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Proceedings of the PSARC Pelagic Subcommittee Meeting

Compte rendu de la réunion du CEESP sur les poissons pélagiques

September 7-8, 2006
Pacific Biological Station
Nanaimo, BC

7 et 8 septembre 2006
Station biologique du pacifique
Nanaimo, C.-B.

M. Potyrala

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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 7-8, 2006 at the Pacific Biological Station in Nanaimo, B.C. The Subcommittee reviewed one working paper and one Science Advisory Report.

Working Paper P2006-04: Stock Assessment for British Columbia Herring in 2006 and Forecast of the Potential Catch in 2007

J.F. Schweigert and V. Haist

Following recommendations from the PSARC Pelagics Subcommittee meeting in May, 2006, forecasts of pre-fishery spawning stock abundance for 2007 are calculated using the recently adopted Herring Catch-Age Model (HCAM). This paper was accepted with minor revisions and the Subcommittee accepted the 2007 commercial fishery yield recommendations (Appendices 4-10). A 2007 harvestable surplus for the five major stock assessment regions is 26,202 tonnes. This surplus is based on forecast abundance using the HCAM model and application of the harvest rule adopted for Pacific herring. The harvest rule has a 20% fixed exploitation rate for biomass forecasts above a commercial fishery cut-off. The cut-off is at 25% of the unfished equilibrium biomass. The forecast biomass for Queen Charlotte Island and West Coast Vancouver Island stocks are both below their respective Cutoff levels. In addition, minor stock contributions to the harvestable surplus include 265 tonnes and 386 tonnes for Areas 27 and 2-West, respectively.

Science Advisory Report: Fraser River Eulachon (*Thaleichthys pacificus*): 2006 Population Assessment and Harvest Recommendations for 2007

T. Therriault

An eulachon assessment framework based on a traffic light assessment approach was approved by PSARC in 2003 and considered four measures of stock status: 1) estimates of spawning stock biomass (SSB) derived from a Fraser River egg and larval survey; 2) an offshore biomass index using data collected in the WCVI shrimp survey; 3) the Columbia River (and Fraser) commercial catch data; and 4) a Fraser River test fishery. The Science Advisory Report (SAR) reviewed at this PSARC meeting applied the methodology adopted in the framework with current data to provide an update on stock status and science advice for management.

Abundance indicators indicate the Fraser River eulachon stock remains depressed. SSB estimated from the egg and larval survey in 2006 was close to a historic low at 29 tonnes. The offshore eulachon index in 2006 from Shrimp Management Areas (SMAs) was very low (90 tonnes for Minor area 124 and 42 tonnes for Minor Area 125). The commercial eulachon fishery in the Columbia River landed less than 14 tonnes and the Fraser River was closed to commercial harvest in 2006. There was no eulachon test fishery in the Fraser River in 2006

SOMMAIRE

Le sous-comité du poisson de fond du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni les 7 et 8 septembre 2006 à la Station biologique du Pacifique de Nanaimo, en Colombie-Britannique. Le sous-comité a passé en revue un document de travail ainsi qu'un avis scientifique.

Document de travail P2006-04 : Évaluation du stock de harengs de la Colombie-Britannique en 2006 et prévision des prises potentielles en 2007

J.F. Schweigert et V. Haist

À la suite des recommandations émises à la réunion du sous-comité du poisson de fond du CEESP en mai 2006, on a calculé les estimations de l'abondance du stock reproducteur avant la pêche pour 2007 à l'aide du modèle des prises selon l'âge pour le hareng (MPAH) récemment adopté. Le sous-comité a accepté le document de travail sous réserve de certaines révisions mineures de même que les recommandations concernant le rendement de la pêche commerciale pour 2007 (annexes 4 à 10). Pour les cinq grandes zones d'évaluation des stocks, on a établi un excédent récoltable de 26 202 tonnes pour 2007. Cet excédent a été estimé à partir de l'abondance prévue avec le modèle MPAH et l'application de la règle de récolte établie pour le hareng du Pacifique. La règle de récolte prévoit un taux d'exploitation fixe de 20 % pour les estimations de la biomasse excédant le seuil minimal convenu pour une exploitation commerciale, soit 25 % de la biomasse d'équilibre non exploitée. Les biomasses estimées pour les stocks de l'île de la Reine-Charlotte et de la côte ouest de l'île de Vancouver sont toutes deux inférieures à leurs seuils minimaux respectifs. Par ailleurs, les contributions mineures des stocks à l'excédent récoltable comprennent 265 et 386 tonnes pour le secteur 27 et le secteur 2 ouest respectivement.

Avis scientifique concernant l'eulakane du fleuve Fraser (*Thaleichthys pacificus*) : évaluation de la population en 2006 et recommandations concernant la récolte pour 2007

T. Therriault

En 2003, le CEESP a approuvé un cadre d'évaluation de l'eulakane établi selon la méthode des feux de circulation. Ce cadre tient compte de quatre mesures de l'état du stock : 1) les estimations de la biomasse du stock reproducteur (BSR) dérivées d'un relevé des œufs et des larves dans le fleuve Fraser, 2) un indice de la biomasse hauturière provenant du relevé sur les crevettes de la côte ouest de l'île de Vancouver, 3) les données sur les prises commerciales dans le fleuve Columbia (et le Fraser), 4) les prises des pêches expérimentales dans le Fraser. L'avis scientifique (AS) examiné à la réunion du CEESP applique la méthodologie adoptée dans le cadre avec des données actuelles pour donner une mise à jour de l'état des stocks et formuler un avis scientifique à l'intention des gestionnaires.

Selon les indicateurs d'abondance, le stock d'eulakane du fleuve Fraser demeure appauvri. La BSR estimée à partir du relevé des œufs et des larves en 2006 était près d'un creux historique à 29 tonnes. L'indice de l'abondance des eulakanes en mer provenant des secteurs de gestion de la crevette était très faible en 2006 (90 tonnes pour la zone statistique mineure 124 et 42 tonnes pour la zone statistique mineure 125). Les débarquements de la pêche commerciale à l'eulakane dans le fleuve Columbia ont atteint moins de 14 tonnes, et le fleuve Fraser a été fermé à la pêche commerciale en 2006. Aucune pêche expérimentale à l'eulakane n'a eu lieu dans le Fraser en 2006.

INTRODUCTION

The PSARC Pelagic Subcommittee met September 7-8, 2006 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, M. Potyrala 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 on herring which is summarized in Appendix 1. A Science Advisory Report on Eulachon also was reviewed. The meeting agenda appears as Appendix 2. A list of meeting participants and reviewers is included as Appendix 3. Herring stock specific yield recommendations are listed in Appendices 4 to 10.

DETAILED COMMENTS FROM THE REVIEWS

Working Paper P2006-04: Stock Assessment for British Columbia Herring in 2006 and Forecast of the Potential Catch in 2007
J. Schweigert and V. Haist

This paper was accepted with revisions.

This review was the second since May 2006 toward developing a comprehensive catch-at-age model for Pacific Herring. The herring catch-age model (HCAM) incorporates the structure and assumptions of both the existing age structured model (EASM) used in previous herring assessments and a new age structured Model (NASM) used in a risk assessment framework also reviewed in May. The latter was in support of the Objectives Based Fisheries Management (OBFM) pilot initiative. The HCAM has added flexibility to investigate a broader range of alternative assumptions about the fishery, data inputs, stock dynamics and error distributions. In May 2006, the PSARC Pelagics Subcommittee accepted the HCAM model and recommended: 1) the HCAM model should be the primary model for predicting biomass and should be used to formulate science advice for management in 2007; and 2) the HCAM approach should be incorporated into the risk assessment framework that was also approved in May 2006. The present Working Paper included additional model development and analysis conducted since the May meeting including the 2007 biomass forecasts for the five Major Area stocks and two Minor Area stocks (Areas 27 and 2W).

Subcommittee Discussion

1. Technical review

Two formal reviews of the Working Paper were presented. The reviewers and other meeting participants agreed that the HCAM model represents a significant step forward in developing a comprehensive model for forecasting biomass of Pacific

herring. The Subcommittee agreed that the analysis in the Working Paper should be the basis for providing science advice for 2007 herring management. The reviewers were complementary of the Working Paper and made several constructive suggestions for future model development.

Both reviewers suggested that appropriate model selection criteria (i.e. Bayes Factor) should be used in future work to allow a formal and consistent comparison of alternative model structures. One reviewer noted that model structural uncertainty is not carried forward into stock assessment advice and therefore the current model potentially underestimates overall uncertainty. The reviewer suggested that a final posterior distribution of biomass could be estimated by weighting each model-specific posterior by the probability associated with each model. Both reviewers recommended that additional parameter convergence tests (i.e. multiple MCMC chains with random initial parameter values) should be used to ensure global parameter convergence.

One reviewer noted that the high fishing mortality estimates in recent years for the Prince Rupert District (PRD) and Strait of Georgia (SOG) stock is a concern. The Authors pointed out that mortality and availability are confounded in the model. Both reviewers and other participants requested clarification of this issue in revision to the paper.

Both reviewers were concerned about the basis for the change in the unfished equilibrium biomass B_0 for the Queen Charlotte Island (QCI) stock and the impact on science advice and the use of harvest rules for management. This prompted a discussion on the link between the HCAM model and the OBFM risk assessment framework for evaluating alternative harvest rules. The Authors clarified that the purpose of the present Working Paper was to implement the model in time for 2007 management advice and not to evaluate alternative harvest rules. The Subcommittee agreed that future modeling work should include incorporating the HCAM model into the risk assessment framework.

One reviewer noted that both the ranges and estimates of the Beverton-Holt stock-recruitment steepness parameter (h) used in the model were relatively high and questioned the resulting underestimation of harvest rates and overestimation of spawning biomass. Meeting participants agreed that future analysis could explore different stock-recruitment functions depending on priorities.

The Subcommittee and authors generally concurred with the reviewers' comments. The addition of a table comparing pre-fishery biomass predictions from EASM and NASM to those from HCAM runs was requested by one Subcommittee member. One reviewer suggested that a table describing past and current model runs be included in the revised Working Paper. There was general consensus that prioritizing and planning of future modeling work could not be concluded at this meeting and should be done in a working group setting. The work group should identify priorities and future HCAM modeling steps and the inclusion of the HCAM model into the risk assessment framework.

Meeting participants reviewed the 2007 recruitment forecasts for the WCVI and SOG stocks based on WCVI trawl survey data. Participants concluded that the high proportions of age 2+ fish and an average recruitment forecast for WCVI is inconsistent with indicators of unexpected mortality for the WCVI stock evident from the observed 2006 spawning stock biomass, low proportions of older age classes and relatively low recruitment. The participants agreed that the recruitment forecast should revert to “poor” given the data.

Discussion ensued over the intent of the current harvest rules the five Major Area stocks. The rule has a fixed exploitation rate of 20% over a broad range of biomass above a commercial fishery cut-off at 25% of the estimated unfished equilibrium biomass. Several meeting participants pointed out that current cut-off represents a commercial fishery threshold and includes all commercial fisheries, including spawn-on-kelp (SOK) but excluding First Nation FSC harvest. The mortality rate imposed on the resource by the SOK harvest practice is unknown but assumed to be non-zero. The cut-off is not a conservation limit reference point in the context of SARA but is designed to maintain the reproductive capacity at a high level of surplus production. Meeting participants accepted the 2006/07 modeling results for Minor Area stocks 27 and 2W noting that this was the first instance where biomass projects have been made for these minor stocks. A fixed 10% harvest rule without a cut-off is applied to Minor Area stocks as a precautionary measure to avoid over fishing in the absence of key assessment data inputs.

Meeting participants discussed the need for clarity in the provision of science advice and the need to communicate the probable biological consequences of harvest in a risk context. Application of the harvest rule puts yield recommendations in a consistent, rules-based context to guide decision making but it does not convey advice in terms of specific probabilities of harvest impacts on selected performance measures. Meeting participants agreed that the risk assessment framework that includes the HCAM model will be required to provide quantitative advice in that regard.

Meeting participants strongly endorsed the need to maintain biological sampling programs in all stock areas for stock assessment and the provision of advice. Participants recognized that this is a costly endeavor due to charter expenses. Participants acknowledged that the impact on the resource due to charter costs increases at low stock biomass if data collection expenses are borne by the resource and in high risk areas. During the last two herring stock assessment years (2004 and 2005), the Pelagics PSARC Subcommittee recommended that a sensitivity analysis be undertaken to determine the minimum number of biological samples required to adequately represent each area without compromising model performance. Participants agreed that this work is important to assess the trade-off between costs of collecting and processing samples and resource risk assessment. Limited resources and other priorities have continued to hinder the completion of this work.

2. Assessment and science advice

Estimates of spawn index, spawning biomass and pre-fishery biomass based on the HCAM model indicate that the abundance of all stocks except QCI declined dramatically in 2006. The estimated spawning biomass in 2006 for the WCVI stock was less than the previous recorded low and at a level not seen since the collapse in the late 1960s. Except for the Strait of Georgia and Prince Rupert, the forecast abundance for all stocks in 2007 is near or below the cut-off. The QCI stock has remained below the fishery cut-off in 7 of the last 8 years. Science advice in the form of yield recommendations are provided in Appendix Tables 4 to 10 and summarized as follows:

- Queen Charlotte Islands and West coast Vancouver Island - Forecast abundance is below the cut-off and commercial harvest at any level is inconsistent with the intent of the harvest rule.
- Prince Rupert District - Forecast abundance is above the cut-off with a potential commercial yield of 3,825 tonnes.
- The Central Coast - Forecast abundance is near the cut-off with a potential commercial yield of 4,083 tonnes.
- The Strait of Georgia - Forecast abundance is above the cut-off with a potential commercial yield of 18,294 tonnes.
- Area 2W - A potential commercial yield of 386 tonnes is consistent with the 10% harvest rule for Minor Areas.
- Area 27 - A potential commercial yield of 265 tonnes is consistent with the 10% harvest rule for Minor Areas.

Participants from Area 7 voiced concern over the Central Coast Major Area stock definition. They were concerned that setting quotas by stock assessment region (i.e. areas 6, 7,, and 8 combined) in the central coast region when biomass forecasts are low impacts the ability of First Nations in Area 7 to harvest. Their concerns were noted but they were informed that a broader discussion and review of area stock definitions was not an objective of the Working Paper and the peer-review meeting.

Subcommittee Conclusions:

- The Subcommittee approved the HCAM model and the biomass forecasts used to project surplus production in 2007.
- Estimates of spawn index, spawning biomass and pre-fishery biomass indicate that the abundance of all stocks except QCI declined dramatically in 2006. The QCI stock has remained below the commercial fishery cut-off in 7 of the last 8 years.
- Except for the Strait of Georgia and Prince Rupert District stock, the forecast abundance for all stocks in 2007 is near or below the cut-off.

- The estimated spawning biomass in 2006 for the WCVI stock was less than the previous recorded low and at a level not seen since the collapse in the late 1960s.

Subcommittee Recommendations:

1. Engage scientific experts in a work group setting to oversee future model development including the development of model selection criteria, model convergence tests, unfished biomass estimation and other modeling issues related to Pacific Herring. Improvements to the HCAM model are required before including the HCAM approach in the risk assessment framework.

2. Maintain core herring test fishing and spawn dive surveys essential to resource assessment and management of Pacific herring.

3. Use the area-specific recommendations in Appendix Tables 4 to10 for management decision making in 2007.

Science Advisory Report: Fraser River Eulachon (*Thaleichthys pacificus*): 2006 Population Assessment and Harvest Recommendations for 2007
T. Therriault

This paper was accepted with revisions.

An eulachon assessment framework based on a traffic light assessment approach was approved by PSARC in 2003 and considered four measures of stock status: 1) estimates of spawning stock biomass (SSB) derived from a Fraser River egg and larval survey; 2) an offshore biomass index using data collected in the WCVI shrimp survey; 3) the Columbia River (and Fraser) commercial catch data; and 4) a Fraser River test fishery. The Science Advisory Report (SAR) reviewed at this PSARC meeting applied the methodology adopted in the framework with current data to provide an update on stock status and science advice for management.

Subcommittee Discussion

Meeting participants agreed that the information in the draft Science Advisory Report indicates that the status of Fraser River eulachon stock is poor. The stock has remained depressed for three consecutive years and all stock status indicators are at very low levels. The spawning stock biomass (SSB) estimated from the egg and larval survey in 2006 (29 tonnes) was close to the historic low observed last year and substantially below the 150 tonne response level that indicates poor status based on the Fraser eulachon assessment framework. The eulachon fishery in the Fraser River was closed to commercial harvest in 2006 and the eulachon test fishery did not operate. The consensus among participants was that the depressed state of Fraser River eulachon is consistent with reports of depressed eulachon coast wide from the Columbia River to northern BC.

Meeting participants noted that biological data on Fraser River eulachon is very limited and has depended on a Fraser River test fishery. Participants agreed that biological data is useful for some monitoring activities but it should be noted that biological data was not collected in 2005 or 2006. Biological samples in 2005 were not available because all the fish were sold to pay for the test fishery. There was no commercial eulachon fishery in the Fraser River in 2006 and the test fishery was cancelled, in part to avoid incurring mortality. Meeting participants noted that collecting biological samples does not necessarily require a test fishery but agreed that biological sampling is a good investment for future research and assessment. The author reiterated the information in the draft SAR noting that as an index of abundance the test fishery data do not correlate with the egg and larval survey spawning stock biomass data and currently is not a pre-season indicator of abundance. However, it is a secondary indicator of general stock trends. Participants agreed that the test fishery index may prove useful in the longer term for assessment or future research as more years of data are collected. Some participants noted that at low abundances, uncertainty in the reliability of the test fishery may increase as a result of the lower encounter probability but there is no way to quantify this. It is an additional consideration to be taken into account should the annual test fishery be resumed. Meeting participants could not agree based on the information presented whether the risk associated with removals using a test fishery on such a low stock is warranted but agreed that exploration of non-lethal assessment is prudent.

Shrimp trawl bycatch was discussed as a source of mortality. It was noted that observer data indicates very low levels of eulachon bycatch following recent changes in the fishery, with bycatch comprising around 1% of the total catch biomass. However, market and stock conditions have significantly reduced total hours fished in the trawl fishery thereby reducing reported bycatch. Further, the observer coverage in the shrimp trawl fleet is minimal making extrapolation about fleet-wide bycatch levels risky. Although the cause of the stock decline is unknown, the very low spawning stock size of Fraser River eulachon, evidence of a general coast-wide eulachon decline and potentially low fishery impacts in recent years suggest to the Subcommittee that the decline could be more dependent on environmental factors than fishing but regardless of the cause of decline, mortality should be reduced wherever feasible.

Given the lack of quantitative data, one researcher commented that even anecdotal information can be useful for assessment purposes if it is collected regularly. The researcher indicated that he maintains contacts with others with knowledge about eulachon abundance and who provide anecdotal information on an annual basis. In addition, some coastal First Nations have started egg and larvae surveys on eulachon systems within their Traditional Territories. It was noted that a thesis at the University of British Columbia is in progress and will attempt to collate all available historical information.

Meeting participants agreed that an assessment of all human impacts on the stock, including dredging and development on the lower Fraser River would be a useful next

step. One Subcommittee member commented that such work on the Fraser can be challenging, even simply mapping spawn beds can be extremely difficult in turbid, flowing water.

Participants discussed the need for offshore index data from Areas 23 and 123. The author commented that this data series is shorter than data for the other two areas presented in the Working Paper and has an anomalous spike in one year. The mixed stock in these areas makes DNA data critical for future work. One paper has been published on stock delineation using DNA from a small sample of fish. It was noted that this data set needs to be built up.

The discussion concluded with consideration of the advice needed by management from this document and how to extend the traffic light approach presented in this document to a coast-wide eulachon assessment.

Subcommittee Conclusions

- The draft Science Advisory Report was accepted with revision.
- Any directed eulachon fishery will reduce the ability of the stock to rebuild beyond the current low level of abundance and will increase conservation risk.
- Any sampling and/or assessment program must be sensitive to current low stock biomass levels.
- The index of eulachon abundance based on the Fraser River test fishery will provide little information for immediate management decision making and is not necessary for management in 2007 given the low stock status.
- A test fishery is not justified due to the inconclusive nature of the results with respect to assessing stock strength at current low levels.
- A Fraser River eulachon sampling program is required and needs to be linked to a planned and broader coastwide assessment framework.

Subcommittee Recommendations

1. It is essential to continue the Fraser River egg and larval surveys as a method of assessing stock abundance.

2. Design and implement a biological sampling program for the Fraser River, consistent with a coast-wide framework.

3. Given extremely low biomass, any sources of mortality which affect spawning stock biomass and future stock recovery should be assessed.

APPENDIX 1: Working Paper Summary

Working Paper P2006-04: Stock Assessment for British Columbia Herring in 2006 and Forecast of the Potential Catch in 2007

J.F. Schweigert and V. Haist

BC herring stocks are managed with conservation and sustainable exploitation as the main objective. The Pacific Science Advice Review Committee process ensures all criteria used to manage BC herring stocks take a precautionary approach to management and, as such, are peer-reviewed and accepted by the Pelagics Subcommittee before implementation. Among the main management criteria for herring management are the fixed harvest rate policy and fishing biomass threshold (cutoff level). The fixed harvest rate of 20% of the forecast annual biomass, coupled with the cutoff level, set at 25% of the unfished equilibrium biomass level, is meant to ensure each of the 5 major BC herring stocks maintain adequate stock abundance in spite of varying annual productivity. A modified harvest rule is used when stock abundance approaches cutoff biomass, in which case the allowable catch is set at the difference between the predicted stock abundance and the fishing biomass threshold. The cutoff is not a conservation threshold, but rather a commercial fishing limit intended to ensure stock productivity over the long term. The minor stock harvest rule states that a maximum of 10% of the estimated abundance in the current season may be harvested in the following fishing season. Recruitment forecasting is inherently difficult in the absence of independent data. For the Straits of Georgia and WCVI stocks, PSARC-accepted recruitment forecasting is accomplished using data from an independent off-shore trawl survey performed during the previous summer. For those stocks lacking independent data, PSARC has recommended decision rules regarding recruitment forecasting which are consistent with the precautionary approach to herring stock management.

Assessments of major stocks in 2006, along with formulation of the 2007 yield recommendations, were conducted using the Herring Catch-Age Model (HCAM), adopted by the Pelagics Subcommittee during the May 2006 session. The paper was accepted with minor revisions and the Subcommittee accepted the 2007 yield recommendations as outlined in Appendices 4-10.

The estimated harvestable surplus of BC herring in 2007 (20% of the 2007 forecast spawning stock biomass), based on forecast abundance to the five assessment regions, is 26,202 tonnes. As was the case in 2006, both the Queen Charlotte Island and West Coast Vancouver Island stocks are below their respective Cutoff levels and can not support removals.

Queen Charlotte Islands – Assuming poor recruitment, the pre-fishery spawning stock biomass forecast for 2007 is 5,004 tonnes. This stock remains well below the Cutoff level of 10,700 tonnes. Thus, there is no available harvestable surplus.

Prince Rupert District – Assuming average recruitment, the pre-fishery biomass forecast for 2007 is 19,126 tonnes. The spawning stock biomass forecast 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 3,825 tonnes.

Central Coast – Assuming average recruitment, the pre-fishery biomass forecast for 2007 is 21,683 tonnes. 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 4,083 tonnes.

Strait of Georgia – Assuming good recruitment, the pre-fishery biomass forecast for 2007 is 91,468 tonnes assuming good 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 18,294 tonnes.

West Coast Vancouver Island – Assuming poor recruitment, the pre-fishery biomass forecast for 2007 is 13,116 tonnes. The forecast of returning biomass is below the Cutoff level of 18,800 tonnes. Thus, there is no available harvestable surplus.

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 386 tonnes for Area 2 West and 265 tonnes for Area 27.

Science Advisory Report: Fraser River Eulachon (*Thaleichthys pacificus*): 2006 Population Assessment and Harvest Recommendations for 2007
T. Therriault

Diminishing coastwide eulachon (*Thaleichthys pacificus*) returns over the past decade have raised concerns about the status of stocks in both the United States and Canada. In an attempt to monitor the health and status of the Fraser river stock, DFO Fisheries Management initiated an egg and larval survey and in-season test fishery in 1995. Additional stock status indicators were added in subsequent years, including an offshore biomass index derived from the annual West Coast Vancouver Island (SMA 124Off and SMA 125Off) shrimp trawl and Columbia River catch data. Hay et al. (2003, 2005) provided Fisheries Management with a stoplight approach to stock management through interpretation of the three pre-season indicators and one in-season indicator for Fraser River eulachon. Minor framework modifications were provided by Therriault and McCarter (2005). These include: 1) Discounting of the commercial catch bias resulting from recent directed management intervention; 2) The SSB estimate from the egg and larval survey should be the main decision making indicator; and 3) To provide completeness, the other three indicators should be included in the analysis. Application of this framework resulted in fishing restrictions on Fraser River eulachon being implemented in 2006.

The results of this evaluation of recent Fraser River stock indicators has lead to the following recommendations: 1) No directed eulachon fisheries, including First Nation,

recreational or commercial, should be conducted on the Fraser River stock in 2007; 2) Low stock levels require minimizing Fraser River eulachon bycatch mortality in other fisheries; 3) the two key indicators continue to signal current and near future conservation concerns and, given the short life cycle of this species, consecutive years of poor returns suggest longer term fishery closures might be necessary to allow stock rebuilding; 4) future egg and larval survey on the Fraser should be continued to track stock changes; and 5) the test fishery should be re-initiated in 2007 to monitor in-season eulachon returns.

APPENDIX 2: PSARC Pelagic Subcommittee Meeting Agenda

DRAFT AGENDA
PSARC PELAGICS SUBCOMMITTEE MEETING
September 7-8, 2006
Seminar Room - Pacific Biological Station
Nanaimo, BC

Thursday, September 7

8:30	Introductions and Opening Remarks.
9:00-12:00	Review of Working Paper: *Pacific Herring Total Allowable Catch for major and minor herring stocks for the 2007 fishery*
12:00	Lunch
1:00-4:00	Continue Review of Working Paper: *Pacific Herring Total Allowable Catch for major and minor herring stocks for the 2007 fishery*

Friday, September 8

9:00-12:00	Review of Science Advisory Report: *Fraser River Eulachon*
12:00	Adjournment

APPENDIX 3: List of Attendees & Reviewers

Subcommittee Chair: Mark Potyrala
PSARC Chair: Al Cass

NAME
EXTERNAL PARTICIPANTS
Benson, Ashleen
Bolton, John Sr.
Chalmers, Dennis
Haist, Vivian
Hill, Don
Jones, Russ
Korman, Josh
Morley, Rob
Newman, Earl
Safarik, Ed
Wallace, Scott
Webb, Lloyd
Wilson, Bill
Internal Participants
Cass, Al
Convey, Laurie
Daniel, Kristen
Flostrand, Linnea
Fort, Charles
Gill, Harpreet
Hamer, Lorena
Harbo, Rick
Potyrala, Mark
McCarter, Bruce
Schweigert, Jake
Spence, Brenda
Tanasichuck, Ron
Therriault, Tom
Thompson, Matt
Wright, Steven

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.

Korman, Josh	Ecometric Research
Martell, Steve	University of British Columbia
Hay, Doug	Retired, Fisheries and Oceans Canada

Appendix 4. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: Queen Charlotte Islands

Criteria	Status
1. Data Quality	
a) All catch reported	a) No commercial harvest in 2006
b) All spawn surveyed	b) Yes, but all surface surveyed
c) Good sample coverage	c) No. Limited to 8 samples
2. Stock status and trends	
a) HCAM	a) Continued depressed state, with 2006 similar to 2005
b) Spawn indices	b) Difficult to compare due to change in survey protocol. Length increased slightly, width decreased.
3. Perceptions of Stock Status	
a) Charter skippers comments	a) and b) 2E showed slight improvement over past few years.
b) Management staff	
4. Recruitment	
a) HCAM	a) Recruitment average in 2003, 2005 and 2006
5. Forecast Abundance	
Recruitment Assumption	a) Abundance — Potential Harvest
• **Poor**	**5 004** — **0**
• Average	6 820 — 0
• Good	12 638 — 1 938
6. Additional Information	
7. Cutoff	**10 700 tonnes**
8. Yield Recommendation	Forecast abundance is below the cut-off and commercial harvest at any level is inconsistent with the intent of the harvest rule.

Appendix 5. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: Prince Rupert District

Criteria	Status
1. Data Quality	
a) All catch reported	a) Yes
b) All spawn surveyed	b) Yes (Missed small spawn in Dries Inlet)
c) Good sample coverage	c) Yes
2. Stock status and trends	
a) HCAM	a) Steady decline since 2003
b) Spawn indices	b) Decline since 2003, with marked decline in 2006
3. Perceptions of Stock Status	
a) Charter skippers comments	a) Area 3/4 down by 1/3 and Kitkatla down slightly. Small fish, with mixed sizes later in the season.
b) Management staff	b) Spawning pattern In Kitkatla more broken and appeared less than in 2005. Spawn in Areas 3 and 4 showed significant decline
4. Recruitment	
a) HCAM	a) Recruitment poor in 2004 and 2006
5. Forecast Abundance	
a) Recruitment Assumption	a) Abundance / Potential Harvest
• Poor	15 380 / 3 077
• **Average**	**19 126** / **3 825**
• Good	28 293 / 5 659
6. Additional Information	
7. Cutoff	**12,100 tonnes**
8. Yield Recommendation	Forecast abundance is above the cut-off with a potential commercial yield of 3,825 tonnes

Appendix 6. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: Central Coast

Criteria	Status
1. Data Quality	
a) All catch reported	a) Yes
b) All spawn surveyed	b) Yes
c) Good sample coverage	c) Yes
2. Stock status and trends	
a) HCAM	a) decreasing since 2005
b) Spawn indices	b) decrease from 2005
3. Perceptions of Stock Status	
a) Charter skippers comments	a) and b) Stock decreasing over past few years. 2006 stock weaker than 2005. Small fish abundant. Spawning down in area and intensity.
b) Management staff	
4. Recruitment	
a) HCAM	a) Recruitment good in 2005 and poor in 2006
5. Forecast Abundance	
a) Recruitment Assumption	a) Abundance Potential Harvest
• Poor	17 549 0
• **Average**	**21 683** **4 083***
• Good	32 643 6 529
6. Additional Information	
7. Cutoff	**17,600 tonnes**
8. Yield Recommendation	Forecast abundance is near the cut-off with a potential commercial yield of 4,083 tonnes.

Appendix 7. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: Strait of Georgia

Criteria	Status
1. Data Quality	
a) All catch reported	a) Yes
b) All spawn surveyed	b) No. Missed 3 km in both Tsaawassen and at Icarus Pt. and missed spawns in Ganges and Bargain Hbrs. Numerous milting events checked with no egg deposition observed
c) Good sample coverage	c) Yes
2. Stock status and trends	
a) HCAM	a) decline from peak in 2003
b) Spawn indices	b) decline, mainly in length, from peak in 2003
3. Perceptions of Stock Status	
a) Charter skippers comments b) Management staff	a and b) Major decline in stock in 2006. Abundance of small fish and absence of older year classes. Large number of age 1+ spawners. Spawn length reduced; Width and intensity down substantially. Disturbing downward trend in stock abundance.
4. Recruitment	
a) HCAM	a) Poor in 2006
b) Offshore Trawl Survey	b) GOOD
5. Forecast Abundance	
a) Recruitment Assumption • Poor • Average • **Good**	a) Abundance / Potential Harvest 57 125 / 11 425 73 224 / 14 645 **91 468** / **18 294**
6. Additional Information	Predictions from off-shore survey should be viewed with caution due to high natural mortality
7. Cutoff:	**21 200 tonnes**
8. Yield Recommendation	Forecast abundance is above the cut-off with a potential commercial yield of 18,294 tonnes.

Appendix 8. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: West Coast of Vancouver Island

Criteria	Status
1. Data Quality	
a) All catch reported	a) No commercial fishery in 2006 FSC fishery took place
b) All spawn surveyed	b) No. Logistical issues and changes in fish behaviour.
c) Good sample coverage	c) No. Difficulty getting test fish
2. Stock status and trends	
a) HCAM	a) decreasing since 2003
b) Spawn indices	b) decline from 2003 and worst in time series
3. Perceptions of Stock Status	a) and b) Overall, WCVI was very poor. Early spawn in Barkley with another later spawn. Deep spawn in Esperanza.
a) Charter skippers comments	
b) Management staff	
4. Recruitment	a) Recruitment average in 2005 and poor in 2006
a) HCAM	b) AVERAGE (Note: Unusual distribution of herring noted during survey)
b) Offshore trawl survey	
5. Forecast Abundance	
a) Recruitment Assumption	Abundance / Potential Harvest
• **Poor**	**13 116** / **0**
• Average*	20 612 / 1 812*
• Good	38 486 / 7 697
6. Additional Information	*2006 observed spawning biomass lowest in time series (< half of previous low). 2007 forecast of age 4+ herring is inconsistent with 2006 spawning biomass. The recruitment forecast is directly linked to the 2007 forecast of age 4+ herring and therefore likely biased high and should be discounted and revert to the decision rule – POOR recruitment.
7. Cutoff	**18 800 tonnes**
8. Yield Recommendation	Based on the Recruitment Decision Rule, we adopt POOR recruitment and any yield in 2007 is inconsistent with the Harvest Rule.

Appendix 9. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: Minor stock Area 2W

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) No commercial harvest in 2006 b) Yes, but all surface surveyed c) No. Limited to 5 samples
2. Stock status and trends a) HCAM	 a) Increasing in recent years
b) Spawn indices	b) Difficult to compare due to change in survey protocol. Length increased slightly, width decreased.
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a) and b) 2W at least as strong as 2005. Stock estimates are very conservative.
4. Recruitment a) HCAM	 a) No recruitment forecast
5. Forecast Abundance Recruitment Assumption • Poor • **Average** • Good	a) Abundance / Potential Harvest 3 670 / 367 **3 864** / **386** 6 032 / 603
6. Additional Information	10 % harvest rule consistent with minor stocks
7. Cutoff	**No cutoff**
8. Yield Recommendation	A potential commercial yield of 386 tonnes is consistent with the 10% harvest rule.

Appendix 10. Criteria for assessment of stock status in 2006 and yield recommendation for 2007: Minor stock Area 27

Criteria	Status
1. Data Quality	
a) All catch reported	a) Yes
b) All spawn surveyed	b) Yes
c) Good sample coverage	c) No samples collected
2. Stock status and trends	
a) HCAM	a) Relatively stable
b) Spawn indices	b) Slight increase
3. Perceptions of Stock Status	
a) Charter skippers comments	a) and b) No comments.
b) Management staff	
4. Recruitment	
a) HCAM	a) No recruitment forecast
5. Forecast Abundance	
Recruitment Assumption	a) Abundance — Potential Harvest
• Poor	2 517 — 252
• **Average**	**2 651** — **265**
• Good	3 646 — 365
6. Additional Information	10 % harvest rule consistent with minor stocks
7. Cutoff	**No cutoff**
8. Yield Recommendation	A potential commercial yield of W65 tonnes is consistent with the 10% harvest rule.