Report to CIE

of

STAR Panel
May 9-13, 2005
Long Beach, CA

Cowcod, gopher rockfish, scorpionfish, vermillion rockfish

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Executive summary

Four rockfish species were scheduled for review by this STAR Panel: cowcod, gopher rockfish, scorpionfish, and vermilion rockfish. Three of these four species were being assessed for the first time. For three of the stocks, a base model could be defined. For the fourth, vermilion rockfish, the data would only support a pair of models which were brought forward to give an indication of the range of uncertainty.

All the assessments were accepted and decision tables produced. The Panel Report drafts for all four stocks were reviewed before the meeting adjourned.

Reviewing four stocks compromised the Panel's ability to investigate each as fully as would have been desirable. As well as the number of stocks, the high number of re-runs required during the week impacted on the Panel's time for deliberation and synthesis of observations.

Background

Four rockfish species were scheduled for review by this STAR Panel: cowcod, gopher rockfish, scorpionfish, and vermilion rockfish. Three of these four were being assessed for the first time. The exception was cowcod, which was last assessed in 1999 when it was declared overfished, and it was subsequently reviewed in 2003.

Three of the four assessments were performed using the recently produced Stock Synthesis 2 (SS2) software. Cowcod was assessed using the earlier version of this package, SS1. When possible, a base run was chosen to best represent the resource, and a number of sensitivity runs accompanied it to explore the various formulations of model structure. The choice of the best model to define the base run combined statistical (goodness-of-fit) and subjective criteria. The data for the vermilion rockfish were not sufficient to define a base model for either the northern or southern assessment areas. In this case, two models were brought forward for each area to illustrate a range of uncertainty, even though it could not be centered about a most probable model.

The STAR Panel consisted of:

Debbie Aseline–Neilson	Groundfish Management Team
Susan Ashcraft	Groundfish Management Team
Jon Brodziak	Northeast Fisheries Science Center
Patrick Cordue	Center for Independent Experts
Martin Dorn (Chair)	Alaskan Fisheries Science Center and Scientific and Statistical Committee
Chris Legault	Northeast Fisheries Science Center
Bob Mohn	Center for Independent Experts
Gerry Richter	Groundfish Advisory Panel

The STAT team members present were:

Scorpionfish	Mark Maunder (Quarantine Resource Assessment), Tom Barnes (California Department of Fish and Game),

	Debbie Aseline–Neilson (California Department of Fish Game) Alec MacCall (Southwest Fisheries Science Center)
Gopher rockfish)	Meisha Key (California Department of Fish and Game), Alec MacCall (Southwest Fisheries Science Center), Traci Bishop (California Department of Fish and Game)
Vermilion rockfish	Alec MacCall (Southwest Fisheries Science Center)
Cowcod	Kevin Piner (Southwest Fisheries Science Center)

The STAT team members were asked to perform a considerable number of re-runs. This meant that they could not contribute to or benefit from discussions on stocks other than their own. This was partially due to the number of new assessments, but it also reflected on the preparedness and anticipation of STAR's expectations. For the Panel, having to review the high number of re-runs, lead to its inability to discuss each stock fully. The Panel was further hampered by the lack of a printer in the room or a LAN connection. This meant runs were reviewed by means of the author picking bits out of the SS2 output file which does not give much scope for documentation and comparison.

Description of review activities

Versions of the draft assessments and background material were received well in advance of the STAR Panel. Work had been performed since the drafts were distributed, and newer versions were presented either at the start of the meeting or before the respective presentations.

The STAR Panel opened with an introduction by the Chairman, Dr. Dorn, in which he put into context the intention of the STAR Panels for this year and the three preparatory workshops that preceded them. He also remarked that the State of California was taking a greater interest in sustainable management, and it had brought a couple of the stocks to the Panel for their first assessments and STAR reviews. Before the assessments were presented, the Chair had asked for Panelists to act as rapporteurs for each stock. I acted as the rapporteur for vermillion rockfish.

The scorpionfish assessment was the first to be presented. The proposed model had seven sub-areas of California and an additional one off Mexico. The Panel felt that this complexity was not warranted and a single stock model was developed into the base model.

The second stock to be reviewed was cowcod, and the submersible line-transect survey was presented before the draft assessment. This survey produced an estimate of the absolute biomass for 2002 which diverged considerably from the model estimate. Incorporation of the line-transect estimates into the model as absolute abundances will not be possible until a number of these estimates are available.

The vermillion rockfish stock was broken into two components with the division approximately off Cape Mendocino. It was also mentioned that recent genetic work defined two separate stocks of vermilion rockfish, but because of its preliminary nature, this information could not incorporated into the analysis. A new method of screening catch-per-unit-effort (CPUE) data (Stephens and MacCall, 2004) was applied to the RecFIN data to develop an index of abundance.

Because of the poor quality and quantity of data a base model could not be defined. Instead, a pair of runs was defined for each area to act as an indication of the range of uncertainty.

Gopher rockfish was the fourth assessment and again used the Stephens and MacCall biological association criteria to define subsets of the CPUE data. This assessment was similar to the vermilion case but benefited from better data.

Although four assessments were presented, draft Panel reports were produced and reviewed during the meeting. The number of assessments presented is compared to the objective in the Review Process Terms of Reference of two full stocks. As an aside, the 23 stocks scheduled to be reviewed in 6 STAR Panels this year suggests that the goal of two per panel has obviously been relaxed. The numerous re-runs required considerable effort from the STAT team members. Four assessments is more than can be reviewed in depth during a five day meeting, especially when three of them are being produced and reviewed for the first time.

The pace and intensity of the meeting did not give me as much opportunity to work with any of the assessment data as I would have liked. However, I did get the opportunity to write a small program to display some of the sanitation survey data used in the scorpionfish assessment. The issue was whether the outfalls acted as attractants and therefore biased the data as an index of abundance. The results suggested that this was not the case.

After the Panel adjourned, review of documents was continued by e-mail.

Summary of findings

That these resources were successfully assessed can be attributed to the talent and dedication of the authors (and their support teams). Their tasks were made more difficult by a lack of understanding of what was required in terms of document completeness and preparation. This lack of understanding was evidenced in the large number of requests for additional analysis and sensitivity runs. Although there had been (presumably) internal reviews, in a couple of instances, the drafts contained formulations that were quickly rejected by the Panel. This calls into question the depth and breadth of the internal review process. In spite of asking several participants, I have not been able to get a clear description of the internal review process.

The relative contributions of data and model to the assessment results needed more attention. Vermilion rockfish provides an example of this in the transitions from raw CPUE data, to GLM output, to the application of the Stephens and MacCall data filter, then GLSM, and finally the SS2 output. It is important to know the contributions of each step and how they relate back to the initial observations. A simple graphical presentation of each step would be adequate. Provision of these linking steps is particularly important when industry has a perception that is divergent to the assessment results, although that was not an issue at this STAR.

Following below are the specific questions from the CIE Terms of Reference:

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

Compared to the flatfish STAR in April 2005, this STAR Panel placed more emphasis to the concept of the “dominant dimension of uncertainty” stated in the STAR Panel Terms of Reference. For example, if natural mortality was considered to be the most important contribution to the uncertainty, a range could incorporated by setting M at high and low values

bracketing the base model, This would be using model error to estimate the impact of the uncertainty on SSB or depletion. To capture uncertainty, the previous Panel placed more emphasis on the measurement error as estimated by the Hessian. This uncertainty would be seriously biased downwards to the degree that parameters are set rather than estimated. Efforts must be made to include both sorts of uncertainty for the decision tables. Of course, Bayesian models could be useful in achieving this, but data and time restrictions precluded them from being developed at this Panel.

The effort to constrain uncertainty to a single dominant dimension, based for example on steepness or natural mortality, I believe is too restrictive. Efforts should be made to compose an artificial dimension, such as an eigenvector; however, it is clear that this may not be easy to communicate. Alternatively, the dimension could be a factor such as productivity which is, in turn, dependent on a myriad of biological (growth, mortality, reproductive success, etc.) and environmental factors. It is easier to communicate, but it is also messier to set up the bounding runs for decision tables. More thought needs to be directed to the capturing of uncertainty, although I expect an evolution in this process in future STARs.

The dominant dimension of uncertainty was carried through to the decision tables. The following table excerpt is from one of the draft decision tables and is presented only as an illustration of some of the issues related to the estimation and reporting of uncertainty. In this case, the dominant dimension of uncertainty was chosen to be the emphasis of the CPUE in the objective function.

Emphasis = 1	Emphasis = 5	Emphasis = 10
Least likely (p = 0.22)	Most likely (p = 0.40)	Less likely (p = 0.38)

Both verbal and quantitative (in this case, to two significant figures) representations of the relative probability of the states of nature are provided. There is some mismatch, at least to me, between verbal descriptions (most likely and less likely) and the very close p values given. Furthermore, these p's were derived from a Delphi method. This method was applied to a few stocks at this STAR and was used to assign the relative probability to the states of nature used in the decision tables when more objective criteria were not available. This was done by polling the STAR Panel members to "vote" on each of the states such that the total of the votes summed to one. These votes were done without much discussion, and criteria were not defined before voting, nor did they accompany the votes. Although this approach has some precedent in previous STAR Panels, I feel that it is not a satisfactory manner to assign probabilities. Even if very carefully labeled, I feel it would tend to mislead clients who have the reasonable expectation that the Panel output is the distillation of scientific investigations. If the data and analysis will not support the quantitative assignment of states, it is best that it be clearly stated as such. The fact that a base model could be defined indicates that the Panel felt that this was the most likely state of nature. It would be more valuable to arrive at labels such as "less likely" or "much less likely" through consensus as such arguments are in the form of "I believe X is less likely because of studies in other rockfish, or M is unrealistically high or whatever". Only in rare cases, and preferably only for qualitative probabilities, should a Delphi approach be entertained. The mean of the votes is essentially an unweighted combination of informed and uniformed opinions. However, the variances of the votes might be informative.

The relationship between stock and recruitment was more uncertain for these stocks than is usual for assessed species. Part of the reason is biological, as some rockfish are episodic spawners and generally exhibit a reduced parental influence. Environmental factors also reduce parental determination. Also, data limitations coupled with long life spans further confound the difficulty

In some cases, the steepness parameter of one gave the best fit to the data. This is essentially random variation about a mean recruitment level. The extrapolation from the lowest observed SSB to lower stock sizes is very suspect and potentially dangerously optimistic. A more prudent extrapolation would be a "hockey stick", whose slope on the left-hand limb would be the highest average recruit per spawner observed. The conflict between objective criteria (best fit to the data) and subjective (for example, if h was never seen above .75 in a meta-analysis) is another dimension of uncertainty or potentially model rejection. Similarly, a Ricker model was seen to fit the data better in one of the vermilion runs, although it displayed an oscillatory behavior in the lead-up period before recruitment deviations were turned on. Subjectively, such oscillations were deemed unlikely by some of the Panel members. Unfortunately, the means by which to resolve these conflicts will be more of an art than of science.

The issue of what period of the modeled population that recruitment deviations should be operant received some discussion. It is a bit surprising that guidelines for this issue did not develop in either the modeling workshop or from years of experience of SS1/SS2. The panel provided the rule of thumb that only those periods of the modeled population should be considered where there exists data to aid in their estimation. In highly interconnected models, data influences may be surprisingly far reaching. Work on objective criteria should be found, if already done, or initiated.

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

These assessments had little or no survey data available as indices of abundance. The survey data that were available only covered a small portion of the stock. The CPUE data, RecFIN and CPFV, present the usual difficulties of lack of design, as well as bias caused by changes in regulation and fishing practice. One example of this was the very high CPUEs observed in 1997 for a couple of the rockfish species. Although a workshop was convened on this subject in 2004, more work is needed which could consider environmental and multispecies implications. The decimation of bocaccio was specifically mentioned as a potential cause of improved recruitment. The work of Stephens and MacCall could perhaps be expanded address more aspects of multispecific interactions.

Unfamiliarity with SS2 was less of an issue at this Panel. The STAT teams had a little more time to become familiar, and SS2 had stabilized a bit since April. There were still some concerns expressed about projections for decision tables within SS2. Capturing uncertainty and incorporating non-standard (for instance, other than 40:10 or pre-specified catches) harvests were the main issues. The possibility of a file format for interchange with other projection programs would be useful, and Punt's program and a stock projection program used by NESFC were specifically mentioned. There were problems in using the MCMC option in SS2; its convergence times were much too long (lasting from hours to days) when this option was tried, especially in the context of re-runs.

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

Alternative model configurations and formulations were recommended throughout the meeting. The process was not as formal as in the previous STAR Panel, but the inclusion of the reason for each request was introduced, which is a good practice. **It is recommended** that in future STAR Panels the Panel's requests, the reason for that request, and the STAT team's response be

captured in a point-by-point basis. The point by point lists help the both the STS team and the Panel keep on track.

As was done by the other Panelists, especially the four of us who were external (two CIE and two NEFSC members) to the process, numerous suggestions for re-runs and additional information were made throughout the week. I would still like to see more attention paid to model and estimation uncertainty. SSB vs. F plots of the terminal year is a convenient way to display this type of information. The estimation error could be shown as error bars and the distance between the points the model uncertainty. In one instance when I requested such a summary, but the authors did not have time to produce it.

With scorpionfish, several of the models estimated a high exploitation rate, in excess of 90%. This was used as a signal to reject the run. I am concerned that these may have been an artifact of the selectivity specifications. If more time had been available, it would have been interesting to try alternate formulations, especially with changes to the domed selectivity pattern, to see if a simple fix were not possible. The descending right-hand side of selectivity curves is often quite difficult to determine from data, but in this instance, it had profound implications to exploitation.

Conclusions/Recommendations.

The STAR Panel successfully reviewed and made improvements to the four assessments under consideration. Hopefully, some of the "value added" by the process will radiate to upcoming STAR Panels. There appears to be no official pathway for innovation in analysis or improvements in communication of results to be promulgated. The Panel has no vehicle for such technical items, although a summary sheet could be initiated. One method of at least assuring their documentation is to have the authors place these innovations in their assessment documents. Another possibility would be to develop a website so all could access it. I am not aware what rules and regulations would apply to such a website in NMFS or a government environment. To some degree, my attendance at all the STARs helps spread the Panel's experience to other Panels. More attendance by NMFS staff and other potential STAT team members would also help distribute ideas and homogenize assessment products.

There is still some uncertainty among the STAT Team authors about what is needed and the correct format. This Panel spent a fair amount of time discussing the format and content of decision tables. As a result, the incorporation of uncertainty in the decision tables took a different emphasis than in the pervious flatfish Panel. Questions about the probability estimates and their verbal description in the decision tables still need some refinement. In the aforementioned example, both a verbal and a quantitative description of the probable states of nature are provided. Arguments against the inclusion of quantitative estimates are that it might lead clients to constructing a weighted average of the states of nature. The arguments against the verbal were how much less likely was "less likely". Considering the divergence in this and the previous Panel's approaches, the calculation or assignment of probabilities still requires clarification.

It would be a benefit to reviewers to have major events superimposed on long term catch (environmental and management), especially when CPUE is used as index. After the presentation of the first assessment, I tried to do this for my own benefit by asking the GMT personnel there. The baroque complexity of the changes in recent years was staggering. Even if only the major changes were summarized, it would aid in the interpretation and use of CPUE and related length-frequency data from either the commercial or recreational sectors. In Appendix C, I append my attempt as an example of a potential format.

It is recommended that three specific areas of research need to be undertaken, at least before the next round of assessments. The justifications for the first two areas have been delineated previously. The first is the interplay between model and measurement error in quantifying uncertainty. The second is an investigation into alternate forms of stock-recruit relationships, especially for episodic and/or events which dominate by environmental factors, i.e. how to determine the relationship and how to use it in projections. The third is a more formal approach to determining reasonable values for M, growth, and steepness. For example, the starry flounder assessment in the previous STAR investigated several methods of estimating M or Z. Several others exist in the literature. The authors who needed values of M did not seem to be aware of several of the methods. At the very least, a list of candidate methods should be compiled. An even better approach would be the development of trials among candidate methods and recommendations.

Appendix A Statement of Work for STAR Flatfish Review May 9-13:

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 gopher rockfish, cowcod, California scorpionfish and vermilion rockfish stock assessments.

The consultants will participate in the Stock Assessment and Review (STAR) Panel of the Pacific Fishery Management Council (PFMC) for the review of the gopher rockfish, cowcod, California scorpionfish and vermilion 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 gopher rockfish, cowcod, California scorpionfish and vermilion rockfish stock assessments;
- Most recent previous stock assessments for cowcod (gopher rockfish, California scorpionfish, and vermilion rockfish have not been assessed previously);
- 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; and
- 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 Long Beach, California from May 9-13, 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.
6) Complete a final report after the completion of the STAR Panel meeting.
7) No later than May 27, 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.

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.

A CD_ROM of four draft assessments and background material was supplied before the Panel convened. Also, an FTP site was provided to access any changes that occurred to the draft assessments. Paper copies were available at the meeting of the CD_ROM contests were provided as well.

Supporting documents, data files and SS2

Draft Assessments:

Key, Marsha, Alec D. MacCall, Traci Bishop, Bob Leos. 2005. DRAFT Stock assessment of the Gopher Rockfish. 32pp.

MacCall, Alec D. 2005. DRAFT. Assessment of Vermillion Rockfish in Southern and Northern California (draft 1) 63pp.

Maunder, Mark N., Tom Barnes, Debbie Aseltine-Nielson, Alec MacCall. 2005. DRAFT The Status of California Scorpionfish (*Scorpaena guttata*) off Southern California in 2004. 263 pp.

Piner, Kevin. 2005. DRAFT 2005 Stock Status of Cowcod in the Southern California Bight and Future Prospects. 138pp.

Supporting Documents:

Anon. 2004. Recreational CPUE Statistics Workshop June 29-30 Santa Cruz, California July 26-30, 2004 in Seattle Washington. MS 17pp.

Anon. 2004. A Summary Report from the West Coast Groundfish Data Workshop held July 26-30, 2004 in Seattle Washington. MS 24pp.

Anon. 2005. A Summary Report from the Stock Assessment Modeling Workshop held October 25-29, 2004 in Seattle Washington. MS 19pp.

GAO (United States General Accounting Office). 2004. Pacific Groundfish: Continued Efforts Needed to Improve Reliability of Stock Assessments. MS. 53pp.

Gerrodette, Tim. 2005(?). Cowcod review, Southwest Fisheries Center, Dec 14-15, 2004. MS.5pp

Kingsley, C.S. Michael. 2004. A visual line-transect survey of cowcod in the Cowcod Conservation Area in the southern California Bight. MS. 31pp.

Methot, Richard D. 2005, Technical Description of the Stock Synthesis II Assessment Program. Version 1.17. MS 54pp.

Methot, Richard D. 2005, User Manual for the Assessment Program Stock Synthesis 2 (SS2). Version 1.17. MS 47pp.

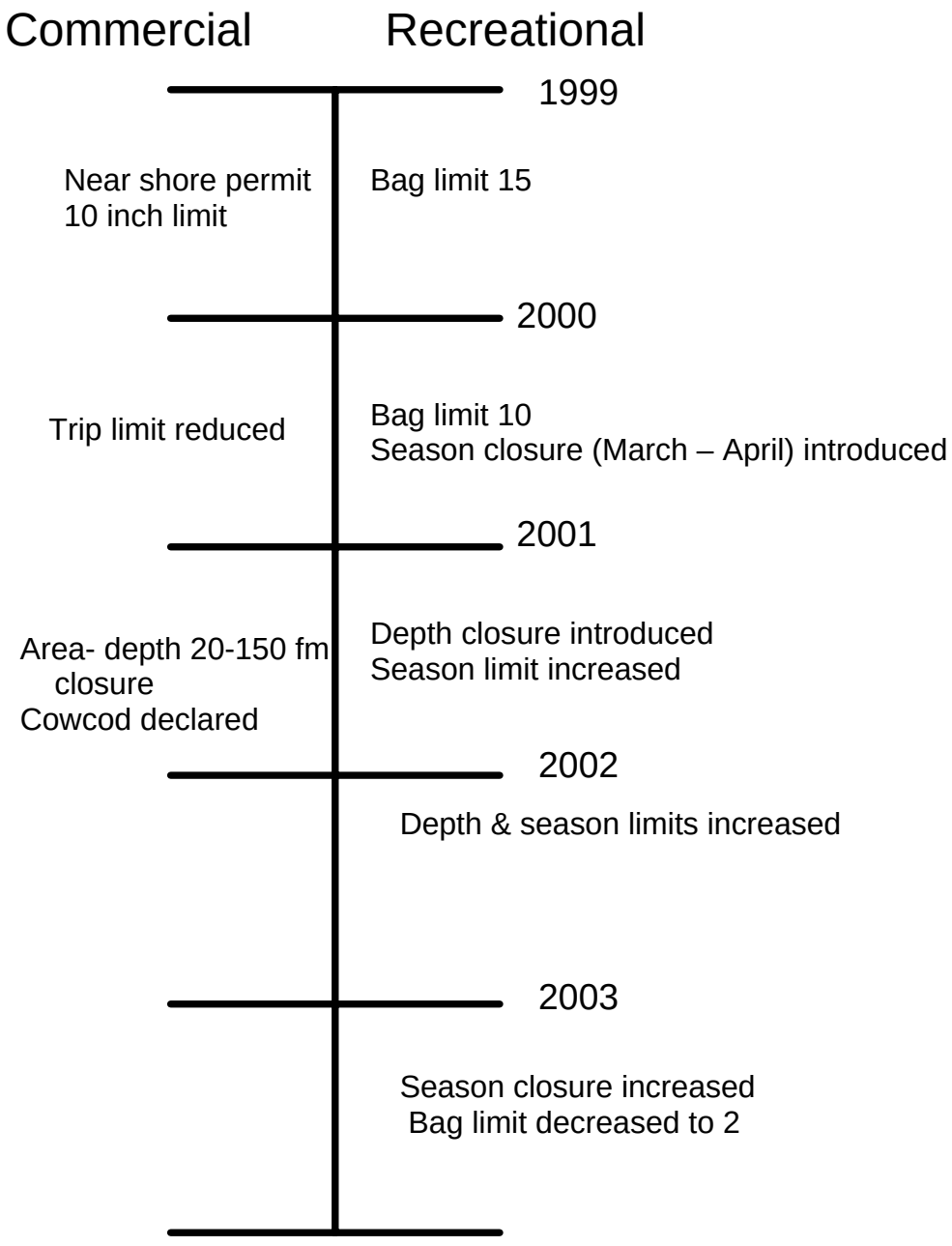
Moser, H. Geoffrey, Richard L. Charter, William Watson, David A. Ambrose, John L. Butler, Sharon R. Charter, Elaine M. Sandknop. 2000. Abundance and distribution of Rockfish (*Sebastes*) larvae in the southern California Bight in relation to environmental conditions and fishery exploitation. CalCOFI Rep. 41:132-147.

Sampson, David B. 2005(?). Cowcod survey review. MS. 4pp.

Stephens, A. and A. MacCall. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. Fish. Res. 70:299-310

Yoklavich, Mary, Milton Love, Karin A. Forney. 2004. A fishery independent assessment of cowcod(Sebastes levis) in southern California's Cowcod Conservation Areas using direct observation from an occupied submersible. MS 36pp.

Yoklavich, Mary, Milton Love, Karin A. Forney. 2005. Response to Review Panel Reports (one each from T. Gerrodette, D. Sampson and M. Kingsley). MS 4pp.



Appendix C. Example of time line to summarize major changes in management that might affect CPUE data.