

Report to CIE

of

STAR Panel

August 15– 19, 2005

Seattle, WA

Canary rockfish, Lingcod, Yelloweye rockfish, Yellowtail rockfish

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Executive summary

Four species were scheduled for review by this STAR Panel, lingcod, canary rockfish, yelloweye rockfish and yellowtail rockfish. Lingcod has been assessed since 1986. The STAR did not accept the lingcod assessment because the STAT could not adequately explain the source of the two large yearclasses the model predicated in the northern component. All the other assessments were accepted. Canary rockfish, which is overfished, is rebuilding very slowly. Yelloweye is also overfished and the extent of rebuilding is very uncertain due to the lack of data. The northern portion of yellowtail was assessed as an update and is not overfished.

Although more time would have improved the depth of some specific investigations, the Panel was successful in its review. Dedicated and talented members of the STAR and the STAT interacted well together in a constructive environment. As well as the assessments themselves, methods and insights were brought forward which will benefit other assessments and future STAR Panels. Furthermore, as I now have had the opportunity of reviewing six STAR Panels, procedural issues are given more emphasis in this report than previously. As well as the time available, specific procedural topics addressed include complimentary analysis, draft assessment preparation, the request from the STAR and the role of previous STAR Panel reports.

Technical issues concerning balancing of the assessment models, alternate analyses, retrospective analyses and convergence came up again at this Panel. Specific to this STAR were the calculation of *BO*, senescent natural mortality and cryptic biomass estimated in the model but not seen in either the fishery or survey data.

Background

Four species were scheduled for review by this STAR Panel, lingcod, canary rockfish, yelloweye rockfish and yellowtail rockfish. All of these stocks had been assessed before, and two were initially scheduled as updates. At the request of the STAT one of the updates, lingcod, was reviewed as a full assessment.

The Panel and assessment team members who presented the assessments are as follows:

Ray Conser, Scientific and Statistical Committee (SSC) Representative, STAR Panel Chair
Chris Francis, Center for Independent Experts (CIE)
Stratis Gavaris, Department of Fisheries and Oceans (DFO)
Dan Kimura, Alaska Fisheries Science Center (AFSC)
Robert Mohn, Center for Independent Experts (CIE)

Brian Culver, Groundfish Management Team (GMT) Representative
Pete Leipzig, Groundfish Advisory Subpanel (GAP) Representative
Mark Saelens, GMT Representative

Stock Assessment Teams (STATs)

Canary rockfish – Rick Methot, Northwest Fisheries Science Center, (NWFSC)

Lingcod – Tom Jagielo and Farron Wallace, Washington Department of Fish and Wildlife (WDFW)

Yelloweye rockfish – Farron Wallace, Tien-Shui Tsou and Thomas Jagielo, WDFW

Yellowtail rockfish – John Wallace and Han-Lin Lai, NWFSC

As has been seen in previous STAR this year, with four stocks were under consideration, there was not enough time to fully review individual stocks. This STAR, compared to others this year, was more investigative and focused more on the underlying data and its relationship to the model results. Due to time constraints, this meant that STAR Panel members aided in analysis more than seen on other Panels. While I found that these investigations were helpful in relieving the STAT and informing the STAR, it did impact on time for review. Indeed, I have been asking for more of this sort of analysis (simpler analysis/models and closer to the data) all year but hoped that the STATs would begin to do more. The cost was that the time constraints were more restrictive; depth of review was performed at the cost of breadth.

This report contains more on procedure than previous reports to CIE as I now have enough experience to synthesize and draw inter-Panel conclusions.

Description of review activities

The draft assessments and background material were written on a CD-ROM and received well in advance of the STAR Panel. Before the Panel convened, its members had been contacted by e-mail and assigned to act as Rapporteurs for stocks. I was given lingcod.

Monday morning the Chair, Ray Conser, opened the meeting with introductions and an overview of what we were expected to accomplish. Because two of the assessments were to be reviewed as updates, the Chair spent some time explaining the philosophy and practice of updates.

The Chair asked for comments before we began with the agenda. I took the opportunity to respond about some of the things that worked well in the previous five STAR Panels which I had attended and emphasized the importance of accompanying the request to the STATs for re-runs or additional analysis with the rationale for the request and the subsequent response to it.

I performed two minor sets analyses to aid the time-pressed STAT in understanding some of the underlying data. The first was a comparison of growth curves which contributed to anomalous shift in biomass. The second was the time trends of length distributions for yelloweye.

A summary of the four assessments is provided below. More detail is available in the STAR Panel Reports.

Lingcod

The resource has been assessed since 1986 and the two most recent assessments, 2000 and 2003, were assessed using a model written in ADMB. The assessment was to have been an update, but the STAT opted to move to the SS2 environment and have the draft reviewed as a full assessment.

The resource is modeled as two sub-stocks, northern (LCN) and southern (LCS). The draft and many subsequent re-runs of the LCN showed two unprecedented recruitment periods in the late 1990s. The STAR was not convinced that the data supported these recruitments and as the STAT could not adequately explain them, the assessment was not accepted. It should be mentioned that industry reported that they have been seeing signs of recent recruitment and that the previous assessment also suggested an improvement to recruitment. However, and taking into account these supporting observations, the STAR could not reconcile the assessment with the underlying

data. The assessment for LCS was also not accepted, mainly because of the similarity to the data sources and model of LCN and its unresolved problems. Considerable progress was made during the Panel, as this may well have been a case with a little more time, or fewer stocks to review, the STAR and STAT could have produced acceptable base cases.

The previous STAR Panel review of lingcod had recommended that Canadian data and assessments be consulted. This, as has been seen with other stocks, was not done. There seems to be a pervasive reluctance to consult this potentially complementary source of data, both fishery and biological, and analysis.

Canary rockfish

Canary rockfish was last assessed in 2002. The model in the draft assessment was re-written in SS2 and reviewed as a full assessment. It has been declared over-fished and is under rebuilding. The biomass was minimal in 1999 and has shown very little recovery since then. There is no indication of an improvement to recruitment in the data and until then rebuilding will be slow at best.

Yellowtail rockfish

The northern portion of this stock was assessed as an update. The STAT used the same ADMB program as the last assessment (2003), which was also an update. The assessed portion of the stock was modeled as having three sub-areas. A GMT member stated that there was no issue with yellowtail as it is closed because of the co-occurrence of canary so advice not needed. The documentation supporting the draft was weaker than average, perhaps because the STAT did not think the STAR would pursue very many details in reviewing an update. This resulted in considerable time being spent by the STAT in preparation and STAR in investigation of the underlying model.

Yelloweye rockfish

Yelloweye is a typical rockfish; it is long-lived and relatively sedentary in rocky habitat. Yelloweye was originally planned as a full assessment, but because there was very little new data since the last assessment (2002), the STAT brought it forward as an update. However, they chose to re-write the model in SS2, which is somewhat at odds to the spirit of an update. Considerable time was spent on this stock as the level of review was somewhat more than an update, but a little less than a full assessment.

The Panel accepted the assessment but noted that the paucity of data, especially abundance data in recent years, made the estimation of the rebuilding of this overfished resource very uncertain.

Summary of findings

As was seen throughout the year, an agenda having four stocks to be assessed, and often with sub-stocks, does not give sufficient time to fully explore all assessments. I agreed with STAR in all issues, and indeed found it to be one of the most thorough STARs that I sat on this year. It was impeded only by the time available and this constraint was more constrictive to the STAT than STAR.

The Chair brought a router so that the Panel had both LAN and wireless communication. A printer was arranged for with the host laboratory. These steps greatly improved communication and tracking of the numerous requests, re-runs, etc. Considering the negligible expense, this degree of support should be available at all STAR Panels.

These stocks were successfully assessed which can be attributed to the talent and dedication of the authors (and their support teams). As well as the assessments themselves, methods and insights were brought forward which will benefit other assessments and future STAR Panels. Furthermore, as I have had the opportunity of reviewing six STAR Panels, procedural issues will be given more emphasis in this report.

There are a couple of common themes among my reviews of the 2005 STAR Panels. The first is that four stocks are too many for a five day STAR Panel. The second is that the STATs do not look at the underlying data enough and do not complement their (generally SS2) analysis with simpler models. If the models agree, the base case is made stronger. If they disagree, the authors then have to contemplate the reasons. It is this contemplation that does not seem to take place, particularly during the drafting of the assessment. The wider experience represented by the STAR can help in the contemplation and resolution of the divergence, but only if the additional analysis and data summary are provided. I realize that there is a cost in developing more than one model and in data summaries, but it leads to results that cannot be obtained in any other way. The more common practice of producing a large number of SS2 runs is a much less effective way to explore alternative descriptions of the resource.

Technical topics:

Many of the technical topics itemized below have been seen at previous Panels. The topics dealing with initial biomass (B0), senescent natural mortality and model stability are more specific to this review.

T.1) Balancing the components of the assessment model

There were several discussions of balancing the components of the objective function. This is done with both variances and lambdas with the distinction that the variances have a bias correction. There is not a general agreement on whether the lambdas should be one. Different statisticians have divergent views. The observation was made that the Hessian only makes sense if the weightings in the objective function are correctly balanced with unit lambdas. On the other hand, it was felt by some that arbitrary (non-statistically defined) lambdas had a role in examining the contributions of various data components. Also, some data could be of higher quality or be more representative (covering a larger geographic area of the resource or from a larger fishery) and hence should be subjectively weighted. While this may be a useful exercise, the prevailing thought was that by the time a base case is defined, the lambdas should be one and the variances and effective N's be balanced.

It is **recommended** that the role of balancing be fully investigated at a technical workshop before the next round of assessments. As well as the topics mentioned above, there was an observation that the weighting could be 'sticky' and become stuck in local minima around one data set or another depending on starting values.

T.2) Alternate analysis (procedural implications as well)

Simpler analysis was needed as a tool to apply the “common sense test”. For example, because of their slow growth and low mortality rate, one would not expect to see sharp discontinuities in the SSB. When this was seen, two simpler analyses were done. One STAR member did an untuned VPA on the catch at age data and the discontinuity disappeared. Similarly, I did plots of the annual growth models, and a comparison of the discontinuous year to its neighbor showed at least part of the problem.

If the STAT had looked at these data after the first trial runs showed the discontinuity, the problem should have easily addressed. At the STAR we did not have time to consult back with the data sources. A fair portion of the technical help from the Panel was simpler analysis, including plotting the data or summaries of the data. At least in some instances, the STAT teams seemed to have been too busy producing the draft to apply the common sense test to their results before the meeting. And not too surprisingly during the STAR, too busy doing re-runs or did not have readily available software, to apply it then. It is **recommended** that this sort of self-generated probing of results and data be institutionalized through practice or imposed by pre-STAR reviews.

T.3) Retrospective analysis

Retrospective analysis is a common diagnostic in stock assessments. Although the situation came up in the lingcod review, it is of broader scope and may be especially important in updates. It tracks, usually year by year, changes in perception of the modeled resource. It has two modes. The one is historic in which the variable of interest, say SSB, from successive assessments is plotted for comparison. The second is technical and uses a single model and changes the period of data under consideration to assess the change due to data alone. A request for a technical retrospective analysis was made during the STAR, but it was not done due of time being dedicated to defining a base model. For most relevance, this analysis should be done after a base model has been chosen, and again there was not enough time.

It is **recommended** that both modes be used routinely at the drafting stage of the assessment, including updates.

T.4) Initial biomass (B_0)

B_0 is of particular importance in the provision of advice for management because it defines both depletion and recovery. It is calculated automatically in SS2, but because of its importance this Panel looked at it more closely than was done previously. The calculation combines two sorts of information. The first is the R_0 or recruitment defined over a suitable period or model based from a stock-recruit model as is done in SS2. The intent for R_0 as stated in the Terms of Reference is that, when possible, it reflects an unexploited stock. Choice of an appropriate R_0 is more difficult when there are environmental factors affecting recruitment or when it is episodic. The second is the expected spawning stock biomass per recruit (SPR) from a yield per recruit analysis with the fishing mortality set to zero. The $SPR(F=0)$, incorporates growth and natural mortality and again is derived for a certain period. It is **recommended** that more attention be given to the production and reporting of B_0 , specifically what time period was used to define the growth and nature mortality (if time varying) and how was the R_0 defined. Although $SPR(F=0)$ is easy to calculate from standard SS2 output, it should be given explicitly.

T.5) Senescent natural mortality (M)

In both the yellowtail and canary assessments, a senescent mortality for females was modeled. I do not recall seeing this for other rockfish. Given the general difficulty in estimating M at all, two questions arise. How well is this supported in data? Should a meta-analysis be performed with other, similar, rockfish to at least develop a prior for age-dependent M ? A thorough analysis of M is **recommended** before the next round of assessments.

T.6) Diminished inclusion of data using non-linear q 's and annual q 's

In two of the assessments, the impact of abundance data was diminished by either adding a power relationship or annually varying q 's. In the canary assessment, a non-linearity was modeled for two of the indices. The STAT team explained that this was done to correct for an assumed time varying relationship. Adding a non-linearity (between the index and abundance) is not good way to model a time dependency. This situation is less tenable than one seen in the previous STAR in which such a relationship was introduced for widow rockfish, for which scientific grounds for the relationship were presented.

Similarly in the yellowtail assessment, the abundance indices, except for the survey, were linked to the model with annual q 's. Giving the model this degree of freedom for fitting greatly reduces the influence of the data suggesting that the data are not to be believed. If there were a reason to suppose a trend or environmental factor this could be incorporated explicitly, but no such effect was suggested for this stock.

If the indices are thought to have some ancillary information, but are not directly useful in tuning, I **recommend** that they be plotted against the appropriate model output after scaling for the power of the index, a single q . Residuals may also be investigated by plotting them directly against time or biomass. This approach would reveal the potential role of the indices and perhaps lead to their eventual inclusion in the assessment model. Such data are shown to be useful even though they are not used in tuning instead of simple in or out status.

T.7) Convergence and stability

A problem with convergence was seen in the yelloweye assessment which probably is a result of the high number of selectivity parameters used. A jitter analysis was requested by the STAR Panel which showed very unstable results, 2 out of the 20 trials converging. Time precluded a higher number of trials. Most of the trials had disastrous likelihoods that would never be accepted. These re-runs showed a distinction between convergence and stability. The results weakly "verified" base model, suggesting that it was not stable but seems to have converged to the right spot, albeit rarely. This is symptomatic of a poorly determined (over-parameterized) problem. The jitter analysis was informative and it is **recommended** it be done at the draft stage, as they can be time consuming within the confines of a STAR Panel.

T.8) Cryptic biomass

In one of the assessments, all the selectivities were chosen to be dome shaped. Thus, the model expects there to be biomass at older ages which is not seen by either the fisheries or surveys, hence cryptic biomass. At least one of the selectivities should be asymptotic to limit the amount in the cryptic portion. Another aspect of domed selectivities is that they require more parameters to fit using generally unreliable data at the oldest ages and/or largest sizes. In simulation studies,

the descending limbs have been seen to be very hard to estimate. If not the base case, certainly a number of sensitivity runs should be made with a number of asymptotic selectivities.

I wish to close the technical section with the acknowledgement of two nice explanatory plots which were presented during the meeting. The first was in the presentation of lingcod assessment where the catch density was plotted geographically. This efficiently showed the distribution of the resource, its extent and patchiness, especially to out of town reviewers. The second was figure 45 of the canary assessment which was a profile of the change in negative log-likelihood as a function of S-R steepness for a number of the components in the objective function. It nice showed the tension among these components within the model. It would be beneficial to see plots like these more frequently in assessment documents.

Procedural topics:

Although a number of specific procedural topics are given later in this section, many of them are related to, or exacerbated by, the constraints imposed by the time available to the Panel. One specific instance of the cost of the time limitation was the inability of the STAT and STAR Panel to come to an agreement on the lingcod assessment, particularly LCN. I am confident that with a little more time some resolution of the perception to the strong yearclasses could have been resolved and perhaps a base case defined.

The limitations of time, particularly for the STAT to do re-runs and contemplate the results, places strain throughout the review process. I do not know what criteria were considered in packing the agenda so tightly. Presumably it was felt that doing more stocks less well was the better strategy. I **recommend** that consideration be given to the development an objective method to assign priorities for full assessments. In addition, updates should be used more frequently and rigidly. As it is unlikely that unforeseen sources of data are found, and with a hopefully stable SS2 environment, updates should be commonly applicable. For example, it was observed that once the Panel slips the restrictions of an update, it is hard to stop searching for a better model.

The Chair brought his own router and software to give us a LAN in the meeting room. A printer was also provided in the meeting area by the host laboratory. These inexpensive technical aids were of great value in optimizing our time and communication between the STAT and STAR Panel. It is **recommended** that such facilities be routinely provided.

Another aspect of the crowded agenda was the comment from one of the STAT members that he was not comfortable that there had not been sufficient time to prepare the draft assessment adequately. While this is perhaps outside the purview of the STAR or this report, it did impact on the preparedness of the draft assessment and the amount of time that the STAR had to devote to work that should have been done at the drafting stage.

P.1) Simpler and complementary analysis

There is too much belief in the model. The Panel had problems getting access to underlying data on the occasions when the STAR wanted it. On three or four occasions, two of the other Panel members and I requested data to do simple analysis to reveal data structure or to illuminate specific aspects of model results. These analyses were performed by STAR Panel members because the STAT did not have time, the STAT did not have suitable skills or software to perform

the requests quickly, but most importantly because the STAT had not considered what went into the model sufficiently.

P.2) Preparation time and critical evaluation prior to the STAR Panel

A couple of the draft assessments were not well prepared when they were received prior to the start of the Panel. It is not known how much time was available to the STATs or what opportunities existed for additional expertise to be sought. It would appear that relatively too much time is spent on the exploration of alternant runs and too little on considering the implications of a few chosen runs. Moreover, it would be valuable to have a pre-STAR technical review in a working group environment or at least have the draft read by someone (technical) in enough time to give the authors some feedback.

P.3) Formal tracking of requests from Panel

This Panel, and indeed several before it in this cycle, did not adhere to the request/rationale/response format to the degree that I would have liked to see. It benefits both STAR and STATs to have explicit requests, for re-runs or analysis, why they were made and the response to those requests. This is especially so when there are many stocks and re-runs under consideration. Later in the week the Panel was always trying to catch up as they switched from stock to stock. The 2005-2006 Terms of Reference mentioned the need for clearly stated requests to the STATs. I **recommend** that future terms of reference specify that as well as clarity that the requests be accompanied by a rationale and the STATs response.

P.4) Previous STAR reports

In general, previous STAR Reports are under-utilized. The deliberations and recommendations of previous STAR Panels do not receive enough prominence in either the assessment drafting or review processes. The draft assessments should summarize previous STAR Reports (and a couple did) and the Panel should keep them (at least the most recent) in mind. In order to tighten the feedback provided by the STAR process, it is **recommended** that an item be placed in the template given in the Terms of Reference that explicitly calls for an evaluation of how well the previous Reports were followed, and if not, why not.

3) *Comment on the primary sources of uncertainty in the assessment.*

As is common with other rockfish, the primary source of uncertainty for these species is the availability of appropriate data. Fishery independent surveys are frequently compromised because of the behavior of the species. Preference for rocky habitat, and in the case of yellowtail, a pelagic distribution, reduces the quality of abundance estimates, or composition data, from trawl surveys. The utility of fishery dependent data have been compromised by recent management restrictions. Aging and discard practices are problems for most stocks as well. These are widespread concerns and this Panel was not greatly different in this regard from the others.

How uncertainty is incorporated into the assessment results does vary from Panel to Panel. When this question came up I cataloged how previous Panels had dealt with the issue. This Panel did not dedicate much time on questions related to the capturing of uncertainty in the projections; instead more was focused understanding the models. Also, because two of the stocks were under rebuilding rules, and one was rejected they did not require projections. In the one case where

projections were to be performed, yellowtail, the uncertainty was bounded by the estimated error in the current biomass. Time did not allow this to be done before the Panel adjourned.

4) *Comment on the strengths and weaknesses of current approaches.*

The strengths of this Panel were those seen in the others. Namely, a dedicated and talented STAT matched with an experienced STAR Panel. This Panel did stand out from the others, in one aspect. That was the degree of its desire to fully understand the models that were presented and illuminate the relationships to data with complementary analysis. This has long been a theme of mine and it was appreciated that this Panel felt similarly.

5) *Recommend alternative model configurations or formulations as appropriate during the STAR panel.*

This was done throughout the meeting and several points are described above in the Description of Review Activities. Many of the recommendations are relatively minor technical points and are captured in the Panel Reports. The recommendations are both from my own scientific experience and from previous STARs attended this year. In general my comments are for simpler analysis showing the data before they are incorporated into the base model and requests for more diagnostics.

Conclusions/Recommendations.

The bulk of my recommendations and conclusions are in the Description of Review Activities above. The word “recommendation” has been put into bold to facilitate finding the word. The recommendations have been broken down into technical and procedural classifications and have been dealt with in point form. As well as these, I made several recommendations regarding the form of the Panel Reports and Decision Tables derived my experience in from earlier.

A more general conclusion, and one that is mentioned repeatedly, is that these Panels are seriously compromised by having four stocks in one week. I am not aware of what criteria were used to arrive at this load nor what trade-offs were considered in sacrificing depth of review for covering more stocks less well. The losses are very difficult to quantify, as they were not explored. Hopefully, the next round will find a way to constrain the Panels to a more manageable number. When I have finished the series of 2005 Panels, I will try to make some recommendations for setting priorities to limit the number of stocks to be considered.

I mentioned during the report generation that there was need for a section from the Chair on broader issues. In the previous STAR, this was accomplished by identifying generic recommendations and putting them in all the individual stock Panel Reports. In this Panel, the Chair agreed with the need for such a vehicle and initiated a Chair’s section for more generic findings and recommendations. This should prove useful and be continued.

Appendix A Terms of reference for STAR sole Review:

General

External, independent review of West Coast groundfish stock assessments is an essential part of the STAR panel process. The stock assessments will provide the basis for the management of the canary rockfish, lingcod, yelloweye rockfish, and yellowtail rockfish off the U.S. Pacific coast.

The consultants will participate in the Stock Assessment and Review (STAR) Panel of the Pacific Fishery Management Council (PFMC) for the review of the canary rockfish, lingcod, yelloweye rockfish, and yellowtail rockfish stock assessments. The consultant should have expertise in fish population dynamics with experience in the integrated analysis type of modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models to process survey and logbook data for use in assessment models.

Documents to be provided to the consultants prior to the STAR Panel meeting include:

- Current drafts of the canary rockfish, lingcod, yelloweye rockfish, and yellowtail rockfish stock assessments;
- Most recent previous stock assessments for canary rockfish, lingcod, yelloweye rockfish, and yellowtail rockfish;
- An electronic copy of the data, the parameters, and the model used for the assessments (if requested by reviewer).
- The Terms of Reference for the Stock Assessment and STAR Panel Process for 2005-2006;
- Summary reports from the Recreational CPUE Statistics workshop and the West Coast Groundfish data and modeling workshops held in 2004.
- Stock Synthesis 2 (SS2) Documentation
- Additional supporting documents as available.

Specifics

Consultant's duties should not exceed a maximum total of 14 days: several days prior to the meeting for document review; the 5-day meeting; and several days following the meeting to complete the written report. The report is to be based on the consultant's findings, and no consensus report shall be accepted.

The consultant's tasks consist of the following:

- 1) Become familiar with the draft stock assessments and background materials;
- 2) Actively participate in the STAR Panel to be held in Seattle, WA from August 15-19, 2005. . *Participants are strongly encouraged to voice all comments during the STAR Panel so the assessment teams can address the comments during the Panel meeting;*
- 3) Comment on the primary sources of uncertainty in the assessment;
- 4) Comment on the strengths and weaknesses of current approaches;
- 5) Recommend alternative model configurations or formulations as appropriate during the STAR panel; and
- 6) Complete a final report after the completion of the STAR Panel meeting.

- 7) No later than September 2, 2005, submit a written report consisting of the findings, analysis, and conclusions (see Annex I for further details), addressed to the “University of Miami Independent System for Peer Review,” and sent to Dr. David Die, via e-mail to ddie@rsmas.miami.edu, and to Mr. Manoj Shrivlani, via e-mail to mshrivlani@rsmas.miami.edu.

Submission and Acceptance of Reviewer’s Report

The CIE shall provide via e-mail the final reports of the consultants in pdf format to Dr. Lisa L. Desfosse for review by NOAA Fisheries and approval by the COTR, Dr. Stephen K. Brown by September 16, 2005. The COTR shall notify the CIE via e-mail regarding acceptance of the report. Following the COTR’s approval, the CIE shall provide the COTR with pdf versions of the final report with digitally signed cover letters.

ANNEX 1: Contents of Panelist Report

1. The report shall be prefaced with an executive summary of findings and/or recommendations.
2. The main body of the report shall consist of a background, description of review activities, summary of findings (including answers to the questions in this statement of work), and conclusions/recommendations.
3. The report shall also include as separate appendices the bibliography of all materials provided by the Center for Independent Experts and a copy of the statement of work.

Appendix B Bibliography of Materials Provided.

Before the review the Panel was provided with electronic copies of the following documents.

I. Current Draft Stock Assessments

A. Canary rockfish

1. Status of the U.S. canary rockfish resource in 2005. Richard D. Methot and Ian J. Stewart. August 1, 2005. *Draft*.
2. Appendix A: Canary rockfish.ctl and .dat assessment input files.

B. Lingcod

1. Assessment of Lingcod (*Ophiodon elongatus*) for the Pacific Fishery Management Council in 2005. Thomas H. Jagielo and Farron R. Wallace. August 2005. *Draft*.
2. Appendix I. Northern Area (LCN) Base Model Output. Assessment of Lingcod for the Pacific Fishery Management Council in 2005.
3. Appendix Ia. Northern Area (LCN) Dat File. Assessment of Lingcod for the Pacific Fishery Management Council in 2005.
4. Appendix II. Southern Area (LCS) Base Model Output. Assessment of Lingcod for the Pacific Fishery Management Council in 2005.
5. Appendix IIa. Southern Area (LCS) Base Model Output. Assessment of Lingcod for the Pacific Fishery Management Council in 2005.

C. Yelloweye rockfish

1. Status of Yelloweye Rockfish off the U.S. West Coast in 2005 (*Sebastes ruberrimus*). *Text*. Farron R. Wallace, Tien-Shui Tsou and Thomas Jagielo. 2005. *Draft*.
2. Status of Yelloweye Rockfish off the U.S. West Coast in 2005 (*Sebastes ruberrimus*). *Tables and Figures*. Farron R. Wallace, Tien-Shui Tsou and Thomas Jagielo. 2005. *Draft*.

D. Yellowtail rockfish (Update)

1. Status of the Yellowtail Rockfish in 2004. John Wallace and Han-Lin Lai. August 1, 2005. *Draft*.

II. Background Materials

A. 2004 Workshop Reports

1. Recreational CPUE Statistics Workshop, June 29-30, 2004, Santa Cruz, California. A Report of the SSC Groundfish Subcommittee –Based on a Meeting Held at the Southwest Fisheries Science Center Santa Cruz Lab, June 29-30, 2004.
2. A Summary Report from The West Coast Groundfish Data Workshop held July 26-30, 2004 in Seattle, Washington. Northwest Fisheries Science Center. February 16, 2005.
3. A Summary Report from the Stock Assessment Modeling Workshop held October 25-29, 2004 at the Northwest Fisheries Science Center, Seattle, Washington. Northwest Fisheries Science Center, FRAM Division. March 16, 2005.

B. SS2 Documentation

1. Technical Description of the Stock Synthesis II Assessment Program. Version 1.17. Richard D. Methot. March 2005.

2. User Manual for the Assessment Program Stock Synthesis 2 (SS2), Model Version 1.17. Richard Methot. April 4, 2005.
3. PowerPoint Presentation: SYNTHESIS 2: Integrated Analysis of Fishery and Survey Size, Age, and Abundance Information for Stock Assessment. Richard Methot. 4. SS2 Model and Examples

C. Miscellaneous

1. STAR Panel Terms of Reference: Groundfish Stock Assessment and Review Process for 2005-2006. The Scientific and Statistical Committee (SSC) of the Pacific Fishery Management Council. 2005.
2. Pacific Groundfish: Continued Efforts Needed to Improve Reliability of Stock Assessments. United States General Accounting Office, Report to Congressional Requesters. June 2004.
3. Canary Rockfish Project – Preliminary Report. 9 June 2005. David Sampson and Scott Heppell.
4. Canary Rockfish Project – Status Report. August 1, 2005. David Sampson and Scott Heppell.

III. Previous Stock Assessments and STAR Panel Reports

A. Canary rockfish

1. Status of the Canary Rockfish Resource off California, Oregon and Washington in 2001. Richard Methot and Kevin Piner. 2002.
2. Canary rockfish STAR Panel Meeting Report. 2002.
3. Status of the Canary Rockfish Resource off Oregon and Washington in 1999. NWFSC Stock Assessment Team (STAT). 1999.
4. Stock assessment of the Canary rockfish resource in the waters off southern Oregon and California in 1999. Erik H. Williams, Stephen Ralston, Alec D. MacCall, David Woodbury, and Donald E. Pearson. 1999.
5. Canary Rockfish STAR Panel Meeting Report. 1999.
6. Status of the Canary Rockfish Resource off Oregon and Washington in 1999. NWFSC Stock Assessment Team (STAT) Summary Report. 1999.

B. Lingcod

1. Assessment of Lingcod (*Ophiodon elongatus*) for the Pacific Fishery Management Council in 2003. Thomas H. Jagielo, Farron R. Wallace, and Yuk Wing Cheng. 2003.
2. Lingcod STAR Panel Meeting Report. 2003.
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