STAR Panel Report

YELLOWEYE ROCKFISH

Alaska Fisheries Science Center
Seattle, Washington, USA
13-15 February, 2006

Stock Assessment Review (STAR) Panel Members:

Owen Hamel (Chair), Northwest Fisheries Science Center and SSC representative
Scott Nichols, Southeast Fisheries Science Center
Michael Wilberg, Michigan State University

Brian Culver, WDFW and GMT representative
Wayne Butler, GAP representative

Stock Assessment Team (STAT) Members Present:

Farron Wallace, WDFW
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General Overview

The STAR Panel met the 13-15 of February 2005 at the NMFS Alaska Fisheries Science Center in Seattle Washington to review the 2006 West Coast yelloweye rockfish (*Sebastes ruberrimus*) stock assessment. A Draft assessment document and extensive background material (previous assessments, previous STAR panel reports, etc.) were provided to the Panel in advance of the meeting.

Yelloweye rockfish were assessed in 2001, 2002, and again in 2005 as an "update" of the 2002 assessment, although the 2005 assessment used the new Stock Synthesis 2 (SS2) model rather than SS1. Both the 2002 and 2005 assessments were coastwide assessments. In November, 2005, a new full assessment was requested by the council to allow inclusion of IPHC longline halibut survey data, which is the only currently collected survey data within the primary habitat of yelloweye rockfish. This assessment was also to consider regional assessments by state.

The STAT successfully completed a new Yelloweye assessment. The new assessment incorporated extensive revisions of landings statistics. The STAT opted for logistic rather than double logistic selectivities as in past assessments. The STAR panel endorsed both changes. A new analytical treatment of Oregon recreational CPUE was presented at the STAR meeting, which supported use of a simple annual means model, which the STAR panel endorsed. The STAT presented analyses on both a coast-wide and individual state basis. The STAR panel saw no appreciable conflict between the coastwide and state by state results, suggesting that either structure could be used for management, although the state results are less precise. The Washington single state model is suspect because of sparse data and failure of convergence with the same steepness and M values used in the California and Oregon models. A considerable amount of time during the STAR panel was spent discussing and reviewing the data. This was partly due to multiple issues with the CPUE data sources, but could have been lessened by more diagnostic reporting in the pre-STAR draft assessment.

During the meeting, the STAR panel made additional requests as detailed below. Most were intended either to look at sensitivity, or to 'tighten up' some issues in the modeling decisions. A new base was selected incorporating information learned in that sequence of runs. The most significant features of the base change appeared to be the choice of which years to allow the model to estimate recruitment, and allowing estimation of M internally in the base coastwide model and then fixing that value in all models.

All runs examined support point estimates of depletion well below the 40% management target. Depletion appears to have proceeded from south to north. Despite the sparse data, the Stock Synthesis 2 model had little problem finding plausible population models to fit the existing data and choices of constraints. Only one data element, the short and localized IHPC CPUE series appeared to be poorly fit. The lack of fit to the IHPC CPUE series is likely partially due to assuming average recruitment in the most recent years based on minimal data on younger age classes. The IPHC survey data is also highly variable over the few years of its existence. There were no major conflicts among the different data elements (landing, CPUE indexes, size/age composition data), and no major conflicts among the different CPUE indices. There was some suggestion of recruitment decline, in that the last several recruitments estimated did not contain a strong year class. The STAR panel saw little significance to the small upturn in abundance in the last years. A small change may well have occurred, but the data available allow little confidence that model can detect its direction correctly.

The panel sees no persuasive reason for a full assessment to be carried out in 2007. An update could be undertaken with another year of IPHC data, and with the possibility of reexamining the catch data.

Analyses requested by the STAR Panel

First Requests

1. Alter yelloweye proportion of general rockfish catch from base of 1% to either 0.5% or to 2% for 1969-1976 for all three states and -1982 in California.

Rationale: To evaluate the effect of uncertainty in the catches prior to 1983 in California and 1977 elsewhere.

Result: Only a small change in overall results

2. Oregon Sport CPUE index - change to two indices through 1987 and 1988 and beyond – for both Oregon and Coastwide models.

Rationale: Catchability may have changed due to subtle change in method of identifying target species.

Result: Almost the same q for both, so leave as one index.

3. Run sensitivities to each index of abundance by changing lambdas by a factor of 5 in each direction, independently for Coastwide model and states (if time allows).

Rationale: To evaluate the influence of each index.

Result: No single index has undue influence on the results coastwide.

Second Requests

1. Put in revised Oregon CPUE series

Rationale: recommended, should see if makes difference

Result: Depletion coastwide up from 17.5% to 19.6%, trajectory flattens out earlier

2. Present recent age data to analyze data on recruitment in recent years

Rationale: need to set an end date for estimating recruitments, 1999 too late

Result: Certainly > 10 years before good data on rec., so about 1990+- 3 years

3. Substitute in Oregon MRFSS for Oregon CPUE series

    Rationale: to see effect of this other series, which is considered inferior.

    Result: Slightly less depleted state in 2006

Third Requests

1, 2, 3, 4 and 5 define new possible base cases for coastwide and individual states

1. Set SD offset to 1 instead of 0.

Rationale: This is the correct setting given size-at-age data.

2. Estimate recruitments only through year 1987 for all models

Rationale: Full selectivity at about age 12 results in lack of good estimating data at end of time series.

3. Set sigma r at 0.7 for all models for consistency.

Rationale: currently variable, but iterated to about 0.7 in coastwide model.

4. Set base steepness (h) at 0.45 for all models.

Rationale: Simply to have fewer significant digits (was 0.437).

5. Change Oregon data to annual mean calculations.

Rationale: Recommended by STAT team, similar to complex Poisson model, but simpler.
Result 1-5: all these changes resulted in a slightly more optimistic current state due to higher recent recruitments from the SR curve, except for Oregon model due to error in input of new Oregon data.

6. Do sensitivities to equilibrium catch for all models:
    a. set = 0
    b. add catch series back to 1925 at equilibrium value, before then = 0

Rationale: Concern about initial biomass being higher than Bzero.
Result: a: Small change coastwide, incomplete by state. b: Fixes issue with mismatch

7. Perform sensitivities to steepness (h) of 0.35 and 0.60 for all models.

Rationale: To see effect of uncertainty in steepness.
Result: Expected directions but not overwhelming changes.

8. Sensitivities to M = 0.03, 0.08

Rationale: To see effect of uncertainty in natural mortality.
Result: expected directions but not overwhelming changes, 0.08 considered unrealistic

9. Do runs with new ageing error assumptions:
    a. ageing error cv = constant at 0.1
    b. ageing error sd constant at 2

Rationale: The current model with decreasing sd with increasing age is counterintuitive and different from other assessments.
Result: Quite small effect

10. Set selectivity parameters for slope of ascending limb of Washington fisheries to be similar to Oregon and California

Rationale: The Washington selectivities are estimated to be quite different from similar fisheries off Oregon and California.
Result: Model did not converge

Fourth requests
Changes to base 1-4:

1. Estimate recruits through 1992

Rationale: Looked at SDs of recruitment estimates in original model and dropped off here, also 13 years from last data and ~ 12 years full selectivity.
Sigma r = 0.5
Rationale: 0.7 seems to allow extremely high recruitments.

2. Correct Oregon data

Rationale: Should have correct data as input.

3. Add catch series back to 1925 at equilibrium value, and 0 before 1925

Rationale: Fixed problem (see above).

4. Estimate Natural mortality internally in coastwide model.

Rationale: see if get a reasonable result close to fixed value of 0.045
Result: M = 0.036

Recommendation from STAT team to use this value, and consensus is that it is a better estimate given that it is closer to values used in Canada and Alaska, life history, etc.

5. New Base with M = 0.036,

Do for coastwide and states, alter Washington model as needed to get convergence. Main axes of uncertainty for decision table agreed upon by STAR and STAT for decision table analysis. For Washington use a single alternative based on submersible study.

Base Models: H = 0.45, sigma r = 0.5, M = 0.036 (except for WA: M = 0.04)
Low state: H = 0.30, sigma r = 0.4, M = 0.030 (except for WA: alternative below)
High state: H = 0.60, sigma r = 0.7, M = 0.045 (except for WA)

Other sensitivities requested:

Estimate recruits through 1987 or 1999 instead of 1992

Final Base-Case Models and Quantification of Uncertainty

	Coastwide	California	Oregon	Washington	CA+OR+WA
Unfished Spawning Stock Biomass (SSB_0)	3322	1715	1258	453	3426
Unfished Exploitable Biomass (B_0)	7448	3877	3789	1017	7686
Log Unfished Recruitment ($Log(R_0)$)	4.85	4.19	3.85	3.00	4.93
SSB_{2006}	588	145	274	95	514
Depletion Level (2006) Base Model	17.7%	8.5%	21.8%	21.0%	15.0%
Depletion – 95%CI	14.2%	5.7%	16.5%	17.3%	
Depletion + 95% CI	21.1%	11.2%	27.0%	24.6%	
Depletion Low State	13.5%	8.0%	16.9%		
Depletion High State	22.8%	10.9%	27.6%		

Alternative to Washington Model results based on NPFMC tier 5 calculations with the assumption of reliable estimates of natural mortality and biomass:

2002 submersible survey study area

Area Description	Area (ha)
NMFS Trawl Survey USVan 55-183 m	351,800
Study Area	55,680
Total Sampled Area	28
Study Area/U.S. Vancouver Area Ratic	15.8%

[1/] *Vancouver US includes areas from 47 30' -U.S. Canac*
Wilkins etal., 2002

2002 submersible survey yelloweye study results

Study results for yelloweye rockfish

	All Fish	Age 3+ Fish [1/]
Mean Length (cm)	50.0	51.7
Length Estimates (#'s of Fish)	38	36
Weight (kg) [2/]	2.73	2.69
Number of Fish Observed	59	57
Mean Density (#'s per ha)	2.02	1.95
Estimated Numbers of Fish in Study Ar	112,586	108,746
Biomass in Study Area (mt)	307	292

[1/] *Fish greater than 30 cm*
[2/] *Weighted biomass*

NMFS Trawl Survey estimates for yelloweye rockfish

NMFS trawl survey swept-area biomass estimates

	Washington State			U.S. Vancouver 55-183 meters			[2/] Adjusted Biomass (mt)	
Year	**Total**	**CV**	**[1/] Tows**	**Total**	**CV**	**[1/] Tows**	**.S. Vancouv**	**tal Washingt**
1977	232	0.29	14	56	0.50	4	47	223.6
1980	82	0.72	8	57	1.00	2	48	73.0
1983	510	0.58	14	140	0.48	7	118	487.9
1986	181	0.31	29	120	0.44	18	101	162.1
1989	463	0.36	8	422	0.38	4	355	396.0
1992	108	0.30	11	82	0.33	8	69	95.2
1995	22	0.60	3	8	0.55	1	7	21.1
1998	61	0.36	5	52	0.39	4	44	53.0
2001	111	0.49	9	64	0.61	7	54	101.2
Mean	197	0.45	11	111		6	94	179
Median	111	0.36	9	64		4	54	101

[1/] *Tows with yelloweye rockfish.*

[2/] *WDFW adjustment to NMFS trawl survey biomass reflecting trawlable habitat in US Vancouver Area only.*

Assuming no biomass outside Untrawlable zone then:
ABC =292 (age 3+ biomass)*0.75*0.036 (natural mortality)=7 .88 mt
OFL =292 (age 3+ biomass) *0.036 (natural mortality)=10.51 mt

Assuming biomass outside Untrawlable zone = median NMFS survey:
ABC =292 (age 3+ biomass)+54 (median NMFS survey biomass for US Vancouver)*0.75*0.036(natural mortality)=9.34 mt
OFL =292 (age 3+ biomass)+54 (median NMFS survey biomass for US Vancouver) *0.036 (natural mortality)=12.46 mt

Areas of Disagreement Regarding STAR Panel Conclusions

There were no areas of disagreement concerning this assessment.

Unresolved Problems and Major Uncertainties

1) By any standards, the data remain ‘sparse,’ and there seem to be no further avenues to improve that situation in the historical series. Size and age composition data are particularly lacking. A heroic effort to update the landings statistics by seeking out secondary sources was completed, and the accuracy of the assessment was no doubt improved by the effort; but many of the decisions about catches early in the time series had to ‘borrow’ from information remote in time and space. Supporting data from fishery dependent CPUE series that might be used to improve them often did not exist, at least for an entire series. Appropriate fishery independent data was generally not available. Those sets that have begun recently are promising, but do not as yet cover enough of the yelloweye spatial range to rely on them heavily.

2) The underlying landings data are basically derived from total landings of unclassified rockfish times an estimated fraction that are yelloweye. In recent years, actual samples are available in many areas, but the meeting participants believed an extensive pattern of substitution for missing cells is still required. In earlier years, estimates of fraction yelloweye had to be borrowed from remote years and areas. The consequence of these estimation steps is that the catch is known only with considerable uncertainty (possibly to a factor of 2 or 3x?). Unfortunately, the current version of SS2 does not allow for uncertainty measurements of landings. This makes it nearly impossible to evaluate the

true uncertainty of model results. Internal estimates of standard error on depletion estimates were on the order of 2-2.5%. These seem likely to be serious underestimates of uncertainty.

3) No Canadian data were available. Spatial distribution plots and genetics information suggest a continuous population extending well into Canada. Thus, the coastwide assessment presented here is probably not a true stockwide assessment.

4) The methods for calculating recreational CPUE for Washington and Oregon differ in that the Oregon CPUE includes trips targeting halibut (as the target data has not been collected in Oregon) but the Washington CPUE calculations exclude those trips. As most of the yelloweye rockfish taken in the sport fishery in both states since ~1990 have been taken in the halibut fishery, this may have an important impact on the trends seen in these CPUE series.

Although these 4 items put limits on we can learn from this particular assessment, we saw nothing to cause us to doubt the basic results seen here. The central tendency estimates from the SS2 model are the best estimate of central tendency currently available, and these central tendencies would be unlikely to change substantially with the addition of uncertainty in the catch data. The relatively good agreement between the individual state and the US coastwide models suggests that the dynamics of exchange across the Canadian border may not be too significant. There were no indications of unaccounted subsidies or depletions that sometimes appear in assessments not incorporating the complete range of a stock, though information from Canadian waters would still be advantageous. The most important change that could be anticipated in a next round of assessment is improved rigor in evaluation of uncertainty.

Recommendations

1) In the current assessment model, catches are assumed known without error. Because yelloweye rockfish are relatively rare in the fisheries, catches are estimated with considerable error. Ignoring this source of uncertainty will lead to an overestimation of model precision. Future assessments should allow catch to have some error to better propagate this key uncertainty to model estimates. SS2 should be modified to allow error in the catch data. This should not be difficult to code, although it may cause some problems with convergence that may require attention. Allowing for some autocorrelation in F might improve the estimation.

2) Formal estimates of uncertainty in catch should be produced by modeling the species composition sampling process. This will require an extended analytical effort, but it should be doable. The analysis may lead to using model-based estimates for missing cells, rather than substitution, which may change the best estimates of catch somewhat. Estimates of uncertainties in the total unclassified rockfish landings and in the species fraction estimates in the earlier years may still have to be assumed.

3) Obtain data from Canada for a truly stockwide model.

4) Continue efforts on the fishery independent survey programs. The most promising should be expanded stockwide.

5) Consider an assessment model incorporating several rockfish species simultaneously.

6) The panel recommends that aging error be explored again in future assessments. The panel was not completely comfortable with decreasing aging error as age increased as is currently in the base model. The panel discussed that it seemed counterintuitive that fish would become easier to age as they became older, and evidence for this pattern was sparse. However, removing the trend in aging error (to either a constant SD or CV) had small effects on model estimates.

7) Data are sparse in the most recent years of the model since the fisheries have been closed. Because of this, there is considerable uncertainty about current age and size structure of the population as well as uncertainty because most of the CPUE time series end in 2001. This uncertainty will become worse for future assessments if no new data streams are added. The best types of data to add would be surveys that estimate absolute abundance such as the submersible survey conducted in 2001. This survey would need to be expanded to include Oregon and California waters. Another option would be to continue and expand the IPHC survey.