



Fisheries and Oceans Canada / Pêches et Océans Canada

Science

Sciences

## **C S A S**

**Canadian Science Advisory Secretariat**

**Proceedings Series 2011/073**

**Pacific Region**

**Proceedings of the Centre for Science Advice Pacific Region for the review of: habitat impact assessment of small-scale geoduck aquaculture, update to the pink and spiny scallop assessment framework, sea cucumber assessment update, Manila clam assessment update on the Central Coast, and inshore shrimp assessment update**

**November 30 – December 2, 2010  
Nanaimo, BC**

**Ray Lauzier,  
Chairperson**

## **S C C S**

**Secrétariat canadien de consultation scientifique**

**Compte rendu 2011/073**

**Région du Pacifique**

**Compte rendu du Centre des avis scientifiques de la région du Pacifique, l'évaluation de l'impact sur l'habitat de l'aquaculture à petite échelle du panope, mise à jour du cadre d'évaluation des pétoncles roses et épineux, mise à jour de l'évaluation du concombre de mer, mise à jour de l'évaluation de la palourdes japonaises de la côte centrale et mise à jour de l'évaluation des crevettes le long de la côte**

**30 novembre – 2 décembre, 2010  
Nanaimo, CB**

**Ray Lauzier,  
Président**

Fisheries and Oceans Canada / Pêches et Océans Canada  
Pacific Biological Station / Station biologique du Pacifique  
3190 Hammond Bay Rd.  
Nanaimo, BC V9T 6N7

**May 2012**

**Mai 2012**

## **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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## SUMMARY

Participants from Fisheries and Oceans Canada (DFO) Science, Habitat Management, and Fisheries and Aquatic Management sectors and external participants industry and First Nations attended a CSAP invertebrate review on November 30 to December 2, 2010 at the Pacific Biological Station in Nanaimo, British Columbia to assess and develop advice for the following working papers:

- Assessing potential habitat impacts of small-scale intertidal geoduck (*Panopea genrosa*) aquaculture
- Update to the assessment framework for the Pink and Spiny scallop (*Chlamys rubidia*, *C. hastata*) dive fishery in water off British Columbia.

Three Science Advisory Reports (SARs) were also reviewed:

- Assessment framework for the giant red sea cucumber (*Parastichopus californicus*) in British Columbia
- Assessment update of Manila clam in the Central Coast of British Columbia and Evaluation of the Area 7 Manila clam fisheries management strategy
- Assessment of inshore shrimp stocks along the Coast of British Columbia

Comments received on the two papers and three SARs are presented in these Proceedings. The papers were accepted subject to revisions. Products of the meeting will be two Research Documents and five Science Advisory Reports.

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## SOMMAIRE

Des membres des secteurs Sciences, Gestion de l'habitat et Gestion des pêches et de l'aquaculture de Pêches et Océans Canada (du MPO), ainsi que des représentants externes de l'industrie et des Premières Nations ont participé à un examen du CASP sur les invertébrés du 30 novembre au 2 décembre 2010 à la station biologique du Pacifique, à Nanaimo, en Colombie-Britannique, dans le but d'évaluer les documents de travail ci-dessous, et pour en tirer des conseils :

- Évaluation des effets potentiels sur l'habitat de l'aquaculture en suspension à petite échelle du panope (*panopea genrosa*).
- Mise à jour du cadre d'évaluation de la pêche en plongée aux pétoncles roses et épineux (*chlamys rubdia*, *c. hastata*) dans les eaux de la Colombie-Britannique.

Également, trois avis scientifiques (AS) ont été examinés :

- Cadre d'évaluation pour l'holothurie du pacifique (*parastichopus californicus*) en Colombie-Britannique
- Mise à jour de l'évaluation des stocks de palourde japonaise dans le secteur 7 de la côte centrale de la Colombie-Britannique et évaluation de la stratégie de gestion de la pêche à la palourde japonaise
- Évaluation des stocks de crevettes le long de la côte de la Colombie-Britannique

Les commentaires reçus concernant les deux documents de travail et les trois avis scientifiques figurent dans ces comptes rendus. Les deux documents ont été adoptés sous réserve de modification. À l'issue de la réunion, on avait produit deux documents de recherche et cinq rapports d'avis scientifique.



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## INTRODUCTION

A Fisheries & Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS), Regional Advisory Process (RAP) meeting was held on November 30 – December 2, 2010 at the Pacific Biological Station, in Nanaimo, British Columbia. External participants from industry and a First Nation attended the meeting. The Chair, R. Lauzier, opened the meeting by welcoming the participants, reviewing the agenda and referring to the terms of reference. During the introductory remarks the objectives of the meeting were reviewed and the participants accepted the meeting agenda.

This meeting reviewed two working papers and five Science Advisory Reports. The meeting agenda appears as Appendix 1, the list of attendees is given in Appendix 2, the terms of reference are in Appendix 3 and the summaries of each working paper are included as Appendix 4.

## DETAILED COMMENTS FROM THE REVIEWS

### ASSESSING POTENTIAL HABITAT IMPACTS OF SMALL-SCALE, INTERTIDAL, GEODUCK CLAM (*PANOPEA GENEROSA*) AQUACULTURE

*Christopher Pearce, Leah Sauchyn, John Blackburn, Laurie Keddy, and Sean Williams*

*\*Working paper accepted with revisions\**

#### General Discussion

There were two reviewers for this paper, one external (Reviewer 1) and one internal (Reviewer 2). Reviewer 1 thought that the paper was clearly written, that sufficient detail was provided on the methods and analysis, and that the summary and conclusions adequately described the statistically-significant results. This reviewer suggested an alternative approach to structuring the statistical analysis, but did not believe the alternative approach would result in conclusions that were much different than those reached with the current analysis, which the reviewer deemed was appropriate. Reviewer 2 raised some concerns about the results that warranted further detail and clarification, including presentation of the Tukey test results. The author explained that showing the Tukey test results on the figures was attempted, but the number of pair-wise comparisons needed to be shown would make the graphs too cluttered for meaningful interpretation. This reviewer suggested that some points made in the discussion needed clarification or expansion, which the author was willing to make. Reviewer 2 also thought that the response to the advice question was too confident, given the concerns raised in her review, and the author agreed to revise the advice section.

Both reviewers thought that there should be more detail in the abstract and advice sections regarding the strong effects on infaunal benthic invertebrates within the culture plot. Both reviewers also expressed concern over the low sample size in the culture plot in comparison to the surrounding area. This was attributed to a combination of time constraints and funding limitations, and the author agreed to a power analysis in the revisions. Both reviewers suggested that the time axes in the graphs should be in real time rather than in a stage format, but the reasoning for the stage format was provided by the author. Both reviewers also raised concerns about the most appropriate representative control site and the author agreed to address those concerns.

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During the discussion it was noted that there may be limitations to the study due to the small size of the culture plot and the short time-line between outplanting and harvest; therefore, the results should therefore be interpreted with caution. The study did not address all potential ecological impacts such as impacts on macro-fauna (a concern raised by Reviewer 2) and nearby eelgrass beds. There was some discussion on the impacts of storm events and how those impacts may confound or exceed the impacts seen from the outplanting and harvest activities. It was agreed that outplant and harvest events should be depicted on the graphs using a different style. There was also some discussion on alternatives to evaluating the results by comparing percent-change values (i.e. before/after outplanting/harvest) instead of raw values. However, it was agreed that the apparent differences were so small that alternative ways to analyze the data would not change the interpretation or conclusions of the study, nor would they be necessarily any more appropriate than the chosen analyses. It was also agreed that 'no statistically significant differences were detected' should be used in the conclusions rather than 'no impacts'. It was noted that the analytical route taken depends on the types of questions that were asked of the study: for example, are they big-picture ecosystem questions or more focused on the immediate area?

## **Conclusions**

This working paper summarizes the results of the first in a series of experiments on assessing the potential benthic impacts of geoduck out-planting and harvesting.

There were few statistically significant differences found in the indicators monitored (grain size, percent organics, total carbon, total nitrogen redox, sulphide concentration infaunal community) that could be attributed to out-planting or harvesting.

There were limitations of the study including the small scale of the work and lack of research on potential impacts to macrofauna and nearby eelgrass.

The interpretation of the results of the study should be used with caution until validated by further research (currently underway) validates findings for larger-scale operations over a broader range of potential ecological indicators.

## **Recommendations**

1. The Participants recommended the acceptance of the working paper, with revisions.
2. The Participants recommended that use of the term "significant" only refer to statistical results (not "impacts") in the paper.
3. The Participants recommended that the Advice section be modified in answering the question: "*Does harvesting geoduck in the intertidal or subtidal marine environment have a significant environmental impact?*" to: to reflect a more precautionary approach, recognizing the small-scale nature of the work and the significant impacts on infauna within the culture plot.
4. The Participants recommended that further larger-scale research examine the potential impacts of geoduck out-planting and harvesting and that this work focuses on a large range of ecological indicators

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# UPDATE TO THE ASSESSMENT FRAMEWORK FOR THE PINK AND SPINY SCALLOP (*CHLAMYS RUBIDA*, *C. HASTATA*) DIVE FISHERY IN WATERS OFF THE WEST COAST OF CANADA

A.M. Surry, K.H. Fong, D.T. Rutherford, and H. Nguyen

*\*Working paper accepted with revisions\**

## General Discussion

There were two reviewers for this working paper, one external and one internal. Reviewer 1 was highly complementary and impressed with the level of effort that went into the working paper, finding it very comprehensive and forthright, with a sound management approach. This reviewer believed it provided an excellent background for the management of the fishery with clearly defined research questions and management goals. The reviewer described the methods developed and data collected as a significant contribution to the management of pink and spiny scallops, with a well reasoned and supported approach to inform fisheries management. The reviewer pointed out that the strength of the paper was the level of detail provided, with well-founded and supported recommendations useful for fisheries management.

Reviewer 2 reiterated many of the comments made by Reviewer 1 on the level of detail, organization and well-supported recommendations and conclusions. Reviewer 2 suggested that there should be a discussion of the cost-benefit of the new survey methods. The consensus of the Participants was that a cost-benefit analysis of different survey methodologies was not within the scope of the paper. It was agreed that while the use of a drop video camera for surveying was considerably cheaper, while the ROV method used for this study provides a better estimate of biomass. Reviewer 2 suggested that more discussion is needed in the selection of X-values for the Fox Model, which generated some discussion by the Participants. Reviewer 2 provided a detailed list of questions and comments particular to the content, understanding, and analysis of the paper as well as errors in legal biomass used for the Fox Model calculations. These will be addressed by the authors in the revision.

There was much discussion on how much the method of data collection and analysis had changed. A re-analysis of previous survey data found an error found in the previous biomass calculations which had resulted in an overestimate of legal biomass; however the older video-image data capture likely resulted in an underestimate of actual scallop counts. The Participants recognized that the previous framework was based on the best available information at the time. Many improvements have been made in the new framework which includes new image-capture technologies that have become available, improved assessment methods with better-defined bed areas, and biomass calculations based on ratio rather than log-transformation relationship. There was discussion on the production model description with suggestions made for clarification. The Participants noted the alarming drop in estimated density in PFMA 29-5 and 18-1 that does not appear to be due to overfishing, which is of concern given that the new methodology provides a better estimate of relative abundance.

There was discussion and suggested changes to the draft Science Advisory Report (SAR) that resulted from the advice and recommendations in the Working Paper, including an additional paragraph in the SAR under Biomass Estimates to discuss the decline in scallop density, and additional wording under Ecosystem Considerations about the potential effects of large scallop declines in abundance in two particular areas. It was suggested that some of the historical text

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could be removed, to focus the SAR on what is being done currently. The Conclusions/Recommendations of the SAR should not only summarize information from the working paper, but also include conclusions of the discussion.

## Conclusions

This working paper describes updated protocols for the collection and analysis of scallop dive fishery-independent data, using high definition imagery and modified analytical techniques.

The assessment indicates a large drop in scallop density between 2001-2002 and 2008-2009 in two Pacific Fishery Management Areas: 36% of original biomass at Mayne Island (PFMA 18-1) and ~20% at Valdes Island (PFMA 29-5). These declines in density should be viewed in light of the realization that the original biomass was overestimated and that the more recent surveys produce more accurate estimates of mean density. However, this drop is alarming and not likely due to overfishing, considering the very low reported effort and catches. Caution is advised before planning any future harvesting opportunities at Mayne Island (PFMA 18-1) and Valdes Island (PFMA 29-5).

## Recommendations

1. The Participants recommended acceptance of the working paper with revisions.
2. The Participants accepted Recommendation 1 of the working paper with the following changes made by the authors: **“Endorse the updated survey methodology and biomass estimation methods, including new estimates of scallop bed area.”**
3. The Participants accepted Recommendation 2 of the working paper with a minor modification, and recommends making it Recommendation 3: **“Update harvest options in light of updated biomass estimates based on recent surveys (2008-2009).”**
4. The Participants accepted Recommendation 3 of the working paper and recommends making it Recommendation 2: **“Given the paucity of time series of assessment surveys and biological time series, maintain the harvest level of 4% of legal biomass estimates for the areas to be fished.”**
5. The Participants accepted Recommendation 4 of the working paper: **“As Mayne Island (PFMA 18-1) and Valdes Island (PFMA 29-5) represent the only areas with any time series of biomass surveys, continue to conduct assessment surveys and collect biological samples at these locations annually or biannually.”**
6. The Participants accepted Recommendation 5 of the working paper: **“Collect biological samples from unexploited areas to address the questions of maximum size and age of these species.”**
7. The Participants accepted a rephrased version of Recommendation 6 of the working paper with the following modification: **“Prior to any survey of additional locations other than Mayne Island or Valdes Island, as a first step in a new area, scallop distribution and bed area needs to be delineated by the best available techniques.”**
8. The Participants recommended that extra caution needs to be taken when considering future fishing opportunities at Mayne Island (PFMA 18-1) and Valdes Island (PFMA 29-

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5) considering the alarming drop in scallop densities between 2001-2002 and 2008-2009.

9. The Participants recommended an additional paragraph in the Science Advisory Report under biomass estimates which discusses the decline in scallop density, with additional text under ecosystem considerations about the potential effects of large scallop declines in abundance in two particular areas.

## **ASSESSMENT UPDATE OF MANILA CLAM IN THE CENTRAL COAST OF BRITISH COLUMBIA AND EVALUATION OF THE AREA 7 MANILA CLAM FISHERIES MANAGEMENT STRATEGY.**

*T. Norgard*

*\*Science Advisory Report accepted with revisions\**

### **General Discussion**

There was discussion on the Magnusson-Stefansson Feedback Gain Model used for developing PFMA Subarea harvest thresholds, in particular that use of the value  $g = 1.0$  was on the line between precautionary and non-precautionary. It was also noted that the entire harvest of the Subarea was presented in the tables, rather than just the index site. In Table 6, it was noted that landings never reach the recommended TAC. The author pointed out that there was catch allowed in areas that were not harvested.

### **Conclusions**

This Science Advisory Report (SAR) provides an updated stock status for Manila clam stocks in harvested portions of Area 7 on the Central Coast of British Columbia and evaluates management strategies employed for the past nine years in this fishery.

The assessment and management regime has resulted in a sustainable fishery in every Subarea during each of the past nine years.

Use of the Magnusson-Stefansson Feedback Gain Model, a fishery management decision framework used for developing Subarea harvest thresholds, appears to have stabilized the harvest management planning process.

The Participants noted that the management and assessment of this fishery is a good example of an effective co-management fishery.

### **Recommendations**

1. The Participants recommended acceptance of the Science Advisory Report, subject to minor revisions.

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## **ASSESSMENT FRAMEWORK FOR GIANT RED SEA CUCUMBER (*PARASTICHOPUS CALIFORNICUS*) IN BRITISH COLUMBIA**

*N. Duprey, C. Hand, J. Lochead and W. Hajas*

*\*Science Advisory Report accepted with revisions\**

### **General Discussion**

There was discussion on no-take reserves. The importance of defining objectives for reserves was reiterated from previous discussion of the Assessment Framework Working Paper. It was agreed that more planning is needed to determine the objectives, what questions need to be answered, and how reserves and the research done on them can be designed to answer these questions and show the benefits of reserves.

### **Conclusions**

This Science Advisory Report summarizes the Assessment Framework for the giant red sea cucumber (*Parastichopus californicus*) fishery in British Columbia that was reviewed and accepted through CSAS review in December 2009.

The Participants reiterated its recommendation that a planning process be initiated to identify biological assessment and management objectives for proposed “no-take” reserves in order to provide direction for the analysis needed to provide advice on the location, size, and number of reserves.

### **Recommendations**

1. The Participants accepted the Science Advisory Report, subject to minor revisions.
2. The Participants reiterated its recommendation that a planning process be initiated to identify biological assessment and management objectives for proposed “no-take” reserves to provide direction for the analysis needed to provide advice on the location, size, and number of reserves.

## **ASSESSMENT OF INSHORE SHRIMP STOCKS ALONG THE COAST OF BRITISH COLUMBIA**

*D.T. Rutherford*

*\*Science Advisory Report accepted with revisions\**

### **General Discussion**

There was discussion on how one of the roles of the Science Advisory Report process is to replace the former Stock Status Report (SSR) updates. During the discussion, it was agreed that the figures need to be completed with the appropriate captions. It was also agreed that the shrimp Management Areas need to be written out or better described, with a suggestion that the map could be refined. There should also be citations for the upper stock reference (USR) and limit reference point (LRP). Figures for Shrimp Management Area 16 and GSTE need to be

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verified for pinks, sidestripes, and combined shrimp species. It was also recognized that the setting of the USR and LRP were set using the guidelines of the Precautionary Approach.

### **Conclusions**

This Science Advisory Report provides a summary of in-season science advice provided for the management of shrimp stocks in eight Shrimp Management Areas (SMAs) on an annual basis compliant with the DFO Precautionary Approach for limit reference points.

The current assessment indicates that shrimp stocks show high natural annual variation in stock size.

In 2010, twelve of the sixteen shrimp stocks assessed were in the Healthy zone; two sidestripe shrimp stocks, SMA 18 and SMA 19 were in the Cautious zone; two pink shrimp stocks, SMA 18 and SMA 19 were in the Critical zone.

### **Recommendations**

1. The Participants recommended acceptance of the Science Advisory Report, subject to minor revisions.

## APPENDIX 1. AGENDA

### CENTRE FOR SCIENCE ADVICE PACIFIC (CSAP) INVERTEBRATE SUBCOMMITTEE MEETING

November 30-December 2, 2010

Pacific Biological Station  
Seminar Room  
Nanaimo, BC

<b>Tuesday, November 30</b>	
Introduction and procedures	9:00 – 9:15
Review of Working Paper, “ <i>Assessing potential habitat impacts of small-scale intertidal geoduck clam (Panopea generosa) aquaculture</i> ”	9:15 – 12:00
**Lunch Break**	12:00 – 1:00
<b>Wednesday, December 1</b>	
Review of Science Advisory Report, “ <i>Assessment update of Manila clam in the Central Coast of British Columbia and Evaluation of the Area 7 Manila Clam Fisheries Management Strategy</i> ”	9:00-10:00
Review of Working Paper “ <i>Update to the assessment framework for the pink and spiny scallop (Chlamys rubida, C. hastata) dive fishery in waters off the West Coast of Canada</i> ”	10:30-12:00
**Lunch Break**	12:00 – 1:00
Review of Science Advisory Report “ <i>Update to the assessment framework for the pink and spiny scallop (Chlamys rubida, C. hastata) dive fishery in waters off the West Coast of Canada</i> ”	1:00-4:00
<b>Thursday, December 2</b>	
Review of Science Advisory Report “ <i>Assessment framework for the giant red sea cucumber (Parastichopus Californicus) in British Columbia</i> ”	9:00-12:00
Review of Science Advisory Report, “ <i>Assessment of Inshore Shrimp Stocks along the Coast of British Columbia</i> ”	
**Lunch Break**	
CSAP Business and Future Planning Discussion	1:00-2:30



**APPENDIX 2. LIST OF ATTENDEES**

<b>NAME</b>	<b>Tues</b>	<b>Wed</b>	<b>Thur</b>
<b>EXTERNAL PARTICIPANTS</b>			
Ridgway, Ken			√
Carpenter, Julie		√	√

<b>DFO MEMBERS</b>	<b>Tues</b>	<b>Wed</b>	<b>Thur</b>
Bureau, Dominique	√	√	√
Clark, Dan			√
Davies, Sandra	√	√	
Davies, Sarah	√	√	√
Dunham, Anya	√	√	√
Dunham, Jason	√	√	√
Duprey, Nick	√	√	√
Ennevor, Bridget	√	√	√
Fogtman, David		√	
Fong, Ken	√	√	√
Gillespie, Graham	√	√	√
Gordon, Elysha			√
Hajas, Wayne	√	√	√
Hand, Claudia	√	√	√
Johansson, Todd	√	√	√
Joyce, Marilyn (CSAP Chair)	√		√
Lauzier, Raymond (Subcommittee Chair)	√	√	√
Lessard, Joanne	√	√	√
Leus, Dan			√
Lothead, Janet		√	
Norgard, Tammy	√	√	
Pearce, Chris	√	√	√
Perry, Ian	√	√	√
Rogers, Juanita	√	√	√
Rutherford, Dennis	√	√	√
Surry, Maria	√	√	√
Zhang, Zane	√	√	√

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

Duprey, Nicholas	Fisheries and Oceans Canada
Ruesink, Dr. Jennifer	University of Washington
Sizemore, Robert	Washington Department of Fish and Wildlife
Sutherland, Dr. Terri	Fisheries and Oceans Canada

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## APPENDIX 3. TERMS OF REFERENCE

### Terms of Reference

*Update to the assessment framework for the Pink and Spiny scallop (*Chlamys rubida*, *C. hastata*) dive fishery in waters off the West Coast of Canada*

*Assessing potential habitat impacts of small-scale, intertidal geoduck clam (*Panopea generosa*) aquaculture*

*Assessment Update of Sea Cucumber (*Parastichopus californicus*) in British Columbia*

*Assessment Update of Manila Clam in the Central Coast of British Columbia and Evaluation of the Area 7 Manila Clam Fisheries Management Strategy*

*Assessment of Inshore Shrimp Stocks along the Coast of British Columbia*

### Pacific Regional Advisory Process

**November 30 – December 2, 2010  
Nanaimo, British Columbia**

Chairperson: Ray Lauzier

#### Context

This Regional Advisory Meeting (RAP) will review two scientific working papers and three Science Advisory Reports for five species of marine invertebrates. Further context and specific objectives are outlined below.

#### Objectives

*Working Paper: Update to the assessment framework for the Pink and Spiny scallop (*Chlamys rubida*, *C. hastata*) dive fishery in waters off the West Coast of Canada:*

Fisheries and Aquaculture Management (FAM) has requested an update on new developments in the Pink and Spiny scallop dive fishery in British Columbia. Since the Framework for Pink (*Chlamys rubida*) and Spiny (*C. hastata*) Scallop Fisheries in Waters off the West Coast of Canada was developed in 2000, there has been an interest in expanding this fishery. An updated assessment framework will be reviewed. Advances in submersible image capture technology, and the acquisition of new Remote Operated Vehicle (ROV) equipment provides an opportunity to update and increase the efficiency of the survey methodology used to assess scallop stocks. Additional years of biological data, collected since the last assessment, allow for review and potential updating of the current reference points, and advice on harvest control rules for the scallop dive fishery.

Specifically, objectives of this paper are to:

1. Document, evaluate and review current protocols for the collection and analysis of scallop data,

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2. Evaluate whether reference points and harvest control rules need to be revised as a result of the updates in assessment methodology, and acquisition of new biological data since 2005, and
  3. Recommend continuing and/or further research activities that are required to support assessment and monitoring of scallop populations in B.C.

*Working Paper: Assessing potential habitat impacts of small-scale, intertidal geoduck clam (Panopea generosa) aquaculture*

Fisheries and Aquaculture Management (FAM) has requested an environmental impact assessment of harvesting cultured geoduck clams in the intertidal or subtidal marine environment. The expansion of geoduck aquaculture is highly desired by the industry, and is publicly contentious. New intertidal sites have been postponed due to concerns about unknown environmental impacts created by normally-used harvest gear. Potential impacts of geoduck aquaculture on the marine environment may be caused by three main activities:

1. Change in material processes,
2. Addition of physical structure, and
3. Sediment disturbance caused by out-planting and harvesting.

Specifically, the objective of the study was to assess the potential benthic impacts of intertidal geoduck culture in a small test plot from out-planting of seed to six months post-harvest by:

1. Using industry-standard techniques for seeding and harvesting,
2. Analysis of physical and chemical indicators from benthic samples from within the test plot and various distances from the plot to determine the spatial extent of impact, and
3. Analysis of biological indicators including patterns in the abundance, species richness, evenness and diversity of infauna to assess potential impacts on the infaunal community.

*Science Advisory Report: Framework for Red Giant Sea Cucumber (Parastichopus californicus) in British Columbia*

This Science Advisory Report summarizes the *Framework for the Red Giant Sea Cucumber (Parastichopus californicus) in British Columbia*, reviewed by the Centre for Science Advice Invertebrate Standing Committee in December 2009 (see *Additional Information and References* section below).

The objective of this Science Advisory Report is to document the following advice respecting the management and assessment of the Sea Cucumber Fishery in British Columbia - specifically to:

1. Consider the application of reserves for conservation and stock assessment purposes,
2. Recommend target and limit reference points compliant with the Fishery Decision-making Framework Incorporating the Precautionary Approach, and
3. Advise on research priorities to support monitoring and stock assessment.

*Science Advisory Report: Assessment Update of Manila Clam in the Central Coast of British Columbia and Evaluation of the Area 7 Manila Clam Fisheries Management Strategy*

Since 2001, resource managers for this fishery have been using the Magnussen-Stefanson Feedback Gain Model that was reviewed by CSAS in 2001 to set in-season thresholds for each of the monitored fishery sub-areas. A review summarizing the biomass estimates from index beaches in 11 sub-areas of Area 7 on the Central Coast, as well as the harvest yield of the 11

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sub-areas has been undertaken, to evaluate the efficacy of the current fisheries management strategy.

The objective of this assessment is to provide the following advice respecting the management and assessment of the Manila Clam Fishery in the Central Coast of British Columbia - specifically to:

1. Provide an updated stock status of Manila Clam stock in harvested areas of the Central Coast of British Columbia; and,
2. Evaluate management strategies employed for the past 9 years in the Area 7 Manila Clam fishery on the Central Coast of British Columbia.

*Science Advisory Report: Assessment of Inshore Shrimp Stocks along the Coast of British Columbia*

This report provides a summary of shrimp stock trends, as indexed through surveys, from inception of surveys in 1997 to 2010, along with commercial catch trends from 1987 to 2010. Commencing in 2010, at the request of Fisheries and Aquaculture Management (FAM), confidence intervals (95% CI) for the estimated shrimp biomass indices are reported. This report does not provide new advice on shrimp stock status but rather documents the advice on stock status which has previously been provided to fishery managers and industry in-season.

The objective of this Science Advisory Report is to document the following advice respecting the management and assessment of the shrimp trawl fishery by Shrimp Management Area (SMA) along the coast of British Columbia – specifically to:

1. Document the biomass estimates for pink and sidestripe shrimp resulting from the annual area-swept fishery independent surveys in selected SMA's; and,
2. Document the fishery performance in selected SMA's in comparison to the recommended catch ceilings.

### **Expected Publications**

- CSAS Proceedings document summarizing the discussion (1)
- CSAS Science Advisory Reports (5)
- CSAS Research Document (2)

### **Participation**

Participants will include internal DFO representatives and potentially participants from the Province of British Columbia, academia, First Nations, NGO's and industry.

### **References Cited**

DFO. 2009 A fishery decision-making framework incorporating the precautionary approach. <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>

Duprey, N., Hand, C.M., Lohead, J. and Hajas, W. 2010. Assessment Framework for Sea Cucumber (*Parastichopus californicus*) in British Columbia. Can. Sci. Advis. Sec. Res. Doc. 2010/105. vi + 44 p.

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## APPENDIX 4. WORKING PAPER SUMMARIES

### ASSESSING POTENTIAL HABITAT IMPACTS OF SMALL-SCALE, INTERTIDAL GEODUCK CLAM (*PANOPEA GENEROSA*) AQUACULTURE

The geoduck clam (*Panopea generosa*) is the largest burrowing clam in the world, adults living a metre or more below the sediment surface. In order to extract them, harvesters use high-pressure water hoses to liquefy the surrounding sediment. High-density culture of clams and/or harvesting to a depth of a metre or more could have profound effects on the local benthic environment, but little research has examined the possibility. A small-scale (3 x 20 m) intertidal plot was seeded with juvenile clams at a commercial density and then harvested a year later using industry-standard techniques. Sediment samples were taken within the harvest zone and at varying distances (5, 10, 25, 50 m) from the area of impact at various times (ranging from a month prior to seed out-planting through to 12 months post-harvest). A number of sediment characteristics were evaluated (*i.e.* grain size, percent organics, total carbon, total nitrogen, sulphide concentration, and redox) as well as infaunal diversity and quantity. Results showed that many of the measured variables were not significantly affected by either the culture or harvesting processes. Any significant effects of harvesting were generally short-lived and/or near-field. Current research is examining the potential effects of larger-scale harvests – both in the intertidal (15 x 30 m plot) and subtidal (60 x 100 m plot) – on turbidity levels, sediment characteristics, infauna, and nearby sensitive aquatic vegetation (*i.e.* eelgrass).

### UPDATE TO THE ASSESSMENT FRAMEWORK FOR THE PINK AND SPINY SCALLOP (*CHLAMYS RUBIDA*, *C. HASTATA*) DIVE FISHERY IN WATERS OFF THE WEST COAST OF CANADA

The framework for pink and spiny scallop assessment has been updated. In place the previous practice of using a video drop camera, scallop biomass surveys were conducted using a remote operated vehicle (ROV) equipped with a high resolution digital still camera. Documentation was provided for the new methodology, and the results of recent surveys using the new methodology were presented. Analytical procedures for biomass estimation were revised, resulting in updates to previously published biomass estimates. Revised estimates were lower than those previously published with implications for existing total allowable catch. Updated estimates of natural mortality and scallop growth rates were provided based on revised previously collected data as well as new data since the last assessment.

Pink and spiny scallop dive fisheries remain data limited, with no consistent time series of assessment surveys or biological data. Despite new estimates of mortality and biomass, the currently used 4% harvest rate remains consistent with best available estimates of MSY. The current assessment framework, if implemented on an annual basis, will facilitate the development provisional reference points compliant with the DFO Precautionary Approach which can then be evaluated to test for robustness to various stock size scenarios.