Forecast for Southern British Columbia Coho Salmon in 2005

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Synopsis

Marine Survival. We expect the marine survival of coho in the Georgia Basin be poor and the survival of west coast of Vancouver Island coho will probably be less than average. Survivals on both coasts of Vancouver Island will probably be no greater than survivals seen in 2004. We don't expect survivals to change in the Lower Fraser Management Unit. Trawl catches of this brood confirm that survivals will likely be lower this year for 'inside' stocks in general.

Abundance. Coho returns to Queen Charlotte Strait and Johnstone Strait are forecast to decline from 2004. Returns to Area 13 are expected to be near the 51 year record low and the forecast Area 12 return is below average. Given similar returns in the last several years, the status of coho in both Areas can be considered low.

The forecast return to the Thompson River watershed is about 31,000, which is approximately 46% of the geometric mean abundance of the time series and represents an expected decrease from the 2002 brood abundance of 53,000 animals. The 2004 return was ~34,000.

Wild abundance on the west coast of Vancouver Island is expected to increase. Since survivals are forecast not to improve, increased returns will be the result of higher smolt abundances for this brood if the survival forecast is accurate.

Introduction

A southern British Columbia coho forecast document has been submitted to PSARC annually since 1996. These documents describe in detail the data sources for the forecast models and the models themselves. This paper represents a format change from previous forecast papers. The PSARC Salmon sub-committee have requested a short document that presents the 2005 coho forecast without the extensive background documentation. This format is to be used as long as there are no substantive changes to the models used in previous PSARC papers. There have been only three changes from the 2004 forecast: (1) forecasts were omitted for coho in Areas 7, 8 and 11; (2) the Str. of Georgia trawl CPUE forecast was re-commenced; and (3) the Chilliwack Hatchery coho stock has been deleted as an indicator.

Methods

Abundance and Survival Forecasts

The data sources, treatments and forecast models used for this document are identical to those used in the previous forecast (Simpson et al. 2005). Some of the following models are applied to forecast each stock aggregate or indicator:

1. Time Series Models. The following four models were applied in all abundance and survival forecasts:

- 'Like last year' (LLY): the survival or abundance will remain the same as the previous year

- Three year average (3YRA): the survival or abundance will equal the mean over the previous three years
- One year trend (RAT1): the change in survival or abundance from last year to this will equal the previous change (from two years ago to last year)
- Average three year trend (RAT3): the change in survival or abundance from last year to this will equal the mean of the previous three changes

2. Sibling Model. This forecasts the adult return to an indicator using a regression that relates past adult returns to the escapement of jacks one year prior. Forecast returns to hatcheries are converted to forecasts of survival by dividing returns by the smolt releases.

3. Euphausiid Model. This model forecasts the return to Carnation Creek using a regression that relates past adult returns to the abundance of an euphausiid species in Barkley Sound one year prior. This species is an important prey for coho in Barkley Sound. [R. Tanasichuk]

4. CPUE Model. This is a forecast of the total return of AdCWT coho to the three hatchery indicators in the Georgia Basin: Quinsam, Big Qualicum and Inch. The catch of hatchery-marked coho in July of their first year in the Strait is related in a regression to the AdCWT return to these hatcheries the following year. The catches are from a standard trawl survey conducted annually. The return forecast is then divided by the total Ad/CWT release from the hatcheries to provide a marine survival forecast. [R. Sweeting]

5. Stock-Recruit Model. The time series of standardized escapements and returns to Area 12 and Area 13 streams were used as inputs to Ricker stock-recruitment analyses, which were then used to forecast recruitment and returns using observed spawner indices in the brood year. [P. van Will]

A retrospective analysis is done for each time series model to choose the one with the best fit to the observed data. If other models were also used, e.g. a sibling model, we did retrospective analyses for them and compared them to the best time series model (using common time periods). We used the forecast from the model that best fits past data.

Distribution Forecast

Young coho originating in the Georgia Basin are thought to rear in the Strait of Georgia until the fall, when they primarily migrate to the west coast of Vancouver Island. A varying proportion return to the Strait soon after, in late winter, and are available to 'inside' fisheries in their last year at sea. This proportion has been related to salinity in the strait in this late winter period: low salinities are associated with few coho returning early. The salinity model predicts the proportion of catch taken in the strait if pre-1997 fishing regimes were in place and this proportion, P_{inside}, is now used as an index of inside distribution. P_{inside} should not be interpreted as the proportion that is occupying the strait in their last year.

Abundance and Survival Forecasts

The following table presents the observed 2004 marine survival or return (catch plus escapement) for all indicators or aggregates, and the corresponding forecast for 2005.

	2004	2005			Change (2005 forecast
	Observed	Forecast	50% CI	Model	minus 2004 observed)
Johnstone Strait [1]					
Area 12	2,213	1,458	993 - 2,140	3YRA	-34%
Area 13	201	168	113 - 249	3YRA	-16%
Georgia Basin West					
Big Qualicum	0.012	0.012	0.008 - 0.019	LLY	0%
Quinsam	0.013	0.012	0.009 - 0.016	3YRA	-8%
Black (wild)	0.044	0.040	0.029 - 0.056	3YRA	-9%
Lower Fraser					
Inch	0.025	0.025	0.013 - 0.044	LLY	0%
Salmon (wild)	0.043	0.043	0.031 - 0.058	LLY	0%
Str. Of Geo. Hatcheries [2]	0.016	0.011	0.010 - 0.012	CPUE	-32%
Interior					
Thompson aggregate	34,476	30,688	19,527 - 48,230	3YRA	-11%
West coast of Vancouver Island					
Robertson	0.039	0.033	0.020 - 0.053	Sibling	-15%
Carnation (wild) [3]	151	214	156 - 272	Euphausiid	42%
Distribution Index (P_{inside})	0.40	0.14	0.10 - 0.21	Salinity	-64%

[1] Average return (catch plus escapement) per monitored stream.

[2] Total return to Inch, Big Qualicum and Quinsam hatcheries of Ad-CWT adults divided by the total release of Ad-CWT coho from those hatcheries.

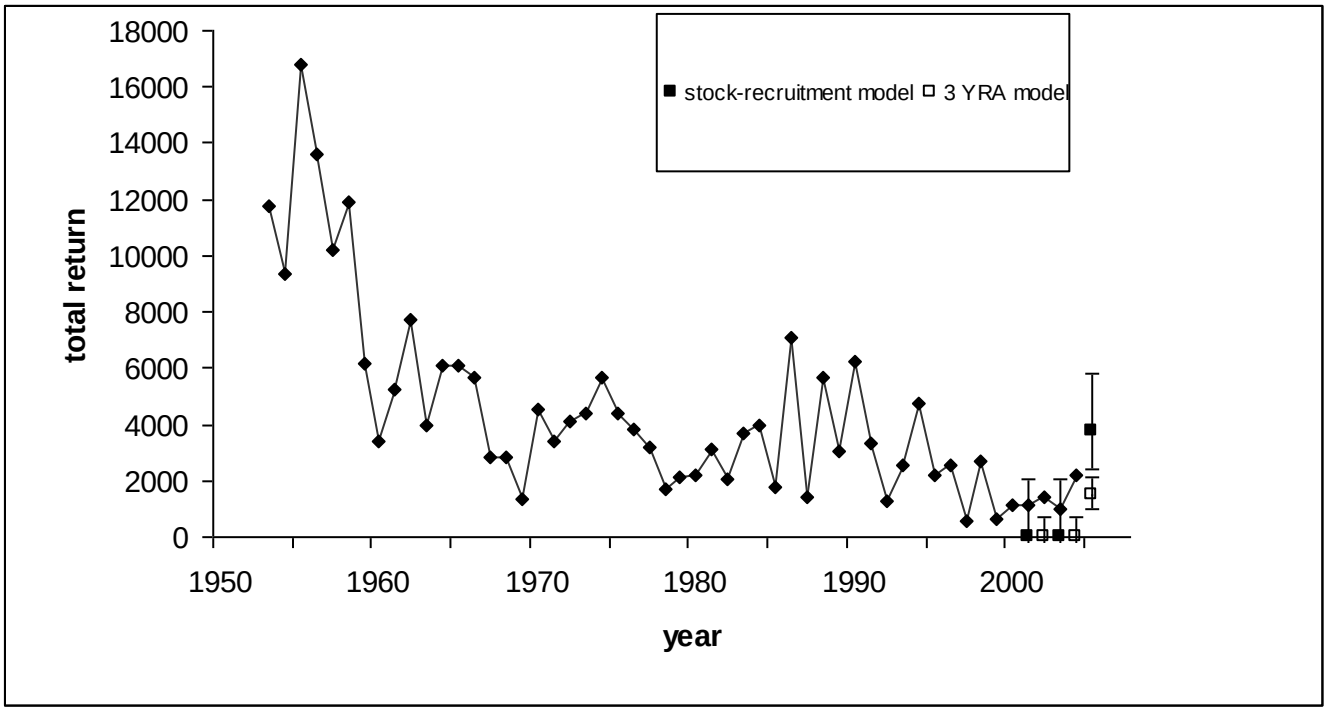
[3] Return of all adults to Carnation Creek (tagged and untagged)

Johnstone Strait / Queen Charlotte Strait Management Unit

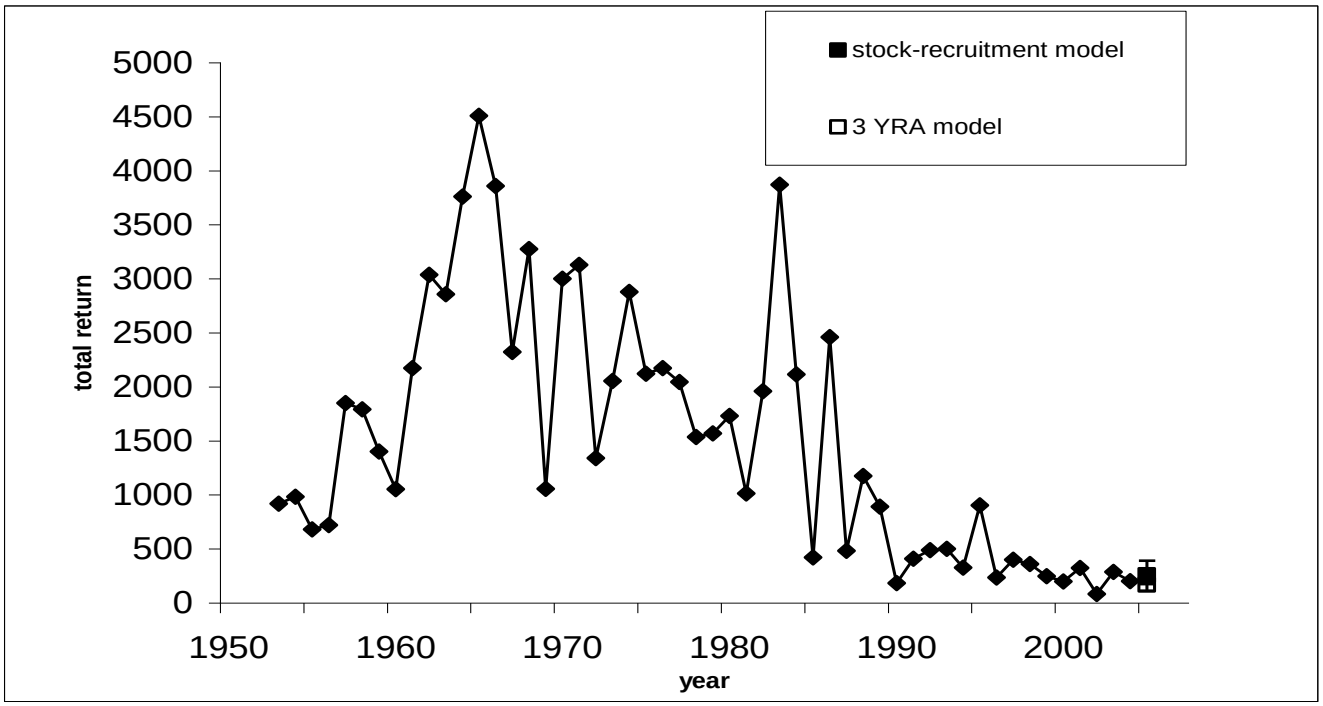
In 2004 the observed return in Area 12 was 65% higher than forecast and the Area 13 return was about as forecast. The Area 12 return was approximate double the brood and over double the previous year return. The Area 13 return was less than the brood year, 2001, and less than the previous year.

The Area 12 and 13 forecasts are approximately the same as the brood and greater than brood, respectively. They are less than 2004 by 17% and 34%, respectively. Coho abundance in this region remains poor and can be characterized as 'below average' (Area 12) and 'well below average' (Area 13). See Simpson et al., 2005 for description of characterizations. The return forecast in this area continues the low abundance trend and the status of coho here is an area of concern.

Area 12 Return



Area 13 Return



Georgia Basin Management Units

We were able to run the CPUE forecast of hatchery survival in the Strait of Georgia this year again (the standard trawl survey was not done in 2003). This model forecasts a marine survival of 1.1% for the 2005 return, a decline from the aggregated survival of 1.6% for the three hatchery stocks in 2004. The forecast is consistent with the individual forecasts for these hatcheries (see below). The forecast calls for low survival, with no evidence that it will improve in 2005.

Georgia Basin West Management Unit

The survival of Quinsam Hatchery and Black Creek coho in 2004 was virtually as forecasted. The marine survival of Big Qualicum Hatchery coho was greater than forecasted (0.6% forecast; 1.2% observed). All survivals can be characterized as poor to very poor.

The time series models used last year still provide the most accurate forecasts over the periods of record and were used again for the 2005 forecast. The 2005 forecasts for these indicators are for little change: 1.2% for the two hatchery stocks and 4.0% for the Black wild stock.

The low marine survival continues to maintain the low status of the Strait of Georgia coho. Of more concern is the Georgia Basin East Management Unit where a lack of information masks the status of the coho. The data that were available in the 2004 forecast indicated that coho status in GBE is almost certainly low and probably lower than elsewhere in the Georgia Basin.

Lower Fraser Management Unit

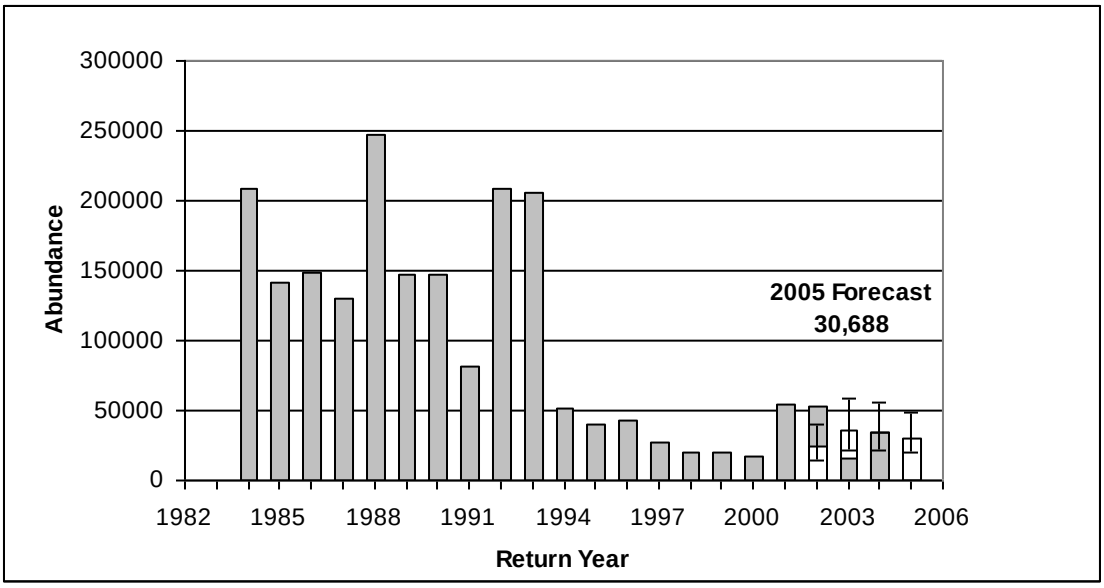
The 2004 observed marine survivals of the Inch hatchery and Salmon R. wild indicator stocks were above the forecast levels (forecasts of 1.0 and 3.6%, respectively; observed survivals of 2.5% and 4.3%).

Retrospective analysis of the forecast models indicate that the LLY models used last year still have the best performance. Hence, the forecast is for no change in marine survival in this Unit.

Interior Fraser Management Unit (Thompson R. Portion)

The return of Thompson River watershed coho in 2004 was approximately 34,000, which was close to the forecast of 34,271. The abundance in 2004 was higher then that observed in 2003 (14,610), but less than the brood year (2001) abundance of 54,122. Rates of exploitation of IFR coho in 2004 from commercial, recreational and First Nations fisheries are believed to be similar to those experienced in 2003.

Based on the 3YRA abundance model we forecast the total abundance of Thompson River coho in 2005 to be 30,688, i.e. similar to returns in 2004. The forecast return to the Thompson River watershed is approximately 46% of the geometric mean abundance of the time series and represents an expected decrease from the 2002 brood abundance of 53,000 animals.



Estimated abundance of Thompson River watershed coho from 1984 to 2004. The forecasts for 2002 to 2005 are shown as clear bars with associated 50% CI's.

West Coast of Vancouver Island Management Units

Marine survival in 2004 at Robertson Hatchery (3.9%) was slightly higher than forecast (2.9%) but slightly below the long term average of 4.7%. It was a substantial drop from the exceptional 9.3% survival of the previous brood. The return at Carnation Creek of 151 in 2004 was substantially more than forecast (29). However, the forecast direction was correct to the extent that 151 is below the average return (335), the brood return (283) and the 2003 return (493).

Retrospective analysis of the models used for Robertson and Carnation (sibling and euphausiid, respectively) showed that these were still the best performing forecast models and they were used again for 2005. The 2005 forecast of 3.3% marine survival at Robertson is similar to the 2004 survival. The forecast for the Carnation stock is for a below average return of 214. The wild return and survival forecasts indicate that the below average levels of abundance observed in 2004 will continue. However, the status of WCVI coho can be considered moderate on the basis that inter-annual variation in returns and survival are higher in the SWVI and NWVI Units and no marked trends are apparent over the time series.

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Distribution Forecast

The preliminary P_{inside} statistic is 0.14, indicating an even stronger 'outside' distribution of coho than in recent years. This model will be updated in April when the March salinities are available but this is a 'strong signal' and it is unlikely that the low salinities that produced it will change sufficiently to alter the conclusion that this will be a marked outside year.

Reference

Simpson, K., Chamberlain, M., Fagan, J., Tanasichuk, R.W., and Dobson, D. 2005 (in preparation). Forecast for southern and central British Columbia coho salmon in 2004. PSARC Working paper S2004-03. 90 pp.