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Proceedings of the PSARC Pelagic Subcommittee Meeting January 25-26, 2005

Compte rendu de la reunion du sous-comité des poissons pélagiques du CEESP, 25-26 janvier 2005

January 25-26, 2005
Nanaimo, BC

Thomas Therriault
Pelagic Subcommittee Chair

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

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Canada

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
PELAGIC SUBCOMMITTEE MEETING

SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) Pelagic Subcommittee met January 25-26, 2005 at the Coast Bastion Hotel, Nanaimo, British Columbia to review scientific information relating to British Columbia herring biology, distribution and assessment. Updates on other pelagic species including Pacific sardine and eulachon also were presented.

SOMMAIRE

Le sous-comité des poissons pélagiques du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni les 25 et 26 janvier 2005 au Coast Bastion Hotel, à Nanaimo (Colombie-Britannique), pour passer en revue les renseignements scientifiques sur la biologie, la répartition et l'évaluation du hareng du Pacifique. Des mises à jour de l'état des stocks d'autres espèces pélagiques, nommément la sardine du Pacifique et l'eulakane, ont aussi été présentées.

INTRODUCTION

The PSARC Pelagic Subcommittee met January 25-26, 2005 at the Coast Bastion Hotel in Nanaimo, British Columbia. External participants from industry and First Nations attended. The Subcommittee Chair, T. Therriault, 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 two Working Papers and received presentations on five Updates. The Working Paper summaries are presented in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants and reviewers is included as Appendix 3.

The Subcommittee discussed the importance/relevance of Updates since management advice generally was not apparent in these documents. However, with no representatives from Fisheries Management present for the Updates, it was not possible to determine if these documents are providing needed information or not. External participants were interested in hearing about ongoing projects through the Updates and would like to see the information presented somewhere if not through the Subcommittee. An Information Bulletin was discussed as an alternative. The Subcommittee has agreed that one meeting per year would be sufficient given the number of Working Papers the Subcommittee has reviewed recently. This would be the annual September meeting where the stock assessment document is presented. It was agreed that focus needs to be on the assessment document and this would be reviewed by the Subcommittee first with Working Papers or Updates to follow.

DETAILED COMMENTS FROM THE REVIEWS

Working Paper P2005-01: Risk Assessment for BC Herring Populations

** Working Paper Not Accepted (to remain a Draft) **

Subcommittee Discussion

Both reviewers and the Subcommittee recognize the tremendous efforts to date and commend the authors on their efforts. However, it was evident that much documentation to support the risk assessment analyses, primarily the population dynamics model, needs to be clarified before this Working Paper can be reviewed adequately. Although the primary goal of this Working Paper was to present a risk assessment framework for Pacific herring, both reviewers had difficulty focusing on this objective without being comfortable with the population dynamics model used for forward projections. The authors acknowledged that increased documentation was required but reiterated their stance that the philosophy of the risk assessment framework, the primary goal of the paper, was sound. This view was supported by both reviewers and the Subcommittee.

Based on documentation provided in the Working Paper it was difficult to identify specific problems with the population dynamics model used for the risk assessment. Further, as neither reviewer nor the author responsible for model development were present at the meeting it was not possible to resolve issues related to the population dynamics model. The Subcommittee felt that extensive discussion of the model at this time would be premature and not productive as clarification of technical issues at the meeting were not feasible. For example, model output for some stocks appeared unrealistic and it was not possible to identify if these potential difficulties were related to model formulation or assumptions about population dynamics (i.e., stock-recruitment relationships). Further, one reviewer was concerned about the number of time-varying estimates in the model and was unsure if this is reasonable given the data available. In general, it was not possible to clarify to what extent, if any, errors identified during the model development stage (last year's Working Paper) remain unresolved. Ultimately, much discussion centered on the model used for population projections and not on the framework for risk assessment. The consensus was the framework was generally reasonable and well received, but outstanding issues with the population dynamics model needed to be resolved first. The authors reiterated that their intention was not to determine the best model for understanding herring dynamics as this was the focus of the preceding Working Paper on this subject that was reviewed and accepted by the Subcommittee in November 2003. The goal of this Working Paper was to provide a framework to evaluate trade-offs in harvesting strategies under a suite of population projection scenarios and harvest rules. These trade-offs would be evaluated against different performance indicators designed to capture information relevant to all stakeholders. Some participants felt the authors were

weighting the performance indicators but the authors clarified this was not the case and beyond the responsibility of DFO Science to do so. Some external participants remained confused by this process and had difficulties understanding the need for such an ambitious project.

Some were concerned about using a performance measure of a 50% decrease in biomass over three generations for a highly dynamic species such as herring. This performance indicator was used because it parallels existing criterion used both by the IUCN and COSEWIC. Further, one author pointed out that COSEWIC already has reviewed Pacific herring and has declined to consider them for listing. Some remained unconvinced and indicated the species could be re-considered in the future. The logic of the criterion is to reflect a long-term unabated threat. The Subcommittee agrees that this criterion alone would not be a useful indicator of population decline for herring because of the large, natural increases and declines in population abundance noted for this species but declined to entertain any alternative rate of decline per unit time as a performance indicator. Hypothetical discussions about what might or might not trigger a conservation listing for herring some point in the future based on population projections is beyond the scope of this paper. By including this performance measure, the Subcommittee is not endorsing its use for herring (and in fact cautions against it) but rather providing a performance indicator commonly used for other species.

This Working Paper highlighted the need to have external reviewers present at the meeting. With Subcommittee membership shrinking, the internal capacity to deal with such complex issues is diminishing. Only six Subcommittee members were present for the review of the Working Papers (2 of which were authors) and five Subcommittee members were present for the Updates (with no representation from Fisheries Management) (see Appendix 3). Given the high profile nature of this paper and the potential impacts, required external participation is recommended.

Subcommittee Conclusions

Both the Subcommittee and the external reviewers recognized the huge effort undertaken to date. However, at this point there is much work to be done to resolve outstanding issues. Given the high profile of this paper and potential longer-term impacts on the herring industry, the Subcommittee would like to ensure the scientific basis for this document is complete and acceptable. Thus, the Subcommittee declined to accept the paper at this point and considers it a work in progress.

Subcommittee Recommendations

1) The authors need to resolve/clarify assumptions about the population dynamics model used for forward projections and risk assessment analyses. Reviewers should be consulted.
2) Once the population model is resolved to the reviewers' satisfaction the risk analyses should be re-done (if needed) and be re-reviewed.

Working Paper P2005-02: The Link Between Interannual Variations in Zooplankton Production and Herring Growth and Recruitment Trends in Northern British Columbia.

** Accepted pending revisions **

Subcommittee Discussion

This Working Paper was largely exploratory with no immediate advice. The main goal was to examine how herring growth and recruitment might be better modeled/understood using environmental indices based on food supply. The work focused on two northern herring stocks (QCI and CC) using environmental data collected in Queen Charlotte Sound and Hecate Strait. Unfortunately, there are no long-term plankton data for this part of BC; consequently, physical measures (i.e., water temperature, wind and current data, etc.) were used to parameterize a nutrient-phytoplankton-zooplankton model of production. Indices from this NPZ model were then used to examine impacts on growth and stock-recruitment relationships.

Both reviewers were concerned that alternative explanations for recruitment were not considered. The author indicated this was not one of the objectives of this Working Paper but recognized the "washout" hypothesis should be considered in a more detailed examination of possible factors affecting herring recruitment.

One reviewer noted that a separate distribution for the two stocks examined in this paper is a critical assumption. The author indicated that each stock has a distinct winter spawning distribution (used for stock ID) but the author acknowledged that some overlap in summer feeding distributions is possible. There have been no studies to determine the amount of spatial overlap among BC herring stocks or the time period over which such an overlap would occur. Modeling the stock-recruitment relationship the author included the combined QCI-CC stock biomass as a potential measure of overlapping distributions on summer feeding grounds.

Both the reviewers and some Subcommittee members were concerned about the details documented in this Working Paper. However, since the analyses presented are exploratory the Subcommittee felt that as long as the author provided more detail, additional analyses were not required. For example, one

reviewer was concerned that not enough model details were presented in the Working Paper and that model output had to be taken on faith. The author indicated the model was a work-in-progress and that unpublished documentation was available. The Subcommittee agreed that if advice was provided then additional information would be required. Also, the other reviewer noted that the assumption of only two regimes between 1951 and 2004 was an over-simplification. The author acknowledged this but suggested that the two regimes defined in the paper were the strongest ones (based on temperature) and that as a "first-cut" the assumption was reasonable. The Subcommittee agreed. Further debate centered on the dramatically different fisheries operating during the cold regime (1951 to 1976) and the warm regime (1977 to 2004). The author recognized this confounding effect but had no suggestion on how to separate regime effects from fishery effects. Again, the Subcommittee decided that as long as the differences/limitations were documented all findings from the exploratory analyses should be presented.

Subcommittee Conclusions

The Subcommittee accepted this paper with revisions. It was acknowledged that this paper was largely exploratory in nature and that no specific conclusions or recommendations are available at this time. The Subcommittee noted that this work might be useful for recruitment predictions and should be explored further.

Subcommittee Recommendations

1) Further development of these (or similar) exploratory analyses to better understanding factors affecting herring growth and recruitment should continue.
2) The methodology should be pursued for forecasting recruitment.

APPENDIX 1: Working Paper Summaries

Working Paper P2005-01: Risk Assessment Framework for BC Herring Populations.

Schweigert, JF, Fu, C, Wood, CC, and Therriault, TW

A risk assessment framework was developed with the goal of determining conservation limit reference points for harvested species as part of the Department of Fisheries and Oceans initiative of Objectives Based Fisheries Management (OBFM). In Pacific Region, Pacific herring (*Clupea pallasi*) was one of two pilot species chosen for its application based on the availability of extensive biological and fisheries data. A critical component of the risk assessment was the development of a population dynamics model of Pacific herring stocks reflecting the best current understanding of fishery and environmental impacts to assess current abundance and project into the future. A series of performance indicators (measures) were developed to evaluate the impacts of various harvest policy options on the viability and sustainability of Pacific herring stocks in British Columbia. The performance indicators were developed through consultations with stakeholders throughout Pacific Region. Performance indicators utilized in the risk assessment were measured over a 15 year projection period and included: the average spawning stock biomass (SSB), the proportion of the population consisting of individuals age 4 and older, the probability of a 50% decline in abundance within 3 generations, the probability of the spawning stock biomass declining to less than 10% of the unfished level, the probability of SSB declining below a fixed threshold (the current 'cutoff' level), the probability of the SSB declining below a floating cutoff level, the average annual catch, the coefficient of variation of the annual catch, the probability of the catch declining to less than 10% of the maximum sustainable yield (MSY), and the probability of the SSB increasing to the biomass generating the MSY (B_{MSY}) in one generation. The performance indicators were compared for a suite of proportional threshold harvest policies of which the current policy is one possible example. Nine scenarios were designed for projection simulations to investigate the sensitivity of performance indicators to structural assumptions in the model (stock recruitment function and variable versus constant natural mortality), initial spawning stock biomass, type of fishing gear, length of closure when biomass falls below cutoff threshold, and average marine survival. Performance indicators were broadly similar across all five herring stocks under each scenario. The existing herring harvest policy can be precautionary for all stocks except perhaps the Queen Charlotte Islands stock, where further review is warranted. The risk assessment framework appears to be robust and applicable across a broad range of species in support of OBFM initiatives.

Working Paper P2005-02: The Link Between Interannual Variations in Zooplankton Production and Herring Growth and Recruitment Trends in Northern British Columbia

Ware, D

The purpose of this exploratory analysis is to describe and evaluate the variations in the annual growth and recruitment rates that have occurred in the Central Coast and Queen Charlotte Island (QCI) herring stocks since 1951. This paper addresses the management issues of stock abundance variations and growth trends. The average weight of 3-yr old herring (W3) is significantly different between most of the migratory herring stocks, with two exceptions. This finding indicates that the cumulative growth rates of BC herring during the first three years of life are primarily determined by local environmental and stock-specific conditions. However, a significant proportion (58%) of the interannual variability in W3 about the mean value appears to be determined by factors that cover a larger spatial scale. Warm ocean conditions (and the associated changes in the ecosystem) appear to have had a strong negative impact on the instantaneous growth rates of QCI herring, particularly in the older age groups. During the pre-1976 cool regime, the average relative growth rates (RGR) of Central Coast herring were significantly correlated with the estimated rate of primary production and annual SST (r^2=0.58). In contrast, during the post-1976 warm regime the mean RGR was most highly correlated with the cumulative upwelling rate (r^2=0.68). During the cool regime, the growth rates of QCI herring were strongly correlated with the body weight at the beginning of the growing season and the annual SST in the region (r^2=0.84). In contrast, most of the observed variation in the average growth rate of QCI herring during the warm regime was poorly correlated (r^2<0.18) with the suite of variables examined. The age 2 relative growth rate time series for the Central Coast and QCI stocks were positively correlated with each other, but the covariability (r-squared) was only 11%. Similarly, the age 3-5 relative growth rate time series for the Central Coast and QCI stocks were also positively correlated with each other, but the covariability (r-squared) was also small (only 18%). This suggests that most of the variation in the annual growth rates in these two stocks appears to be determined primarily by local factors in each stock assessment area. This interpretation is consistent with the finding that during the same regime, different growth modifying factors appear to be important in the two stock assessment regions.

Recruitment in the Central Coast population was significantly affected by changes in parent stock biomass, particularly during the cool regime, and in the estimated production of plankton in Queen Charlotte Sound during the second year of life, when juvenile herring are believed to be feeding in this area. The three strongest year-classes that have occurred since 1959 (when the estimated plankton production time series begins) all coincided with an above average copepod production. However, not all years of above average copepod production have resulted in strong year-classes. Therefore since 1959, a high copepod production has been a necessary, but not a sufficient condition for producing large year-classes in the Central Coast.

During the cool regime, QCI herring year class strength was negatively (and very significantly) correlated with the combined biomass of age 3 and older QCI and Central Coast herring in the Queen Charlotte Sound region during the year of birth. The negative sign of this correlation implies that a large biomass of adult herring in the region may reduce the supply of zooplankton, and thereby increase the vulnerability of larval (and small juvenile) herring to local predators. Variations in parent stock biomass and the estimated production of euphausiids also had an important impact on recruitment in the QCI stock assessment region. Although the recruitment models examined in this paper have been widely used in previous studies, the form of these models may be too restrictive to explain much of the variation in a complex process, like recruitment. Therefore, their usefulness for recruitment forecasting is probably limited. As an alternative, perhaps the graphical approach illustrated in the paper can be extended, and applied to produce more accurate recruitment forecasts.

APPENDIX 2: PSARC Pelagic Subcommittee Meeting Agenda

PSARC Pelagic Subcommittee Agenda
January 25-26, 2005
9:00-4:00
Coast Bastion Inn, Nanaimo BC

January 25:

9:00-12:00	Review of Working Paper*, Risk Assessment for BC Herring Populations* – Authors: Schweigert, Fu, Wood, Therriault
12:00-1:00	Lunch
1:00-4:00	Review of Working Paper, *The Link Between Interannual Variations in Zooplankton Production and Herring Growth and Recruitment Trends in Northern British Columbia* – Author: Ware

January 26:

9:00-10:00	Ware cont'd
10:00-10:30	Update – Spawn-on-kelp mortality
10:30-11:15	Update – Coded-wire tagging
11:15-11:30	Update - Strait of Georgia juvenile herring survey
11:30-12:00	Update – Sardine
12:00-1:00	Lunch
1:00-2:00	Update - Fraser River Eulachon
2:00-4:00	Subcommittee Discussion

APPENDIX 3: List of Attendees & Reviewers

Subcommittee Chair: Tom Therriault
PSARC Chair: Al Cass

NAME	TUESDAY	WEDNESDAY
EXTERNAL PARTICIPANTS		
Benson, Ashleen (SFU)	X	
Chalmers, Dennis (MAFF)	X	
Hill, Cecil (SOKOA)	X	X
Jones, Russ (Haida Fisheries Program)	X	X
Safarik, Ed (HCRS)	X	
Tallman, Doug (JO Thomas & Assoc.)		X
Ware, Dan	X	X
Webb, Lloyd (FVOA)	X	X
Wilson, Bill (AFVO BC)	X	
DFO Members (* Subcommittee Member)		
Cass, Al *	X	X
Clark, Dan		X
Daniel, Kristen	X	X
Flostrand, Linnea	X	X
Fort, Charles *	X	X
Hamer, Lorena *	X	
Hrabok, Christa	X	X
McCarter, Bruce	X	X
Schweigert, Jake *	X	X
Tanasichuk, Ron *	X	X
Therriault, Tom *	X	X
Thompson, Matt	X	X
Wood, Chris	X	

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

Cox, Sean	Simon Fraser University
de la Mare, Bill	Simon Fraser University
Mackas, Dave	DFO (IOS)
Perry, Ian	DFO (Shellfish Stock Assessment)