

ProjectID: 30010

Canada-USA Shelf Salmon Survival Study

Sponsor: DFO

Province: Columbia Estuary

Subbasin: Columbia Estuary

FY03 Request: \$418,800

5YR Estimate: \$2,094,000

Short Description: This project surveys the size, condition, and biological condition of juvenile salmon occupying the British Columbia & SE Alaskan continental shelf regions in the autumn (October). The survey also includes extensive collection of oceanographic data.

Response Needed? Yes

ISRP Preliminary Recommendation and Comments:

This proposal requests funding from BPA for an additional coastwide survey (October) of juvenile salmonids and oceanographic conditions along the continental shelf to complement summer surveys conducted by the Science Branch, Canadian Department of Fisheries and Oceans (CDFO). The proposal includes an extensive and informative summary of recent findings based on similar surveys conducted since 1998 by CDFO (some previous funding apparently provided by BPA but not reviewed by ISRP). Based on these surveys, the proponents indicated that salmon from the Columbia River tend to migrate northward along the continental shelf, that growth of salmon (in particular chinook and coho salmon) and marine environmental conditions are not equal along the shelf, and that certain stocks of salmon have a propensity to rear in specific areas of the coast. These investigators' hypothesize that the productivity of some Columbia River salmon stocks is more dependent upon where they rear in the ocean than due to their freshwater or estuary conditions.

The proposal requests ongoing (5 years) support for 28 days of ship-time for an October survey and sample processing. The proposal refers to an end of winter survey but its never clear whether that survey is funded or requested (it is not considered further in this proposal).

The end of winter survey was started last year (a 4 week cruise in February), and has been supported again this year (a 3 week cruise in Feb-March). We initiated this cruise when it became clear that there were large differences in size evident by the autumn. The results from this year's survey, just ending, are identical to last year's cruise, and provide solid evidence for major overwinter movements of coho and chinook salmon, something not previously known to occur, and the first clear data on how much they grow and gain or lose energy reserves over the winter. As such, the results are providing useful basic information on salmon and would seem likely to continue to be supported in the future. The winter surveys also provide critical oceanographic data as to pre-bloom conditions on the shelf by measuring strength of stratification, temperature-salinity fields, and nutrient levels. Given that tests of important bottom-up hypotheses about control of salmon growth and survival depend on these data (e.g. the Gargett hypothesis), the

winter surveys are very important. The data are also important for providing data on which to evaluate Dr Beamish's critical period idea hypothesis.

However, much of the proposal is not so carefully worded and is more narrowly focused on the 1998 results as opposed to the latter three years of data. We disagree with the inference that the west coast of Vancouver Island (WCVI) is an inherently "poor" area of ocean production (see objectives stated above).

At this point, it is not possible to respond to the ISRP's comment, because enough years of data has not been collected. We started the shelf survey in 1998 because there was evidence that British Columbia's southern stocks of salmon were much less productive than those stocks in northern British Columbia or SE Alaska. Our first year of results saw very large differences in mean size and condition. The change to a new climate regime in 1999 saw these north-south differences disappear, and (in 2001) the return of record or near record salmon runs to both the Columbia River and to parts of southern British Columbia. The survey results for 2000 and 2001 are very similar to those for 1999 and suggest that the improved salmon runs will persist for some time. Until conditions swing back to the pre-1999 condition we will not get further measurements on what salmon growth was like off the west coast of Vancouver Island. As an El Nino is currently being forecasted for this year, we may not need to wait long.

We are also concerned that concluding that specific salmon stocks rear in specified areas of the ocean. Extensive past data from coded-wire tagged salmon indicate very wide distributions of salmon populations ... but we do acknowledge that these recoveries are based on the locations of fisheries and generally for older aged fish.

We believe that the distinction between first-ocean year fish and immature fish in their second and later years is very important. There is truly little data on where salmon go and what they are doing during that first 6 months at sea. Given that this is supposed to be a critical life history stage for determining salmon returns, again, dealing specifically with younger fish is important.

We also have significant concern for statements concerning the value of restoration efforts in freshwater habitats (3rd para., page 25).

"Whatever the specific causes of the reduced productivity, the decreases in marine survival over time for many stocks appear to be much greater than the changes taking place in freshwater survival. This suggests that it may not be possible to manipulate the freshwater environment for affected stocks sufficiently to compensate for what is occurring in the ocean."

The ISRP agrees fully with the value of measuring the survival of salmonids in freshwater and marine environments, but the inference based on the last sentence is not helpful to this Region. For example:

- i) If ocean conditions are poor, then it is likely that agency rebuilding goals may not be met regardless of efforts in freshwater; but it is also likely that improved freshwater conditions can protect diversity within populations and increase production during those poor marine survival periods. During those periods, only freshwater and fisheries can be managed to preserve future production.
- ii) Conversely, if ocean conditions are very good, then production requires sustained production from freshwater spawning and rearing habitats.

The Basin no longer debates the needed integration of freshwater and marine conditions for salmonid recovery and clearly recognizes the value of studies in the marine environment (as in recent BiOPs).

Little specific data is available on which to base judgements of the relative impact of the ocean and freshwater on salmon returns. What little directly comparative data we could find supports the interpretation stated in our paper, but we acknowledge that further data may not. We would certainly like to see such data presented. At present, we are unaware of any.

Specific comments on Proposal:

- 1) Protein electrophoresis and DNA analysis ... these seem to be duplicate tasks. The proposal suggests that this provides for “finer level of resolution” but it may also result in conflicting results. What evidence is there to support this added cost? Further, the DNA sub-proposal may be important but it does not seem to be included in the proposal budget. Is this accounted for elsewhere?

We have been actively working with Dr Terry Beacham’s lab on the application of the DNA method to our data. Costs were not properly split out in the original proposal, and we have corrected this. (We assume a cost per sample processed of \$50, to cover both Beacham’s direct costs and some of our own). The samples for protein electrophoresis were provided to NMFS at no cost to our program other than our staff time for sample preparation (which is extensive, and does eliminate the fish from being a candidate for several other tests because of the extensive tissues removed). NMFS has not requested further samples for several years. Once the past samples are run for stock ID we will be able to compare the two methods to get a sense of their relative merits and to assess whether they do provide additional independent information on stock of origin.

- 2) Similarly, while we see the merit of testing for yearling chinook along the shelf, the task described on page 37 does not have any budget assigned to this task. Who is conducting this analysis and is there a cost to this proposal?

This work has been initiated as part of a Ph.D. program at the University of Victoria by Laurie Gallagher in the Laser ICP-MS laboratory under the supervision of Dr Kevin Telmer. The intent of this research is to develop a chemical assessment of where on the otolith entry into seawater occurs. These measurements will be compared in a double-blind trial with the visual measurements made by Mr Kerin Nayar, a former MSc student with experience at visual assessment of otoliths. This work, and that of Gallagher, will

be co-supervised by Drs Welch & Trudel. Ms Gallagher only began her program this spring at U. Victoria, so we have now formally broken out the funds for this work in our revised budget.

3) Oceanographic Analyses (page 38) refers to the development of a predictive model integrating oceanographic and atmospheric data, but where is this identified in the budget and who would conduct this study? Other investigators are proposing similar models, so the ISRP should evaluate the need for each.

It was not our intention to imply that we would develop a complicated numerical model here. Our intention is to complete a simple and relatively straight-forward "back of the envelope" calculation of the relative importance of these processes. Dr Zamon, one of our two post-doctoral fellows has completed some of the data preparation for this analysis. As she has taken a job with NMFS, we are hoping that one of the new post-docs we will be hiring to help assist her with completing the write-up on this aspect of her work.

4) It has been identified that other programs in Alaska and GLOBEC are also sampling juveniles along the continental shelf. How does this proposal link with those projects, and/or does it support the multi-agency/national effort already underway? What is the unique contribution of this proposal?

The BC coast represents important habitat for first-ocean year salmonids, particularly chinook and coho. Columbia River salmon migrate through this region on their way to Alaska while others apparently remain as shelf residents in our study region. If part of the goal is to understand when, where, and how changes in salmon growth and survival occur in the ocean, and if current hypotheses indicate that a good deal of mortality is associated with the first 1-6 months at sea, then it is sensible to include this habitat. Without it, a large "hole" would be present in understanding salmon distributions, growth, and stock compositions. The BC coast also represents an important environmental transition in terms of habitat for these fish: from a predominantly upwelling zone (CA, OR, WA, southwestern BC) to a predominantly downwelling zone (SE Alaska) - see Ware and MacFarlane (1989) for the designation of this area as an important and potentially dynamic faunal and fishery boundary, and also as an area where very little is known about the marine ecology and oceanography.

With reference to collaborative work: We are collaborating with Dr Kym Jacobsen of the NMFS group and have provided her with extensive kidney tissue samples for her parasite studies; Dr Marc Trudel of our lab is discussing plans with Dr Ric Brodeur to organise a joint paper of feeding; and we have provided extensive tissue samples for protein electrophoretic stock ID work by Dr David Teel. Dr Zamon of our lab is putting together paper with Drs Bill Peterson and David Mackas to provide an unprecedented, near-synoptic look at the zooplankton field in continuous swath from Oregon to SE Alaska; this effort is supported largely by BPA funding. As we have noted, Dr Zamon will be headed south to join the NMFS group, which ought to foster even closer collaboration

Finally, we have had significant interactions with our colleagues at the NMFS lab in Juneau (Auke Bay) and some discussions with Prof Weingartner's group running the

Seward Line in the northern Gulf of Alaska, but have not yet exchanged samples or developed closer collaborations.

5) While the ISRP does not normally address budget items there are some issues that should be responded to in this case.

- Personnel lists 5.1 FTE but time allocations and staff are not identified. Two of the investigators are post-doctoral fellows, has their support already been committed and will they be available through the duration of the project?
- *We are currently in the process of trying to hire Dr Trudel onto a term position in order to maintain his contribution in the group. Dr Zamon is leaving in June for NMFS, but we are planning to advertise for a replacement PDF with skills in oceanographic analysis (particularly with a physical oceanographic background). We also are looking for a statistically oriented PDF or MSc with an interest in taking the DNA data coming from Beacham's lab and developing a statistical measure of average condition for different stocks over the entire survey area. In this approach, rather than compare size and fat levels of chinook or coho from different areas, we wish to assign a probable stock of origin to individual salmon, and then calculate the size or fat content of all the putative members of a specific stock –such as Snake River chinook–no matter where they are found, and then compare how this compares to other stocks (the key issue here is how to properly integrate the statistical uncertainty inherent in the DNA characteristics into the analysis). The idea is to develop a picture of how individual stocks fare– since there is some evidence for fairly wide distribution of each stock– and thus avoid some of the pitfalls inherent in having to assume that key stocks remain as static entities within some specific areas, and that the good ocean conditions that some of their members may have experienced elsewhere is of negligible importance.*
- *The remaining staff are:*
 1. *Full-time seagoing technician #1 and #2 (fish and zooplankton collection, fish processing, basic biological data, database maintenance)*
 2. *Full-time laboratory technician #1 (fish processing, database maintenance, logistical support for cruises)*
 3. *Postdoctoral fellow #1 (cesium, growth, consumption analyses; bioenergetics modelling; data synthesis and publication)*
 4. *Full time statistician #1 (CWT data management & analysis, statistical analysis of size, age, energy content data)*
- Benefits and Indirect costs are not presented as usually done for U.S. agencies. Are these accepted cost estimates from the Canadian agency?
- Yes.
- The utility of a BPA commitment of funds would be contingent on continued support through CDFO. Are these likely to continue and could a Letter of Support be provided before final commitment of funds?
- *This letter of support has been requested from senior management, and will be sent under separate cover when it is provided.*

- The section on Cost Sharing indicates a significant allocation of senior staff time to this proposal. Since Dr. Welch is already the principle noted on the proposal, what other staff are participants? This is particularly relevant given the first bullet above.
- *See above.*