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Proceedings of the PSARC Pelagic Subcommittee Meeting

September 8, 2004
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 September 8-9, 2004 at the Pacific Biological Station, Nanaimo, British Columbia to review scientific information relating to British Columbia herring biology, distribution and assessment. Also, the Subcommittee adopted recruitment rules to be used in the absence of independent information.

Working Paper P2004-01: Stock Assessment For British Columbia Herring In 2004 And Forecasts Of The Potential Catch In 2005.

The five major herring stocks in BC are managed by a fixed harvest rate policy in conjunction with a fishing threshold or Cutoff level. Cutoff levels are set at 25% of the estimated unfished equilibrium biomass. Cutoff levels have been established through stock-recruitment curves or bootstrapping of the observed recruitment time series. Biomass forecasts are provided for three classifications of recruitment assumption: poor, average and good. In the age-structured model, these recruitment levels are calculated as the mean of the lowest 33%, the mid 33%, and the highest 33% of the estimate of historic age-2+ fish abundance, respectively. The Subcommittee reviews spawn survey information, perceptions of test fishing skippers and managers, age-structured model information, and biological data. An offshore mid-water trawl survey provides information to determine the appropriate recruitment strength assumption for the West Coast Vancouver Island stock. Yield recommendations are set at 20% of the forecast annual biomass unless the forecast is near or below Cutoff levels (in which case a modified harvest rule is used).

Assessments of major herring stocks in 2004 were conducted using the age-structured model adopted for the 2003 assessment. The paper was accepted with minor revisions and the Subcommittee accepted yield recommendations as outlined in Appendices 4-8 for 2005.

Coastwide, the estimated pre-fishery stock biomass for all assessment regions in 2004 was 221,000 tonnes based on the age-structured model which represents a 2% decrease from the 2003 abundance level. In 2004, recruitment of the 2001 year-class was very poor in the north and poor to average in the south.

The estimated harvestable surplus in 2005 (20% of the 2005 forecast herring run) based on forecast abundance to the five assessment regions is 37,540 tonnes for the BC coast assuming average recruitment to all areas except the Queen Charlotte Islands where the stock remains at depressed levels and no surplus is available.

Queen Charlotte Islands – The pre-fishery biomass forecast for 2005 is 5,400 tonnes assuming poor recruitment. This stock is well below the Cutoff level. Thus, there is no surplus identified.

Prince Rupert District – The pre-fishery biomass forecast for 2005 is 27,390 tonnes assuming average recruitment. The forecast of returning biomass is above the Cutoff level of 12,100 tonnes. Application of the 20 percent harvest rule to the forecast results in a potential harvest of 5,480 tonnes.

Central Coast – The pre-fishery biomass forecast for 2005 is 33,880 tonnes assuming average recruitment. The forecast of returning biomass is above the Cutoff level of 17,600 tonnes. Application of the 20 percent harvest rule to the forecast results in a potential harvest of 6,780 tonnes.

Strait of Georgia – The pre-fishery biomass forecast for 2005 is 97,420 tonnes assuming average recruitment. The forecast of returning biomass is well above the Cutoff level of 21,200 tonnes. Application of the 20 percent harvest rule to the forecast results in a potential harvest of 19,480 tonnes.

West Coast Vancouver Island – The pre-fishery biomass forecast for 2005 is 28,980 tonnes assuming average recruitment. The forecast of returning biomass is above the Cutoff level of 18,800 tonnes. Application of the 20 percent harvest rule to the forecast results in a potential harvest of 5,800 tonnes.

Minor Stocks – Potential harvest for minor stocks are identified as 10% of observed spawning biomass in the previous year. The Subcommittee identified a potential harvest of 114 tonnes for Area 27 and a potential harvest of 274 tonnes for Area 2 West.

SOMMAIRE

Le Sous-comité des poissons pélagiques du Comité d'examen des évaluations scientifiques du Pacifique s'est réuni les 8 et 9 septembre 2004 à la Station biologique du Pacifique à Nanaimo, en Colombie-Britannique, pour étudier la biologie, la répartition et l'évaluation du hareng de la Colombie-Britannique. De plus, le Sous-comité a adopté les taux de recrutement qui seront utilisés en l'absence d'information indépendante.

Document de travail P2004-01 : Évaluation des stocks de hareng de la Colombie-Britannique en 2004 et prévisions des prises potentielles en 2005

La pêche des cinq principaux stocks de hareng en Colombie-Britannique est régie selon un taux d'exploitation fixe, assorti d'une limite de pêche. Les limites sont fixées à 25 % de la biomasse équilibrée non exploitée estimée et elles sont établies à partir de courbes stock-recrutement ou par la méthode *bootstrap* appliquée aux séries chronologiques du recrutement observé. Les prévisions de la biomasse sont présentées selon trois catégories de recrutement possible : faible, moyen et bon. Dans le modèle de structure par âge, ces catégories de recrutement correspondent respectivement à la moyenne du tiers le plus faible, du tiers moyen et du tiers le plus élevé de l'estimation de l'abondance antérieure des poissons d'âge 2+. Le Sous-comité examine les données tirées des relevés des géniteurs, les perceptions des capitaines et des gestionnaires de pêches expérimentales, les données tirées du modèle de structure par âge et les données biologiques. Un relevé au chalut pélagique permet de déterminer la bonne hypothèse de recrutement concernant le stock de la côte Ouest de l'île de Vancouver. Le taux d'exploitation est fixé à 20 % de la biomasse annuelle prévue, à moins que la prévision ne soit proche de la limite ou qu'elle n'y soit inférieure (en pareil cas, on établira un autre taux d'exploitation).

Les évaluations des principaux stocks de hareng en 2004 ont été réalisées à l'aide du modèle de structure par âge adopté pour les évaluations de 2003. Le document a été accepté après que l'on y ait apporté des modifications mineures, et le Sous-comité a accepté les taux d'exploitation décrits aux annexes de 4 à 8 pour 2005.

Le long de toute la côte, la biomasse des stocks dans toutes les zones évaluées avant que la pêche n'y soit pratiquée en 2004 était estimée à 221 000 tonnes d'après le modèle de structure par âge, ce qui représente une diminution de 2 % par rapport à 2003. En 2004, le recrutement de la classe d'âge 2001 a été très faible dans le Nord et il était de faible à moyen dans le Sud.

Sur la côte de la Colombie-Britannique, l'excédent pouvant être pêché en 2005 (20 % du nombre prévu de reproducteurs en 2005) estimé d'après l'abondance prévue dans les cinq zones d'évaluation se chiffre à 37 540 tonnes dans l'hypothèse où le recrutement serait moyen dans toutes les zones, sauf aux îles de la Reine-Charlotte, où le niveau du stock demeure faible et où il n'existe aucun excédent.

Îles de la Reine-Charlotte – La biomasse prévue avant la pêche en 2005 est de 5 400 tonnes dans l'hypothèse où le recrutement serait faible. Le niveau de ce stock se situe bien en dessous de la limite de pêche. Ainsi, aucun excédent n'a été relevé.

District de Prince Rupert – La biomasse prévue avant la pêche en 2005 est de 27 390 tonnes dans l'hypothèse où le recrutement serait moyen. La prévision de la biomasse qui retourne dans les eaux côtières est supérieure à la limite de 12 100 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne des prises potentielles de 5 480 t.

Côte centrale – La biomasse prévue avant la pêche en 2005 est de 33 880 tonnes dans l'hypothèse où le recrutement serait moyen. La prévision de la biomasse qui retourne dans les eaux côtières est supérieure à la limite de 17 600 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne des prises potentielles de 6 780 tonnes.

Détroit de Georgie – La biomasse prévue avant la pêche en 2005 est de 97 420 tonnes dans l'hypothèse où le recrutement serait moyen. La prévision de la biomasse qui retourne dans les eaux côtières est bien supérieure à la limite de 21 200 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne des prises potentielles de 19 480 tonnes.

Côte ouest de l'île de Vancouver – La biomasse prévue avant la pêche en 2005 est de 28 980 tonnes dans l'hypothèse où le recrutement serait moyen. La prévision de la biomasse qui retourne dans les eaux côtières est supérieure à la limite de 18 800 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne des prises potentielles de 5 800 tonnes.

Stocks mineurs – La récolte potentielle pour les stocks mineurs est établie à 10 % de la biomasse des géniteurs observée l'année précédente. Le Sous-comité a établi pour la zone 27 la récolte potentielle à 114 tonnes et à 274 tonnes pour la zone 2 ouest.

INTRODUCTION

The PSARC Pelagic Subcommittee met September 8-9, 2004 at the Pacific Biological Station 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 Chair presented recommendations and discussion items from the December 5, 2003 meeting of RMEC at which recommendations from the November 17-18, 2003 Pelagic Subcommittee meeting was presented.

The Subcommittee reviewed decision rules for recruitment strength predictions in the absence of additional, independent data and one Working Paper. This Working Paper summary is presented in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants and reviewers is included as Appendix 3. Appendices 4 to 8 contain stock specific yield recommendations.

Decision Rules for Recruitment Strength Predictions

During discussions at the October 2003 RMEC meeting concerns were expressed about the decision rules used by the Subcommittee to determine recruitment (and subsequent forecasts) for Pacific herring. RMEC requested the decision rules for determining recruitment strength for herring stocks in the absence of independent data be clarified and documented. In response, the Subcommittee formulated the following decision rules and the underlying rationale. The Subcommittee agreed to accept these decision rules for determining the level of recruitment (poor, average, or good) to be used in future forecasts, including the 2005 forecast presented here, in the absence of recruitment predictors.

Forecasting Herring Recruitment in the Absence of Independent Data

The primary goal of the harvest strategy for Pacific herring is to allow sustainable harvest opportunities while assuring conservation of the resource. Currently, the five major herring stocks in BC are managed using both a commercial fishery Cutoff and 20% harvest rule. Previously, the Pelagic Subcommittee of PSARC determined that a 20% exploitation rate was sustainable when stocks were above the Cutoff level. For stocks near the Cutoff level (e.g., those where a 20% exploitation rate would reduce biomass to a level below the Cutoff) a modified harvest rule is used (Catch = Forecast Abundance - Cutoff). This modified rule allows potential harvest while stock conservation is maintained.

It is important to note that the current Cutoff represents a commercial fishery cutoff only and does not represent a conservation cutoff or conservation reference point. It is a reference point intended to maintain the reproductive capacity of the stock. Thus, even when a stock is near (or below) the stock-specific Cutoff, conservation concerns may be unwarranted as this information alone is insufficient to conclude a stock may be at risk. The current commercial fishery Cutoff is used to maintain stock productivity or rebuild stock biomass following years when stock size decreases below the Cutoff. This approach worked well when the WCVI stock fell below Cutoff in 2001 but has proven less successful in recovery of the QCI stock (see below).

Predicting recruitment for Pacific herring and most other fish species is difficult. In the absence of independent information, the Subcommittee often has chosen average recruitment to minimize forecasting errors. Currently, only one stock (WCVI) has a recruitment forecasting method that has been tested and validated for use by PSARC. (Note that the methodology has been developed for the SOG stock but is still being evaluated). This forecast relies upon independent, offshore survey data collected during the summer prior to the recruitment of age-2+ fish to the spawning population. Although methodologies are being developed for other herring stocks, none are available at this time. As such, determination of a level of recruitment must be made in the absence of independent data. Any decision about recruitment strength must be consistent with the precautionary approach to fisheries management while assuring harvest opportunities are not unduly restricted.

In the absence of alternative recruitment forecasting methods, the following rules apply:

1. If the pre-fishery biomass was below Cutoff in the previous year, then assume POOR recruitment for the forecast. The modified harvest rule is likely to apply.
2. If the pre-fishery biomass was above Cutoff in the previous year and recruitment has been GOOD in the two previous years, then assume GOOD recruitment for the forecast.
3. If Rule 1 or Rule 2 DO NOT APPLY then assume AVERAGE recruitment for the forecast. The modified harvest rule may apply.

Reconstruction of Recruitment Forecasts (1995 to 2005)

Rule 1: This rule never applied to PRD, CC or SOG stocks. The WCVI stock has had an independent forecast for a number of years. The QCI assessment region was below Cutoff (and closed to roe harvest) in 1994, 1995, 1996, 1997, 2001, 2003, and 2004. Thus, POOR recruitment would have been assumed in 1995, 1996, 1997, 1998, 2002, 2004, and 2005 using the proposed decision rules. As a result, there would have been no surplus identified in four years (1995, 1996, 2004, and 2005); the modified harvest rule would have been used in two years (1997 and 2002); and the usual 20% harvest rule would have been used in one year (1998). Recently, the QCI stock has remained near or below Cutoff requiring frequent application of this rule.

Rule 2: Based on the most recent assessment document, this rule would only have applied once to the CC stock and three times to the SOG stock (primarily during the rapid increase in biomass since the late 1990s).

Rule 3: This rule would have been used almost exclusively for all stocks except QCI for forecasts since 1995. Assuming AVERAGE should minimize forecasting errors in most cases as standard errors are reduced.

DETAILED COMMENTS FROM THE REVIEWS

Working Paper P2004-01: Stock Assessment For British Columbia Herring In 2004 And Forecasts Of The Potential Catch In 2005.

J. Schweigert

This paper was accepted with minor revisions.

Subcommittee Discussion

The author indicated that the age-structured model used for this year's assessment and forecast was identical to the one used last year. It was noted that recruitment of the 2001 year-class was one of the weakest observed for BC herring populations since 1951, especially those in the north. It also was noted that for one stock, WCVI, the biomass projected by the age-structured model and that projected by the spawn index were divergent. Overall, both reviewers were impressed with the herring stock assessment document and with the exception of some minor points that needed clarification; both made suggestions that could improve future herring assessments.

The first reviewer was concerned about potential variability introduced to the age-structured model through variability in age data used in the model. The Subcommittee agreed that this might be an important source of model uncertainty and provision of advice. The Subcommittee had further discussion about the potential impact of a reduction in ageing effort in recent years and expressed concern that insufficient samples may have been aged. As limited research has been done to determine the number of samples required to be aged for each stock, the Subcommittee recommends that a sensitivity analysis be conducted (and PSARC paper prepared) to determine minimum sample sizes (and spatial sample coverage) required to have confidence in the age-structured model output. Until results of the analysis are completed and reviewed, the Pelagics Subcommittee recommends no further reduction in herring ageing effort. It is possible that some stocks already could be below the minimum threshold and further reductions could threaten resource sustainability. The Subcommittee noted that due to other financial and personnel limitations, it may be necessary to contract this work to receive results in a timely fashion (additional resources would be required).

The second reviewer noted the biomass estimates in the most recent assessment were lower than estimated in earlier assessments and this point was minimized in the working paper. This gives the appearance the age-structured model is over-estimating biomass in the most recent year. This reviewer further noted that the potential problem is different for different stocks with the greatest retrospective departures noted for the QCI and WCVI stocks. The Subcommittee agreed with this observation and it was recommended that future research examine the potential retrospective "over-estimation" of abundance by the age-structured model. It was noted that this issue is not unique to the herring age-structured model but is common among models of this type, which have a tendency to "over-estimate" when stocks are decreasing and "under-estimate" when stocks are increasing.

The Subcommittee had extensive discussion about the status of the QCI stock. Briefly, the estimated spawning biomass for this stock has been below Cutoff since 1991/92 with the exception of the 1997/98 season (Working Paper Appendix 2.1). Recently, commercial harvest in QCI has been limited to spawn on kelp fisheries operating under a precautionary management plan (there have been no commercial seine or gillnet openings). Despite this limited harvest, the stock continues to decline. The Subcommittee concluded that based on its current understanding of herring dynamics, and the perceived limited removals, this stock should have been rebuilding but clearly this is not the case.

Evidently, aspects of the population dynamics in the QCI stock are functioning differently than in other BC herring stocks. Without focused research, the cause(s) of the observed decline will remain unknown. The stock decline could be due to changes in natural or fishing mortality, ecosystem changes that have resulted in changes in predator populations or prey availability, climate or regime

impacts, changes in dispersal rates (immigration or emigration), etc. It was noted that this stock has an anomalous recruitment pattern with an average of only one strong year-class every 10 years. The Subcommittee also noted that there might be no net loss in productivity (g/m^2) among northern herring stocks (QCI, PRD, CC) but it is possible migration patterns have changed with a net movement of QCI fish to other assessment areas. Finally, the actual removals by SOK operations remain unknown and additional research has been proposed (but remains unfunded) to examine mortality associated with SOK operations. The Subcommittee agreed that immediate action is required and would like support to initiate a broad-scope study to determine factors that are limiting the recovery of this stock. Special funding will need to be obtained to support this initiative.

The Subcommittee stresses that given the current stock biomass, even minimal removals from QCI could represent substantial harvest levels that in turn may be limiting stock recovery.

The Subcommittee noted a slight discrepancy between the spawn predicted by the age-structured model and that observed based on diver surveys (relationship might not be 1:1). The residuals from this relationship suggest possible time-trends for two of the five herring stocks (PRD and WCVI). It is possible these time trends are a function of climate or regime impacts and should be considered in future research.

The Subcommittee received input on a potential recruitment-forecasting tool for the SOG stock that is based on an offshore, summer herring survey off the WCVI. This methodology was presented and accepted by PSARC in 2002 but the Subcommittee recommended it be evaluated for a few years before application. The Subcommittee appreciates the efforts involved and would like to see this work continue. The recruitment prediction from this survey will be used in next year's forecast.

The Subcommittee also received information from a juvenile survey conducted annually in the Strait of Georgia. Although the 2002-year class does not appear anomalous, the 2003-year class looks especially weak and should be noted for the 2006 forecast when these fish will be recruiting.

Although not directly related to the working paper presented, the Subcommittee was alarmed by the reduction in funding and expertise relative to the value of the herring fishery and relative to contributions by industry. The Subcommittee recognizes the importance of herring to ecosystem processes (e.g., the role of herring as prey to salmonids, groundfish, and marine mammals) and notes that little research is being done in these areas due to a lack of scientific personnel and funding. It was noted that the Pelagics section has only 7 FTEs (soon to be 6) and the number of species the Subcommittee is responsible for has increased (thereby decreasing effort devoted entirely to herring). This contrasts with 12

FTEs only 10 years ago when herring was the only species of focus. The Subcommittee also noted the anticipated reduction of industry funding to stock assessment as industry responsibility for fisheries management costs increases.

Subcommittee Conclusions

1. This paper was accepted with minor revisions and the Subcommittee accepted yield recommendations outlined in Appendices 4 to 8 of this report.
2. The Subcommittee is concerned with the reduction in funding available to the Pelagics section and believes that advice will be compromised if reductions in funding continue. Also, the Subcommittee noted that PYs continue to be reduced.
3. The Subcommittee is alarmed about the reduced support available to the Pelagics section from the Fish Aging Laboratory. By reducing the number of samples aged, age-structured model performance may be compromised. This needs to be examined and reviewed.
4. The Subcommittee noted the tendency for the retrospective estimation of biomass to be over-estimated, especially for the WCVI and QCI stocks. This should be examined further.
5. The Subcommittee is extremely concerned that the QCI stock has not recovered despite several years of roe fishery closures. Additional research on this stock is needed urgently to determine what factors are suppressing recovery.
6. The recruitment forecast for the SOG stock in 2006 will be based on the offshore trawl survey forecast.

Subcommittee Recommendations

1. The Subcommittee recommended the maximum potential yields for each major stock assessment area as outlined in Appendices 4-8.
2. A maximum potential yield of 114 tonnes (based on the 10% harvest rule for the minor stock areas) is recommended for Area 27.
3. A maximum potential yield of 274 tonnes (based on the 10% harvest rule for the minor stock areas) is recommended for Area 2 West.
4. A spawn survey should be continued in 2005 in Area 2 West.
5. A sensitivity analyses should be undertaken to determine the minimum acceptable number of samples needed for the stock assessment. This research should be completed as soon as possible due to the potential impacts on model performance. Further, no additional reduction in the number of herring samples aged by the aging lab is acceptable until this issue is resolved.
6. An analysis should be undertaken to determine the mechanism (and the seriousness) of the tendency for the retrospective "over-estimation" of stock biomass.

7. The QCI stock appears to be functioning differently than other BC herring stocks. The initiation of research efforts in QCI to examine stock dynamics is needed. This work should be well focused and examine multiple possible impacts on stock productivity and dynamics. Such a project could be developed as a collaborative effort in conjunction with other client groups (e.g., HCRS, SOKOA, First Nations).

APPENDIX 1: Working Paper Summary

Working Paper P2004-01: Stock Assessment For British Columbia Herring In 2004 And Forecasts Of The Potential Catch In 2005.

J. Schweigert

Herring stock abundance in British Columbia waters was assessed for 2004 and forecasts were made for 2005 using an age structured assessment model for the major stock assessment regions and an escapement model for the minor stocks in Areas 2W and 27. These models have been applied to assess herring abundance since 1984. As in recent assessments a fixed spawn conversion or catchability factor was applied for the dive survey era beginning in 1988 and a free fitted parameter was estimated for the earlier surface survey period. In addition, a year specific logistic function was applied to model the availability of fish on the spawning grounds. Penalty weights adopted for the preceding assessment were again used this year. All available biological data on total harvest, spawn deposition, and age and size composition of the spawning runs were used to determine current abundance levels. No significant problems were evident in the extent and comprehensiveness of the data collections. However, fewer samples were aged in 2004 due to constraints imposed on the ageing laboratory. All available data were included in and summarized from an Access database. Coastwide, the estimated pre-fishery stock biomass for all assessment regions in 2004 was 221,000 tonnes based on the age-structured model which represents a 2% decrease from the 2003 abundance level. This reflects stable or minor increases in all stocks except the Strait of Georgia where biomass decreased moderately. Recruitment of the 2001 year-class was very poor in the north and poor to average in the southern stocks.

The estimated harvestable surplus in 2005 (20% of the 2005 forecast herring run) based on forecast abundance to the five assessment regions is 37,540 tonnes for the B.C. coast assuming average recruitment to all areas except the Queen Charlotte Islands where the stock remains at depressed levels and no surplus is available.

APPENDIX 2: PSARC Pelagic Subcommittee Meeting Agenda September 8-9, 2004

AGENDA
PSARC PELAGIC SUBCOMMITTEE MEETING
September 8-9, 2004
Seminar Room - Pacific Biological Station
Nanaimo, BC

Wednesday, September 8, 2004

9:00	Introductions and Opening Remarks.
9:30-10:30	Recruitment Guidelines for RMEC. T. Therriault
10:30-12:00	Stock Assessment for British Columbia Herring in 2004 and Forecasts of the Potential Catch in 2005. J. Schweigert
12:00	Lunch
1:00-2:00	Schweigert Presentation Continued
2:00-4:00	Review and Discussion of Presentation.

Thursday, September 9, 2004 (as required)

9:00-12:00	Formulation of Subcommittee Conclusions and Recommendations
12:00	Lunch
1:00-4:00	Continued Formulation of Subcommittee Conclusions and Recommendations (as required.)

APPENDIX 3: List of Attendees & Reviewers

Subcommittee Chair: Tom Therriault
PSARC Chair: Al Cass

NAME	WEDNESDAY	THURSDAY
EXTERNAL PARTICIPANTS		
Don Hall	✓	
Russ Jones	✓	✓
Cecil Hill	✓	
John Bolton	✓	✓
Ed Safric	✓	
Dennis Chalmers	✓	
Dan Ware	✓	✓
Lloyd Webb	✓	✓
Ross Holkestad	✓	
DFO MEMBERS (* Subcommittee Member)		
Cass, Al*	✓	✓
Daniel, Kristen	✓	
David Einarson	✓	
Fort, Chuck*	✓	✓
Hamer, Lorena*	✓	✓
Hay, Doug*	✓	✓
Kristmanson, Jim	✓	✓
McCarter, Bruce*	✓	✓
Midgley, Peter*	✓	✓
Potyrala, Mark*	✓	✓
Rusch, Bryan	✓	✓
Schweigert, Jake*	✓	✓
Tanasichuk, Ron*	✓	✓
Therriault, Tom*	✓	✓
Thomas, Greg*	✓	
Trager, Diana*	✓	

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.

Alec MacCall	U.S. National Marine Fisheries Service
Noel Cadigan	DFO – Science Branch

Appendix 4. Criteria for assessment of stock status in 2004 and yield recommendation for 2005: Queen Charlotte Islands

Criteria	Status
1. Data Quality	
a) All catch reported	a) No. FSC estimated by managers
b) All spawn surveyed	b) Yes. Selwyn and Huston surface survey only.
c) Good sample coverage	c) Yes, but reduced from 2003
2. Stock status and trends	
a) ASM-2q	a) Decreasing trend since 1998. Slight increase since 2002.
b) Spawn indices	b) Decreasing trend since 1998. Small decline from 2003; length increased from 2003 but deposition and width decreased.
3. Perceptions of Stock Status	
a) Charter skippers comments	a) Stocks "cautiously rebuilding"
b) Management staff	b) 2E abundance very low and "unstable". Biomass mostly young age classes and possibly higher than that represented by biological samples.
4. Recruitment	
a) Age-structured model	a) Recruitment poor from 1999 to 2002, average in 2003 and poor in 2004
5. Forecast Abundance	
a) Profile Likelihood	a) 95% CI: 6 800 to 9 700 tonnes
b) Recruitment Assumption	b) Abundance / Potential Harvest
• **Poor**	**5 400** / **0**
• Average	6 930 / 0
• Good	12 440 / 1 740
6. Additional Information	Stock has been below Cutoff for 5 of the last 6 years. Stock is not recovering as expected. Lowest recruitment in 2004 since reduction fishery years (second lowest on record).
7. Cutoff:	**10 700 tonnes**
8. Yield Recommendation	No yield

Appendix 5. Criteria for assessment of stock status in 2004 and yield recommendation for 2005: Prince Rupert District

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) No. FSC not reported b) Yes c) Yes, but reduced from 2003
2. Stock status and trends a) ASM-2q b) Spawn indices	 a) steady, increased from 2002 b) very slight decline from 2003. Length, width and deposition similar to 2003.
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a) Appear down slightly from 2003 but still healthy. Kitkatla continues to have both early and late spawners b) reflected above
4. Recruitment a) Age-structured model	 a) Recruitment average from 2000 to 2002, good in 2003 but poor in 2004
5. Forecast Abundance a) Profile Likelihood b) Recruitment Assumption • Poor • **Average** • Good	 a) 95% CI: 25 900 to 32 700 tonnes b) Abundance — Potential Harvest 24 490 — 4 900 **27 390** — **5 480** 36 680 — 7 340
6. Additional Information	
7. Cutoff:	**12 100 tonnes**
8. Yield Recommendation	Maximum potential yield of 5 480 tonnes

Appendix 6. Criteria for assessment of stock status in 2004 and yield recommendation for 2005: Central Coast

Criteria	Status
1. Data Quality	
a) All catch reported	a) No. FSC incomplete for Heiltsuk
b) All spawn surveyed	b) Yes
c) Good sample coverage	c) Yes, but reduced from 2003
2. Stock status and trends	
a) ASM-2q	a) increasing since 2002
b) Spawn indices	b) increasing since 2002. Length up slightly, width and deposition similar to 2003.
3. Perceptions of Stock Status	
a) Charter skippers comments	a) Improved over 2003 and improving
b) Management staff	b) Average stock with average recruitment
4. Recruitment	
a) Age-structured model	a) Recruitment average in 2002, good in 2003 but poor in 2004
5. Forecast Abundance	
a) Profile Likelihood	a) 95% CI: 29 600 and 36 100 tonnes
b) Recruitment Assumption • Poor • **Average** • Good	b) Abundance / Potential Harvest 31 310 / 6 260 **33 880 / 6 780** 42 920 / 8 580
6. Additional Information	
7. Cutoff:	**17 600 tonnes**
8. Yield Recommendation	Maximum potential yield of 6 780 tonnes

Appendix 7. Criteria for assessment of stock status in 2004 and yield recommendation for 2005: Strait of Georgia

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) Yes b) Yes c) Yes, but reduced from 2003
2. Stock status and trends a) ASM-2q b) Spawn indices	 a) decline from peak in 2003 b) decline from peak in 2003. Length is down from 2003.
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a-b) Stocks down from previous high. Inseason shift from Denman/Hornby towards Nanoose Bay. Spawn length down accompanied by major shifts in distribution. Less below Dodd's Narrows and along Bowser/Qualicum shore and more in 17N.
4. Recruitment a) Age-structured model	 a) Recruitment average to good since 2000
5. Forecast Abundance a) Profile Likelihood b) Recruitment Assumption • Poor • **Average** • Good	 a) 95% CI: 86 300 to 110 300 tonnes b) Abundance — Potential Harvest 85 480 — 17 100 **97 420** — **19 480** 113 300 — 22 660
6. Additional Information	
7. Cutoff:	**21 200 tonnes**
8. Yield Recommendation	Maximum potential yield of 19 480 tonnes

Appendix 8. Criteria for assessment of stock status in 2004 and yield recommendation for 2005: West Coast of Vancouver Island

Criteria	Status
1. Data Quality	
a) All catch reported	a) Yes
b) All spawn surveyed	b) Yes
c) Good sample coverage	c) Yes, but reduced from 2003
2. Stock status and trends	Unexplained discrepancy between ASM and Spawn Indices.
a) ASM-2q	a) increasing since 2000
b) Spawn indices	b) decline from 2003. Decrease in length but considerable reduction in number of layers from 2003.
3. Perceptions of Stock Status	
a) Charter skippers comments b) Management staff	a and b) Overall, WCVI not great. Barkley, Clayquot and Nootka were poor. Esperanza looked good but inseason observation not supported by spawn deposition.
4. Recruitment	
a) Age-structured model	a) Recruitment average in 2002 and 2003 but poor in 2004
b) Offshore trawl survey	b) forecast is AVERAGE
5. Forecast Abundance	
a) Profile Likelihood	a) 95% CI: 26 200 to 42 300 tonnes
b) Recruitment Assumption • Poor • **Average** • Good	b) Abundance — Potential Harvest 23 810 — 4 760 **28 980** — **5 800** 43 020 — 8 600
6. Additional Information	
7. Cutoff:	**18 800 tonnes**
8. Yield Recommendation	Maximum potential yield of 5 800 tonnes