Fisheries and Oceans Canada
Science

Pêches et Océans Canada
Sciences

C S A S

Canadian Science Advisory Secretariat

S C C S

Secrétariat canadien de consultation scientifique

Proceedings Series 2003/002

Série des compte rendus 2003/002

Proceedings of the PSARC Groundfish Subcommittee Meeting January 14-15, 2003

January 14-15, 2003
Nanaimo, B.C.

J. Fargo
Groundfish Subcommittee Chair

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

March 2003

Canada

Proceedings of the
PSARC Groundfish Subcommittee Meeting
January 14-15, 2003

January 14-15, 2003
Nanaimo, B.C.

J. Fargo
Groundfish Subcommittee Chair

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

March 2003

ISSN 1701-1280

Published and available free from:
Une publication gratuite de:

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

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

CSAS@DFO-MPO.GC.CA

Printed on recycled paper.
Imprimé sur papier recyclé.

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

DFO Can. Sci. Advis. Sec. Proceed. Ser. 2003/002.
Secr. can. de consult. sci. du MPO, Compte rendu. 2003/002.

PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
GROUNDFISH SUBCOMMITTEE MEETING

SUMMARY

The PSARC Groundfish Subcommittee met January 14-15, 2003 to consider the sablefish assessment and to discuss and evaluate papers on electronic monitoring at sea, and a feasibility study of multispecies groundfish surveys.

Working Paper G2003-01: Sablefish (*Anoplopoma fimbria*) in British Columbia, Canada: Stock Assessment for 2002 and Advice to Managers for 2003.

The Subcommittee endorsed the Decision Table in the Working Paper as providing an appropriate characterization of the harvest options for 2003/2004.

The Subcommittee recommended the production level of 1.25 times the 1996-2002 reference period (1.25P) because of the evidence noted in the Working Paper of an increase in spawning biomass in Alaska due to the 1997 year class, the evidence for above average 1999 and 2000 year classes from the lower US slope and shelf surveys and the evidence from the west coast Vancouver Island (WCVI) shrimp trawl survey. The Subcommittee also noted that the annual data collection and annual stock assessment affords the opportunity to adjust the Total Allowable Catch (TAC) each year.

Working Paper G2003-02: Feasibility of Multispecies Groundfish Bottom Trawl Survey on the BC Coast.

The Subcommittee agreed that the trawl survey should incorporate stratified random design methods. They concurred with the authors that stratification should be based on the depth (D) ranges $50 < D \le 125$ m, $125 < D \le 200$ m, $200 < D \le 330$ m, and $330 < D \le 500$ m and adhere to the Pacific Marine Fisheries Commission (PMFC) major area boundaries and that station allocation should be made in proportion to the surface areas of these strata.

The Subcommittee recommended that a pilot survey of 200 to 500 tows be conducted in PMFC major areas 5AB to first verify the predicted Coefficients of Variation (CVs) before considering an expanded coastwide survey.

Working Paper G2003-03: The Efficacy of Video-Based Electronic Monitoring Technology for At-Sea Monitoring of the Halibut Longline Fishery

The Subcommittee agreed that the focus on technical aspects and limitations during the development phase of the video monitoring system was appropriate. The Subcommittee supported the next phase of testing: at-sea monitoring of the halibut fishery, with an integrated Electronic Monitoring (EM) – observer sample design. This would thereby expand fleet coverage to include small vessels and possibly reduce at-sea monitoring costs.

The Subcommittee also endorsed the use of combined observer EM deployments in the Zn rockfish fishery where rockfish species identification methodology can be further refined and evaluated.

SOMMAIRE

Le Sous-comité sur le poisson de fond du CEESP s’est réuni les 14 et 15 janvier 2003 afin d’examiner l’évaluation de la morue charbonnière et de discuter et d’évaluer des documents sur la surveillance électronique en mer ainsi qu’une étude de faisabilité sur les relevés plurispécifiques du poisson de fond.

Document de travail G2003-01 : La morue charbonnière (*Anoplopoma fimbria*) en Colombie-Britannique (Canada) : évaluation du stock de 2002 et conseils pour les gestionnaires en vue de 2003

Le Sous-comité a approuvé la table de décision présentée dans le document de travail et il a reconnu qu’elle fournit une caractérisation appropriée des possibilités de récolte pour l’année 2003-2004.

En raison des données présentées dans le document de travail qui montrent une hausse de la biomasse des géniteurs en Alaska due à la classe d’âge de 1997, des données des relevés sur la plate-forme et le talus inférieur américains qui montrent que les classes d’âge de 1999 et 2000 étaient supérieures à la moyenne et des données du relevé au chalut à crevettes effectué sur la côte Ouest de l’île de Vancouver (COIV), le Sous-comité a recommandé un niveau de production égal à 1,25 fois celui de la période de référence de 1996 à 2002 (1,25 P). Le Sous-comité a également souligné que la collecte de données et l’évaluation des stocks annuels permettent d’ajuster le total autorisé des captures (TAC) annuellement.

Document de travail G2003-02 : Faisabilité d’un relevé au chalut de fond plurispécifique du poisson de fond sur la côte de la Colombie-Britannique

Le Sous-comité a reconnu que le relevé au chalut devrait comprendre des méthodes de conception aléatoires stratifiées. Il est d’accord avec les auteurs du document pour fonder la stratification sur les intervalles de profondeur (D) suivants : $50 < D \leq 125$ m, $125 < D \leq 200$ m, $200 < D \leq 330$ m et $330 < D \leq 500$ m. Cette stratification devrait également respecter les limites des principales zones établies par la Pacific Marine Fisheries Commission (PMFC), et les allocations aux stations devraient être proportionnelles à la superficie de ces strates.

Le Sous-comité a recommandé la tenue d’un relevé pilote de 200 à 500 traits de chalut dans la zone importante 5AB de la PMFC afin de vérifier les coefficients de variation (CV) prévus, avant d’envisager un relevé sur toute la côte.

Document de travail G2003-03 : Efficacité de la technologie vidéo de surveillance électronique pour la surveillance en mer de la pêche à la palangre du flétan de l'Atlantique

Le Sous-comité a reconnu qu'il convenait de porter une attention particulière aux aspects et limites techniques au cours de la phase d'élaboration du système de surveillance vidéo. Il a appuyé la phase d'essai suivante : surveillance en mer de la pêche au flétan de l'Atlantique à l'aide d'un modèle combinant une surveillance électronique et des observateurs. Ce dispositif permettrait d'étendre la surveillance aux petits bateaux et, peut-être, de réduire les coûts liés à la surveillance en mer.

Le Sous-comité a également approuvé le déploiement combiné d'observateurs et de dispositifs de surveillance électronique dans le cadre de la pêche au sébaste à l'aide de bateaux exploitant un permis ZN. Dans cette pêche, les méthodes d'identification à l'espèce de sébaste peuvent être évaluées et améliorées davantage.

INTRODUCTION

The PSARC Groundfish Subcommittee met January 14-15, 2003, at the Pacific Biological Station in Nanaimo, British Columbia. External participants from the Canadian Groundfish Research and Conservation Society, Canadian Sablefish Association, Nuu Chah Nulth Tribal Council, Hook and Line Groundfish Association, Sport Fish Advisory Board, Pacific Halibut Management Association, NOAA, Sierra Club, Pacific Fisheries Management Inc., and the Kwakiult Fisheries Commission attended the meeting. The Subcommittee Chair, J. Fargo, opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, the confidential nature of the discussion was highlighted, and the Subcommittee accepted the meeting agenda.

The Subcommittee reviewed three Working Papers. Summaries of the Working Papers are in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants, observers and reviewers is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEW

G2003-01: Sablefish (*Anoplopoma fimbria*) in British Columbia, Canada: Stock Assessment for 2002 and Advice to Managers for 2003.
A.R. Kronlund, V. Haist, M. Wyeth and R.H. Hilborn (**Paper accepted subject to revisions**)

Subcommittee Discussion

Both reviewers agreed with the Working Paper authors that the stock assessment and the presentation of advice would be facilitated by identification of clear fishery objectives. The Subcommittee endorsed the idea that the Department should organize a workshop to facilitate the development of fishery objectives for sablefish.

One of the reviewers noted that the assessment tends to describe sablefish as two stocks for the analysis but provides advice for the combined population. The authors noted that while there are obvious spatial differences, providing separate assessment advice would require more detailed analysis of tagging data to separate north and south relative abundance indices and to estimate mixing rates, between the zones. The authors intend to conduct more analysis of this information for the next assessment.

A reviewer asked whether there was an estimate of the ratio of vulnerable to total biomass. The authors stated that this would require indexing the nearshore component (shallower than 150 fm) of Hecate Strait and the Mainland inlets. The interpretation of these data is complicated by a lack of understanding about the movement of fish from outside the Canadian zone. Furthermore, age composition data will be necessary for interpreting data. The authors noted that there were ongoing problems with ageing for sablefish but that there is a project underway that is designed to resolve this.

Clarification as to why the catch rate analysis separated the fishing year into “seasons” of January-March and April-December was requested. The authors suggested this stratification, in addition to having an historical legacy in the sablefish assessments, reflects two distinct “periods” in the fishery as noted for example in catch rates. It is a simple way to deal with inter-annual variability in the fishery as identified by the month effect in the revised tagging model. The April-Dec period is thought to be most “typical” of the fishery.

It was noted that estimates of catch from dockside monitoring differed from those made by observers and the impact of this on the advice was questioned. The authors noted that if the bias was constant over time it would simply translate to a scalar in a relative index. They noted that it is possible that the bias might vary over time, but there was no information with which to resolve this problem.

Why the “full” General Linear Model was not used in examining tag recovery data was questioned. The authors noted that, typical of many large fishery data sets, while many terms can be statistically significant, these additional terms explained very little variation and their inclusion does not influence the trends. Therefore, the reduced model was used. The authors agreed to provide clarification in the document.

One of the reviewers conducted a re-assessment of the same data, and although using slightly different assumptions, including modeling absolute instead of relative biomass, reached the same conclusions about the stock biomass trajectory. He also noted that many of the suggestions for improvement that he would have suggested were anticipated in the authors’ Appendix J. However, he asked the authors for clarification as to why they modeled relative and not absolute biomass. The authors noted that assuming knowledge of absolute biomass required making a number of assumptions that are not supported. Estimates of abundance from the tagging program could be regarded as absolute if specific and rigorous assumptions of the tagging program were met. These include, for example, random distribution of tagged animals, random recapture of tagged animals, or complete mixing of the fish. The authors suggest that these assumptions are not met and that treating the tagging estimates as absolute values could be misleading. Also, the authors noted that, by treating the tagging biomass estimate as relative with a large coefficient of variation, the Bayesian procedure employed in this assessment would automatically capture a large part of the uncertainty associated with the tagging biomass index.

One of the reviewers noted that commercial Catch Per Unit Effort (CPUE) is now playing a larger role in the assessment and wondered why data from earlier years could not be used. The authors plan to examine these data in the next assessment. This task involves resolving data aggregated by trip, into their original structure by set.

It was questioned whether a stratified random design rather than a ‘fixed grid” would be a better choice for the survey. The authors noted that the survey was not planned to provide a biomass index and they were reluctant to change the design without a full analysis of the costs and benefits. They also pointed out that doing so would interrupt what is now a 12-year time series that represents consistent survey protocols, essentially restarting the index and introducing the problem of calibration with the existing series.

The Subcommittee recognized the improvements in this assessment compared to past assessments. For example, the Decision Table (Table 1) encompasses the uncertainty in the analysis and allows managers to choose from among a range of options.

The Subcommittee requested a comparison of this year’s advice with the methodology and advice provided in the January 2002 stock assessment. The authors agreed to add a section with this comparison. However, the Subcommittee felt that the current assessment is superior to the previous assessment.

Table 1 Decision table showing the expected outcome of the performance measures, $P(B_{2008} > B_{2003})$ and $E(B_{2008}/B_{2003})$ at 2003 to 2008 catch levels from 0 to 3500 mt for three levels of future stock production. (Table 21 of Working Paper G2003-01).

		Biomass in 2003			
		Poor	Medium	Good	Exp.
	Mean B_{2003}	11.9	18.2	36.4	21.2
Productivity Assumption	2003–2008 Annual catch	$P(B_{2008} > B_{2003})$			
$1\bullet\bar{P}$	0	0.99	0.96	0.71	0.91
$1\bullet\bar{P}$	2000	0.89	0.74	0.43	0.70
$1\bullet\bar{P}$	2500	0.72	0.56	0.31	0.54
$1\bullet\bar{P}$	3000	0.36	0.32	0.19	0.30
$1\bullet\bar{P}$	3500	0.05	0.09	0.07	0.07
$1.25\bullet\bar{P}$	0	0.99	0.97	0.76	0.92
$1.25\bullet\bar{P}$	2000	0.95	0.89	0.59	0.83
$1.25\bullet\bar{P}$	2500	0.92	0.83	0.52	0.78
$1.25\bullet\bar{P}$	3000	0.84	0.72	0.45	0.68
$1.25\bullet\bar{P}$	3500	0.66	0.56	0.35	0.53
$1.5\bullet\bar{P}$	0	0.99	0.98	0.78	0.93
$1.5\bullet\bar{P}$	2000	0.97	0.94	0.66	0.88
$1.5\bullet\bar{P}$	2500	0.95	0.90	0.63	0.85
$1.5\bullet\bar{P}$	3000	0.93	0.86	0.59	0.81
$1.5\bullet\bar{P}$	3500	0.89	0.79	0.52	0.75

Productivity Assumption	2003–2008 Annual catch:	$E(B_{2008}/B_{2003})$			
$1\bullet\bar{P}$	0	1.95	1.57	1.16	1.56
$1\bullet\bar{P}$	2000	1.25	1.11	0.90	1.09
$1\bullet\bar{P}$	2500	1.07	0.99	0.84	0.97
$1\bullet\bar{P}$	3000	0.90	0.88	0.78	0.86
$1\bullet\bar{P}$	3500	0.73	0.76	0.71	0.74
$1.25\bullet\bar{P}$	0	2.27	1.79	1.28	1.78
$1.25\bullet\bar{P}$	2000	1.57	1.33	1.03	1.31
$1.25\bullet\bar{P}$	2500	1.39	1.21	0.96	1.20
$1.25\bullet\bar{P}$	3000	1.22	1.10	0.90	1.08
$1.25\bullet\bar{P}$	3500	1.05	0.99	0.83	0.96
$1.5\bullet\bar{P}$	0	2.59	2.02	1.40	2.01
$1.5\bullet\bar{P}$	2000	1.89	1.55	1.15	1.54
$1.5\bullet\bar{P}$	2500	1.71	1.44	1.08	1.42
$1.5\bullet\bar{P}$	3000	1.54	1.32	1.02	1.30
$1.5\bullet\bar{P}$	3500	1.37	1.21	0.96	1.18

Presentation of an Industry Perspective

The Canadian Sablefish Association tabled a document entitled "2003 Industry Perspective on the Canadian Sablefish Resource". This document summarized the industry view on current biomass and expected population trends for sablefish based on the observations of various fishers from a variety of license categories. This document is available from the PSARC Secretariat. The Subcommittee thanked the authors for the contribution and commented that it was a valuable asset to bring to the stock assessment review process and would become more valuable over time. Moreover, the Subcommittee encouraged written submissions from other clients as well.

The Subcommittee asked for clarification from the PSARC Secretariat on two issues related to the PSARC terms of reference:

1. Will stakeholder reports be available from the PSARC website, stored in the files, or included in the Subcommittee report?
2. What style/format guidelines are appropriate for these reports?

Subcommittee Conclusions

The Subcommittee agreed with the Working Paper conclusions that sablefish production can be expected to improve in the 2003 to 2008 projection period relative to the 1996 to 2002 reference period. The Subcommittee noted the difficulty in predicting production (recruitment, immigration, emigration, and growth) but recommended that future assessments work towards improving the predictive capacity.

The Subcommittee also endorsed the authors' opinion that harvest choices should provide for some increase in biomass, since current biomass levels are the lowest in the period covered by the three primary stock indices over the 1990 to 2002 period.

Subcommittee Recommendations

During the presentation, the Subcommittee noted that the 20-30cm mode in Quarter 4 of the trawl observer and Hecate Strait survey data was the "young-of-the-year". The Subcommittee recognized the value to sablefish assessments of obtaining additional trawl samples. The Subcommittee recommended that this be considered in planning the coast-wide trawl survey, and assigning priorities in the trawl observer program.

The Subcommittee endorsed the Decision Table (Table 1) as an appropriate characterization of the harvest options for 2003/2004.

The Subcommittee agreed that sablefish production was likely to increase over the 2003 to 2008 projection period and supported the selection of harvest advice from yields identified under the assumption of 1.25 (1.25P in Table 1) times the production for the 1996-2002 reference period. The Subcommittee noted that the current process for annual collection of survey data and stock assessment should allow managers adequate time to make adjustments in the TAC in response to a change in stock abundance while avoiding a high risk to the stock.

G2003-02: Feasibility of Multispecies Groundfish Bottom Trawl Surveys on the BC Coast

A. Sinclair, J. Schnute, R. Haigh, P. Starr, R. Stanley, J. Fargo, and G. Workman
(**Paper accepted subject to revisions**)

Subcommittee Discussion[1]

It was suggested that clearly establishing the purpose of the survey, to obtain an estimate of absolute abundance or a time series of relative abundance, will help to determine the sampling design – random or fixed systematic design. If the purpose is to obtain an estimate of absolute abundance then a random sampling design should be used. If the goal is to establish a time series of relative abundance then a fixed systematic sampling design is indicated. In the fixed systematic sampling design, the towing stations are the same on each survey so that the only variables are fish abundance and perhaps fish location.

One of the reviewers then referred to a National Oceanic and Atmospheric Administration (NOAA) survey review in the USA and specifically to the issue of sample design enabling catchability to change over time. The Subcommittee would be interested in following up on this point after the review.

One of the reviewers indicated that he was confused by the terminology in reference to the use of stratified random design versus fixed station systematic design. The authors agreed that further clarification was needed. He stated that with a systematic fixed grid design, the selection of sites is repeated with each survey. The authors stated that one can use fixed stations in a stratified design as well. The authors agreed indicating that their approach was to reallocate stations every survey. The reviewer noted that with rugged terrain you are better off with fixed stations as the area for trawling might be extremely limited.

One reviewer noted that the process for selection of indicator species was particularly good, and he applauded the authors for not shying away from difficult issues. He then indicated that depth stratification will define the bio-geographical stratification, and perhaps it would be better that the bio-geographical distribution not be based on CPUE. The reviewer stated that it is important to repeat the survey several times and by using a broad spread of points you will get better distribution data. The Subcommittee further discussed how stratification might negatively impact the results. This reviewer indicated that we stratify to tighten up precision and theoretically to tighten the confidence interval. The author stated that if you use a systematic survey grid and then change the

1 Two of the reviews were not tabled and discussed at the PSARC meeting on January 14-15, 2003. They were subsequently discussed in a teleconference call on February 6, 2003.

grid that this would have a large impact, but if a stratified random design was used and then a change is made, such as depth, then the issue would not be significant.

It was questioned whether any geographic variable other than depth could be used to stratify the design. The authors noted that currently they only have depth information for stratification purposes. When habitat data becomes available, they can consider incorporating them in definitions of bio-geographical strata. They are also constrained somewhat by management area boundaries. It was also pointed out that error can be estimated for systematic designs (e.g., Kriging). The authors felt that they can discuss Kriging in the context of systematic design; however, the method is irrelevant for stratified random designs. Producing CVs for all species caught on the survey was suggested. The authors indicated that it will be done once survey data becomes available.

One of the reviewers asked for a comparison of total surface area to the amount of area that can be covered by trawl gear. The reviewer asked how the area for the pilot survey was chosen. The authors responded that the major commercial species in 5AB, Pacific ocean perch (POP), experiences the lowest CV in this area and would require 365 tows to achieve a coastwide CV of 20%. It was questioned whether the target of 1000 tows was logistically possible? The authors stated that that was why a pilot study was being recommended. Once the true CVs are available then the number of tows required can be estimated. They also stated that a CV of 20% may be more precise than stock assessment requires. The number of tows required was directly proportional to the CV desired.

The reviewers and some Subcommittee members thought that clarification is required on why we are using a stratified random design instead of a systematic design (fixed stations or grids). The National Marine Fisheries Service (NMFS) uses a systematic random design. One reviewer stated that a fixed station design is equivalent to a random station design if the population re-distributes itself throughout the study area between surveys. He suggested that the power of a systematic design to detect changes in standing stock assumes that populations remain physically stationary.

Finally, there was discussion concerning the impact of a coastwide survey on available resources. The proposed survey is beyond the scope of existing resources. The working paper looked at the feasibility of such a survey, without regards to fiscal constraints. This study was conducted in response to a longstanding request from the fishing industry. Cost estimates for the project should be reviewed and discussed between science, management and industry.

Subcommittee Recommendations

The Subcommittee accepted the paper subject to revisions.

G2003-03: The Efficacy of Video-Based Electronic Monitoring Technology for At-Sea Monitoring of the Halibut Longline Fishery
H. McElderry, J. Schrader and J. Illingworth (**Paper accepted subject to revisions**)

Subcommittee Discussion

Results from a study to evaluate the use of electronic monitoring (EM) equipment for at sea monitoring of the halibut longline fishery were discussed. The EM system was developed by Archipelago Marine Research Ltd. and has been proposed as an additional at-sea monitoring tool to be used for longline fisheries. Archipelago conducted a large-scale pilot project using observers and EM equipment to test the efficacy and data quality from EM-based monitoring. The author explained that this testing was not just hardware design and included field technical operations, data analysis systems, and coordination with the fleet. One of the authors explained the system and summarized the results from the pilot study.

The project findings clearly indicated that EM is a useful technology for expanding the scope of at-sea data collection, particularly on the small, unobserved fleet component. There was some discussion concerning sample design and Subcommittee members acknowledged that, rather than following a randomized fleet sample design, it was correct at this phase of the testing to focus on the technical aspects/limitations of the EM system on volunteer host vessels. The report provided catch comparisons between EM and observers, showing high levels of agreement for many species, particularly those that are distinctive and common. Species that are indistinct and uncommon were not clearly resolved by EM. The Subcommittee agreed with the authors that identification between certain species (shortraker and rougheye rockfish) will always be problematic but the proportion within specific assemblages could be estimated from observer and dockside monitoring observations.

The Subcommittee agreed with the authors' difficulty in evaluating EM when at-sea monitoring objectives for the halibut fishery require further elaboration. The process of technology development and setting objectives are interrelated and iterative, whereby technology becomes more refined as the research questions become more focused. More refined monitoring objectives will also enable determination of how useful the system will be.

The authors recommended for the next phase of testing that at-sea monitoring of the halibut fishery proceed with an integrated EM – observer sample design, thereby expanding fleet coverage, to include small vessels, and possibly reducing at-sea monitoring costs. As well, the use of combined observer EM deployments should continue in selected fisheries (e.g., Zn rockfish) where rockfish species identification methodology can be further refined and evaluated.

Subcommittee Recommendations

The Subcommittee accepted the paper subject to revisions. The Subcommittee supported the next phase of testing as recommended in the Working Paper.

APPENDIX 1. Working Paper Summary

G2003-01: Sablefish (*Anoplopoma fimbria*) in British Columbia, Canada: Stock Assessment for 2002 and Advice to Managers for 2003.
A.R. Kronlund, V. Haist, M. Wyeth and R.H. Hilborn

Sablefish (*Anoplopoma fimbria*) stock status in British Columbia for 2002 was assessed and advice to managers provided for the 2003/2004 fishing year. The assessment of sablefish stock status in recent years has depended upon the interpretation of three stock abundance indices: (1) annual estimates of vulnerable biomass derived from a tagging model that utilizes tags recovered in the first year after release, (2) catch rates obtained from a fishery-independent trap gear survey, and (3) commercial catch rates derived from sablefish trap fishery logbooks. No stock reconstruction is available due to the absence of age data since 1996 and unresolved difficulties in the modeling of tag recovery data. Sablefish were last assessed using an age-structured population dynamics model that integrated tag recovery information in 2000.

The three primary stock indices analyzed in the assessment share two common features (1) the time series are short compared to the longevity (70+ years) and hence long generation time of sablefish, and (2) they relate to sablefish that are vulnerable to trap gear. Each series is limited to about 10 to 15 years of data that must be judged relative to the long history of sablefish exploitation. At least two of the primary stock indices do not provide an absolute estimate of sablefish abundance. If tag reporting rates and other scaling factors are accurate, then the tagging model estimates of vulnerable biomass could be considered absolute. However, uncertainty regarding these parameters, and the suspect nature of assumptions regarding basic assumptions of the tagging model suggest that estimates of vulnerable biomass should be regarded as relative values.

There is general agreement among the trends in stock indices that sablefish vulnerable to trap gear experienced a decrease in abundance from (relatively) high levels in the early 1990s to low levels in the mid 1990s. The rate of decline slowed markedly in the mid-1990s for both stock areas. For the north stock area, a period of relative stability occurred in the mid 1990s until 2001 when historically low commercial CPUE and indexing survey results were observed. Index survey catch rates in the north improved in 2002, and were comparable to those observed in the mid 1990s. In contrast, the decline in commercial trap and survey indices for the south stock area was more gradual through the mid 1990s, but has continued through 2002. The pattern of monthly tagging model estimates of vulnerable biomass was generally consistent with the trends indicated by the commercial catch rate and index survey series, though it is variable through the late 1990s. A synopsis of the stock indicators for vulnerable biomass is provided in the following list:

- *Standardized commercial trap CPUE* (North). Trap fishery catch rates for the north coastal area declined from 1991 to 1998 prior to the mandatory adoption of escape rings in the trap fishery. Subsequent to 1998 the four-year trend indicates a decline, with a historic low in 2001 and improvement in 2002 in agreement with the indexing survey trajectory.

- *Standardized commercial trap CPUE* (Central). Catch rates in the central coastal area increased in the early 1990s, and then experienced a large decrease from 1994 to 1996. The trend subsequent to 1998 indicates a decline. The central B.C. coast did not decline between 2000 and 2001.
- *Standardized commercial trap CPUE* (South). The south coastal area catch rates initially increased and then declined from 1992 through 1998. Subsequent to 1998, the four-year trend indicates a decline. Like the north area, it is noteworthy that the index for the southern region decreased substantially between 2000 and 2001, as occurred in the indexing survey.
- *Standardized commercial longline CPUE*. Longline catch rates show no long-term trend over the period 1987 to 2002.
- *Indexing survey* (North). Results for the north stock area in 2002 indicated improvement in catch rates to a level comparable to the mid 1990s. This change was largely driven by the two most northern indexing localities. The compression of catch rate variance observed in 2001 was not evident in 2002.
- *Indexing survey* (South). Results for the south stock area in 2002 show no improvement from levels in the mid 1990s.
- *Tag-recovery estimates of vulnerable biomass*. Assuming the estimated tag reporting rates, the vulnerable biomass indicated a decline in abundance from 1993 through 1998, an increase from 1998 to 1999, followed by a decline through 2002.
- *Nominal trap CPUE in British Columbia 1979-2001.* Recent catch rate levels are at, or slightly below, levels experienced in the early 1980s. This time series is not standardized and coincides with a period of change in the fishery management regime and fishing practices. The timing of the peak of nominal trap CPUE during the early 1990s is consistent with a similar pattern observed for the Gulf of Alaska stock.
- *Gulf of Alaska stock status.* The U.S. stock assessment concluded that abundance is moderate and increased from recent lows, in a large part due to the influence of the 1997 year class.

The following list of indicators relate to expected increases in sablefish production through recruitment and/or immigration to the Canadian zone:

- *Gulf of Alaska stock status*. Exploitable biomass is expected to increase 6 percent from 2002 to 2003 due to the above average 1997 year class, which now accounts for 24 percent of the 2003 spawning biomass. The 1998 year class may also emerge as being above average with the accumulation of one or two more years of data.
- *Continental U.S. indicators*. Relatively strong 1999 and 2000 year classes were observed by the triennial shelf survey, and the 2001 shelf survey results are the highest in the 1980 to 2001 series. This optimism that the 2001 year class might be very good follows poor recruitment through the 1990s and a consequent decline in sablefish spawning stock biomass in the lower 48 States.

- *Shrimp survey.* WCVI shrimp survey shows marked increase in sablefish catch rates in 2001 and 2002, in agreement with results from the lower 48 shelf and slope surveys and U.S. Pacific hake fishery bycatch, which suggest above average 1999 and 2000 year classes.
- *Hecate Strait Observer Data.* Analyses of these data suggested an increase in the abundance of juvenile sablefish in 1998 and 1999 attributed to the 1998 year class.

This assessment incorporated the results of the fall 2002 abundance indexing survey, a new standardized commercial catch rate index, and a new tag-recovery model that adjusts tag returns for month effects. Analysis of sablefish recruitment indicators from various sources in British Columbia and the United States suggested that future production of sablefish should improve over low levels experienced in the 1990s. A simple biomass dynamics model was used to combine the stock indices and to examine the consequences of assumed levels of future production on projected stock biomass, where production, $\bar{P}$, was considered to be the combined effects of recruitment, immigration, emigration, and growth. It was recommended to pursue fishery objectives that will increase abundance from current levels. The decision-making procedure based on output from the simple biomass dynamics model depended explicitly on two considerations external to available data:

1. the degree of optimism regarding future production during the 2003 to 2008 projection period, e.g. $1\bar{P}$ to $1.5\bar{P}$, relative to the 1996 to 2002 reference period;
2. the desired trade-off between fishery yield and the objective to increase stock biomass, *B*, in 2008 relative to 2003, e.g. $P\left(B_{2008} > B_{2003}\right)$ and $E\left(B_{2008}/B_{2003}\right)$.

Advice to managers was cast in the form of decision tables (see Table 1) and was not intended to set harvest levels for the five-year duration of the projection period. By necessity, frequent review of the stock indicators will be required pending the development of a satisfactory population dynamics model for examining the consequences of long-term harvest strategies for sablefish. Fishery managers and industry should anticipate that re-assessment of stock indices and production indicators will allow the opportunity to revise yield in response to changing trends.

G2003-02: The Efficacy of Video-Based Electronic Monitoring Technology for At-Sea Monitoring of the Halibut Longline Fishery
H. McElderry, J. Schrader and J. Illingworth

This project involved the large-scale deployment of an electronic monitoring (EM) system on the 2002 British Columbia halibut longline fishery in order to evaluate its feasibility as an alternative to observer-based at-sea monitoring. EM systems were deployed on 59 regular halibut fishing trips involving 19 fishing vessels, providing about 700 usable sets, 1,000 hours of imagery, and 350,000 observed hooks. Catch items identified by EM represented over 60 fish, invertebrate or seabird species or species groupings, and the 15 fish most abundant species accounted for 98% of the catch. Data from fishing trips where EM and observers were deployed (about 55% of trips) were compared by total overall catch, total catch by set, and catch by individual hook.

EM and observer identifications overall agreed within 2%, and, when matched by individual hook, agreed in over 90% of the catch records. Individual species identification rates were high for most of the 15 most abundant species. However, some species, particularly non-distinct forms, were not identified well by EM and sample sizes were too small among half the species for estimation of an EM identification rate. Close agreement between EM and observer was also evident with species utilization determination (i.e., kept or discarded) and time, location and depth at set start and finish.

As compared with at-sea observers, the authors conclude that EM provided excellent catch accounting overall and for common distinctive species, but did not provide the same level of species resolution, particularly with the less common, non-distinctive species. Considering practical issues of the necessity for higher fleet coverage levels, the unsuitability of many vessels to host observers, and the substantially lower cost of EM-based monitoring, the authors suggest that a combined EM-Observer based monitoring approach should be employed for the halibut longline fishery. Further testing using combined EM and observers on the same trip should occur in the ZN fishery to improve EM rockfish identification capability. The authors also recommend that DFO strengthen their support for EM-based monitoring approaches to further development of the technology.

Working Paper G2003-03: Feasibility of Multispecies Groundfish Bottom Trawl Surveys on the BC Coast.
A. Sinclair, J. Schnute, R. Haigh, P. Starr, R. Stanley, J. Fargo, G. Workman

This paper examines the feasibility of conducting a coastwide groundfish trawl survey aimed at developing a relative index of abundance for as many groundfish species as possible. This paper used commercial trawl fishery data as a proxy for survey data in order to plan the survey. While it is acknowledged that there are major differences between commercial and survey data, it was recognized that the trawl fishery database was the only source suitable for the task. Comparisons of survey and commercial data from Hecate Strait and for the longspine thornyhead survey indicated a general agreement in CV estimates for species of commercial interest. These comparisons also indicated that the commercial fishery data may overestimate the CVs for rare and by-catch species. In such cases, the number of tows required to meet the CV target would be overestimated.

The authors recommended that the coastwide trawl survey follow a stratified random design. Stratification should be based on the depth (D) ranges $50 < D \leq 125$ m, $125 < D \leq 200$ m, $200 < D \leq 330$ m, and $330 < D \leq 500$ m and adhere to the PMFC major area boundaries. Station allocation should be made in proportion to the surface areas of these strata.

The analysis predicts that a survey of 1000 tows on a coastwide basis would achieve the 20% target CV for 15 species/area combinations. As a next step, the authors recommended that a pilot survey in a reduced area at this sampling intensity to verify the predicted CVs be conducted. The survey should be conducted in PMFC major areas 5AB.

APPENDIX 2: PSARC Groundfish Subcommittee Meeting Agenda January 14-15, 2003

AGENDA
PSARC GROUNDFISH SUBCOMMITTEE
January 14-15, 2003
Pacific Biological Station
Seminar Room - Nanaimo, B.C.

Tuesday, January 14, 2003

Sablefish Stock Assessment – A.R. Kronlund et al,	9:00am
Lunch	12:00
Sablefish Cont'	1:00
Adjournment	4:30

Wednesday, January 15, 2003

Electronic Monitoring at Sea –H. McElderry et al.	9:00am
Feasibility of multispecies groundfish surveys – A. Sinclair et al.	10:00
Lunch	12:00
Subcommittee Conclusions and Recommendations	1:00
Adjournment	4:30

APPENDIX 3. List of Attendees

Subcommittee Chair: Jeff Fargo
PSARC Chair: Al Cass

DFO Participants	**Tuesday**	**Wednesday**
* Subcommittee Members		
Acheson, Schon		✓
Ackerman, Barry*	✓	✓
Bonnet, Terri	✓	✓
Cass, Al	✓	✓
Choromanski, Ed		✓
Fargo, Jeff*	✓	✓
Haigh, Rowan*	✓	✓
King, Jackie*	✓	✓
Krishka, Brian	✓	
Kronlund, Rob*	✓	✓
MacDonald, Allan*	✓	✓
McFarlane, Sandy*		✓
Olsen, Norm	✓	✓
Rutherford, Kate	✓	✓
Schnute, Jon	✓	✓
Sinclair, Alan*		✓
Stanley, Rick*	✓	✓
Surry, Maria	✓	✓
Workman, Greg		✓
Wright, Rob	✓	
Wyeth, Malcom	✓	✓
Yamanaka, Lynne*	✓	✓
External Participants:		
Anderson, Kelly	✓	✓
Chow, Sharon		✓
Dickens, Brian	✓	
Fraumani, Bob	✓	
Haist, Vivian	✓	
Harling, Wayne	✓	
Illingworth, Jennifer		✓
Koolman, John		✓
Lane, Jim	✓	✓
McElderry, Howard		✓
Mose, Brian	✓	✓
Otway, Bill	✓	✓
Ronald, Peter	✓	
Schrader, Jessica		✓
Sewid, Alvin	✓	✓

Sporer, Chris		✓
Starr, Paul	✓	✓
Turris, Bruce	✓	
Wilkins, Mark		✓
Observers:		
Wallace, Scott	✓	

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

Jim Boutillier	Fisheries and Oceans Canada
Sean Cox	Simon Fraser University
Martin Hall	Inter-American Tropical Tuna Commission
Bruce Leaman	International Pacific Halibut Commission
Carl Schwarz	Simon Fraser University
Tom Therriault	Fisheries and Oceans Canada
Mark Wilkins	NOAA