Saturday).
- All bags must be labelled completely with DFO-supplied Freezer Troll Bag labels and securely closed.
- The vessel master shall ensure that all bags containing heads are offloaded at the first designated fish landing station at which chinook or coho catch is offloaded.

All freezer heads that were landed were sampled electronically to acquire CWTs. Essential sample information included the recording of compliance data to support enforcement using Freezer Troll Delivery Record and Mark Recovery Sample forms, to support tracking and adjudication, to collect data to ensure that samples meet DFO standards for quantity (> 95% heads landed vs. # bodies landed) and quality (> 80% heads landed frozen with correct head cut > 1 cm behind eye), and to

provide sample resolution at the individual bag level. All data associated to the landing, the sampling of bags, and tag recoveries were delivered to the Project office within one week of field sampling. Freezer Troll Bag Labels and Freezer Troll Delivery Records can be found in Appendix 7.

T'aaq-wiihak and Kamloops Lake Demonstration Economic Fisheries

CWT sampling for First Nations demonstration fisheries was not within the scope of this project, while operational support and sampling supplies were provided by the Mark Recovery Unit for consistency in program delivery. The WCVI T'aaq-wiihak fishery had the same target sample rate and sampling methods as commercial and economic fisheries, but the First Nations contracted directly with the DFO-selected service provider. All procedures were the same, with Mark Recovery Unit personnel involved in training and audits for quality assurance/quality control.

In 2016, the Kamloops Lake Demonstration fishery had a higher requirement for catch monitoring by the Department, which included CWT sampling of 100% of the catch.

3.1.2 Test Fisheries

CWT sampling for Test fisheries was not within the scope of this project, while operational support and sampling supplies were provided by the Mark Recovery Unit for consistency in program delivery.

In 2016, DFO and PSC fisheries were required to sample 100% of their catch visually. CWT sampling protocols and MRP Research Head Labels were provided to DFO area-based project leads, who were responsible for CWT sampling, attaching barcoded waterproof labels to head recoveries, labelling boxes or containers of samples with MRP Container labels, shipping or delivering the containers to the DFO Head and data entry of research sample data into the DFO Fisheries system. Research head labels can be found in Appendix 6.

3.1.3 Recreational Fisheries

For all recreational fisheries, samples were provided to DFO through fisher submissions to Salmon Head Recovery Depots throughout BC. The target sample rate is 20% of the estimated marked catch in the fishery within each catch region and month. Because of the reliance on fisher-provided samples, sample rates are also known as submission rates in recreational fisheries. It is cost-prohibitive to acquire the 20% sample target through direct sampling of recreational fisheries due to the wide distribution of the fishery throughout the year and throughout BC.

For all recreational fisheries, the sampling method involved public relations and promotion of the sampling requirements to support best fishing practices for conservation and future sustainable fisheries. Samples were acquired by requesting marinas, tackle stores, fishing lodges, and hatcheries to sign-up as Salmon Head Recovery Head Depots and by requesting anglers, guides or lodges to use visual sampling protocols to identify samples, label heads with DFO-supplied water-proof labels, and submit the labelled head with catch information to a Salmon Head Depots. Maintaining positive public relations is essential in this sampling regime so the Department maintained a toll-free line for inquiries or issues, maintained detailed records of servicing, provided feedback to Depots regarding

servicing events via a Depot Service Log and Postcard, and provided letters with CWT results to anglers, guides, and depots at regular intervals through the season.

More than 250 Salmon Head Depots were located throughout BC, and Salmon Head Depot operators provided sampling supplies to anglers and stored the samples in freezers or buckets containing a brine solution to preserve them. Scheduled servicing and maintenance of Salmon Head Depots was performed by J.O. Thomas and Associated under contract or by area-based DFO personnel. All samples picked up from depots were labelled in batches with barcoded DFO container labels to associate the samples to the service event. Recreational Head Labels and Container Labels can be found in Appendix 6. Additional Salmon Head Recovery Program public relations and sampling materials are provided in Appendix 8.

Fisher-provided samples may introduce bias in the CWT data. Anglers who return tags may not represent the fishing patterns of all anglers, resulting in some tag groups being overestimated and others underestimated. There is no recovery of unmarked tags (from double index tag (DIT) groups).

3.1.4 First Nations Food Social and Ceremonial (FSC) and Treaty Fisheries

CWT sampling methods varied in these fisheries due to the variation in area-based delivery of catch monitoring programs in FSC and Treaty fisheries and regional differences in priorities for catch monitoring.

Collaboration with First Nations fisheries managers and communities is essential to access samples. In some FSC fisheries, CWT sampling was integrated into the catch monitoring program and samples were acquired by First Nations monitors as fish were landed. In other fisheries, samples were acquired as they are for recreational fisheries by requesting aboriginal harvester to use visual sampling protocols to identify samples, label heads with DFO-supplied water-proof labels, and submit the head to a fishery monitor, guardian, or to a Salmon Head Depot.

As in all other fisheries, each head sample was labelled with a barcoded waterproof label and all samples were shipped or delivered to the DFO head lab with barcoded waterproof container labels to associate the samples to the service event and shipment.

FSC Head Labels can be found in Appendix 6. CWT sampling for these fisheries is not within the scope of this project, while operational support and sampling supplies were provided by the Mark Recovery Unit for consistency in program delivery.

3.2 Estimates of Total Catches and Sample Rates

In order to estimate the total number of tagged fish in harvest, the sampled tags are expanded for the fraction sampled by strata (area, gear, and period). The sample fraction is the number sampled over the total available for sample, i.e., the total catch. Catch data for each fishery was collected and assembled by DFO resource managers and stock assessment programs from a variety of sources such as logbooks (paper and electronic), fishery phone-in hails, harvester/creel surveys, aerial or on-water gear counts, on-board observers, dockside monitoring/validation tallies, individual quota

fishery reports, landing slips, and buyer fish slips. The extent and intensity of the monitoring requirements varied significantly with the fishery's size and location, particular management risks and information challenges, and other factors. (DFO 2012).

While the form of catch monitoring may vary across fisheries, all DFO catch monitoring programs collected data to support an estimate of the total pieces caught in the fishery by Pacific Fishery Management Area. DFO Recreational and First Nations FSC catch monitoring programs had the additional objective to estimate the mark rate by adipose clip status by Pacific Fishery Management Area.

3.3 Lab Operations

All fish head samples collected in fisheries and DFO escapement sampling programs were processed to recover and decode CWTs at the DFO-contracted J.O.Thomas and Associates CWT dissection lab in Vancouver. This process involved the management of all samples received and the dissection, reading (decoding) the tag using microscopes electronically equipped with LCD screens, transcribing the tag information to appropriate forms, and data entry.

Dissection requires the use of a specialized electronic metal detector that indicates which portion of the snout the CWT is in after successive sectioning of the sample. If no tag was found, the sample was passed through a magnetic field to re-magnetize the tag (if present).

Tag dissection schedules were structured to process sport and commercial recoveries within six weeks of receipt. Commercial recoveries were processed by sampling location and by statistical week, while sport recoveries were processed by area and month of recovery. Escapement heads were processed on the basis of priorities established by DFO stock assessment and hatchery personnel to ensure completion of milestones for analysis by January and February.

The lab maintained quality control checks on the reading of CWTs to ensure that tags were accurately read and data entered. To check the accuracy of tag reading, each tag was initially read by a technician and then read a second time by a different technician to verify the first reading. Several error checks were run, including verification that the tagcode is legitimate (ie, was previously released), that the species is correct, and that the age is reasonable.

3.4 Data Collection, Management and Analysis

All personnel responsible for sampling received training in the purpose and methods for the surveys and were supervised by experienced staff for quality control/quality assurance. Standard forms and data collection processes were developed to optimize field data collection, and all forms were manually reviewed by field chiefs and office staff to ensure that obviously erroneous data were corrected. For commercial and First Nations economic fishery sampling, the Mark Recovery Sample Forms were designed to record incomplete or problem samples as an addition quality control measure. All samples were managed with barcoded container labels and head labels.

Data forms were delivered from all programs within a week of sampling, where they were sorted by data prior to data entry. Custom J.O. Thomas and Associates data entry applications were used

throughout the season to input and validate field data. DFO audit procedures of field work and data entry were performed for early checking of the quality of the data collection process.

Data was uploaded and validated by the MRP Information System (MRPIS) at regular intervals and further validated against an extensive set of checks to verify the in integrity and accuracy of the data. The rules are specified in the PSC Data Standards Workgroup (DSWG) database specification report (PSC-DSWG 2014).

Data Analysis was conducted using the MRPIS system to integrate sample data with lab data and post-season catch estimates from January – Feb 2017. Kuhn et al. (1988) summarize formulae utilized by the MRPIS to calculate CWT tag estimates, stratified by gear, geographic area and time. All samples from direct sampling programs in commercial, test and First Nations economic fisheries were expanded to the estimated total catch in the fisheries. Samples mark catch from submission sampling programs were expanded to the estimated total of marked catch in the fisheries.

Upon completion of the CWT estimation process, CWT data was available to DFO users directly from the MRPIS. Upon completion of the data exchange with the PSMFC, validated datasets of summary Canadian CWT recoveries, catch and samples are available to U.S. users through RMIS. Likewise, U.S. CWT recoveries, catch and samples provided by the PSMFC is imported into the MRPIS. The data flow process for the MRPIS and RMIS are documented in Figure 1 (PSC TR25).

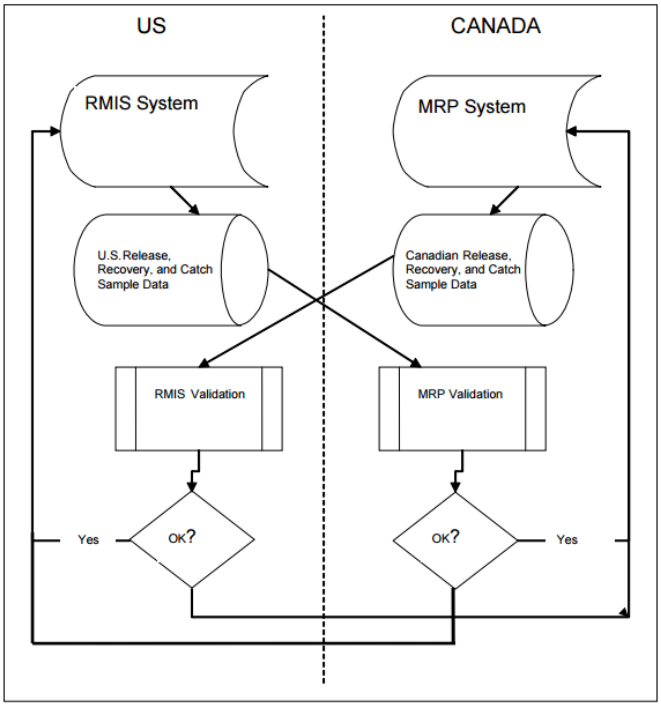

Figure 1 – The main components of the data exchange protocols between the Canadian and U.S. CWT database systems

4. Results

4.1 Sampling Effort

4.1.1 Commercial and First Nations Economic Fisheries

All BC commercial and First Nations salmon fisheries with retention of Chinook or Coho as target species or by-catch were sampled consistently over the entire season. See Appendix 4 for a list of sampled commercial fishery openings in 2016.

Commercial catches are landed and processed at a wide variety of locations, landing sites, and processing plants. The extremely complex mixture of net and troll fisheries which occur simultaneously for salmon, the large number of processors involved at different locations, and the differing processing and grading systems used by these processors all combine to make the task of obtaining representative samples from each statistical area for each type of gear a very difficult undertaking. A further complication is the requirement for electronic detection sampling, and the availability of physical space. Allocation of resources to meet sampling requirements was accomplished by a dynamic "Coordinated Location Sampling Strategy." This method relies on the experience of several key management personnel as well as senior staff coordinating schedules in each of the field sample locations to achieve necessary sample quotas. Project managers allocate sampling effort based on past and present experience of fishery dynamics and in-season reports from DFO to predict probable vessel landing locations and known processors where fish would be landed. Sampling crews kept in constant contact with project managers to ensure that sampling quotas were being met and to coordinate sampling effort between different locations. This system ensured coastwide, representative catch and biological sampling by MRP crews in an efficient and cost-effective manner.

Net and troll fisheries present different problems in estimating catches and therefore required different catch assessment procedures. Net fisheries operate in a more restrictive spatial and temporal profile from those of troll fisheries. The primary process to establish quotas is to first acquire information on the fleet size by gear, and second, determine the catch of the target species. Most net fisheries target on more abundant species like sockeye, pink or chum salmon. For gillnet fisheries, sample quotas are set on sampling a prescribed number of boat deliveries, as well as a number and weight of the target species catch. Seine fisheries are generally sampled to a specified number of vessel landings. Sampling levels are established to acquire 20% of troll and net vessel deliveries and account for the unloading of approximately 20% of the target species catch, respectively by gear type. For troll fisheries, quotas and sample rates are generally calculated and monitored by evaluating weekly and accumulated boat days sampled.

Geographic strata used in the MRP divides the British Columbia coast into 14 net and six troll fishery specific strata (Table 3). Each stratum may contain one or more Pacific Fishery Management Areas (PFMAs).

Fishery/Gear	Fishery Strata	PFMAs
Commercial/Troll	Northern Troll	1 to 5,101 to 105,2W,142
	North Central Troll	6,106,7,107,8,108,9,109
	South Central Troll	10,110,11,111,12
	Georgia Strait Troll	13 to 18, 29
	Southwest Vancouver Is Troll	21,121,23,123,24,124
	Northwest Vancouver Is Troll	25,125,26,126,27,127
Commercial Net, First Nations Economic & Test Fisheries	Northern Net	1 to 5,101 to 105,2W,142
	Central Net (excluding PFMA 8 terminal)	6,106,7,107,9,109,10,110
	Central Net Terminal PFMA 8, 108	8,108
	Johnstone Strait Net	11,12,13
	Georgia Strait Net	14 to 18
	Juan de Fuca Net	20
	Northwest Vancouver Is Net	25 to 27
	Fraser Seine	29-3,29-4,29-6
	Fraser Gillnet & Test Fisheries	29
	Skeena Test Fishery	4
	South Taaq-wihak Economic Fishery	23,123,24,124
	North Taaq-wihak EO Fishery	25,125,26,126
	SW Vancouver Is Net excl. Alberni Inlet	21, 24
	Alberni Inlet Gillnet + Tsu-mass Economic Fishery	23

Table 3 - Strata and corresponding Pacific Fishery Management Areas (PFMAs) by Fishery/Gear type

Commercial sampling effort was distributed throughout BC at 4 ports and 8 landing sites in Northern BC and at 10 ports and 17 landing sites in Southern BC. Distribution of sampling effort closely followed fishing effort during the season. In NBC fisheries, the sampling period extended from June to September, while in SBC fisheries, the sampling period was year round.

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The majority (60%) of commercial landings of chinook were sampled in North Coast locations in 2016, mostly from the Area F troll fishery and a smaller amount from Skeena River chinook directed net fisheries (Area 4). Masset, Port Edward, Prince Rupert, and Queen Charlotte City sampled 30%, 25%, 3%, and less than 1%, of all samples, respectively. The remaining 40% of samples originated primarily in the Area G troll chinook and T'aaq-wiihak troll chinook demonstration fishery off the west coast of Vancouver Island. Most samples were obtained from these fisheries in Ucluelet, Tofino, and Nanaimo/French Creek. Chinook samples from the Bella Coola gillnet chinook fishery were obtained from sampling operations in Vancouver, Richmond, Delta, Coal Harbour, and Port Hardy. Samples obtained in Port Alberni originated exclusively from the Somass River commercial gillnet and First Nations Economic Opportunity fisheries in September.

A total of 6,553 CWTs were detected and recovered from chinook from random commercial fishery samples in 2016, representing a 184% increase over the number of CWTs observed in 2015 (3,568).

	2015			2016		
Sample Location	Number sampled	Number of CWT mark recoveries	Percent mark incidence	Number sampled	Number of CWT mark recoveries	Percent mark incidence
Northern BC						
Masset	15,911	526	3.3	20,380	1,513	7.4
Port Edward	23,722	953	4	17,394	1,168	6.7
Prince Rupert	451	3	0.7	3,281	208	6.3
Queen Charlotte City				98	3	3.1
Southern BC						
Port Hardy	827	64	7.7	5,565	533	9.6
Zeballos	3,644	175	4.8	9,273	1,482	16
Coal Harbour	3,967	302	7.6	6,317	1,125	17.8
Tofino	2,928	239	8.2	823	119	14.5
Ucluelet	3,426	365	10.7	1,068	95	8.9
Port Alberni				635	30	4.7
Nanaimo	3,161	336	10.6	2,550	169	6.6
French Creek	1,450	93	6.4	232	19	8.2
Delta	2	0	0	352	36	10.2
Vancouver	7,717	286	3.7	310	27	8.7
Richmond	1,587	226	14.2	262	26	9.9
Total	**68,813**	**3,568**	**5.2**	**68,540**	**6,553**	**9.6**

Table 4 - Number of Chinook sampled, CWTs recovered, and Mark Incidence by Sampling Location in BC Commercial Fisheries in BC in 2015 and 2016

Freezer Trollers

When fish were landed to port, sample crews were required to intercept the offloads of all designated freezer trollers to maximize the recovery of heads retained. Vigilant communication with processors who receive troll deliveries was also required in order to intercept and sample all the freezer troll vessels designated for head retention. This process was aided during the Area F chinook ITQ fishery because, under a separate individual quota management contract with harvesters, fishers are required to hail in to a JO Thomas toll-free phone number before delivering their fish to a port processor.

Freezer troll offloads were also visually sampled for the presence of adipose fin-clipped fish in addition to the electronic sampling of any heads that were retained by the vessel to obtain mark rates. If a freezer vessel retained all of the heads, the offload was to obtain the total number of fin-clips in the sample; however, the fin-clip status for each head that contained a CWT was unknown as it is impossible to determine which “body” the head originated from. Occasionally, a less desirable situation occurred when the vessel selectively retained the heads of only adipose fin-clipped fish. This resulted in a non-random sample that could not be utilized for analysis.

MRP sampling involved visual identification and counting of all mixed chinook and coho bodies delivered by a vessel. All bagged freezer heads were sampled for CWTs by the MRP crew by thawing out the heads and putting them through the R9500 detector, segregated by bag data where provided. The corresponding heads from that vessel were also counted by species and adjudicated for "cut quality" – basically a tally of good (head cuts that met DFO criteria) and bad (head cuts that did meet DFO criteria) was made. The data comparing the number of chinook/coho heads to the number of chinook/coho bodies delivered and the percent of good and bad head cuts are key to the determination of an acceptable quality sample or not. Good quality samples that had greater than 95% of heads retained and good quality head criteria resulted in the sample being defined as "Random". Samples of less than 95% of heads retained and an unacceptable proportion (>20% bad head cuts) rendered a non-compliant sample, and was designated as a "Select" sample

4.1.2 Recreational Fisheries

Recreational sampling effort occurred primarily from May –September. Sport anglers provided head samples of adipose fin-clipped salmon to over 250 Sport Head Recovery Program's Salmon Head Recover Depots located throughout the province at marinas, resorts, tackle shops, DFO offices, or DFO Hatcheries as shown in Figure 2.

Depots were provided with an information package at the beginning of the season which contained head labels and promotional materials. They were also provided a letter summarizing the origins of all the heads that were returned to them in the previous year. In many sport fishing locations, chest freezers and associated infrastructure (freezer and bucket enclosures, sign boards, and posters) were supplied by DFO and distributed and maintained by the contractor.

Dedicated contractor MRP sport samplers picked up heads from and serviced all depots with supplies along the Strait of Georgia, west coast Vancouver Island, and the Fraser Valley and maintained visitation and service records. Depots in the North and Central coast were maintained and serviced by contracted field staff in Prince Rupert and Masset. For the BC Interior and remote locations and lodges in Areas 12, 13 in Johnstone Strait, and Areas 26, 126 and 25, 125, 27 and 127 in Northern West Coast Vancouver Island, Salmon Head Recovery Depots were serviced with support from DFO personnel in Kamloops, Campbell River, and Port Hardy. Heads from the BC Interior were shipped to the CWT head lab, while JO Thomas and Associates were responsible for the pick-up of heads through staging depots in Port Hardy for Areas 12, 13, 26, 126, 27, and 127 and Campbell River for Areas 12, 13, 25, and 125. DFO Fishery Offices or representatives from regional DFO offices also received head submissions and shipped them to the DFO-contracted head lab.

A total of 10,883 salmon head recoveries were submitted by sport anglers and collected through the MRP Sport Head Recovery Program (SHRP) in 2016. Of this total, 6,449 heads were identified as chinook and 3,413 were coho. The remaining heads were comprised of 19 chum, 14 pink, five sockeye, and three steelhead. A total of 1,031 heads were received as unknown salmon in 2016 but here speciated by experienced lab personnel. The total number of sport heads collected or submitted in 2016 was very similar to the number of heads received in 2015 (10,382).

The majority of heads originating from recreational fisheries were caught and submitted in the summer months from June to September. Most (80%) of the heads submitted were caught in fisheries off the west coast of Vancouver Island (Areas 23-27, 123-127) (33%), the Queen Charlotte Islands (Areas 1,101,2W,142) (17%), Northern Georgia Strait (Areas 13 to 16) (17%), and the Strait of Juan de Fuca (Areas 19,20) (13%). This distribution reflects the distribution of effort in the recreational fishery.

The number of sport recoveries in 2016 is comparable to historic highs seen in the early 1990s (10,000+ recoveries annually). The number of heads submitted to the program dropped dramatically in the mid-1990s as a result of lowered overall abundance, regulatory catch restrictions, the introduction of mass marking and the associated de-sequestering of the adipose fin clip as a visual clue for anglers to submit heads. A breakdown of the number of heads received by month and area is presented in Figure 3 and Table 5.

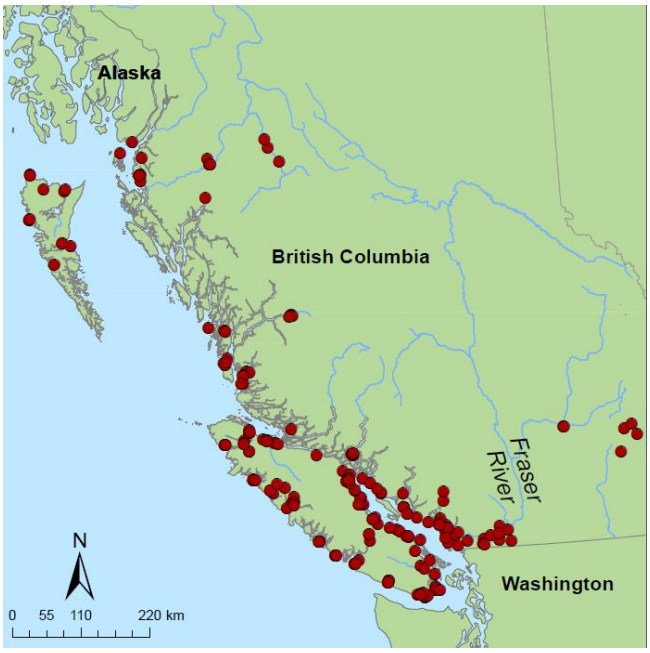


Figure 2 - Salmon Head Recovery Depot Locations

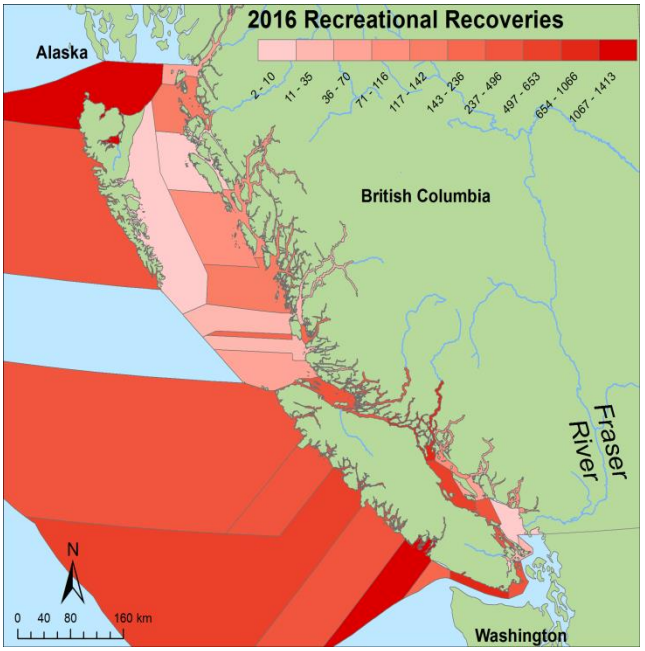


Figure 3 - Recoveries by Pacific Fishery Management Area

PFMA	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1			1	1	31	395	441	502	28	3	11		**1,413**
2W	1	1			18	267	27	75					**389**
3					4	23	15	4	3				**49**
4	4		5	1	11	50	39	26		5	5	2	**148**
5													**0**
6					1	40	43	22	1				**107**
7					3	39	27	59			13		**141**
8						4	17	14			1		**36**
9						66	72	99	1				**238**
10						6	11	11					**28**
11						13	27	24	2				**66**
12				2	3	26	188	130	21				**370**
13		2	2	6	39	149	326	332	151	30	4	11	**1,052**
14	1	3		12	31	98	281	154	52	8	3		**643**
15	3		4	1	5	30	22	15	8	5	1	1	**95**
16	1	4	1	6	10	9	15	17	12	1			**76**
17		1		12	84	75	85	50	16		7	7	**337**
18	3	5	4	2	2	4			3				**23**
19	57	33	22	34	39	36	25	36	38	13	9	17	**359**
20	8	16	18	27	41	85	132	304	351	51	7	7	**1,047**
21													**0**
121						50	94	58	15	4	2		**223**
23	3	1	8	27	17	73	77	288	43		30		**567**
123					14	118	361	197	103		1		**794**
24	1		1	3	1	4	13	8	6	7			**44**
124		1	2	10	23	84	210	88	10	1	9		**438**
25		1			3	35	136	53	11		2		**241**
125					1	60	267	57	3	1	2		**391**
26						5	26	51	4		4		**90**
126	1				1	62	214	87	1	10	7		**383**
27	2	6	3	5	5	37	164	65	6	2	1		**296**
127				3		41	72	52	4		1		**173**
28	4	5	4	15	8	26	12	8	24	1	1	6	**114**
29	1	1	5	5	10	12	2	16	16	82	28	3	**181**
FW		2		2		11	20	15	77	143	47		**317**
Unknown							3	1			10		**14**
Total	**90**	**82**	**80**	**174**	**405**	**2,033**	**3,464**	**2,918**	**1,010**	**367**	**206**	**54**	**10,883**

Table 5 - Number of Sport Samples Collected by Area and Month in 2016

4.2 Estimates of Total Catches

Northern British Columbia (NBC) Fisheries

NBC Chinook Aggregate Abundance-Based Management (AABM)

The pre-season abundance index for NBC troll and Haida Gwaii AABN chinook fisheries in 2016 was 1.7, which permitted a total allowable catch of 248,000 chinook salmon in these fisheries. Catch estimates indicated a total catch of 190,181 chinook salmon; 147,381 caught in commercial troll fisheries and 42,800 in the Haida Gwaii recreational fishery (Queen Charlotte Islands Areas 1 and 2).

The North Coast B.C. troll fishery was opened for chinook fishing from June 21 to August 1 and from August 25 to September 30. In 2016, 73.3% of the fleet froze their catch at sea.

	2015	2016
Pre-Season Abundance Index	1.23	1.7
Maximum Allowable Catch	160,400	248,000
Total Catch	158,302	190,181
Commercial Troll	106,702	147,381
Haida Gwaii Recreational	51,600	42,800

Table 6 – Northern BC Fisheries Abundance Index and Total Catch for 2015 and 2016

NBC Chinook Individual Stock-Based management (ISBM)

Fisheries included in this category are commercial net fisheries throughout north and central BC, First Nations FSC fisheries in both marine and freshwater areas, marine recreational fisheries along the mainland coast, and freshwater recreational.

North Coast commercial gill net catches totalled 1,262 chinook from Areas 3 to 6 (from hailed catch data) with 830 from Area 3, 392 from Area 4, none from Area 5, and 40 from Area 6. Central Coast commercial gill net catches totalled 3,192 chinook with 3,185 from Area 8 and 7 from Area 7. A total of 392 large chinook and 107 jacks were caught in the Tyee Test fishery on the Skeena River. Chinook catches at the Tyee Test Fishery in 1995 and 2016 were the lowest experienced since 1984.

Preliminary estimates for tidal recreational catches near the mainland coast of NBC in were 10,043 from a creel survey conducted in Areas 3 and 4 in 2016. Approximately 5,559 chinook were retained at lodges operating in Smiths Inlet, Rivers Inlet, Hakai Pass and Bella Bella in areas 6-9 of the central coast in 2016. Non-tidal recreational fishery catch from a freshwater creel survey conducted in the Skeena River below Terrace in 2016 was 2,246 large chinook and 984 jacks.

In the North Coast, Haida catches on Haida Gwaii were not provided. Nisga'a and Gitanyow catches from the Nass River were 5,445 chinook and catches by First Nations fisheries in the Skeena River were estimated at 3,606 chinook. Catches by First Nations in the tidal portion of the Central Coast were reported as 180 chinook. The non-tidal catches included 1,870 Atnarko River chinook (Area 8) from May – September.

Southern British Columbia Fisheries

For the 2015/2016 chinook year (October 2015 to September 2016), fisheries were shaped by conservation concerns for the following domestic stocks: natural WCVI, Lower Strait of Georgia (LGS), and Fraser River Spring $4_{2,}$ Spring $5_{2,}$ Summer 5_2 chinook and Interior Fraser River coho. Commercial measures included barbless hooks, time and area closures, gear restrictions, mandatory use of revival tanks, daily catch reporting, mandatory logbooks and non-retention provisions for most fisheries. Recreational measures included barbless hooks, time/area closures, size restrictions and mark selective fisheries. In 2016, recreational fisheries in freshwater areas were also closed for parts of the summer in many parts of SBC due to high water temperatures. FSC management actions included time and area closures and reduced fishing times.

SBC Chinook Aggregate Abundance-Based Management (AABM)

For the period October 2015 through September 2016, the forecast chinook abundance index was 0.89 of the PST base period. Therefore, under treaty provisions, the maximum allowable catch was 133,300 chinook for WCVI AABM fisheries.

	2015	2016
Pre-Season Abundance Index	.85	.89
Maximum Allowable Catch	127,278	133,300
Total Catch	113,293	95,323
Commercial Troll	54338	49,119
T'aaq-wiihak	6234	6,049
FSC fisheries	3946	2,346
WCVI Recreational	48775	37,809

Table 7 – Southern BC Fisheries Abundance Index and Total Catch for 2015 and 2016

Commercial

The total estimated commercial Area G troll catch was 49,119. The total number of chinook harvested during the Mquqwin Brooks Chinook Troll test fishery was 354.

First Nations Economic

In 2016, the Department authorized an AABM chinook salmon economic fishery for the T'aaq-wiihak Nations between July and September. This fishery was monitored by T'aaq-wiihak fishery monitors and DFO staff. Both the WCVI troll fishery and the T'aaq-wiihak fishery were verified by J.O. Thomas and Associates, a company that provides independent certified dockside monitoring services. 6,049 (preliminary) chinook were caught in the T'aaq-wiihak economic fishery

First Nations Food Social and Ceremonial (FSC) and Treaty

Total AABM chinook reported for First Nations FSC and domestic fisheries was 2,346.

Recreational

The total chinook catch in the 2016 WCVI AABM fishery was estimated to be 37,809, which is down 40% from the 5 year average of 62,900.

SBC Chinook Individual Stock Based management (ISBM)

Fisheries included in this category are commercial net fisheries throughout SBC, marine recreational fisheries along the inside areas, freshwater recreational, and First Nations FSC fisheries in both marine and freshwater areas.

In 2016, there were no seine fisheries; however an Area D gillnet opening in Alberni Inlet in late August and early September targeting chinook returns to Robertson Creek Hatchery had a total catch of 1555 pieces, Alberni inlet sockeye openings had a catch of 116 pieces, and an Area D gillnet opening in Tlupana Inlet targetting chinook returns to the Conuma River hatchery had a catch of 3451 pieces. There were no Area B seine or E gillnet fisheries in Georgia Strait in 2016.The total number of chinook harvested during the Fraser River Albion test fisheries from April to October was 1,460. An additional 831 were harvested in the Fraser River PSC test fisheries at Whonnock, Cottonwood, and Qualark.

In 2016 marine recreational fisheries were monitored by creel surveys in five main areas:

1) Johnstone Strait including Areas 11 to 13;
2) The Strait of Georgia including Areas 14 through 18, that portion of Area 19 north of Cadboro Point, Areas 28 and 29; and West Coast Vancouver Island;
3) Juan de Fuca including Victoria (south of Cadboro Point)
4) WCVI, and
5) Fraser River.

Monitoring of these fisheries has been fairly consistent from year to year using an access point (landing site) survey for collecting catch and CPUE, combined with an aerial survey for effort counts. In addition, logbook programs, directed at estimating the recreational catch by fishing guides during guided trips, were conducted in the Campbell River, Victoria and WCVI Areas in 2016. In 2016, the total recreational catch was 9,420.

	2015	2016
Johnstone Strait (11, 12)	12,127	8,349
Strait of Georgia (13-19, 28, 29)	51,483	27,443
Juan de Fuca (19,20)	30,558	22,866
WCVI – Inshore (20W-27)	31,753	33,574
Fraser River	13,186	1,968
TOTAL SBC ISBM Recreational Catch	139,107	94,200

Table 8 – Summary of SBC ISBM Catch Estimates for 2015 and 2016

First Nations Economic

In 2016, in the WCVI inshore area, there was a First Nations economic fishery in Alberni Inlet in late August and early September targeting chinook salmon returns to Robertson Creek Hatchery with an estimated catch of 10,248 chinook, and a T'aaq-wiihak economic fishery in Nootka Sound targeting enhanced returns to Conuma River and Burman River with a catch of 56 chinook from Conuma and 261 chinook from Burman.

In the B.C. Interior, the inland demonstration fisheries did not occur in 2016 for ISBM chinook in either the upper or lower reaches of the Fraser River. An inland commercial fishing enterprise (CFE) operated by Riverfresh (Secwepemc Fisheries Commission), received an allocation for chinook in the B.C. Interior but did not conduct a fishery due to sockeye constraints.

First Nations Food Social and Ceremonial (FSC) and Treaty

The Hupacasath and Tseshaht First Nations caught a total of 1,991 chinook by gillnet, rod and reel and as by catch during other salmon fisheries in Area 23. Catch reports for Maa-nulth domestic harvest indicate a combined ISBM FSC chinook harvest of 378 pieces. NTC First Nations ISBM catch reported to date is 1,157 pieces. The total WCVI FSC chinook catch to date was 3,526 pieces.

The 2016 Catches by First Nations fisheries in Johnstone Strait, Strait of Georgia is estimated at 347 and 650 respectively.

Catches by First Nations in the Fraser and Thompson watershed were 9797. 3985 Chinook were harvested in the Upper Fraser and 5812 were harvested in the Lower Fraser.

4.3 Sample Rates

Chinook Salmon Retention Fishery Area		% Sample Rate		
		2014	2015	2016
Northern BC (Areas 1-5, 101-105, 142)				
1	AABM Troll	20.3%	32.7%	23.4%
2	AABM Sport – Haida Gwaii (Areas 1, 2W)	60.9%	27.3%	58.8%%
3	ISBM Net – Area 3 & 4 Gillnet	6.9%	31%	64%
4	ISBM Sport – Nass/Skeena Tidal (Areas 3-5)	12.4%	34.3%	14.6%
5	ISBM Troll	No Fishery	No Fishery	No Fishery
Central BC (Areas 6-10, 106-110, 130)				
8	ISBM Net – Area 7 & 8 Gillnet	39.2%	17.5%	14.4%
9	ISBM Sport – Areas 7-10	41.1%	78.5%	50%
10	ISBM Troll – Areas 6-10	No Fishery	No Fishery	No Fishery
West Coast Vancouver Island (Areas 21-27, 121-127)				
12	AABM Troll	26.5%	29%	32.3%
13	AABM Sport	17.1%	26.7%	14.4%
15	ISBM Net	No Fishery	No Fishery	16.3%
16	ISBM Sport	26.6%	29.1%	17.7%%
Johnstone Strait (Area 11-13)				
18	ISBM Net	No Fishery	No Fishery	No Fishery
19	ISBM Sport	35.8%	31.9%	35.5%
Strait of Georgia (Areas 14 – 18, 28, 29)				
21	ISBM Net	No Fishery	No Fishery	No Fishery
22	ISBM Sport	20.2%	22%	11.8%
Strait of Juan de Fuca (Areas 19, 20)				
24	ISBM Net	No Fishery	No Fishery	No Fishery
25	ISBM Sport	15.8%	8.2%	7.1%%
Fraser River				
26	ISBM Net – Area E Gillnet	25%	No Fishery	No Fishery
27	ISBM Sport	14.9%	8.3%	42.6%
NOT WITHIN PROJECT SCOPE				
Northern BC (Areas 1-5, 101-105, 142)				
6	ISBM First Nations Food, Social, Ceremonial (FSC) [1]	0%	0%	0%
7	ISBM Test Fishery – Skeena Tyee Gillnet	83.4%	85%	100%
Central BC (Areas 6-10, 106-110, 130)				
11	ISBM First Nations – Nuxalk Bella Coola R FSC	100%	100%	100%
West Coast Vancouver Island (Areas 21-27, 121-127)				
14	AABM First Nations Commercial – T'aaq-wiihak	27.6%	46.1%	40.9%
17	ISBM First Nations Economic – Tsu-Ma-Uss Alberni Inlet	0.6%	28.3%	23%
Johnstone Strait (Area 11-13)				
20	ISBM First Nations FSC [1]	0%	0%	0%
Strait of Georgia (Areas 14 – 18, 28, 29)				
23	ISBM First Nations FSC [1]	0%	0%	0%
Fraser River				
28	ISBM First Nations FSC	8.6%	14.7%	Not available
29	ISBM Test Fishery – Albion, Cottonwood, Whonnock, Qualark	90%	99.5%	97%

Table 9 - Percentage Sampling Rates by Fisheries in 2014, 2015, and 2016.

[1] Multiple complex First Nations Food, Social and Ceremonial (FSC) harvest agreements with no First Nations catch monitoring and low catch.

4.4 Lab Operations

The MRP dissection laboratory processed 30,095 salmon head samples in 2016, representing a n insignificant decrease from the previous year (Table 10).

Category	2015	2016
Commercial	5,330	7,353
Escapement	11,081	10,601
First Nations (FSC)	316	590
Sport	13,036	11,081
Misc. / Small Projects	488	470
Total	**30,251**	**30,095**

Table 10 - Number of salmon heads dissected by category in 2015 and 2016

Commercial head dissections, which included samples from Test Fisheries (Albion, Cottonwood, Whonnock, Qualark (Fraser River); Tyee (Skeena River); and Yukon (lower Stikine River)), and First Nations Economic and Demonstration fisheries, decreased by 40% in 2016 compared to 2015. First Nation FSC dissections were increased by 30% over the previous 3-year average. Sport head recoveries were down by 16% in 2016 compared to those processed in 2015. Escapement samples were also down modestly by about 4% in 2016 compared to those received in 2015.

The lab processed 127 heads from DFO and PSC Test Fisheries in 2016; 77 from Albion (DFO Fraser River), 19 from Whonnock/Cottonwood (PSC Fraser River), 13 from Tyee (DFO Skeena River), 12 from the Yale First Nations Qualark Creek Test Fishery (Middle Fraser River), and 6 from the Brooks Peninsula Test Fishery (WCVI).

Very few tags that are initially identified by technicians are subsequently lost during or after dissection. There were a total of 19 (.063%) “Lost Pins” out of 30,095 heads dissected by lab staff in 2016, which represents approximately one lost pin for every 1,584 heads dissected. Approximately half of these lost pins were associated with escapement samples which can be problematic for lab staff due to mineral and metallic contaminants in the samples originating from the spawning grounds. Some of these samples can also be heavily decomposed and therefore can be difficult or impossible to dissect and recover the pin.

Whenever tags were perceived to be lost during dissection, laboratory staff made every attempt to recover them using earth magnets and conducting systematic searches of the surrounding dissection area. If a tag is ‘found’, it is recorded as a ‘lost and found’ status as a quality control measure should there be an inquiry as to the validity of the tag read.

Laboratory procedures included observations on the specific location of tags recovered within each fish head. This information is important as a measure of tagging quality.

4.5 Data Collection, Management and Analysis

4.5.1 Commercial and First Nations Economic Fisheries Data Management

The processing and data entry of 2016 commercial salmon fishery sample data began in May 2016 and continued through to March 2017. No commercial samples were processed in April 2016. The number of commercial CWT sample and recovery data records entered by month is presented in Table 11.

Entry Year	Entry Month	Number of Samples	Number of Recoveries Entered	% of Total Recoveries Entered	Total Records Entered	% of Total Records Entered
2016	Apr	–	–	–	–	–
2016	May	35	296	4.0%	331	3.7%
2016	Jun	127	1,983	26.7%	2,110	23.3%
2016	Jul	150	781	10.5%	931	10.3%
2016	Aug	493	1,960	26.4%	2,453	27.1%
2016	Sep	556	1,584	21.3%	2,140	23.6%
2016	Oct	262	699	9.4%	961	10.6%
2016	Nov	0	6	0.1%	6	0.1%
2016	Dec	0	0	0%	0	0%
2017	Jan	1	31	0.4%	32	0.4%
2017	Feb	5	18	0.2%	23	0.3%
2017	Mar	5	63	0.8%	68	0.8%
Total		**1,634**	**7,421**	**100%**	**9,055**	**100%**

Table 11 - Number of commercial fishery sample records entered by month in 2016/17

Differences in the chronology of entry of recovery records and tag codes are due to the lag between collection and entry of sample data and laboratory dissection of the associated heads. Disruptions in tag code entry are normally caused by the laboratory periodically switching priorities to sport recoveries for a particular month. Sample data and heads from different weeks and locations are sometimes mixed which may causes difficulties or delays in data entry of individual recovery data.

With the exception of the Area G troll winter fishery (January to March), all commercial recoveries are normally dissected by the end of December to allow the data processing department to complete entry and verification of data so that summary reports can be generated. This also allows the laboratory to switch priorities to escapement samples which usually begin arriving late in the fall of each year.

Batch uploading of 2016 commercial and sport sample and recovery data from the project office to the DFO MRP database occurred on the following dates:

Date Exported	Commercial CWT Data	Sport CWT Data
Apr 27, 2016		✓
May 10, 2016		✓
May 16, 2016		✓
May 17, 2016		✓
May 18, 2016		✓
May 27, 2016		✓
Jun 06, 2016		✓
Jun 10, 2016	✓	✓
Jun 16, 2016		✓
Jun 20, 2016	✓	
Jun 21, 2016	✓	✓
Jun 28, 2016	✓	
Jul 08, 2016		✓
Jul 18, 2016	✓	
Jul 22, 2016		
Jul 27, 2016		✓
Aug 02, 2016		✓
Aug 08, 2016	✓	
Aug 09, 2016	✓	
Aug 25, 2016	✓	
Sep 12, 2016	✓	
Sep 15, 2016	✓	
Sep 20, 2016		
Sep 21, 2016	✓	
Sep 28, 2016	✓	
Oct 04, 2016	✓	

Date Exported	Commercial CWT Data	Sport CWT Data
Oct 06, 2016	✓	
Nov 01, 2016		✓
Nov 14, 2016	✓	
Nov 17, 2016	✓	
Nov 21, 2016	✓	
Dec 01, 2016		✓
Dec 02, 2016	✓	
Dec 05, 2016		✓
Dec 06, 2016	✓	
Dec 13, 2016	✓	
Dec 20, 2016	✓	
Dec 21, 2016	✓	
Jan 13, 2017		✓
Jan 17, 2017	✓	✓
Jan 25, 2017	✓	
Jan 27, 2017		✓
Jan 30, 2017	✓	
Jan 31, 2017	✓	
Feb 07, 2017	✓	
Feb 17, 2017	✓	
Feb 20, 2017	✓	
Feb 22, 2017	✓	
Feb 24, 2017	✓	
Mar 15, 2017	✓	
Mar 21, 2017	✓	

Commercial data undergoes a rigorous system of error checks and coding procedures. Pre-entry tasks included checking data for completeness and integrity, coding any subareas that were not supplied by the samplers, or adding new location codes as required.

Another key task during coding is examining the relationship of statistical week landed versus the date of landing. It is critical that samples from trucks and packers are properly "backdated" to attribute samples to the correct week of catch. Backdating is most common for truck deliveries of troll samples as troll fisheries can and often overlap two or more statistical weeks while most net fisheries are of much shorter duration and occur within one particular statistical week. Proper allocation of samples is critical to catch sample ratios, and hence tag expansion calculations.

Online edits focused on the legitimacy of the tag code compared to the reported species as well as the validity of the tag code itself and whether the brood year provided by the code is feasible for that species. Fish length is also checked against valid ranges for each species. Additionally, coding

of subarea, stat area, and catch region and fishing gear are checked against each other for valid combinations.

Records which did not meet acceptable entry criteria were isolated and reviewed by senior program personnel. All questionable tag codes were re-read. Species conflicts were evaluated by reviewing the size and age relationships of the tag and the associated biological data collected. When a tag was discovered to be outside of its normal temporal and geographic distribution of recovery, the recovery data was scrutinized to ensure the accuracy of this data and rule out any transcription errors.

4.5.2 Recreational Fisheries Data Management

Sport fishery sample data was processed by the contracted Sport Data Technician. Primary duties included correspondence with anglers, data entry and editing, and production of data summaries and in-season and post-season reports that are used for checking and editing data as well as providing updates to DFO and feedback to anglers that submit data to the program.

A total of 10,939 submissions from anglers were received and processed during the project period from April 2016 to March 2017 (Table 12).

Year	Month	Number of sport heads entered
2016	Feb	48
	Mar	0
	Apr	37
	May	291
	Jun	205
	Jul	717
	Aug	80
	Sep	0
	Oct	2,183
	Nov	6,281
	Dec	566
2017	Jan	241
	Feb	289
	Mar	1
Total		10,939

Table 12 - Number of sport caught salmon heads processed by month in 2016/17

Numerous error checks are conducted on sport data, many similar to those conducted on the commercial data. Pre-entry checks are done to confirm the presence of the angler's name on the database and to code the catch location with the correct sport fishery location abbreviation. Online verification of valid tag codes are performed, as well as any issues related to species conflicts or problems with brood year (i.e. age related). All anomalous tag recoveries are re-read and the angler contacted if necessary to confirm catch information. Most problem recoveries were caused by

incomplete or ambiguous catch information or incorrect identification of the species of fish by the angler.

	Capture Year		
Species	2016	2017	Total
Chinook	6,399	50	6,449
Coho	3,413	0	3,413
Pink	14	0	14
Chum	18	1	19
Sockeye	5	0	5
Steelhead	3	0	3
Unk Salmon	1,031	5	1,036
Total	**10,883**	**56**	**10,939**

Table 13 - Summary of sport head recoveries submitted and processed by species and capture year in 2016/17

4.5.3 CWT Estimates

All analysis was completed by Mark Recovery Unit staff, following standard algorithms for the calculation of CWT estimates, using the MRP Information System to synthesize catch, sample, recovery, and lab data across multiple DFO systems. Canada submitted all observed and estimated CWT tag recovery data and associated catch and sample data to the PSMFC for validation and upload into RMIS on February 6, 2017.

5. Summary and Project Evaluation

Under this collaborative project, the 2016-17 Canadian Mark Recovery Program was successful in meeting its project objectives to conduct a statistically reliable and timely CWT sampling and recovery program to support domestic and international stock assessment and sustainable fisheries management.

1) Did the intended activities take place within scope, within budget?

Yes. All objectives of the project were achieved. See Appendix 9 for the Financial Statement for the project. As this was the second year of the project and the budget was established in August during the first year of the project, some errors were made in the budget phase resulting in some categories of expenditures were over-estimated or underestimated. For example, DFO salary was underestimated by 15K, travel was overestimated by 117K, sampling materials were overestimated by 25K and disposal of waste was overestimated by 19K. Contractor salary was underestimated by 96K and lab rentals of 57K were erroneously not included in the budget. However, the project was under-budget by $18,461 and a total of $23,847.67 was returned to the Pacific Salmon Commission.

2) Were the resources allocated in the most efficient and effective manner, or given the results would a different allocation have been more appropriate, and if so will be considered for any potential future projects as applicable?

In future years, the budget will be modified to better reflect the actual expenditures.

3) Were the milestones achieved?

All milestones were achieved.

4) Were the deliverables of the project delivered?

All deliverables of the project were delivered as planned.

5) Did the collaboration achieve its purpose?

Yes – While an overall sample rate of 20% was not achieved in all fisheries, the project was successful in maintaining sample rates across all fisheries at the levels achieved during the CWTIP period and data was delivered to the U.S. CWT data repository according to agreed schedules for use by PSC Committees.

6) Were there any difficulties encountered within the performance of the project and if so, how were they managed to achieve resolution?

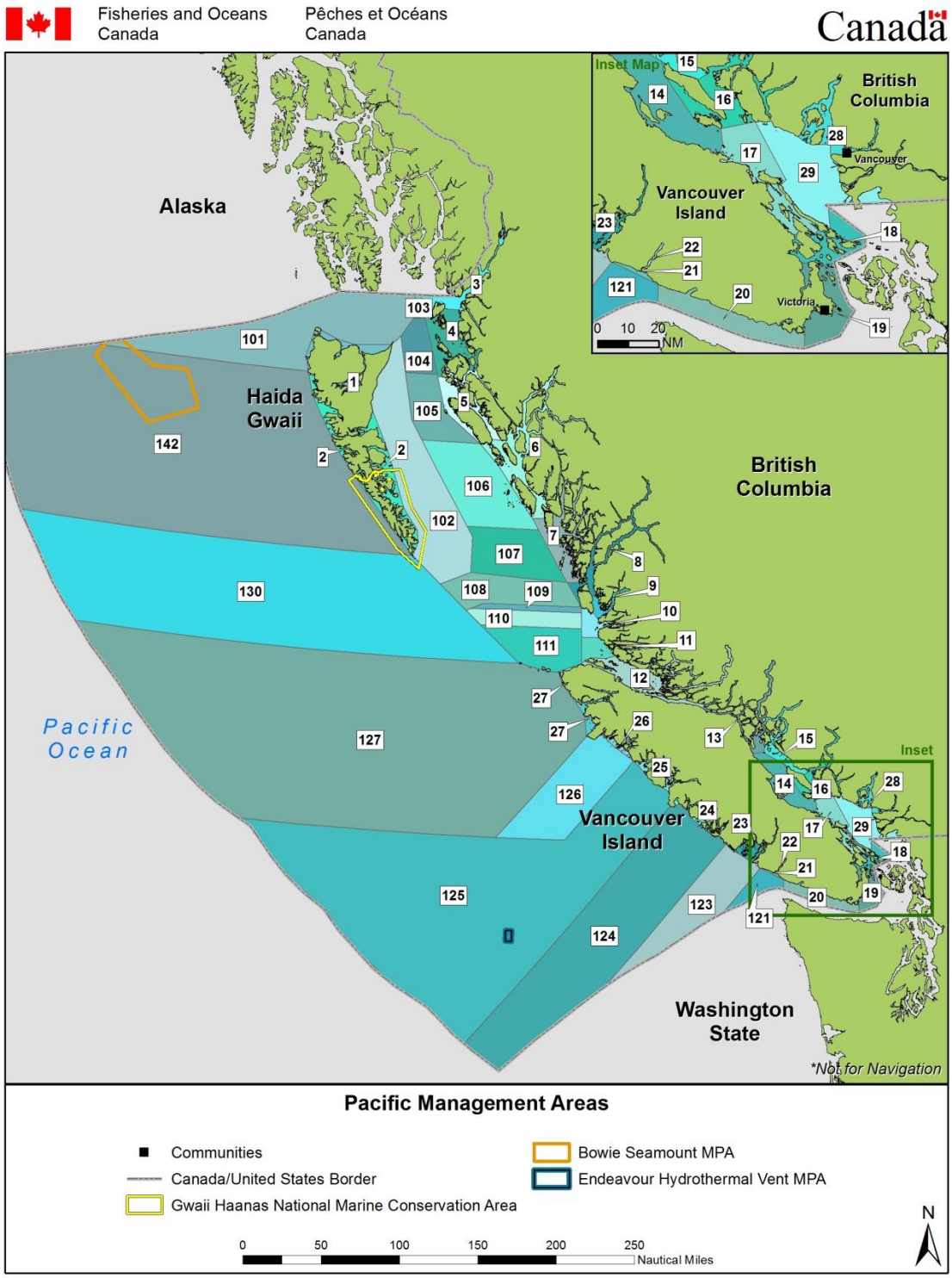
The project was challenged with a significant increase in AABM total allowable catch. As a result, adjustments were made to the target sample rate in the Area F freezer troll fishery, with a recognition that non-compliance by harvesters might result in lower sample rates than targeted. With additional communication of the importance of compliance and the introduction of additional feedback and enforcement measures, a sample rate greater than 20% was achieved.

6. Acknowledgements

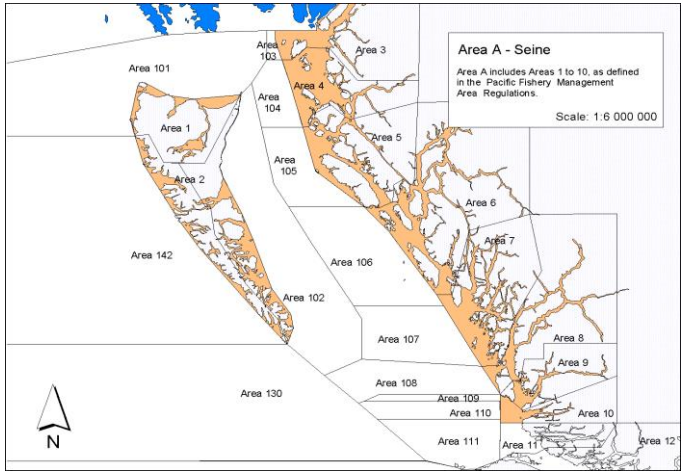
Fisheries and Oceans Canada is grateful for the financial support for this project from the Pacific Salmon Commission Endowment Fund. The author wishes to thank the DFO Core Stock Assessment Mark Recovery Program Unit biologists and technicians - Nicholas Komick, Brenda Ridgway, Doug Herriott and Erik Grundmann - for their commitment and hard work for all aspects of the project, as well as the various DFO Regional resource management, stock assessment staff, and salmon enhancement program for their valuable roles in regional catch monitoring program delivery and CWT sampling, and J.O.Thomas and Associates in performing fisheries sampling and CWT lab operations. Finally, thanks to the many thousands of harvesters who participate in all aspects of DFO catch monitoring – providing catch data and biological samples to support sustainable fisheries management.

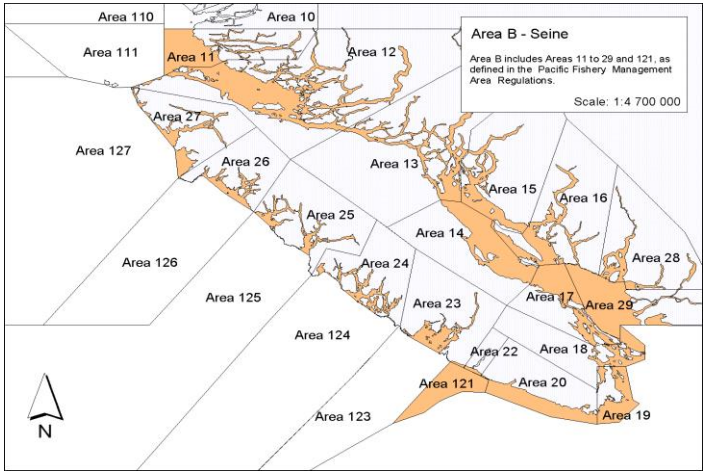
Appendices

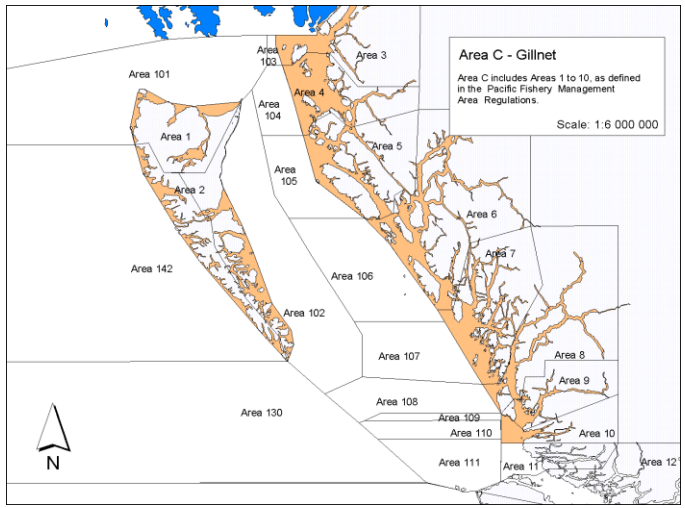
Appendix 1. DFO Pacific Fishery Management Areas

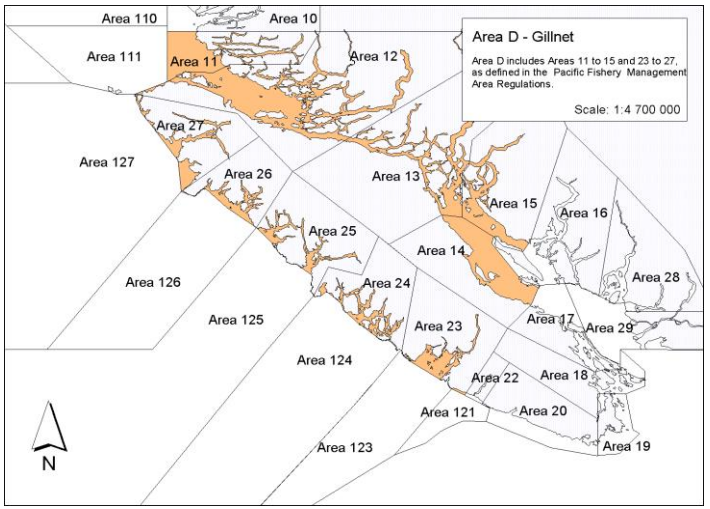


Appendix 2. DFO Commercial Salmon License Areas

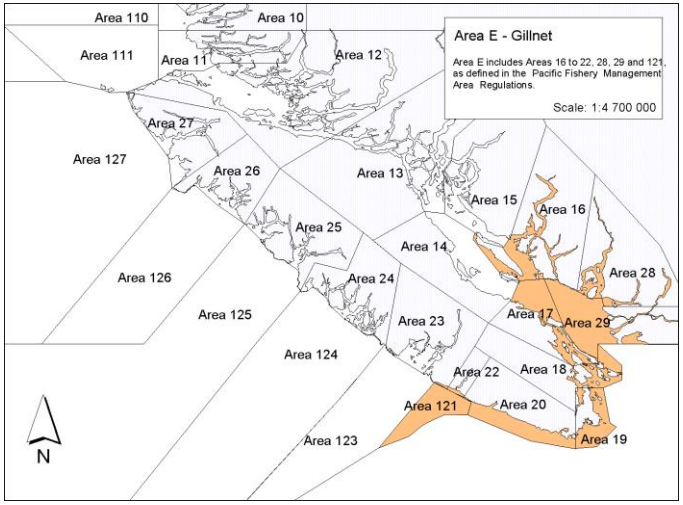


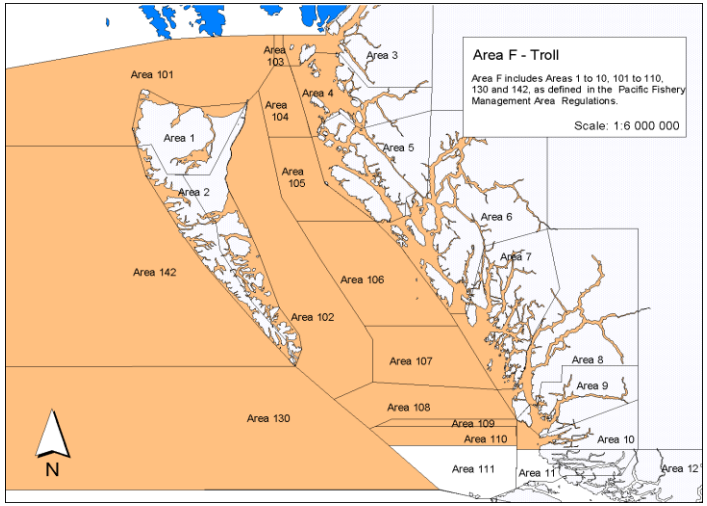


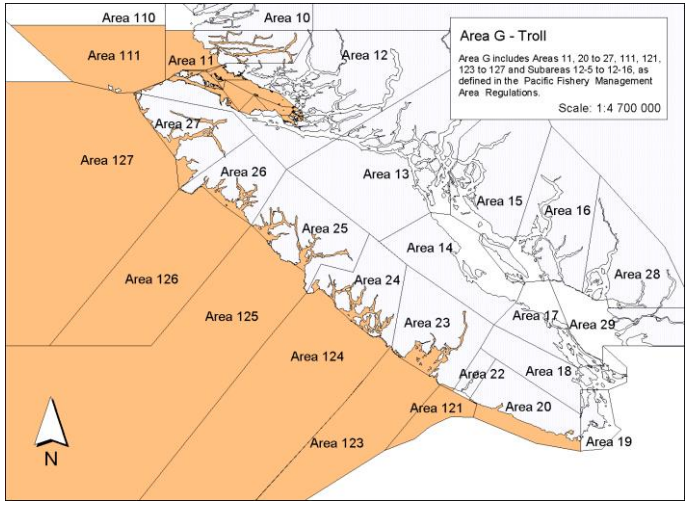


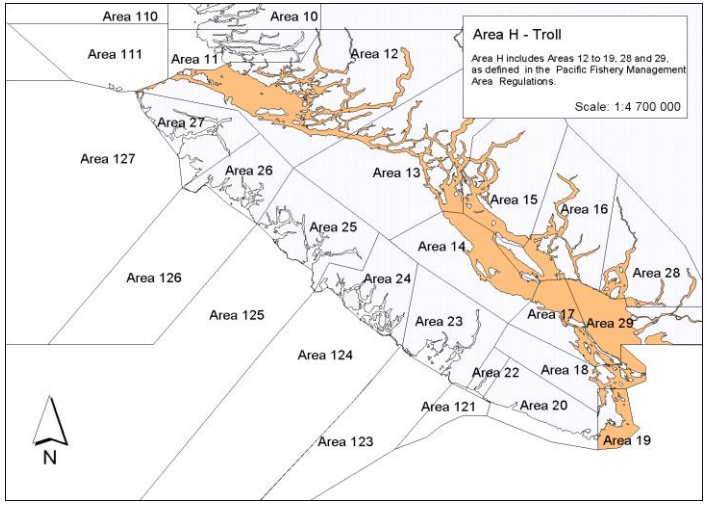


Appendix 2 - cont'd. DFO Commercial Salmon License Areas









Appendix 3. 2016/17 Statistical Week Calendars

2016				2017			
DFO STATWEEK CODE	PSC STATWEEK CODE	FROM	TO	DFO STATWEEK CODE	PSC STATWEEK CODE	FROM	TO
				011	01	01-Jan-17	07-Jan-17
				012	02	08-Jan-17	14-Jan-17
				013	03	15-Jan-17	21-Jan-17
				014	04	22-Jan-17	28-Jan-17
				015	05	29-Jan-17	04-Feb-17
				021	06	05-Feb-17	11-Feb-17
				022	07	12-Feb-17	18-Feb-17
				023	08	19-Feb-17	25-Feb-17
				024	09	26-Feb-17	04-Mar-17
				031	10	05-Mar-17	11-Mar-17
				032	11	12-Mar-17	18-Mar-17
				033	12	19-Mar-17	25-Mar-17
				034	13	26-Mar-17	01-Apr-17
041	14	27-Mar-16	02-Apr-16				
042	15	03-Apr-16	09-Apr-16				
043	16	10-Apr-16	16-Apr-16				
044	17	17-Apr-16	23-Apr-16				
045	18	24-Apr-16	30-Apr-16				
051	19	01-May-16	07-May-16				
052	20	08-May-16	14-May-16				
053	21	15-May-16	21-May-16				
054	22	22-May-16	28-May-16				
061	23	29-May-16	04-Jun-16				
062	24	05-Jun-16	11-Jun-16				
063	25	12-Jun-16	18-Jun-16				
064	26	19-Jun-16	25-Jun-16				
071	27	26-Jun-16	02-Jul-16				
072	28	03-Jul-16	09-Jul-16				
073	29	10-Jul-16	16-Jul-16				
074	30	17-Jul-16	23-Jul-16				
075	31	24-Jul-16	30-Jul-16				
081	32	31-Jul-16	06-Aug-16				
082	33	07-Aug-16	13-Aug-16				
083	34	14-Aug-16	20-Aug-16				
084	35	21-Aug-16	27-Aug-16				
091	36	28-Aug-16	03-Sep-16				
092	37	04-Sep-16	10-Sep-16				
093	38	11-Sep-16	17-Sep-16				
094	39	18-Sep-16	24-Sep-16				
101	40	25-Sep-16	01-Oct-16				
102	41	02-Oct-16	08-Oct-16				
103	42	09-Oct-16	15-Oct-16				
104	43	16-Oct-16	22-Oct-16				
105	44	23-Oct-16	29-Oct-16				
111	45	30-Oct-16	05-Nov-16				
112	46	06-Nov-16	12-Nov-16				
113	47	13-Nov-16	19-Nov-16				
114	48	20-Nov-16	26-Nov-16				
121	49	27-Nov-16	03-Dec-16				
122	50	04-Dec-16	10-Dec-16				
123	51	11-Dec-16	17-Dec-16				
124	52	18-Dec-16	24-Dec-16				
125	53	25-Dec-16	31-Dec-16				

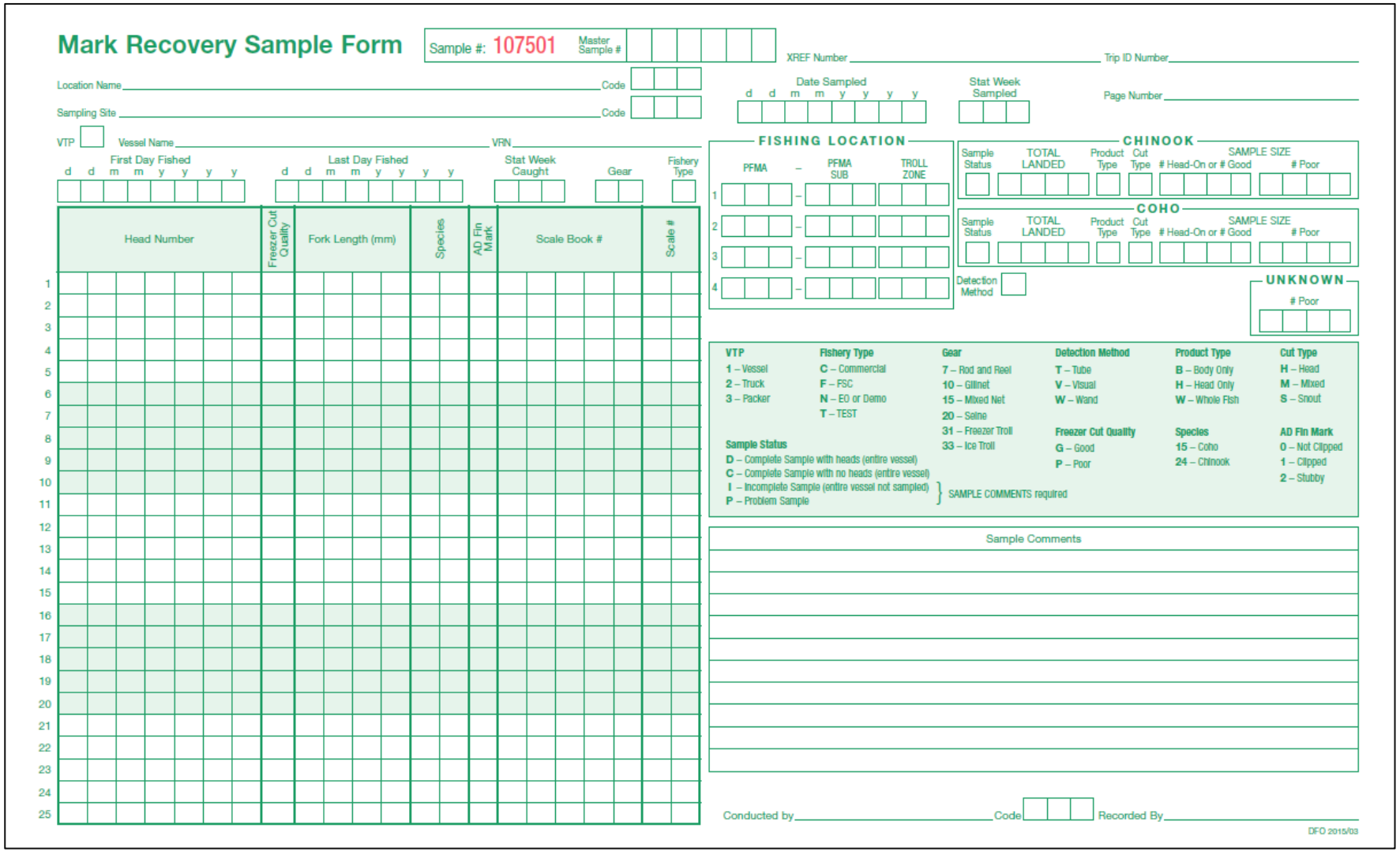
Appendix 4. 2016/17 Chronological Commercial and First Nations Economic Fishery Openings by Gear, Period, and Species

Gear	Licence Area	Open Date	Close Date	Target Species	Non-retention Species	Pacific Fishery Management Areas
Troll	Area G	19-Apr-16	30-Apr-16	WCVI Aggr. CN	SK,CO,ST	Areas 23,24,25,26,27,125,126,127
Troll	Area G	01-May-16	20-May-16	WCVI Aggr. CN	SK,CO,ST	Areas 23,24,25,26,27,124,125,126,127
Troll	Area G	21-May-16	31-May-16	WCVI Aggr. CN	SK,CO,ST	Areas 23,24,25,26,27,123,124,125,126,127
Troll	FN-T'aaq-wiihak	27-May-16	31-May-16	WCVI Aggr. CN	SK,CO,ST	Areas 24,25,26,124,125,126
Gill Net	Area C	30-May-16	31-May-16	Atnarko CN	CO,ST	Area 8
Gill Net	Area C	06-Jun-16	07-Jun-16	Atnarko CN	CO,ST	Area 8
Gill Net	Area C	07-Jun-16	08-Jun-16	Nass SK	CM,ST	Area 3
Gill Net	Area D	07-Jun-16	07-Jun-16	Barkley SK	CO,ST	Area 23
Gill Net	Area C	13-Jun-16	14-Jun-16	Nass SK	CM,ST	Area 3
Gill Net	Area C	13-Jun-16	14-Jun-16	Atnarko CN	CO,ST	Area 8
Gill Net	Area D	14-Jun-16	14-Jun-16	Barkley SK	CO,ST	Area 23
Gill Net	Area C	17-Jun-16	17-Jun-16	Skeena CN	SK,CO,CM,ST	Area 4
Gill Net	Area C	20-Jun-16	21-Jun-16	Nass SK	ST	Area 3
Gill Net	Area C	20-Jun-16	21-Jun-16	Atnarko CN	CO,ST	Area 8
Troll	Area F	21-Jun-16	30-Jun-16	CN [ITQ]	SK,CO,CM,ST	Areas 1,2W,101,142
Gill Net	Area D	21-Jun-16	21-Jun-16	Barkley SK	CO,ST	Area 23
Gill Net	Area C	24-Jun-16	25-Jun-16	Skeena CN	SK,CO,CM,ST	Area 4
Gill Net	Area C	27-Jun-16	28-Jun-16	Nass SK	ST	Area 3
Gill Net	Area C	27-Jun-16	28-Jun-16	Atnarko CN	CO,ST	Area 8
Gill Net	Area D	28-Jun-16	28-Jun-16	Barkley SK	CO,ST	Area 23
Troll	Area F	01-Jul-16	09-Jul-16	CN [ITQ] (1,2W,142)	SK,CO,CM,ST	Areas 1,2W,142
Troll	Area F	01-Jul-16	09-Jul-16	CN/CO/PK (101 only)	CM,ST	Area 101
Seine	Area A	04-Jul-16	04-Jul-16	Nass SK/PK	CN,ST	Area 3
Gill Net	Area C	04-Jul-16	04-Jul-16	Bella Coola CM	CO,ST	Area 8
Gill Net	Area C	04-Jul-16	04-Jul-16	Nass SK	ST	Area 3
Gill Net	Area D	06-Jul-16	07-Jul-16	Barkley SK	CO,ST	Area 23
Gill Net	Area C	08-Jul-16	08-Jul-16	Skeena SK	CN,CM,ST	Area 4
Gill Net	Area C	08-Jul-16	08-Jul-16	Skeena SK	CN,CM,ST	Area 5
Troll	Area F	10-Jul-16	01-Aug-16	CN/CO/PK	CM,ST	Areas 2W,142
Troll	Area F	10-Jul-16	01-Aug-16	CN/CO/PK/SK (101&1)	CM,ST	Areas 1,101
Troll	Area F	10-Jul-16	01-Aug-16	CO/PK (102)	CN,CM,ST	Areas 102,105,106
Troll	Area F	10-Jul-16	01-Aug-16	CO/PK/SK (103&104)	CN,CM,ST	Areas 103,104
Seine	Area A	11-Jul-16	12-Jul-16	Nass PK	CN,SK,ST	Area 3
Gill Net	Area C	11-Jul-16	12-Jul-16	Bella Coola CM	CO,ST	Area 8
Gill Net	Area C	13-Jul-16	13-Jul-16	Skeena SK	CN,CM,ST	Area 4
Gill Net	Area C	13-Jul-16	13-Jul-16	Skeena SK	CN,CM,ST	Area 5
Gill Net	Area D	13-Jul-16	15-Jul-16	Barkley SK	CO,ST	Area 23
Seine	Area A	15-Jul-16	15-Jul-16	Nass PK	CN,SK,ST	Area 3
Gill Net	Area C	15-Jul-16	15-Jul-16	Area 6 CM (PK/CN)	SK,CO,ST	Area 6
Seine	Area A	16-Jul-16	16-Jul-16	Nass PK	CN,SK,ST	Area 3
Seine	Area A	18-Jul-16	19-Jul-16	Nass PK	CN,SK,ST	Area 3
Gill Net	Area C	18-Jul-16	19-Jul-16	Area 8 CM	CO,ST	Area 8
Gill Net	Area C	19-Jul-16	19-Jul-16	Area 6 CM (PK/CN)	SK,CO,ST	Area 6
Gill Net	Area D	20-Jul-16	22-Jul-16	Barkley SK	CO,ST	Area 23
Seine	Area A	21-Jul-16	21-Jul-16	Nass PK	CN,SK,CM,ST	Area 3
Gill Net	Area C	22-Jul-16	23-Jul-16	Skeena SK	CN,CM,ST	Area 4
Gill Net	Area C	22-Jul-16	23-Jul-16	Skeena SK	CN,CM,ST	Area 5
Seine	Area A	25-Jul-16	26-Jul-16	Nass PK	CN,SK,CM,ST	Area 3
Gill Net	Area C	25-Jul-16	26-Jul-16	Area 6 CM (PK/CN)	SK,CO,ST	Area 6
Gill Net	Area C	25-Jul-16	26-Jul-16	Area 7 CM	CO,ST	Area 7
Gill Net	Area C	25-Jul-16	26-Jul-16	Area 8 CM	CO,ST	Area 8
Gill Net	Area D	26-Jul-16	28-Jul-16	Barkley SK	CO,ST	Area 23
Troll	FN-T'aaq-wiihak	27-Jul-16	30-Jul-16	WCVI Aggr. CN	--	Areas 24,124,125,126
Seine	Area A	28-Jul-16	28-Jul-16	Nass PK	CN,SK,CM,ST	Area 3

Appendix 4 - cont'd. 2016/17 Chronological Commercial and First Nations Economic Fishery Openings by Gear, Period, and Species

Gear	Licence Area	Open Date	Close Date	Target Species	Non-retention Species	Pacific Fishery Management Areas
Gill Net	Area C	28-Jul-16	29-Jul-16	Area 6 CM (PK/CN)	SK,CO,ST	Area 6
Troll	Area F	01-Aug-16	15-Aug-16	CC Demo CO	CN,SK,CM,ST	Areas 6,7,8,106,107,108,109
Gill Net	Area C	01-Aug-16	02-Aug-16	Area 7 CM	CO,ST	Area 7
Gill Net	Area C	01-Aug-16	02-Aug-16	Area 8 CM	CO,ST	Area 8
Gill Net	Area D	01-Aug-16	05-Aug-16	Barkley SK	CO,ST	Area 23
Troll	Area F	02-Aug-16	24-Aug-16	CO	CN,CM,ST	Areas 2,102,105,106,142
Troll	Area F	02-Aug-16	24-Aug-16	CO/PK/SK	CN,CM,ST	Areas 1,101,103,104
Gill Net	Area C	02-Aug-16	02-Aug-16	Area 6 CM (PK/CN)	SK,CO,ST	Area 6
Troll	FN-T'aaq-wiihak	02-Aug-16	04-Aug-16	WCVI Aggr. CN	--	Areas 124,125,126
Seine	Area A	03-Aug-16	03-Aug-16	Nass PK	CN,SK,CM,ST	Area 3
Gill Net	Area C	05-Aug-16	06-Aug-16	Skeena SK	CN,CM,ST	Area 4
Troll	Area G	06-Aug-16	13-Aug-16	WCVI Aggr. CN	SK,CO,ST	Areas 123,124,125,126,127
Troll	FN-T'aaq-wiihak	06-Aug-16	09-Aug-16	WCVI Aggr. CN	--	Areas 124,125,126
Seine	Area A	08-Aug-16	08-Aug-16	Nass PK	CN,SK,CM,ST	Area 3
Gill Net	Area C	08-Aug-16	08-Aug-16	Area 7 CM	CO,ST	Area 7
Gill Net	Area C	08-Aug-16	08-Aug-16	Area 8 CM	CO,ST	Area 8
Gill Net	Area C	09-Aug-16	09-Aug-16	Skeena SK	CN,CM,ST	Area 4
Troll	Area F	10-Aug-16	30-Sep-16	CO/PK	CN,CM,ST	Area 3
Seine	Area A	11-Aug-16	15-Aug-16	Skeena SK/PK/CO	CN,CM,ST	Area 4
Troll	FN-T'aaq-wiihak	11-Aug-16	16-Aug-16	WCVI Aggr. CN	SK	Areas 124,125,126
Troll	Area G	14-Aug-16	27-Aug-16	WCVI Aggr. CN	SK,CO,ST	Areas 123, 124, 125, 126, 127
Troll	Area F	16-Aug-16	31-Aug-16	CC Demo CO	CN,SK,CM,ST	Areas 6,7,8,106,107,108,109
Gill Net	Area C	22-Aug-16	22-Aug-16	Area 8 CM	CO,ST	Area 8
Gill Net	Area D	22-Aug-16	23-Aug-16	Barkley CN	SK,CM,ST	Area 23
Troll	Area F	25-Aug-16	09-Sep-16	CN/CO/PK	CM,ST	Areas 2W,142
Troll	Area F	25-Aug-16	30-Sep-16	CO/PK (102)	CN,CM,ST	Areas 102,105,106
Troll	Area F	25-Aug-16	09-Sep-16	CO/PK/SK (1&101)	CM,ST	Areas 1,101
Troll	Area F	25-Aug-16	30-Sep-16	CO/PK/SK (103&104)	CN,CM,ST	Areas 103,104
Troll	FN-T'aaq-wiihak	25-Aug-16	30-Aug-16	WCVI Aggr. CN	SK	Areas 124,125,126
Troll	Area G	28-Aug-16	02-Sep-16	WCVI Aggr. CN	SK,CO,ST	Areas 123, 124, 125, 126, 127
Gill Net	Area C	29-Aug-16	29-Aug-16	Area 7 (Neekas) CM	CO,ST	Area 7
Troll	Area G	03-Sep-16	14-Sep-16	WCVI Aggr. CN	SK,CO,ST	Areas 123, 124, 125, 126, 127
Gill Net	FN-Maanulth	04-Sep-16	10-Sep-16	Alberni CN,CO	SK,PK,CM,ST	Area 23
Gill Net	Area D	05-Sep-16	06-Sep-16	Barkley CN	SK,CM,ST	Area 23
Troll	FN-T'aaq-wiihak	07-Sep-16	11-Sep-16	WCVI Aggr. CN	SK	Areas 124,125,126
Troll	Area F	10-Sep-16	14-Sep-16	CO/PK (101&1)	CM,ST	Areas 1,101
Troll	Area F	10-Sep-16	14-Sep-16	CO/PK (2W&142)	CN,CM,ST	Areas 2W,142
Gill Net	Area D	10-Sep-16	11-Sep-16	Barkley CN	SK,CM,ST	Area 23
Gill Net	FN-Tsu-ma-uss	10-Sep-16	10-Sep-16	Alberni CN,CO	SK,PK,CM,ST	Area 23
Gill Net	Area C	12-Sep-16	13-Sep-16	Area 7 CM	CO,ST	Area 7
Troll	Area F	15-Sep-16	30-Sep-16	CO/PK	CM,ST	Areas 2W,142
Troll	Area F	15-Sep-16	30-Sep-16	CO/PK (101&1)	CM,ST	Areas 1,101
Troll	Area G	15-Sep-16	30-Sep-16	WCVI Aggr. CN	SK,ST	Areas 123,124,125,126,127
Troll	FN-T'aaq-wiihak	15-Sep-16	20-Sep-16	WCVI Aggr. CN	SK	Areas 124,125,126
Gill Net	Area D	15-Sep-16	16-Sep-16	Barkley CO	SK,CM,ST	Area 23
Gill Net	Area D	19-Sep-16	21-Sep-16	Barkley CO	SK,CM,ST	Area 23
Troll	FN-T'aaq-wiihak	22-Sep-16	30-Sep-16	WCVI Aggr. CN	SK	Areas 124,125,126
Troll	Area H	24-Oct-16	04-Nov-16	Fraser CM	CN,SK,CO(wild),ST	Area 29
Gill Net	Area E	24-Oct-16	24-Oct-16	Fraser CM	CN,SK,CO(wild),ST	Area 29
Gill Net	Area E	27-Oct-16	27-Oct-16	Fraser CM	CN,SK,CO(wild),ST	Area 29
Seine	Area B	30-Oct-16	31-Oct-16	Fraser CM	CN,SK,CO(wild),ST	Area 29
Troll	Area G	01-Jan-17	28-Feb-17	WCVI Aggr. CN	SK,CO,ST	Areas 23,24,25,26,27,123,124,125,126,127
Troll	Area G	01-Mar-17	15-Mar-17	WCVI Aggr. CN	SK,CO,ST	Areas 23,24,25,26,27,125,126,127

Appendix 5. Mark Recovery Sample Form



Mark Recovery Sample Form

Sample #: 107501 Master Sample #

XREF Number _____ Trip ID Number _____

Location Name _____ Code

Sampling Site _____ Code

Date Sampled d d m m y y y y

Stat Week Sampled

Page Number _____

VTP

Vessel Name _____ VRN _____

First Day Fished d d m m y y y y

Last Day Fished d d m m y y y y

Stat Week Caught

Gear

Fishery Type

FISHING LOCATION

PFMA – PFMA SUB TROLL ZONE

1 –

2 –

3 –

4 –

CHINOOK

Sample Status | TOTAL LANDED | Product Type | Cut Type | SAMPLE SIZE # Head-On or # Good | # Poor

COHO

Sample Status | TOTAL LANDED | Product Type | Cut Type | SAMPLE SIZE # Head-On or # Good | # Poor

Detection Method

UNKNOWN # Poor

	Head Number	Freezer Cut Quality	Fork Length (mm)	Species	AD Fin Mark	Scale Book #	Scale #
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

VTP
1 – Vessel
2 – Truck
3 – Packer

Fishery Type
C – Commercial
F – FSC
N – EO or Demo
T – TEST

Gear
7 – Rod and Reel
10 – Gillnet
15 – Mixed Net
20 – Seine
31 – Freezer Troll
33 – Ice Troll

Detection Method
T – Tube
V – Visual
W – Wand

Product Type
B – Body Only
H – Head Only
W – Whole Fish

Cut Type
H – Head
M – Mixed
S – Snout

Sample Status
D – Complete Sample with heads (entire vessel)
C – Complete Sample with no heads (entire vessel)
I – Incomplete Sample (entire vessel not sampled)
P – Problem Sample
} SAMPLE COMMENTS required

Freezer Cut Quality
G – Good
P – Poor

Species
15 – Coho
24 – Chinook

AD Fin Mark
0 – Not Clipped
1 – Clipped
2 – Stubby

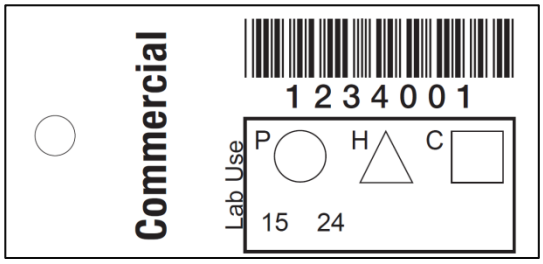
Sample Comments

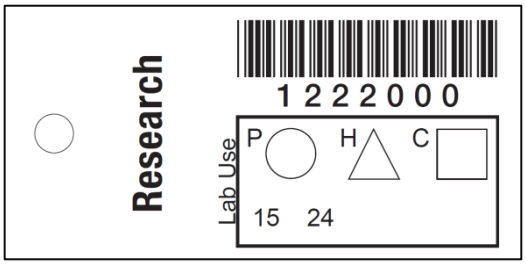
Conducted by _____ Code Recorded By _____

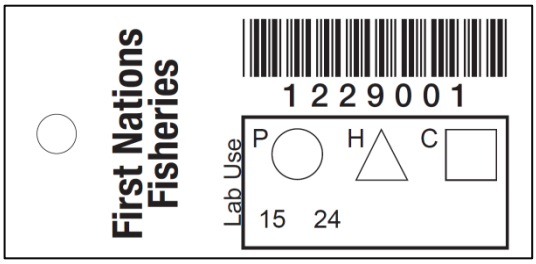
DFO 2015/03

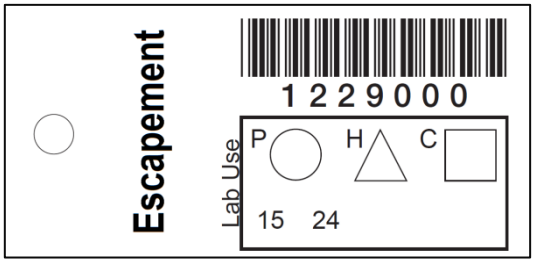
Appendix 6 – Head Labels and Container Labels

Head Labels – Commercial, First Nations Economic, Test Fisheries, and Escapement

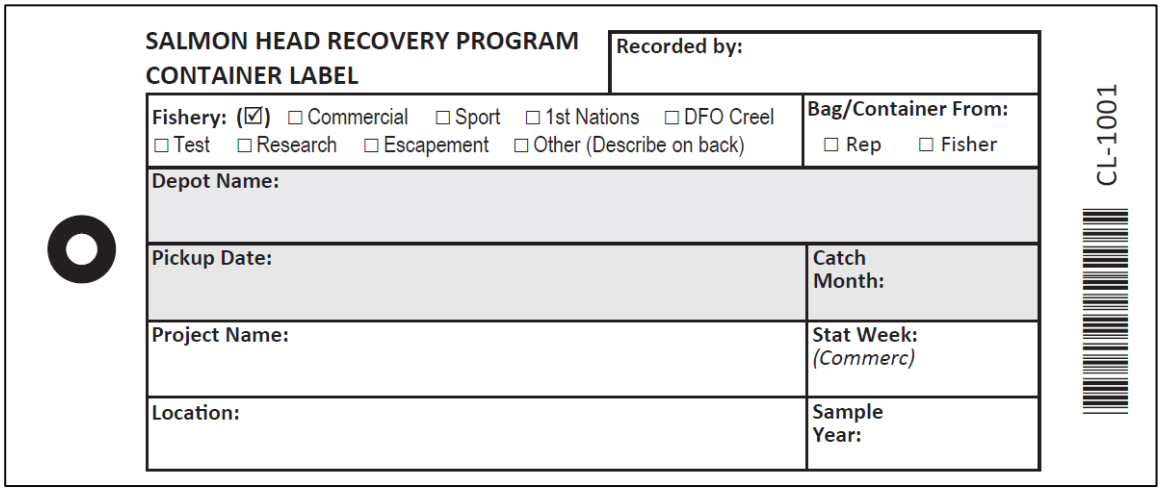






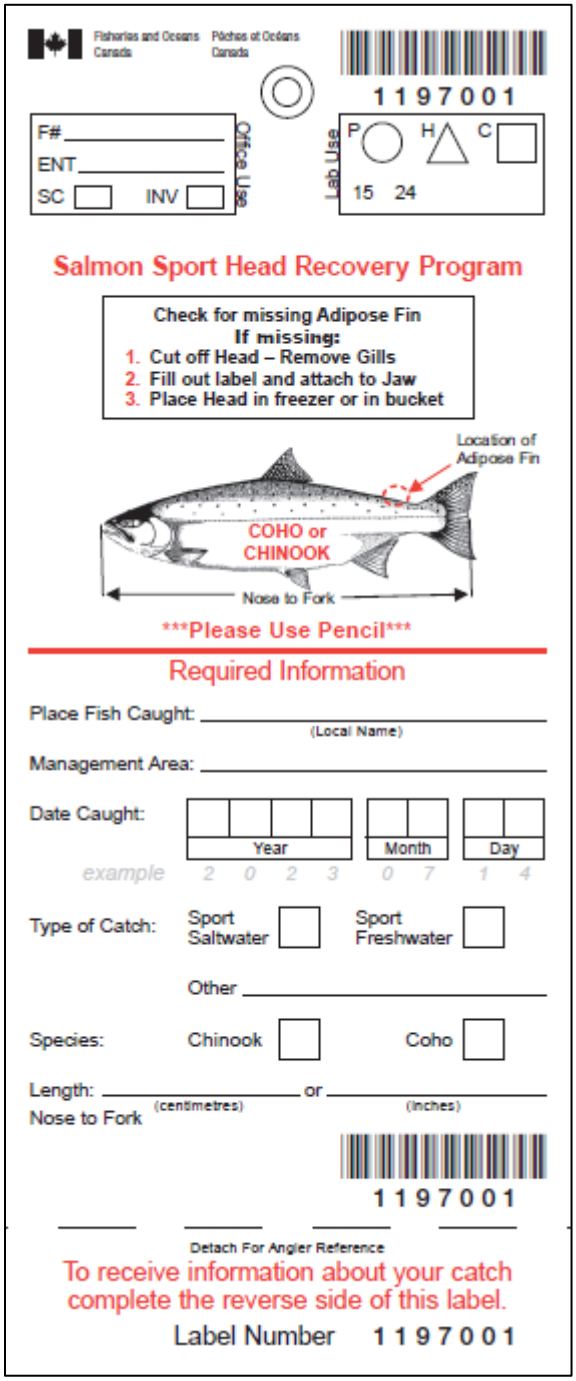


Container Labels – Used for all shipments of samples to the Lab



Appendix 6 - cont'd. Head Labels and Container Labels

Head Labels - Recreational Fisheries (front and back)



Fisheries and Oceans Canada / Pêches et Océans Canada

1197001

F# _____
ENT _____
SC ☐ INV ☐
Office Use

Lab Use
P ○ H △ C ☐
15 24

Salmon Sport Head Recovery Program

Check for missing Adipose Fin
If missing:
1. Cut off Head – Remove Gills
2. Fill out label and attach to Jaw
3. Place Head in freezer or in bucket

Please Use Pencil

Required Information

Place Fish Caught: _____ (Local Name)

Management Area: _____

Date Caught: ☐☐☐☐ Year ☐☐ Month ☐☐ Day
example 2 0 2 3 0 7 1 4

Type of Catch: Sport Saltwater ☐ Sport Freshwater ☐
Other _____

Species: Chinook ☐ Coho ☐

Length: _____ (centimetres) or _____ (inches)
Nose to Fork

1197001

Detach For Angler Reference

To receive information about your catch complete the reverse side of this label.

Label Number 1197001

Optional (to receive email about your catch)

Angler Contact Information

Name: _____

E-mail: _____

Phone: _____

Mailing Address (alternative to email)

Address: _____

City: _____

Prov / State: _____

Postal / Zip Code: _____

Guide Contact Information

Guide #: To receive your guide # contact 1-866-483-9994

OR

Name: _____

E-mail: _____

Phone: _____

Mailing Address (alternative to email)

Address: _____

City: _____

Prov / State: _____

Postal / Zip Code: _____

Place Fish Caught: _____

Date Caught: _____

Salmon Sport Head Recovery Program **1-866-483-9994**

Appendix 6 - cont'd. Head Labels and Container Labels

Head Labels - Food, Social, and Ceremonial Fisheries (front & back)

Fisheries and Oceans Canada / Pêches et Océans Canada

1001111

F# _____ ENT _____ SC ☐ INV ☐ Office Use

Lab Use: P ○ H △ C ☐ 15 24

First Nation Salmon Head Recovery Program

If your Chinook or Coho is missing the Adipose Fin:

1. Cut off the head and remove the gills
2. Fill out a label and attach to the jaw
3. Leave the head with your Fishery Monitor or Guardian or take it to your Community Salmon Head Recovery Depot

Please Use Pencil

Required Information

_____
Nation or Band or Monitoring Organization

Place Fish Caught: _____ (Local Name)

Management Area: _____

Date Caught: Year ☐☐☐☐ Month ☐☐ Day ☐☐

example 2 0 2 3 0 8 1 4

Type of Catch: Food, Social or Ceremonial ☐ Economic or Demonstration ☐

Other _____

Species: Chinook ☐ Coho ☐

Length: _____ (centimetres) or _____ (inches)
Nose to Fork

Gear:

☐ Troll ☐ Drift Net
☐ Set Net ☐ Beach Seine
☐ Dip Net ☐ Fish Wheel
☐ Gill Net

Other: _____

1001111

○

Optional Information

Please Print Clearly

Fisher Mailing Information

Complete this section to receive information about your catch.

Name: _____

E-mail: _____

OR

Address: _____

City: _____

Province: _____

Postal Code: _____

Phone Number: _____

Appendix 7 – Freezer Troll Bag Labels and Head Delivery Records

R.D. PENHALL LTD. - MADE IN VANCOUVER, CANADA - DURASEAK WATERPROOF

Vessel Name: _____

VRN: _____

Trip ID: _____

Management Area(s): _____

EACH BAG MUST CONTAIN SNOUTS/HEADS FROM CHINOOK AND COHO CAUGHT WITHIN THE SAME WEEK AND SAME TRIP ID

START A NEW BAG EVERY SUNDAY AND EVERY NEW TRIP

Heads/Snouts in this bag were caught between:

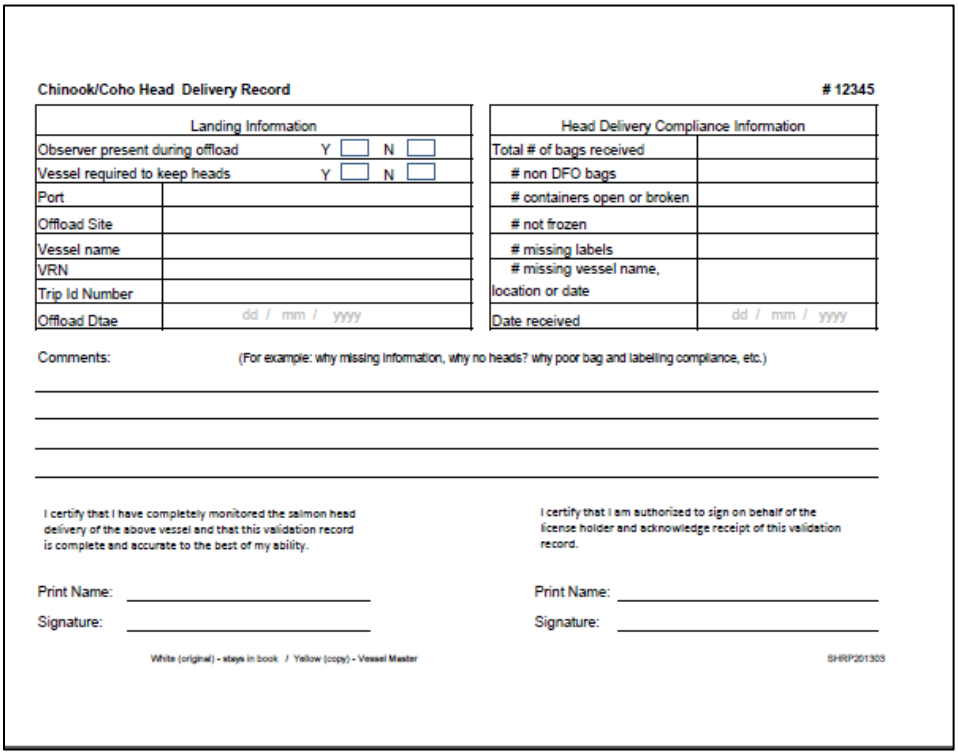
Start Date: 2 0 | | | | | | (year) (mm) (dd)

End Date: 2 0 | | | | | | (year) (mm) (dd)

PLEASE USE PENCIL

Contact: J.O Thomas & Assoc. for collection.
Toll Free 1-800-663-3344

Chinook/Coho Head Delivery Record



Chinook/Coho Head Delivery Record **# 12345**

Landing Information		Head Delivery Compliance Information	
Observer present during offload	Y ☐ N ☐	Total # of bags received	
Vessel required to keep heads	Y ☐ N ☐	# non DFO bags	
Port		# containers open or broken	
Offload Site		# not frozen	
Vessel name		# missing labels	
VRN		# missing vessel name, location or date	
Trip Id Number			
Offload Dtae	dd / mm / yyyy	Date received	dd / mm / yyyy

Comments: (For example: why missing information, why no heads? why poor bag and labelling compliance, etc.)

I certify that I have completely monitored the salmon head delivery of the above vessel and that this validation record is complete and accurate to the best of my ability.

Print Name: _____

Signature: _____

I certify that I am authorized to sign on behalf of the license holder and acknowledge receipt of this validation record.

Print Name: _____

Signature: _____

White (original) - stays in book / Yellow (copy) - Vessel Master

SHRP201303

Appendix 8. Recreational Fisheries - Salmon Head Recovery Program Public Relations, Sampling Materials, and Procedures

Poster

Appendix 8 cont'd. Recreational Fisheries - Salmon Head Recovery Program Public Relations, Sampling Materials, and Procedures

Depot Sign-up Form

Fisheries and Oceans Pêches et Océans

Salmon Sport Head Recovery Program
Depot Signup Sheet

Canada

Date Month/Day

1. Depot Details

ID#	Depot Name		
Zone	PFMA	Location	
Physical Address			
Coordinates (Decimal Degrees) Latitude		Longitude	

Depot Type ☐ Marina ☐ Store ☐ Lodge ☐ Charter ☐ Federal ☐ Other	Accessibility ☐ Public ☐ Private	Operational ☐ Seasonal ☐ Year Round	Setup Type ☐ Visit ☐ Mail	
Minimum Service Level(s)	☐ Weekly ☐ 2 Weeks ☐ 6 Weeks ☐ Monthly ☐ 2 Months ☐ 3 Months ☐ Start & End of Season ☐ Closed			
	From ☐ Early ☐ Mid ☐ Late Month	To ☐ Early ☐ Mid ☐ Late Month		
	☐ Weekly ☐ 2 Weeks ☐ 6 Weeks ☐ Monthly ☐ 2 Months ☐ 3 Months ☐ Start & End of Season ☐ Closed			
	From ☐ Early ☐ Mid ☐ Late Month	To ☐ Early ☐ Mid ☐ Late Month		
	Other			
Hours of Operation				

2. Storage Details

Storage Type ☐ Freezer ☐ Bucket	Storage Owner ☐ DFO ☐ Depot ☐ SHRP	DFO Storage ID	Approx. Landing to Storage Distance (m)
SHRP Freezer Size ☐ 3 ☐ 5 ☐ 5W ☐ 7 ☐ 14	Shelter for Freezer / Bucket ☐ Yes ☐ No	Off-season Depository for Freezer / Bucket ☐ Onsite ☐ Offsite	Off-season Depository for Shelter ☐ Onsite ☐ Offsite
Storage Location (website description)			

3. Contact Details

Mailing Address (if different)		
Town		Postal Code
Manager Owner		Alternate
Phone Public	Phone 1	Phone 2
Fax		Email

4. Additional Information

#Poster	#Hats	Pictures	Derby Dates

Depot Signature	Service Rep Signature

Printed:

Appendix 8 cont'd. Recreational Fisheries - Salmon Head Recovery Program Public Relations, Sampling Materials, and Procedures

Depot Service Form

Fisheries and Oceans Canada / Pêches et Océans Canada

Salmon Sport Head Recovery
Depot Servicing Form

Toll Free Number
1-866-483-9994

Y Y Y Y M M D D	Individual Contacted:	Depot Id#:	Depot Name:

☐ Visit ☐ Phone ☐ Post **Total # of Heads:** | **Method:** ☐ Count ☐ Estimate | **Time of Visit (24hr):**

Checklist:
- ☐ Checked supply of labels + pencils
- ☐ Service Log signed and dated
- ☐ Cleaning of DFO head bucket or freezer as required
- ☐ Signage checked and replaced as necessary (e.g. posters, toll free#, depot sign, label instructions)

Container Labels:	New Head Labels Distributed:	Issues/Suggestions/Additional Information:
CL- _ _ _ _		
	Service Rep (Print):	

Send To: J.O. Thomas Associates Ltd martlews@jothomas.com Fax: (604) 291-6496 1370 Kootenay Street Vancouver, BC, V5K 4R1 | DFO 2015-04

Generic Depot Service Log Sticker

SALMON HEAD RECOVERY PROGRAM

HEAD DEPOT SERVICE LOG

for servicing or additional supplies call toll free 1-866-483-9994

Month	Day	Time	Service Rep

Fisheries and Oceans Canada / Pêches et Océans Canada — Canada

Generic Servicing Record for Depot - Postcard

SALMON HEAD RECOVERY PROGRAM

Working Together For Future Fisheries

SALMON HEAD RECOVERY PROGRAM

Service Date: _____

Number Of Heads Picked Up: _____

Comments:

Our goal is to provide excellent service throughout our program. If you have any suggestions as to how we can better serve you, or if you have any questions about Salmon Head Recovery, please feel free to call our toll free line: 1-866-483-9994

Appendix 8 cont'd. Recreational Fisheries - Salmon Head Recovery Program Public Relations, Sampling Materials, and Procedures

Depot Instructions

Fisheries and Oceans Canada / Pêches et Océans Canada

SALMON HEAD RECOVERY PROGRAM

HEAD DEPOT INSTRUCTIONS

Call toll free 1-866-483-9994 for assistance or for head pickup

Labeling Procedures

When an angler brings in a CHINOOK or COHO head:

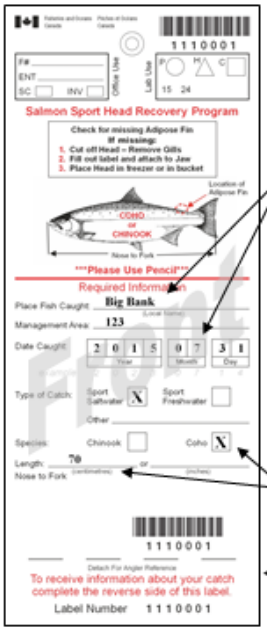
1. **Ensure the adipose fin was missing.**

   Before accepting a head, ask the angler if the fish was missing its adipose fin. Do not accept the head from a fish with a clipped maxillary or ventral fin, unless its adipose fin was also absent.

2. **Give the angler a label to fill out and tie to the jaw.**

   - Instruct the angler to **COMPLETELY** fill out the catch information on the front of the label. The back of the label is for contact information so that the angler/guide can receive information about their catch.
   - Tie the label to the fish's jaw and deposit it in your bucket or freezer. Each head must have its own label. If you can't attach a label to a head put both in a plastic bag and tie off the bag (for frozen heads only).

We keep track of label numbers distributed to each depot. **Please do not trade labels with other depots.** If you are running low on labels please call toll free 1-866-483-9994 **before you run out**.



USE PENCIL ONLY

Record the name of the location and management area where the fish was caught. Record the precise catch date (e.g. 2015/07/31)

Anglers who wish to receive information about their catch must write their name, AND either an email address, OR mailing address and phone number.

If the trip was guided, record the guide's information to also receive catch information. OR simply record their guide id. Call 1-866-483-9994 to receive a guide id.

Mark off salt or freshwater and the species. Record the length in cm or inches.

Anglers can tear off the receipt portion to keep for their own records.

Canada

Appendix 9. Financial Statement

	TOTAL BUDGET			ACTUALS			
Fiscal Year – "2016-17" Consolidated Budget	**PSC**	**DFO**	**Total**	**PSC**	**DFO**	**Total**	**Variance**
Labour / Subcontractors / Consultants							
DFO Salary	$ 20,250	$ 419,250	$ 439,500	$ 24,053	$ 427,889	$ 451,942	$ (12,442)
DFO Employee Benefits	$ 4,050	$ 83,850	$ 87,900	$ 4,811	$ 85,578	$ 90,388	$ (2,488)
Contractor	$ 277,913	$ 423,338	$ 701,251	$ 295,034	$ 502,355	$ 797,389	$ (96,138)
Site / Project Costs	$ -	$ -	$ -				$ -
Travel & Living	$ 100,000	$ 190,000	$ 290,000	$ 51,900	$ 121,100	$ 173,000	$ 117,000
Sampling Supplies & Materials	$ 27,000	$ 94,000	$ 121,000	$ 28,746	$ 67,074	$ 95,819	$ 25,181
Lab Supplies & Materials	$ 1,200	$ 4,000	$ 5,200	$ 3,656	$ 8,531	$ 12,187	$ (6,987)
Repairs & Maintenace	$ -	$ 10,000	$ 10,000		$ 5,678	$ 5,678	$ 4,322
Disposal of waste	$ 8,000	$ 15,000	$ 23,000	$ 1,196	$ 2,790	$ 3,986	$ 19,014
Shipping	$ 5,000	$ 10,000	$ 15,000	$ 3,653	$ 8,525	$ 12,178	$ 2,822
Overhead / Administration Costs	$ -	$ -	$ -	$ -			$ -
Field office retntals	$ 10,000	$ 18,000	$ 28,000	$ 4,290	$ 10,010	$ 14,300	$ 13,700
Lab rental	$ -	$ -	$ -	$ 17,100	$ 39,900	$ 57,000	$ (57,000)
Office supplies	$ 2,000	$ 4,000	$ 6,000	$ 300	$ 700	$ 1,000	$ 5,000
Communications	$ 7,500	$ 15,000	$ 22,500	$ 4,304	$ 11,696	$ 16,000	$ 6,500
GST (5%) of PSC Contributions	$ 21,931	$ -	$ 21,931	$ 21,952		$ 21,952	$ (21)
TOTAL	**$ 484,844**	**$ 1,286,438**	**$ 1,771,282**	**$ 460,996**	**$ 1,291,825**	**$ 1,752,821**	**$ 18,461**
VARIANCE				**$ 23,848**	**$ (5,387)**	**$ 18,461**	