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Report of the PSARC Invertebrate Subcommittee Meeting June 16-17, 1998 and the Steering Committee Meeting July 10, 1998

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Report of the PSARC Invertebrate Subcommittee Meeting June 16-17, 1998 and the Steering Committee Meeting July 10, 1998

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PACIFIC STOCK ASSESSMENT REVIEW COMMITTEE

PSARC ADVISORY DOCUMENT 98-4
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INVERTEBRATES

I. STEERING COMMITTEE REPORT

PSARC Steering Committee met 10 July 1998 at the Pacific Biological Station to review the Invertebrate Subcommittee report. The Subcommittee report was accepted by the Steering Committee. Steering Committee provided the following comments pertaining to general Subcommittee concerns, to individual Working Papers, and to Fishery Updates summarized in the Subcommittee Report.

Steering Committee Discussion on General Subcommittee Concerns

(i) Problems with Fish Slip Data for Invertebrate Fisheries

Steering Committee notes the continuing concerns of the Invertebrate Subcommittee regarding the utility of official catch statistics produced by DFO and the discrepancies of these statistics with other sources of data, in particular for validated (i.e. IQ) fisheries.

Steering Committee notes that inaccurate catch data may arise from (1) misreporting of data to the Department, or (2) no reconciliation of the discrepancies due to data management problems, or absence of alternate data sources, or access to alternate data sources. The Steering Committee recommends discussion and resolution of this issue within the Shellfish Working Group. One approach to solving this problem would be to include a review of Catch Statistics Unit data by Fisheries Management personnel involved in each fishery.

(ii) Concerns regarding the number of demands for new and developing fisheries

Steering Committee notes the increase in requests for new and developing fisheries for invertebrate species (requests for 18 new fisheries are currently tabled), and the lack of resources to deal with these requests. In addition, Steering Committee agreed with the recommendations (expressed in the Fishery Updates) to increase biological information about many present fisheries through application of the phased approach established for new and developing fisheries.

Steering Committee Discussion on Working Papers and Fishery Updates

The Steering Committee reviewed the Invertebrate Subcommittee report dealing with two Working Papers and eight Fishery Updates.

I98-11 Quota options and recommendations for the 1999 and 2000 Geoduck clam fisheries

Steering Committee endorsed the Subcommittee recommendations and notes the progress in addressing uncertainties relating to harvest bed areas. Steering Committee

recommends that further work be performed to reduce uncertainties in other areas of the assessment, such as bed density estimates. The Steering Committee suggested this assessment move towards a more population dynamics-based approach, which could include formal assessments of the risks involved with the various quota options. Steering Committee suggested consideration of the approach used by Richards *et al.* to address similar questions for long-lived slope rockfish species, or consideration of other dynamic approaches applied to long-lived benthic species.

The Steering Committee also expressed concern regarding potential culling (high-grading) of dark coloured geoducks and recommended that the issue be evaluated in the next assessment. Steering Committee recommended that the proportion of dark to light coloured animals in the population be estimated during surveys and compared with the proportion in the catch, in order to estimate the extent of this problem. If it is a problem, then measures such as including the proportion of high-grading into the quota should be considered.

I98-12 Framework for a Tanner crab (*Chionoecetes tanneri* and *C. angulatus*) fishery in waters off the west coast of Canada

Steering Committee endorsed the Subcommittee recommendations that directed fishing should not be entertained prior to the completion of distributional and biomass surveys, and that the variety of management approaches listed in the paper be considered, including the establishment of refugia to protect a significant proportion of the stock from exploitation. Steering Committee further noted the multi-species nature of this fishery, which includes more than 1 species of crab, and which could have significant interaction with the sablefish pot fishery (and *vice versa*).

Fishery Updates

Steering Committee concurred with the Subcommittee comments, and noted with respect to horse clams that there is a commitment by the Department to provide opportunities for the inclusion of First Nations in the development (or expansion) of such fisheries.

II. INVERTEBRATE SUBCOMMITTEE REPORT

1. Introduction

The Subcommittee met at the Dorchester Hotel in Nanaimo on June 16 and 17, 1998. Two working papers and eight fishery updates were reviewed. The previously reviewed quota estimates for red sea urchins for 1998 is appended (Appendix 3). RMEC approved the release of the advice on red sea urchins at the meeting held on May 5, 1998.

2. General Subcommittee Concerns

A recurring issue highlighted in every fishery update presented at this meeting and in many previous working papers is the persistent problems with fish slip data for invertebrate fisheries. The Subcommittee has grave concerns about the invertebrate catch data in the fish slip database. The quality of data available has lead the authors to question the utility of information from the Catch Statistics Unit for use within DFO and suggest that this information is not suitable for public distribution. Where fish slips provide the only catch data for a fishery (i.e. where there is no catch validation), the data presented in the fishery updates are misleading and do not present an accurate view of the fishery.

The Subcommittee recommends that the fish slip data system be reviewed. Fish slip landing records may not be required for those fisheries with validated landings. Market reports may provide an alternative source of landed value information where fish slip records do not appear to be providing accurate records. Those parts of the existing fish slip system which are not providing reliable information and cannot be improved should be discontinued. Fish slip system resources should be refocused on those parts of the system which provide the most reliable information and the greatest benefit to management.

Catch data should be reviewed by someone involved in the fishery prior to use as official statistics. The Fishery Updates should form the source for official catch statistics as the fish slip database is not accurate and does not include the best catch information such as validated landings.

Illegal harvests and deliberate misreporting of catch and fishing activity are major problems in invertebrate fisheries. Fishermen over report fishing effort and catch to benefit from employment insurance and/or to create a history in a fishery where licenses may become limited. Fishermen under report catch and fishing effort to avoid taxation and to extend the duration of a fishery by not having catches registered against quotas.

Catch information is inadequate for most invertebrate fisheries without catch validation. This dearth of data hampers assessment which ultimately threatens conservation. The Subcommittee discussed opportunities for improving catch data including the use of vessel activity logs by DFO vessels, more forensic enforcement activity using the catch and harvest log databases, the use of ticketing systems for noncompliance with licence conditions, and possible changes to licensing requirements for unlimited fisheries (where fishers can simply buy another licence to get around reporting requirements).

The Department has experienced a huge demand (18 species) for new and developing fisheries as fishermen look to replace traditional fisheries. However, there is a lack of resources to deal with the fisheries that are currently licensed. The Subcommittee identified the need to systematically apply the phased approach to the existing licensed fisheries where management regimes were lacking.

3. Working Paper Summaries, Reviews and Discussion

I98-11 Quota options and recommendations for the 1999 and 2000 Geoduck clam fisheries. C.M. Hand, B.G. Vaughan and S. Heizer. **Accepted subject to revisions.**

Working Paper Summary

Geoduck (*Panopea abrupta*, Conrad 1849) stocks were examined and quota options presented for the north coast, west coast of Vancouver Island, and waters inside Vancouver Island for 1999 and 2000. The assessment methodology was unchanged from previous assessments, where the area of geoduck habitat reported by fishers, estimated geoduck densities and mean geoduck weights formed the basis of biomass estimates, and a fixed sustainable harvest rate was applied to derive quota options. Changes in the estimates of biomass resulted from updated geoduck density estimates from survey data, updated estimates of mean geoduck weight from commercial market samples, and new estimates of geoduck harvest areas from recent harvest log data and re-measurements of all pre-existing geoduck beds. The approach initiated in 1994 of reducing quotas where over harvesting had occurred, according to stock status relative to a 50-year cycle, was continued coast wide, as was the correction of landings reported on harvest logs with sales slip or port validation information. A range of quota options was presented, based on the uncertainty around mean geoduck densities, around mean geoduck weights and around geoduck bed area.

For the 1999 fishery, recommended low, medium and high risk quota options are 1,160.2 tonnes (t) (2,558,278 lbs), 2,119.4 t (4,673,376 lbs) and 3,396.3 t (7,488,812 lbs). Quota options for the 2000 fishery are 920.2 t (2,029,124 lbs), 1,752.6 t (3,864,422 lbs) and 2,883.5 t (6,358,092 lbs).

Reviewers' Comments

Reviewer #1

Reviewer 1 concluded that the paper was well written, clearly presenting the quota options for geoduck management areas. He suggests data and information on observer fisheries, geoduck quality and high grading be included to strengthen the assessment. Considering the "major" management implications of moving several vessel IVQ's from northern areas to southern areas, he suggests the full three year rotation of 1998-1999-2000 be presented. A greater discussion of north coast stocks compared to south coast stocks is warranted in light of the drop of the estimated biomass in 2000.

Reviewer 1 noted that a major question posed by industry is whether the survey areas are representative and questions whether the surveys provide a reliable index of geoduck biomass. The basis for much of the section on geoduck biomass is unpublished survey results that have not been reviewed by industry. He notes that the

major reason for changes in the north is that surveys have not supported the advice from fishers that densities of geoducks were much greater and suggests a review of the survey site selection and survey protocols.

Reviewer 1 suggested a discussion be included on quality and high grading problems that affect the TAC's and the landings. He also requested that the description of "bed scaling" be more detailed. Reviewer 1 listed a number of editorial comments and provided a marked text to the lead author.

Reviewer #2

Reviewer 2 was complimentary, stating the paper summarized a remarkable amount of very good work in a relatively short paper and that the work was an example to emulate. He felt the data generally supported the range of quota options and that the advice reflected the uncertainty in the data.

Reviewer 2 felt that bed area estimates were a concern given the potential for overestimates. He acknowledged that the scaling method based on landings and density data seemed appropriate but queries how bed area thresholds were calculated. Reviewer 2 requested clarification on how fisher's observations are used in determination of bed perimeters and noted that some of the methods required more detailed descriptions in order to be evaluated. He endorsed the conservative approach of not attempting absolute accuracy in estimating show factors as a safeguard to over-exploitation. He also questioned whether sample weights accurately estimated weights prior to a fishery but acknowledged that it was precautionary to use current weights as they probably present an underestimate.

Reviewer 2 highlighted the uncertainty in estimates of virgin biomass as the major issue in the paper. He suggests a precautionary approach to the problem would be to take current biomass estimates as surrogates for estimates of virgin biomass, and to continue to do so until better surveys, better bed size estimates, amortizations, and other corrections are completed to the satisfaction of DFO biologists and the industry. He concluded that the harvest rate of 0.5 B_O was a major assumption that requires further research. He also suggested that research to estimate recruitment frequency and intensity and response to harvest is critical.

Subcommittee Discussion

The representativeness of the surveys was discussed and it was noted that survey areas are not selected randomly. Questions were raised regarding diver calibration, show factors and whether the density estimates are representative of Queen Charlotte Islands. A diver calibration procedure has been discarded in favor of a statistical comparison between divers. Surveys are conducted to 15.2 m chart datum but fishers may go deeper to exploit higher density beds. Survey densities may therefore be lower than fishers estimates. Show factor data underestimates total density, therefore density estimates are likely conservative. The authors believe that the scaling system presently

in use is reasonable and preferable to past practices. The authors will provide clarification, editorial changes and citations as requested by the reviewers. The discussion of error needs to be elaborated. The authors were requested to include the graph(s) to show how individual bed areas had changed with the bed revision procedure that had occurred since the last development of quotas in this fishery. The authors agreed to describe the application of survey results in more detail. There was a discussion of the use of the amortization process.

Subcommittee Recommendations

The Subcommittee supports the quota options presented in the paper.

I98-12 Framework for a Tanner Crab (*Chionoecetes tanneri and C. angulatus*) fishery in waters off the west coast of Canada. J.A. Boutillier, R.B. Lauzier, A.C. Phillips and L. Barton. **Accepted subject to revisions.**

Working Paper Summary

A review and response to the results and recommendations on the initial Phase 0 review of tanner crab (*Chionoecetes tanneri and C. angulatus*) is presented. A framework is presented for a Phase 1 management system including: stock definition; data considerations; assessment models and policy evaluations. Management options and data requirements including: size, sex and season; TAC's based on harvest rates or biomass estimates; target of reference point thresholds; area closures; and other management options are outlined. A survey plan for potential Tanner crab harvest areas is presented

Reviewers' Comments

Reviewer #1

Reviewer 1 was critical of the format used in the document and suggests a more complete paragraph style. Reviewer 1 encouraged further discussion of the experiences gained in the extensive fisheries for the genus *Chionoecetes* on both coasts.

Reviewer 1 suggested that the paper elaborate on the logistical aspects of the surveys and detail what can be expected from the data obtained. He questions the economic benefit of the program and whether one year of surveys would be adequate.

Reviewer 1 noted that it is not possible to measure post release mortalities of shallow water crab species so it would be unlikely that it is possible to do so for *Chionoecetes sp.* The reviewer also questioned why it is critical to understand recruitment at this stage of the fishery development and suggested the authors assume that a stock recruit relationship does not exist, unless data can be shown that it does.

Reviewer 1 recommended that the manuscript be revised extensively before being accepted.

Reviewer #2

Reviewer 2 felt that the authors succeeded in proposing a management and assessment framework for a developing Tanner crab fishery but that the paper did not adequately address the first objective of providing more information about other majid crab fisheries. He suggested further discussion on which fisheries were viewed as successful or not and why.

Reviewer 2 acknowledged that assessment of fisheries effects on co-occurring species were necessary. He suggested that the authors be more clear on which species were being assessed.

Reviewer 2 suggested that the authors elaborate on the concept of large reserves, and partitioning the rest of the available fishing area into conservative open areas and experimental areas. He continues that the final proportions of areas might not be determined until the baseline survey and at least one year's information has been assessed.

Reviewer 2 suggested the paper include a concise summary of the potential management tools, their information requirements, their suitability for tanner crab fisheries. This summary might be in tabular form, or a decision diagram.

Subcommittee Discussion

The Subcommittee agrees with the authors on the following steps:

1. Begin with distributional surveys using traps;
2. then do biomass surveys using trawls.
3. After obtaining these data, develop a management system that incorporates quotas, experimental management and refugia.

The Subcommittee discussed some of the logistical considerations of tanner crab surveys including gear type, vessels, funding and timing. "Fishing for information" does not imply a directed fishery. It is important to understand the population distribution and have an estimate of the biomass prior to a directed fishery.

The Subcommittee notes that area swept trawl surveys are the preferred method to determine biomass. Considerable research is required to understand the effects of effort on abundance indices derived from trap surveys.

The authors will modify Table 1 to show that information on Alaskan fisheries for tanner crab is unavailable (rather than unknown).

The Subcommittee discussed bycatch problems which will require consideration in the development of a fishery. This will include both bycatch of tanner crab in the black cod and king crab fisheries and bycatch of other species in a tanner crab fishery.

The Subcommittee discussed larval dispersal patterns relative to bathymetry and ocean current patterns and concluded that larval entrainment may affect stock structure.

Subcommittee Recommendations

The Subcommittee accepted the paper subject to revisions and made the following recommendations:

1. That directed fishing not be entertained prior to the completion of surveys to determine distribution and biomass.
2. The use of refugia may be an appropriate management tool, however specific areas cannot be determined until the distribution of the animals is known.

4. Fishery Updates[1]

Fishery Updates are summaries of commercial fishery performance for the preceding season. Updates are prepared annually by fishery managers in consultation with C&P and Stock Assessment. The Invertebrate Subcommittee uses fishery updates to identify and discuss significant assessment and conservation concerns in each fishery.

The Subcommittee recommends that fishery updates include a section on "Stakeholder Participation" that details industry funded programs and collaborative work with industry and first Nations. Tables of the numbers of catch validations should be included in fishery updates where landings are validated.

Geoduck

The value of the geoduck fishery dropped to $33.7 million in 1997 from the 1995 record high of $43.3 million. The 1997 quota was 1796 t, compared to the 1995 quota of 2097 t. The 1997 price was $8.51/lb. compared to $9.36/lb. in 1995. The drop in value was attributed to product from Washington state. The Subcommittee notes that new quotas could imply a shifting of licenses from north to south. High-grading is an issue in the geoduck fishery where fishermen discard dark geoduck in favor of lighter colored geoduck which demand a higher price. The Subcommittee recommends an evaluation of the Underwater Harvester Association's (UHA) enhancement activities. DFO has not extended the licence fee offset to "G" licence holders which could lead to a reduction in industry support for management and assessment activities.

[1] Fishery Updates consist of factual information with little analysis or interpretation. They do not require peer review and therefore, do not provide scientific assessments of stock status.

Horse Clams

Managers have restricted the development of the horse clam fishery pending appropriate stock assessments. Horse clam harvests are limited to those areas and times of geoduck openings and by precautionary quotas in some areas. There was increased activity in the horse clam fishery in 1997. Effort was 140 boat days for landings of 7.46 t, up from the record low of 0.01 t in 1996. Interest in developing the fishery is not reflected in the historical catch as catch has been curtailed by management actions rather than by interest or stock availability. Licence holders want to test and develop markets unfettered by current DFO restrictions. The Steering Committee supported development of horse clam fisheries in response to the "Phase 0" assessment presented in January (I98-3). However, there is a stalemate in advancing this development as licence holders want an experimental fishery, with the proceeds to finance assessment work, and DFO wants structured surveys prior to a fishery. The complicated issue of allocation requires attention prior to development of the fishery.

Green Sea Urchins

The green sea urchin fishery took place from November 10, 1997 to March 15, 1998. Landings were 160 t, just short of the 166 t quota. Value increased in 1997/98 from the 1996/97 season. The green sea urchin fishery is limited by quotas and exploratory protocols. Catch and effort data has been improved through industry funded validation programs. The validated landings were more reliable than the fish slip data for the fishery. Management and stock assessment programs are in place for the next two to five years.

Octopus

The Subcommittee recommended several edits to the octopus fishery update qualifying the catch and effort data. The octopus fishery was identified as one of the fisheries where the data in the fish slip database was so poor that fishery trends could not be interpreted. Value appeared to increase in 1997 and there is a trend for greater reporting of landings of octopus bycatch in trap fisheries. Licenses are not limited and there are no restrictions on catch or effort in this fishery. The Subcommittee recommends that a process for management and assessment (Phase 1) be developed for this fishery.

Scallop

Markets have limited the development of the scallop fishery and there has been a decline in trawl vessel participation and landings. The majority of effort and landings comes from divers but landings and effort has also declined for this gear type. Although scallop fishing is managed through the use of size limits fishermen have expressed concern that local stocks cannot sustain current levels of harvest. No assessments are available but managers have implemented some closures due to concerns of over fishing. The Subcommittee suggested that "Phase 0" documents be undertaken for this

and other minor data limited fisheries. The Subcommittee recommends monitoring of the bycatch in scallop trawls.

Intertidal Clams

1997 was the last year of an open fishery for clams. Licence limitation is in effect for 1998 and appeals are ongoing. Managers expect between 1000 and 1100 licenses. Landings were slightly reduced in 1997 due to a minor decrease in effort. The clam fishery highlights problems in the fish slip database. Landings of Manila clams reported in the fish slip database were 1 million pounds short of landings verified by managers. The price of manila clams was $5.40/kg early in the year, then declined to $3.97/kg. Depuration landings were just under 450 t in 1997. The extent of contamination closures continues to increase and depuration harvests are expected to exceed 500 t in 1998. Almost 50% of clam depuration occurs as joint ventures between First Nations and industry. Community Management Boards were implemented in Area C and Area F in 1997. Boards were attempted in other areas but stake holders were not yet ready. Illegal harvests continue to plague the fishery. The Subcommittee notes the presence of varnish clams is steadily increasing and that there is the potential for replacement or competition with presently harvested species. The Subcommittee supports the incorporation of the depuration database into the corporate database.

Sea Cucumber

The sea cucumber fishery was conducted under the first year of an Adaptive Management Strategy in 1997. Management and stock assessment programs are in place for the next two to five years. The strategy allowed a 233 t quota (split weight) to be harvested from approximately 25% of the coast. (The strategy was detailed in working paper I96-12.) Licenses fished individual quotas in 1997. The Subcommittee suggested that catch per effort data by diver be removed from the update as the data is of limited use and doesn't accurately reflect trends in the fishery. Landings are validated in the fishery and the Subcommittee notes that the data from fish slips are incomplete when compared to the validations.

Opal Squid

Only 6 t of opal squid were reported landed in 1997 compared to 71 t in 1996. Landings appear to be under reported. Californian stocks of opal squid appear to have collapsed but Canadian trends cannot be determined because catch data is so poor. Managers cannot determine if reduced catch is due to landings not being reported, decreased effort or pending stock collapse. The number of licenses issued are decreased in 1997. The Subcommittee recommends an improvement in data collection and enforcing compliance of reporting catches and reiterates that opal squid should have a phased approach to fishery development. The Subcommittee supports the initiative of DFO/CCG collaboration in fishing activity logs to address the under-reporting and non-reporting concerns.

Appendix 1 Participants at Invertebrate Subcommittee Meeting June 16-17, 1998

Subcommittee Chair: Ivan Winther
PSARC Chair: Max Stocker

	Mon	Tues
Subcommittee Members:		
B. Adkins	✓	✓
J. Boutillier	✓	✓
A. Campbell	✓	✓
G. Gillespie	✓	✓
C. Hand	✓	✓
R. Harbo		✓
S. Heizer	✓	✓
M. Kattilakoski	✓	✓
R. Lauzier	✓	✓
J. Morrison	✓	✓
S. Neifer	✓	✓
G. Parker	✓	✓
I. Perry	✓	✓
L. Richards	✓	
J. Rogers	✓	✓
R. Webb	✓	
K. West	✓	✓
Observers:		
D. Clark	✓ (pm only)	
L. Barton	✓	
B. Vaughan	✓	✓

Appendix 2. Reviewers of Working Papers

No.	Title	Authors	Reviewers
I98-11	Quota options and recommendations for the 1999 and 2000 Geoduck clam fisheries.	C.M. Hand B.G. Vaughan S. Heizer	R. Harbo D. Woodby*
I98-12	Framework for a Tanner crab fishery in waters off the west coast of Canada.	J. Boutillier R. Lauzier A. Phillips L. Barton	G. Gillespie G. Jamieson

* Alaska Department of Fish and Game, Douglas, Alaska

Appendix 3 Quota estimates for the 1998 Red sea urchin fishery in B.C.

PSARC held an extraordinary Steering Committee meeting by teleconference on May 4, 1998, to review the Invertebrate Subcommittee report The Steering Committee accepted the Subcommittee report and provided the following comments.

INVERTEBRATE SUBCOMMITTEE REPORT

The Subcommittee met in Nanaimo at the DFO Front Street office Monday April 27, 1998. The Subcommittee reviewed one working paper, titled "Quota estimates for the 1998 Red Sea Urchin Fishery in B.C."

I98-10 Quota estimates for the 1998 Red Sea Urchin Fishery in B.C.
A. Campbell, D. Bureau, D. Brouwer.

Working Paper Summary

Annual landings of red sea urchin (*Strongylocentrotus franciscanus*) increased rapidly in the early 1980s for the south coast of British Columbia (B.C.) and in the late 1980s for the north coast, but subsequently were reduced and stabilized by arbitrary quotas. Coastwide landings were 6272 t valued at $12.4 M (Cdn.), with 109 licenses issued during 1996. Data from harvest logbooks indicated that there were no clear trends in annual CPUE (kilogram per diver hour) over the 1984-1996 period in each statistical area or general region in B.C. Bed areas were obtained by digitizing locations on charts indicated in harvest logbooks. Analyses of recent surveys and review of published survey reports provided estimates of density and mean weights allowing preliminary estimates of red sea urchin biomass in B.C. Recent published reports on growth rates indicate red sea urchin may grow at a slower rate and that natural mortality could be lower than previously reported. Assuming natural mortality rates between 0.05 and 0.10, and with estimated biomass, preliminary quotas options were calculated between 2,673 t and 5,140 t for red sea urchins in B.C. Further surveys for red sea urchin density, especially in the south coast of B.C., and more accurate estimates of red sea urchin bed areas, natural mortality and recruitment rates are required.

Reviewers' Comments

Reviewer 1 stated that the presentation in the working paper were clear and logical, and the conclusions seem very reasonable. The reviewer believed that biomass estimates coupled with reasonably conservative harvest rates were the key to a sustainable red sea urchin fishery, and both of these elements are contained in the working paper. The reviewer noted that the discussion on CPUE was very good. The working paper points out many pitfalls inherent in assuming that stable CPUE means stable populations. The reviewer suggested that since individual CPUEs were calculated, variance estimates should be calculated. These variance estimates will help to make between year or between area comparisons in the future.

Reviewer 2 found the working paper was well done. The reviewer found no major problems with the analysis, and recommended general acceptance of the working paper. The reviewer raised a number of points for consideration: where is this assessment going, and what can be done to improve the analysis of a major B.C. invertebrate fishery? The major uncertainty of biomass estimation is the calculation of bed areas, and a detailed analysis of bed sizes and changes over time would be helpful in assessing the uncertainty. The reviewer was concerned that the analysis provides no indication of the dynamics of red sea urchin stocks, by either changes in bed areas or biomass over time. The reviewer suggested analytical approaches as a time series, even if only in limited areas, in order to indicate possible changes in stock abundance.

Subcommittee Discussion

The general consensus of the Subcommittee was that the paper was well done. There was discussion as to the difficulty in annual estimates and bed size area delineation, due to problems in the database and reporting protocols. This is being addressed. The original objective of these surveys was to conduct very general broadbrush surveys to estimate biomass for large areas. This could be refined by increasing the number of transects and redesigning the surveys. There was some discussion as to the feasibility of reconstructing the database to include historical bed areas, which could be possible for 80% of the areas, but not necessarily for the whole time because of inadequate data.

The Subcommittee discussed the maximum depth of the surveys (9.1 m below chart datum) , and this was clarified as both a safety issue, and a maximum depth which included most of the red sea urchin fishing activity. The Subcommittee discussed the merits of a rotational fishery at length, and concluded that it was not justified at this time. The Subcommittee also expressed concern as to the issue of wet weight variability, and how wet weights are determined (i.e. the urchins are often left to drain for several hours before being weighted).

Subcommittee Recommendations

1. A rotational fishery is not justified at this time.

2. Further surveys to estimate density and growth (especially juveniles 5 - 30 mm TD), mortality and recruitment rates of red sea urchins in B.C. are required to assist with production modelling.

3. More accurate estimates of bed areas holding populations of red sea urchins are required, with improved reporting by fishers and changes in the design of the logbook.

4. Mean weights on commercial samples should be taken.

5. Mortality estimates from fishing activity, such as removal from rocks and breakage for quality checks, should be determined.

6. Other survey approaches, such as by bed basis or time series should be considered.

7. Support yield recommendations outlined in the Working Paper. We have reason to be more conservative due to Ebert's work on mortality rates, as well as the uncertainty in bed areas and biomass estimates.

Participants at Invertebrate Subcommittee Meeting April 27, 1998.

NAME	AFFILIATION
A. Campbell	Stock Assessment Division, PBS
C. Hand	Stock Assessment Division, PBS
S. Neifer	Stock Assessment Division, Prince Rupert
G. Parker	Fisheries Management, South Coast
S. Heizer	Fisheries Management, South Coast
R. Lauzier	Stock Assessment Division, PBS
I. Perry	Stock Assessment Division, PBS
Observers:	
M. Stocker (Meeting chair)	Chair, PSARC
L. Richards	Head, Stock Assessment Division, PBS
D. Bureau	Pacific Urchin Harvesters Association, Nanaimo

Reviewers of Working Paper:

NAME	AFFILIATION
A. Bradbury	Washington Department of Fish and Wildlife
I. Perry	Stock Assessment Division, PBS