Report on the 2005 Assessments of Canary Rockfish, Lingcod, Yelloweye Rockfish, and Yellowtail Rockfish off the U.S. West Coast

NIWA Client Report: WLG2005-56
September 2005

NIWA Project: ERI06901

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Author
R.I.C.C. Francis

Prepared for

The Center for Independent Experts

University of Miami

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National Institute of Water & Atmospheric Research Ltd
301 Evans Bay Parade, Greta Point, Wellington
Private Bag 14901, Kilbirnie, Wellington, New Zealand
Phone +64-4-386 0300, Fax +64-4-386 0574
www.niwa.co.nz

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Reviewed and Approved for release by:

Dr Rosie Hurst

Executive Summary

A STAR panel reviewed the 2005 assessments of four stocks off the U.S. west coast: Canary rockfish, lingcod, yelloweye rockfish, and yellowtail rockfish. The Panel met 15-19 August 2005 at the Northwest Fisheries Science Center of NOAA/NMFS in Seattle, Washington. The assessments were presented to the Panel, additional analyses were requested and carried out, and the Panel discussed the results and drafted its report.

The organization of the STAR was excellent, but the quality of the Panel's review was substantially compromised by the need to consider four species, and was not helped by the fact that some assessment teams appeared not to have had sufficient time to complete their assessments.

The Panel accepted three of the four assessments. The lingcod assessment was not accepted because it was not possible to resolve an apparent inconsistency between the assessment results and the data. Significant uncertainties in the other assessments were associated with a relative paucity of data (in particular a lack of recent biomass indices) and problems associated with data weighting and selectivities. The Stock Synthesis 2 software used for most of the assessments was sophisticated and of international standard.

A series of recommendations is given that is intended to improve the STAR panel process, future stock assessments in general, and the next assessments of these species.

1. Background

This report reviews, at the request of the University of Miami (see Appendix 1), the 2005 assessments of four stocks off the U.S. west coast: canary rockfish, lingcod, yelloweye rockfish, and yellowtail rockfish. The author was provided with various documents (Appendix 2) and participated in the Stock Assessment and Review (STAR) panel of the Pacific Fishery Management Council (PFMC) which considered the assessment.

2. Review Activities

The STAR panel met 15-19 August 2005 at the Northwest Fisheries Science Center of NOAA/NMFS in Seattle. Those attending the meeting included five reviewers (including the Chair), three advisors, and six members of the STATs (Stock Assessment Teams) (Appendix 3).

STAT members presented their draft assessments (Section I, Appendix 2). The Panel discussed the assessments and requested various changes, additional analyses, and alternative runs. STAT members presented further analyses, and these were discussed by the Panel. The STAR panel drafted their report.

3. Findings

3.1 The STAR process

3.1.1 Quality of the reviews

I believe that the quality of the reviews carried out by the Panel was substantially compromised by the need to cover four species (seven assessments in total) in one week.

The Panel did the best it could but only a limited time was available for each species. Also, it was difficult to keep track of the many details of each assessment. The four assessments documents comprised more than 500 pages and there were many other background documents (Appendix 2). The species under consideration by the Panel changed frequently (because of the need to allow STATs time to respond to requests), which increased the difficulty of focussing on the important issues. Because of these difficulties and the lack of time, I do not feel that I achieved a clear overview of all

assessments and was unable to raise all the matters I would have liked to. There was insufficient time for STATs to respond to all Panel requests.

I note that the document *Groundfish Stock Assessment And Review Process For 2005-2006* (document C1 in part II of Appendix 2) states that the number of assessments reviewed by a STAR Panel should not exceed two 'except in unusual circumstances'. I don't know what the exceptional circumstances were that led to the scheduling of six panels considering more than two species this year, but I believe it was inconsistent with the assertion (p. 2) that the first goal of the STAR process is quality assurance.

3.1.2 Lack of time for STATs

Not all of the STATs appeared to have had sufficient time to complete their assessments before the STAR. Some of the assessment documents were clearly incomplete and hastily written (e.g., tables copied from previous assessments without updating), and there were two instances in which anomalous patterns in output biomass trajectories were not adequately examined before the review, so that the parameter errors that caused them were not detected. This incompleteness may not have been a problem had there been only one or two assessments for the Panel to review, but it was a significant hindrance when there were four.

It is very easy to make mistakes in these sorts of assessments. This is particularly so when the software used is relatively new, so there may still be unfound bugs and users may misunderstand what the program does or how to structure input files. But even with well-tested programs that have long been used by STATs there is, in my experience, plenty of scope for errors. Because of this STATs should always treat assessment output sceptically. Any output which appears odd, or anomalous, in any way should be checked. Even when no anomalies are apparent it is often a good idea to carry out manual cross checks, where possible. It is important to try alternative model runs even when it seems obvious what they will show, because sometimes the 'obvious' is incorrect, and there is a lesson to be learned. This careful checking takes time. Without adequate time, mistakes will be made and assessment results will be misleading.

3.1.3 Responses to previous STAR panels

I was pleased to see that two of the assessment documents included a section in which the STAT described their responses to suggestions from a previous STAR panel. This type of explicit response is an important way of ensuring that the STAR panel system is effective and transparent. There will often be good reasons (if only a lack of time) for not following some suggestions, but these should be stated.

3.1.4 Organization of the review

I was impressed by the organization of the STAR. The Panel was well supported by the Stock Assessment Coordinator (Stacey Miller), and the local area network and ftp site provided personally by the Panel chair greatly facilitated the flow of documents, both within the Panel and between it and the STATs.

3.2 General assessment matters

3.2.1 Assessment software

Overall, I was impressed by the Stock Synthesis 2 (SS2) software that was used for three of the four species. This is sophisticated software of international standard. Features such as the (almost) Bayesian framework, time-varying selectivities, and varying bin widths and super years for composition data, allow the STATs considerable flexibility in formulating their assessment models.

I was surprised to see that SS2 allowed only two types of prior distributions for estimated parameters: normal and beta. An obvious omission is the uniform distribution, which is commonly used when an uninformative prior is intended (where prior distributions were mentioned in the assessment reports there was a clear intention, in almost all cases, that these be uninformative). Another useful prior is the log-uniform (i.e., uniform in log space), which I believe is the appropriate uninformative prior for R0 (or B0) and catchabilities.

In several assessments, the Panel discussed the possibility of rejecting the model estimate of unfished spawning biomass in favour of an estimate calculated by multiplying the spawning biomass per recruit by some estimate of mean recruitment. This could have been done fairly easily within SS2 if the user were allowed to specify which years' recruitments would be used to calculate R0 (this implies making a distinction between the set of years for which recruitment deviations are estimated and the set whose deviations are forced to average zero).

3.2.2 Statistical framework

The statistical framework used for these assessments was not clearly stated (and perhaps not clearly formulated). My impression was that the intention was to be Bayesian, but that practical difficulties prevented a complete adoption of this approach. Some elements of the Bayesian approach were evident: the estimation procedure used an objective function that included a likelihood component associated with each data set, and prior distributions associated with model parameters.

However, I did not find the word 'Bayesian' in the documentation of either the assessments or SS2. Also, there were clear non-Bayesian elements, such as penalty functions and data-weighting parameters; estimation via maximization (i.e, seeking the mode of the posterior distribution); and the characterization of uncertainty using the Hessian, or posterior profiles, rather than the posterior distribution.

3.2.3 Data weighting

I think the question of data weighting could have been treated more rigorously in these assessments. When, as is not uncommon, the conclusions of a stock assessment are dependent on the relative weightings given to different data sets, it is important that data-weighting decisions are as clear and objective as possible. A good starting point is the iterative re-weighting procedure in which the error assumptions are adjusted to be consistent with the size of residuals (this allows the data to speak for themselves). It may then be necessary to adjust the resulting weights (e.g., to down-weight to allow for correlations between two lots of data derived from the same samples), but the justification and the adjustments should be well documented. The resulting weightings are much more easily interpretable, and thus transparent, if they are expressed in terms of error distributions (e.g., as coefficients of variation) rather than a combination of error distributions and weighting parameters (λs).

In two assessments, CPUE indices were effectively down-weighted by modifying assumptions about catchability (either allowing this to be time-varying, for yellowtail rockfish, or dependent on abundance, for canary rockfish). This appeared to be an attempt to reach a compromise between the views that these indices should not be used because they were unreliable, and that they must be used because they exist. I found this unsatisfactory because (a) unreliability is not an appropriate justification for these catchability assumptions, and (b) it hindered the transparency of the assessments (the indices appeared to be used but can have had very little influence).

3.2.4 Selectivities

Selectivity curves are often a great, but necessary, nuisance in stock assessments, and they certainly were in this review. They are not usually important assessment outputs in their own rights, but we need to estimate them in order for the model to interpret the data, and the assumptions required to allow their estimation (principally time-invariance) are often dubious. I mention three areas of some concern, though how serious these are is hard to judge because there wasn't time to explore them fully.

Both the canary and yellowtail rockfish assessments had difficulty in estimating selectivities and had to constrain some parameters. I can think of two possible reasons

for these difficulties. First, perhaps too many parameters were being estimated (85 and 76, respectively) given the amount and quality of data available. We know that fishery selectivities change over time, and it is an admirable feature of SS2 that it allows these changes to be estimated. However, the extent to which we do this should be limited by the quantity of data and the plausibility of the estimated changes. Second, although the double-logistic curves used in these assessments are admirably flexible, some parameters may be inherently difficult to estimate (so a change of parameterization may be helpful).

Where estimated selectivities are very domed (as they were in several assessments) there is a potential problem with "cryptic" biomass (this is the part of the spawning biomass that is not selected). It is dangerous to rely on an assessment in which the proportion of biomass that is cryptic is high or shows a strong trend. The problem is that this cryptic biomass is inferred, rather than observed, and the inference is often questionable because it depends strongly on weak model assumptions (e.g., age-independent natural mortality). Thus there is a danger in saying "don't worry that you can't see very many fish out there; my model says there's plenty of fish but they're just not available to your gear". My preference is to avoid domed selectivities where possible, but where this is not possible to calculate the cryptic biomass proportion and look for any trend in this proportion.

I think length-based selectivity curves are preferable to those that are age-based because the physical processes that drive selectivity are more likely to relate to the size of a fish than to its age. If selectivity is truly size based then there are limits to how rapidly the proportion selected can change from one age class to the next (because there is usually a lot of overlap between the size distributions of adjacent age classes). These limits can easily be broken when selectivity is modelled as age-based (this appeared to happen for yellowtail rockfish).

3.2.5 Lack of recent biomass indices

All assessments suffered from a lack of recent biomass indices. CPUE series generally stopped in the late 1990s and the triennial survey (not available for yelloweye rockfish) was often only a weak source of biomass information because of its infrequency and, sometimes, high c.v.s. This lack of information meant that a key assessment output – which direction has the biomass been moving in recent years? – was quite uncertain.

I wonder whether it might be possible to start new CPUE series for these species, to cover the recent years. It is clear that recent management changes have altered the nature of the fisheries for these stocks so much that recent CPUE is not comparable to

that before these changes. However, it may be possible to create new CPUE series starting after the management changes (possibly using observer data?).

3.2.6 Ageing error

I was not sure that ageing error was treated correctly in all assessments. It is easy to make a mistake in the calculation of ageing error from a replicate-age data set by wrongly equating the standard deviation of the difference of replicate ages with the standard deviation of the ageing error (the former is actually $\sqrt{2}$ times the latter). I am not certain, but I think this error was made for yellowtail rockfish and lingcod. If so, ageing error will have been over-estimated. The approximate method used for yelloweye rockfish (involving a regression on absolute differences) will also tend to over-estimate ageing error, but less so.

For yelloweye rockfish there was a further problem: ageing bias. It was apparent from the STAT's presentation (though this cannot be seen in their assessment document) that there was a strong relative bias between the two institutions that were compared in the replicate-age data set (one institution produced higher ages than the other for about three-quarters of fish younger than 30 y). This bias was, inappropriately, built into estimates of the standard deviation of ageing error. A better approach is for age readers from the two institutions to try to resolve their differences.

3.2.7 Lack of Canadian information

For three of the four species (all except canary rockfish), I was surprised to see relatively little information from Canadian waters and researchers. All the species considered extend into these waters and, for some of them, a significant part of the total coast-wide population appears to lie there. A catch history for Canadian waters, and Canadian research, including stock assessments, could be useful in these assessments. In some cases a joint U.S.-Canadian assessment may be desirable (as recommended by the canary rockfish STAT).

3.3 Individual assessments

3.3.1 Canary rockfish

I felt confident that this assessment was thorough and well-considered, and found the STAT willing and able to respond to Panel requests. The stock is strongly depleted, but appears to be rebuilding, though the lack of a clear signal in the data make the extent of rebuilding uncertain. Poor recruitment in recent years is of concern.

Selectivities and data weighting are significant sources of uncertainty in this assessment. Age- and size-based selectivities produced quite different results (including different estimates of steepness), and with the latter it was necessary to constrain some parameters to allow calculation of error estimates (via the Hessian matrix). I did wonder whether the large number of selectivity parameters estimated for this stock (85) was really justified, given the quantity and quality of data available. The relative weights applied to different data sets clearly has a strong effect on the estimated steepness of the stock-recruit relationship, so data weighting is important.

I was interested in the use of growth morphs to allow the effect of size-based selectivity to modify the population structure, but disappointed that time did not allow any discussion of the effect of this feature.

I wondered about the wisdom of applying an ageing bias correction derived from recent bomb radiocarbon analyses. The plotted data (only 16 fish) clearly showed a relative bias between ages estimated from bomb radiocarbon and annulus counts, but I see no reason to believe that all of this bias must have come from the latter method. The former method is not without uncertainty.

3.3.2 Lingcod

This was the only assessment in which there was significant disagreement between the Panel and the STAT.

I concur with the Panel's unwillingness to accept the assessments for lingcod, either for the northern (LCN) or southern (LCS) stock. The primary concern was with LCN, which was assessed to be rebuilding rapidly because of two outstanding year classes (born in 1998 and 1999) that were estimated to be two to three times as big as any preceding year class. I felt that these outstanding year classes ought to be clearly apparent in the input data, and if they weren't, the assessment was unreliable. A brief analysis, by the Panel, found no evidence for the great strength of these year classes in either the commercial or recreational age composition data. Although the triennial survey showed a strong increase in estimated biomass in 2001 and 2004, this seemed to be spread across many year classes, suggesting that it might be caused by an increase in catchability, rather than a true increase in biomass. The LCS assessment was suspect because it might also have been affected by a similar increase in catchability in this survey.

It may well be that lingcod stocks are rebuilding. Industry advisors to the Panel believed this to be true (although they found it hard to quantify the extent of rebuild)

and I am in no position to reject that belief. What I can say is that there is doubt as to whether the data used in the assessment support it.

There is some doubt about the status of the male spawning stock. When calculating spawning biomass, SS2 ignores males on the grounds that it is only females that matter because a few males can fertilise the eggs from many females. This assumption is usually reasonable, but may not be appropriate in this species, where males are needed for nest guarding.

3.3.3 Yelloweye rockfish

Although there were substantial uncertainties in this assessment (mostly deriving from the paucity of data) I feel that it would be appropriate for use in management of the stock. The stock remains in an overfished state, but appears to have been rebuilding slowly since 2000, although the lack of recent biomass indices makes the extent of this rebuild uncertain. Another source of uncertainty was the instability associated with the parameterisation of selectivities (the model behaved poorly when required to estimate all selectivity parameters at once).

The absolute size of this stock is not well determined because a profile on R0 (mean recruitment in the unfished stock) showed very little constraint by the data. It is of concern that R0 did appear to be constrained by the assumed prior distribution for the recruitment deviates (which was specified by the arbitrary assumption that σ_R, their standard deviation in log space, was equal to 0.4).

There was some discussion on the merits of providing separate regional assessments. The GMT representatives mentioned the desirability of this from a management perspective, and all the data inputs are already split by region. This would be worth exploring, but it may be that the data for some region, or regions (particularly Washington) are found to be insufficient to support separate assessments.

I applaud the STAT's decision to move this assessment to SS2, though I note that this appears to have been in conflict with the decision that this was supposed to have been only an update, rather than a full assessment.

3.3.4 Yellowtail rockfish

Only the northern part of the stock was assessed, and this was done using separate assessments for each of three sub-areas. The assessment, which was scheduled as an update only, was hard to understand because of the weak documentation of the model, some aspects of which are still not clear to me. For example, what are the functions of

the three separate constraints on the estimated fishing mortalities? What does it mean to give more weight to the whiting bycatch index (λ = 12.5) than to the triennial survey index (λ = 1.653) and then strongly down-weight the former by allowing its catchability to vary from year to year?

There appears to be little management concern about this species because constraints on other fisheries prevent the OY (optimum yield) from being caught. Nevertheless, I can have little confidence in the calculation of the OY because the data are so weak. At first glance it appeared that there were three independent biomass indices for this species, but two of these (CPUE and whiting bycatch) had little influence (because their catchabilities were allowed to vary from year to year) and the third (the triennial survey) showed little contrast and low precision (high coefficients of variation). The extent of variation in the estimated catchabilities of this survey in the three sub-areas (0.22, 0.11, and 0.27, from north to south) was not reassuring. Poor fits to the age composition data suggest that estimates of year-class strength are not reliable.

I think it was probably a mistake to use different growth curves for every year. Before this is done there needs to be an analysis that tests the null hypothesis that growth rates have not changed over time (because apparent changes in growth rate may arise simply from sampling error). A plot of the growth curves by the Panel revealed some startling outliers that were not likely to be real. Even if there is evidence of year-to-year changes in growth rates I think a good case can be made, on grounds of robustness, for ignoring these changes unless they show a trend.

4. Recommendations

4.1 The STAR process

STAR panels should not consider more than two assessments in a week (see Section 3.1.1).

STATs should be allowed more time to prepare their assessments before presenting them to a STAR Panel (see Section 3.1.2).

Stock assessment documents should include a section describing the STAT's responses to suggestions from the previous STAR panel (see Section 3.1.3).

STAR Panels should, where possible, be provided with a local-area network to facilitate the sharing of data and information (see Section 3.1.4).

4.2 General assessment matters

Two modifications to SS2 that could be useful in future assessments are a wider choice of prior distributions and more flexibility in the definition of R0 (see Section 3.2.1).

The preferred starting point for arriving at an appropriate data weighting should be the use of iterative re-weighting (see Section 3.2.3).

Consideration be given to making selectivities length-based, rather than age-based (see Section 3.2.4).

Where domed selectivities are estimated the extent of, and any trend in, cryptic biomass should be analysed (see Section 3.2.4)

The possibility of calculating new CPUE series for all stocks should be investigated (see Section 3.2.5).

It would be useful if a standard method or software were provided for calculating the ageing-error information needed by SS2 from replicate ageing data (see Section 3.2.6).

Where a significant proportion of a stock extends into Canadian waters, data and analyses from Canadian researchers should be presented and the feasibility of a joint assessment considered (see Section 3.2.7).

4.3 Individual assessments

4.3.1 Canary rockfish

For canary rockfish there is a need to resolve, as much as possible, uncertainties associated with the parameterisation of selectivities. Since there is some conflict between different data sets about the best estimate of steepness it is important to take care in the relative weight assigned to each data set (see Section 3.3.1).

4.3.2 Lingcod

There is an immediate need to determine (a) whether the estimated strong rebuild in the northern stock, which is associated with outstanding 1998 and 1999 year classes, is reliable, and (b) whether the apparent increase in biomass in the recent triennial survey is real or caused by changes in catchability. Trajectories of male spawning biomass would be a useful diagnostic for this stock (see Section 3.3.2).

4.3.3 Yelloweye rockfish

Consideration should be given to providing separate regional assessments. Uncertainties associated with the parameterisation of selectivities need to be resolved and the problem of relative ageing bias should be addressed (see Section 3.3.3).

4.3.4 Yellowtail rockfish

This assessment should be transferred to better-documented software, such as SS2, and the decision to use annual growth curves should be reconsidered (see Section 3.3.4).

APPENDIX 1: Statement of Work

This appendix contains the Statement of Work that formed part of the consulting agreement between the University of Miami and the author.

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 Shivlani, via e-mail to mshivlani@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 I to Appendix 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 2: 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.
3. Assessment of Lingcod (*Ophiodon elongatus*) for the Pacific Fishery Management Council in 2000. Thomas Jagielo, Deborah Wilson-Vandenberg , John Sneva1, Sandra Rosenfield, and Farron Wallace. 2000.
4. Coastwide Lingcod STAR Panel Report. 2000.

C. Yelloweye Rockfish

1. Status of Yelloweye Rockfish off the U.S. West Coast in 2002. Richard Methot, Farron Wallace, and Kevin Piner. 2002.
2. Yelloweye Rockfish STAR Panel Meeting Report. 2003.
3. Status of the Yelloweye rockfish resources in 2001 for Northern California and Oregon Waters. Farron R. Wallace. 2001.
4. Yelloweye rockfish STAR Panel Meeting Report. 2001.

D. Yellowtail Rockfish

1. Status of the Yellowtail rockfish resource in 2003. Han-Lin Lai, Jack V. Tagart , James N. Ianelli and Farron Wallace. 2003.
2. STAR Lite Panel NWFSC. 2003.
3. Status of the Yellowtail rockfish resource in 2000. Jack V. Tagart, Farron R. Wallace, and James N. lanelli. 2000.
4. Yellowtail rockfish STAR Panel Meeting Report. 2000.

APPENDIX 3: List of Participants

Participants in the STAR included the following

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

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

STAT (Stock Assessment Team) members
Canary rockfish[1] – 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

[1]Ian Stewart, was part of the canary rockfish STAT but did not attend the STAR