

SALMON STOCK ASSESSMENT PLAN – 2004/05

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Report Contents

Executive Summary	1
Introduction.....	4
Process	5
Direction	5
Participants	5
Assumptions.....	5
Salmon Stock Assessment Framework	6
Designing the regional salmon assessment program.....	6
Final steps	6
Part B – Summaries By Species.....	7
Sockeye.....	7
Chinook.....	14
Coho.....	23
Chum	33
Pink.....	40
Fisheries Monitoring.....	45
Infrastructure (core).....	49
Part C – Program summary by Area.....	51
Part D – Summary comments and recommendations	52
General comments on the state of salmon assessment	52
Specific comments on the proposed 2004/05 assessment program.....	53
Performance summary of the planning approach.....	54
Options for 2004/2005	55
Appendices	56

Executive Summary

The approach taken in designing the regional assessment program for salmon had four objectives, which are presented below along with a brief performance assessment.

Objective 1: To develop cooperative and integrated stock assessment programs building on previous activities and planning processes. Cooperation between StA, FM and HEB was encouraged.

- Business planning did build on previous work by adopting some of the strengths of past work while avoiding some of the pitfalls
 - Focus on stock units was maintained.
 - Adoption of frameworks allowed SACC to focus on information required to deliver credible advice to Fisheries Management in support of prioritized DFO objectives. Attention was thereby changed from our perception of the importance of the stock to the importance of information requirements to deliver requested advice.
 - Historical shares of resources were not considered a driver in the allocation of resources.
- The approach lends some credibility to the assertion that the plan contained is both regional and integrated.

Objective 2: To comply with RMC direction on meeting obligations, which were understood to be particularly those related to the PST, while considering other priorities such as conservation.

- There was general but not unanimous agreement on the relative weights given to PST, Area and other priorities as directed by RMC.
- One Area felt disenfranchised and another disadvantaged by the emphasis on PST obligations.

Objective 3: The timely delivery of a regional assessment plan.

- The problems encountered in 2003/04 leading to a lack of direction on spring projects and non-approved projects going to completion was avoided by early Area Director and FM approval of spring projects recommended by SACC.
- The time-line for completion of the regional plan was not met.
- The principal reason for non-compliance was the uncertainty in budget ceiling, which, as in past years, varied by 10% on a weekly and sometimes daily basis into July.

Objective 4: To provide improved capacity and opportunity for First Nations

- Improving capacity and providing opportunity for FN's in a period of budget reduction and heightened expectations, while complying with government financial and workforce regulations remains a significant challenge.

- Timely interaction with FN's on the assessment frameworks and preliminary project plan was initiated through BCAFC and local area contacts.
- Progress toward this objective cannot be assessed with the information collected during this exercise.

A summary of the framework elements applied to each species is presented in the following Table. The contents may be viewed as brief characterizations of the overriding factors that structured the assessment plan. The YTB assessment program is not included because that Area did not participate in the regional planning process due to their absence at the initial planning meetings. Assessment frameworks were completed for all species except pink salmon.

Species/Sector	Overriding factors	Comments
Chinook	<ol style="list-style-type: none"> 1. Provision of data necessary for the CTC coast-wide model under the PST 2. Domestic management of fisheries 	<ul style="list-style-type: none"> ○ Uniformly applied across the region.
Chum	<ol style="list-style-type: none"> 1. Domestic management of terminal net fisheries 	<ul style="list-style-type: none"> ○ Generally low ER and empirical management approaches. ○ Uniform application.
Coho	<ol style="list-style-type: none"> 1. In nBC management of domestic fisheries 2. In sBC management of domestic fisheries for interior Fraser coho & implementation of PST agreement on ABM 3. WCVI and CC, management of localized recreational fisheries 	<ul style="list-style-type: none"> ○ nBC, moderate to high ER, lack of indicators necessitates development/maintenance of indicators to calibrate management models ○ sBC and WCVI, anticipated very low ER and presence of hatchery indicators requires minimal extensive monitoring and does not require wild indicators ○ CC, anticipated very low ER favors minimal extensive monitoring and suspension of development of wild indicator
pink	<ol style="list-style-type: none"> 1. Management of domestic fisheries 	<ul style="list-style-type: none"> ○ Empirical management has surveys appropriate to scope and scale of exploitation ○ Extent of Charter Patrol surveys remains unknown (due to FM budget deliberations)

Sockeye	<ol style="list-style-type: none"> 1. PST and antecedent international study designs 2. Management of domestic fisheries 	<ul style="list-style-type: none"> ○ Off-cycle years in all Fraser sockeye. ○ Requirements of extant agreements do not recognize fiscal limitations especially with growing spawner abundance, utility of forecasts, alternative approaches, or variation of assessment requirements with ER
Infrastructure	<ol style="list-style-type: none"> 1. Provision of data necessary to support species assessment 	<ul style="list-style-type: none"> ○ Lack of commitment to Regional salmon data strategy is continuing to compromise maintenance, development and implementation of regional data program.

The regional assessment plan can be summarized in terms of performance level by **Assessment Framework Stock Unit (AFSU)** within species (see following Table). The AFSU's used by SACC were constructed based on the provision of advice to fisheries management. For coho, chinook and chum the AFSU's broadly conform to the stock units of the WSP. For sockeye the AFSU's are generally larger than the WSP units and for pink smaller than those units. The assessment performance levels are described in Table 1 in the introduction, with the quality of advice decreasing from level 1 to level 5. Generally, the "better" the advice is the more it costs to obtain.

Species	Count of AFSU by Assessment Performance Class					Species totals
	1: high quality	2: good quality	3: fair quality	4: poor quality	5: status cannot be determined	
Chum		5	3	3		11
Chinook	2	8	8	3		21
Coho		7	7	3	2	19
Pink		3	1	2	3	9
Sockeye	3	5	5	4	1	18
Class totals	5	28	24	15	6	78

One important conclusion from this analysis is that salmon stock assessment staff continue to deliver a credible assessment program for a majority of stock assessment units despite the numerous problems. The continued delivery of a credible assessment program attests to the dedication and ingenuity of assessment staff.

Specific issues that arise out of the assessment plan

1. Lack of full compliance with Fraser sockeye study design. Without a 25%+ increase to assessment budgets this deficiency cannot be resolved. On the other hand, assessment of Fraser sockeye does not put stocks at risk and maintains a much higher standard than is applied to sockeye AFSU's in the rest of the region.
2. The difficulties encountered this year in formulating a regional assessment program will be small compared to those in 2005/06 as dominant cycles of Fraser sockeye and Fraser pink return.

The following three conclusions are interrelated.

3. Expectations remain high while resources diminish. The decade long infusion of B-base resources beginning with the Green Plans and ending with CFAR allowed an ambitious expansion of salmon assessment work and helped create tremendous expectations for large programs with extensive NGO participation. With the termination of all but the new PSC endowment program and the continuing loss of A-base and new PST funding, those expectations cannot be met.
4. Decisions to discontinue projects are very difficult. A good example of this is the coho indicator program in sBC. The assessment program for sBC coho would remain adequate if the wild indicators were dropped. At least three hatchery indicators continue to operate in the area of concern, development of the wild indicator for interior Fraser coho, where there is no hatchery indicator, is continuing, the anticipated ER's are very low (<15%), wild indicator coho will not be detected in most fisheries, which are mark-selective, and there are escapement monitoring programs in place that at the very least are capable of differentiating expected (near capacity) escapements from recruitment failures. These facts notwithstanding, there is continued debate over whether available funds are best used for escapement enumeration or for wild indicators. A review is in progress and should be completed by August.
5. Cooperative approaches with NGO's and FN's cannot succeed without greater security of funding. The loss of programs because of uncertain funding further damages the credibility of the DFO and will compromise the development of co-operative programs in the future.
6. Assessment activities in the Central Coast Areas 7 to 12 are again minimal in part because there are few PST priorities in the Area but also because most of the Area's fisheries are on pink and chum, the two "low-value" species.

7. Little attention is directed toward pink and chum salmon. This is understandable in part because the management of both species is largely terminal and empirical and thus does not require large investments in assessment. However, the complexity of chum life history and population structure would argue for more investment in assessment to avoid conservation issues.
8. Little attention is directed toward small-lake sockeye. This lack of attention is due partly to the lack of commercial fisheries interests and partly due to the expense and impracticality of assessing hundreds of individual populations. However, the sockeye of each of these small lakes is very likely a SARA unit and, as is the case with Sakinaw Lake sockeye, our lack of attention can have costly consequences.

Introduction

The primary task of stock assessment (StA) is to advise fisheries management, commissioners, First nations, stakeholders, and the public on the status of the fisheries resource, i.e. the stocks. Status is a specific and technical term that means, simply, a comparison of estimated fish abundance to a desired abundance that would allow a pre-defined set of objectives to be met with some specified level of certainty. That desired level of abundance is technically termed a “reference point”. The assessment of stocks is quantitative and therefore data-intensive. Because of the importance of data most of the activities that stock assessment staff are involved in deal with the collection of data and data-management. A much overlooked set of activities that is central to modern governance models is that concerned with the interface between stock assessment and clients. These interface functions involve reporting, consultation, outreach (technical support), informational, and public relation functions. The following table shows how the time of the currently 161.6 indeterminate and determinate area and core salmon stock assessment staff is allocated.

Activity	Indeterminate and determinate CFT	Percentage allocation of CFT
Administration (excludes StAD administrative staff of approximately 2 CFT's)	12.7	8%
Stock Assessment	114.8	71%
o Analysis & formal reporting	12.1	
o Data collection (escapement and catch)	91.6	
o Data management	11.1	
DFO-support	31.5	19%
o PST technical processes	7.7	
o FN technical processes	1.8	
o Interface functions between stock assessment and clients	22.0	
Research	2.6	2%
Totals	161.6	

Consistent with the data-intensive nature of stock assessment 64% of the total CFT complement is devoted to data collection and data management. Only 8% of the staff time is involved in analysis and formal reporting. Interface activities occupy 19% of staff time.

This regional assessment plan is focused on stock assessment activities. With the exception of activities explicitly supported by projects, support for the activities listed in the above table is derived largely from administrative support envelope and to an increasingly limited extent from project funding. No attempt is made in this plan to account for staff activities. Consequently, there are few comments on the capacity of current staff to effectively manage the program and complete the numerous and diverse assignments not captured in the project lists.

Since the primary objective of stock assessment is the provision of specific kinds of advice, it reasonable to use a categorical index of performance that gauges the quality of the advice provided to advise the reader on how SACC judges the performance of the proposed program (Table 1). The performance score is applied to the stock unit, which in this report is called the “Assessment Framework Stock Unit” or AFSU, which is explained in the following text. The projects that make up the assessment program for each AFSU are thus judged collectively not individually. Other project mixes could conceivably deliver equivalent performance in terms of stock assessment but different performance levels for objectives other than those considered by SACC (e.g. public perception, regional economic diversification, etc.).

Table 1. Performance classes of assessment programs defined by their ability to provide credible and defensible advice to fisheries management on stock status.

Performance class	Characteristics	Example
1: Deductive	<ul style="list-style-type: none"> ▪ Status and levels of threats are known with considerable certainty through direct observation. ▪ Current time-series of quantitative escapement estimates available for entire unit. ▪ Active management. 	Barkley Sound sockeye; southern Transboundary sockeye.
2: Strong inference	<ul style="list-style-type: none"> ▪ Defensible ability to infer status and levels of threat. ▪ Current time-series of quantitative escapement estimates available for either significant proportion of unit or for representative populations (indicators). ▪ Active management. 	Skeena coho, StG coho, Interior Fraser coho, WCVI chinook
3: Weak inference	<ul style="list-style-type: none"> ▪ Some capacity to infer status and levels of threat. ▪ Current time series of qualitative escapement estimates for some proportion of unit. ▪ Current time-series of quantitative escapement estimates for neighboring units. ▪ Active management. 	QCI coho, WCVI pink, most species in coastal 3/6 and northern CC.
4: Hypothetical	<ul style="list-style-type: none"> ▪ Some capacity to infer status ▪ No current qualitative escapement data ▪ Passive management. 	Yukon River coho
5: Unsubstantiable	<ul style="list-style-type: none"> ▪ No current qualitative escapement data ▪ No defensible grounds for inferring status. 	Georgia Strait East pink

Process

Objectives of the planning exercise

From an administrative perspective, the approach taken in designing the regional assessment program for salmon had four objectives:

1. To develop a cooperative and integrated stock assessment program building on previous activities and planning processes. Cooperation between StA, FM and HEB was encouraged.
2. To comply with RMC direction on meeting obligations, which were understood to be particularly those related to the PST, while dealing with other priorities such as conservation.
3. The timely delivery of a regional assessment plan.
4. To provide improved capacity and opportunity for First Nations.

The summary section of this report contains a brief performance assessment against these objectives.

Direction

The development of a regional assessment plan was directed by RMC in a recorded decision of 4 Nov. 2003 (Appendix 1).

Participants

The regional assessment plan was developed by Area and regional stock assessment heads and representatives of FM and HEB and led by the chair of the Salmon Assessment Coordinating Committee under the participatory supervision of the Division Head of Stock Assessment. Other Area and regional assessment and fisheries management staff participated as requested.

Assumptions

Several assumptions were made in designing the program:

1. The 2004/05 budget was estimated as the 2003/04 budget less a reduction to O&M of 10% in anticipation of national and regional reductions. Actual budget figures were adopted as they became available.
2. Administrative costs and salaries for indeterminate FTE's were taken "off-the-top".
3. Meeting PST obligations was considered as the primary but not exclusive driver. Additional drivers considered in priority order were perceived interests of FN's, provision of advice to fisheries management, and "conservation"¹.
4. Funding by Areas was not considered as a driver, (i.e., the maintenance of historical proportional allocations).

¹ Provision of advice on vulnerable stocks including the identification of such stocks.

Salmon Stock Assessment Framework

Planning began with an examination of “Stock Assessment Frameworks” for each species. A framework outlines *stock units (termed the Assessment Framework Stock Units or AFSU’s)* and the information requirements for supporting prioritized obligations including the provision of advice to Fisheries Management. Assessment Frameworks are tools used to facilitate mutual understanding and joint planning with external partners, and for prioritizing activities. An assessment framework has several components:

1. Descriptions of the AFSU’s, which include details of their component populations and their characteristics (e.g. assessment aggregates; life history). These descriptions were assembled into the so-called “Tables 1” for each species. These Tables 1 are included in this report.
2. Statement of resource management goals (e.g. sustainable fisheries & viable populations).
3. Descriptions of the current management framework (e.g. TAC; in-season forecasts).
4. Outlines of information needs for stock and fisheries management, and the methods used to acquire that information.

Summaries of the frameworks are given in each species section. The complete assessment frameworks except for pink salmon are available on the Regional salmon drive.

Designing the regional salmon assessment program

The following process was followed for the five species and for the infrastructure (regional) programs:

1. “Table 1”, which outlines the AFSU’s and their characteristics, was reviewed noting AFSU status and anticipated exploitation rate (ER) along with its regional significance to the PST and to fisheries. All AFSU’s were assumed to be significant to First Nations.
2. Information requirements required to provide advice to fisheries management as outlined in the assessment framework were reviewed, noting such needs for escapement coverage, fisheries monitoring, survival/ER indicators and substitutability of hatcheries for wild indicators and noting the capacity of FN and NGO partnerships.
3. A summary of proposed projects at the AFSU level grouped by type was used to do a high level comparison of the proposed program in meeting the information requirements and to compare coverage and resources between AFSU’s.
4. A detailed review of projects was then done to (attempt to) rationalize the projects by AFSU, activity type, and by area to best meet the framework information requirements.

5. The project rationalization was inter-mixed with project adjustments to match estimated budgets with project requirements. Species expenditures in 2003/04 were used as a rough guide for species caps.
6. Additional cuts to programs were made after all species and the sectoral programs were reviewed to bring planned expenditures within the estimated budget cap. Changes to the program made at this time were largely devised and proposed by the SACC chair. The adjustments were based on the priorities established by RMC and an ad-hoc assessment of AFSU status, planned ER, and current threats.

Final steps

O&M budget ceilings were changed by approximately 10% twice in late June and July. Program adjustments were made by majority vote of SACC at two extended SACC meetings in early July. These meetings involved extensive discussions of the changes in the context of the original objectives of the exercise.

Part B – Summaries By Species

Sockeye

Essential components of Assessment Framework:

1. Escapement estimates [quantitative in PST areas; qualitative in others] are the focus of assessment programs coupled with.
2. Catch estimates [stock specific in PST fisheries; approximate/estimated in other], and
3. Age composition of return for traditional stock-recruitment modeling and forecasting, which are the foundation of stock management.
4. Fisheries management objectives are generally to extract the MSY catch where it has been identified or to fish using an adaptive approach intended to first identify MSY and then obtain it.

Assessment programs must focus on these three critical information requirements by AFSU and preferably major stock components of the AFSU particularly in the Fraser River. Activity levels should be greatest for AFSU's with PST significance (i.e., in priority order, Fraser River ordered by available harvest, Babine Lake Development Project (BLDP), Nass, Taku, Stikine, Alsek), followed by AFSU's with domestic fisheries significance (i.e., Barkley Sound). The remaining AFSU's (QCI, coastal 3/6, northern CC, Rivers/Smith (RISI), southern inside, WCVI, and southern trans-boundary) have little current significance to either PST or domestic fisheries, although some have been significant to domestic fisheries in the past (e.g. RISI) and some have current significance to FN fisheries (e.g. RISI, southern trans-boundary). Within priority AFSU's priority information needs pertain to those stock components that support fisheries. All sockeye AFSU's were assumed to be of high significance to First Nations.

5. Survival indicators are not generally used but should be present in major ocean survival domains of which there are at least four (northern; southern CC-sBC inside; Barkley Sound; Fraser).

There are three survival indicator stocks² within the region (Tahltan in the Stikine AFSU, Babine in the Skeena AFSU and Chilko Lake in the Fraser-summer AFSU). The latter two indicators are used largely for study of survival patterns over long time frames and would not be considered essential for

² FW and marine survival are both measured.

short-term fisheries management. Tahltan survivals are used in assessments and forecasting of both wild and enhanced populations.

6. Significant fisheries are managed using effort/time/space models so, when possible, assessment should collaborate with fisheries management to acquire the information necessary to develop and test these models.

Vital statistics

Number of Assessment Framework Stock Units:	17 ³
Approximate maximum number of SARA units ⁴ :	214
Minimum number of spawning populations:	582

Summary statistics from the proposed sockeye assessment project list

1. 70% of total sockeye assessment funding is allocated to escapement monitoring.
2. 40% of total sockeye assessment funding is allocated to Fraser escapement monitoring or 57% of total escapement funding.
3. AFSU's without any escapement coverage: QCI, Coastal 3/6, northern CC (Area 7/8), and small northern Transboundary rivers (e.g. Whiting).
4. AFSU's with inadequate escapement coverage adjusted for status or exploitation rate (ER): Southern Inside, WCVI.
5. AFSU's with marginally adequate escapement coverage: Skeena exclusive of BLDP ;
6. AFSU's with adequate or better escapement coverage adjusted for status or ER: Alsek, Stikine, Taku, Nass, RISI, Barkley Sound, Fraser (all run-timing groups), Transboundary South.
7. Approximate minimum number of SARA units with no escapement coverage 93 or 43% of total; with inadequate escapement coverage: 51 or 24% for a minimum total of 144 or 67%. Note however, that nearly all of these populations are in areas with no PST or commercial fishing significance and presumably experience little exploitation.
- 8.

Summary of SACC findings

- Most significant production issues are
 - Management of mixed-stock fisheries in all major stock areas;

³ Small Transboundary rivers in the north such as the Whiting will likely be included as at least two additional AFSU's in the future should this approach continue. For this report these systems are reported as if they were one AFSU (misc. northern TB) but do not appear in the sockeye "Table 1".

⁴ Identification of the of population units designatable under the Species at Risk Act (SARA) is solely the responsibility of the Committee on Species of Endangered Wildlife in Canada (COSEWIC). SACC's estimate is based on the assumption that the runs to individual sockeye rearing lakes constitute one SARA Unit and thus is an approximate maximum.

- Determining reference points and hence status. For example, the efforts to identify the carrying capacity of sockeye lakes in the Fraser and Skeena have, so far, been largely inconclusive.
- Most significant conservation issues are
 - Skeena wild
 - Southern inside
 - WCVI (not Barkley Sound)
 - Fraser lates
 - RISI.
- Conservation issues have arisen from multiple factors and not exclusively fisheries, except in the Skeena.
- Escapement programs are adequate except for QCI, coastal 3/6, northern CC, WCVI (does not include Barkley Sound, Southern Inside and misc. nTB AFSU's).
- Escapement programs for Fraser sockeye do not meet PSC study-design criteria, with coverage of early-summer and summer groups being most deficient.
- Catch monitoring of ocean fisheries is adequate for all major stocks and fisheries.
- Assessment efforts in YTB & Fraser are relatively high compared to other Areas.
- Juvenile programs in many areas, especially Fraser and YTB, may not be supportable.

- SACC advises that withdrawal of resources from the proposed programs for any of the sockeye AFSU's noted in the previous bullet would further limit and or delay detection of abundance trends in those AFSU's.
- SACC advises with some concern that the assessment budget for 2004/05 is adequate only because all run-timing groups of Fraser sockeye are in off-cycle, there are no Fraser pink and fisheries for coho and chinook are limited.
- SACC advises that the current budget precludes investigation of known (e.g. southern inside AFSU) and suspected (e.g. WCVI, northern CC, coastal 3/6 AFSU's) conservation concerns.

SACC advice and recommendations

- SACC advises that full support for PSC study-design objectives would require further internal reallocations to the sockeye assessment budgets for Fraser and northern trans-boundary AFSU's.
- Inability to provide full support for PSC study-design objectives does not appear to compromise provision of credible advice to fisheries management on the status of Fraser and northern trans-boundary AFSU's in 2004/05.
- SACC advises that the current assessment plan is adequate to support planned fisheries on all major commercial stocks.
- SACC therefore recommends against further reallocations of assessment resources to Fraser and YTB sockeye assessment programs.
- If funds were reallocated to the Fraser and YTB assessment programs the following program areas should be considered in the listed order:
 - Admin. components of the overall budget.
 - Sockeye AFSU programs in areas with no PST significance, e.g. RISI, northern CC, coastal 3/6, WCVI, Barkley Sound, or Southern Inside;

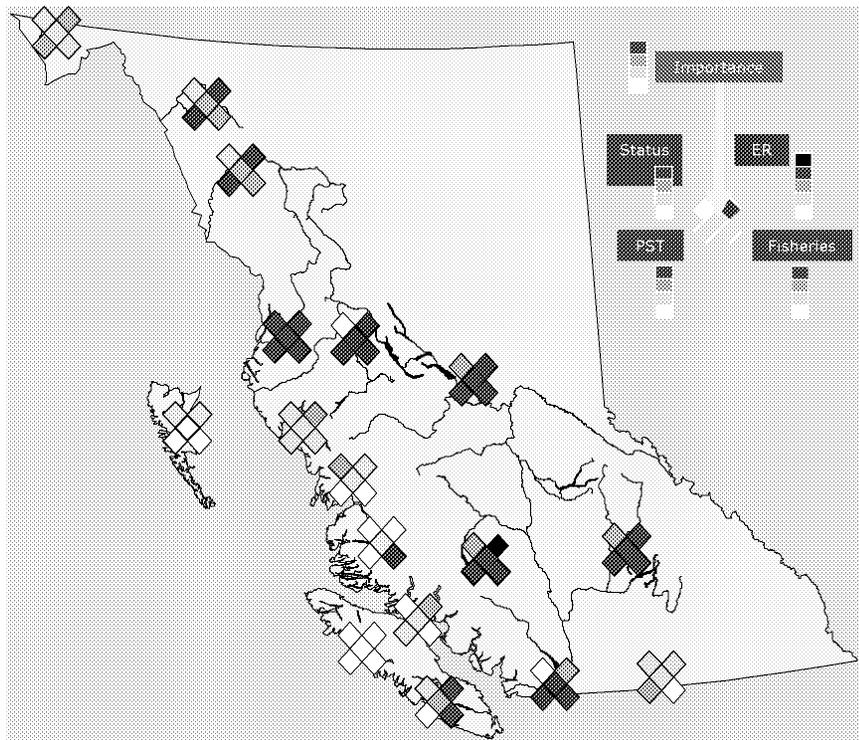


Figure 1. Visual summary of some characteristics of the sockeye AFSU's. Overall importance, significance to PST and significance to commercial & recreational fisheries are coded from not significant (white) to high significance (dark blue). Status is coded from poor (white) to abundant (dark blue). ER is coded from low (white) to excessive (black).

Table 2. Summary of the performance class of the proposed sockeye assessment program.

Performance class of assessment program	AFSU
1	Barkley Sound
	RISI
	Southern Transboundary
2	Fraser-Early Stuart
	Fraser-Summer
	Fraser-Late
	Stikine
	Taku
3	Alsek
	Nass
	Skeena
	Southern Inside
	Fraser-Early Summer
4	Coastal 3/6
	northern CC
	QCI
	WCVI (possibly category 5)
5	misc. northern TB

Table 3. "Table 1" for sockeye Assessment Framework Stock Units. Explanations of the column headings are given in Appendix 2.

AFSU	Performance Class	Approx. number of potentially designatable SARA units	Number of modeled subcomponents	Approximate number of spawning populations	Indicators		Extensive escapement				Fisheries monitoring			Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	Importance			
					Current/potential	comments	none	1	2/3	4/5	comments	rec	comm					FN	FST	C&R fisheries	FN
Aisek	2	7	2	30	no current/Klukshu potential					2	1 major weir (Klukshu), 1 electronic count (Neskataheen)	1, monitored by creel census as part of weir project	0	1, monitored by CAFN	US Dry Bay gn, US Yakutat area nets	3.?	2-3	3	3	2	4
Stikine	2	7	2 wild, 2 enh'd	40	Tahltan/Tuya	used also for enhancement evaluation - enh'd fry are thermally marked			6	2	1 weir, one system-wide m/r	0	2, monitored by sampler in lower river and by T&IFN in upper Stikine	1, monitored by T&IFN	US D-8,6 gn, Cdn gn	4.?	2-4	4	4	3	4
Taku	2	12	4, Trapper, Tatsamenie, Kuthai, mainstem	30	Tatsamenie smolt/King Salmon	used also for enhancement evaluation - enh'd fry are thermally marked				4	3 weirs (L. Trapper, Tatsamenie, Kuthia (AFS), 1 system-wide mark-recap	0	1, monitored by m/r project	1, monitored by TRTFN	US D-11 gn, Cdn inriver gn	4.?	2-3	4	4	3	4
Nass	3	12		15					1	2	Meziadin, Nass watershed from fishwheel/M/R	None	reg	Nisga'a/LGL	AK, 3-5 nets, FSC,	4.?	4	4	4	4	4
Skeena	3	26	3	65	Babine, Slamgeesh	modeled groups are run-timing (early,middle,late)		8	12		Babine (10 tribs within Babine), Slamgeesh, Sustut, Kitwanga, Moricetown	None	reg	Gitksan, Kitselas, Gitanyow, Good programs	AK, 3-5 nets, FSC, ESSR	5.?	1-4	4	4	4	4
QCI	4	11	0	16				2	3	1	Copper (Haida)	Haida Creel Survey	N/A		Haida	3.?	2-3	2	1	1	4
Coastal 3/6	4	60	0	85				10	10	1	Drake, others are charter patrol				AK, 3-5 nets, FSC,	4.?	2-3	3	2	2	4
northern CC	4	8	0		-/-													1	1	4	

AFSU	Performance Class	Approx. number of potentially designatable SARA units	Number of modeled subcomponents	Approximate number of spawning populations	Indicators		Extensive escapement					Fisheries monitoring			Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	Importance		
					Current/potential	comments	none	1	2/3	4/5	comments	rec	comm	FN					PST	C&R fisheries	FN
RISI	1	2	2	12	Long/-	requires better smolt estimates		6	5	1	Docee River fence on Long Lake				Area 9/10 net	3.4	2	1	1	2	4
Southern Inside	3	13	2	13	Heydon Creek (Loughborough Inlet Area 13),	Under development for both Coho, Sockeye and Chum. Multi-species system				5	3	Heydon Fence, Klinaklini fishwheel, Village Bay Fence, 2/3 by Charter Patrol, AFS and community group coverage on 8 systems	1, Non-Fraser stock composition (mainly Nimpkish) monitored in the Round Island GN Test Fishery	Fraser Sockeye (Early Summer Timing), some stocks such as Quaste are not seen to be impacted by any JS fisheries due to their extremely early timing (Peak lower River May 20)	3.?	1-2	1-3	2	1	4	
WCVI	4	15	0		Hobiton,??					2	Hobiton, Jansen?	none	none	terminal FSC				1	1	4	
Barkley Sound	1	3?			GCL, Sproat/Henderson					2	GCL monitored through fishway; Henderson fence	BSnd creel	reg	Barkley Sound net				1	4	4	
Fraser-Early Stuart	2	4	all as 1 aggregate	43	Forfar, Gluske / Driftwood	Major production differences between lower spawning areas and the DW - which was a major contributor pre-1997.	3	1	35	4		NA	Std	FSC reporting, monitoring	Fraser FN net	3.4	3	3-4	4	4	4
Fraser-Early Summer	2	14	8	46	-/-	Major diversity in production potential over vast geographic area. No feasible indicator at present.	0	1	39	6		LF creel	Std	FSC reporting, monitoring	Approach and Panel Area Net, Fraser FN net	4.4	3	3-4	4	4	4

AFSU	Performance Class	Approx. number of potentially designatable SARA units	Number of modeled subcomponents	Approximate number of spawning populations	Indicators		Extensive escapement					Fisheries monitoring			Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	Importance		
					Current/potential	comments	none	1	2/3	4/5	comments	rec	comm	FN					PST	C&R fisheries	FN
Fraser-Summer	2	9	4	92	Chilko / -	Chilko is the only long term marine survival indicator sockeye project in the Fraser.	50	2	35	3		LF creel	Std	FSC reporting, monitoring	Approach and Panel Area Net, Fraser FN net, LF Rec	5.5	3	4-5	4	4	4
Fraser-Late (Fall)	2	10	7	68	Cultus / -	Cultus project critical for status monitoring. This is not a MS indicator for the total Fraser Late aggregate.	44	0	22	2		NA	Std	FSC reporting, monitoring	Approach and Panel Area Net, Fraser FN net, LF Rec	4.4	1-2	2-3	4	4	4
Southern Transboundary (Okanagan)	1	1	1	1	-/-		0	0	1	0		NA	NA	FSC reporting,	none	2.2	2	1-2	3	1	4

Table 4. Summary of currently approved expenditures by sockeye AFSU. The expenditures have been categorized into DFO O&M (A-BASE + PST) and other (external funding) with the "Is it O&M?" variable, which is either FALSE or TRUE. The project types are "E: escapement", "J: juvenile (either smolt or lake survey)", "JE: E+J", "Bio: biological traits such as age, size, otoliths", and "MISC: e.g. carrying capacity".

2004/05 funding AFSU (see Table 1)	External funding					Total	DFO-O&M					Total	Total funding all sources
	Project type Bio	E	J	LRM	MISC		Project type Bio	E	J	JE	MISC		
Alsek		15.9				15.9		89.5			10.0	99.5	115.4
Barkley Sound								77.0	18.0			95.0	95.0
Coastal 3/6	17.0				25.0	42.0				25.0		25.0	67.0
Fraser (all run timings)	131.0	834.9	227.8	288.4	398.0	1880.1		785.6	64.3		10.5	860.4	2740.5
Nass		50.0				50.0		50.0				50.0	100.0
North Coast (multi AFSU)	85.0					105.0						5.0	105.0
QCI											5.0	5.0	5.0
RISI			50.0		1.0	51.0		95.0	14.0			109.0	160.0
Southern Inside					32.0	32.0				77.0		77.0	109.0
Skeena	730.6	15.0	6.5		0.0	752.1	50.0	266.0	19.0		63.0	398.0	1150.1
Stikine		303.1				303.1	7.0	100.0	32.0		30.0	169.0	472.1
Taku		54.5			65.0	119.5		69.0	30.0			99.0	218.5
Trans-boundary South		50.0			56.2	106.2		25.0	15.0			40.0	146.2
YTB (multi-AFSU)						0.0					75.0	75.0	75.0
Grand Total	963.6	1323.4	284.3	288.4	597.2	3456.9	57.0	1557.1	192.3	77.0	218.5	2101.9	5558.8

Chinook

The coast wide chinook management regime requires that joint Canada/US models (e.g. the chinook model), tools (e.g. cohort analysis) and their supporting databases (e.g. MRP, FOS, age) be maintained and developed. In addition, methods for determining such things as status, stock composition of fisheries, biologically based escapement goals, and total mortality in fisheries are to be developed and the required sampling programs and their associated databases are to be established. Under the PST, AABM fisheries are managed to achieve a TAC, which requires catch information in a timely manner. ISBM fisheries require catch and CWT information for determining stock specific harvest rates. In addition to the PST requirements, there are domestic considerations such as stock status, allocation, terminal opportunities, etc.

The assessment plan for chinook follows the “intensive/extensive” model. Survival and ER indicators, largely hatcheries, are the intensive component. Wild escapement estimates are the extensive component. The number and location of the indicators should be such to allow at least weak inference for all exploited AFSU’s (class 3 assessment) and there should be some escapement information available for all AFSU’s. Other important components of the assessment plan include forecasts of ocean abundance by CTC⁵ stock group, escapement goals for the CTC stock groups or wild indicators, and the estimation of total fishing mortality.

Essential components of Assessment Framework:

The information requirements for the assessment and management of chinook salmon are the most demanding of all the salmon species. The direction by RMC to prioritize activities to deliver on PST obligations served to structure the assessment framework for chinook. The management framework for chinook has the following components:

- The PST management regime identifies 6 major chinook stock groups in BC, including the Fraser spring/summer, Fraser falls, LGS summer/falls, JST and mainland inlets, WCVI falls, north-central coastal group. Many of these stock groupings can be further delineated based on differences in life history (e.g. run timing, maturation, distribution, etc.), genetic similarity, or manageability (Table 6).
- Ocean fisheries for coastal BC chinook are managed under an international coast-wide regime mandated by the PST. The overall objective of the regime is to obtain MSY on an aggregate basis. The regime identifies Aggregate Abundance-based Management Areas (AABM), which are collectively managed to variable TACs that are soon to include total mortality. In the

⁵ The Chinook Technical Committee of the Pacific Salmon Commission. The CTC is responsible for setting the annual TAC for ocean fisheries.

approach areas or Individual Stock-Based Management Areas (ISBM) fisheries, there are national obligations for reduced harvest rate on specific stock groupings.

- Management in all Canadian fisheries is also dictated by requirements to protect domestic stocks of concern, including considerations that may arise through the *Wild Salmon Policy* (WSP) and the *Species at Risk Act* (SARA).

The assessment program is focused on providing information for the coast-wide models of the Chinook Technical Committee of the PSC, which are:

1. Catch by fishery and gear-type is required to evaluate the AABM TAC. For stock and fishery analyses additional resolution by period, by stock and age is required. The distribution and number of coded-wire tags (CWT) recovered by the Mark Recovery Program (MRP) is the current means of providing this information on a coast wide basis.
2. Releases of chinook by fishery, by age and by stock. Under the total mortality regime described in the most recent PST annexes, the number, age, stock and mortality of releases must be estimated.
3. Biological information of the catch and principally fisheries-specific stock, and age composition. This information can be captured for CWT’d fish only through the MRP and is required for cohort analysis and run-reconstruction and ultimately by the coast-wide chinook model.
4. Indicator stock escapement. (to determine ER) by age plus associated CWT recoveries.
5. Total escapement by CTC stock group.
6. Escapement goals. The PST requires the development of biologically based escapement targets. Those targets and similarly based limit reference points are required for domestic management.
7. Forecasts of abundance by management or other specified unit, using spawner and recruit data, terminal return summaries, sibling relationships, Ricker parameters and associated variables such as environmental scalars. These are the basis for determining annual abundance in the AABM fishing areas.
8. Other information requirements are described in the chinook assessment framework

The information requirements for the AFSU’s in the northern trans-boundary rivers and the Yukon River are also covered in the PST but in separate annexes. Information requirements are similar but are focused on the freshwater components since all ocean fisheries take place in foreign waters.

SACC noted that fisheries management was increasingly taking advantage of genetic techniques that allow the identification of stocks of concern in fisheries on fine temporal and spatial scales. Projects that further the development of these techniques should be given mid-level priority.

Vital statistics

Number of Assessment Framework Stock Units:	21
Approximate number of potential SARA units:	20
Minimum number of spawning populations:	254

Summary statistics from current chinook assessment project list

- 79% of total chinook assessment funding is allocated to indicator populations (47%) and escapement monitoring (33%). These proportions are similar across most of the AFSU's.
- 30% of the funding is allocated to Fraser River chinook, 20% to Skeena/Nass, 24% to WCVI, 15% to Strait of Georgia, 8% to northern Transboundary, and 0.2% to the Yukon AFSU's.
- Assessment expenditures (all sources) on some AFSU's are very small (northern and southern mainland inlets, Fraser summer age 1.3, Yukon and lower Georgia Strait wild).

Summary of SACC findings

- Most significant production issues are
 - Management of northern mixed-stock fisheries to minimize impacts on WCVI naturals.
 - Continuing uncertainty over FW exploitation levels on early spring Fraser chinook.
- Most significant conservation issues are
 - Yukon River. Although showing signs of improvement, the Yukon River AFSU is of some concern due to poor ocean survival and excessive fishing in foreign fisheries.
 - Lower Strait of Georgia naturals. There are developing problems in some of the populations on the southern Strait possibly related to poor marine survival.
 - Coastal 3/6. Little is known about status due to minimal assessment program and ER is believed to be excessive.
 - Fraser springs ages 1.2 and 1.3. There are concerns with some stocks and with over-exploitation in FW fisheries.
 - WCVI wild. There are continuing issues with natural populations in some inlets.
 - Rivers Inlet stream type. Are slowly recovering from mid-1990's depression but assessment programs are inadequate for the Owikeno Lake components.
- Conservation issues appear to have resulted from varying or poor marine survival but excessive fisheries may have been a factor for some AFSU's.
- The distribution of funding to indicators and escapement programs is broadly reflective of the assessment framework.
- Performance assessment of the current program indicates generally adequacy with some concerns over possibly marginal assessment programs in the Skeena (production), coastal 3/6 (status), Rivers Inlet (status), and the mainland inlets (status). AFSU's.

- SACC is concerned about the cancellation of new indicator projects. These projects were essential components of the TB award for PST implementation. The loss of the new Fraser and CC indicators is particularly worrisome.
- Catch monitoring of ocean fisheries is adequate for all major stocks and fisheries.
- Assessment efforts in the northern Trans-boundary rivers are relatively high compared to other Areas when adjusted for regional importance and status. However, SACC notes that the applicable PST annex requires this level of activity.

SACC advice and recommendations

- SACC advises that the proposed assessment program is adequate to support planned fisheries.
- SACC advises that the proposed assessment program is inadequate to provide full support for PST objectives and is not adequate to provide for further development of PST and domestic objectives related to development of biologically based escapement goals.
- SACC advised that fully supporting PST objectives would require additional funding for assessment activities for some Fraser and CC AFSU's.
- SACC recommends that there be no internal reallocations within the chinook envelope to provide those funds.
- SACC advises that the assessment programs for some AFSU's may be inadequate to detect changes in status in a timely fashion. Of most concern are the RISI, southern and northern mainland inlets and coastal 3/6 AFSU's.

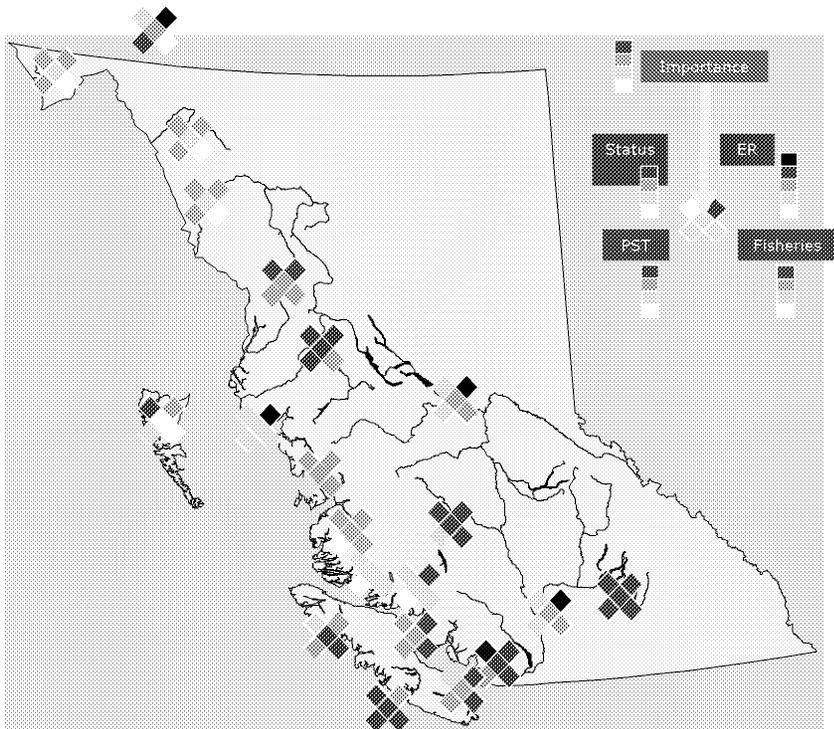


Figure 2. Visual summary of some characteristics of the chinook AFSU's. Overall importance, significance to PST and significance to commercial & recreational fisheries are coded from not significant (white) to high significance (dark blue). Status is coded from poor (white) to abundant (dark blue). ER is coded from low (white) to excessive (black).

Table 5. Summary of the performance class of the proposed chinook assessment program.

Performance class of assessment program	AFSU
1	Fraser Late
	WCVI hatchery
2	Alsek
	Lower Georgia Strait
	Nass
	North Central
	Stikine
	Taku
	Yakoun (QCI)
	Yukon
3	Fraser Spring Age 1.2
	Fraser Spring-Age 1.3
	Fraser Summer Age 0.3
	Fraser Summer-Age1.3
	Rivers/Smith Inlet
	Skeena
	Upper Georgia Strait
	WCVI Falls
4	Coastal 3/6
	Northern Mainland Inlets
	Southern Mainland Inlets

Table 6. "Table 1" for chinook Assessment Framework Stock Units. Explanations of the column headings are given in Appendix 2.

AFSUp	PST stock group	CTC model stock group	Class of assessment program	Indicators		Escapement monitoring				Ocean fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categor ical status	Categor ical ER	Importance to		
				Current /potential	comment on IND	none	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	comm/rec fisheries	FN
Taku	Taku	Taku	3	system wide indicator/potential stock specific indicators limited due to lack of level 4/5 escapement projects	mainstem wild CWT program used in conjunction with adult m/r			6	1, composite m/r project	no active monitoring - guided operations submit to Province but Province does not share info. with us.	as part of m/r project fishery is currently limited to incidental harvest due to PST	monitored by TRTFN	~20	50-100k	US sport, US terminal gn, US troll, Cdn gn	3	2/3	3	1	4
Stikine	Stikine	Stikine	3	-/Tahltan	Mainstem wild CWT program used in conjunction with adult m/r			2	2, 1 weir (L.Tahltan) 1 composite m/r	creel census - Tahltan R.	2, monitored by lower Stikine sampler, and by T&IFN in upper river	1, monitored by T&IFN	~25	50k	AK sport, gn. Troll	3	3	3	1	4
Alsek	Alsek	Alsek	3	-/Klukshu					2, one weir (Klukshu) 1 system composite m/r	creel census in conjunction with weir project	no commercial in Canada	1, monitored by CAFN	~20	20k	AK Dry Bay gn, Yakutat area nets	3/4	3	3	1	4
Yukon	Yukon	Yukon	3	Whitehorse hatchery CN	CWT sampling program needs cooperative effort in US			5	3 - composite m/r, Whitehorse Fishway, Blind Cr weir (external)	post season estimates thru Yukon Conservation Catch Card	1, monitored remotely by mail-in/phone in	9 - monitored by individual FN's under coordination by DFO	~100	120k	AK Yukon R. fisheries esp in lower river	2	4/5	4	1	4
Yakoun	North/Central BC	Northern BC	2	-/-	one population, no need for indicator			1		200k Haida	reg		1	2000	AK troll, nrec	4	3	2	1	4
Nass			3	Kitsumkalum/-	Kalum currently used. Kincolith an option.			2	Meziadin fishway, u/s of fishwheel	partial intermittent creel (Nisga'a)	reg	Nisga'a accurate monitoring	16	45k	AK troll, nTR, in-river	4	4	3	3	4

AFSUp	PST stock group	CTC model stock group	Class of assessment program	Indicators		Escapement monitoring				Ocean fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	Importance to		
				Current /potential	comment on IND	none	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	comm/rec fisheries	FN
coastal 3/6			3	-/-	behavior is thought to be different but no candidate identified. Kitimat might be proxy.		2	4	Kwinamas	rotational creel 3/4/5 only (DFO)	reg	None	18		troll + Nass, Skeena nets	2	5	2	2	4
Skeena			3	Kitsumkalum/-	only northern indicator, inputs to coastal model.		4	14	Babine(?), Kitwanga, Sustut	rotational ocean 3/4/5; issue-driven rotational FW (DFO)	reg	Babine poor of no consequence; Gitsan Good, Wetsuweten and Kitselas OK, rest are mixed to poor	48	70	Ak troll, nTR, in-river	4	4	4	3	4
North Central		Central BC	3	-/Atnarko (Snootli)	only 2 stocks one small wild and the other heavily enhanced. Suspend development?			1	Atnarko Mark-recapture	rotational creel	reg	very limited terminal ocean fishery, in-river reporting is good	2	35		3	3	2	3	4
Rivers/Smith Inlet			2	-/Atnarko (Snootli)	PSC index comprised of Wannock, Chuckwalla, Kibbela			9		rotational creel	reg	very limited terminal ocean fishery, in-river reporting is good	5			3	3	1	3	4
WCVI Falls	WCVI	WCVI naturals	3	Robertson/-		10	8	36		WCVI creel survey (area 20-27), Barkley Sd. Creel survey	WCVI chinook fishery Monitored by observers and logbooks	As per FSC Agreement	100	30K	AK troll, nTR, nSpt, wVI sport and troll	2	3	3	4	4
WCVI hatchery		WCVI hatchery	3	Robertson/-		0	0	2	Somass (Robertson)	WCVI creel survey (area 20-27), Barkley Sd. Creel survey	WCVI chinook fishery Monitored by observers and logbooks	As per Agreement, Nitinat monitored by hatchery and Somas not monitored	3	100k	AK troll, nTR, nSpt, wVI sport and troll	4	3	4	4	4
Fraser Late	Fraser Late	Fraser Late	3	Chilliwack/-	esc in Chilliwack is crap, recommendations from CTC required on how to proceed.			1	Harrison	annual creel on Chilliwack	reg	?		>250K		3	4	3	4	4
Upper Georgia Strait	Upper Georgia Strait	UGS	3	Quinsam / Heydon	Quinsam/Campbell system indicator for both natural and hatchery component.		charter patrol on some streams	1	Heydon	Area 12/13 Creel Survey	Potential for commercial retention to be monitored by observers and logbooks	In-river fisheries monitored by FN groups and reported to Fish Managers	50			3	4	3	4	4

AFSUp	PST stock group	CTC model stock group	Class of assessment program	Indicators		Escapement monitoring				Ocean fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	Importance to		
				Current /potential	comment on IND	none	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	comm/rec fisheries	FN
Lower Georgia Strait	Lower Georgia Strait	LGS	2	Cowichan/-BQ, Puntledge (summers)/-	Cowichan remains the only indicator for LGS natural stocks. Big Qualicum is the hatchery indicator (fall stocks). Puntledge summer stock is the indicator for this summer group.			11	3	Georgia Strait creel survey (area 13-19, 28, 29). Terminal SMF creel survey coverage (Big Qualicum, Porpoise Bay, Davis Bay).	Potential for commercial retention to be monitored by observers and logbooks	In-river fisheries monitored by FN groups and reported to Fish Managers	11		Georgia Strait sport	2/3	4	3	4	4
Northern Mainland Inlets		NOMN	3	-/Klinaklini	Klinaklini is desirable if this is a separate management group not represented by Quinsam. Possible to detect 2 years of tags without escapement. Use DNA to find in fisheries? Very expensive project. Not present in fisheries perhaps like other spring runs. At this point suggest drop as indicator	4		1		Area 12/13 Creel Survey	Potential for commercial retention to be monitored by observers and logbooks	In-river fisheries monitored by FN groups and reported to Fish Managers	4			2	unknown	1	2	4
Southern Mainland Inlets		SOMN	3		Squamish was initially considered the indicator for this management group. Questions about representativeness of southern Boundary & Squamish Capilano	4			Lang Cr. (hatchery)	Georgia Strait creel survey (area 13-19, 28, 29). Terminal SMF creel survey coverage (Big Qualicum, Porpoise Bay, Davis Bay).	Potential for commercial retention to be monitored by observers and logbooks	In-river fisheries monitored by FN groups and reported to Fish Managers	5		Georgia Strait sport	2	4	1	2	

AFSUp	PST stock group	CTC model stock group	Class of assessment program	Indicators		Escapement monitoring				Ocean fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	Importance to		
				Current /potential	comment on IND	none	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	comm/rec fisheries	FN
Fraser Spring-Age 1.3	Fraser Early	Fraser Early. Note. For CTC escapement reporting, runs are now reported as per AFM stock group. Change was made with 2001 C&E Report	3	-/Dome (Penny)	Three way partnership between Timber company, FN, DFO in delivery. FN Treaty implications: terminal run catch provisions for FN in upper river area with overage and underage considerations. BH - includes earliest groups and then main upper river/Nthom. Ind compromised by difficulties monitoring FN (only) fishery. Straying and tag# are concerns. HEB wants to bail. Will being Ed "I want to kill the fish."	45	10	30	1	Assessed in annual M/S Fraser creel in Lower River; FN creel @ PG; FN creel @ Bridge R.	no terminal harvest	poorly documented	86 (±)	3	Northern BC, JuandeFuca/GS Spt LF FN gillnet	2-3	3/5	2	3	
Fraser Summer-Age 1.3			3	-/Chilko	Indicator possible but difficult at Chilko. DIDSON site? ER 40% with slow but consistent upward trend in escapement? Need contingent on Fraser SX ER?	4	3	7	0	annual lower M/S creel; Chilko, Quesnel, Clearwater, N. Thompson - no creel Fo estimates of catch only	Taken in Area E GN targeting sockeye, with request for directed chinook fishery	reporting in association with FR SX fisheries.	14	3	Gof A, NC troll; entrance sockeye fisheries; LF rec; FN GN (~15K)	4	4	2	4	

AFSUp	PST stock group	CTC model stock group	Class of assessment program	Indicators		Escapement monitoring				Ocean fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	Importance to		
				Current /potential	comment on IND	none	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	comm/rec fisheries	FN
Fraser Summer Age 0.3			3	-Lower Shuswap (Shuswap)	Deliver very high precision MR. Works in direct coop with HEB, concurrent and cost effective Petersen tagging/brood stock capture (major savings to both programs): willing to investigate alternate recovery strategy (savings 10K), currently get 500 total CWT. Need to rationalize HEB tagging with our recovery? STA had to assist with brood capture due to link and short notice withdrawal. BH - Decide go or not. Suggest tagging dropped?? Move to whole system M/R based on test fishery and single upstream esc est. top priority?? Multiple timing components / hydrological regime variation make representative sampling next to impossible.	1	2	3	1	heavy rec fish pressure in L.Fraser sport sockeye floss. And on L. Thompson @ Spences NM; S. Thompson M; L. Shuswap; Mabel Lake M; Middle Shuswap NM	Area E sockeye incidental; Fraser Seines	increasing and experimental fisheries L. Shu GN - monitoring is low, catch is reported Bonaparte/Skeetch Spall harvest, KIB	8	3/4	Northern troll and rec.G. of Alaska, Entrance sport and net fisheries; in-river FN and sport fisheries	4	4	4	4	
Fraser Spring Age 1.2			2	-Nicola (Spius)	Low cost cooperative project with HEB, Nicola Tribal. Rec. Fish Sector and DFO all contributing to delivery. 50% funding through FN. Has longest time series. Primarily domestic issues.	2	1	5	1	in LF Creel; terminal creel at Nicola and at Bonaparte; Fraser Canyon Creek mouths	None	L Fraser FN GN (Cheam - Yale); Terminal Harvest @ Nicola, Bonaparte, Deadman, Louis: minor monitoring mostly catch reporting	9	3	JdeF (Minor), Lfraser FN, rec; Nicola, Bonaparte terminal sport	2-3	3/5	2	3	

Table 7. Summary of currently approved expenditures by chinook AFSU. The expenditures have been categorized into DFO O&M (A-BASE + PST) and other (external funding) with the The project types are “E: escapement”, “IND: survival/ER indicators, and “PST: regional technical support costs for the CTC.”.

2004/05 funding2 AFSU (see Table 1)	External funding					DFO-O&Mg					Total funding all sources	
	Project Type					Project type						
	Bio	E	Ind	Misc	Fish Mon	Total	Bio	E	Ind	PST	Total	
Fraser River multi-AFSU		0				0		171			171	171
Fraser fall age0.3			24			24		110	32		142	166
Fraser spring age1.2			31			31			40		40	71
Fraser spring age1.3	11	20	16			47		0	30		30	77
Fraser summer age 0.3			20	0		20			60		60	80
Fraser summer age 1.3								0			0	0
Lower Georgia Str. hatchery			41	9		50		18	90		108	158
Lower Georgia Str. wild			2	9		11		0			0	11
Nass			0			0		32			32	32
North Coast multi-AFSU	78	0		0		78						78
Rivers Inlet								35			35	35
Skeena	0		0	0		0		55	157		212	212
Trans-boundary		0	0			0		72	85		157	157
Upper Georgia Strait			16	40		56			52		52	108
WCVI hatchery	151		21	52		223	0		151		151	374
WCVI wild							0	72			72	72
Yukon								4			4	4
Regional assessment support										31	31	31
Southern mainland inlets		0				0					0	0
Northern mainland inlets									0		0	0
North Central Coast		0	12			12		16	0		16	28
Coastal Areas 3/6					10	10		12			12	22
Grand Total	240	20	183	109	10	562	0	598	697	31	1325	1888

Coho

The assessment plan for coho follows the “intensive/extensive” model. Unlike chinook assessment, which follows the same model, the survival and ER indicators were, prior to this year, mostly wild populations. Coho also differ from chinook in the size (abundance), distribution and relatedness of populations. Coho are typically found in small populations in nearly all accessible fresh waters and neighboring populations are generally closely related.

Essential components of Assessment Framework:

The information requirements for the assessment and management of coho salmon can by and large be generalized across the region. Although there are large areas where there are no PST obligations related to abundance-based management, an abundance-based approach is applied throughout the region.

The PST abundance-based management agreement for sBC coho dictates maximum ER’s for Fraser and Strait of Georgia coho units based on their abundance (status). The agreement also limits impacts of major troll and recreational fisheries around WCVI on US stocks, thereby effectively extending the management regime to all sBC coho units. Similar abundance-based regimes are being developed for CC, NC and the TB stock units.

The assessment program is focused on providing the information essential to the abundance-based management approach. Those information requirements are:

1. Total catch and catch resolved to AFSU or indicator for all fisheries and gear-type where appropriate. In most fisheries resolution by period is also required. The distribution and number of coded-wire tags (CWT) recovered by the Mark Recovery Program (MRP) is the current means of providing this information on a coast wide basis.
2. Indicator stock escapement. Escapement in indicator stocks by age plus associated CWT recoveries. These are generally level 4-5 assessments providing escapement estimates of high precision and known accuracy.
3. Biological information of the catch and principally fisheries-specific stock composition. This information can be captured for CWT’d fish only through the MRP and is required for cohort analysis and run-reconstruction and ultimately by the sBC and NC/CC models.
4. Forecasts of abundance by management or other specified unit, using spawner and recruit data, terminal return summaries, sibling relationships, Ricker parameters, smolt estimates coupled with survival information, and associated variables such as environmental scalars. These are the basis for determining annual abundance in the mixed stock ocean fishing areas.

The information required to develop the predictive models and to make the forecasts is similar to that gathered from the escapement surveys and indicator systems.

5. Extensive escapement: A set of low precision escapement estimates sufficient to detect pre-specified levels of trending should be conducted each year. The necessity of doing this increases with applied ER. The spatial resolution should also be increased with increasing ER.
6. Other information requirements are described in the chinook assessment framework

SACC noted that fisheries management was increasingly taking advantage of genetic techniques that allow the identification of stocks of concern in fisheries on fine temporal and spatial scales. Projects that further the development of these techniques should be given mid-level priority.

Wild indicators are preferable to hatchery indicators because they also allow the estimation of smolt numbers, which are useful in forecasts and in the estimation of habitat capacity and trends in productive capacity that may be due to climate change and human activity. However in a situation where three hatchery indicators are available, where exploitation rate is very low, where a change in status is likely to result only from a change to marine survival and where there are severe financial constraints, should DFO continue to run wild indicators at the expense of escapement surveys?

The initial decision to suspend the Georgia Strait wild indicators (Black Creek, Salmon River, Myrtle Creek and Heydon Creek) has been challenged by the three Areas affected. The discussions focused on the merits of maintaining long time series (Black and Salmon), on fully implementing survival rate indicators in areas where there are questions about the applicability of hatchery indicators (Heydon and Myrtle), and whether the coho escapement indices that would be curtailed by maintaining one or more indicator are adequate to track changes in marine survival.

SACC decided to allocate the current level of funding⁶ (\$131k) to the three Areas with the direction that they are to propose an agreed upon program for the Strait of Georgia comprised of some mix of indicators and escapement.

Vital statistics

Number of Assessment Framework Stock Units:	19
Approximate number of potential SARA units:	6
Minimum number of spawning populations:	> 2185

Summary statistics from current sockeye assessment project list

1. 97% of total coho assessment funding is allocated to indicator populations (49%) and escapement monitoring (48%). This represents a major shift in funding from indicators to a more qualitative, extensive approach. All AFSU’s that are subject to fisheries or that are

⁶ Excludes funds already expended and funds allocated for CoABM development.

status category 1 or 2 have a funded indicator under the proposal, although many of the indicators are hatchery populations. The distribution of funding to indicators and escapement programs is broadly reflective of the assessment framework.

2. 38% of the funding is allocated to NC coho, which is deemed appropriate because of the magnitude of the resource and the anticipated resumption of most historical fisheries. The allocation to the NC is distorted somewhat by funding an expensive indicator (Drake Inlet). This indicator was given high priority by Fisheries Management in the north because it is necessary to calibrate the fishery model under development there.
3. 19% of the coho funding is allocated to BCI, and will fund an adequate program for the two interior Fraser AFSU's.
4. 15.9% of coho funding is allocated to SC. This level of funding represents a significant reduction over recent levels and will mean the loss of two indicators, numerous smolt programs done in collaboration with community groups, and some escapement work. There are concerns over the greatly diminished effort in the StGe AFSU.
5. 16.5% of coho funding was allocated to Transboundary rivers. This represents a disproportionate allocation to these AFSU's, which are relatively small and currently provide few fishing benefits to Canadians due to stringent interim harvest sharing restrictions.
6. The remaining resources were allocated to CC (5.3%) and to the lower Fraser (3.2%). The assessment program in the CC is inadequate to support more than low level fisheries. Assessment information in the lower Fraser remains adequate because of the continuation of escapement surveys, the presence of one hatchery indicator, and the proximity to the StGw AFSU, which continues to be adequately funded.

Summary of SACC findings

- Most significant production issues are
 - Management of northern mixed-stock fisheries to moderate impacts on Area 5/6 and Skeena high-interior AFSU's.
 - Determining ER in southern BC fisheries.
- Most significant conservation issues are
 - Yukon River. This is a poorly known AFSU. The status of this AFSU cannot be determined but is likely poor based on the poor status of coho stocks around the Bering Sea.
 - The Skeena-high interior AFSU continues to recover from the 1997 recruitment failure but slowly.

- AFSU's of the Georgia Basin (Strait of Georgia, lower Fraser, interior Fraser) are not recovering strongly despite the maintenance of a low ER probably because of continuing poor marine survivals.

- Conservation issues appear to have resulted from varying or poor marine survival but excessive fisheries may have been a factor for Yukon River coho.
- Performance assessment of the current program indicates that for most AFSU's it remains adequate to support planned fisheries.
- AFSU's for which the planned program is marginal are those in the CC, where few projects remain and StGe, where there will be only a low level of escapement coverage. Concern is greatest for the StGe AFSU because of the poor status of coho in the Georgia Basin. Status of CC stocks is generally good to abundant.
- There are currently no projects planned for the three QCI AFSU's and for the Yukon River AFSU. SACC is particularly concerned about the Yukon River AFSU because very little is known about the coho of the upper Yukon and the as yet unsubstantiated concerns over the status of that unit. QCI coho are thought to be stable or increasing with no discernable threat.
- SACC is very concerned about the cancellation of both new and long-term indicator projects. Cancelled indicators include Lachmach (Area 3, old); Black Creek (StGw, adult component, old); Salmon River (LoFr, old), Myrtle (StGe, new), Martin River (Area 7/11, new), Heydon Creek (Area 12, new). The loss of these indicators, particularly the long-term indicators will severely compromise provision of advice if fisheries in southern BC intensify.
- Catch monitoring of ocean fisheries adequate for all major stocks and fisheries. However, the ability to provide advice on fishing mortality has been reduced and catch monitoring of small and moderate fisheries has completely ceased in many areas.
- Assessment efforts in the northern Trans-boundary rivers are relatively high compared to other Areas when adjusted for regional importance and status. However, SACC notes that the applicable PST annex requires this level of activity.

SACC advice and recommendations

1. SACC advises that the proposed assessment program is adequate to support planned fisheries.
2. SACC advises that the proposed assessment program may no longer be adequate to support levels of fishing in southern BC because of the closure of wild indicators and the reduction in escapement survey effort.
3. SACC advises that the assessment programs for some AFSU's may be inadequate to detect changes in status in a timely fashion. Of most concern are the CC (Areas 7-11), QCI, and the Yukon River. In particular, nearly all assessment activities for coho in the CC have been terminated.

4. SACC advises that the proposed assessment program is adequate to meet PST objectives in southern BC and implementation of the abundance-based management regime for southern Panel fisheries should not be affected at the current level of stock assessment activities. However, the current approach to the implementation of the southern coho agreement utilizes wild indicators to estimate fisheries- and stock⁷-specific exploitation rates. Wild indicators are also important in the determination of stock status and in forecasting ocean abundance. If exploitation of **wild** stocks increased beyond the current very low levels through the resumption of wild retention fisheries, particularly commercial fisheries, then a case could be mounted to restart the wild indicators. The primary rationale would be the need to extend indicator coverage to areas distant from hatchery indicators (e.g. StGe and the northern and southern mainland inlets, NWVI) and to monitor the productivity of freshwater habitat (i.e., to measure smolt production per spawner.)
5. SACC recommends that there be no internal reallocations within the coho envelope to provide those funds.

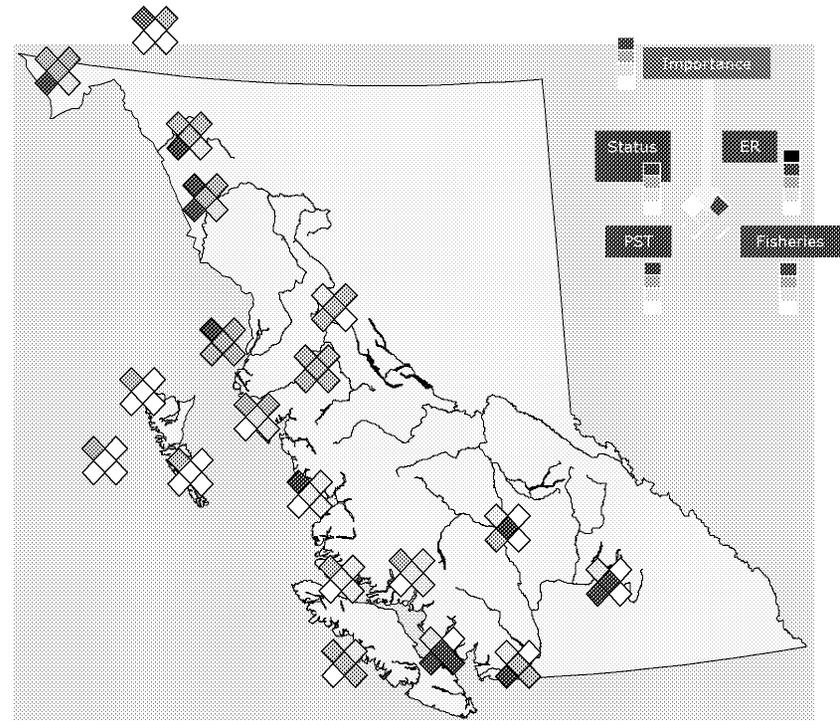


Figure 3. Visual summary of some characteristics of the coho AFSU's. Overall importance, significance to PST and significance to commercial & recreational fisheries are coded from not significant (white) to high significance (dark blue). Status is coded from poor (white) to abundant (dark blue). ER is coded from low (white) to excessive (black). Status cannot be determined for Yukon River coho, which is indicated by the red square.

⁷ Within the context of the southern coho agreement, stock refers to the large stock units identified in the agreement. Those units correspond approximately to the AFSU's.

Table 8. Summary of the performance assessment of the proposed program by AFSU for coho salmon.

Performance class of assessment program	AFSU
2	
	Alsek
	Area 5/6
	Georgia Str E&W
	Skeena – high interior
	Stikine
	Taku
	Thompson River
3	
	Area-12
	Area 13-N
	Area-3
	Lower Fraser
	mid/upper Fraser
	Skeena
	WCVI
4	
	Area-7/11
	QCI-E
	QCI-N
5	
	QCI-W
	Yukon River

Table 9. "Table 1" for coho Assessment Framework Stock Units. Explanations of the column headings are given in **Appendix 2.**

AFM stock group	PST model stock group	possible SARA stock groups	Performance class of assessment program	Indicators		Extensive escapement			terminal fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	importance to		
						class 1	class 2/3	class 4/5	rec	commercial	FN						PST	fisheries	FN
Mid/upper-Fraser	Interior Fraser	Interior Fraser	3	/McKinley	Life histories unknown. McKinley under development as escapement indicator. Juvenile recruitment work starting with SARA \$. Coop with CTC. Examining feasibility of CWT application.	7	6	1	n/a	n/a	n/a	50	2	sBC, US SMF, pink, sockeye	2	1	3	1	4
Thompson	Interior Fraser	Interior Fraser	2	DLL(h)/Eagle(w), Nicola (Coldwater@Spus)	Re FW production, Lemieux is good for North Thompson, Eagle for South and Coldwater for Lower. All are very different systems. Only exploit. Rate from Coldwater. Coldwater and Louis-Lemieux are coop HEB and FN with STAD. Eagle is STAD wild indicator. Juvenile tagging at Eagle	10	49	3	n/a	n/a	n/a	180	<3	sBC, US SMF, pink, sockeye	2	1	4	1	4
Lower Fraser	Lower Fraser	StG	3	Salmon(w),Chilliwack(h), Inch(h)/	Rank indicators to assess quality and scope of information. Salmon River indicator may not run in the fall of 2004.	FN survey 30+ streams to assess coho abundance (reliability of information is developing)		1 - Salmon River fence/M-R stem, only wild indicator in Lower Fraser - accurate smolt abundance and escapement information	Fraser main stem, Nicomen and Chilliwack creel provide important catch and CWT information			100	~50-100k	JS REC, Alaska Troll,	2	1	4	3	4

AFM stock group	PST model stock group	possible SARA stock groups	Performance class of assessment program	Indicators		Extensive escapement			terminal fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	importance to		
				Current/potential	comments	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	fisheries	FN
Area-12	JStr/MI	WCVI/sCC	3	Keogh/	Most consistently run program for both smolt production and adult escapement for JS in regards to coho. Newly installed crump weir providing improved abundance estimates. Joint program with the Province. Minimal Cost for the quality of the data. Working towards providing a better estimate of Marine survival through CWT application	Charter Patrol/FN enumeration on many systems, some contracts not extending into in-river coho migration	Approx 14 systems reliable AUC/peak counts	Keogh fence; Fence/Fish wheel on Klinaklini - only 4/5 if extend program to cover coho migration	Area 12/13 creel survey; SMF study in Area 12 gives good mark-rate information	REG	Reports sent to FM, Fairly good system/cooperation in place	100	30-50K	JS, GS REC, Alaska Troll,	3	2	1	2	4
Area-13 North	JStr/MI	WCVI/sCC	3	-Heydon	Under development as Mainland Indicator. Capacity development with the Campbell River Indian Band. Accurate escapement estimates for coho, sockeye, chum and pink (multi-species system)	Charter Patrol/FN enumeration on many systems, some contracts not extending into in-river coho migration	Approx 17 systems with reliable AUC/peak counts (index)	Heydon, some years 12/13 Village Bay creel survey but not in 2003 (fence not in for most of migration)	Area 12/13 creel survey	REG	Reports sent to FM, Fairly good system/cooperation in place	100	10-20K	JS, GS REC, Alaska Troll,	3	2	1	2	4
Georgia Strait	SIG-west & east	StG-SIG	2	Black(w), Quinsam(h), BQ(h), Myrtle(w)/Goldstream(h)		15	51	4	Georgia Strait creel survey (area 13-19, 28, 29). Terminal SMF creel survey coverage	Potential for commercial hatchery retention of marked, to be monitored by observers and logbooks	FN Big Qualicum terminal coho fishery monitored by the hatchery	225	150-200K	sBC, US SMF, pink, sockeye	2	1	4	4	4

AFM stock group	PST model stock group	possible SARA stock groups	Performance class of assessment program	Indicators		Extensive escapement			terminal fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	importance to		
				Current/potential	comments	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	fisheries	FN
									e (Big Qualicum, Porpoise Bay, Davis Bay).										
WCVI	WCVI	WCVI/sCC	3	RC(h), Carnation(w)		17	53	5	WCVI creel survey (area 20-27), Barkley Sd. Creel survey	Nootka and Barkley Sd. Monitored by observers and logbooks	FN Roberts on Creek terminal coho fishery monitored by the hatchery	550	300-400K	SBC, SMF	3	2	1	3	4
Area-7-11	CC	WCVI/sCC	4	Martin/	Without fence in place in Martin it is a poor survival/exploit indicator - very low accuracy. After 2003, only stocks tagged will be McLoughlin coho (enhanced).	Charter Patrol/FN AFS enumeration on Approx 50 systems in 7-10. Most programs end before coho at peak therefore even index	2003- mixture of AUC/Index/Peak: Area 7 = 7; Area 8 = 7; Area 9 = 0; Area 10 = 1 (Nekite); Area 11 = 10	2003 - Area 7 = 0 (Tankeah Fence from 7-2004 but not full estimate for 2003; Hatchery - McLoughlin /Kitsao fence estimates not complete); Area 8 = 1	Lodge Logbook Data from 7-2004 limited info on coho from rotational hatchery - rivers creel; guardian info from Bella Coola in-river	Reg - commercial retention only in part of Area 7 for coho (troll fishery/terminal hatchery stocks - Mcloughlin); no commercial harvest in 9/10 of any species	Bella Coola (A8) is good; A7 is good; A9/10 limited fishery.. All reports sent to FM; fairly good cooperat ion/syst	500		NC troll	4	2	1	2	4

AFM stock group	PST model stock group	possible SARA stock groups	Performance class of assessment program	Indicators		Extensive escapement			terminal fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	importance to			
				Current/potential	comments	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	fisheries	FN	
						difficult to determine			(Marlin River); Area 9 = 0, Area 10 = 1 (Long Lake/Doce)	fishery										
Area 5/6	NC	NC/QCI	2	-/Drake Inlet	Indicator is high priority for FM and development of north coast model							120	200K	NC, AK troll, Skeena/Nass sockeye	3	3	1	2	4	
Area-3	NC	Skeena/TB	3	Lachmach(w),Zolzap(w)/	Lachmach terminated. Visual counts are difficult to obtain and survival patterns at Zolzap are dissimilar from Lachmach.							50	250K	NC, AK troll, Skeena/Nass sockeye	4	3	3	3	4	
QCI-E	QCI	NC/QCI?	4	-/Deena								95	100K	none	3	1	1	1	4	
QCI-N	QCI	NC/QCI	4	-/Chown	Some possibilities have been investigated							20	50K	none	3	1	1	1	4	
QCI-W	QCI	NC/QCI	5	-/	This Area is unlike the other AFSU's on the QCI so without information status cannot be inferred.							30	20K	none	3	1	1	1	4	
Skeena	NC	Skeena/TB	2	Toboggan/				Kitwanga					150K	NC troll, Skeena sockeye	3	3	3	3	4	
Skeena - high Interior	NC	Skeena/TB	2	Slamgeesh(w), Babine(h)/	Slamgeesh has been terminated. Questions about representative Babine (large lake) is of river and small lake production. Slamgeesh should be a high priority to maintain.								15K	NC troll, Skeena sockeye	2	3	3	1	4	

AFM stock group	PST model stock group	possible SARA stock groups	Performance class of assessment program	Indicators		Extensive escapement			terminal fisheries monitoring			Number of spawning populations	Aggregate size	Principal impacting fisheries	Categorical status	Categorical ER	importance to		
				Current/potential	comments	class 1	class 2/3	class 4/5	rec	commercial	FN						PST	fisheries	FN
Aisek	TB	Skeena/TB	2	-/-			1	1	0	1		15	~50k	AK	4	3	4	2	4
Stikine	TB	Skeena/TB	2	-/-			6	1	0	1		20	~100k	AK	3	3	4	2	4
Taku	TB	Skeena/TB	2	-/-				1	0	1	1	25	~250k	AK	3	3	4	2	4
Yukon	n/a	Yukon	5	-/-	Performance class downgraded. Although there is info from US the Can. Populations would be considered headwater and inferences about status could be unreliable.						1	5	~5k	AK	ND	3	1	1	4

Table 10. Summary of currently approved expenditures by coho AFSU. The expenditures have been categorized into DFO O&M (A-BASE + PST) and other (external funding). The project types are "E: escapement", "IND: survival/ER indicators, and "PST: regional technical support costs for the CoTC."

2004/05 funding2 AFM stock group (see Table 1)	External funding				DFO O&M					Grand Total
	Project type E	Ind	Misc	Bio	Total	Project type E	Ind	J	PST	
Area 13 North		6.4			6.4					6.4
Area 3	15.0	80.0			95.0	23.0				23.0
Area 5/6						52.3	185.0			237.3
Area 7-11										0.0
CC						25.0				25.0
Interior Fraser	16.0	45.0	4.4		65.4	108.6	105.0	5.0		218.6
Johnstone Str/northern mainland inlets						10.0	25.0		0.0	35.0
Lower Fraser / Strait of Georgia E	95.0	12.8			107.8	51.0	0.0			51.0
NC – multi AFSU			60.0		60.0		30.0			30.0
QCI										
QCI-E										
QCI-N						9.0				9.0
QCI-W										
Regional assessment support									21.8	21.8
Skeena						0.0	30.0			30.0
Skeena-high interior		79.0			79.0	22.6	146.3	10.0		178.9
StG					0.0	80.0				80.0
StGe										
StGw		6.4	38.7		45.1		25.0			25.0
TB	0.0				0.0	142.0	44.0			186.0
WCVI		7.0		23.5	30.5	35.0	40.0			75.0
sBC			75.0		75.0					75.0
Grand Total	126.0	236.6	178.1	23.5	564.1	558.5	630.3	15.0	21.8	1225.6

Chum

Chum salmon are typically found in the same coastal systems as coho although in numbers that are generally an order of magnitude (10-20×) larger. Neighboring populations are generally closely related. Most of the populations are coastal and have a fall run-timing. Long migrations upstream are unusual but are certainly known (e.g. Yukon River chum) as are early-migrating or “summer-run” chum (e.g. southern mainland inlets). Sustainable exploitation rates are estimated to be between 25% and 40% compared to 50% to 65% for coho for example. Chum is a mainstay of FN FSC fisheries along the coast and in the Yukon, and is very significant to commercial fisheries. There is a growing interest in the species by recreational anglers.

The management plan for chum salmon follows two basic designs. For the Strait of Georgia and Fraser AFSU's non-terminal fisheries in Johnstone Strait and the Strait of Georgia are managed through effort controls to achieve capped exploitation rates. Terminal fisheries are subsequently managed to achieve target escapements. For all other AFSU's terminal fisheries are managed to achieve target escapements.

In southern British Columbia, the PST management regime identifies 4 major chum stock groups, which are the Fraser, Nitinat, non-Fraser inside stocks and US stocks. Fraser, non Fraser and US stocks have been delineated based on allozyme information (Genetic Stock Identification program). Oceans fisheries for southern BC chum are generally managed under a Canadian domestic regime with overall management of US fisheries by the PST treaty arrangements. Canadian fisheries are often managed with a low overall harvest rate in mixed stock fisheries, in conjunction with escapement base terminal strategy management. The US fisheries harvesting Canadian stocks are managed on a ceiling based approach. The ceiling based approach has been modified in 2004 to include an abundance based strategy. Canadian First Nation fisheries for Food Social and Ceremonial purposes are managed in most First Nation adjacent areas, with a priority after conservation.

Essential components of Assessment Framework:

Since the management of non-terminal fisheries is based on catch ceilings or effort controls that both respond to in-season estimates of run size, in-season estimates of run size are important. Terminal fisheries are generally managed to escapement targets so in-season estimates of terminal abundance and escapement are also important. For some AFSU's in southern BC, notably the Fraser River and Strait of Georgia units there have been efforts to develop classical assessment models, which estimate sustainable exploitation rates and target escapements. For the most part however management and assessment of chum remains largely empirical. Provided that exploitation rates

remain low, which seems to be generally interpreted as less than 30%, and that there are appropriate management responses to in-season estimates of run size, then an empirical approach is entirely appropriate. With such an approach the information requirements for assessment are modest. Those information requirements are:

1. Catch by fishery and gear-type as required to manage the run-size and ceiling fisheries.
2. Catch by stock is required for major mixed-stock fisheries (principally in the sBC PST fisheries).
3. Escapement estimation in all AFSU's is required with sufficient precision to reliably detect trends that may require management adjustment. Quantitative escapement estimates may be more important in AFSU's where there are developed management regimes (e.g. that specify catch ceilings or where there is abundance-based management) than elsewhere but there should be a set of consistently surveyed streams in all AFSU's.
4. For those components of AFSU's where stock modeling is required, then collection of stock-specific catches and biological measures (age is the most important) of the catch and escapement are required.
5. For the development of fisheries models fisheries- and stock-specific catches are required. Fisheries modeling may be a cost-effective response to reduced capacity to directly monitor fisheries.
6. The development of biologically based escapement targets may be important for AFSU's where the empirical approach is failing or where there are pressures to exploit at rates closer to theoretically sustainable limits. The requirements for such models are similar to those for other species but there is currently no development activity.
7. Forecasts of abundance by management or other specified unit are based on escapement or stock-size time series, information that is routinely collected.

SACC notes that the assessment of chum salmon poses a distinct challenge for DFO. From a commercial fisheries perspective chum are generally seen as a low value species. Many FN's view chum very differently, especially in southern BC, as chum is the most abundant species in many small coastal systems. Except for the Yukon, chum salmon generally use the lower reaches of coastal streams and it is those areas that have experienced the greatest impacts from human settlement both directly and through the cumulative effects of up-river habitat disruptions. Finally, chum salmon are known to be both morphologically and behaviorally diverse, at least as diverse if not more so than coho salmon. However, because chum salmon are regarded as a low-value species their assessment invariably bears the brunt of budget reductions to assessment.

Vital statistics

Number of Assessment Framework Stock Units:	11
Approximate number of potential SARA units:	6
Minimum number of spawning populations:	> 1161

Note that the minimum number of spawning populations is likely a significant underestimate.

Summary statistics from current sockeye assessment project list

1. All but ~\$397k of the \$440k proposed expenditures are dedicated to escapement programs. This expenditure is consistent with the assessment framework and information requirements.
6. 57% of the proposed expenditures are within the AFS envelope within the lower Fraser. DFO O&M expenditures total only \$142k.
7. The apparent lack of expenditures in some AFSU's (Taku, Coastal 3-6, QCI, Area 7-10) can be attributed to the lack of full accounting for charter patrol escapement coverage.
8. O&M and other resources are not allocated to the Areas proportionally to the number of spawning populations and are likely not allocated proportionally to resource values (Table 13). For example, no funding has been directly allocated by NC-Area to chum assessment but 29% of the spawning populations are located there and there are both conservation concerns and high exploitation. YTB has 1% of the spawning populations but 57% of the DFO O&M funding. This reflects the inadequacy of assessment effort in the remainder of the region, not an undue emphasis in YTB!

Summary of SACC findings

- Most significant production issues are
 - Management of northern mixed-stock fisheries to moderate impacts on coastal 3/6 and Skeena-Nass AFSU's. (SACC notes that there is a similar coho production issue.)
 - Significant exploitation of several AFSU's without adequate assessment programs (Skeena-Nass, Area 7-10, Fraser).
- Most significant conservation issues are
 - Yukon River and Porcupine River component. Poor status has resulted from poor ocean survivals (all Bering Sea salmon are affected) and over-exploitation.
 - The Taku, Skeena-Nass and coastal 3-6 AFSU's. The reasons are unknown but are probably due to over-exploitation in Area 3-4 fisheries and poor ocean survivals. Pink abundance has been very high in the same areas.

- The assessment program is inadequate to evaluate the impact of planned fisheries in three AFSU's (Skeena-Nass, Area 7-10 and the Fraser River).
- The inadequacies in those three areas are most acute in the Skeena-Nass AFSU where there are conservation issues and anticipated high exploitation rates. High exploitation rates are also expected in Area 7-10 but there status is good (Table 12).
- The situation in the Coastal 3-6 AFSU is in many ways similar to the Skeena-Nass in that there are conservation issues and exploitation rate is anticipated to be high. In this instance however, one of the few remaining coho indicators also serves as a chum indicator and nearly the Charter Patrol enumerates 30% of the coastal 3-6 populations.
- Catch monitoring of ocean fisheries appears to be adequate for all major stocks and fisheries.

SACC advice and recommendations

1. SACC advises that the proposed assessment program is inadequate to evaluate the impacts of planned fisheries on Fraser River, Area 7-10 and the Skeena-Nass AFSU's.
9. SACC advises that low levels of assessment are not compatible with fisheries that exploit near the probable biological limits of the stocks, as they do in these areas.
10. SACC advises that the lack of assessment funding directed at chum is putting at some level of risk diversity values in this under-studied species. While not posing a direct or major threat to commercial fisheries the lack of attention to chum salmon may have implications to FN fisheries.
11. SACC advises that the assessment programs for some AFSU's (Skeena-Nass, Area 7-10, Fraser River and possibly QCI, Area 11-13/Mainland Inlets) may be inadequate to detect changes in status in a timely fashion. This is of most concern in the Skeena-Nass where there are already known conservation concerns.
12. SACC advises that development of an adequate assessment program would require a long-term commitment and might be best accomplished through cooperative agreements with coastal FN's.

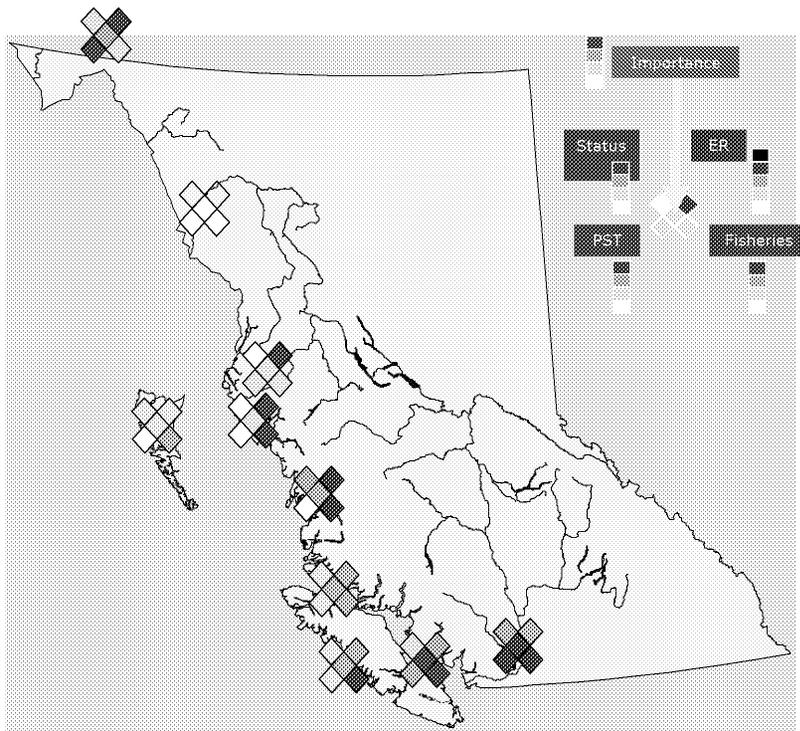


Figure 4. Visual summary of some characteristics of the chum AFSU's. Overall importance, significance to PST and significance to commercial & recreational fisheries are coded from not significant (white) to high significance (dark blue). Status is coded from poor (white) to abundant (dark blue). ER is coded from low (white) to excessive (black). Status cannot be determined for Yukon River coho, which is indicated by the red square.

Table 11. Summary of the performance assessment of the proposed program by AFSU for chum salmon.

Assessment Performance Level	AFSU
2	Coastal Areas 3/6 Georgia Strait Porcupine (Yukon) WCVI - Areas 20-27 Yukon
3	Johnstone Strait & mainland inlets (Area-11-13) QCI Taku
4	Area-7-10 Fraser River Skeena-Nass

Table 12. "Table 1" for chum Assessment Framework Stock Units. Explanations of the column headings are given in **Appendix 2.**

					Extensive escapement			comments	Fisheries monitoring						Significance to				
AFSU	SARA Unit	Assessment Performance Level	Approximate number of spawning populations	Indicator stock	none	1	2/3	4/5	comments	rec	comm	FN	Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	sig:PST	sig:fisheries	sig:FN
Fraser River	Fraser	4	100		78	20	1	1	All wild Chum assessment in the lower Fraser is conducted by FN. Albion Test Fishery			Assessed by lower Fraser Fisheries monitoring program	JS Area 12 and 13 and Fraser River Area 29	>1.0 mil.	2 to 3?	3?	4	4	4
Georgia Strait	SC	2	160	BQR	107	7	44	2	Most surveys are directed at smaller coho streams and include chum in the enumeration	Georgia Strait creel survey (area 13-19, 28, 29)	Logbook and charter patrol and observers	BQR chum monitored by hatchery staff, other FSC by Charter patrol, some FSC reporting	Johnstone Strait, Qualicum, Nanaimo, Cowichan, Goldstream, Jervis commercial fisheries and terminal FSC fisheries.	700k	2 to 3	3	2	4	4

					Extensive escapement			comments	Fisheries monitoring							Significance to			
AFSU	SARA Unit	Assessment Performance Level	Approximate number of spawning populations	Indicator stock	none	1	2/3	4/5	comments	rec	comm	FN	Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	sig:PST	sig:fisheries	sig:FN
Johnstone Strait & mainland inlets (Area-11-13)	WCVI-CC	3	100		40-50	40-50	2	Heydon Creek Fence, Klinaklini FishWheel (Funding through Chinook and Coho)		Logbook and charter patrol and observers	FSC reporting	JS Area 12 and 13 Commercial and Sport	150-250K	2 to 3	3	2	3	4	
WCVI - Areas 20-27	WCVI-CC	2	250		180	20	48	2	The majority of streams were not surveyed. Only where chinook and coho escapements estimated.		Logbook and charter patrol and observers	Nitinat chum monitored by hatchery staff, other FSC by Charter patrol, some FSC reporting	Nootka, Nitinat, commercial fisheries	600k	2 to 3	3	2	4	4
Area-7-10	WCVI-CC	4	200				?		Charter patrol coverage only				CC nets	400-500 K	3	4	1	4	4
Coastal Areas 3/6	NCTB	2	135			25	30	Drake	Kitimat is enhanced.	None	reg	poor	AK, nnets	400 K	1 to 4	4	1	4	4
QCI	QCI	3	145			70	40			Haida creel	reg	poor	nnets	300 K	2 to 4	2	1	3	4

					Extensive escapement			comments	Fisheries monitoring							Significance to					
AFSU	SARA Unit	Assessment Performance Level	Approximate number of spawning populations	Indicator stock	none	1	2/3	4/5	comments	rec	comm	FN	Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	sig:PST	sig:fisheries	sig:FN		
Skeena-Nass	NCTB	4	60			4	6	1	Skeena Test Fishery / Kitwanga Weir	Rotating	reg		Nisga'a, some components of Skeena good	AK, nnets	75 K	1 to 2	4	2	2	4	
Taku	NCTB	3	1					1						low	?1	?	1	1	4		
Yukon	Yukon	2	8					3	1			1	1	9	AK - Yukon R.	200k	2	3 to 4	4	2	4
Porcupine (Yukon)	Yukon	2	2					1				1	1	1	AK - Yukon R.	50k	1 to 2	3 to 4	4	2	4

Table 13. Proportional distribution of chum populations and proposed project funding by Area. The funding does not include charter patrol.

Area	Approximate number of spawning populations	%populations	O&M project funding (\$k)	%O&M	total proposed funds (\$k)	%total
FR	100	9%	0	0%	225	51%
SC	410	35%	41.1	40%	72.1	16%
CC	300	26%	20	20%	20	5%
NC	340	29%	0	0%	0	0%
YTB	10	1%	40.5	40%	122.8	28%
totals	1160		101.6		439.9	

Table 14. Summary of currently approved expenditures by chum AFSU. The expenditures have been categorized into DFO O&M (A-BASE + PST) and other (external funding) with the "Is it O&M?" variable, which is either FALSE or TRUE. The project types are "E: escapement", "BIO: biological (e.g. age)", "MISC: miscellaneous", and "StockID: assembly of nuclear genetic baseline".

2004/05 funding	External funding			Total	DFO-O&M			Total	Grand Total
	Project type				Project type				
AFM stock group (see Table 1)	Bio	E	StockID		E	Misc	StockID		
FR	0.0	225.0		225.0	0.0			0.0	225.0
GStr			9.0	9.0	29.1			29.1	38.1
JStr/MI					20.0		0.0	20.0	20.0
JStr/MI, GStr, FR	22.0			22.0					22.0
NC			0.0	0.0			0.0	0.0	0.0
Taku					0.0			0.0	0.0
WCVI						12.0		12.0	12.0
Yuk		164.5		164.5	81.0			81.0	245.5
Grand Total	22.0	389.5	9.0	420.5	130.1	12.0	0.0	142.1	562.6

Pink

With the exception of fisheries for Fraser River pink salmon, the assessment plan for pink salmon follows the “terminal-empirical” management model. Significant fisheries are terminal and their management focuses on the attainment of qualitative or categorical escapement targets. Management of the Fraser River pink fisheries is based on effort control of fisheries and projections of catch, in-season estimates of run-size and escapement targets. In general, estimates of pink catch are not stock-specific and need not be under the current management approach.

Pink salmon have a fixed two-year life cycle and the odd-year and even-year brood years are reproductively isolated. The even-year brood line is very rare and possibly absent in the Fraser River and Strait of Georgia but is present elsewhere and from the CC northward the two brood-lines are equally abundant. The SARA units of pink are thought to be very large (SACC speculates that there are four × two brood-lines) and there are only nine AFSU’s (Table 16).

Pink salmon spawn in the lower reaches of most coastal systems although they also migrate far upstream in large river systems. With the reduction in overall exploitation in Fraser River fisheries over the last two cycles pink salmon appear to be re-colonizing the upper Fraser. Of the five Pacific salmon species pink salmon is the least dependent on fresh water as newly emerged fry move quickly down-river and spend little time in estuaries. Pink salmon do spend several months in the near-shore migrating slowly northward along the coast until they move into the open ocean in late-summer.

Pink salmon are the most abundant of the five species and the populations of many of the ASFU’s number in the millions. The odd-year Fraser River ASFU now numbers in excess of 20M. The abundance of pink salmon has also been characterized as highly variable. Because of their abundance pink salmon are very important to net fisheries coast-wide. Pink salmon can also be caught selectively with hook and line gear and there is growing interest in recreational and commercial troll fisheries.

Enhancement is limited to some spawning channels most of which are in the CC AFSU’s.

Essential components of Assessment Framework:

The Assessment Framework for pink salmon has not been completed at the time of this report.

The general model for pink assessment supports the “terminal-empirical” management model. In this model in-season estimates of escapement and/or run-strength are judged on the ordinal scale of

“abundant”, “adequate” and “inadequate” and fisheries are adjusted accordingly. This method is empirical because it relies exclusively on managers to determine escapement or probable escapement relative to their experience of what escapement range has proven adequate to sustain production. Escapement goals are qualitative and experiential rather than quantitative and analytical. In situations where exploitation rates are low or moderate, where fisheries are highly terminal, where in-season information is collected rapidly and on scales appropriate to the fisheries and where fisheries managers have local experience, this approach has proven to be highly successful in producing sustainable fisheries. The approach is also one that can be handled exclusively by local fisheries managers. In general the involvement of stock assessment staff is confined to the production of forecasts but these were dropped for the current assessment year because of lack of interest by fisheries management.

The approach to Fraser River pink is different and is more similar to a quantitative-analytical approach. There are several reasons for this. First, catch sharing is subject to provisions in the PST. Second, fisheries for Fraser pink salmon are not terminal as they are for other AFSU’s but take place in Johnstone, Juan de Fuca and Georgia Straits, terminally and in the Fraser River. Unlike other pink fisheries those for Fraser River pink have considerable impacts on other AFSU’s. Fraser River pink are exclusively odd-year, although even-year populations might persist, and the Fraser River AFSU is by far the largest with the current size estimated at more than 20M. The catch-sharing arrangements of the PST have led to a requirement for a high precision M/R estimation program in the Fraser River. The resource requirements for this enumeration (nearly \$400k) make it the second largest single project in salmon stock assessment (after the Mark-recovery Program). The requirement for the project only in odd-years has been a continual stress on stock assessment project planning because the funding must be matched by projects totaling approximately 7% of the total budget that either operate in only even-years or that are of short duration. The cessation of fisheries on Fraser pink salmon because of conservation concerns in other species, primarily late-run Fraser sockeye and interior Fraser coho has led to the abandonment of the Fraser pink enumeration. Although not a concern in 2004, there is currently no prospect of finding sufficient resources to resume counts in the future, in which case the management of Fraser pink would likely change to the terminal-empirical approach. Enumeration of migrant fry can serve as an index of escapement. This approach was used this year leading to the funding of the “Mission downstream” project.

The assessment program is focused on providing the information essential to the terminal-empirical approach. This information is restricted to in-season escapement estimates at a scale commensurate with the fisheries.

1. Catch by fishery and gear-type is required in all fisheries at the spatial scale of management (i.e., the same scale over which escapement is measured). Catch should be accurately measured but precision need not be high because in no case is escapement precisely

determined. No stock information ID work is conducted so stock partitioning of the catch is based on the time and location and assumptions about migration timing and pathways.

2. Categorical escapement at a spatial scale commensurate with fisheries management. Three levels of escapement are typically measured: low-fisheries stopped; adequate-normal fisheries; and abundant-fisheries may be extended or expanded.
3. Escapement indicator stock escapement. These are generally level 3 assessments but can be M/R or weir counts. These measures provide estimates of known accuracy and enable escapement trends to be tracked for the purpose of evaluating the performance of fisheries management. There are escapement indicator streams in most of the AFSU's.
4. Forecasts of abundance by AFSU have been made in the past using either stock-recruitment or naïve time-series models but these have generally been abandoned. Outside of the Fraser River ASFU there are significant questions about the accuracy and precision of escapement estimates and in some locations little defensible ability to do catch partitioning.

Vital statistics

Number of Assessment Framework Stock Units (even-year only):	9
Approximate number of potential SARA units (even-year only):	4
Minimum number of spawning populations:	> 1000

Summary statistics from current sockeye assessment project list

1. There are only two recommended projects, the Mission D/S fry enumeration in the Fraser AFSU and the Atnarko tower count, the main escapement indicator in the Area 7/10 AFSU. There may be regional funding to continue at some scale the work of the past year in the Area 11/13 AFSU (Broughton Archipelago) studying the impacts of net-pen aquaculture. Some funding might be available for pre-aquaculture baseline studies and escapement calibration work in the NC/TB AFSU.
2. Note that for the most part pink assessment work done through charter patrol or AFS has not been captured in the project sheets although it is captured in "Table 1". In the CC, NC and QCI AFSU's charter patrol enumeration is a significant part of fisheries management.

Summary of SACC findings

- Most significant production issues are
 - There is uncertainty over the impacts of net-pen aquaculture on the ocean-ward migration routes of CC pink populations of the Area 11/13 AFSU.
- Most significant conservation issues are
 - The undetermined status of sBC inside and Fraser River **even-year** AFSU's.

- Pink salmon assessment typifies very well the end point of assessment planning that is driven largely by the requirements of fisheries management – even-year stocks at the southern end of pink salmon's geographical range, which are small and of no fisheries significance, are not assessed.
- With this exception the assessment approach for pink salmon is well matched to the terminal-empirical management framework.
- Assessment information throughout the region is highly dependent on charter patrol estimates of escapement. This is of concern only because of the continuing lack of coordination between fisheries management and stock assessment. One consequence of the lack of planning coordination is that SACC cannot determine what the total assessment expenditures are for pink salmon (and sockeye and chum) where most of the escapement estimates come from charter patrol. It is probable that the actual assessment budget for pink salmon is an order of magnitude larger than the expenditures SACC has captured.

SACC advice and recommendations

1. SACC advises that the proposed assessment program is probably adequate to support planned fisheries assuming that the level of effort in charter patrol is as described by fisheries management.
13. SACC advises that the assessment program for some AFSU's is inadequate to determine status or to detect changes in status in a timely fashion. This is of most concern for the two Strait of Georgia AFSU's and for the WCVI AFSU because populations in these areas are small, are at the southern limit of the species range in Canada, are in areas of potentially high human impact and are suspected of being impacted by fisheries on other species or on the very abundant Fraser River ASFU when it is fished.
14. SACC advises that the proposed assessment program is inadequate to monitor the impacts of net-pen aquaculture in all localities.
15. SACC advises that full integration of fisheries management and stock assessment programs for pink salmon, specifically the charter patrol, would benefit the assessment program.
16. SACC advises that investigations into alternative assessment programs for Fraser River pink should be undertaken in anticipation of increasing fiscal constraints.

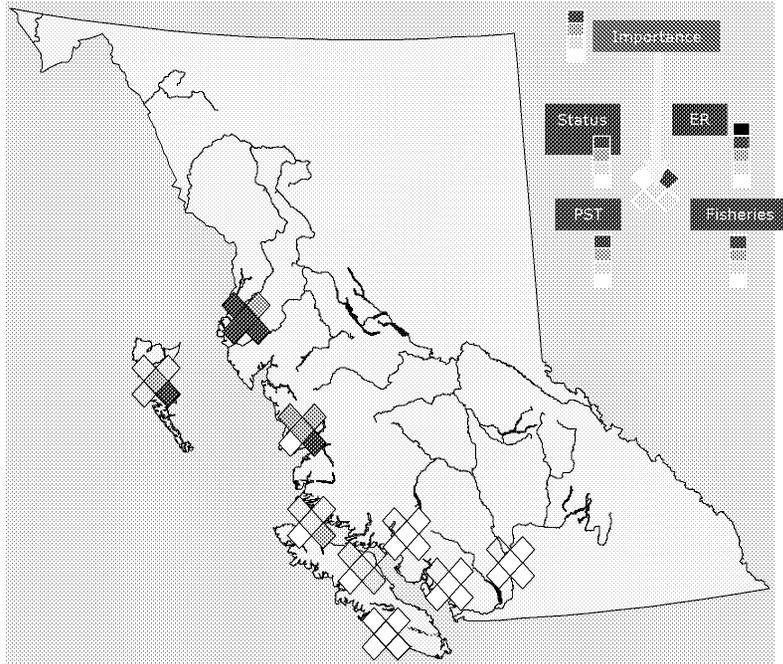


Figure 5. Visual summary of some characteristics of the pink (even-year) AFSU's. Overall importance, significance to PST and significance to commercial & recreational fisheries are coded from not significant (white) to high significance (dark blue). Status is coded from poor (white) to abundant (dark blue). ER is coded from low (white) to excessive (black). A clear cell indicates that the value of the attribute is unknown.

Table 15. Summary of the performance assessment of the proposed program by AFSU for pink salmon.

Assessment performance class	AFSU
2	Area-7/10-even North Coast - Areas-3/6-even QCI-even
3	Area-11/13-even
4	Georgia Strait - west WCVI-even
5	Fraser-even Georgia Strait - east Squamish

Table 16. "Table 1" for pink Assessment Framework Stock Units. Explanations of the column headings are given in **Appendix 2**.

AFM stock group	SARA Unit	Assessment performance class	Approximate number of spawning populations	Extensive escapement				comments	Fisheries monitoring			Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	Significance to	
				none	1	2/3	4/5		rec	comm	FN					PST	Commercial rec fisheries
Fraser-even	sBC-even	5	?					populations are speculated to exist but there are no surveys				Fraser sockeye net&troll, sBC Rec Fisheries	?	ND	1	1	1
Squamish	sBC-even	5	?									Fraser sockeye fisheries, sBC Rec fisheries	?	ND	1	1	1
Georgia Strait - east	sBC-even	5	6	5		1		AFS funded first nation visual assessment of adult spawners on the Indian River.				Fraser sockeye fisheries, sBC Rec Fisheries	?	ND	1	1	1
Georgia Strait - west	sBC-even	4	?									Fraser sockeye fisheries, JS Rec fisheries	?	2 to 3	1	1	2
WCVI-even	WCVI-CC-even	4	50		40			Opportunistic records of unknown completeness associated with chinook enumerations in many streams				WCVI nets, troll, Rec fisheries	<10k	1	1	1	1
Area-11/13-even	WCVI-CC-even	3	55			15	4	Extensive coverage, especially in inlets that may have been affected by lice associated with aquaculture operations.		Reg	FSC monitoring	Fraser Sockeye/Pink Fisheries, JS Rec Fisheries	~1M +	1 to 3	2	1	3

AFM stock group	SARA Unit	Assessment performance class	Approximate number of spawning populations	Extensive escapement				comments	Fisheries monitoring			Principal impacting fisheries	Aggregate size	Categorical status	Categorical ER	Significance to	
				none	1	2/3	4/5		rec	comm	FN					PST	Commercial rec fisheries
Area-7/10-even	WCVI-CC-even	2	150			100	5	Atnarko tower counts are expanded for total run size and related to coho run strength	Guardian Creel Survey	C&P/Charter Patrol	Guardian patrol	CC nets	~2M+	3	3	1	4
North Coast - Areas-3/6-even	NC-even	2	240	108	80	50	2	Charter patrol?	partial rotating	reg	N/A	AK net, nnet	3M	4	3	4	4
QCI-even	QCI-even	2	120	50	40	30		Charter patrol?	Haida creel	reg	N/A	Terminal net	1.5M	2 to 4	2	2	3

Fisheries Monitoring

Catch estimates of known accuracy and precision figure prominently in the information requirements detailed in the assessment frameworks of all species. DFO has routinely collected catch information for all commercial troll and net fisheries through mandatory landing records (i.e., "sales-slips"). A small number of recent audits have indicated that the landing records significantly under-estimate catch in fisheries where fish are used or sold through channels other than fish-plant sales. Furthermore there may be extensive lack of compliance in all fisheries. To manage many net fisheries management canvases fishermen about their catches on the fisheries grounds (i.e., hails). Hails are an alternative method of estimating catch. The deficiencies of landing records have led to the introduction of mandatory log books and phone-in reports of catch. FOS, the Fisheries Operation System has been developed by SC and PBS in part to allow the capture and resolution of alternative estimates of catch. Although there is general acceptance of the necessity of FOS there continue to be technical and other issues hindering regional adoption of common procedures and minimal standards for catch estimation and reporting. The result is that final catch reporting for salmon is not timely and accuracy is compromised.

Catches in recreational salmon fisheries surpass commercial catches for chinook and coho in most areas. Catch estimation in recreational fisheries invariably involves "creel" surveys: the catch per unit effort is estimated by interviewing anglers and total effort is estimated through some form of observation, commonly over-flights of the fishing areas. Running a creel survey for a year-round fishery in the vast geography of even southern inside waters is an expensive undertaking. The monitoring of recreational fisheries is made further complex by their mobility and the large impacts they can have in localized areas. With increasing fiscal pressures creel surveys are either being curtailed, rotated, or cancelled.

Estimating catch in aboriginal FSC fisheries is highly problematic for a variety of technical, historical and cultural reasons that are well outside the purview of SACC to comment upon. SACC did note that the lack of resources to adequately fund technical support and audit projects will further limit the already slow progress toward obtaining credible catch estimates from FN fisheries.

In the Yukon/Transboundary Area, fishery monitoring in the Transboundary commercial fisheries is done in conjunction with stock assessment projects (e.g. Taku mark-recapture, Stikine test fishery and sampling). Harvest data for the Yukon commercial fishery are collected by phone and/or drop boxes, however there is little verification of the data, or who actually fishes. FN harvest monitoring in the Transboundary rivers (Stikine, Taku and Alsek) is done by individual FN's mostly through AFS programs. On the Yukon, until 2003, the *Yukon River Drainage Basin Salmon Harvest Study*, implemented under the Umbrella Final Agreement of the Yukon Land Claims agreement, was in place

to collect harvest estimates and report on them annually. Most FN's continued to provide estimates in 2003, however, funding issues for 2004 and future years remain a topic of controversy and discussion. For the Yukon recreational salmon fishery, the returns from the Yukon Conservation Catch Card (mandatory for all salmon anglers) provide harvest and release estimates. Estimates from the recreational fisheries on northern B.C. Transboundary rivers are generally non-existent, with exception of one area (of high conflict) in the Stikine drainage. Here a limited creel census is conducted by DFO through the local FN.

Fisheries monitoring has been further complicated by the requirement of the 1999 PST agreement to incorporate estimates of total fishing mortality into the coast-wide chinook management framework. Estimates of total mortality for coho will also be required eventually. These estimates can only be obtained through observation of encounters in fisheries. It is possible though extremely expensive for direct observation in commercial fisheries but direct observation is not feasible in recreational fisheries.

Fisheries monitoring and the management of catch data highlight the fundamental difference in philosophy between stock assessment and fisheries management. Stock assessment is a data-intensive activity and the data systems that service assessment activities must be capable of readily accessing and correcting historical data and on reporting it in flexible and often unforeseen ways. For fisheries managers catch is used to manage fisheries in-season and for reporting catch post-season. Data are viewed as static and there is little need to access historical data and no need to correct it. Exploration of the implications of this dichotomy is beyond this report so suffice it to note that the different perspectives persist and are hindering the modernization of salmon assessment data systems.

Summary of SACC findings

- The fisheries monitoring program (Table 17) will deliver an acceptable level of activity in most commercial fisheries in the region.
- The most significant issues in fisheries monitoring are
 - Discontinuation by Fisheries Management of FSC sockeye and chinook fisheries monitoring in the Fraser River. Stock assessment does not have the capacity to assume this program.
 - The veracity of aboriginal catches cannot be certified. There is little or no audit capability in most programs.
 - Credibility of mortality estimates in coho and chinook fisheries.
 - Lack of adequate coverage for sBC winter recreational chinook fishery. This data gap results from funding-driven reductions in the scope of Strait of Georgia and Victoria creel censuses.

- Impacts of northern recreational fisheries (principally Langara) on southern stocks of concern (WCVI naturals).
- No regional consistency in recreational catch estimation for non-salmonids, principally halibut and rockfish. The veracity of catch estimates for those species cannot be determined.
- Ad-hoc approach to the use of genetic stock identification in fisheries, lack of a regional strategy for resource expenditures in this area and lack of adequate data management. One symptom of this issue is that there is no apparent mechanism for prioritizing these expenditures in the context of either the regional fisheries monitoring or regional stock assessment program.
- Lack of resources to import historical information into FOS. This is one aspect of the generally poor data management practices within salmon stock assessment.

- SACC recommends that a strategy be developed to integrate stock ID capabilities with appropriate technologies and to integrate the program into the regional fisheries monitoring strategy and a salmon assessment data management strategy.
- Table 18 identifies a number of projects that were supported by SACC but which were not recommended for funding. SACC recommends that these projects, be considered for funding if funds are available beginning with the two projects in bold.

SACC advice and recommendations

- SACC advises that the monitoring of commercial ocean fisheries in the region is generally adequate in scope to produce defensible estimates of catch. However, due to persistent issues with data management some questions remain about DFO's ability to actually produce those estimates.
- SACC advises that there are significant deficiencies in the monitoring of recreational ocean and fresh water fisheries throughout the region. The deficiencies are most notable in the CC and in winter fisheries in sBC.
- SACC advises that there are significant deficiencies in the monitoring of aboriginal FSC fisheries particularly in the Fraser River due to funding constraints.
- SACC advises that PST obligations to estimate total fishing mortality in chinook cannot be met with current resource levels. This obligation might not be attainable regardless of funding.
- SACC advises that progress is being made by Stock Assessment, FM and AFS in improving the planning integration of fisheries monitoring (and stock assessment in general). However, SACC notes **with emphasis** that declining funding, continual delays in funding decisions and uncertainty about priorities frustrate further development of cooperative programs and capacity building in FN's.
- SACC recommends that under the direction of SACC that core be directed to develop an aggressive program to rationalize and modernize the management of salmon assessment data. This program specifically requires strong commitment by Areas to support and participate in regional programs.

Table 17. Fisheries monitoring recommended project funding by Area and funding source.

		2004/05 funding source								
Funding source	Area	A-BASE	AFS	Ext-unfunded	Fish Mon	FM B-base	Nisga'a	PST	SMF	Grand Total
External funding			215	30		15	22		300	582
	BCI		215			15				230
	CC									0
	LF		0							0
	NC				30			22		
	SC								300	300
DFO O&M	BCI	0								0
	CC				10			15		25
	Core	167						25		192
	LF				146.4					146.4
	NC				140			135		275
	SC	169.3			338.9					508.2
	YTB				9					9
Total funding		336.3	215	30	644.3	15	22	175	300	1737.6

Table 18. Fisheries monitoring projects that were recommended by SACC but not funded. The two projects in bold have the highest priority for funding.

Area	Project name	Key project deliverable	AFM stock group (see Table 1)	Project type	Has spring component	2004/05 funding source	2004/05 funding
BC	Mid- and Upper Fraser River First Nation Catch Monitoring Program Chinook	Catch Monitoring Program operates from April 1 through June 30 from Sawmill Creek to Kelly Creek. Provides catch estimate for First Nations FSC fisheries in the Fraser River and tributaries. Land-based, water-based and aerial survey.	FRspr1.2; FRspr1.3	FM	y	A-BASE	15
NC	Fishery Monitoring Recreational Lower Skeena	Lower Skeena creel survey. Fall coho proposed for 2004. Management/conservation on some tribes	SKNA	FM	n	Fish Mon	81.0
SC	Recreational Log Book Program	Provides estimates of remote lodge sport effort and chinook catch in Southern BC. 2. Estimates are made for other species of salmon, rockfish, halibut, and lingcod. 3. Biological and mark sampling are conducted.		FM	y	Fish Mon	20.6

Infrastructure (core)

The PBS salmon section provides various forms of logistical, analytical and administrative support to the areas and supports regional data systems and programs. The projects in this section of the report are a mix of infrastructure projects and PST support projects. All of these projects were reviewed by SACC. Most of the projects (Table 19) support the travel and work of PST technical committees. Not all of this work has been captured in this table as cost accounting differs in some Areas such that PST travel budgets are not accounted for separately. The travel projects have typically been reduced 10% to 20% from 2003/04 budgets.

The Mark Recovery Program (MRP) sampling contract is the largest O&M project in stock assessment. MRP is one part of the coast-wide coded-wire tag program, which includes the application of tags, their recovery (MRP), the decoding of tags (the "head-lab"), and the management of application, sampling and recovery data. A conservative estimate of the actual operating requirement of this program and the associated data management activities is \$935k to \$1.2M depending on assumptions about which fisheries will actually proceed in 2004/05. The cost of the program has spurred inquiry into alternatives in both Canada and the US. However, the coded-wire tag program is crucial to delivery of the chinook and coho assessment programs and its replacement would require retooling the entire coast-wide chinook assessment program. The need for any alternative program to be run in parallel to MRP would place any switchover well into the future.

Resources for the MRP program have not been increased in over a decade. Improved productivity, reductions or cessation of coho and chinook fisheries, cessation of chum fin-clipping, and reductions in coverage and tasks have enabled the program to continue operating. Significant operational savings have been achieved by SC-Area staff assuming sampling and coordination for fisheries within their area. The other Areas are either unwilling or unable to assume these roles. The control of DFO FTEs under a cap will restrict opportunities to reduce costs such as SC Area has accomplished for the MRP. The prospect of increased fisheries in 2004/05 and no budget flexibility mean that reductions in coverage are already occurring.

The proliferation of mass-marking in southern BC and the US Pacific NW has severely compromised the MRP program in recreational fisheries as angler participation in voluntary tag recoveries has faltered. An educational campaign to possibly address the causes of this problem cannot be funded this year. In any event the proportion of hatchery coho and chinook in many southern fisheries is leading to questions about the need for coded-wire tags and the MRP in the management of wild populations. Perhaps the most urgent requirement in this vein is a critical

examination of alternative approaches to the assessment of wild coho and chinook and to the management of southern BC coho and chinook fisheries.

Funding constraints will also severely limit the improvement of existing data systems (e.g., Salmon Escapement Data System (SEDS), the Fisheries Operations System (FOS)), the development of new data systems (e.g., thermal marking, Biological Traits) or the integration of data systems (genetic, thermal stock ID of fisheries). Other issues affect the efficiency of salmon data systems. There continues to be resistance to the use of some sanctioned systems (e.g. SEDS, FOS) in some Areas and there is a general lack of support for the development of new systems (e.g. thermal marking).

SACC advice and recommendations

- SACC advises that the MRP program remains under-funded and will be unable to adequately respond to the resumption of coho fisheries or expanded chinook fisheries. Resources will be insufficient to sample some time-area strata.
- SACC recommends that Fisheries Management and Stock Assessment staff work cooperatively with MRP program management in the development of fishing plans to insure that MRP resources are effectively used.
- SACC recommends that examination of alternative approaches to the assessment of wild coho and chinook and to the management of southern BC coho and chinook fisheries be undertaken with high priority. This will require additional investment.

Table 19. Proposed infrastructure "core" projects for 2004/05.

Project name	Key project deliverables & comments	Project type	2004/05 funding source	approved amount (O&M only)	other funding
Chinook Assessment Support	Support for core staff to participate in CTC and PSC meetings.	PST	A-BASE	17.8	
Consultations / Policy Development	Directed studies of enhancement and farming effects on wild salmon. This will be a joint project with HEB and might be funded by them in part.	Research	A-BASE	15.0	
Escapement Data Management	Escapement data coordination costs, printing of regional field forms, software/upgrades, hardware, office supplies	InfraS	A-BASE	8.5	
MRP Sampling Contract	Coast wide sampling of commercial salmon catch for CWT, average weights, scales, and DNA. Includes operation of the "head" lab. The requirement will increase if FM increases fisheries, e.g. proceeds with coho retention in nets in sBC fisheries.	InfraS	A-BASE	775.0	
PSC Selective Fishery Evaluation Committee (SFEC)	Deliver work plan as approved by PSC and Canadian Commissioners (e.g. protocol in 2002 for PSC evaluation of mass marking programs and mark selective fisheries in Canada and USA)	PST	PST	5.0	
PSC Tech Committee & Panel Assignments	PSC Technical Committee and Panel Assignments . Travel	PST	PST	3.0	
PST Tech Comm / Panel Assignments	1. Report writing assignments from Southern and Fraser Panel through Chinook, Coho, Chum and Fraser Sockeye Technical Committees. 2. Travel and assignments incurred by duties of PSC Technical Committee of which South Coast Stock Assessment staff Chair two of above Technical committees and are members of all Chinook, Coho, Chum and Fraser Sockeye committees. 3. Assignments include reporting of chinook and coho DNA, mortality and interception rates pertaining to Treaty fisheries.	PST	A-BASE	22.0	
PST-CoTC - Travel	Travel Requirements	PST	PST	3.2	
SOUTHERN PANEL / TECH. COMMITTEE	This is southern panel coho requirements, travel for non-panel members of coho WG, etc.	PST	PST	11.2	
Fish-Water Management Tools	User friendly, simulation models of water mgt and fish production outcomes. Improve water mgt decisions & sockeye production in the Okanagan basin. Contribute to ecosystem-based mgt framework.	Research	SPA		50.0

Part C – Program summary by Area

Table 20 summarizes the current project proposal by Area/Sector and species. The largest allocation by Area of project O&M is to the Fraser (26.1%, combining LF and BC), followed closely by NC (21.9%), SC (17.1%) and core PBS (15.7%) have smaller and similar allocations, followed by YT (12.7%) and CC (6.5%).

The allocations by Area reflect PST, fisheries management and species priorities with few qualifying comments required. Note that there is an allocation of \$775k to core for the Mark-recovery Program, a regional infrastructure project that is essential for coast-wide chinook and coho assessments. As noted in the species sections the allocations to pink, chum and sockeye do not reflect the contributions to escapement monitoring made by charter patrol.

Table 20. A summary of DFO O&M expenditures by species and by Area. Row (Area) and column (species) totals and percentage of the overall total (\$6.927M) are also shown.

Project O&M funding by species/sector									
Area	sockeye	chinook	coho	chum	pink	fisheries monitoring	Infra-structure	Area total	% by Area
BCI	788.1	301.0	218.6			0.0		1307.7	18.9%
LF	107.3	142.4	51.0	26.0	25.0	146.4		498.1	7.2%
SC	87.0	331.2	180.0	41.1	0.0	508.2	36.4	1183.9	17.1%
CC	186.0	102.6	60.0	20.0	25.0	55.0	3.0	451.6	6.5%
NC	478.0	256.0	508.2	0.0		275.0		1517.2	21.9%
YTB	442.5	161.1	186.0	81.0		9.0		879.6	12.7%
Core	13.0	31.0	21.8			192.0	831.3	1089.1	15.7%
Species total	2101.9	1325.3	1225.6	168.1	50.0	1185.6	870.7	6927.1	
% by species	30.3%	19.1%	17.7%	2.4%	0.7%	17.1%	12.6%		

Part D – Summary comments and recommendations

General comments on the state of salmon assessment

SACC advises that funding for salmon assessment has fallen to the point where the delivery of services is in jeopardy. The challenge will increase in 2005 as Fraser sockeye enter dominant cycles and Fraser pink return. Increased pressures to resume fishing on Fraser sockeye and chinook stocks, on CC sockeye and coho, on WCVI chinook and coho and probably other stocks will exacerbate the situation.

Assessment programs throughout the region cannot be made more efficient in the short-term. SACC notes that in many cases there have been no increases in funding levels for nearly 20 years (e.g. the original CanUS projects, MRP) and the fact that these projects continue to deliver credible assessment information is testimony to the resourcefulness of assessment staff in making huge gains in productivity. Brief infusions of large amounts of O&M in the late 1990's and early 2000's have now terminated, significant funds have been re-directed within the 1998 PST TB funding, BCMOU funding has ceased, CFAR concluded and A-Base funding has been severely reduced. SACC notes that there have been no corresponding reductions in expectations. In reality, the increasing involvement of FN's, NGO's and new internal demands generated by treaty negotiations has significantly increased expectations.

Technological change could, perhaps, alleviate some of the cost pressures in the long term. For instance, substituting acoustic counters for M/R estimates of large river sockeye, pink, chum and chinook populations might be slightly cheaper but there will be pressures, especially where the PSC is involved, to continue existing programs in parallel for several years of calibration. The consequence will be that savings, if there are any, will take some time to materialize. Alternative approaches to enumeration might also be cheaper in the long-term. For example, using genetic stock ID in lower river sampling to estimate stock proportions together with a few upstream enumerations can, in theory provide stock-specific, complete system estimates of escapement for all species. This approach has been demonstrated in the Nass River and for interior Fraser coho. However, application of this approach for Fraser River sockeye would require assumptions about in-river mortality and fishing losses that the PSC may not be amenable to. A project that followed this protocol for interior Fraser coho was abandoned because of inadequate resources to run the project in parallel with the customary suite of spawning ground enumerations.

With the proliferation of hatchery-mark only fisheries the integrity of the coast-wide CWT-MRP program is being questioned. This program, which is the most expensive single salmon assessment project, is central to chinook and coho assessment. Mass-marked hatchery release groups can no longer

be used to represent unmarked wild fish. Detection of tags in unmarked fish is technologically challenging in field conditions typical of an indicator stream or a creel survey and is expensive regardless of the site. Genetic stock ID can readily proportion the catch into stocks but the cost of identifying proportionately small stocks in ocean fisheries (e.g. a small hatchery or a large natural system) is prohibitive and a comprehensive sampling program, which constitutes 75% of the MRP cost, is still required. Greater use of genetic techniques might actually drive costs up. The ability to do stock ID on small groups of fish, i.e., the daily catch of a single troll boat, has already led to demands for micro-management such as daily tracking of stock ID on a fine geographic scale. This will inevitably lead to increases in exploitation that occur on time and spatial scales that are inappropriate for already stressed assessment programs based on deteriorating escapement and indicator-stream programs. It seems unlikely that new technology is going to lead to significant savings in the short-term.

The monitoring of salmon fisheries presents additional challenges. Cost recovery or user-pay has been difficult to implement in the salmon fishery. Direct observation of fisheries has proven to be very expensive and, in the case of recreational fisheries, unworkable. Reliance on technology, logbooks, and other forms of self-reporting, could be inexpensive but audit programs are not sufficient and although there are penalties for false reporting and for failing to report, enforcement appears lax. Bearing in mind the 90-10 rule (90% of fish are caught by 10% of fishermen), the potential of underreporting of catch is enormous. The monitoring of FN fisheries has also proven problematic and expensive. Coverage of recreational fisheries has been increasingly restricted to the Strait of Georgia and other high-intensity fisheries while some geographic areas are sporadically surveyed if at all.

SACC acknowledges that there are serious data management issues in salmon assessment. The most serious problem is the lack of credible catch data for some fisheries but there are concerns over the timely delivery of credible escapement data, the timely availability of data from indicators, the comparability of HEB and StAD data, the availability and credibility of biological traits data and the lack of a comprehensive and affordable data strategy with Area and regional support. There are several key reasons for this that include lack of a practicable strategy, past administrative decisions, a general failure to recognize that the nature of salmon catch data is different than catch data in other species⁸, and a reliance on a plethora of desktop datasets often maintained by individuals.

⁸ Salmon catch is of limited use in assessment without stock composition information. This is unlike all other fisheries where species resolution is important but within species structure is either not present, is not recognized or is ignored. Currently, there is no data system that captures stock composition when it has been determined.

Specific comments on the proposed 2004/05 assessment program

The assessment program, as outlined in the species/envelope project spreadsheets represents, in the view of the majority of SACC members, a balanced (species & Area) program that meets the most important PST and domestic obligations.

That claimed, SACC would not submit that anybody is particularly satisfied. The major implications of the proposed project to PST and domestic obligations are:

- Assessment activity in the CC has been greatly reduced. This may threaten stock safety in the area, particularly sockeye (outside of Rivers and Smith Inlets). Cessation of most activities could also be seen as renegeing on DFO's stated intentions to increase assessment activity in the CC.
- Enumeration of Fraser sockeye does not fully meet PSC study design criteria, even with the reinstatement of early-summer enumerations and the upgrade to some summer enumerations. As proposed, the program will enable enumeration of all major stocks, albeit with considerably reduced precision in some cases.
- Development of Fraser and CC chinook indicators has largely stopped. This does not threaten stock safety but will stall efforts to gain production benefits under the PST. Also, indicator stocks help assess fishery-specific impacts, develop biological reference points, and assess stock status.
- Maintenance of programs supporting PST obligations will cause distortions in the regional assessment program as resources are withdrawn from non-PST areas and species (CC all species, WCVI coho sockeye and pink everywhere) to support obligations for assessment with fewer domestic benefits.
- Wild coho indicators, upon which the new coho abundance-based management system in sBC is based, have been almost completely eliminated. Assessment will now rely on hatchery indicators. The hatchery indicators will allow us to track general trends in survival. In 2004/05 exploitation rates on coho will not be directly measured. However, should fisheries resume, hatcheries cannot be used as exploitation rate indicators for wild populations because of mass-marking. This would pose a risk at high exploitation rates. Finally, wild indicators are required to monitor freshwater survival (production), which is an issue in the interior Fraser and the extensively developed areas around Georgia Strait.
- Working relationships with FN's are going to deteriorate as DFO withdraws from fledgling cooperative programs because of a lack of resources. Joint planning utilizing the assessment frameworks will be essential to ensure best use of all available resources.

- SACC notes that funding for some high priority issues is large compared to funding available for core programs. For example, expenditures on Broughton pink exceeded \$700k in 2003/04, and will be several times the \$42k O&M funding slated for pink assessment in the entire region this year. Also, the planned expenditures on Sakinaw and Cultus Lake sockeye, >\$500k this fiscal, are approximately 25% of the total regional sockeye assessment budget. [This comment should not be viewed as a criticism of those programs but rather as a caution against including that funding in totals of expenditures for salmon assessment in the region.]
- Finally, levels of pink assessment fail to meet even minimal standards throughout southern B.C.

Despite the limitations of the assessment program, a performance assessment indicates that the majority of AFSU's of all species but pink are adequately assessed (class 3 or better) given their current status and anticipated levels of exploitation. (Table 21)

Table 21. Performance of assessment program by species and AFSU.

Species	Count of AFSU by Assessment Performance Class					Species totals
	1	2	3	4	5	
Chum		5	3	3		11
Chinook	2	8	8	3		21
Coho		7	7	3	2	19
Pink		3	1	2	3	9
Sockeye	3	5	5	4	1	18
Class totals	5	28	24	15	6	78

Performance summary of the planning approach

The approach taken in designing the regional assessment program for salmon had four objectives, which are presented below along with a brief performance assessment.

Objective 1: To develop cooperative and integrated stock assessment programs building on previous activities and planning processes. Cooperation between StA, FM and HEB was encouraged.

- o Business planning did build on previous work by adopting some of the strengths of past work while avoiding some of the pitfalls
 - Focus on stock units was maintained.
 - Adoption of frameworks allowed SACC to focus on information required to deliver credible advice to Fisheries Management in support of prioritized DFO objectives. Attention was thereby changed from our perception of the importance of the stock to the importance of information requirements to deliver requested advice.
 - Historical shares of resources were not considered a driver in the allocation of resources.
- o The approach lends some credibility to the assertion that the plan contained is both regional and integrated.

Objective 2: To comply with RMC direction on meeting obligations, which were understood to be particularly those related to the PST, while considering other priorities such as conservation.

- o There was general but not unanimous agreement on the relative weights given to PST, Area and other priorities as directed by RMC.
- o One Area felt disenfranchised and another disadvantaged by the emphasis on PST obligations.

Objective 3: The timely delivery of a regional assessment plan.

- o The problems encountered in 2003/04 leading to a lack of direction on spring projects and non-approved projects going to completion was avoided by early Area Director and FM approval of spring projects recommended by SACC.
- o The time-line for completion of the regional plan was not met.
- o The principal reason for non-compliance was the uncertainty in budget ceiling, which, as in past years, varied by 10% on a weekly and sometimes daily basis into July.

Objective 4: To provide improved capacity and opportunity for First Nations

- o Improving capacity and providing opportunity for FN's in a period of budget reduction and heightened expectations, while complying with government financial and workforce regulations remains a significant challenge.
- o Timely interaction with FN's on the assessment frameworks and preliminary project plan was initiated through BCAFC and local area contacts.
- o Progress toward this objective cannot be assessed with the information collected during this exercise.

Options for 2004/2005

There are two general options available:

1. Accept the revised program as proposed in this document. **This option is recommended by the majority of SACC.**
2. Adopt the recommended program but more completely fund Fraser sockeye and chinook assessment by further reductions in coho assessment in southern BC, specifically by not supporting reinstatement of one or more sBC wild indicators. Exploitation rates are minimal on sBC stock groups including the interior Fraser and marine survivals are being monitored at hatcheries. In the opinion of the chair, further reductions in the escapement program would not place these stocks at increased risk in the short-term. It should be emphasized that this is a short-term solution that is valid only so long as survivals do not further decrease, that hatchery indicators continue to operate and that exploitation rates remain low (<3% in Canada). If any of these conditions are not maintained then risk will increase, dramatically so in the case of decreased survival rates and higher exploitation.

Appendices

Appendix 1. Supporting document outlining the planning process and the priorities for the regional salmon assessment plan.

The following is an excerpt from the Record of Decisions of the Regional Management Committee meeting on Tuesday, November 4, 2003. The full document is available at

<http://info.pac.dfo.ca/policy/committees/rmc/word/decisions/76%20-%20Record%20of%20Decisions%20-%20Nov%204.%202003.doc>

Record of Decisions

Participants: B. Bauer; J. Boland; D. Carson; D. Innell; L. Kinney; P. Macgillivray (Chair); A. Murdoch; J. Norris; D. Phelan; D. Radford; R. Reid; B. Rosenberger; G. Savard; C. Webb; J. Wild
Absent: J. Davis; S. Farlinger; S. Johal; R. Kadowaki; J. Lubar; L. Richards; T. Tebb; G. Zealand
Alternates: T. Perry; S. Steele; E. Woo

3. Decision/Approval Process

Approval Process – RD Science will lead an annual budget process. The RD will allocate the financial resources expected from NHQ among Area and Regional program activities. Where consensus cannot be reached on a particular allocation the RD Science will make the final decision. Those Area Directors not in agreement may appeal to the RDG.

We need to have a clear process for budget allocation, transparent to other Branch Directors so that they're able to integrate their programs. We also need early decisions so external partners are able to plan joint programs.

Summary: The RD will make allocation decisions.

4. The Stock Assessment Coordinating Committee – will provide recommended program to RD Science based on prioritization system and will serve as forum for Fisheries Management input.

5. Establishing priorities for salmon assessment funding allocations

- o Meeting treaty obligations was acknowledged as the highest priority but concerns were raised over the potential for these to use all available funds and need to address other concerns.
- o Noted that PST obligations include the original Canada-US treaty.
- o Concern raised about how/who to pay for health and safety capital issues at field locations?

Summary: PST – primary driver but not only support PST projects. Other high priorities are conservation objectives and domestic mgmt requirements.

Appendix 2. Explanations of the table headings for species' "Table 1".

AFSU: The Assessment Framework Stock Unit.

Performance Class: An assessment of the capability of the proposed assessment program to deliver advice to fisheries management as outlined in **Table 1**.

Approx. number of SARA units: Emphasis on approximate.

Number of modeled subcomponents: For sockeye, the number of populations where formal forecasting or stock-recruit modeling is done.

Approximate number of spawning populations: Generally, the number of populations enumerated.

Indicators (current/potential): Indicators are populations where FW and marine survival can be estimated. This means that ER can also be estimated. Current indicators are fully developed. Potential indicators are either those being developed or those that could be developed.

Extensive escapement: The number of populations that are enumerated in one of five classes that are described in the following Table.

Level	Methods	Recommended usage
1	presence/absence	Not recommended but if used then in situations of <ul style="list-style-type: none"> ▪ Low ER <u>and</u> ▪ No known or suspected threat
2	visual peak count	Provides an index of abundance. Used only under situations of low ER <u>and</u> no known or suspected threat.
3	visual counts (AUC estimates)	Provide either index or total estimates of low precision and low accuracy. Should be used only under situations of low ER <u>and</u> no known or suspected threat.
4	mark/recapture	Provide total estimates of low precision and accuracy. Escapement estimates by themselves cannot be used to partition FW and marine survival. Can be used in all situations
5	weir or equivalent acoustic count	Provide total estimates of high precision and accuracy. Escapement estimates by themselves cannot be used to partition FW and marine survival. Can be used in all situations

Fisheries monitoring: The approach and level of effort expended in monitoring commercial, recreational and FN fisheries. "reg" means the "regular" approach and level of effort.

Principal impacting fisheries: Various codes for the principal impacting fisheries.

Aggregate size, Categorical status, and Categorical ER: These codes are described in the following Table.

Descriptor/ Categories	Narrative
ABUNDANCE	
<p>Two categories in the form N1.N2</p> <p>N1: recent average escapement</p> <p>1: ≤1000 adults</p> <p>2: ≤10,000 adults</p> <p>3: ≤100,000 adults</p> <p>4: ≤1,000,000 adults</p> <p>5: >1,000,000 adults</p> <p>N2: escapement target</p> <p>1: ≤1000 adults</p> <p>2: ≤10,000 adults</p> <p>3: ≤100,000 adults</p> <p>4: ≤1,000,000 adults</p> <p>5: >1,000,000 adults</p>	<p>Escapements over the last cycle should be averaged unless there is convincing evidence of severe or unexplained declines in the some shorter period. Note that it will be possible to have a status category 1 with an abundance category 4.5 for instance. That situation is probably less worrisome than one where a status category 1 is coupled with an abundance category or 1.1, which is also possible.</p>
STATUS	
<p>1: Stock of concern – stock is less than 25% of target or is declining rapidly or is forecast to be in such situations.</p> <p>2: Low – stock well below target or below target and declining.</p> <p>3: Near target – stock within 25% of target and stable.</p> <p>4: Abundant – stock well above target.</p>	<p>These categories were taken from the Outlook 2003 document and were renamed to clarify their meaning. The probable consequences to fisheries of these status levels remain unchanged from the Outlook 2003 document:</p> <p>1: Stock of concern: No directed fisheries and possible requirement to avoid stock.</p> <p>2: Low: Fisheries are uncertain and likely small. Allocation policy will determine harvest opportunities.</p> <p>3: Near-target: Directed fisheries subject to allocation policy.</p> <p>4: Abundant: Direct fisheries subject to allocation policy.</p> <p>Note that although the fisheries consequences of a particular status level are clearly implied, the status category assigned should reflect the biological status of the stock regardless of the consequence of that status to any particular fishery. If there is no official target use either the long-term mean or your judgment. Also note that for declines to be of significance they should either be sustained declines or if not then catastrophic. For example the coho of Area 5/6 had seen declines of</p>

	<p>5%/year sustained over 30 years. Knight Inlet pink declined by nearly 1000% in one cycle. Both would warrant a category 1 designation in the absence of a formal target.</p> <p>Also note that this category allows forecasts to be taken into account. If a significant decline is anticipated then this could lead to heightened concern than might be warranted based on historical trends.</p>
ER (exploitation rate)	
<p>1. Very low or <10%</p> <p>2. Low or <20%</p> <p>3. Moderate or <40%</p> <p>4. High or <60%</p> <p>5. Not sustainable or >60%</p>	<p>The values associated with the categories assume that the maximum sustainable ER under long-term average conditions is 60%. If the maximum ER is lower then the category boundaries should be changed accordingly. The maximum ER is not the ER that has been chosen for fisheries planning in the current year.</p>

Importance to PST, commercial/recreational fisheries and to FN's: These are categorical and largely subjective scales ranging from 1 (little importance) to 4 (highest importance). These ratings were used to roughly guide some aspects of resource allocation.