2013 MARINE SURVIVAL FORECAST OF SOUTHERN BRITISH COLUMBIA COHO

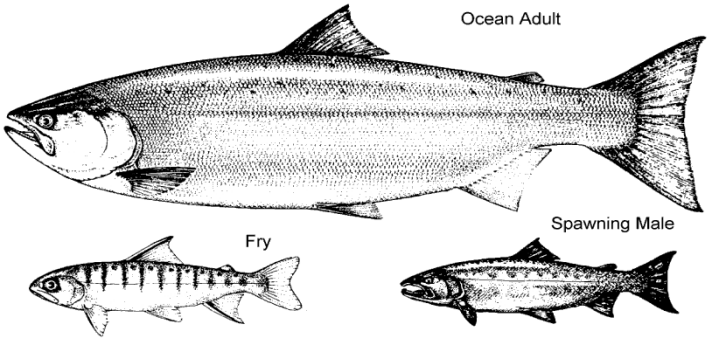

Figure 1: Coho salmon at three life stages: freshwater rearing fry; ocean rearing adult; and returning male. This image has been used on previous coho Stock Status reports, origin unknown.

Figure 2: The Province of British Columbia, showing the major rivers in the South Coast, Lower Fraser and Interior BC areas.

SUMMARY

Indicator marine survivals and aggregate abundances from 2012 were generally higher than the previous year with the exceptions of Quinsam Hatchery and Carnation Wild (same) and Robertson Hatchery (lower). The Interior Fraser aggregate abundances and Lower Fraser Hatchery indicator marine survival in particular at least doubled over the previous year.

The 2013 forecast for coho indicators are mixed with some indicators increasing, decreasing or remaining the same from 2012.

The trend of low marine survivals that started in the 1990's is continuing although the tread over the last few years suggest a slight rise. Restrictive fishing regulations have been eased recently with openings on marked hatchery coho and some localized unmarked openings.

The result from the Goldstream Hatchery indicator is not representative of actual marine survival trends because of the unusual source of mortality from the fuel spill during the release of smolts in 2011. Despite this unusual source of smolt mortality, the marine survival of this indicator still increased slightly from the previous year.

INTRODUCTION

Previously, marine survival or aggregate abundance forecasts for southern BC coho stock groups have been published as Science Advisory Reports. Starting in 2012, this information is set out in an unpublished internal document for use in coho stock management processes.

Descriptions of the assessment methods, data sets, forecast models and sources of uncertainty have been documented in previous papers and will not be described herein. For more information see Simpson et al. (2004), DFO (2006), DFO (2007), DFO (2008), DFO (2009) and DFO (2012). Baillie et al. (2005) and DFO (2005) are similar reports that are unpublished but are available from the author.

The data set used for the Area 12/13 aggregates is based on a subset of coho populations from each Area. It does not represent the entire abundance of coho. For the Interior Fraser aggregates, the data does represent the estimated total abundance for those areas. All other indicators in this forecast use the survival rate between release of smolts and the resulting return of adult coho.

Directed commercial and recreational fisheries on coho were severely restricted in the late 1990s in response to decreasing stock abundances. Until recently most exploitation of coho was incidental catch in fisheries that targeted other species. Generally, non-retention of unmarked coho is in effect in most areas except for Food, Social and Ceremonial fisheries for First Nations in specific areas where local abundances allow for retention of unmarked coho (PSC 2013).

Graphical depictions of the observed marine survival or aggregate abundance for all coho indicators used in this forecast are shown in Appendix 1.

RESULTS

Appendix 2 shows the observed 2011 and 2012 values, and the results from the forecast models for 2013.

Johnstone Strait/Mainland Inlets

In 2012 the observed return in Area 12 was 37% higher than forecast and the Area 13 return was about 20% lower than forecast. The Area 12 return was 5% greater than the 2009 brood return and approximately 85% higher than what was estimated for the previous year's return (2011). The Area 13 return demonstrated a 52% decrease in abundance relative to the brood year (2009) and 16% lower than the previous year's return (2011). Based on the observed 2012 returns at those and other system in the area, marine survival had improved in Area 12 and declined slightly in Area 13 relative to the 2011 return.

The Area 12 and 13 2013 forecasts are very similar to the brood returns in 2010. The Area 12 and 13 forecasts are respectively 30% lower and 18% higher than the 2012 observed indices. Coho abundance in this region remains low and can be characterized

as 'below average' for both Area 12 and 13 stocks. See Simpson et al. (2004) for description of characterizations.

Georgia Basin – West
The observed 2012 marine survival from Quinsam Hatchery continues to be at a low level of 0.8% but the survival at Big Qualicum Hatchery improved to 1.4%. In the previous year survivals at both indicators were 0.8% and 0.9%, respectively.

The marine survival estimate for Goldstream Hatchery is compromised by a fuel spill during the sea entry period of 2011. The spill occurred immediately after the coded-wire tagged cohort of coho smolts had been released into the river. Subsequently there was a massive fish kill in the river, the extent of which was not estimated at the time. Despite this event, the marine survival estimate still improved from the previous year from 0.6% to 0.7% however this survival estimate is not indicative of the actual marine survival, which likely would have been higher without the fuel spill.

The 2012 marine survival of the wild indicator, Black Creek, increased slightly from 1.3% to 1.4%. The 2013 forecast is for a slight increase to 1.5%.

The 2013 marine survival forecast indicates that the hatchery stocks will continue to survive between 0.7% and 1.2% and the wild stocks will increase slightly to 1.5%.

The marine survival forecast, using a CPUE model, for the Inside Hatchery Aggregate (Quinsam, Big Qualicum and Inch) indicates that the marine survival will remain at the average observed rate of 1.8%

Georgia Basin – East
The 2012 marine survival for the wild indicator, Myrtle Creek, increased from the previous year from 2.2% to 3.0%. The 2013 forecast model indicates that this stock will drop to 2.2%, a level that is slightly higher than the Georgia Basin – West wild indicator at Black Creek.

Lower Fraser
2012 marine survival from the Inch Creek Hatchery indicator increased from 1.0% in the previous year to 3.5%. The best performing forecast model indicates that this stock will remain at 3.5% in 2013.

Interior Fraser
The observed 2012 aggregate abundance for the Thompson River basin and Interior Fraser coho aggregates increased substantially from the previous year. The modeled exploitation rates (not shown) on these stocks remain at the 13% level where they have been since the 2003 return. The 2013 forecast model indicates that the level of population abundance will decrease from the previous year but still higher than 2011.

Southwest Vancouver Island
Observed 2012 marine survival for the hatchery indicators dropped from the previous year from 10.6% to 6.0%. The marine survival for the wild indicator remained at the same level of 1.4%.

The forecast models indicate that the marine survivals for both the hatchery and wild indicators will increase in 2013 to 8.6% and 3.4%, respectively.

ACKNOWLEDGEMENTS

The coho forecast for southern British Columbia requires data from many sources and is very much a collaborative document. Steve Baillie completed analysis of Strait of Georgia and WCVI indicators. Data analysis of Inch Creek and Thompson River coho was completed by Lynda Ritchie and Johnstone Strait by Pieter Van Will.

Fresh water creel survey data were provided by Lower Fraser STAD staff, and Joan Bennett (Strait of Georgia). The marked coho escapement for Robertson Creek Hatchery was supplied by Jeff Till. The CPUE data were collected by Dr. Ruston Sweeting and his staff. Cheryl Lynch provided escapement data from the hatcheries. Wild coho data were provided by Dave Nagtegaal (Black Creek), Ian Matthews (Myrtle Creek) and Dr. Peter Tschaplinski (BC Ministry of Environment - Carnation Creek). Thanks to Dr. Marc Trudel for contributing the Growth Model for forecasting marine survivals of WCVI salmon stocks.

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FOR MORE INFORMATION

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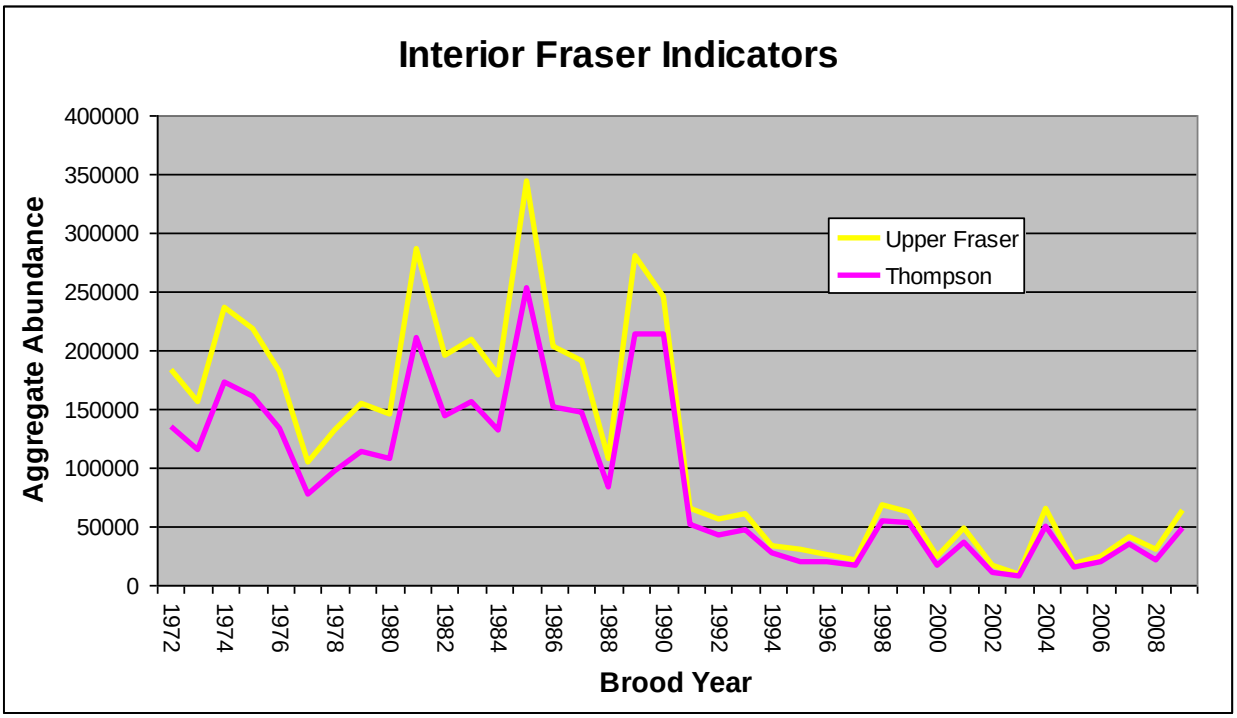
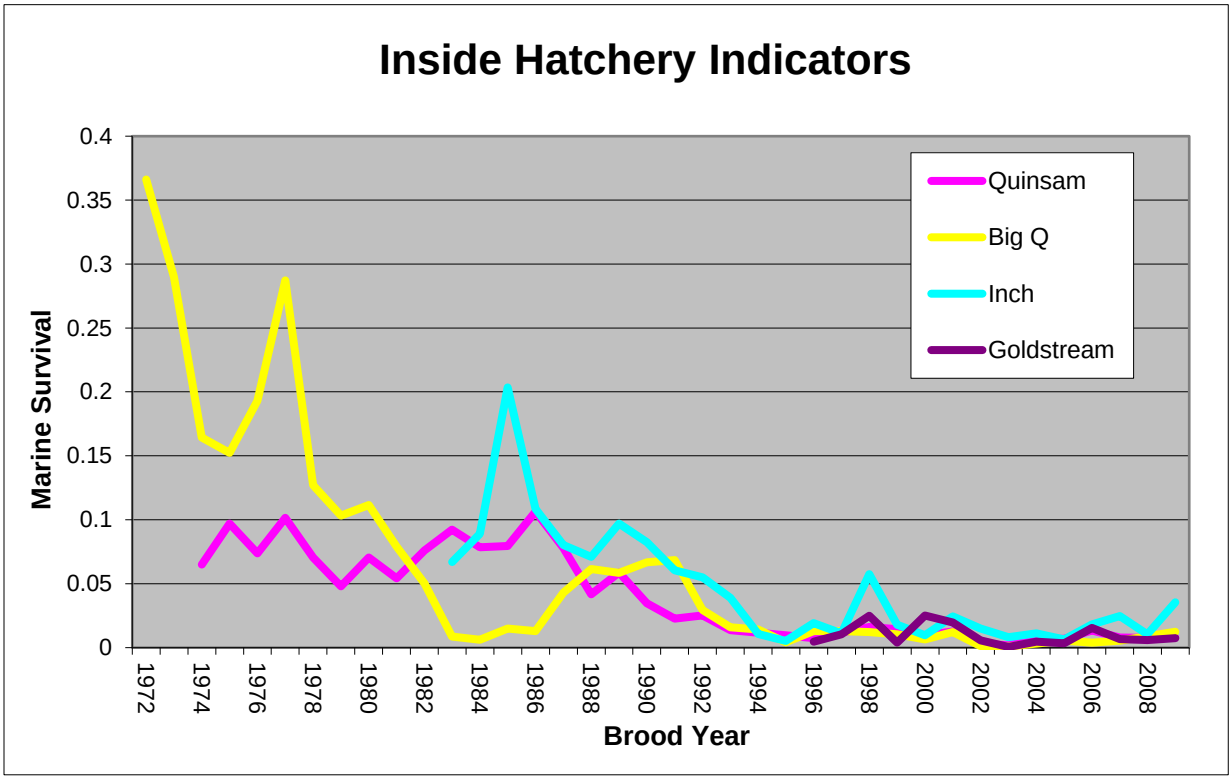
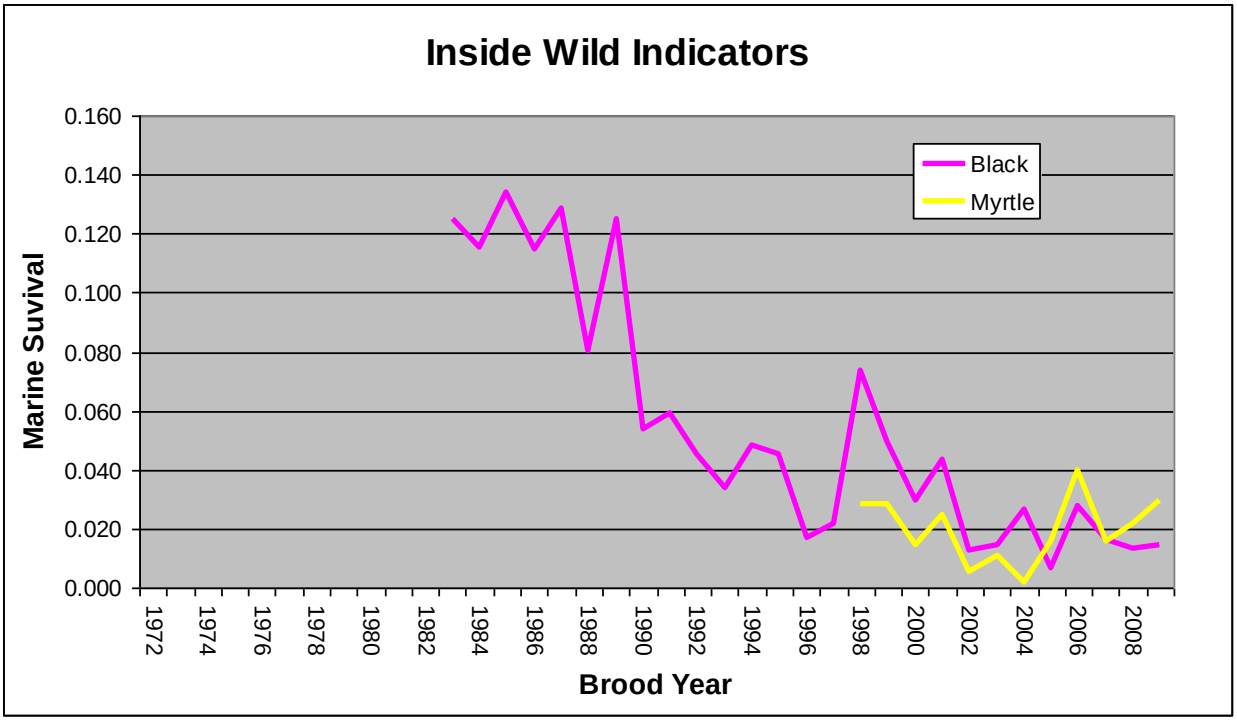
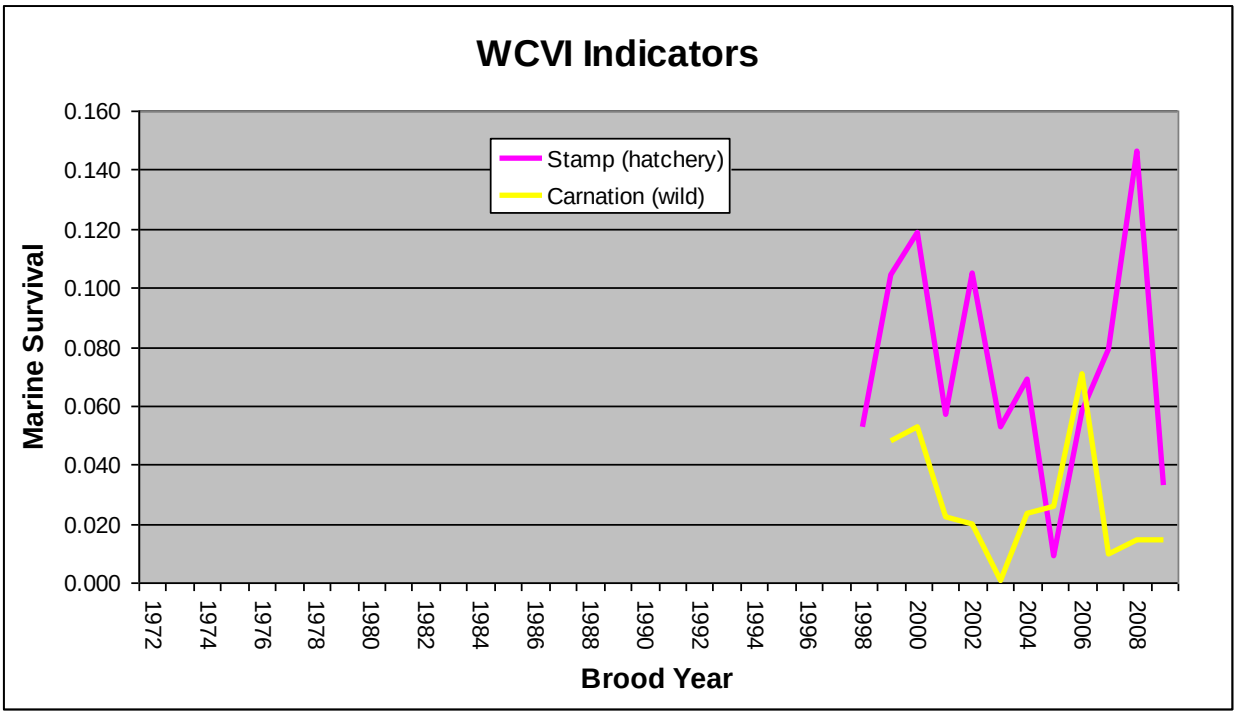
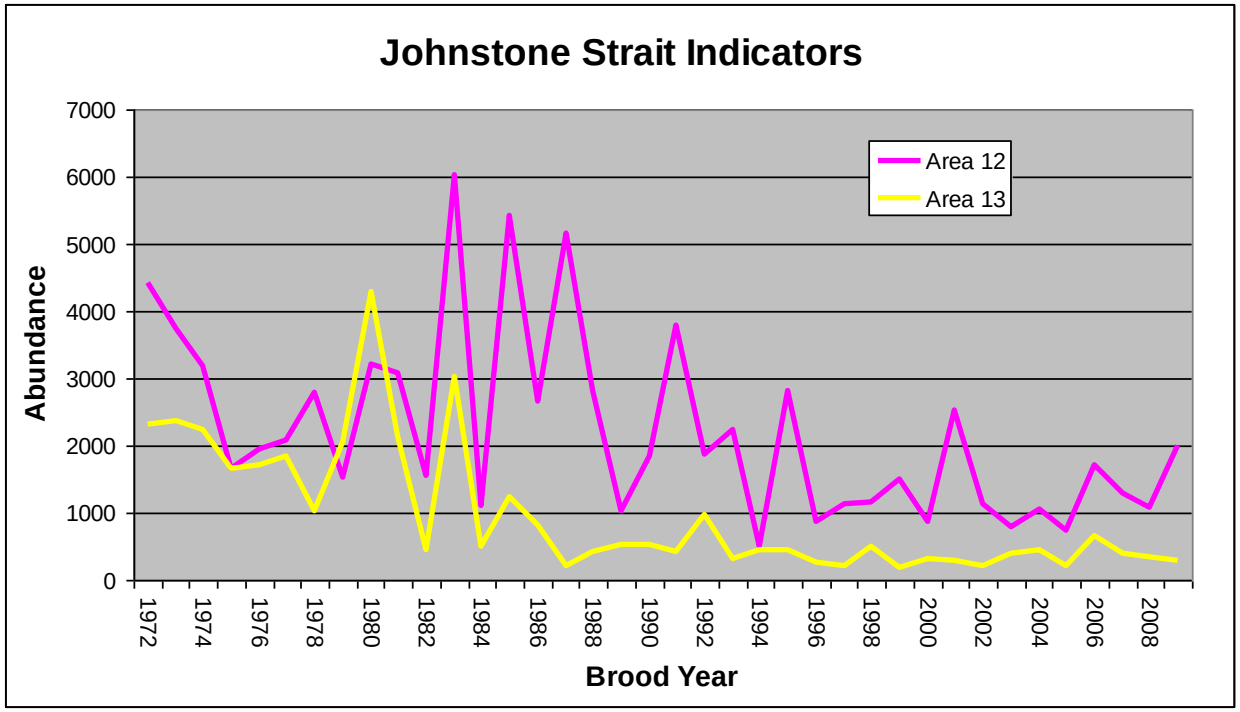
Appendix 1. Marine survival or aggregate abundances for southern BC coho indicators.






Inside Wild Indicators
Marine Suvival
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Black
Myrtle
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Brood Year


WCVI Indicators
Marine Survival
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Stamp (hatchery)
Carnation (wild)
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Brood Year



Appendix 2. Observed and forecast marine survival and aggregate abundance indicators from southern BC coho indicator stocks.

Column Headings

Stock: The name of the Management Unit in **Bold**, followed by the individual indicator or stock grouping within that Management Unit.

2011 Observed: The values in this column represent either the aggregate value (whole numbers) or the estimated marine survival (decimal numbers), from the 2011 return year.

2012 Forecast, 50% CI, and Model refer to the forecast for the 2012 return year. The actual forecasted value is given first, followed by the 50% confidence interval, then the forecasting model used.

2012 Observed, Change from forecast and Change from 2011 refer to the estimated values for each indicator, then the % change from the forecasted value and the observed value in the previous year. The % change is in relation to the base value so a marine survival of 1.5% in year one increasing to 2.0% in the next year is expressed as a 33% change. A decrease of 2.0% to 1.5% is expressed as a – 25% change.

2013 Forecast, 50% CI and Model refer to the forecast for the current year.

Change from 2012 is the change in value from the observed 2012 to the 2013 forecast.

Stock	2011	2012			2012	Change from	Change from	2013			Change from
	Observed	Forecast	50% CI	Model	Observed	forecast	2011	Forecast	50% CI	Model	2012
Johnstone Strait/Mainland Inlets											
Area 12	1,135	1,456	970 - 2183	3YRA	2,002	38%	76%	1,405	935 - 2111	3YRA	-30%
Area 13	244	347	148 - 522	3YRA	280	-19%	15%	330	220 - 494	3YRA	18%
Georgia Basin - West											
Big Qualicum Hatchery	0.009	0.009	0.005 - 0.016	LLY	0.012	33%	33%	0.012	0.001 - 0.022	LLY	0%
Quinsam Hatchery	0.008	0.009	0.006 - 0.014	3YRA	0.008	-11%	0%	0.008	0.005 - 0.011	3YRA	0%
Goldstream Hatchery	0.006	0.008	0.003 - 0.022	3YRA	0.007	-13%	17%	0.007	0.003 - 0.016	3YRA	0%
Black Creek (wild)	0.013	0.018	0.013 - 0.026	3YRA	0.014	-22%	8%	0.015	0.010 - 0.021	3YRA	7%
Georgia Basin - East											
Myrtle Creek (wild)	0.022	0.024	0.010 - 0.056	3YRA	0.030	25%	36%	0.022	0.010 - 0.048	3YRA	-27%
Lower Fraser											
Inch Hatchery	0.010	0.010	0.006 - 0.018	LLY	0.035	250%	250%	0.035	0.021 - 0.060	LLY	0%
St Geo Hatchery aggregate	0.009	0.008	0.006 - 0.009	CPUE	0.018	125%	100%	0.018	0.016 - 0.020	CPUE	0%
Interior Fraser											
Interior Fraser watershed	25,487	31,036	19,793 - 48,665	3YRA	54,832	77%	115%	42,729	27,091 - 67,393	3YRA	-22%
Thompson River aggregate	18,578	24,394	15,426 - 38,574	3YRA	42,364	74%	128%	33,342	20,986 - 52,972	3YRA	-21%
South-west Vancouver Island											
Robertson (Stamp Falls) Hatchery	0.106	0.044	0.035 - 0.055	Growth	0.060	36%	-43%	0.086	0.069 - 0.106	Growth	43%
Carnation Creek (wild)	0.014	0.011	0.008 - 0.018	Growth	0.014	27%	0%	0.034	0.024 - 0.049	Growth	143%