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Proceedings of the PSARC Review on Lower Fraser River White Sturgeon

Compte rendu de l'examen par le CEESP de l'esturgeon blanc du bas Fraser

June 21, 2005
Nanaimo, BC

Alan Cass
Meeting Chair

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

August 2005

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC) LOWER FRASER RIVER WHITE STURGEON REVIEW

SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) met on June 21, 2005 at the Pacific Biological Station in Nanaimo, B.C. to review one Working Paper titled, "An Assessment of White Sturgeon Stock Status and Trends in the Lower Fraser River". The Working Paper was accepted with revisions.

SOMMAIRE

Le Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni le 21 juin 2005 à la Station de biologie du Pacifique de Nanaimo, en Colombie-Britannique, pour examiner un document de travail portant sur l'état des stocks d'esturgeon blanc et les tendances dans le bas Fraser. Le document de travail a été accepté avec révisions.

INTRODUCTION

The Pacific Scientific Advice Review Committee (PSARC) met on June 21, 2005 at the Pacific Biological Station in Nanaimo, B.C. to review one Working Paper titled, "An Assessment of White Sturgeon Stock Status and Trends in the Lower Fraser River". External participants from industry, academia, First Nations, and conservation groups attended the meeting. The Subcommittee Chair, A. Cass, opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda.

The Subcommittee reviewed one Working Paper which is summarized in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEW

An assessment of white sturgeon stock status and trends in the lower Fraser River

C. Walters, J. Korman and S. McAdam

The focus of the working paper was on Lower Fraser River (LFR) white sturgeon (Yale to the Strait of Georgia). The LFR population is one of six populations in BC and one of four in the Fraser River watershed designated by COSEWIC as "endangered". This paper and PSARC review is a first step towards a full Recovery Potential Assessment (RPA) for white sturgeon in BC. The paper presented methods to: 1) develop robust estimates of natural mortality; 2) assess trends in the population structure; and 3), assess impacts of the recreational and First Nations gill net fisheries. The analysis relied on extensive mark-recapture PIT tag data, recent age and size composition data and historical catch data to project population trends using stock-reduction-analysis (SRA).

Two formal reviews were solicited prior to the PSARC meeting. Both reviewers concluded that the paper provided a comprehensive assembly of the available data and that the modeling approach was appropriate. An unsolicited review distributed to participants during the meeting acknowledged that the assessment made a major contribution to the assessment of the lower Fraser sturgeon population. All three reviews acknowledged the high degree of uncertainty in assessing stock status given the ambiguity of the data.

Discussion among participants centered on the implications of uncertainty in the data on estimates of natural mortality (plus emigration), abundance, stock trajectory and recovery potential. The authors identify three areas of uncertainty: 1) uncertainty in the impact of the early gill net fishery (pre-1900) on stock depletion due to information gaps relating the number of fish caught versus weight; 2) uncertainty whether the recent recruitment surge of age 7-10 fish is an isolated phenomenon related to production of a

few strong year-classes in response to reduced harvest impacts on mature fish that spawned in the 1990s or improved environmental/habitat conditions; and 3) uncertainty in the estimated absolute abundance of fish.

Meeting participants agreed that the estimate of natural mortality presented in the paper of 7-14% per year was supported by the analysis but acknowledged the potential for bias caused by spatial shifts in the distribution of tagging and recapture over time. The paper reported minimal estimates of the current population (+60 cm) in the range of 40,000-60,000 fish. The paper further reported that the population size could be as high as 100,000 fish if a significant spatial refuge exists in unmonitored estuarine or ocean areas. One reviewer cautioned that absolute estimates of population abundance derived from tagging data are difficult to reliably measure when capture probabilities are heterogeneous. An author responded that ultimately, in the context of SARA and any future RPA, stock status should be evaluated relative to absolute population benchmarks. The reviewer noted that estimates of population growth are more robust to heterogeneous catchability and can be estimated directly from tagging data without first estimating population size and then fitting a curve to the data. The reviewer also questioned why the mark-recapture analysis wasn't undertaken using standard software (i.e. MARK). An author reported that the analysis used the same methods but that output from full state-space models such as MARK that provide uncertainty in parameter estimates (i.e. confidence intervals) are meaningless given that structural uncertainty (different models) rather than parameter uncertainty is key to the sturgeon analysis given the ambiguity of the data.

One reviewer asked whether a posterior sample of current population size from the tagging model could be included in the SRA model to more fully quantify uncertainty in population trajectories. The reviewer also questioned whether a single "global" model could be developed to get a posterior sample of all parameters simultaneously. The senior author subsequently presented more detail on the SRA model fitting methods and posterior sampling used to stochastically quantify uncertainty. The reviewer suggested more detailed presentation of the raw data and greater clarity in the model formulations would be helpful in revisions to the paper. The authors were advised to consider the reviewer's suggestions when revising the paper.

The unsolicited reviewer was concerned that the basis for some key variables used in the analysis was not adequately described and in some cases were not consistent with the available information. In his opinion, the sensitivity on model outcome to alternative sturgeon weight information should be evaluated. The reviewer was also critical of the data used to estimate First Nations gill net catch estimates and the values provided in the paper noting uncertainty in gill net fishing effort and CPUE data. The reviewer encouraged the authors to consider his concerns in a future analysis.

Two extreme interpretations of the data were presented in the paper. At one extreme, the population could be small and growing. At the other extreme the population could be larger with stable growth. The mark-recapture data, the Albion test fishery and the SRA suggests that current egg production is about 10% of the unfished population and

that the population is growing. This interpretation however is inconsistent with the age composition data and gill net catch estimates that indicate the population is larger (egg production equal to about 40% of the unfished population). Current population size of fish vulnerable to line gear may be in the range of 35%-60% (60,000 or 100,000 fish) of the historical abundance, which the SRA model estimates as about 160,000 fish. Meeting participants accepted the alternative interpretations of status.

Conclusions

- The working paper was accepted with revisions. Participants agreed that the methods were appropriate and no alternative methodology was provided.

- Participants agreed with the authors' conclusion that the ambiguity in the data implies different interpretations. At one extreme, the tagging data, the Albion test fishery index and SRA modeling indicates that the vulnerable population is about 60,000 individuals and growing in the presence of the current harvest regime. Conversely, the age composition data and gill net catch estimates imply that the population could be larger (100,000) with stable growth.

- Participants agreed that the weight of evidence supports the hypothesis for positive population growth under the current harvest regime. Participants acknowledged that the recent increase in young sturgeon recruitment is encouraging but that the potential for sustained recruitment cannot be predicted.

- Participants concluded that the benchmark for assessing survival and recovery probabilities in any future assessments of human harm impacts should rely on egg production rather than the abundance of mature individuals in the population. The former accounts for lags in population trajectories and recovery by weighting fish by size-fecundity relationships and spawning frequency.

Recommendations

Meeting participants identified six research activities to improve the understanding of population structure, fishery impacts and estimates of mortality and abundance.

1. Design PIT tagging studies to spread tagging more evenly in the lower river to improve estimates of mortality by reducing the potential for biased estimates resulting from spatially disproportionate tagging and recapture over time.

2. Use acoustic tags and regular tracking programs (i.e. POST) to determine distribution of tagged fish over time and assess the potential extent of spatial refugia and impact on estimates of abundance and fishery impacts.

3. Expand test fisheries similar to the Albion test fishery to several other locations for a few years to evaluate whether the Albion fishery is measuring abundance changes or just shifts in sturgeon distribution.

4. Sample the age composition from the PIT tagging programs and the Albion test fishery using the methods used in 1995-99 to improve estimates of stock structure and age composition.

5. Consider alternative methods for assessing abundance and for providing seasonal-spatial data (i.e. DIDSON acoustic technology) for distinguishing among hypotheses about change in tag recovery rates due to changes in distributions versus changes in vulnerability to fishing gear.

6. Increase the accuracy and precision of catch estimates through designed catch monitoring programs to better understand fishery impacts on sturgeon survival and recovery potential.

APPENDIX 1: WORKING PAPER SUMMARY

An assessment of white sturgeon stock status and trends in the lower Fraser River

C. Walters, J. Korman and S. McAdam

Recovery Potential Assessments (RPAs) will be required for species formally listed as endangered under the Species at Risk Act when there is the potential for either direct or indirect mortality due to human activities. The principle goal of an RPA is to ensure that recovery is not unduly limited by anthropogenic affects, and to demonstrate the effects that might be expected under various impact scenarios. Once complete, an RPA could provide justification for permitting activities which have an acceptably low level of impact or harm. Examination of natural and anthropogenic mortality rates is a critical component of an RPA, and efforts to estimate white sturgeon mortality rates are limited.

We used a variety of information sources to estimate natural and fishing mortality rates and to assess recent trends and current abundance of white sturgeon in the lower Fraser River from Yale to the Strait of Georgia. These sources included:

1) estimates of current population structure and recruitment-mortality rates over the last few decades, from age composition sampling in 1995-99 and size composition sampling since 1999;
2) estimates of capture and recapture rates of over 18100 sturgeon tagged with PIT tags since 1999, which provide information on growth, mortality rate, total abundance, and movement;
3) estimates of historical harvests since 1880, which can be used to back-calculate how large the stock must have been before fishing and how much it must have declined in order to be near the current size indicated by the PIT tag data.
4) indices of recent abundance trend from the gill net test fishery at Albion.

The age and size composition data suggest a stock that has relatively healthy numbers of older fish and is either stable or increasing over time. The PIT tag data indicate that natural mortality plus emigration rates may be as low as 7%/yr or as high as 14%/yr. Higher rate estimates are obtained when the data are analyzed with simple aggregate abundance models while lower rates are indicated by models which recognize that data come from a complex spatial sampling regime with variable marking and capture rates among sections of the lower river. Reconstructions of the stock history from catch data indicate that numerically the current stock is about 30% of its historic abundance. However, annual egg production, which is a more appropriate measure of stock condition, is probably now at about 10% of its natural level, and may have been impacted most severely over its history by gill net fishing in the 1960-90 period rather than the pre-1920 period. Catches in the Albion test fishery suggest a very rapid increase in abundance of small fish (ages 1-7) since 2000, and this apparent rapid increase is also evident in the size structure of fish captured for PIT tagging.

The stock is most likely increasing in abundance under the current management regime which includes both a catch and release recreational fishery and gill net fishery.

However, it is also most likely to be well below its most productive level for harvest management, and its recovery to that level could be delayed, or halted, if anthropogenic mortality is increased either by allowing any retention fisheries or through increases in by-catch mortality associated with catch and release angling or commercial and first nations gillnet fisheries.

APPENDIX 2: MEETING AGENDA

PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE
STURGEON REVIEW

Tuesday, June 21, 2005
Pacific Biological Station, Nanaimo, B.C.
Seminar Room

TUESDAY – June 21	
Introduction and procedures	9:00 – 9:15
An assessment of white sturgeon stock status and trends in the lower Fraser River – authors presentation	9:15 – 10:00
Reviewers comments General discussion and formulation of advice	10:00 – 11:00 11:00 – 12:00
Lunch Break	*12:00 – 1:00*
General discussion and formulation of advice	1:00 – 4:00

APPENDIX 3: LIST OF ATTENDEES

Name	Affiliation
External Participants	
English, Karl	LGL Ltd.
Gazey, Bill	W.J. Gazey Research
Jacobs, Tony	Tsawwassen First Nation
Johnston, Tom	MWALP
Kwak, Frank	Lower Fraser Sport Fish Advisory Board
McAdam, Steve	MWALP
Nelson, Troy	FRSCS, LGL Ltd.
Nootebos, Tony	Sturgeon Angling Guide
Schmidt, Dana	Golder Associates
Schwartz, Carl	SFU
DFO Participants	
Boutillier, Jim	
Cass, Al (Chair)	
Cronkite, George	
Ennevor, Brigid	
Eros, Carole	
Holmes, John	
Lawseth, Don	
Schnute, Jon	
Schweigert, Jake	
Sneep, Daniel	
Wood, Chris	

Reviewers for the PSARC papers presented at this meeting are listed below. Their assistance is invaluable in making the PSARC process work.

Schnute, Jon	Fisheries and Oceans Canada
Schwarz, Carl	Simon Fraser University