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Report of the PSARC Salmon Subcommittee Meeting, November 14-16, 2000

M. Stocker and A. Macdonald (Editors)
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

December 2000

Canada

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[1] Fisheries and Oceans Canada
100 Annacis Parkway, Unit 3
Delta, British Columbia V3M 6A2

SALMON

SUMMARY

The PSARC Salmon Subcommittee met November 14-16, 2000 at the Pacific Biological Station in Nanaimo. External participants from the Pacific Fisheries Resource Conservation Council, Sport Fish Advisory Board, South Coast Intertribal Fisheries Committee, Fraser River Watershed Committee, Aboriginal Fishing Vessel Owners of B.C., and the Fraser River Aboriginal Fisheries Resource Conservation Council attended the meeting.

Working Paper S00-19: Status in 1999 of coho stocks on the West Coast of Vancouver Island

The Subcommittee recommended continuation of a cautious approach to management is recommended and warranted given uncertainty in marine survival. Even under the current low exploitation rate (~10%), there is no evidence that stock abundance will increase under prevailing low levels of marine survival.

The issue of the discrepancy of mark rate estimates, both at the fishway and at the hatchery, needs to be resolved. The Subcommittee recommended assessment of the cause of the discrepancy and its effect on exploitation and survival rates.

Working Paper S00-20: Assessment of Rivers and Smith Inlet sockeye salmon, with commentary on small sockeye salmon stocks in Statistical Area 8

The Subcommittee recommended no or minimal harvests of Owikeno and Long Lake stocks, even under the optimistic scenario which would result in returns above target escapements to Owikeno in 2001 and 2002, but below the target in 2003 and below the provisional Limit Reference Point in 2004.

The Subcommittee recommended a cautious approach to the management of Area 8 sockeye stocks due the uncertain stock status and the clear indication that these stocks have shown similar marine survival and abundance trends as Owikeno and Long Lake stocks.

The Subcommittee noted that the Docee fence is critical for inseason management of central coast sockeye and recommended that this structure be maintained.

Working Paper S00-21: Acoustic and trawl based estimates of juvenile sockeye salmon (*Oncorhynchus nerka*) production from 1976-1999 brood year adults returning to Smith Inlet and Long Lake, British Columbia

The Subcommittee recommended that the preliminary historic estimates of juvenile sockeye abundance by brood year be replaced with estimates provided in this paper, and that these revised estimates be used as indices of abundance.

The Subcommittee recommended that annual acoustic/trawl survey estimates of juvenile sockeye abundance be maintained and continue at least two surveys annually to monitor over-winter growth and survival success.

The Subcommittee recommended that the accuracy of the acoustic and trawl survey (ATS) estimates be calibrated with absolute counts/estimates of smolt production at Long Lake. Such estimates would require either a weir count or extensive mark-recapture estimation techniques.

Working Paper S00-22: Early returning chinook salmon of the Fraser River Watershed

The Subcommittee did not accept this working paper. The Subcommittee encouraged the authors to address the suggestions of the reviewers and the Subcommittee and to re-submit for PSARC review in time for fisheries management planning for the 2001 fishing season.

INTRODUCTION

The Subcommittee Chair opened the meeting welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda (Appendix 1).

The Subcommittee reviewed four working papers. Working paper titles and authors are listed in Appendix 2. A list of meeting participants, observers and reviewers is included as Appendix 3.

SUBCOMMITTEE GENERAL CONCERNS

Two papers on central coast sockeye were presented at the meeting and recommendations by the authors have important implications for stock assessment and management of these stocks. Current estimates of juvenile abundance and escapement have been reliable enough to allow detection of large magnitude changes in marine and freshwater survivals. Such estimates are currently available for Long and Owikeno lakes. For Long Lake sockeye, the acoustic and trawl based estimates of juvenile production in Long Lake and the adult enumeration at the Docee fence at the outlet of Long Lake are currently the best sources of data to estimate these survivals. Therefore, the Subcommittee recommended continuance of these programs. However, the Subcommittee noted that improvements are required in juvenile abundance estimates to acquire more precise estimates of marine survival that are required for recovery planning.

This would require development of alternate assessment programs that directly estimate the smolt population. The Subcommittee noted that the Docee fence requires major repair or replacement. Both adult and smolt enumerations could be incorporated into the design of a new fence.

WORKING PAPER SUMMARIES, REVIEWS AND DISCUSSION

S00-19 Status in 1999 of coho stocks on the West Coast of Vancouver Island

D. Dobson, K. Simpson, J. Till, R. Ferguson, P. Tschaplinski, and S. Baillie
Accepted subject to revisions

Summary

The assessment of West Coast Vancouver Island (WCVI) coho stocks indicates a general trend of improving escapement and juvenile density since the period of extremely low marine survival rates resulting from the El Niño event of the early 1990s. This improvement is attributable mostly to dramatically reduced exploitation rates. Prior to the severe restrictions implemented for conservation in 1997 and 1998, exploitation rate of WCVI coho averaged approximately 62%. Since then, estimated exploitation rates have ranged between 5 to 10%. In recent years, marine survival rates have been higher than the critically low level experienced in 1994, but 1996 brood survival still remained below long-term averages and decreased from the previous year.

In the absence of significant exploitation, escapement has improved to the point that 1999 levels exceeded 1996 brood year escapement for most WCVI streams having reliable escapement data. An important exception to this trend was the Carnation Creek wild indicator stock. The 1996 brood year experienced extremely low marine survival rate (1.1%) compared to the long-term average (9.0%) and consequently escapement was below brood replacement levels. The Robertson Creek Hatchery 1996 brood also had a low survival rate of 1.8% compared to the long-term average (4.5%).

Patterns of juvenile abundance are consistent with escapement trends. In the summer of 1999, the highest juvenile densities were observed since the survey began in 1995. These levels likely resulted from high 1998 brood escapement and suggest there may have been a relatively strong 2000 smolt run on the WCVI. Correspondingly, smolt counts from wild indicator streams were high. Preliminary data from 2000 returns indicates escapement will meet or exceed 1999 levels.

Reviewers' Comments

Reviewer #1

Reviewer #1 recommended acceptance of the paper subject to revisions. This reviewer suggested that the purpose of the paper be more clearly stated in order to provide advice to managers. In particular, he suggested that the authors provide advice to managers regarding the health of WCVI coho stocks, the impacts of recent management actions on the stock, and the likely range of sustainable exploitation rates for this stock group. This reviewer noted that while escapements on the 1996 brood line have improved, there is reason for pessimism because of only modest increases in escapement and little evidence for improved ocean survival. This reviewer considered the 1996 brood of WCVI coho an ongoing conservation concern.

This reviewer was concerned about the Robertson Hatchery indicator data and believed that specific recommendations should be made to resolve this issue.

Reviewer #2

Reviewer #2 noted that this paper provides a useful review of data on the abundance, survival and exploitation history of coho populations on the West Coast of Vancouver Island. This reviewer agreed with the authors that the increase in spawning abundance in the last few years was due to the near elimination of fishing mortality, and this point could be strengthened with a calculation of estimated total abundance trends for the whole aggregate. This reviewer suggested that the authors could also further emphasize the point that sustainable exploitation requires both reasonable levels of abundance, and adequate productivity; it appears that current and forecast poor marine conditions are resulting in lower than average productivity for the aggregate. This reviewer reiterated the need for a comprehensive regional review of the fry survey data, and for agreement on the use of provisional reference points (e.g., fry/m^2 or females/km) in assessment documents.

Subcommittee Discussion

Two main issues emerged from the Subcommittee discussion: 1) unexpected discrepancies in the estimates of adipose clip rates from the Robertson Creek hatchery versus the Stamp Falls fishway, and 2) the consequence of harvest in 2001 given the lack of evidence for improved ocean survival.

The disparity between estimates of marked coho measured at the Stamp Falls fishway viewing site and at the hatchery was disconcerting and may have significant effects on estimates of exploitation and survival rates. Estimates of exploitation rates for the Robertson Creek stock are currently used in assessment and management for all WCVI stocks. Problems with Coded-wire

Tag (CWT) derived exploitation and survival rates will impact all WCVI stocks. The reasons for the difference in mark rates estimated at the Stamp Falls site and at the hatchery are unknown. Despite some re-sampling at these sites in 2000, there was no resolution of the problem. Alternative explanations to account for the disparity have not been explored. These include the potential that more hatchery fish spawned naturally than is currently assumed as well as the potential that unmarked naturally spawned fish return to the hatchery. Additionally, significant hatchery fish interaction with natural/wild spawners may have a profound impact on wild stock production in the Stamp system. The discrepancy in the mark rate raised the concern that hatchery production in this system may exceed current guidelines for hatchery versus wild production.

The Subcommittee recognized that recent fishery management has resulted in a combined exploitation rate and release mortality rate of about 10% and increased escapements in recent years. However, the total stock abundance for the WCVI stock aggregates has continued to decline (Fig. 3). As a consequence, increases in exploitation rates are not warranted. The Subcommittee noted that an updated forecast of WCVI coho is to be presented to PSARC in spring 2001. At that time, data from 2000 will be used to estimate ocean survival rates.

Subcommittee Recommendations

1. The Subcommittee recommended continuation of a cautious approach to management and felt this is warranted given the uncertainty in marine survival. Even under the current low exploitation rate (~10%), there is no evidence that stock abundance will increase under prevailing low levels of marine survival.

2. The issue of the discrepancy of mark rate estimates at the fishway and at the hatchery needs to be resolved. The Subcommittee recommended assessment of the cause of the discrepancy and its effect on exploitation and survival rates.

S00-20 Assessment of Rivers and Smith inlet sockeye salmon, with commentary on small sockeye salmon stocks in Statistical Area 8

D. Rutherford, C. Wood **Accepted subject to revisions**

Summary

Rivers Inlet (Owikeno Lake; Area 9) and Smith Inlet (Long Lake; Area 10) sockeye salmon stocks have shown recent dramatic declines in total abundance (Fig. 4). Similar declines in total abundance of sockeye originating from Statistical Area 8 are also documented (Fig. 4). All available data indicate that the critically low sockeye returns to both Rivers and Smith Inlet in 1999 and 2000 resulted from very poor marine survival for three consecutive brood years (1994-1996), not a failure in freshwater productivity. Marine survival indices for

Owikeno and Long Lake indicate that marine survival has generally been poor for all brood years entering the ocean from 1992-1998. The critically low escapements in 1999 and 2000 are a result of the compounding effect of poor marine survival and low brood year escapements. If marine survival continues to be poor for Rivers and Smith Inlet sockeye, drastic measures may be required to prevent a downward spiral to extirpation. On the other hand, if marine survival returned to normal for sea-entry year 1999, returns to Rivers Inlet will exceed the escapement target in 2001 as a result of the above target escapement in 1997. This is not the case for Smith Inlet where escapements have been well below target since 1995.

Reviewers' Comments

Reviewer #1

This reviewer commended the authors for assessing the available Area 8, Smith and Rivers Inlet sockeye data. The conclusion that the abundance of central coast sockeye has declined as a result of adverse ocean survival rather than freshwater events is supported by the analysis. This reviewer agreed with the authors that poor escapement data is a major impediment to resource assessment of Rivers Inlet and Area 8 sockeye. Attempts to refine the validity of the clear stream index (CSI) extrapolations based on the mark-recapture experiment are noteworthy and represent an improvement over previous assessments based on Salmon Escapement Database System (SEDS) data. Attempts to develop alternative escapement estimation methods, such as the fishwheel experiment, are commendable and should be continued. Given the conservation concerns and the persistent assessment problems in particular for Rivers Inlet sockeye created by poor escapement data, the question of whether the logistics of alternative methods such as riverine acoustic methods are fully explored arises. The authors rightfully argue that even if the returns in 2001 are near the optimistic level (above the target escapement for Rivers Inlet) the consequences of a potential harvest will undermine rebuilding efforts. Except for 2001, run size projections are low for the immediate future because of low escapement resulting from the very low ocean survival rates experienced for most years in the 1990s.

The paper does not contain enough detail on the supplementation and captive broodstock recovery programs identified by the authors as a potential means to jump start Rivers and Smith stocks. This reviewer was concerned that the recovery plan developed for the Rivers Inlet stock external to the PSARC process was not available to evaluate details. Unless more detail on potential among species covariation of ocean survival is provided, the inferences in the paper that suggest ocean survival of central coast sockeye may have improved should be omitted or at least discounted.

Reviewer #2

Reviewer #2 noted that it was important to point out that the state of knowledge about Rivers and Smith Inlet sockeye has notably come together over the last two years and the working paper reflected it. This reviewer also noted that although the general lack of data makes assessment a challenge, the authors did a credible job of working with the available information. This reviewer concluded that there are still major assessment questions that can only be answered by fieldwork and expenditure of funds.

This reviewer pointed out that the authors assumed that relative escapement and productivity of clear versus silty streams has remained constant through time However, changes to silty watersheds may have occurred from logging, unstable flows, and erosion influences. This reviewer also noted that historical catch data from commercial and First Nations fisheries potentially harvesting Smith and Rivers inlet sockeye outside of Statistical Areas 9 and 10 were not included. Even though many of these intercepting fisheries have recently been reduced or eliminated this reviewer felt that it was important to include these data.

Subcommittee Discussion

The Subcommittee agreed that critically low sockeye returns to both Rivers and Smith Inlet in 1999 and 2000 resulted from very poor marine survival for the three consecutive sea entry years 1996, 1997, and 1998, and not from a decline in freshwater productivity. There has been a trend of declining marine survivals since the 1992 sea entry year. The Subcommittee agreed that this trend is also evident in total stock size for Area 8 sockeye. The congruence of all these declines suggests that central coast sockeye stocks in general experienced poor marine survival beginning in 1992, culminating in near zero marine survivals in 1996 through 1998 sea entry years.

The Subcommittee noted that future marine survivals are highly uncertain. However, marine survival for sockeye in sea-entry year 1999 may have improved given that the oceanographic and meteorological indicators for the northeast Pacific and coastal British Columbia returned to near average conditions. If marine survival has improved, returns to Rivers Inlet (Owikeno Lake) in 2001 and 2002 will exceed the target escapement as a result of the escapement in 1997 (Table 1). This is not the case for Smith Inlet (Long Lake), where escapements have been low since 1995. The Subcommittee agreed with the authors that if marine survival has returned to average levels (optimistic scenario), the returns in 2001 would be above the target escapement for Rivers Inlet. Harvest should remain at minimal levels to avoid compromising long-term recovery of this stock. Even under the optimistic scenario, returns will be below the provisional LRP for Rivers Inlet in 2004 due to recent low escapements.

The Subcommittee raised several concerns regarding various elements of the

working paper. The authors were asked to document changes to counting protocols for distinguishing sockeye and coho past the Docee fence on Long Lake now that sockeye no longer greatly outnumber coho. The authors were also asked to examine and evaluate possible stock interceptions of Rivers and Smith sockeye by commercial and non-commercial fisheries outside the areas reported in the paper. The Subcommittee noted unreported catches would not affect the current stock status assessment but may be significant for stock recovery.

The Subcommittee reiterated its concern about the ongoing problems of obtaining accurate escapement estimates for Owikeno Lake sockeye and central coast sockeye stocks in general. The Subcommittee noted that the lack of dedicated program funding for central coast sockeye stock assessments would continue to hinder the evaluation of past, present, and future production relationships. New escapement monitoring programs are presently being assessed (fishwheels) and are encouraged by the Subcommittee. The Subcommittee acknowledged the serious conservation concern for central coast sockeye stocks.

Subcommittee Recommendations

1) The Subcommittee recommended no or minimal harvests of Owikeno and Long Lake stocks, even under the optimistic scenario which would result in returns above target escapements to Owikeno in 2001 and 2002, but below the target in 2003 and below the provisional LRP in 2004.

2) The Subcommittee recommended a cautious approach to the management of Area 8 sockeye stocks due the uncertain stock status and the clear indication that they have shown similar marine survival and abundance trends as Owikeno and Long Lake stocks.

3) The Subcommittee noted that the Docee fence is critical for inseason management of central coast sockeye and recommended that this structure be maintained.

S00-21 Acoustic and trawl based estimates of juvenile sockeye salmon (*Oncorhynchus nerka*) production from 1976-1999 brood year adults returning to Smith Inlet and Long Lake, British Columbia

K. Hyatt, D.P. Rankin and B. Hanslit **Accepted subject to revisions**

Summary

Acoustic and trawl survey (ATS) procedures are now applied routinely throughout British Columbia and Alaska to produce juvenile sockeye abundance estimates of known precision to satisfy a variety of stock assessment functions. This paper reviews the development of ATS based estimates of juvenile sockeye in Long

Lake, B.C. over the 23 year interval (1977-1999) of survey work there and includes an examination of: (i.) the general methods used for ATS abundance estimates, (ii.) the potential effects of changes in survey personnel, instrumentation, field procedures and environmental effects on the reliability of ATS estimates, and (iii.) the most appropriate set of ATS estimates to resolve critical stock assessment issues about whether recent declines of Long Lake sockeye have principally fresh water or marine origins.

Work completed here indicates that improvements in ATS estimates of juvenile sockeye abundance are required in multi-species fish communities such as those encountered in Long Lake. This may be achieved by applying size and species-specific adjustments to trawl catch data used to partition acoustics estimates of all fish into species specific estimates of abundance. Further, analysis based on revised juvenile sockeye abundance estimates, suggests that recent declines in adult escapement have been associated with significant increases in freshwater survival of Long Lake sockeye. Recommendations suggested by the authors are that: (i.) preliminary, historic estimates of juvenile sockeye abundance should be replaced with the revised estimates of abundance provided in the present paper and (ii.) ATS estimates of juvenile sockeye abundance in Long Lake be conducted during a summer- fall interval and then again during the late winter (Jan-March) of each year.

Reviewers' Comments

Reviewer #1

The first reviewer felt that the paper provides an excellent source of information on juvenile sockeye salmon populations and other limnetic fish species in coastal B.C. lakes. He indicated that the goals were clearly stated, and that the methodology and data supports the authors' conclusions. He agreed with the authors' recommendations but urged caution in declaring the values in the paper to be "final" estimates. This reviewer recommended that the authors apply and evaluate two additional methodologies that could potentially increase both the accuracy and precision of acoustic surveys, namely measurement of effective beam width and determination of limnetic fish size and target strength.

Reviewer #2

The second reviewer felt that the authors had done a good job of documenting methods and taken a reasonable approach to identify and correct the capture efficiency issue. He did not, however, feel that hydro-acoustic/trawl method used at Long lake produces reliable estimates of true sockeye abundance nor even an index of true abundance as there has been no calibration of the method with accurate estimates of overall production from the lake. This reviewer was concerned about this point as he could find no relationship between brood year escapement and subsequent juvenile production, nor any density dependent

relationship between total fish density determined hydro-acoustically vs sockeye size. Both types of relationships have been shown previously on other lakes with juvenile sockeye. This reviewer recommended the inclusion of further statistical evaluation on the decrease in efficiency seasonally and that more effort be directed to obtaining absolute, as opposed to index, estimates of juvenile production from Long Lake, given the comprehensive information on catch and escapement over the years.

The authors noted that the provided estimates of juvenile abundance of sockeye in Long Lake are of unknown accuracy but, as a result of the analytical approaches in this paper, are of improved precision (plus or minus 35%). They agreed that it would be useful to have an absolute estimate of production of sockeye smolts from Long Lake, however, noted that most methods of obtaining such values would also produce only estimates, whose accuracy would be unknown (i.e. mark-recapture techniques). The authors pointed out that calibration of the acoustic/trawl sampling method would be valuable over a few years. They stated that they are now able to explain about 60% of the variance in abundance as a result of incorporating corrections based on fish size. They felt that additional investigation into other possible controlling factors, such as moon phases, as suggested by the reviewer would not be fruitful. As well, they noted that many such variables were not continuous.

Concerning the comments of one reviewer, that density dependent effects did not seem evident and the juvenile abundance did not relate to spawner escapement, the authors pointed out that the effect of other species such as sticklebacks would have to be included in such analyses.

Subcommittee Discussion

The Subcommittee requested that the paper present both the revised and previous estimates and that both estimates be displayed graphically to show where changes occurred, as now shown in Figure 5.

The Subcommittee accepted that the issues raised concerning beam width and fish size/target strength would only be applicable if the method involved echo integration. The authors' methods use echo counting, not echo integration, and hence additional determinations of beam width and target strength were not necessary.

The Subcommittee discussion focussed on the need for an independent estimate of the production of sockeye smolts from Long Lake to assess the accuracy of the ATS estimates. Such assessment is important because the Long Lake system is currently a sockeye indicator system for the Central Coast. Where similar acoustic/trawl surveys have been used to estimate sockeye abundance in Northern B.C. (Tahltan Lake), there is also a weir for calibrating such estimates and it has been noted that the acoustic survey technique produced negatively

biased estimates of acoustic estimates of fish targets. It is likely that estimates produced by this technique in Long Lake are similarly biased. The Subcommittee also noted that in one year, the late winter surveys estimated more sockeye in the lake than the fall survey.

The Subcommittee acknowledged the difficulty in estimating sockeye populations in Long Lake by ATS methods and recognized that the authors had addressed, to the extent possible, the variance introduced as a result of changing sockeye size over the season and its influence on their catchability, and stickleback effects. The Subcommittee was concerned about other potential but unaccounted sources of variability, particularly the separation of sockeye and stickleback populations, and agreed that independent assessments would improve the reliability of the estimates. Confidence in the estimates is necessary to partition freshwater and marine survivals, as recovery strategies for central coast sockeye in general depend on this knowledge.

Subcommittee Recommendations

1. The Subcommittee recommended that the preliminary historic estimates of juvenile sockeye abundance by brood year be replaced with estimates provided in this paper, and that these revised estimates be used as indices of abundance.

2. The Subcommittee recommended that annual acoustic/trawl survey estimates of juvenile sockeye abundance be maintained and continue at least two surveys annually to monitor over-winter growth and survival success.

3. The Subcommittee recommended that the accuracy of the ATS estimates be calibrated with absolute counts/estimates of smolt production at Long Lake. Such estimates would require either a weir count or extensive mark-recapture estimation techniques.

S00-22 Early returning chinook salmon of the Fraser River Watershed

R.E. Bailey, J.R. Irvine, J. Candy, C.K. Parken, S.L. Lemke, M. Sullivan and N. Todd **Not Accepted**

Subcommittee Recommendations

The Subcommittee did not accept this working paper. The Subcommittee encouraged the authors to address the suggestions of the reviewers and the Subcommittee and to re-submit for PSARC review in time for fisheries management planning for the 2001 fishing season.

APPENDIX 1: PSARC SALMON SUBCOMMITTEE MEETING AGENDA, NOVEMBER 14-16, 2000

PSARC Salmon Subcommittee Meeting Agenda
November 14-16, 2000
Seminar Room, PBS, Nanaimo

Tuesday, November 14, 13:00-16:30

Acoustic and trawl based estimates of juvenile sockeye salmon *(Oncorhynchus nerka*) production from 1976-1999 brood year adults returning to Smith Inlet and Long Lake, British Columbia (K. Hyatt et al.)

Assessment of Rivers and Smith Inlet sockeye salmon, with commentary on small sockeye salmon stocks in statistical area 8 (D. Rutherford et al.)

Wednesday, November 15, 08:30-16:30

Status in 1999 of coho stocks on the West Coast of Vancouver Island (D. Dobson et al.)

Early returning chinook salmon of the Fraser River watershed (Bailey et al.)

Lunch

Review of Rapporteur reports

Thursday, November 16, 08:30 – 14:30

Review of Rapporteur reports/General Subcommittee Discussion and Concerns

APPENDIX 2: PSARC SALMON WORKING PAPERS FOR NOVEMBER 2000

Paper #	Title	Authorship
S00-19	Status in 1999 of coho stocks on the West Coast of Vancouver Island	D. Dobson K. Simpson J. Till R. Ferguson P. Tschaplinski S. Baillie
S00-20	Assessment of Rivers and Smith inlet sockeye salmon with commentary on small sockeye salmon stocks in statistical area 8	D. Rutherford C. Wood
S00-21	Acoustic and trawl based estimates of juvenile sockeye salmon (*Oncorhynchus nerka*) production from 1976-1999 brood year adults returning to Smith Inlet and Long Lake, British Columbia	K. Hyatt D.P. Rankin B. Hanslit
S00-22	Early returning chinook salmon of the Fraser River Watershed	R.E. Bailey J.R. Irvine J. Candy C.K. Parken S.L. Lemke M. Sullivan N. Todd

APPENDIX 3: PARTICIPANTS AT SALMON SUBCOMMITTEE MEETING, NOVEMBER 14-16, 2000

Subcommittee Chair: Allan Macdonald
PSARC Chair: Max Stocker

DFO Participants	**Tues**	**Wed**	**Thurs**
* Subcommittee Members			
Anderson, D.*		✓	
Bailey, D.*	✓	✓	
Bailey, R.		✓	
Cass, A. *	✓	✓	✓
Cox-Rogers, S.*	✓	✓	
Dobson, D.	✓		
Ennevor, B.		✓	
Ferguson, R.		✓	
Finnegan, B.	✓	✓	
Godbout, L.	✓		
Hargreaves, B.*	✓	✓	✓
Holtby, B.*	✓	✓	✓
Hyatt, K.*	✓	✓	✓
Irvine, J.*	✓	✓	✓
Ladwig, A.	✓		
Matthews, I.		✓	
Meerburg, D.*	✓	✓	✓
Potyrala, M.	✓		
Rankin, P.	✓		
Rutherford, D.	✓	✓	
Schubert, N.		✓	
Simpson, K.		✓	
Sullivan, M.*		✓	✓
Tanasichuk, R.		✓	
Till, J.		✓	
Wood, C.*	✓		✓
External Participants:			
Atkinson, M.	✓	✓	
Kristianson, G.		✓	
Milligan, L.		✓	
Staley, M.	✓	✓	
Starr, P.		✓	
Tautz, A.*	✓	✓	

Warren, R.	✓		
Wilson, B.	✓		
Wilson, K.	✓	✓	
Observers:			
Blackbourn, D.	✓	✓	

List of Reviewers

Bradford, M.	DFO, Marine Environment and Habitat Science
Cass, A.	DFO, Stock Assessment Division
Hume, J.	DFO, Marine Environment and Habitat Science
Luedke, W.	DFO, Stock Assessment Division
Rutherford, D.	DFO, Stock Assessment Division
Starr, P.	Canadian Groundfish Research and Conservation Society
Wilson, K.	Fraser River Aboriginal Fisheries Resource Conservation Council
Wood, A.	Consultant

TABLES AND FIGURES

Table 1. Projected returns to Owikeno and Long Lake based on pessimistic and optimistic survival rates.

OWIKENO LAKE

Scenario [a]	Brood Year	Escapement [b]	Sockeye Returns in Calendar Year 2001	2002	2003	2004
Pessimistic	1996	45600	1398			
	1997	249300	4197	7642		
	1998	35900		604	1100	
	1999	3600			60	109
	2000	20000				337
	Combined		**5,595**	**8,246**	**1,160**	**109**
Optimistic	1996	45600	1398			
	1997	249300	238720	434695		
	1998	35900		34357	62563	
	1999	3600			3390	6173
	2000	20000				19151
	Combined		240,118	469,052	65,953	**25,324**

LONG LAKE

Scenario [a]	Brood Year	Escapement [b]	Sockeye Returns in Calendar Year 2001	2002	2003	2004
Pessimistic	1996	54000	1349			
	1997	32000	419	778		
	1998	76000		995	1847	
	1999	5900			72	133
	2000	1430				18
	Combined		**1,768**	**1,773**	**1,919**	**151**
Optimistic	1996	54000	1349			
	1997	32000	25648	47632		
	1998	76000		60914	113126	
	1999	5900			4729	8782
	2000	1430				1074
	Combined		26,997	108,546	117,855	9,856

[a] Pessimistic scenario assumes continued poor survival (as measured for sea-entry year 1996)
Optimistic scenario assumes a return to the long term average survival rate

[b] Escapement target is 200,000 sockeye

Bold type indicates projected stock sizes that fall below the provisional Limit Reference Points (LRP's)
Provisional LRP's are 30,000 and 8,000 for Owikeno and Long Lake sockeye respectively (Holtby 2000)

Figure. 1. Marine exploitation of Robertson Hatchery fish, 1976 to 1999.

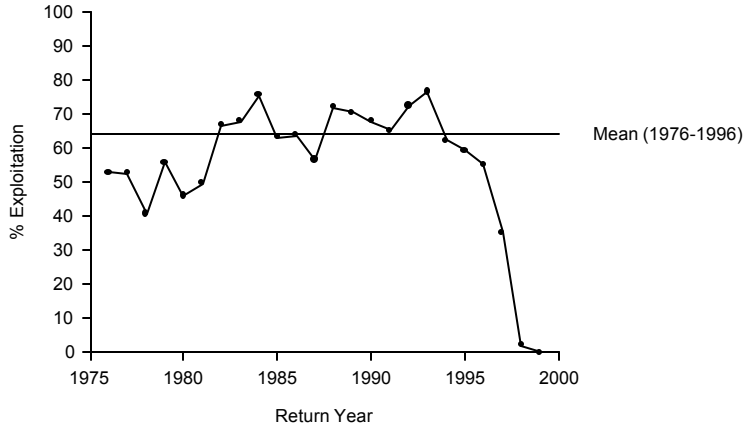

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Figure 2. Survival of Carnation Creek (line) and Robertson Hatchery (bars) stocks, 1976 to 1999 return years.

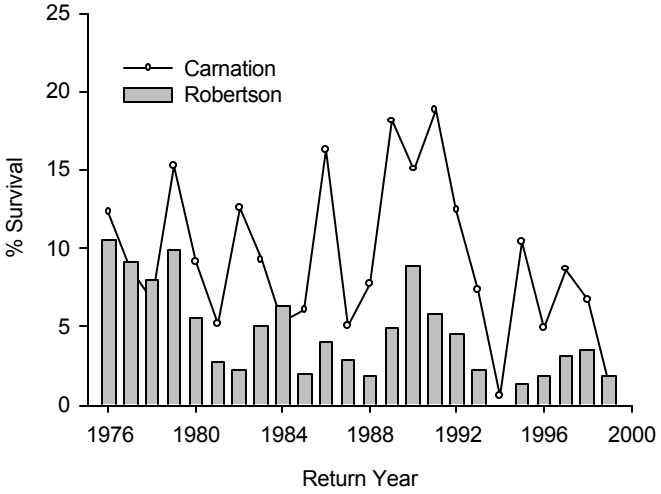

Figure 3. Abundance indices of the northern (NWVI) and southern (SWVI) stock aggregates of coho of the west coast of Vancouver Island.

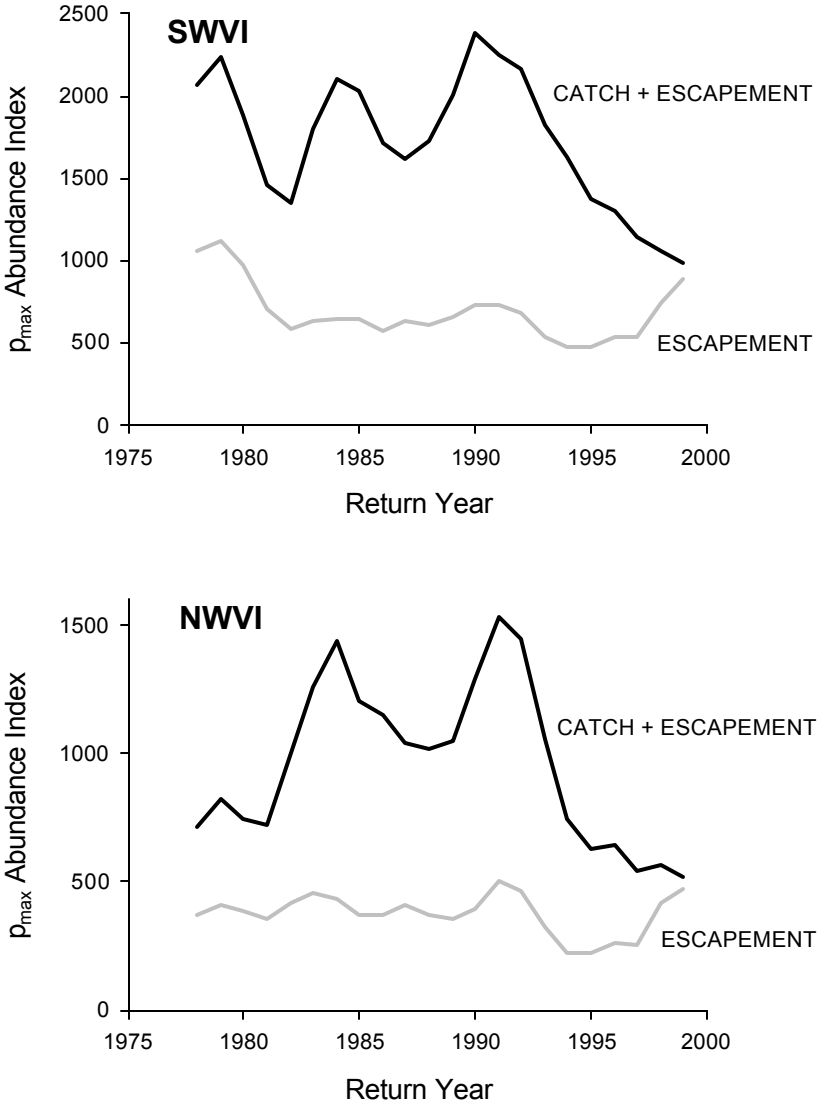

Figure 4. Trends in total stock size for Area 8, 9, and 10 sockeye salmon.

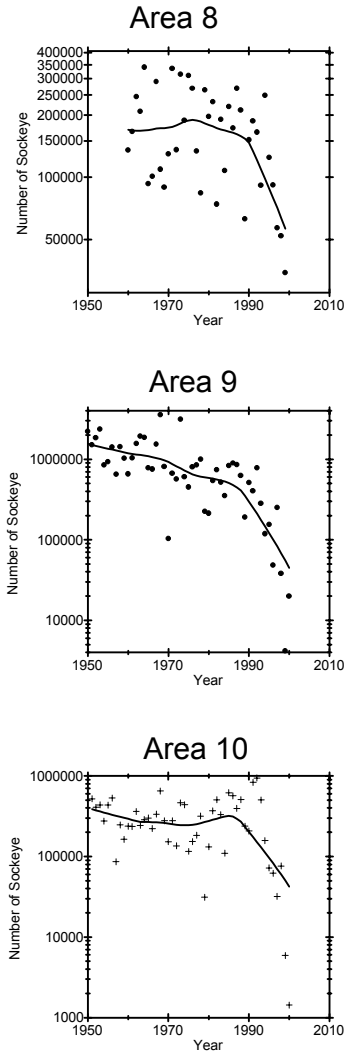

Figure 5: ATS Estimates of Long Lake Sockeye Fry