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**Proceedings of the PSARC
Groundfish Subcommittee Meeting**

**Compte rendu de la réunion
du Sous-comité du CEESP sur
le poisson de fond**

**May 26, 2005
Nanaimo B.C.**

**J. Fargo
Groundfish Subcommittee Chair**

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

July 2005

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200, rue Kent Street
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K1A 0E6

<http://www.dfo-mpo.gc.ca/csas/>

CSAS@DFO-MPO.GC.CA



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**PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
GROUNDFISH SUBCOMMITTEE MEETING**

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SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) Groundfish Subcommittee met May 26, 2005 at the Pacific Biological Station in Nanaimo, B.C. The Subcommittee reviewed one working paper on lingcod.

Working Paper G2005-03: Management Framework for Strait of Georgia Lingcod

The Subcommittee accepted 'Management Framework for Strait of Georgia Lingcod' including the recommendations in the Working Paper subject to revisions. The Subcommittee concluded that: 1) the robustness of the reference points, the impacts of uncertainty in biomass estimates on selection of reference points and timeframes need to be investigated; 2) impacts of climate variation on recruitment and implications for harvest of depressed populations need to be assessed; 3) the document went beyond providing scientific advice given the mandate of the Lingcod Management Framework Committee and also provided explicit management recommendations which is not typical of a PSARC Working Paper; 4) proportional harvest among geographic areas in relation to their abundance is important; 5) continued research needs to be conducted to derive fishery-independent estimates of biomass and to estimate recruitment variability. The Subcommittee provided six recommendations affecting management and research.

SOMMAIRE

Le Sous-comité sur le poisson de fond du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni le 26 mai 2005 à la Station biologique du Pacifique, située à Nanaimo (C.-B.), pour examiner un document de travail sur la morue-lingue.

Document de travail G2005-03 : Cadre de gestion de la morue-lingue dans le détroit de Géorgie

Le Sous-comité accepte « Le cadre de gestion de la morue-lingue dans le détroit de Géorgie » et les recommandations formulées dans le document de travail sous réserve de révisions. Il a conclu que : 1) la robustesse des points de référence, les répercussions de l'incertitude liée aux estimations de la biomasse sur la sélection de points de référence et les échéanciers doivent faire l'objet d'un examen; 2) les effets des variations du climat sur le recrutement et les conséquences pour la pêche de populations appauvries doivent être évalués; 3) le document de travail va au-delà du mandat du comité du cadre de gestion de la morue-lingue puisqu'il contient davantage que des avis scientifiques et comprend des recommandations explicites en matière de gestion, ce qui n'est pas habituel dans un document de travail du CEESP; 4) la répartition proportionnelle des activités de pêche en fonction de l'abondance dans chacune des zones géographiques est importante; 5) la poursuite des activités de recherche est nécessaire pour obtenir des estimations de la biomasse indépendantes de la pêche et pour estimer la variabilité sur le plan du recrutement. Le Sous-comité formule six recommandations en matière de gestion et de recherche.

INTRODUCTION

The PSARC Groundfish Subcommittee met May 26, 2005 at the Pacific Biological Station in Nanaimo, British Columbia. External participants from industry, academia, First Nations and conservation groups attended the meeting. The Subcommittee Chair, J. Fargo 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 and reviewers is included as Appendix 3

DETAILED COMMENTS FROM THE REVIEW

G2005-03: Management Framework for Strait of Georgia Lingcod

G. Logan, W. de la Mare, J. King and D. Haggarty

The Subcommittee acknowledged that the Working Paper presented a unique framework for fisheries management of the severely depressed lingcod population in the Strait of Georgia. While other jurisdictions have been implementing decision rules in their analyses, this appears to be the first instance that DFO has produced a research document with consensus-based management advice in partnership with a diverse group of clients. The Subcommittee agreed that the approach taken by the Lingcod Management Framework Committee (LMFC) and in the Working Paper, in the development of harvest decision rules, has precedent-setting application for other groundfish stocks.

In keeping with the PSARC Terms of Reference, there were two solicited reviews of the Working Paper. One individual member of the LMFC provided unsolicited, written commentary on the paper. In addition, at the request of the Subcommittee Chair, a perspective on the limit reference points (LRP) presented in the Working Paper was solicited from the DFO Pacific representative on a National Team tasked with reviewing methods for choosing LRPs.

Both of the solicited reviews complemented the authors for a thorough analysis. The reviewers and Subcommittee agreed that the framework was, in principle, going in the right direction.

The first solicited review raised issues regarding the various hypotheses tested in the paper. The authors pointed out that the analysis was limited by the data available but that the results were generally robust to various changes to model assumptions (e.g., Ricker vs. Beverton-Holt, male vs. female selectivity, etc.).

There was some confusion over whether the parameter λ , which affects the relationship between CPUE and exploitable biomass, was estimated or treated as a nuisance parameter. A $\lambda < 1$ implies that the rate of change in CPUE declines relative to biomass at high biomass levels. A $\lambda > 1$ implies a non-linear increase in CPUE relative to biomass. The authors' stated that a reliable estimate of λ does not exist given the data. The authors further clarified that in the paper λ was treated as a nuisance parameter since the true objective of the exercise was to determine the ratio B_{2013}/B_{2003} . The reviewer further suggested that an estimate of absolute biomass could be obtained through tagging. The authors noted that this would be expensive and impractical given the low abundance of the stock and absence of a fishery which would recover tags. The authors suggested that alternative methods of estimating absolute abundance should be explored. DFO's work on inshore rockfish using submersibles and multibeam habitat typing was cited as an example.

One Subcommittee member pointed out that the recovery phase of the model is strongly influenced by the recreational CPUE. He pointed out the CPUE is always an issue and questions if recreational fishers can change their fishing behaviour to maintain a high CPUE. The commercial sector representative also pointed out that advancements in technology now readily available to sports fishers such as depth sounders and GPS would affect the CPUE.

One author showed creel survey data broken down by area to show that the greatest improvements in catch rates originated in the one sub-area of statistical area 19. The subarea in question is at the southern extent of the Strait of Georgia and its proximity to west coast stocks may be influencing the high catch rates.

As one Subcommittee member described, in the event that there is a sudden stock crash some time in the future, for example, then the projections in the paper are not a good indication of how the stock should be managed at that point to achieve recovery. One author noted that in its present form, the model is static since it projects the average stock response to a fixed future harvest. The author stressed that, in reality, implementation of a management framework is a dynamic process where management responds to changes in stock dynamics in relation to harvest.

It was suggested that simulations should explore the full dynamics of the management procedure. The Subcommittee agreed that the robustness of various decision rules and reference points be assessed in a management strategy evaluation (MSE) as suggested in one review. The authors did not concur with one reviewer, in questioning whether the current model was too complex for the questions being asked by managers. The authors argued that the performance of MSE depends on the complexity of the model.

A reviewer was supportive of the various surveys yielding data that supports the current framework. Concern was expressed that the monitoring of recovery is

constrained by available resources within the Department. The authors stated that there is an ongoing responsibility on behalf of the Department to ensure continuity of the surveys, even if the frequency is multi-year. The young-of-year (YOY) survey was defended as a necessary link in the chain: egg mass → larvae → YOY → adults. This survey may help reduce the largest uncertainty in the modeled recruitment. Enhanced recruitment information would also address regime shift questions. It was pointed out that egg masses were a good indicator of spawning female abundance (1 egg mass = 1 female).

One reviewer questioned why the authors did not use CPUE data from the trawl fishery from 1980-89 for an abundance index. The authors defended their use of CPUE from the commercial hook and line landings, where rockfish increasingly became the target species after the late 1970s. The reviewer also questioned why the authors did not use the expanded estimates from recreational creel survey data for non-fishing months. The authors noted that the expanded estimates for non-fishing months were comparable to those used in the current paper, and would therefore not make much difference to the model outcome.

The Subcommittee discussed the historical impact of the internment of Japanese hook and line fishermen during WWII. Lingcod landings in the Strait of Georgia during this event were potentially affected because the removal of these fishermen comprised a large percentage of the fleet.

It was noted that when the Strait of Georgia was modelled as four geographic areas (Southeast, Northeast, Northwest and Southwest) that the current biomass estimates for two of the areas fell well below the 10% of historic biomass cutoff outlined in the decision rule framework, and as such no harvest should be permitted in the Southeast (Statistical Areas 28 and 29) and the Northwest (Statistical Areas 13 and 14). While this decision rule was applied to the Southeast area, with its subsequent removal from the final modelling scenario, the same decision rule was not applied to the Northwest in which the current biomass estimate was only 6% of historic biomass. The authors agreed that the decision rule was not applied for the Northwest. They noted that auxiliary information regarding the reliability of early catch statistics and catch per unit effort data for the Southeast area augmented the LMFC decision to remove this area from the final modelling exercise. Subsequent discussion centered proportioning harvest among the three geographic areas in relation to their proportional abundance in order to deal with the disproportionate estimates of current biomass among the Southwest, Northwest and Northeast.

The perspective of the Pacific DFO representative on the National review of limit reference points centered on the differing use of $B_{10\%}$, $B_{25\%}$, and $B_{40\%}$ reference limits between the current framework and that which is used in the US. Confusion stems from the omission of the qualifiers “short-term” and “long-term” when referring to targets. The authors agreed to clarify this. It was pointed out that the US system bases its targets on optimum yield while the current framework does

not. The authors also commented that time scales are extremely uncertain and suggested that despite legislated recovery times, nature has its own agenda.

Another area of uncertainty involves the management of the four quadrants within the Strait of Georgia. The current framework has not explored the possibility of removing the entire quota from one quadrant or minor statistical area. The Subcommittee noted that disproportionate distribution of effort among the four quadrants is ill advised given the potential for distinct stocks within the Strait of Georgia. One suggestion was to assign proportions of fishing effort to each quadrant. Once limits are reached in any one quadrant, fishing is closed in that particular quadrant. Concern was expressed that red light/green light systems may work in larger areas, but would be impractical in small areas due to limited enforcement resources.

There was some concern about the way the regime hypothesis was incorporated into the model. In this model, only the carrying capacity parameter was adjusted and not the recruitment compensation parameter that determines the productivity at the origin. The Subcommittee suggested some effort should be made to assess the effect of adjusting the compensation in future analyses.

Participants from First Nations groups questioned how the proposed quotas would accommodate their requirements for FSC (food, social, and ceremonial) purposes. The issue was deemed to be outside the scope of the framework and the PSARC review process. It was noted that the proposed harvest was above and beyond FSC needs and that First Nations catch remains largely unknown. It was also noted that if First Nations catch remains constant it would not affect the results of the model. However, if First Nations catch increases, it could affect the results. One participant felt that First Nations catches are increasing and if there is a fishery opening the view would be that the stock is no longer a conservation concern and fishing effort would increase greatly. The Subcommittee noted that unreported or mis-reported catch will impact recovery. Effort should be made to obtain all lingcod catches from all sectors.

An industry participant from the commercial hook and line fishery expressed concern that there should be more focus on the commercial data rather than the recreational data. The former is well-documented through efforts and expense of the industry. The latter is spotty and incomplete. That participant noted that the creel survey is being cut back. Additionally, the participant stated that the model is insufficient on its own. The results need to be backed up with scientific research.

Regarding recommendation 6 in the Working Paper, some Subcommittee members from the management sector were concerned about the difficulty in enforcing barbless hook regulations in one groundfish species that do not apply to others. While the effectiveness of the management options other than catch restrictions was not addressed in the Working Paper, they were recognized as

potential management decisions that may reduce specific source of fishing mortality.

The unsolicited, written comments provided by one member of the LMFC voiced concern about the semantics of the word “consensus” as described in the Working Paper. In the opinion of that individual, during the numerous meetings of the LMFC, there were many disagreements that did not necessarily constitute a consensus other than that it was based on the majority. The authors agreed to re-write the overview in the Working Paper with a clear definition of consensus. The comments of the individual emphasized the fact that many landings reported for District 1 (minor statistical areas 28-29, port of Vancouver) were actually caught in areas outside District 1. For instance, many lingcod removals from the southern Gulf Islands were landed in Vancouver. One Author of the Working Paper agreed to explore the new hypothesis of “double landings” put forth in the written comments provided to the Subcommittee. The Subcommittee noted that the current analysis does not use District 1 so there was no impact on the report results.

Subcommittee Conclusions

The Subcommittee accepted the paper with editorial revisions. The Subcommittee commended the Lingcod Management Framework Committee for its contribution and commended the authors on providing a unique document that incorporates a management framework with stock assessment research.

The Subcommittee concluded that:

- continued exploratory research needs to be conducted to investigate the robustness of the reference points, the impacts of uncertainty in biomass estimates on selection of reference points and timeframes;
- impacts of decadal-scale climate and ocean variability on recruitment and the implications for the selection of harvest rates for a population with such a low level of abundance;
- because the mandate of the Lingcod Management Framework Committee was to develop a management framework, the document went beyond providing scientific advice but also provided explicit management recommendations which is not typical of a PSARC Working Paper. As such, the Subcommittee accepted the recommendations made by the Lingcod Management Framework Committee including those with management advice;
- since the current biomass estimates are higher in the southwest quadrant than in the Northwest or Northeast, that it would be advisable to devise a

means of proportioning harvest among geographic areas in relation to their proportional abundance;

- continued research needs to be conducted to derive fishery-independent estimates of biomass and to estimate recruitment variability.

Subcommittee Recommendations

1. The criteria and recovery timeframe outlined in the Management Framework Section should be applied when formulating management strategies for Strait of Georgia lingcod. Namely that:
 - a. if current biomass levels are estimated to be within 10-25% of historic biomass levels, then the population would be considered to be overfished. A suitable short-term recovery target for the lingcod population would be 25% of historic biomass levels. Any harvest should be associated with at least a 90% probability of maintaining a positive increase in biomass levels in 10 years.
 - b. no harvest should occur when biomass levels are estimated to be at or below 10% of historic biomass estimates.
2. The Subcommittee recommended that fishery managers consider a harvest of between 5,000 to 7,000 lingcod (pieces) for the 2005/2006 fishing year. Any harvest should be restricted to Statistical Areas 13 through 19, including sub-area 29-5 (of Statistical Area 29) only. Harvest should be proportioned across geographic areas in relation to proportional abundance. Non-retention of lingcod should remain in effect for Statistical Area 28, and the remaining portions of Statistical Area 29.
3. If a commercial fishery is permitted, the Subcommittee recommended that:
 - a. a fishery be conducted as an experimental fishery, structured to obtain reliable data on catch and effort by depth and location
 - b. all trips be observed
 - c. all lingcod landings be sampled for biological information
4. If a recreational fishery is permitted, the Subcommittee recommended that:
 - a. the fishing season be limited to June through September.
 - b. the fishery must be closely monitored to ensure that the total allowable catch is not exceeded. Currently, recreational catch statistics are estimated and not verified, and the Subcommittee recommended that monitoring of the recreational fishery includes some measure of accuracy for the catch estimates. Additionally, the precision associated with the catch estimates need to be improved by addressing the precision of the effort estimate.
 - c. monitoring of the fishery must include reliable estimates of released lingcod. A 4% mortality rate would be applied to the estimates of

released lingcod to estimate mortality due to capture and release. The released mortality would be included in the total allowable catch limit.

- d. if, within the season, the total allowable catch is exceeded, the fishery will be closed.
 - e. the fishery be permitted for one year only, after which a review of the monitoring program for the lingcod recreational fishery is conducted to assess its success and ability to provide reliable information to manage the fishery.
 - f. restrictions to the fishery should include:
 - i. minimum 65 cm size limit
 - ii. daily limit of 1; annual limit of 10
 - iii. spear fishing be prohibited
5. Research should be conducted to derive fishery-independent estimates of absolute biomass and to estimate recruitment variability subject to other priorities and resource availability.
6. Research should be conducted to explore: i) the robustness of reference points, ii) the impacts of uncertainty in biomass estimates on selection of reference points and, iii) the impacts of decadal-scale climate and ocean variability on recruitment with the implications for harvest management of depleted populations.

APPENDIX 1. Working Paper Summary

Working Paper G2005-03: Management Framework for Strait of Georgia Lingcod

G. Logan, W. de la Mare, J. King and D. Haggarty

Lingcod populations in the Strait of Georgia have been severely depressed for several decades. As such, the commercial fishery has been closed since 1990 and the recreational fishery has been subject to regulations. In 2002, the recreational fishery was closed for the retention of lingcod as an additional measure to protect this stock. A Stock Assessment Framework (King et al. 2003) for lingcod suggested that a management framework be developed in consultation with stakeholders that would identify benchmark abundance levels as reference points to measure recovery in abundance and identify management action associated with those benchmarks.

In response to that recommendation, the Lingcod Management Framework Committee was formed in 2004 and included federal and provincial fisheries agencies' staff along with representatives of the recreational fishery sector, the commercial fishery sector and conservation groups. The committee identified criteria to be used as reference points in classifying the status of Strait of Georgia lingcod and to be used as decision rules for fishery management. The committee also reviewed sources of commercial and recreational catch and catch per unit effort data to be used in estimating historic and current biomass levels of Strait of Georgia lingcod. An age-structured stock assessment model was used to estimate lingcod biomass, and the development of the model was directed by the committee. The committee provided input on the spatial-scale of the population model, the stock-recruitment relationship, biological parameters, and assumptions regarding recruitment variability.

The suggested criteria and recovery targets for Strait of Georgia lingcod are based on the process and standards for rebuilding plans adopted by the US Pacific Fishery Management Council for the US Pacific coast groundfish fisheries. Estimates of historic high levels of biomass are used in lieu of biomass estimates for the unfished Strait of Georgia lingcod population. Proportions of historic high biomass of 40% ($B_{40\%}$), 25% ($B_{25\%}$) and 10% ($B_{10\%}$) were selected as reference points for defining the status of lingcod populations and as decision rules for management actions. The $B_{40\%}$ level was identified as a desirable, long-term recovery target for Strait of Georgia lingcod abundance. Between $B_{25\%}$ and $B_{10\%}$, the population would be considered to be overfished. $B_{25\%}$ was identified as a desirable, short-term recovery target for Strait of Georgia lingcod if the current biomass levels fell below this reference point. The recommended timeframe for assessing forecasted biomass trajectories is 10 years. At $B_{25\%}$ the acceptable level of probability associated with identifying potential harvest levels should be at least 90%. At $B_{10\%}$ this probability level should be between 99-

100%, and as such no harvest would be permitted for population estimates at or below $B_{10\%}$.

A Ricker stock-recruitment age structured model was selected by the committee to estimate historic and current biomass levels. The Strait of Georgia was modelled as a single unit (Statistical Areas 13-19; 28 and 29); as four geographic areas (Southeast: Statistical Areas 28 and 29, excluding 29-5; Northeast: Statistical Areas 15 and 16); Northwest: Statistical Areas 13 and 14; Southwest: Statistical Areas 17, 18, 19 and 29-5); and as a modified geographic area that excluded the Southeast area since catch and effort data for this area were unreliable and its current biomass estimates were less than 1% of historic biomass estimates. Current biomass estimates for the Northeast, Northwest and Southwest geographic areas were 12%, 7% and 20% respectively of historic biomass estimates.

The population model selected by the committee combined these three geographic areas and estimated the lowest level of depletion to have occurred in 1990 (2% of historic biomass) and the current biomass of lingcod is estimated to be 15% of historic biomass levels. Using the outlined management framework, this population is classified as overfished and any harvest level selected should be associated with a 95% probability of maintaining an increase in biomass for 10 years. For stock projections over the next 10 years (year 2013), the committee selected results based on annual harvests with a minimum size limit of 650 mm and an assumption of high recruitment variability (C.V.=1.0). Stock projections suggests that with no annual harvest, there is a 50% probability that the stock will be at 46% of historic biomass in 10 years. Stock projections for various harvest levels suggests that 26,930 pieces can be removed annually with only a 3.33% probability of a decline in biomass from current estimates. Stock projections for suggests that this annual harvest rate will have a 50% probability that the stock will be at 36% of historic biomass, which falls below the long-term target of 40% of historic biomass.

The mean annual estimate of recreational landings prior to the closure in 2002 (1991-2001) was 4,880 pieces, ranging from 2,912 pieces in 1999 to 8,219 pieces in 2001. Based on these historic recreational fishery harvest levels, the committee recommended an annual harvest between 5,000 – 7,000 pieces. Stock projections for 5,000 and 7,000 pieces annually for the next 10 years suggests that there is a 50% probability that the stock will be at 44% and 43% respectively of historic biomass in the year 2013.

**APPENDIX 2: PSARC Groundfish Subcommittee Meeting
Agenda**

**AGENDA
PSARC Groundfish Subcommittee Meeting
May 26, 2005
Pacific Biological Station - Nanaimo
Seminar Room**

THURSDAY – MAY 26	
Introduction and procedures	9:00 – 9:15
Management Framework for Strait of Georgia Lingcod	9:15 – 12:00
<i>Lunch Break</i>	<i>12:00 – 1:00</i>
Subcommittee Discussion of Proceedings	1:00 – 4:00

APPENDIX 3. List of Attendees

Date:

Subcommittee Chair: Jeff Fargo

PSARC Chair: Al Cass

External Participants	
Name	Affiliation
Ayers, Cheri	Hul'qumi'num Treaty Group
Chalmers, Dennis	MAFF
DeLeeuw, Valentyn	Commercial Harvester
de la Mare, Bill	Simon Fraser University
Furnell, Don	Malaspina College
La Boucan, Guliduniia	Cowichan Tribes
Wallace, Scott	Sierra Club of BC
DFO Participants	
Adams, Devona	
Cass, Al (PSARC Chair)	
Fargo, Jeff (Meeting Chair)	
Haigh, Rowan	
Haggarty, Dana	
Hodes, Vanessa	
Huang, Ann-Marie	
Johansson, Todd	
Krishka, Brian	
King, Jackie	
Lothead, Janet	
Logan, Gary	
Martin, Jonathan	
McFarlane, Sandy	
Schnute, Jon	
Shaw, Bill	
Stanley, Rick	
Trager, Diana	
West, Kim	

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.

Martell, Steve	University of British Columbia
Anonymous	Fisheries and Oceans Canada