Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

C S A S | *S C C S*

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Proceedings Series 2006/015 | **Série des comptes rendus 2006/015**

Proceedings of the PSARC meeting on Deep Sea Corals, April 26, 2006

Compte rendu de la réunion du CEESP sur les coraux de haute mer, 26 avril 2006

April 26, 2006
Pacific Biological Station
Nanaimo, BC

Le 26 avril 2006
Station biologique du pacifique
Nanaimo, C.-B.

Al Cass

Al Cass

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

August 2006

Août 2006

Proceedings of the PSARC meeting on Deep Sea Corals, April 26, 2006

April 26, 2006
Pacific Biological Station
Nanaimo, BC

Al Cass

Compte rendu de la réunion du CEESP sur les coraux de haute mer, 26 avril 2006

Le 26 avril 2006
Station biologique du pacifique
Nanaimo, C.-B.

Al Cass

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

August 2006

Août 2006

ISSN 1701-1272 (Printed / Imprimé)

Published and available free from:
Une publication gratuite de :

Fisheries and Oceans Canada / Pêches et Océans Canada
Canadian Science Advisory Secretariat / Secrétariat canadien de consultation scientifique
200, rue Kent Street
Ottawa, Ontario
K1A 0E6

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

CSAS@DFO-MPO.GC.CA

Printed on recycled paper.
Imprimé sur papier recyclé.

Correct citation for this publication:
On doit citer cette publication comme suit :

DFO, 2006. Proceedings of the PSARC meeting on Deep Sea Corals. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2006/015.

TABLE OF CONTENTS

SUMMARY

Cold water corals of British Columbia

G.S. Jamieson, N. Pellegrin, and S. Jessen

The working paper documented the taxonomy and known distribution of cold water corals based on fishery observer and survey data as well as published literature. Meeting participants acknowledged that the scientific knowledge base of corals and sponges in BC is limited. Participants provided three recommendations: 1) using non-intrusive survey methods to increase the understanding of the spatial distributions of theses species subject to the availability of resources and other priorities; 2) Improve coral species identification and reporting in all relevant fishing activities and provide improved taxonomic guides to observers for coral species identification subject to resources and other priorities; and 3) initiate the development of predictive models in collaboration with other agency to take advantage of available tools and assets.

Reducing bycatch of cold-water corals and sponges in British Columbia's groundfish trawl fishery through trawl fishery closures

J. A. Ardron and G.S. Jamieson

The paper presents an analysis of fishery observer data for catches of coral and sponge species in the BC groundfish trawl fishery. Participants acknowledged that policy on the conservation of corals and sponges is lacking. Participants agreed that policy direction would help focus future science activities. Participants agreed on four recommendations: 1) establish a process to engage appropriate government sectors, industry and conservation groups in the development of strategies to maintain the species diversity and abundance in unfished areas; 2) if policy guidelines support the concept of "freezing" existing fishery footprints to protected unfished areas then all appropriate industry groups should be involved in the determination of the fishing boundaries of all affected fisheries; 3) survey research using non-intrusive techniques should focus on high-density fished areas to determine the significance of corals and sponges in fished areas with neighbouring unfished areas subject to resources and other priorities; and 4) trawl observers should be provided with the necessary training and taxonomic guides to enhance identification and catch reporting of corals and sponges. Recommendations in the paper to restrict or close specific areas to trawling were not accepted because the mapping technique used may overestimate the spatial extent of catches; the areas identified have already been fished; and therefore damage may already have occurred, and additional research is needed to identify potentially high density areas that have not yet been disturbed.

SOMMAIRE

Coraux d'eaux froides de Colombie-Britannique

G.S. Jamieson, N. Pellegrin et S. Jessen

Le document de travail vise à documenter la taxonomie et la répartition connue des coraux d'eaux froides, d'après les données recueillies au cours de la pêche par des observateurs et au cours de relevés, et tirées de publications existantes. Les participants à la réunion ont reconnu que les connaissances scientifiques sur les coraux et les éponges en C.-B. sont limitées. Ils ont formulé trois recommandations : 1) utiliser des méthodes de relevé sans intrusion pour élargir la compréhension de la répartition spatiale de ces espèces, sous réserve de la disponibilité des ressources et d'autres priorités; 2) améliorer l'identification des espèces de coraux et la déclaration des prises dans le cadre de toutes les activités de pêche pertinentes et fournir des guides taxinomiques aux observateurs pour l'identification des espèces de coraux, sous réserve de la disponibilité des ressources et d'autres priorités; 3) entreprendre l'élaboration de modèles de prévision en collaboration avec d'autres organismes, afin de tirer parti des outils et du matériel disponibles.

Réduction des prises accidentelles de coraux et d'éponges d'eaux froides au cours du chalutage du poisson de fond en Colombie-Britannique, au moyen de fermetures de pêche

J. A. Ardron et G.S. Jamieson

Le document présente une analyse des données recueillies par les observateurs de la pêche concernant les prises de coraux et d'éponges au cours du chalutage de poisson de fond en C.-B. Les participants ont reconnu l'absence de politique sur la conservation des coraux et des éponges. Ils ont convenu qu'une orientation stratégique contribuerait à cibler les activités scientifiques futures. Ils se sont entendus sur la formulation de quatre recommandations : 1) établir un processus visant à engager les secteurs appropriés du gouvernement, l'industrie et les groupes de conservation à élaborer des stratégies visant à préserver la diversité des espèces et l'abondance dans les zones non exploitées; 2) si la politique appuie l'idée de « figer » les empreintes existantes de la pêche pour protéger les zones non exploitées, alors, tous les groupes appropriés de l'industrie devraient participer à la délimitation de toutes les pêcheries touchées; 3) les relevés scientifiques à l'aide de techniques sans intrusion devraient porter sur les zones exploitées à forte densité, afin de déterminer l'importance des coraux et des éponges dans les zones exploitées avoisinant des zones non exploitées, sous réserve de la disponibilité des ressources et d'autres priorités; 4) les observateurs de la pêche au chalut devraient recevoir la formation et les guides taxinomiques nécessaires pour améliorer leur capacité d'identification et de déclaration des prises de coraux et d'éponges. Les recommandations formulées dans le document visant à restreindre ou interdire le chalutage dans des zones précises n'ont pas été acceptées, parce que la technique de

cartographie utilisée pourrait avoir surestimé l'étendue spatiale des prises; les zones délimitées ont déjà été exploitées; par conséquent, des dommages pourraient avoir été déjà causés et il faudra faire des recherches additionnelles pour déterminer les zones possibles de haute densité qui n'auraient pas encore été perturbées.

INTRODUCTION

The Pacific Scientific Advice Committee (PSARC) met on April 26, 2006 at the Pacific Biological Station in Nanaimo, B.C. to review working papers on cold water corals (Paper #1) and catch of corals and sponges in trawl observer records (Paper #2). External participants from industry, academia, and conservation groups attended the meeting. Participants were invited based on there particular expertise rather than their affiliation with any particular PSARC subcommittee. The meeting Chair, Al Cass, 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. Summaries of the Working Papers are in Appendix 1. The meeting agenda appears as Appendix 2 and a list of meeting participants and reviewers is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEW

Cold water corals of British Columbia

G.S. Jamieson, N. Pellegrin, and S. Jessen

The working paper documented the taxonomy and known distribution of cold water corals based on fishery observer and survey data as well as published literature. Two formal reviews were provided. The reviewers and other meeting participants thought the paper was a useful first summary of the taxonomy and known locations of corals in British Columbia. One reviewer was concerned that the current manuscript title should clearly specify the focus of the paper and suggested that the title should be expanded to “Taxonomy and Zoogeography of Cold Water Corals in Explored Areas of Coastal British Columbia”. The reviewer also thought that speculation in the introduction about coral biology was misleading given that the paper does not deal with the biology of these organisms. In his opinion the reference to certain coldwater coral as filter feeders is incorrect given that many (perhaps all) cnidarians corals are predators not filter feeders. The Subcommittee concurred and the authors agreed to change the name in a revised document and clarify comments on coral biology dealing with predator versus filter feeding strategies. The reviewer also argued that the paper needs to make the distinction between cold and warm water corals.

The reviewer made extensive comments on the inadequacies of the higher taxonomic classification in the paper. In the reviewer’s opinion, the utility of the paper to fisheries managers will relate to the utility of the taxonomy compiled in Appendix A and Table 2 of the current working paper. The reviewer noted that the appendix does not relate in a straightforward fashion to the organization of Table 2 and that neither relates clearly to the higher classification in the introduction to the companion paper reviewed at this meeting (see below). The reviewer concluded that because the authors recommended further training of

on-board trawl fishery observers in the identification of deep water corals, both the higher taxonomy and the common names need to be used in a more rigorous fashion, without leaving room for misinterpretation. The reviewer recommended that revisions to the tables on taxonomic classification be revised or at the very least the authors should include a disclaimer to indicate that the paper is not intended to advance taxonomic differences. The authors concurred and agreed to take them into account in a revised document.

The reviewer noted that the distribution of deep water corals reported in the paper was primarily based on groundfish trawl fishery observations. A more thorough reporting in a future paper on the distribution should include additional information on scuba diving observations and documentation of the abundance in BC's coastal fjords, especially since those coastal areas are more subject to impacts from prawn trapping than from groundfish trawling. Meeting participants agreed that the paper did not provide a thorough description of the distribution of deep water corals since it was not based on fishery independent survey data not information from non-trawl gear types. Participants noted that a systematic survey using non-intrusive sampling methods and random design properties is required to increase understanding of the species diversity and distribution of deep water corals in BC. Participants discussed the utility of aggregating the data by depth. They agreed that this would be useful for distinguishing differences in species structure and habitat. An author agreed that coral catches could be separated by depth given that depth is reported in recent catch data. A reviewer and other meeting participants noted that the paper should make the distinction between warm and deep water corals. One participant commented the dots on maps showing the spatial distribution of coral in BC are several kilometres in size and don't capture the spatial scale. He suggested that some consideration in the future be given to alternative methods for quantifying spatial distributions.

Participants noted that there are now a few more years of observer data and a re-analysis of that information could be insightful. Participants agreed, however, that the authors would not be required to include the new data in the current paper.

Working paper recommendations:

Participants discussed the merits of the recommendations in the working paper. Recommendations focused on the need 1) for non-destructive survey methods to map spatial distributions of corals in BC, 2) to improve coral species identification and reporting in all relevant fisheries and improve taxonomic guides, 3) to construct predictive models based on habitat and oceanographic features and 4) to restrict/close fishing in sensitive areas. Similar recommendations pertaining to surveys and species identification were also presented in the companion paper (see below).

Participants recognized that a specific policy for conserving sensitive coral habitat is lacking and supported future work on the Regional coral and sponge strategy. Participants agreed that policy direction on the conservation and management of corals would serve to focus research questions on coldwater corals. If resources become available for surveys then careful consideration of objectives and design will be required. Future research and modelling should be done in collaboration with other agencies to take advantage of their tools and assets. With regard to species identification, one participant indicated that samples of coldwater corals are available for processing and that they may be useful for improving taxonomic guides for species identification. Participants agreed that the recommendations in the working paper to restrict/close fishing in sensitive areas were not supported by rationale in the paper. The authors agreed to delete reference to recommendations affecting fisheries management.

Subcommittee Conclusions:

- Participants concluded that the paper was a good first description of the taxonomy and known occurrences of coldwater corals in BC.

- The paper was accepted subject to the following revisions 1) clarify in the title of the paper that the focus was on taxonomy and zoogeography, 2) resolve the taxonomic issues identified by reviewers and meeting participants and 3) delete recommendations in the paper that are not supported by analyses.

- Participants supported future monitoring activities and research to improve the understanding of species distributions and the importance of their habitats to other species given resources and other priorities. Future research priorities in support of management decision making will ultimately depend on policy direction for conservation and management.

- Surveys used to map spatial distributions of coral needs to consider non-intrusive methods.

- Participants agreed that identification and classification of coldwater coral is difficult and that more appropriate keys are needed to improve the observer program in this regard.

Subcommittee Recommendations:

1. Meeting participants acknowledged that scientific knowledge of corals and sponges in BC is limited. Participants recommended that mapping using non-intrusive survey methods to increase the understanding of the spatial distributions of theses species be undertaken subject to the availability of resources and other priorities.

2. Improve coral species identification and reporting in all relevant fishing activities and provide improved taxonomic guides to observers for coral species identification subject to resources and other priorities.

3. Initiate the development of predictive coral habitat models using oceanographic and substrate parameters in collaboration with other agencies to take advantage of all available tools and assets.

Reducing bycatch of cold-water corals and sponges in British Columbia's groundfish trawl fishery through trawl fishery closures

J. A. Ardron and G.S. Jamieson

The paper presents an analysis of fishery observer data (1996-2002) for catches of coral and sponge species in the BC groundfish trawl fishery. The weight of catches is reported along with the spatial distribution of these catches. The working paper provided a number of recommendations to reduce future catch of these species and increase their protection from fishing, improve their identification, and improve knowledge of their distribution.

All three reviewers raised technical issues and suggested that the paper would benefit from a more detailed description of the methods. One reviewer thought that the paper lacked a clear statement of the problem being addressed, sufficient detail of the methodology employed, and the criteria used to derive the conclusions from the results of the analyses. The implication of choosing the particular grid size on the estimated distribution of corals and sponges was discussed and identified by all three reviewers as a potential source of error. There was agreement that the bias in the estimation procedure probably overstates the spatial distributions. One reviewer noted that there may be a downside in the choice of grid size in terms of interpreting the analyses.

One reviewer suggested that alternative ways of estimating the spatial extent of coral and sponge catches should be considered to evaluate the implications for identifying potential area closures. An inverse distance weighted density analysis was used in the working paper. There is an implicit interpolation in this technique that does not account for local variations in factors affecting spatial distributions. Fishing effort is usually distributed along isobaths and when a fishing tow is represented by the mid-point of the tow, as was done in the working paper, it is more likely that the catch from that tow was realized along the isobath adjacent to that point rather than cut across isobaths. The inverse distance weighting distributed the influence of the tow in all directions to a radius of 10 km. This would introduce some local distortion of the true patterns of catch. The observer data represents a complete census of fishing activities. The reviewer noted, therefore, that there is less of a need to extrapolate between observations than in a case where the high resolution spatial data were taken from a subsample of the complete distribution. This smoothing effect will tend to make

the proposed area closures larger than the data would suggest. The reviewer cited two examples where the distribution of coral was smoothed over bottom which had no fishing and thus no catch of the coral and sponge species in question. Additional tow references such and the start and end points would likely have helped reduce the effect of smoothing. The authors acknowledged that it would have been better to have other trawl references. They noted however, that they were supplied only tow mid-points for the analysis.

Another reviewer focused on the observer data and associated collection procedures. Given his expertise in observer sampling methods, he advised data users to proceed with caution when collating the BC trawl Observer program data from 1996 to 2000 with later years noting that the collection and reporting structure has evolved significantly since the 2000. This was also flagged by another reviewer as a potential source of error in the analysis given the early observer years were "learning" years. In particular, the observers trained to identify sponge beginning in 2000. Reported catches prior to then would be vastly underestimated as sponge catches were not reported on a regular basis.

The working paper identified 12 areas of high catch density based on the trawl observer records. The working paper recommended trawl areas closures in these areas to reduce catch and to promote re-growth of coral and sponge species. This prompted discussion of whether management objectives are to 1) enforce area-closures to protect the species and promote re-growth in areas of the coast most sensitive to destruction from human activity, and/or 2) maintain the species diversity in areas that have not been impacted. Participants noted that policy guidelines are lacking on this issue and that policy development would help focus future science activities. Participants agreed that the priority for the conservation of corals and sponges should be on the areas of the coast that have not been fished, recognizing that existing fished areas represent a small portion of the coast. This conclusion is consistent with the outcome a recent National workshop on the subject based on comments from participants who attended the workshop as well as this review. Freezing the existing fishing footprint would require the identification of boundaries of fishing areas in order to restrict fishing beyond existing boundaries. The boundaries of all activities that are shown to impact coral and sponge habitat, including trawl, trap and longline fishing methods, would need to be identified. Participants agreed that if the priority management objective is to protect unfished areas then the best way to map fishing boundaries is to engage all appropriate fishing sectors and delineate existing fishing footprints.

Participants acknowledged that while the paper focused on the trawl catch and the protection of species and their habitats in those areas, it says very little about the distribution of species outside trawled areas. Participants noted that little is known about the distribution of coral and sponge species in unfished areas and that trawling is not the best tool for mapping the overall spatial distribution off the BC coast. The importance of the 12 high-density trawling locations identified in

the working paper to the overall species abundance was unknown. Participants noted that these areas are likely indicative of important coral and sponge habitat in neighbouring unfished areas. Future, non-intrusive surveys that focus on high catch areas and adjacent unfished areas would be useful for mapping the overall abundance and species diversity in BC.

Working paper recommendations:

Participants discussed the merits of each of the recommendations in the working paper.

Recommendation 1: "*The twelve areas shown to contain corals/sponges should be closed immediately to bottom trawling and other gear types that could harm corals or sponges…"*. This recommendation was not supported by meeting participants for reasons discussed above: the mapping technique used may overestimate the spatial extent of catches; the areas identified have already been fished; and therefore damage may already have occurred, and additional research is needed to identify potentially high density areas that have not yet been disturbed.

Recommendation 2: "*Those areas not yet well surveyed by non-destructive means should be surveyed as soon as practical to gain a better understanding of the spatial distributions and abundances of species…*". This recommendation was supported given resources and considering other departmental priorities with the caveat that the priority should be in particularly high density areas to determine their contribution to overall biogenic habitat.

Recommendation 3: "*Trawl observers should be provided with the necessary training and taxonomic guides and keys to enhance field identification and bycatch reporting…*". This recommendation was supported but participants recognized that development of taxonomic guides and keys for species identification is evolving and resources would be required to assemble and maintain them.

Recommendation 4: "*A sampling program should be implemented whereby samples of landed corals and sponges along with their catch location be sent to DFO Science Branch coral experts for full identification, so that a more complete spatial mapping of biogenic species in BC can be developed*". Participants supported the need to improve species identification and spatial distribution. As discussed above, however, the utility of mapping distributions using trawl gear is ineffective except in trawlable habitats and not suited for mapping in other areas.

Recommendation 5: "*Protection of substantial coral and sponge areas should become a priority of fishery, habitat and oceans resource managers*". Meeting participants agreed that this was a policy issue and supported future work on the Regional coral and sponge strategy.

Recommendation 6. "*Bycatch data and the spatial mapping of bycatch species, most of which are non-commercial species should be appropriately analysed as soon as practical to facilitate ecosystem-based management in BC waters*". This recommendation could be a subject of interest once policy on the conservation of corals and sponges and other non-commercial species is developed and focuses research questions in support of management.

Subcommittee Conclusions:

- Participants and reviewers agreed to accept the paper following revisions that include more details on the methods. The authors agreed to delete recommendations that are not supported by their analyses or that pertained to policy issues beyond the mandate of the PSARC review.

- Participants recognized that policy for conservation of coral and sponge species is lacking and that policy development in this area could help focus research questions for the provision of future science advice.

- Participants concluded that it is more prudent to focus attention on the protection of habitat forming species outside existing fishing locations rather than close existing fishing areas that have been trawled for decades and that represent a small portion of the overall coast.

- Although policy direction is lacking, participants did not support the recommendation in the paper for trawl area-closures in 12 high density coral and sponge catch locations.

- Depending on future policy direction, participants concluded that all interested parties and user-groups should become engaged in the development of strategies and tactics for conserving and managing coral and sponge species. Specifically, this would include delineating existing fishing boundaries should policy choose to freeze existing fishing footprints (all appropriate gears) to protect unaffected areas potentially important for maintaining coral and sponge species and habitat diversity.

Subcommittee Recommendations:

1. Establish a process to engage appropriate government sectors, industry and conservation groups in the development of strategies to maintain the species diversity and abundance in unfished areas.

2. If policy guidelines support the concept of “freezing” existing fishery footprints to protected unfished areas then all appropriate industry groups (i.e. trawl, trap and longline) should be involved in the determination of the fishing boundaries of all affected fisheries.

3. Surveys using non-intrusive techniques should focus on high-density fished and adjacent unfished areas to determine the significance of corals and sponges in fished areas to overall species abundance and diversity in BC subject to resources and other priorities.

4. Trawl observers should be provided with the necessary training and taxonomic guides and keys to enhance field identification and catch reporting of corals and sponges subject to the availability of resources and other priorities.

Appendix 1: Working Paper Summaries

Cold water corals of British Columbia

G.S. Jamieson, N. Pellegrin, and S. Jesson

The current state of knowledge of cold water corals in British Columbia is summarised in this WorkingPaper. Pacific Canada has a more diverse coral community than does Atlantic Canada, as is the case for most taxonomic groups. A list of Pacific Canada's known coral species and potential species based on records from adjacent jurisdictions is presented, along with maps derived from existing records showing all currently known locations of corals in British Columbia. To date, five Orders, 23 Families and 60 species of corals are documented from British Columbian waters, but an additional Order, three Families and 50 species may also occur in British Columbia, as these species have been documented from south-east Alaska, Gulf of Alaska sea mounts and Washington/Oregon.

Reducing bycatch of cold-water corals and sponges in British Columbia's groundfish trawl fishery through trawl fishery closures

J. A. Ardron and G.S. Jamieson

From 1996 to 2002, about 295 tonnes of corals and sponges were observed as bycatch in BC's groundfish bottom trawl fishery. Many of the damaged coral and sponge fragments likely remained on the sea floor, suggesting that gear impact was much more extensive. Recovery from trawl damage can take several decades to centuries. While these animals remain poorly studied in BC, it is generally accepted that the destruction of structural habitat has a negative impact on benthic ecosystem dynamics and fished stocks.

Year-round bottom trawling closures have been established in Australia, the European Union, New Zealand, Norway, Iceland, Scotland, the USA, and BC, all with the goal of protecting corals and/or sponges. This paper explores the most efficient spatial establishment of closures to significantly reduce bycatch and thus destruction of habitat-forming corals and sponges. Density analyses of bycatch indicates 12 areas of high species concentration, that had they been closed, would have prevented 97% of all coral/sponge bycatch by weight. Diversity of deep water corals and sponges appears to also be represented by these twelve areas, though site-specific verification is required. Economically, these 12 areas are of average economic value to the fishery. However, because the fishery is an individual quota fishery, and because of the mobility of many groundfish species, it is difficult to estimate the potential economic cost of establishing these closures. Closing an area does not necessarily mean that mobile individuals are not caught, only that they will not be caught in the closed area. Overall, these potential closures would represent 7.5% of BC's continental shelf and slope.

Appendix 2: **Deep Sea Coral Agenda, April 26, 2006**

Pacific Scientific Advice Review Committee
Deep Sea Coral Review

Wednesday, April 26 2006
Pacific Biological Station, Nanaimo, B.C.
Seminar Room

WEDNESDAY – April 26	
Introduction and procedures	9:00 – 9:15
Review of Working Paper - "Cold Water Corals of British Columbia"	9:15 – 10:00
Reviewers comments and General discussion/formulation of advice	10:00 – 12:00
Lunch Break	*12:00 – 1:00*
Review of Working Paper - "Reducing Bycatch of Corals and Sponges in British Columbia's Groundfish Trawl Fishery through Trawl Fishery Closures"	1:00 – 2:00
Reviewers comments and General discussion/formulation of advice	2:00-4:00

Appendix 3: List of Attendees & Reviewers

NAME
EXTERNAL PARTICIPANTS
Ardron, Jeff (via telephone),
Barrie, Vaughn,
Buchanan, Scott,
Conway, Kim
Cook, Sarah
de la Mare, Bill
Hangaard, Dorthea
Marliave, Jeff
Mose, Brian
Munro, Krista
Stark, Jodi
Tamascik, Tomas
Turris, Bruce
Wallace, Scott
INTERNAL PARTICIPANTS
Ackerman, Barry
Boutillier, Jim
Cass, Al (Chair)
Conley, Kevin
Fargo, Jeff
Francis, Kelly
Haigh, Rowan
Harbo, Rick
Jamieson, Glen
Lucas, Barbara
Mathias, Jack
Pellegrin, Nicole
Rutherford, Kate
Sinclair, Alan

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.

Buchanan, Scott	Archipelago Marine Research
De la Mare, Bill	Simon Fraser University
Fargo, Jeff	Fisheries and Oceans Canada
Marliave, Jeff	Vancouver Aquarium
Sinclair, Alan	Fisheries and Oceans Canada