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**Proceedings of the PSARC
Invertebrate Subcommittee Meeting**

**Compte rendu de la réunion du Sous-
comité du CEESP sur les invertébrés**

November 29-30, 2006

29-30 novembre 2006

Russell Mylchreest

Russell Mylchreest

Fisheries and Oceans Canada
Pacific Biological Station
Nanaimo, BC V9T 6N7

September 2007

Septembre 2007

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)

INVERTEBRATE SUBCOMMITTEE MEETING

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SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) Invertebrate Subcommittee met November 29-30, 2006 at the Pacific Biological Station in Nanaimo, B.C. The Subcommittee reviewed two working papers.

Working Paper I2006-03: Scientific advice for input to the Allowable Harm Assessment for northern abalone, *Haliotis kamtschatkana*

J. Lessard, A. Campbell, Z. Zhang, L. MacDougall, S. Hankewich

The paper reviewed literature and available research to examine factors affecting recovery potential and to assess source mortality rates affecting permitting under SARA. Recent surveys show northern abalone abundance is continuing to decline and the analysis and modelling indicates that abalone mortality would need to be reduced below 20% for recovery to occur.

The paper documented estimates of mortality rates and indicate that a primary threat to recovery is illegal harvest.

Considerable discussion ensued on the interaction between SARA listed sea otters and abalone. It was noted that sea otters and abalone co-existed before otters were extirpated in BC, but there is high uncertainty over long-term impacts both positive and negative, of sea otters on abalone. There is an opportunity to conduct research, depending on available resources and priorities, to assess factors affecting abalone mortality including the impacts from sea otter predation (on abalone and on abalone predators, such as Dungeness crab, and /or abalone competitors, such as sea urchins) in areas with and without sea otters.

Participants discussed First Nations interest in abalone Food, Social and Ceremonial (FSC) fisheries in areas benefiting from local enhancement and protection activities. The Subcommittee acknowledged that First Nations harvest opportunities will need to be consistent with recovery goals. Science advice is not yet available to set density levels that would support limited harvests for FSC purposes, although the Subcommittee agreed with the paper's recommendation to commence these discussions.

Little is known about localized impacts of other human activities (e.g., finfish aquaculture, log-dumps) on abalone habitat and abalone. The recommendation was to use assessment protocols for habitat developments on, in and under the water as recommended in the paper, including the collection of data.

Working Paper I2006-04: The development of ROV video survey and data classification protocols for monitoring hard seabed substrates

B. Emmett, P. Thuringer, S. Cook, and B. Burd

In British Columbia many finfish aquaculture operations are sited over hard bottom substrates. Provincial regulations for operational monitoring of organic waste impacts require video survey effort (quadrants stations and survey transects) but lack standard protocols for the field survey, data interpretation and analysis. The paper presented a review of video survey protocols in other jurisdictions, an assessment of video imagery from Provincial Ministry of Environment operational monitoring at 16 sites in BC and results of field studies conducted in collaboration with DFO, MOE and Industry.

The Subcommittee agreed that there is a need to set minimum standards for data collection and a need for a harmonized approach to collecting the information from both BC MOE and DFO perspectives. However, the Subcommittee struggled with the paper's specific recommendations as to the protocols for the ROV surveys and the data collection, particularly the transect methodology.

There are two key recommendations from the paper that were considered important to the Subcommittee: to adopt a protocol for ROV video surveys (Section 3.4) and to adopt a data collection and classification protocol (Section 4.3). Clear supporting documentation needs to be provided in support of each recommendation.

SOMMAIRE

Le Sous-comité du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) sur les invertébrés s'est réuni les 29 et 30 novembre 2006 à la Station biologique du Pacifique, à Nanaimo (C.-B.). Le Sous-comité a examiné deux documents de travail.

Document de travail I2006-03 : Avis scientifique pour l'évaluation des dommages acceptables concernant l'orveau nordique, *Haliotis kamtschatkana*

J. Lessard, A. Campbell, Z. Zhang, L. MacDougall, S. Hankewich

Le document est le résultat d'une étude de la documentation et des recherches existantes visant à examiner les facteurs susceptibles d'avoir une incidence sur le potentiel de rétablissement et à évaluer les taux de mortalité à la source qui ont des conséquences sur la délivrance d'autorisations en vertu de la LEP. De récents relevés montrent que l'abondance de l'orveau nordique continue à diminuer; l'analyse et la modélisation montrent que la mortalité de l'orveau devrait être abaissée sous la barre des 20 % pour qu'il y ait rétablissement.

Les auteurs ont estimé le taux de mortalité et notent qu'une des principales menaces qui se posent au rétablissement est la pêche illégale.

Suit une très longue discussion sur l'interaction entre la loutre et l'orveau nordique. On fait remarquer que les loutres de mer et l'orveau coexistaient avant que la loutre disparaisse de la C.-B., mais les effets à long terme, positifs et négatifs, de la loutre sur l'orveau sont empreints d'incertitude. Il y a là matière à recherche, selon les ressources et les priorités, de manière à évaluer les facteurs qui influent sur la mortalité de l'orveau, y compris les effets de la prédation de la loutre de mer (sur l'orveau et sur les prédateurs de l'orveau, tels que le crabe dormeur ou les concurrents de l'orveau comme les oursins) dans les zones où vivent des loutres et dans les zones sans loutres.

Les participants ont examiné l'intérêt des Premières nations pour les pêches de l'orveau à des fins alimentaires, sociales et rituelles dans des zones qui bénéficient d'activités locales de mise en valeur et de protection. Le Sous-comité reconnaît que les possibilités de pêche par les Premières nations devront être en accord avec les objectifs de rétablissement. Aucun avis scientifique n'est encore disponible pour l'établissement de niveaux de densité propres à soutenir une pêche limitée à des fins alimentaires, sociales et rituelles, bien que le Sous-comité soit d'accord avec la recommandation du document de commencer les discussions à cette fin.

On sait peu de chose à propos des effets localisés d'autres activités anthropiques (p. ex. pisciculture, décharges à billots) sur l'orveau et son habitat.

La recommandation consiste à utiliser des protocoles d'évaluation pour les projets de développement d'habitat sur l'eau, dans l'eau et sous l'eau, comme le recommande le document, y compris la collecte de données.

Document de travail I2006-04 : Mise au point d'un relevé vidéo par véhicule télécommandé et protocoles de classification des données pour la surveillance des substrats durs du fond marin

B. Emmett, P. Thuringer, S. Cook et B. Burd

En Colombie-Britannique, de nombreuses activités piscicoles se déroulent au-dessus de substrats durs. Les règlements provinciaux de surveillance opérationnelle des effets des déchets organiques exigent l'utilisation de relevés vidéo (quadrants et transects de relevé), mais ne proposent malheureusement pas de protocoles standard pour les relevés sur le terrain, l'interprétation des données et l'analyse. Le document présente un examen des protocoles de relevé vidéo dans d'autres secteurs de compétence, une évaluation de l'imagerie obtenue dans le cadre de la surveillance opérationnelle du ministère provincial de l'Environnement à 16 emplacements de la C.-B. et les résultats d'études sur le terrain réalisées conjointement par le MPO, le MdE et l'industrie.

Le Sous-comité convient qu'il faut fixer des normes minimales pour la collecte de données et harmoniser les méthodes de collecte de l'information du point de vue tant du MdE de la C.-B. que du MPO. Toutefois, les recommandations précises du document concernant les protocoles de relevé par véhicule télécommandé et la collecte de données, en particulier la méthode par transects, lui ont posé quelques difficultés.

Deux recommandations clés du document de travail ont été jugées importantes par le Sous-comité : l'adoption d'un protocole pour les relevés vidéo par véhicule télécommandé (section 3.4 du document de travail) et l'adoption d'un protocole de collecte et de classification des données (section 4.3 du document de travail). Il faut fournir une documentation claire à l'appui de chaque recommandation.

INTRODUCTION

The PSARC Invertebrate Subcommittee met November 29-30, 2006 at the Pacific Biological Station in Nanaimo, British Columbia to review two working papers, which are summarized in Appendix 1. External participants at the meeting included representatives from aquaculture, Parks Canada, and consulting. The Subcommittee Chair, R. Mylchreest opened the meeting by welcoming the participants, reviewing the objectives and protocols of the meeting, and reviewing the agenda.

The meeting agenda appears in Appendix 2, while a list of meeting participants and reviewers is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEWS

Working Paper I2006-03: Scientific advice for input to the Allowable Harm Assessment for northern abalone, *Haliotis kamtschatkana*

J. Lessard, A. Campbell, Z. Zhang, L. MacDougall, S. Hankewich

There was only one review available for this paper which was generally positive and provided suggestions for improvement, particularly with the technical aspects of the paper. It was noted by the reviewer that more detail is needed describing how the recovery targets presented in the paper were derived and it was pointed out that these targets differ from the abalone recovery strategy. The reviewer also noted the need for the abalone and sea otter recovery teams to collaborate on a precautionary approach to allow for the recovery of both species. It was noted that both species have co-existed in the past, but little is known about interactions between the two species and a long term planning approach will be needed.

Subcommittee Discussion

Subcommittee discussion began with the determination that this paper meets the requirements of a Recovery Potential Assessment, and that the title should be changed to reflect this. This paper is the first Recovery Potential Assessment to be done in the Pacific Region.

There was a discussion about how information from this paper would feed into the Abalone Recovery Strategy and determined that information from this paper may be added (i.e., updated) to the recovery strategy due to be adopted under SARA in June 2007.

The Subcommittee had a lengthy discussion about the impacts of sea otters on the recovery potential of abalone. It was noted by several participants and the reviewer that otters and abalone have evolved together and co-existed up until humans hunted otters to extinction on the BC coast. After lengthy discussion,

the Subcommittee agreed that more research on the ecology of otter/abalone interactions is required to understand the impact on the life history parameters of abalone from sea otters. It was also noted that model predictions and density target levels have been determined from otter free areas and it can be expected that these targets may not be applicable in otter inhabited areas.

Technical issues of the abalone population model described in Appendix 1 were discussed. The estimation of parameters within the model was questioned, particularly the growth equations used and recruitment relationships used. It was determined that it may be possible to improve the model performance using different methods to deal with the uncertainty in parameter estimates, and it was suggested that the authors re-run some scenarios to determine what effects portions of the uncertainty have on the results. Given the limited amount of data available for this analysis, the authors believe that the model as presented provides a reasonable representation of population parameters; however it could be improved with more data. There was some question raised by the reviewer on compensation versus depensation. The modelling has shown that there is some depensation at low population abundance; an improved explanation could be added to the paper.

Considerable time was spent dealing with the wording of the recommendations presented in this paper. It was determined that the paper needs the addition of a Conclusions section to support the recommendations presented. In addition, some recommendations (i.e., targets) as presented need more supporting explanation in the paper and some sections of the paper will need to be elaborated. The Subcommittee concluded that the wording of the recommendations in the paper needs to focus on the supported scientific consequences and not on management and policy decisions.

Subcommittee Conclusions

- The Subcommittee concluded that this paper is acceptable, with revisions. Revisions to the paper should include an emphasis on re-wording recommendations and adding a conclusion section.
- Comments received by the authors from the aquaculture industry should be considered in the final document.
- The considerations to examine abalone population parameters in the context of sea otters and the technical suggestions from the reviewer should also be considered in the final revisions.
- A Science Advisory Report is to be written based on the revised paper. It will be circulated to the Subcommittee prior to finalization.

Subcommittee Recommendations

1. The Subcommittee strongly encouraged abalone and sea otter science staff to collaborate to examine the interactions of sea otters and the affect on the abalone population.
2. The Subcommittee supported the recommendation in the paper for the use of the assessment protocols as presented in Appendix 2, including the requirement for the proponent to collect data.

Working Paper I2006-04: The development of ROV video survey and data classification protocols for monitoring hard seabed substrates

B. Emmett, P. Thurlinger, S. Cook, and B. Burd

This report was prepared for the British Columbia Aquaculture and Research and Development Committee (BCARDC). The purpose of the study was to develop and field test ROV video survey protocols and video classification standards for monitoring finfish aquaculture sites located over hard seabeds. It concluded that ROV video transects should be used to conduct operational monitoring of hard seabed finfish aquaculture sites. Survey design and technical performance levels for transect surveys are recommended.

Subcommittee Discussion

One review felt that the objectives of the paper were not clear (there was no request for working paper), that the paper was lacking in rigorous experimentation or survey design and statistical analysis, and that the paper was lacking management objectives or trigger points for management that would better allow the monitoring “parameters” to be determined.

The second review found the document to be very important and timely as it will provide information regarding the collection of data associated with potentially impacted hard-bottom substrates. This review noted that the information provided in the recommending of standards for video methods used to monitor the benthic environment surrounding fish farms is needed.

Whether the format of the paper was appropriate for PSARC was questioned and whether it would be more appropriate for the paper to go forth for review and discussion with industry instead.

The Subcommittee acknowledged that although there is a need to know what is required to trigger management options, and that any monitoring program needs to allow for those decisions to be made, there is currently insufficient baseline info on which to define these thresholds.

The Subcommittee noted that there is strength in having a request for working paper. While this paper is unorthodox in this regard, there was discussion that this paper is timely as there are currently no defined decision rules or standards

and, while the recommendations are not based on scientific assessment, they are needed. While it would be easier to have developed thresholds or management triggers first, these thresholds can not be set without the standardized collection format presented in the paper. The Subcommittee acknowledged that a cohesive methodology is needed, as is harmonization with BC MOE and DFO for the collection of this data. They also acknowledged that a central database for collecting, classifying and storing data needs to be made available for analyses.

While this was not written as a PSARC paper and does not follow that structure, it could be restructured as two separate entities, a literature review and documentation of a standardized database.

In consideration for revisions, the Subcommittee felt the paper needed to include rationale as to when to use transects over quadrats, and also when to use both. It needs to strengthen the argument on the most appropriate methodology. There are situations where quadrats may be preferred, as they can be standardized and can provide for comparisons. The decision to use one method over the other will be based on what needs to be achieved over the long term for management purposes. The paper should better reflect the situations where each, or both, methods may be used. The paper's strength, however, was seen in the development of standardized methodology. The classification protocol should allow the leeway to adopt either the use of transects or quadrats.

Both reviewers and the Subcommittee felt that the paper needed to include additional background information, including to clarify this as a Phase II document within a broader process and to include a summary of the Phase I report outcomes. Additional suggestions to improve the protocols and technical edits were provided in both reviews for the author's consideration.

Subcommittee Conclusions

- There is a need to set minimum standards for data collection. The Subcommittee struggled with the paper's specific recommendations regarding the protocols for the ROV surveys and the data collection.
- There was no basis in the paper for adopting the transect methodology over quadrats as the management objectives are not yet defined, the current state of knowledge is weak and there is little scientific justification available in the paper.
- There is a need for a harmonized approach to collecting the information from both BC MOE and DFO perspectives.
- While a better format for vetting review and scientific support outside PSARC is needed for a technical paper such as this, the Subcommittee nonetheless recognized that there is a need to move recommendations

forward. The Subcommittee concluded that the paper could be reformatted into the 2 main sections as discussed above and be modified to fit with a request for working paper (to be developed in collaboration between DFO Aquaculture Managers and Science) that would define management objectives for the paper.

Subcommittee Recommendations

1. Adopt a protocol for ROV video surveys and adopt a data collection and classification protocol. These protocols would set the current standard, but these would be minimal standards that may need to be reviewed as management objectives and/or triggers are better defined or as new survey technologies become available. This information needs to be put in to a centralized database.
2. The Subcommittee requested major revisions as outlined in the Subcommittee discussion and conclusions, particularly to include justifications for the protocols that are recommended in Section 3.4 and 4.3 of the Working Paper and to highlight the needs for further work (i.e., as included in Section 5.2). Chair to distribute revisions prior to final acceptance.

APPENDIX 1: WORKING PAPER SUMMARY

Working Paper I2006-03: Scientific advice for input to the Allowable Harm Assessment for northern abalone, *Haliotis kamtschatkana*

J. Lessard, A. Campbell, Z. Zhang, L. MacDougall, S. Hankewich

This paper discusses allowable harms assessment and suggested mitigation of factors affecting populations of the SARA “threatened” northern abalone in British Columbia (BC). Recent surveys indicated northern abalone abundance is continuing to decline. Time series analyses of abalone survey data from sea otter free areas of south east Queen Charlotte Islands and Central Coast during 1978-2002 provided stock-recruitment relationships, recruitment trends and mortality estimates of > 0.20 . Simulations indicate that abalone populations will continue to decline if current mortality rates remain >0.20 . Mortality rates of < 0.20 are required for abalone populations to recover.

Several human activities were considered that could potentially harm and cause direct mortality to abalone populations. In order of importance, these activities were: 1) Directed fishing; 2) habitat alterations, including finfish aquaculture, log booms and log dumps, and dredging; 3) abalone aquaculture; 4) fisheries on food supplies (i.e. kelp harvest); 5) scientific research; and 6) rebuilding activities, including larvae or juveniles outplanting and adult aggregations. In general, allowable harms that can be given permits under SARA have little aggregated mortality relative to poaching or sea otter predation. No allowable direct mortality is recommended.

With the intention of fostering stewardship, consultations should be initiated to look at a protocol under which small enhancement projects are carried out over specific sites by local First Nation community followed by a small conditional harvest of abalone with strict controls. The harvest would only take place if enhancement activities have been carried out and the abalone densities are above a set threshold. Considering a “precautionary approach” to northern abalone species survival, we suggest the following: (1) Poaching by humans should continue to be actively discouraged with enforcement; (2) Sea otters (currently protected by SARA) be placed on the AHA category, and population management should be considered (i.e., identify and maintain/enforce sea otter free zones) because: (a) sea otter populations abundances have been influenced by humans for more than a century, (b) their populations continue to grow and spread throughout BC, and (c) they threaten to accelerate the decline and may significantly contribute (in combination with other mortality factors) to the demise of northern abalone populations in BC.

Abalone are most threatened by poaching in areas without sea otters present. Adding mortality caused by sea otter predation in many areas will accelerate

abalone population declines and possibly induce declines to unrecoverable densities in as little as 26 years.

Working Paper I2006-04: The development of ROV video survey and data classification for monitoring hard seabed substrates

B. Emmett, P. Thurlinger, S. Cook, and B. Burd

In British Columbia many finfish aquaculture operations are sited over hard seabed substrates with moderate to high currents and little accumulation of natural seabed sediments. The British Columbia regulations for operational monitoring of organic waste impacts at these sites define video survey effort (quadrat stations and survey transects) but lack standard protocols for the field survey, data interpretation and analysis. As most hard seabed aquaculture operations are sited in water deeper than 30m, most video surveys are currently conducted using remotely operated vehicles (ROVs). A previous review study (Emmett *et al.* 2005) concluded that video surveys are the preferred tool for operational monitoring of hard seabed aquaculture sites. The objective of the present study was to develop and field test ROV video survey protocols and video classification standards for monitoring finfish aquaculture sites located over hard seabeds.

To address this objective a review of video survey protocols in other jurisdictions (Canadian east coast, Scotland, Tasmania, Norway) was conducted. Video imagery from current operational monitoring at 16 hard seabed aquaculture sites in British Columbia was reviewed to define hard seabed habitats, impact scenarios, potential indicators of organic waste impacts and to develop pilot video classification standards for field testing. Directed field studies were conducted to assess best methods for conducting an ROV transect survey as well as to assess the efficacy of video transect and quadrat methods in describing organic waste impacts to hard seabed benthic communities.

Rock cliff and bedrock outcrop/boulder fields were the most common seabed habitats at the 16 review sites, with coarse gravel and sand/fine gravel flats being less common. Gradients (net pen edge to edge of tenure) in the occurrence of key indicators of organic waste impacts such as *Beggiatoa*, fish feed and feces, and sensitive megafauna (Hexactinellid sponges) were evident in the video surveys. Comparison of video imagery data collected by ROV transect and quadrat methods indicated that the transect method provides the appropriate level of information to conduct a gradient analysis of the key indicators of organic waste impacts, although each method has advantages and constraints for specific classification attributes. Results of the ROV field trials suggest that cost effective methods of ROV seabed positioning remains an important survey protocol issue, and a number of methods for verification of transect end point position are suggested.

It is concluded that video transects not quadrats should be used to conduct operational monitoring of hard seabed aquaculture sites. A survey design and technical performance levels for transect surveys are recommended. A gradient approach to video imagery classification, based on video time segments, is proposed and video classification protocols for this transect segment method have been developed. A video classification database and a video imagery reference base have been developed in Microsoft Access to support the recommended classification protocols.

APPENDIX 2: PSARC INVERTEBRATE SUBCOMMITTEE MEETING AGENDA

PSARC Invertebrate Subcommittee Agenda
November 29-30, 2006
Seminar Room
Pacific Biological Station
Nanaimo, BC

Wednesday, November 29:

1:00	Introduction and Overview of the agenda
1:15	Review of working paper, -Development of ROV video survey and data classification protocols for monitoring hard seabed finfish aquaculture sites
2:30	Formulation of Subcommittee conclusions and recommendations.
3:30	Review of future PSARC requests
4:00	Adjournment

Thursday, November 30:

9:00	Introduction and Overview of the agenda
9:15	Review of working paper, – Scientific advice for input to the Allowable Harm Assessment for northern abalone, <i>Haliotis kamtschatkana</i>
12:00	Lunch
1:00	Continued Review of working paper, – Scientific advice for input to the Allowable Harm Assessment for northern abalone, <i>Haliotis kamtschatkana</i>
2:30	Formulation of Subcommittee conclusions and recommendations.
4:00	Adjournment

APPENDIX 3: LIST OF ATTENDEES & REVIEWERS

Subcommittee Chair: R. Mylchreest
 PSARC Chair: Al Cass

DFO Participants	Nov 29	Nov 30
Boutillier, Jim	X	X
Boutillier, Palmira	X	X
Bureau, Dominique	X	X
Campbell, Alan	X	X
Carolsfeld, Wolfgang	X	
Cass, Alan (PSARC Chair)	X	X
Clark, Dan	X	
Convey, Laurie	X	X
Dunham, Jason	X	X
Ennevor, Bridget		X
Ford, John		X
Gillespie, Graham	X	X
Hajas, Wayne	X	X
Hand, Claudia	X	X
Hankewich, Sandie	X	X
Harbo, Rick	X	X
Jepps, Shelley	X	
Jorgensen, Georg	X	
Joyce, Marilyn		X
Klaver, March	X	
Lauzier, Ray	X	
Lessard, Joanne		X
Leus, Dan		X
Lothead, Janet	X	X
Mylchreest, Russell (Subcommittee Chair)	X	X
Nichol, Linda		
Parker, Guy		X
Pegg, James	X	X
Rogers, Juanita	X	X
Rusch, Bryan	X	X
Rutherford, Dennis	X	X
Yamanaka, Lynne	X	
West, Kim		X
Zhang, Zane	X	X

External Participants:	Nov 29	Nov 30
Emmett, Brian	X	
Thuringer, Pam	X	
Cook, Sarah	X	
Haggarty, Dana		X

External Participants:	Nov 29	Nov 30
Heath, Bill	X	X
Holmes, Heather	X	X
Norgard, Tammy	X	X
Richards, John	X	X
Taekema, Bernie		
Tomascik, Tomas		X
Watson, Jane		X
Whyte, Guy		X
Lucas, Barbara		X

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

Sutherland, Terri	Fisheries and Oceans Canada
Wood, Chris	Fisheries and Oceans Canada
Yamanaka, Lynne	Fisheries and Oceans Canada