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Proceedings of the PSARC Groundfish Subcommittee Meeting

Compte rendu de la réunion du sous-comité des poissons pélagiques du CEESP

January 17-18, 2007
Pacific Biological Station
Nanaimo, BC

17-18 janvier 2007
Station biologique du pacifique
Nanaimo, C.-B.

G. Logan

G. Logan

Fisheries and Oceans Canada
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3190 Hammond Bay Road
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Canada

Foreword

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

Avant-propos

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

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
GROUNDFISH SUBCOMMITTEE MEETING

SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) Groundfish Subcommittee met January 17-18, 2007 at the Pacific Biological Station in Nanaimo, B.C. The Subcommittee reviewed two Working Papers.

Working Paper G2007-01: Petrale sole (*Eopsetta jordani*) in British Columbia, Canada: Stock assessment for 2006/07 and advice to managers for 2007/08

The Groundfish Subcommittee accepted the paper subject to clarification of several phrases used within the document; these are illustrated in the summary discussion below. Questions arose over the use of historic catch data to define the B_{refref} point since some reviewers thought the Petrale sole population may have been substantially more abundant prior to the mid 1960s. The Subcommittee accepted the Working Paper recommendation that management decision be based on the decision tables presented in Tables 1 and 2 (split CPUE and CGRCS series) which used an age of recruitment of 6 years and estimated natural mortality, *M.M* The Subcommittee noted that the observed abundance trends input to the model and the model outputs indicate a doubling of the biomass over the last decade. This is consistent with anecdotal reports from industry that Petrale sole abundance had increased in B.C. during this period.

Working Paper G2007-02: English sole (*Parophrys vetulus*) in British Columbia, Canada: Stock Assessment for 2006/07 and advice to managers for 2007/08

Information pertaining to English sole in British Columbia was reviewed and updated for inclusion in a delay-difference stock assessment model. This model was used to determine the status of two stocks of English sole in management areas 5CD (Hecate Strait) and 3CD5AB (combined west coast Vancouver Island and Queen Charlotte Sound). Model outputs were used to provide quantitative advice on the probability of achieving specified performance measures at various fixed catch levels. The Groundfish Subcommittee accepted the paper subject to clarification of terminology used within the paper. These clarifications are identified in the discussion below. The assessment models applied to both stocks do not fit the available survey biomass indices very well, possibly because stock-specific biological data are not available. For example, in the case of the 3CD5AB assessment biological data drawn from area 5CD biological data was used.

SOMMAIRE

Le sous-comité des poissons pélagiques du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni les 17 et 18 janvier 2007 à la Station biologique du Pacifique à Nanaimo, en C.-B., et a passé en revue deux documents de travail.

Document de travail G2007-01 : Petrale sole (*Eopsetta jordani*) in British Columbia, Canada: Stock assessment for 2006/07 and advice to managers for 2007/08 (Plie de Californie (*Eopsetta Jordani*) en Colombie-Britannique, Canada : Évaluation des stocks pour 2006-2007 et avis aux gestionnaires pour 2007-2008)

Le sous-comité des poissons pélagiques accepte le document à condition que l'on apporte des éclaircissements à plusieurs phrases, tel qu'indiqué ci-après. Des interrogations sont soulevées quant à l'utilisation des données historiques sur les prises pour définir le point B_{refref}, certains membres estimant que la population de plie de Californie a probablement été beaucoup plus abondante avant le milieu des années 1960. Le sous-comité accepte la recommandation du document de travail à l'effet que la décision des gestionnaires doit être fondée sur les tableaux de décision (tableaux D7 et D11, séries fractionnées des PUE et du CGRCS) qui utilisent un âge au recrutement de 6 ans et une mortalité naturelle estimée *M.M.* Le sous-comité note que les tendances relatives à l'abondance observée que l'on a utilisées avec le modèle et les résultats du modèle indiquent que la biomasse a doublé au cours de la dernière décennie. Ce résultat va dans le même sens que les rapports anecdotiques de l'industrie voulant que l'abondance de la plie de Californie se soit accrue en C.-B. au cours de cette période.

Document de travail G2007-02 : English sole (*Parophrys vetulus*) in British Columbia, Canada: Stock Assessment for 2006/07 and advice to managers for 2007/08 (Carlottin anglais (*Parophrys vetulus*) en Colombie-Britannique, Canada : Évaluation des stocks pour 2006-2007 et avis aux gestionnaires pour 2007-2008)

L'information concernant le carlottin anglais en Colombie-Britannique est passée en revue et mise à jour afin d'être incluse dans un modèle d'évaluation des stocks à différence retardée. Ce modèle a été utilisé pour déterminer l'état de deux stocks de carlottin anglais dans les zones de gestion 5CD (détroit de Hecate) et 3CD5AB (côte ouest de île de Vancouver et détroit de la Reine-Charlotte). Les résultats du modèle ont été utilisés pour formuler un avis quantitatif sur la probabilité d'atteinte des niveaux de rendement indiqués selon divers scénarios de prises. Le sous-comité des poissons pélagiques accepte le document à condition que l'on clarifie la terminologie utilisée, tel qu'indiqué ci-après. Les modèles d'évaluation appliqués aux deux stocks ne conviennent pas

très bien aux indices de la biomasse des relevés dont on dispose, probablement en raison de l’absence de données biologiques propres aux stocks. Par exemple, dans le cas de l’évaluation de la zone 3CD5AB, les données biologiques ont été dérivées des données biologiques de la zone 5CD.

INTRODUCTION

The PSARC Groundfish Subcommittee met January 17-18, 2007 at the Pacific Biological Station in Nanaimo, British Columbia. External participants from industry and conservation groups attended the meeting. The Subcommittee Chair, G. Logan opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda.

The Subcommittee reviewed the two Working Papers summarized in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants and reviewers is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEW

G2007-01: Petrale sole (*Eopsetta jordani*) in British Columbia, Canada: Stock assessment for 2006/07 and advice to managers for 2007/08

P.J. Starr

<u>Subcommittee Discussion</u>

The Subcommittee noted that the analysis assumed there were no U.S. vessel catches from B.C. waters following Extended Jurisdiction in 1976. Although U.S. landings were likely reduced to low levels between 1976 and 1980 relative to earlier removals, these data should be sought and included in future assessments. The Subcommittee asked the author to be more explicit about the definition of the “Safe Zone” referred to on page 11 of the Working Paper, or delete this comment from the document. In addition, the Subcommittee requested that the document be revised to indicate the reduction in data that resulted from adopting the “wide-area” selection of data for catch per unit effort (CPUE) calculation to the “Canadian Groundfish Research Conservation Society (CGRCS)” selection.

The external reviewer recommended that more justification be provided for assuming a steepness estimate of 0.75. The author responded by saying that he felt there was consensus, based on previous west coast flatfish assessments, that *M* was near 0.2 and that this established a good basis to construct an informed prior with which to proceed with the assessment. On the other hand, there was no equivalent consensus for the steepness parameter and the author consequently felt there was less guidance to construct an informed prior. He added that previous reviewers of assessments using the delay-difference model had criticized how the tradeoff in estimating *M* and fitting to the mean weight data had been accommodated. The author argued that there was a greater need to explore this aspect of the assessment rather than focus on the assumed value of the steepness parameter. The external reviewer also identified that the model notation required some corrections.

The Subcommittee noted that the fishery removals of Petrale sole occurred prior to 1966, the first year used in the analysis. Indeed, Petrale sole landings were much higher before 1966 and persisted for many years. This history suggests a scenario wherein the Petrale sole population may have undergone a substantial fishing-down period prior to 1966. Such a scenario calls into question the appropriateness of using a B_{ref} determined from a low point within the 1966-2005 period, which might be an optimistic benchmark. One plausible alternative, for example, would be to use the 1966 biomass as the B_{ref}, rather than B_{67-74}.

The Subcommittee noted that the phrase “a bit higher” in Recommendation 5 in the Working Paper was ambiguous and therefore instructed the author to either provide an appropriate rationale for recommending a higher quota, or to remove the statement. Similarly, the Subcommittee requested that the term “Safe Zone” be defined or removed. The author agreed to revise the document to remove the ambiguity.

Subcommittee Conclusions

- The Subcommittee accepted the paper subject to revisions.

- The abundance trends used in the model and the model output indicate a doubling of the biomass over the last decade. The increase in stock biomass suggested by the assessment model is consistent with anecdotal reports from industry that Petrale sole catch rates have increased.

- The decision tables were accepted as the basis for advice to managers for the 2007/08 Petrale sole fishery in the designated management areas.

- When interpreted in the context of the National position on harvest strategies compliant with the precautionary approach (DFO, 2006)[1], the performance measures advanced in the Working Paper differ in that they generally cast the consequences of various future catch levels in terms of change in *relative biomass* instead of *removal rate*.

- In the vernacular of DFO (2006), the *limit reference point* is represented by the beginning of year biomass in 2008-2012 compared to the minimum biomass over the 1966-2006 period. However, there are no analogs in the Working Paper that correspond to the upper stock reference point or

[1] DFO, 2006. A harvest strategy compliant with the precautionary approach. DFO Can. Sci. Sec. Adv. Rep. 2006/023.

removal reference point advanced in the National policy. Instead the following probabilities are contemplated:

- ***stock increase***: beginning of year biomass in 2008-2012 compared to 2007 beginning of year biomass, and

- ***stock status relative to a mean level: beginning of year biomass in 2008-2012 compared to mean beginning of year biomass 1977-1984.*** Although the long-term suitability of such measures has not been evaluated against harvest rate-based alternatives by simulation studies, the Subcommittee accepted their application as reasonable criteria for decision making in the short-term.

Subcommittee Recommendations

Fishery managers should use the decision tables provided as Table 1 and Table 2 in this document which correspond to Tables D.7 (single CPUE and CGRCS series) and D.11 (split CPUE and CGRCS series) of the Petrale sole Working Paper. Both decision tables are based on an age of recruitment of 6 years and a value of M estimated by the model.

Performance measures proposed in the Working Paper were evaluated at a range of fixed catch levels from 0 to 1000 t over the 2008 to 2012 period. In particular, the decision tables suggest that a harvest of 600 t in each year of the projection period for the recommended assessment runs provides a probability of 0.5 to 0.7 that Petrale sole biomass will decline, depending on the model and data assumptions.

If the fishery objective is to maintain the biomass at the beginning of year 2007 level, then a harvest of approximately 500 t corresponds to a probability of 0.5 that the beginning of year 2012 biomass will be at least the 2007 level over all analyses.

Further definition of the “best” harvest strategy, especially given the implication of the possible fishing down period prior to 1966, would require the provisions of fishery objectives for managing Petrale sole within a multi-species complex since much of the catch is taken incidentally to directed fishing on other groundfish species.

Table 1: Tables of the probability and the expected value of the beginning year biomass in the projection year exceeding reference biomass levels for one to five year projections starting from the beginning year biomass in 2007 for the Case 1 (single CPUE series/estimate M/CGRCS selection rules) and Case 2 (single CPUE series/fix M/CGRCS selection rules) Petrale sole runs. The approximate level of the current TAC is indicated with grey shading.

Project Catch	single CPUE series | $r = 6$ | CGRCS rules									
	Estimate M					Fix M				
	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
$P\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$										
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
200	0.99	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
300	0.99	0.99	0.99	1.00	1.00	0.97	0.99	0.99	1.00	1.00
400	0.97	0.97	0.97	0.98	0.98	0.93	0.94	0.95	0.96	0.97
500	0.94	0.91	0.90	0.88	0.88	0.89	0.85	0.84	0.84	0.84
600	0.90	0.81	0.75	0.71	0.68	0.83	0.73	0.67	0.64	0.61
700	0.84	0.69	0.58	0.51	0.46	0.75	0.58	0.50	0.46	0.41
800	0.77	0.56	0.41	0.34	0.28	0.65	0.45	0.36	0.33	0.28
900	0.68	0.43	0.29	0.23	0.19	0.55	0.36	0.28	0.26	0.24
1000	0.60	0.33	0.21	0.16	0.15	0.47	0.30	0.23	0.23	0.22
$E\left(\tilde{B}_y / \min\{B_t\}_{t=1966}^{2006}\right)$										
0	1.98	2.39	2.75	3.07	3.33	2.12	2.70	3.23	3.70	4.12
100	1.89	2.23	2.52	2.78	3.00	2.00	2.47	2.90	3.29	3.64
200	1.80	2.06	2.29	2.49	2.66	1.88	2.24	2.57	2.87	3.14
300	1.71	1.89	2.05	2.19	2.31	1.76	2.01	2.23	2.45	2.64
400	1.63	1.73	1.82	1.89	1.96	1.64	1.77	1.90	2.02	2.13
500	1.54	1.56	1.58	1.60	1.61	1.52	1.55	1.57	1.61	1.64
600	1.45	1.40	1.35	1.32	1.29	1.41	1.35	1.29	1.27	1.24
700	1.37	1.25	1.15	1.08	1.02	1.30	1.17	1.08	1.03	0.99
800	1.28	1.11	0.98	0.90	0.85	1.20	1.03	0.94	0.89	0.86
900	1.20	0.99	0.86	0.78	0.74	1.11	0.93	0.85	0.82	0.80
1000	1.12	0.89	0.77	0.71	0.69	1.03	0.86	0.80	0.78	0.77
$P\left(\tilde{B}_y > \text{mean}\{B_t\}_{t=1977}^{1984}\right)$										
0	0.90	0.99	1.00	1.00	1.00	0.91	1.00	1.00	1.00	1.00
100	0.83	0.95	0.99	1.00	1.00	0.85	0.98	1.00	1.00	1.00
200	0.75	0.88	0.95	0.98	0.99	0.77	0.91	0.97	0.99	1.00
300	0.67	0.78	0.86	0.90	0.93	0.67	0.80	0.88	0.93	0.96
400	0.57	0.65	0.71	0.74	0.78	0.55	0.64	0.70	0.74	0.79
500	0.48	0.50	0.51	0.53	0.54	0.45	0.47	0.48	0.50	0.51
600	0.40	0.37	0.33	0.32	0.29	0.35	0.31	0.29	0.28	0.27
700	0.32	0.25	0.20	0.16	0.14	0.27	0.20	0.17	0.14	0.12
800	0.26	0.17	0.12	0.08	0.06	0.20	0.14	0.09	0.07	0.07
900	0.20	0.10	0.07	0.04	0.04	0.15	0.09	0.06	0.05	0.04
1000	0.15	0.06	0.04	0.02	0.02	0.11	0.06	0.05	0.04	0.04

Project Catch	single CPUE series | $r = 6$ | CGRCS rules									
	Estimate *M*					Fix *M*				
Catch	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
$\mathrm{E}\left(\tilde{B}_y / \mathrm{mean}\{B_t\}_{t=1977}^{1984}\right)$										
0	1.31	1.58	1.82	2.02	2.19	1.38	1.76	2.10	2.41	2.68
100	1.25	1.47	1.66	1.83	1.98	1.31	1.61	1.89	2.15	2.37
200	1.19	1.36	1.51	1.64	1.75	1.23	1.46	1.67	1.87	2.05
300	1.13	1.25	1.35	1.45	1.53	1.15	1.31	1.46	1.60	1.72
400	1.07	1.14	1.20	1.25	1.30	1.07	1.16	1.24	1.32	1.39
500	1.02	1.03	1.04	1.06	1.07	0.99	1.01	1.03	1.05	1.07
600	0.96	0.93	0.89	0.87	0.85	0.92	0.88	0.85	0.83	0.81
700	0.90	0.82	0.76	0.71	0.68	0.85	0.76	0.71	0.67	0.65
800	0.85	0.73	0.65	0.60	0.56	0.78	0.67	0.61	0.58	0.56
900	0.80	0.65	0.57	0.52	0.49	0.73	0.61	0.56	0.54	0.52
1000	0.74	0.59	0.51	0.47	0.45	0.67	0.56	0.52	0.51	0.50
$\mathrm{P}\left(\tilde{B}_y > B_{2007}\right)$										
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
200	0.96	0.96	0.98	0.99	0.99	0.99	0.99	1.00	1.00	1.00
300	0.85	0.85	0.89	0.93	0.95	0.89	0.92	0.94	0.97	0.98
400	0.61	0.66	0.71	0.76	0.79	0.65	0.68	0.75	0.79	0.84
500	0.40	0.43	0.46	0.47	0.49	0.40	0.43	0.46	0.49	0.51
600	0.23	0.26	0.26	0.25	0.24	0.21	0.25	0.25	0.26	0.24
700	0.12	0.14	0.14	0.13	0.11	0.10	0.14	0.14	0.12	0.12
800	0.06	0.08	0.08	0.06	0.05	0.04	0.09	0.08	0.08	0.08
900	0.03	0.05	0.05	0.03	0.03	0.02	0.07	0.07	0.06	0.06
1000	0.01	0.03	0.03	0.03	0.02	0.01	0.06	0.06	0.05	0.06
$\mathrm{E}\left(\tilde{B}_y / B_{2007}\right)$										
0	1.27	1.55	1.79	2.00	2.18	1.38	1.78	2.15	2.47	2.76
100	1.21	1.44	1.64	1.81	1.96	1.30	1.62	1.92	2.19	2.43
200	1.15	1.33	1.48	1.61	1.73	1.21	1.46	1.69	1.90	2.09
300	1.09	1.22	1.33	1.42	1.50	1.13	1.30	1.46	1.61	1.75
400	1.03	1.11	1.17	1.22	1.27	1.05	1.15	1.23	1.32	1.40
500	0.98	1.00	1.01	1.03	1.04	0.97	1.00	1.02	1.04	1.07
600	0.92	0.89	0.86	0.84	0.83	0.90	0.86	0.84	0.82	0.81
700	0.86	0.79	0.73	0.69	0.66	0.82	0.75	0.71	0.68	0.66
800	0.81	0.70	0.63	0.58	0.55	0.76	0.67	0.62	0.59	0.58
900	0.76	0.63	0.55	0.51	0.48	0.70	0.61	0.57	0.55	0.54
1000	0.71	0.57	0.50	0.46	0.45	0.65	0.57	0.54	0.53	0.52

Table 2: Tables of the probability and the expected value of the beginning year biomass in the projection year exceeding reference biomass levels for one to five year projections starting from the beginning year biomass in 2007 for the Case 9 (split CPUE series/estimate M/CGRCS selection rules) and Case 10 (split CPUE series/fix M/CGRCS selection rules) Petrale sole runs. The approximate level of the current TAC is indicated with grey shading.

Project Catch	split CPUE series | r = 6 | CGRCS rules – Estimate M					Fix M				
	2008	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
	$\mathrm{P}\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$									
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
500	1.00	1.00	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00
600	1.00	0.99	0.98	0.97	0.96	0.99	0.99	0.99	0.98	0.97
700	0.99	0.97	0.94	0.91	0.89	0.99	0.97	0.95	0.93	0.92
800	0.98	0.93	0.86	0.80	0.74	0.98	0.94	0.88	0.85	0.82
900	0.97	0.88	0.75	0.66	0.58	0.97	0.89	0.80	0.77	0.72
1000	0.96	0.80	0.64	0.54	0.47	0.96	0.82	0.73	0.69	0.65
	$\mathrm{E}\left(\tilde{B}_y / \min\{B_t\}_{t=1966}^{2006}\right)$									
0	3.03	3.61	4.14	4.62	5.03	3.71	4.58	5.40	6.14	6.80
100	2.92	3.40	3.85	4.25	4.61	3.56	4.29	4.99	5.63	6.20
200	2.81	3.20	3.56	3.88	4.17	3.41	4.00	4.57	5.10	5.58
300	2.71	2.99	3.26	3.51	3.74	3.26	3.71	4.16	4.58	4.96
400	2.60	2.78	2.97	3.14	3.29	3.11	3.41	3.74	4.04	4.33
500	2.49	2.57	2.67	2.76	2.85	2.96	3.12	3.32	3.51	3.69
600	2.38	2.36	2.37	2.38	2.40	2.81	2.84	2.90	2.98	3.06
700	2.27	2.16	2.08	2.01	1.96	2.66	2.55	2.50	2.47	2.46
800	2.17	1.96	1.80	1.67	1.58	2.51	2.28	2.14	2.04	1.98
900	2.06	1.76	1.54	1.39	1.29	2.37	2.03	1.83	1.72	1.64
1000	1.95	1.58	1.33	1.19	1.1	2.23	1.81	1.6	1.49	1.43
	$\mathrm{P}\left(\tilde{B}_y > \mathrm{mean}\{B_t\}_{t=1977}^{1984}\right)$									
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
200	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
300	0.99	0.99	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
400	0.97	0.98	0.98	0.99	0.99	0.98	0.99	0.99	1.00	1.00
500	0.96	0.95	0.94	0.94	0.95	0.97	0.97	0.97	0.97	0.98
600	0.94	0.89	0.87	0.85	0.84	0.95	0.93	0.92	0.91	0.90
700	0.91	0.82	0.75	0.70	0.66	0.93	0.87	0.80	0.78	0.76
800	0.87	0.73	0.61	0.54	0.47	0.89	0.77	0.67	0.62	0.58
900	0.82	0.61	0.47	0.37	0.30	0.85	0.67	0.54	0.47	0.45
1000	0.77	0.50	0.34	0.24	0.20	0.80	0.55	0.43	0.37	0.35

Project Catch	split CPUE series | r = 6 | CGRCS rules									
	Estimate M					Fix M				
Catch	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
$\mathrm{E}\left(\tilde{B}_y / \mathrm{mean}\{B_t\}_{t=1977}^{1984}\right)$										
0	2.05	2.44	2.79	3.11	3.39	2.46	3.03	3.57	4.06	4.50
100	1.97	2.30	2.60	2.87	3.11	2.36	2.84	3.30	3.72	4.10
200	1.90	2.16	2.40	2.62	2.81	2.26	2.65	3.03	3.38	3.69
300	1.83	2.02	2.20	2.37	2.52	2.16	2.45	2.75	3.03	3.28
400	1.75	1.88	2.00	2.12	2.22	2.06	2.26	2.47	2.68	2.87
500	1.68	1.74	1.80	1.86	1.92	1.96	2.07	2.20	2.32	2.44
600	1.61	1.60	1.60	1.61	1.62	1.86	1.88	1.92	1.97	2.02
700	1.54	1.46	1.41	1.36	1.33	1.76	1.69	1.66	1.64	1.63
800	1.46	1.32	1.22	1.13	1.07	1.67	1.51	1.41	1.35	1.31
900	1.39	1.19	1.05	0.94	0.87	1.57	1.34	1.21	1.14	1.09
1000	1.32	1.07	0.90	0.80	0.74	1.47	1.20	1.06	0.99	0.95
$\mathrm{P}\left(\tilde{B}_y > B_{2007}\right)$										
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
200	0.96	0.97	0.98	0.99	0.99	0.99	0.99	1.00	1.00	1.00
300	0.85	0.88	0.92	0.94	0.96	0.92	0.94	0.97	0.99	0.99
400	0.66	0.72	0.77	0.83	0.86	0.75	0.79	0.87	0.92	0.94
500	0.43	0.51	0.57	0.60	0.64	0.54	0.59	0.67	0.73	0.77
600	0.26	0.32	0.35	0.38	0.39	0.35	0.40	0.42	0.47	0.50
700	0.15	0.19	0.20	0.19	0.19	0.20	0.23	0.26	0.27	0.27
800	0.08	0.11	0.11	0.09	0.09	0.12	0.14	0.14	0.14	0.13
900	0.04	0.06	0.06	0.05	0.04	0.06	0.08	0.08	0.08	0.07
1000	0.02	0.03	0.03	0.02	0.02	0.03	0.05	0.05	0.04	0.04
$\mathrm{E}\left(\tilde{B}_y / B_{2007}\right)$										
0	1.22	1.46	1.68	1.87	2.04	1.29	1.60	1.90	2.17	2.40
100	1.17	1.37	1.56	1.72	1.87	1.23	1.50	1.75	1.98	2.19
200	1.13	1.29	1.44	1.57	1.69	1.18	1.39	1.60	1.79	1.96
300	1.08	1.20	1.31	1.42	1.51	1.12	1.29	1.45	1.60	1.74
400	1.04	1.11	1.19	1.26	1.33	1.07	1.18	1.29	1.40	1.51
500	0.99	1.03	1.07	1.11	1.14	1.02	1.07	1.14	1.21	1.27
600	0.95	0.94	0.95	0.95	0.96	0.96	0.97	0.99	1.02	1.05
700	0.90	0.86	0.83	0.80	0.78	0.91	0.87	0.85	0.84	0.84
800	0.86	0.77	0.71	0.66	0.63	0.86	0.77	0.72	0.69	0.67
900	0.82	0.70	0.61	0.55	0.51	0.80	0.69	0.62	0.59	0.56
1000	0.77	0.62	0.53	0.47	0.44	0.75	0.61	0.54	0.52	0.50

G2007-02: English sole (*Parophrys vetulus*) in British Columbia, Canada: Stock Assessment for 2006/07 and advice to managers for 2007/08

P.J. Starr

Subcommittee Discussion

The Subcommittee noted that the landings history used in the assessment assumed no U.S. landings from B.C. waters following Extended Jurisdiction in 1976. Although U.S. landings were likely reduced to low levels between 1976 and 1980 relative to earlier removals, these data should be sought and included in future assessments. The external reviewer requested that the author clarify what is meant by "average recruitment" on page 8 of the Working Paper. The Subcommittee noted that the rationale offered for choosing the "wide" data selection for CPUE calculations over the "industry" selection be revised, given the statement that it was based on minimizing the loss of data and improving model performance. The Subcommittee requested that an explicit definition of the "Safe Zones" referred to on page 11 of the Working Paper be provided, or that the discussion be deleted from the document.

Subcommittee Conclusions

- The Subcommittee accepted the paper with the revisions.

- The current 5CD TAC of 544 t is projected to allow the stock to remain above critical reference points. For example, $\mathrm{P}\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$ is at least 0.98 and $\mathrm{P}\left(\tilde{B}_y > \mathrm{mean}\{B_t\}_{t=1978}^{1988}\right)$ is at least 0.71 (single CPUE series, *M* estimated) at the end of the projection period in 2012 for annual catches of 530 t. However, the model runs also predict a decline in current stock abundance with landings much greater that the current TAC. For example, for total catches of 636 t per year the $\mathrm{P}\left(\tilde{B}_y > B_{2007}\right)$ is no greater than 0.5 over the projection period and declines rapidly with increasing catch regardless of the model formulation.

- Model diagnostics indicated some model misspecification, as evidenced by the unlikely recruitment spike in 1998 in one run, but overall the runs were similar and indicated that the population is currently at, or near, historical highs within the data series used in the assessment. The CPUE index and Hecate Strait survey are consistent in showing an upward trend over the last 10 years.

- The lack of contrast in the commercial fishery abundance index prohibits use of B_{rec} as a harvest reference point although in the "single CPUE version" there was a low point from which the population recovered. The Subcommittee concluded that it might be possible to derive a B_{lim} from this run. Nevertheless, the Subcommittee accepted the author's suggestion to use the mean estimated biomass from 1978-1988 ($B_{78\text{-}88}$) as the target reference point.

- The current combined 3CD5AB TAC of 186 t is projected to allow the stock to remain above the minimum biomass over the 1966 to 2006 period. For example, $\mathrm{P}\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$ is at least 0.53 at the end of the projection period in 2012 and 0.88 for the split CPUE series with r=5 and *M* estimated. The $\mathrm{P}\left(\tilde{B}_y > \mathrm{mean}\{B_t\}_{t=1978}^{1988}\right)$ is less than 0.18 over all years of the projection period for the single CPUE series with M estimated and ranges from 0.68 to 0.57 over the projection period for the split CPUE series with *M* estimated. All probabilities decline rapidly with increasing total catch above 186 t for this performance measure. Total catches at the current TAC result in $\mathrm{P}\left(\tilde{B}_y > B_{2007}\right)$ ranging from 0.31 to 0.37 over the projection period for the single CPUE series and from 0.27 to 0.29 for the split CPUE series, both with M estimated.

- As with the 5CD assessment, the lack of contrast in 3CD5AB population abundance prevents use of a B_{lim} for the target reference point. The Subcommittee accepted the author's recommendation to use the mean biomass from 1974-1986 as the B_{ref}.

<u>Subcommittee Recommendations</u>

The 5CD Stock

The Subcommittee recommended that fishery managers adopt decision Table 3 and Table 4 where *M* was estimated as the science advice for English sole in area 5CD. These tables correspond to Table D.7 (5CD) and Table D.9 (3CDAB) of the Working Paper.

The 3CD5AB Stock

Managers are encouraged to use the results summarized by Tables 5 and 6 which correspond to Table D.10 and D.11 of the Working Paper in which *M* was estimated, to guide quota selection for 2007-2008.

Table 3: Tables of the probability and the expected value of the beginning year biomass in the projection year exceeding reference biomass levels for one to five year projections starting from the beginning year biomass in 2007 for the Case 2 (single CPUE/estimate M) and Case 3 (single CPUE/fix M) 5CD English sole runs. Total projection catch has been rounded up to next highest 1 t based on the mean proportion of males in the 5CD sampled commercial catch from 1996–2005: 0.0555. The approximate level of the current TAC is indicated with grey shading.

Projection Catch		5CD: single CPUE series $\mid r = 5$									
		Estimate M					Fix M				
Total	**Female**	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
$\mathrm{P}\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$											
0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
106	100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
212	200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
318	300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
424	400	1.00	1.00	1.00	1.00	1.00	0.99	0.99	1.00	1.00	1.00
530	500	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.99	0.98	0.99
636	600	0.99	0.98	0.98	0.96	0.97	0.97	0.95	0.93	0.93	0.93
742	700	0.99	0.96	0.92	0.91	0.87	0.95	0.90	0.85	0.84	0.80
848	800	0.97	0.91	0.85	0.78	0.74	0.92	0.81	0.74	0.67	0.62
953	900	0.95	0.83	0.74	0.64	0.58	0.88	0.72	0.60	0.52	0.43
1059	1000	0.92	0.76	0.60	0.49	0.41	0.83	0.61	0.48	0.36	0.29
$\mathrm{E}\left(\tilde{B}_y / \min\{B_t\}_{t=1966}^{2006}\right)$											
0	0	1.86	2.13	2.36	2.56	2.72	1.97	2.35	2.68	2.95	3.18
106	100	1.82	2.05	2.25	2.41	2.55	1.91	2.23	2.51	2.74	2.94
212	200	1.77	1.96	2.12	2.25	2.37	1.84	2.11	2.34	2.53	2.69
318	300	1.72	1.87	2.00	2.10	2.18	1.78	1.98	2.16	2.31	2.43
424	400	1.67	1.78	1.87	1.94	2.00	1.71	1.86	1.99	2.09	2.18
530	500	1.63	1.69	1.75	1.79	1.82	1.64	1.74	1.81	1.87	1.92
636	600	1.58	1.61	1.63	1.64	1.64	1.58	1.61	1.64	1.66	1.66
742	700	1.53	1.52	1.50	1.48	1.46	1.51	1.49	1.47	1.44	1.42
848	800	1.49	1.43	1.38	1.33	1.28	1.45	1.37	1.30	1.24	1.19
953	900	1.44	1.34	1.25	1.17	1.11	1.38	1.25	1.15	1.07	1.00
1059	1000	1.39	1.25	1.13	1.03	0.95	1.32	1.15	1.02	0.93	0.86
$\mathrm{P}\left(\tilde{B}_y > \mathrm{mean}\{B_t\}_{t=1978}^{1988}\right)$											
0	0	0.85	0.97	0.99	1.00	1.00	0.88	0.98	1.00	1.00	1.00
106	100	0.80	0.94	0.98	0.99	1.00	0.84	0.96	0.99	1.00	1.00
212	200	0.74	0.89	0.95	0.97	0.99	0.78	0.92	0.97	0.99	0.99
318	300	0.68	0.81	0.88	0.92	0.95	0.70	0.84	0.91	0.95	0.97
424	400	0.62	0.70	0.78	0.82	0.87	0.62	0.73	0.81	0.87	0.90
530	500	0.55	0.60	0.66	0.69	0.71	0.54	0.62	0.68	0.72	0.75
636	600	0.48	0.51	0.52	0.54	0.54	0.46	0.49	0.52	0.53	0.53
742	700	0.42	0.40	0.39	0.38	0.36	0.39	0.37	0.38	0.34	0.33
848	800	0.36	0.30	0.28	0.25	0.22	0.32	0.27	0.24	0.21	0.19
953	900	0.30	0.24	0.19	0.16	0.13	0.26	0.20	0.15	0.13	0.10

Projection Catch		5CD: single CPUE series | $r = 5$									
		M Estimate					M Fix				
Total	**Female**	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
1059	1000	0.26	0.17	0.13	0.10	0.07	0.21	0.14	0.10	0.07	0.06
		$E\left(\tilde{B}_y / \text{mean}\{B_t\}_{t=1978}^{1988}\right)$									
0	0	1.19	1.36	1.51	1.63	1.74	1.25	1.49	1.70	1.88	2.02
106	100	1.16	1.31	1.44	1.54	1.63	1.21	1.42	1.60	1.74	1.87
212	200	1.13	1.25	1.36	1.44	1.51	1.17	1.34	1.49	1.61	1.71
318	300	1.10	1.20	1.28	1.34	1.40	1.13	1.26	1.37	1.47	1.55
424	400	1.07	1.14	1.20	1.24	1.28	1.09	1.18	1.26	1.33	1.38
530	500	1.04	1.08	1.12	1.15	1.17	1.05	1.10	1.15	1.19	1.22
636	600	1.01	1.03	1.04	1.05	1.05	1.00	1.03	1.04	1.05	1.06
742	700	0.98	0.97	0.96	0.95	0.94	0.96	0.95	0.93	0.92	0.90
848	800	0.95	0.91	0.88	0.85	0.82	0.92	0.87	0.83	0.79	0.76
953	900	0.92	0.86	0.80	0.75	0.71	0.88	0.80	0.73	0.68	0.64
1059	1000	0.89	0.80	0.73	0.66	0.61	0.84	0.73	0.65	0.59	0.55
		$P\left(\tilde{B}_y > B_{2007}\right)$									
0	0	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
106	100	0.98	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00
212	200	0.93	0.95	0.97	0.98	0.99	0.97	0.98	0.99	0.99	1.00
318	300	0.82	0.87	0.91	0.94	0.95	0.89	0.92	0.95	0.97	0.98
424	400	0.68	0.74	0.80	0.83	0.86	0.73	0.79	0.85	0.89	0.91
530	500	0.50	0.57	0.63	0.66	0.70	0.55	0.61	0.68	0.71	0.74
636	600	0.35	0.42	0.46	0.48	0.50	0.36	0.42	0.47	0.48	0.50
742	700	0.24	0.30	0.32	0.32	0.30	0.22	0.29	0.31	0.30	0.29
848	800	0.16	0.20	0.21	0.20	0.18	0.14	0.19	0.19	0.17	0.15
953	900	0.09	0.13	0.14	0.11	0.10	0.07	0.12	0.11	0.10	0.07
1059	1000	0.06	0.09	0.08	0.06	0.05	0.04	0.08	0.08	0.05	0.04
		$E\left(\tilde{B}_y / B_{2007}\right)$									
0	0	1.15	1.33	1.48	1.60	1.70	1.22	1.46	1.68	1.86	2.00
106	100	1.13	1.28	1.40	1.51	1.59	1.18	1.39	1.57	1.72	1.85
212	200	1.10	1.22	1.32	1.41	1.48	1.14	1.31	1.46	1.59	1.69
318	300	1.07	1.16	1.25	1.31	1.37	1.10	1.23	1.35	1.45	1.53
424	400	1.04	1.11	1.17	1.21	1.25	1.06	1.15	1.24	1.31	1.36
530	500	1.01	1.05	1.09	1.12	1.14	1.01	1.08	1.13	1.17	1.20
636	600	0.98	1.00	1.01	1.02	1.03	0.97	1.00	1.02	1.03	1.04
742	700	0.95	0.94	0.93	0.92	0.91	0.93	0.92	0.91	0.90	0.88
848	800	0.92	0.88	0.85	0.82	0.80	0.89	0.84	0.81	0.77	0.74
953	900	0.89	0.83	0.78	0.73	0.69	0.85	0.77	0.71	0.66	0.62
1059	1000	0.86	0.77	0.70	0.64	0.59	0.81	0.70	0.63	0.58	0.54

Table 4: Tables of the probability and the expected value of the beginning year biomass in the projection year exceeding reference biomass levels for one to five year projections starting from the beginning year biomass in 2007 for the Case 5 (split CPUE/estimate M) and Case 6 (split CPUE/fix M) 5CD English sole runs. Total projection catch has been rounded up to next highest 1 t based on the mean proportion of males in the 5CD sampled commercial catch from 1996–2005: 0.0555. The approximate level of the current TAC is indicated with grey shading.

Projection Catch		5CD: split CPUE series | $r = 5$									
		Estimate M					Fix M				
Total	**Female**	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
		$P\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$									
0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
106	100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
212	200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
318	300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
424	400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
530	500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
636	600	1.00	1.00	1.00	0.99	0.99	1.00	1.00	1.00	0.99	0.99
742	700	1.00	1.00	0.99	0.98	0.97	1.00	0.99	0.98	0.97	0.96
848	800	1.00	0.99	0.97	0.95	0.92	1.00	0.98	0.95	0.91	0.88
953	900	1.00	0.98	0.95	0.90	0.84	0.99	0.96	0.88	0.82	0.75
1059	1000	1.00	0.96	0.90	0.81	0.73	0.99	0.91	0.80	0.68	0.58
		$E\left(\tilde{B}_y / \min\{B_t\}_{t=1966}^{2006}\right)$									
0	0	1.95	2.12	2.25	2.36	2.45	2.17	2.46	2.70	2.90	3.07
106	100	1.92	2.06	2.17	2.26	2.33	2.12	2.37	2.57	2.74	2.89
212	200	1.89	2.00	2.08	2.15	2.21	2.07	2.27	2.44	2.58	2.69
318	300	1.85	1.93	2.00	2.05	2.09	2.02	2.17	2.30	2.41	2.50
424	400	1.82	1.87	1.91	1.94	1.97	1.97	2.08	2.17	2.24	2.30
530	500	1.79	1.81	1.83	1.84	1.84	1.92	1.98	2.03	2.07	2.10
636	600	1.75	1.75	1.74	1.73	1.72	1.87	1.89	1.90	1.90	1.91
742	700	1.72	1.69	1.66	1.63	1.60	1.82	1.79	1.76	1.74	1.71
848	800	1.69	1.63	1.57	1.52	1.47	1.77	1.70	1.63	1.57	1.51
953	900	1.66	1.57	1.49	1.41	1.35	1.72	1.60	1.50	1.40	1.32
1059	1000	1.62	1.51	1.40	1.31	1.23	1.67	1.51	1.36	1.24	1.14
		$P\left(\tilde{B}_y > \text{mean}\{B_t\}_{t=1978}^{1988}\right)$									
0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
106	100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
212	200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
318	300	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
424	400	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00
530	500	0.99	0.98	0.98	0.98	0.98	0.99	0.98	0.98	0.99	0.98
636	600	0.98	0.96	0.95	0.94	0.94	0.98	0.97	0.95	0.95	0.95
742	700	0.98	0.94	0.92	0.89	0.87	0.97	0.94	0.90	0.88	0.86
848	800	0.96	0.91	0.85	0.80	0.76	0.95	0.88	0.81	0.77	0.71
953	900	0.95	0.87	0.77	0.71	0.64	0.93	0.82	0.73	0.63	0.54
1059	1000	0.93	0.81	0.69	0.58	0.49	0.90	0.75	0.61	0.48	0.38

Projection Catch		5CD: split CPUE series | $r = 5$									
		M Estimate					M Fix				
Total	Female	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
		$\mathrm{E}\left(\tilde{B}_y / \mathrm{mean}\{B_t\}_{t=1978}^{1988}\right)$									
0	0	1.61	1.75	1.86	1.95	2.02	1.80	2.03	2.23	2.39	2.53
106	100	1.59	1.70	1.79	1.86	1.93	1.75	1.95	2.12	2.26	2.38
212	200	1.56	1.65	1.72	1.78	1.82	1.71	1.87	2.01	2.12	2.22
318	300	1.53	1.60	1.65	1.69	1.72	1.67	1.80	1.90	1.99	2.06
424	400	1.50	1.55	1.58	1.60	1.62	1.63	1.72	1.79	1.85	1.90
530	500	1.48	1.50	1.51	1.52	1.52	1.59	1.64	1.68	1.71	1.74
636	600	1.45	1.45	1.44	1.43	1.42	1.54	1.56	1.57	1.57	1.57
742	700	1.42	1.40	1.37	1.34	1.32	1.50	1.48	1.46	1.43	1.41
848	800	1.40	1.35	1.30	1.26	1.22	1.46	1.40	1.35	1.30	1.25
953	900	1.37	1.30	1.23	1.17	1.12	1.42	1.32	1.24	1.16	1.09
1059	1000	1.34	1.25	1.16	1.08	1.02	1.38	1.25	1.13	1.03	0.95
		$\mathrm{P}\left(\tilde{B}_y > B_{2007}\right)$									
0	0	0.92	0.93	0.95	0.96	0.97	0.99	0.99	0.99	0.99	1.00
106	100	0.86	0.88	0.91	0.93	0.93	0.97	0.97	0.98	0.98	0.99
212	200	0.77	0.80	0.84	0.86	0.88	0.92	0.93	0.94	0.96	0.97
318	300	0.64	0.69	0.73	0.76	0.79	0.82	0.84	0.88	0.91	0.92
424	400	0.50	0.56	0.60	0.64	0.65	0.67	0.70	0.76	0.79	0.81
530	500	0.39	0.45	0.47	0.49	0.50	0.51	0.56	0.59	0.63	0.66
636	600	0.29	0.34	0.36	0.36	0.35	0.36	0.41	0.43	0.45	0.45
742	700	0.21	0.26	0.26	0.25	0.23	0.23	0.28	0.30	0.29	0.27
848	800	0.15	0.19	0.19	0.16	0.15	0.15	0.19	0.19	0.17	0.16
953	900	0.10	0.14	0.13	0.10	0.10	0.09	0.13	0.12	0.10	0.09
1059	1000	0.07	0.09	0.09	0.07	0.06	0.06	0.08	0.08	0.06	0.04
		$\mathrm{E}\left(\tilde{B}_y / B_{2007}\right)$									
0	0	1.08	1.18	1.25	1.32	1.37	1.14	1.30	1.43	1.54	1.63
106	100	1.06	1.14	1.21	1.26	1.30	1.12	1.25	1.36	1.45	1.53
212	200	1.05	1.11	1.16	1.20	1.23	1.09	1.20	1.29	1.36	1.42
318	300	1.03	1.07	1.11	1.14	1.16	1.06	1.15	1.21	1.27	1.32
424	400	1.01	1.04	1.06	1.08	1.10	1.03	1.09	1.14	1.18	1.21
530	500	0.99	1.01	1.02	1.02	1.03	1.01	1.04	1.07	1.09	1.11
636	600	0.97	0.97	0.97	0.96	0.96	0.98	0.99	1.00	1.00	1.00
742	700	0.95	0.94	0.92	0.90	0.89	0.95	0.94	0.93	0.91	0.90
848	800	0.93	0.90	0.87	0.84	0.82	0.93	0.89	0.86	0.82	0.80
953	900	0.92	0.87	0.82	0.79	0.75	0.90	0.84	0.78	0.74	0.69
1059	1000	0.90	0.83	0.78	0.73	0.68	0.87	0.79	0.71	0.65	0.60

Table 5: Tables of the probability and the expected value of the beginning year biomass in the projection year exceeding reference biomass levels for one to five year projections starting from the beginning year biomass in 2007 for the Case 7 (single CPUE series/estimate M) and Case 8 (single CPUE series/fix M) 3CD5AB English sole runs. Total projection catch has been rounded up to next highest 1 t based on the mean proportion of males in the 5CD sampled commercial catch from 1996–2005: 0.0555. The approximate level of the current TAC is indicated with grey shading.

Projection Catch		3CD5AB: single CPUE series | $r = 5$									
		Estimate M					Fix M				
Total	**Female**	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
		$\mathrm{P}\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$									
0	0	0.95	0.98	1.00	1.00	1.00	0.96	0.99	1.00	1.00	1.00
53	50	0.90	0.96	0.97	0.98	0.99	0.90	0.95	0.98	0.99	0.99
106	100	0.83	0.87	0.89	0.92	0.93	0.82	0.87	0.90	0.91	0.93
159	150	0.75	0.75	0.74	0.75	0.75	0.70	0.71	0.70	0.69	0.69
186	175	0.71	0.68	0.66	0.64	0.62	0.66	0.62	0.58	0.56	0.53
212	200	0.66	0.61	0.57	0.53	0.48	0.60	0.52	0.47	0.43	0.39
265	250	0.57	0.46	0.39	0.32	0.28	0.49	0.37	0.30	0.24	0.19
318	300	0.48	0.34	0.26	0.19	0.16	0.40	0.25	0.17	0.13	0.10
371	350	0.41	0.24	0.16	0.12	0.09	0.31	0.17	0.10	0.07	0.06
424	400	0.33	0.17	0.11	0.07	0.05	0.25	0.11	0.07	0.04	0.03
477	450	0.28	0.12	0.08	0.04	0.03	0.20	0.07	0.04	0.03	0.02
530	500	0.23	0.09	0.05	0.03	0.02	0.15	0.05	0.03	0.01	0.01
		$\mathrm{E}\left(\tilde{B}_y / \min\{B_t\}_{t=1966}^{2006}\right)$									
0	0	1.28	1.41	1.53	1.62	1.69	1.31	1.49	1.64	1.75	1.85
53	50	1.23	1.33	1.41	1.47	1.52	1.25	1.37	1.48	1.56	1.62
106	100	1.19	1.25	1.29	1.32	1.35	1.19	1.26	1.32	1.35	1.39
159	150	1.14	1.16	1.17	1.18	1.18	1.12	1.14	1.15	1.15	1.15
186	175	1.12	1.12	1.12	1.10	1.09	1.09	1.09	1.08	1.06	1.04
212	200	1.10	1.08	1.06	1.03	1.01	1.06	1.03	1.00	0.96	0.93
265	250	1.05	0.99	0.94	0.89	0.84	1.00	0.92	0.85	0.79	0.74
318	300	1.01	0.91	0.83	0.75	0.69	0.95	0.82	0.73	0.66	0.60
371	350	0.96	0.83	0.72	0.63	0.57	0.89	0.74	0.63	0.56	0.51
424	400	0.92	0.75	0.63	0.54	0.49	0.83	0.66	0.56	0.49	0.45
477	450	0.87	0.68	0.55	0.48	0.44	0.78	0.60	0.50	0.45	0.42
530	500	0.83	0.62	0.50	0.43	0.40	0.74	0.55	0.46	0.41	0.39
		$\mathrm{P}\left(\tilde{B}_y > \mathrm{mean}\{B_t\}_{t=1974}^{1986}\right)$									
0	0	0.34	0.60	0.77	0.87	0.92	0.32	0.61	0.79	0.89	0.93
53	50	0.27	0.45	0.58	0.69	0.76	0.24	0.43	0.58	0.69	0.77
106	100	0.21	0.32	0.40	0.44	0.47	0.17	0.26	0.37	0.41	0.46
159	150	0.16	0.20	0.23	0.24	0.25	0.11	0.16	0.20	0.21	0.21
186	175	0.14	0.15	0.18	0.18	0.17	0.09	0.12	0.13	0.14	0.13
212	200	0.12	0.12	0.13	0.13	0.12	0.08	0.09	0.10	0.09	0.08
265	250	0.09	0.08	0.08	0.06	0.06	0.05	0.05	0.04	0.04	0.03
318	300	0.07	0.05	0.05	0.04	0.03	0.04	0.03	0.02	0.01	0.01
371	350	0.05	0.03	0.03	0.02	0.01	0.03	0.02	0.01	0.01	0.01
424	400	0.04	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.00	0.00

Projection Catch		3CD5AB: single CPUE series | $r = 5$									
		M Estimate					*M* Fix				
Total	**Female**	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
477	450	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
530	500	0.03	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00
		$E\left(\tilde{B}_y / \text{mean}\{B_t\}_{t=1974}^{1986}\right)$									
0	0	0.96	1.06	1.14	1.21	1.26	0.95	1.07	1.18	1.27	1.34
53	50	0.92	0.99	1.05	1.10	1.14	0.90	0.99	1.07	1.12	1.17
106	100	0.89	0.93	0.97	0.99	1.01	0.86	0.91	0.95	0.98	1.00
159	150	0.85	0.87	0.88	0.88	0.88	0.82	0.83	0.84	0.84	0.84
186	175	0.84	0.84	0.83	0.83	0.82	0.80	0.79	0.78	0.77	0.75
212	200	0.82	0.81	0.79	0.77	0.75	0.77	0.75	0.73	0.70	0.68
265	250	0.79	0.74	0.70	0.66	0.63	0.73	0.67	0.62	0.58	0.54
318	300	0.75	0.68	0.62	0.56	0.52	0.69	0.60	0.53	0.48	0.44
371	350	0.72	0.62	0.54	0.48	0.43	0.65	0.54	0.46	0.41	0.37
424	400	0.69	0.56	0.47	0.41	0.37	0.61	0.48	0.41	0.36	0.33
477	450	0.65	0.51	0.42	0.36	0.33	0.57	0.44	0.37	0.32	0.30
530	500	0.62	0.46	0.37	0.33	0.30	0.54	0.40	0.34	0.30	0.28
		$P\left(\tilde{B}_y > B_{2007}\right)$									
0	0	0.97	0.97	0.98	0.99	0.99	0.98	0.99	0.99	1.00	1.00
53	50	0.89	0.91	0.92	0.94	0.95	0.92	0.94	0.95	0.97	0.98
106	100	0.66	0.72	0.76	0.80	0.81	0.71	0.73	0.79	0.82	0.84
159	150	0.41	0.47	0.50	0.51	0.52	0.42	0.45	0.48	0.49	0.49
186	175	0.31	0.36	0.38	0.37	0.37	0.29	0.34	0.35	0.34	0.32
212	200	0.23	0.26	0.29	0.26	0.26	0.20	0.25	0.25	0.22	0.20
265	250	0.12	0.15	0.15	0.14	0.11	0.09	0.13	0.11	0.09	0.08
318	300	0.07	0.09	0.09	0.07	0.05	0.04	0.06	0.06	0.04	0.03
371	350	0.04	0.05	0.05	0.03	0.03	0.02	0.03	0.03	0.02	0.02
424	400	0.02	0.03	0.03	0.02	0.01	0.01	0.02	0.02	0.01	0.01
477	450	0.01	0.02	0.02	0.01	0.01	0.00	0.02	0.01	0.01	0.01
530	500	0.01	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00
		$E\left(\tilde{B}_y / B_{2007}\right)$									
0	0	1.11	1.24	1.34	1.42	1.49	1.15	1.32	1.46	1.56	1.65
53	50	1.07	1.16	1.24	1.29	1.34	1.10	1.21	1.31	1.38	1.44
106	100	1.03	1.09	1.13	1.16	1.18	1.04	1.11	1.16	1.20	1.23
159	150	0.99	1.01	1.02	1.03	1.03	0.99	1.01	1.02	1.02	1.02
186	175	0.97	0.97	0.97	0.96	0.95	0.96	0.96	0.95	0.93	0.91
212	200	0.95	0.93	0.92	0.90	0.88	0.93	0.90	0.88	0.84	0.82
265	250	0.91	0.86	0.81	0.77	0.73	0.88	0.81	0.75	0.69	0.65
318	300	0.87	0.79	0.71	0.65	0.60	0.83	0.72	0.64	0.57	0.53
371	350	0.83	0.71	0.62	0.55	0.50	0.77	0.64	0.55	0.49	0.45
424	400	0.79	0.64	0.54	0.47	0.43	0.73	0.58	0.49	0.43	0.40
477	450	0.75	0.58	0.48	0.41	0.38	0.68	0.53	0.44	0.39	0.37
530	500	0.71	0.53	0.43	0.37	0.35	0.64	0.49	0.41	0.37	0.35

Table 6: Tables of the probability and the expected value of the beginning year biomass in the projection year exceeding the minimum observed biomass for one to five year projections starting from the beginning year biomass in 2007 for the Case 9 (split CPUE/estimate M) and Case 10 (split CPUE/fix M) 3CD5AB English sole runs. Total projection catch has been rounded up to next highest 1 t based on the mean proportion of males in the 5CD sampled commercial catch from 1996–2005: 0.0555. The approximate level of the current TAC is indicated with grey shading.

Projection Catch		3CD5AB: split CPUE series | $r = 5$									
		Estimate M					Fix M				
Total	**Female**	**2008**	**2009**	**2010**	**2011**	**2012**	**2008**	**2009**	**2010**	**2011**	**2012**
		$P\left(\tilde{B}_y > \min\{B_t\}_{t=1966}^{2006}\right)$									
0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
53	50	0.99	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
106	100	0.99	0.99	0.98	0.99	0.99	0.98	0.99	0.99	0.99	1.00
159	150	0.98	0.96	0.95	0.95	0.94	0.96	0.95	0.95	0.93	0.93
186	175	0.97	0.95	0.92	0.90	0.88	0.95	0.93	0.90	0.88	0.85
212	200	0.96	0.92	0.89	0.85	0.82	0.94	0.90	0.85	0.80	0.75
265	250	0.93	0.85	0.79	0.72	0.66	0.90	0.80	0.69	0.60	0.53
318	300	0.89	0.77	0.66	0.56	0.47	0.85	0.67	0.53	0.43	0.35
371	350	0.85	0.70	0.54	0.43	0.34	0.79	0.56	0.40	0.29	0.22
424	400	0.81	0.59	0.43	0.31	0.24	0.72	0.46	0.30	0.20	0.14
477	450	0.76	0.51	0.32	0.23	0.16	0.66	0.36	0.22	0.13	0.10
530	500	0.71	0.42	0.26	0.17	0.11	0.59	0.29	0.16	0.10	0.07
		$E\left(\tilde{B}_y / \min\{B_t\}_{t=1966}^{2006}\right)$									
0	0	1.60	1.72	1.82	1.89	1.95	1.66	1.82	1.96	2.07	2.15
53	50	1.56	1.64	1.70	1.75	1.79	1.60	1.71	1.81	1.88	1.93
106	100	1.52	1.56	1.59	1.61	1.63	1.54	1.60	1.65	1.68	1.71
159	150	1.48	1.48	1.48	1.47	1.46	1.48	1.49	1.50	1.49	1.48
186	175	1.45	1.44	1.42	1.40	1.38	1.45	1.44	1.42	1.39	1.37
212	200	1.43	1.40	1.37	1.33	1.30	1.42	1.38	1.34	1.30	1.25
265	250	1.39	1.32	1.26	1.20	1.14	1.37	1.27	1.19	1.11	1.04
318	300	1.35	1.24	1.15	1.06	0.99	1.31	1.16	1.05	0.95	0.86
371	350	1.30	1.16	1.04	0.93	0.85	1.25	1.06	0.92	0.81	0.73
424	400	1.26	1.08	0.94	0.82	0.73	1.19	0.97	0.81	0.71	0.63
477	450	1.22	1.01	0.85	0.72	0.64	1.14	0.88	0.73	0.63	0.56
530	500	1.18	0.94	0.76	0.64	0.57	1.08	0.81	0.66	0.56	0.51
		$P\left(\tilde{B}_y > \text{mean}\{B_t\}_{t=1974}^{1986}\right)$									
0	0	0.88	0.95	0.97	0.98	0.99	0.86	0.95	0.98	0.99	1.00
53	50	0.83	0.89	0.92	0.94	0.95	0.80	0.89	0.93	0.95	0.96
106	100	0.78	0.80	0.83	0.83	0.84	0.73	0.77	0.81	0.83	0.84
159	150	0.71	0.70	0.69	0.68	0.67	0.65	0.64	0.63	0.62	0.60
186	175	0.68	0.65	0.61	0.59	0.57	0.60	0.57	0.54	0.50	0.47
212	200	0.66	0.59	0.54	0.51	0.46	0.56	0.50	0.45	0.40	0.37
265	250	0.59	0.48	0.41	0.35	0.29	0.48	0.37	0.30	0.24	0.20
318	300	0.52	0.39	0.29	0.23	0.18	0.41	0.27	0.20	0.13	0.10
371	350	0.47	0.30	0.21	0.15	0.11	0.34	0.19	0.12	0.08	0.06
424	400	0.41	0.24	0.15	0.10	0.07	0.28	0.14	0.07	0.04	0.03

Projection Catch		3CD5AB: split CPUE series | $r = 5$									
		M Estimate					*M* Fix				
Total	Female	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
477	450	0.36	0.18	0.11	0.07	0.04	0.23	0.09	0.05	0.03	0.02
530	500	0.32	0.14	0.07	0.04	0.03	0.19	0.07	0.04	0.02	0.01
$\mathrm{E}\left(\tilde{B}_y / \mathrm{mean}\{B_t\}_{t=1974}^{1986}\right)$											
0	0	1.21	1.30	1.37	1.43	1.47	1.21	1.33	1.43	1.50	1.57
53	50	1.18	1.24	1.29	1.32	1.35	1.17	1.25	1.31	1.37	1.41
106	100	1.15	1.18	1.20	1.22	1.23	1.12	1.17	1.20	1.23	1.24
159	150	1.11	1.12	1.12	1.11	1.11	1.08	1.09	1.09	1.09	1.08
186	175	1.10	1.09	1.08	1.06	1.05	1.06	1.05	1.03	1.02	1.00
212	200	1.08	1.06	1.03	1.01	0.98	1.04	1.01	0.98	0.95	0.92
265	250	1.05	1.00	0.95	0.90	0.86	1.00	0.93	0.87	0.81	0.76
318	300	1.02	0.94	0.87	0.80	0.75	0.95	0.85	0.77	0.69	0.63
371	350	0.99	0.88	0.79	0.71	0.64	0.91	0.78	0.67	0.59	0.53
424	400	0.95	0.82	0.71	0.62	0.56	0.87	0.71	0.60	0.52	0.46
477	450	0.92	0.76	0.64	0.55	0.48	0.83	0.65	0.53	0.46	0.41
530	500	0.89	0.71	0.58	0.49	0.43	0.79	0.59	0.48	0.41	0.37
$\mathrm{P}\left(\tilde{B}_y > B_{2007}\right)$											
0	0	0.89	0.90	0.91	0.93	0.95	0.93	0.95	0.96	0.97	0.97
53	50	0.76	0.78	0.82	0.85	0.85	0.83	0.86	0.89	0.91	0.92
106	100	0.55	0.58	0.62	0.64	0.66	0.62	0.65	0.68	0.72	0.74
159	150	0.35	0.38	0.40	0.41	0.40	0.35	0.40	0.42	0.43	0.41
186	175	0.27	0.30	0.32	0.30	0.29	0.25	0.31	0.30	0.30	0.27
212	200	0.21	0.24	0.25	0.22	0.20	0.18	0.22	0.22	0.20	0.18
265	250	0.12	0.14	0.14	0.11	0.09	0.09	0.12	0.11	0.09	0.07
318	300	0.07	0.08	0.07	0.06	0.04	0.04	0.06	0.05	0.04	0.03
371	350	0.04	0.05	0.05	0.03	0.02	0.02	0.03	0.03	0.02	0.01
424	400	0.02	0.03	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
477	450	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
530	500	0.00	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00
$\mathrm{E}\left(\tilde{B}_y / B_{2007}\right)$											
0	0	1.07	1.15	1.22	1.27	1.32	1.10	1.22	1.31	1.39	1.45
53	50	1.04	1.10	1.14	1.18	1.21	1.06	1.14	1.21	1.26	1.29
106	100	1.01	1.04	1.07	1.08	1.09	1.02	1.06	1.10	1.12	1.14
159	150	0.98	0.99	0.99	0.99	0.98	0.98	0.99	0.99	0.99	0.98
186	175	0.97	0.96	0.95	0.94	0.92	0.96	0.95	0.94	0.92	0.91
212	200	0.95	0.93	0.91	0.89	0.87	0.94	0.91	0.89	0.86	0.83
265	250	0.92	0.88	0.83	0.79	0.76	0.90	0.84	0.79	0.73	0.69
318	300	0.89	0.82	0.76	0.70	0.65	0.86	0.77	0.69	0.62	0.57
371	350	0.86	0.77	0.68	0.62	0.56	0.82	0.70	0.60	0.53	0.48
424	400	0.83	0.71	0.62	0.54	0.48	0.78	0.64	0.53	0.46	0.42
477	450	0.81	0.66	0.55	0.47	0.42	0.75	0.58	0.48	0.41	0.37
530	500	0.78	0.61	0.50	0.42	0.37	0.71	0.53	0.43	0.37	0.34

APPENDIX 1. Working Paper Summary

Petrale sole (*Eopsetta jordani*) in British Columbia, Canada: Stock assessment for 2006/07 and advice to managers for 2007/08

P.J. Starr

Information pertaining to Petrale sole (*Eopsetta jordani)* in British Columbia was reviewed and updated for inclusion in a delay-difference stock assessment model. This model was used to determine the status of this coastwide stock and to provide quantitative advice on levels of catch and the associated risk relative to selected management performance indicators.

A range of model uncertainties were explored through sensitivity runs which varied model assumptions which could not be easily reconciled through inspection of the model fits to the data. Four pairs of alternative model assumptions were investigated: a) estimating M, the rate of instantaneous natural mortality through the use of mean weight data sampled from the fishery or fixing M at the preferred value of 0.20 and dropping the mean weight data; b) varying the age of knife-edged recruitment between age 6 and age 7; c) applying a single CPUE series for the entire model period, effectively assuming that the fishery catchability has been constant for 40 years or splitting the CPUE series between 1995 and 1996 in recognition of the severe management restrictions that were applied at that time; d) estimating alternative standardised CPUE series based on different data selection criteria: one set of criteria was suggested by fishing industry representatives to optimise the data for Petrale sole and the other data set used criteria that allowed more peripheral data into the data set.

Model results showed that within the range of the criteria investigated, the effects of fixing or estimating M and the age of knife-edge recruitment were relatively minor, with the management advice almost identical across these options. However, the effect of splitting the CPUE series was major, with the model estimating a drop in catchability in recent years and consequently being much more optimistic about stock status. Finally, the CPUE series optimised for Petrale sole indicated a much stronger recent rebuild for this species and thus also provided more optimistic advice.

None of the model runs indicated that the stock would increase in size over the next five years at the current TAC, but the split CPUE series model runs predicted that the stock would stay above the B_{ref} reference point and well above the B_{min} reference point. The failure of the stock to increase under current levels of catch may be the result of using mean recruitment to drive the predictions. There is some evidence from the MPD model fits that recruitment over the most recent 10 years is 5-15% above the average, depending on the model run selected.

English sole (*Parophrys vetulus*) in British Columbia, Canada: Stock Assessment for 2006/07 and advice to managers for 2007/08

P.J. Starr

Information pertaining to English sole (*Parophrys vetulus)* in British Columbia was reviewed and updated for inclusion in a delay-difference stock assessment model. This model was used to determine the status of two stocks of English sole: 5CD (Hecate Strait) and 3CD5AB (combined west coast Vancouver Island and Queen Charlotte Sound) and to provide quantitative advice on levels of catch and the associated risk relative to selected management performance indicators for each of these stocks.

A range of model uncertainties in both stock assessments were explored through sensitivity runs which varied model assumptions which could not be easily reconciled through inspection of the model fits to the data. Three pairs of alternative model assumptions were investigated: a) estimating *M*, the rate of instantaneous natural mortality through the use of mean weight data sampled from the fishery or fixing *M* at the preferred value of 0.20 and dropping the mean weight data; b) varying the age of knife-edged recruitment between age 4 and age 5 (5CD only); c) applying a single CPUE series for the entire model period, effectively assuming that the fishery catchability has been constant for 40 years or splitting the CPUE series between 1995 and 1996 in recognition of the severe management restrictions that were applied at that time.

The 5CD modelling results showed that within the range of the criteria investigated, the effects of fixing or estimating *M* and the age of knife-edge recruitment were relatively minor, with the management advice almost identical across these options. However, the effect of splitting the CPUE series was important, with the model estimating a drop in catchability in recent years and consequently being more optimistic about stock status. Both of the CPUE hypotheses indicate that current 5CD landings will allow the stock to remain above B_{min} and B_{ref} reference points and that there is some potential for an increase in TAC. However, these model runs also predict a decline in current stock abundance with landings greater than the current TAC.

The 3CD5AB modelling results are less optimistic, with stronger differences between the CPUE hypotheses. The split CPUE hypothesis indicates that the current TAC will remain above the selected B_{min} and B_{ref} reference points while the single CPUE hypothesis indicates that landings at this level are too high. There is also some sensitivity to the *M* estimation method, with the model runs which fix *M* being less optimistic than the model runs which estimate *M*.

The credibility of both assessments is dependent on the assumption that the fishery dependent CPUE series are tracking the abundance of these stocks. Neither assessment fits the available survey biomass indices very well and the 3CD5AB assessment is based on 5CD biological data because it lacks stock specific biological information.

Glossary

Biomass (B) The weight of a fish stock, or of some defined portion of it.

B_{lim} A minimum or maximum stock abundance at which point a pre-determined management option is triggered.

B_{min} The lowest level of biomass from which a stock subsequently recovers to a Level above the **B_{ref}** reference point.

B_{ref} The observations based reference point. It corresponds to three measures:

- Minimum biomass over the 1966-2006
- Average biomass for 1974-78 (Areas 5CD) and the average biomass for 1986-88 Areas 5AB and 3CD)
- The beginning year biomass in 2007.

B_{rec} The recovered level of biomass at which a fishery can be implemented.

APPENDIX 2: PSARC Groundfish Subcommittee Meeting Agenda

AGENDA
PSARC Groundfish Subcommittee Meeting
January 17-18, 2007
Seminar Room
Pacific Biological Station

<u>Wednesday, January 17</u>	
Introduction and procedures	9:00 – 9:15
Petrale sole (*Eopsetta jordani*) in British Columbia, Canada: Stock Assessment for 2006/07 and Advice to Managers for 2007/08	9:15 – 12:00
Lunch Break	***12:00 – 1:00***
English sole (*Parophrys vetulus*) in British Columbia, Canada: Stock Assessment for 2006/07 and Advice to Managers for 2007/08	1:00 – 4:30
Adjournment	***4:30***
<u>Thursday, January 18</u>	
English sole continued	9:00
Adjournment	***12:00***

APPENDIX 3. List of Attendees

Subcommittee Chair: Gary Logan
PSARC Chair: Al Cass

External Participants	
Name	**Affiliation**
Buchanan, Scott	Archipelago Marine Research
Ketchen, Keith	DFO, retired
Starr, Paul	Canadian Groundfish Research Conservation Society (CGRCS)
Turris, Bruce	CGRCS and Pacific Fisheries Management Inc.
Harling, Wayne	Sport Fish Advisory Board
DFO Participants	
Acheson, Schon	
Ackerman, Barry	
Cass, Al	
Fargo, Jeff	
Haigh, Rowan	
Kronlund, Rob	
Logan, Gary	
McFarlane, Sandy	
Sinclair, Alan	
Stanley, Rick	
Workman, Greg	
Yamanaka, Lynne	

The reviewer for the PSARC papers presented at this meeting is listed below. His assistance is invaluable in making the PSARC process work.

Cox, Sean	Simon Fraser University