Lingcod

STAR Panel Meeting Report

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Overview

The STAR Panel (hereafter the Panel) reviewed the assessment documents prepared by the STAT team for the lingcod fisheries. The entire STAT Team was available to present and discuss aspects of the report. This species was assessed previously in 1986 (coastal), 1994 (northern area), 1997 (northern area), 1999 (southern area) and 2000 (coastal).

This assessment treated the lingcod resource as two independent stocks; a northern stock (LCN: US-Vancouver, Columbia) and a southern stock (LCS: Eureka, Monterey, Conception). Both stocks were assessed using the multiple fleet age and sex structured model Coleraine, which also allows fitting length distributions. Both assessments utilized multiple tuning indices, the NMFS triennial surveys, trawl logbook CPUE, and in LCN only the WDFW tagging index (Table 1). The southern assessment was less well defined due to fewer data available, particularly the number of indices and years with catch at age.

The assessments were both sensitive to the levels of natural mortality rate (M) and steepness assumed. After considerable discussion and examination of many sensitivity analyses, the Panel agreed that steepness of 0.9 should be used as the base case in both LCN and LCS assessments. For LCN, the base case assessment resulted in current depletion of 29% while for the LCS current depletion is estimated to be 16%. The current assessments estimated depletions of 14% LCN and 9% LCS in 2000 compared to the 2000 assessments of 11% LCN and 14% LCS. This change in perception appears to be due to a combination of extension of the logbook indices back in time, extension of the NMFS triennial survey index forward in time, additional commercial and recreational catch at age data in recent years, and changes in the model structure.

Sensitivity analyses conducted by the STAT Team showed the level of depletion could vary widely due to changes in the natural mortality rate and the steepness parameter of the stock recruitment relationship. Neither of these parameters could be estimated by the model and had to be assumed but higher steepness was associated with better fit. Thus, different input assumptions lead to different results and management advice.

The consensus of the Panel is that the assessment has used the best available data and the analyses provide an adequate basis for Council decisions, if sufficient uncertainty in current depletion levels is considered. The Panel agreed that the stocks have been depleted and are now increasing; it is the level of decrease and subsequent increase that are not clearly defined, particularly for LCS.

The Panel commends the STAT Team for their cooperative spirit and willingness to respond to the Panel's requests for additional analyses. The large number of runs conducted during the meeting greatly facilitated the Panel's deliberations.

Requests made and comments to the STAT Team during the meeting

1. **Eliminate smoothing over years in the logbook CPUE index**. In the initial assessments the logbook index was estimated using a generalized additive model (GAM) that smoothed over years. This was thought to be inappropriate because the stock assessment model can be thought of as a smoother and so should receive year independent indices as input. The STAT Team initially conducted a GAM with years as factors, but could not estimate values for 1991 and 1997 due to missing variables in the dataset. The STAT Team then reanalyzed the logbook index using a generalized linear model (GLM) with years as factor, similar to the 2000 assessment, to address this request. The Panel agreed these GLM estimates provided a more appropriate index of abundance using the logbook CPUE data.
2. **Change years used in logbook CPUE index**. In the initial assessments the logbook data ranged from 1976 through 2002. Due to small sample sizes, the first two years of the LCS, but not the LCN, were dropped. Due to significant regulatory measured implemented in 1998, both series were truncated in 1997.
3. **Maintain consistency with the definition of water haul when forming the NMFS triennial index (Zimmermann et al. 2003[1])**. Although lingcod are a demersal species in general, they were not included in the list of species that determined water hauls in the NMFS triennial survey. The large change in the 1980 value when one tow was classified as a water haul demonstrates the responsiveness of the index to single tows with large catches. After much deliberation, the Panel agreed that consistency with the definition of water haul takes precedence when computing this index.
4. **Examine both the percent positive and density parts of the delta lognormal estimates for the logbook CPUE index**. The Panel initially had concerns regarding the large discrepancy between the raw and standardized catch rates, particularly in the early years. However, this appeared to be consistent with the data on proportion of positive tows.
5. **Report Canadian catches and results from their assessments**. Due to the artificial separation of a biological unit stock due to national boundaries it was thought that information from the Canadian stock could improve understanding of the LCN assessment.
6. **The fits of commercial catch at age in early years are not good for LCN**. The model predicts much younger catches than those observed in the first years of data. This means the model is predicting a more depleted stock than was present in those years, or else that the gear selectivities are incorrect for those years. Despite many sensitivity runs, there were no results that were able to fit these data at all.
7. **Convergence problems should always be noted when presenting results**. The apparent inconsistent responses seen in early sensitivity analyses were due to problems with convergence that were also not noted in the report. The STAT Team noted convergence problems in all later runs.

[1] Zimmermann, M., Wilkins, M.E., Weinberg, K.L., Lauth, R.R., and Shaw, F.R. 2003. Influence of improved performance monitoring on the consistency of a bottom trawl survey. ICES J. Mar. Sci. 60:818-826.

8. **The Panel requested a retrospective analysis that only included data up through 1999**. The STAT Team attempted this analysis but was unable to get the model to converge. However, the unconverged results were similar to the results using the full dataset.
9. **Compare dome with asymptotic selectivity patterns**. Although the parameter to cause dome selectivity could be estimated in the model, the STAR Panel requested sensitivity runs assuming asymptotic selectivity because there was difficulty in explaining how the dome pattern could be formed. The STAT Team provided a number of sensitivity runs with different combinations of allowed dome and assumed asymptotic by gear. Based on fit characteristics and lack of sensitivity to this specification, the Panel agreed to use the runs that allowed estimation of the parameter that causes a dome in both the commercial and recreational fisheries for both stocks. However, see Recommendations Item 13.
10. **Present management related statistics, such as depletion, when reporting sensitivity analysis results**. Initial tables of sensitivity results did not contain this information. The STAT Team provided this information for all runs conducted during the meeting.
11. **Correct "other" gear catch in US-Vancouver**. There was an error when generating the catch table of this gear type. This error has minor effects on the base runs. The STAT Team corrected this error in the subsequent runs.
12. **Modify sample sizes input for catch at age and length**. The multinomial-like method used to fit the catch at age data requires "effective" sample sizes as input, not "actual" sample sizes. The STAT Team produced runs that multiplied the initial sample sizes by 10% for input to the model in response to this request.
13. **Examine asymptotic and dome selectivity patterns applied by gender**. Due to differences in growth patterns, it was thought that one gender may be more susceptible to fishing at older ages than the other gender. This analysis was not possible due to limitations in the software used for the assessments.
14. **Provide summary tables of sensitivity analyses in hard copy form**. The STAT Team conducted an impressive number of sensitivity analyses during the meeting for which the Panel had trouble later recalling specific results. However, the results were only presented on screen because of the large number of runs conducted.

Technical merits and/or deficiencies of the assessment

The Panel appreciated the efforts of the STAT Team to transition the modeling from a flexible but stock specific approach to a tested and documented software package used in response to the recommendations of the 2000 STAR Panel. This should reduce the possibility of coding errors when conducting assessments. However, this standardized software does not eliminate the problem of poor data, especially in the LCS assessment, and reduces flexibility in representing the details of the fisheries. Results from a simple model, such as a production model or stock reduction analysis, would provide a check on the complex model results.

Areas of disagreement

There were no major disagreements between the STAR Panel and the STAT Team at the conclusion of the meeting.

Unresolved problems and major uncertainties

1. The influence on the LCN of the Canadian catches is not known. This could alter the interpretation of the status of the stock.
2. The strong dome selectivity patterns estimated by the model for the commercial and recreational fisheries, particularly for LCS, could not be easily explained based on biology, distribution, or gear effects.
3. It was reported to the Panel that both recreational and commercial fishers are seeing a lot more lingcod in recent years than they have seen previously. It is unclear whether this is due to a shift in fishing area due to management regulations, local abundance changes, or total abundance changes. However, recent increases in discarding suggest the possibility of recent good recruitment. Although the model results show an increasing trend in recent years, there are not signs of much higher recruitment. This apparent discrepancy needs to be explored further.
4. The incomplete split in biological parameters between LCN and LCS was noted. The two stocks have separate estimates of von Bertalanffy growth parameters and maturity ogives but the same parameter values for natural mortality, length weight relationship, and fecundity at age. In general, higher K values in the growth equation are associated with higher M values and fecundity at age is often related to weight at age.
5. The STAT Team was unable to reproduce the 2000 assessment due to structural differences in the models used in the two assessments. This was inevitable given the software used in response to recommendation by the previous STAR Panel.

Recommendations

The following recommendations are not given in priority order.

Data and monitoring issues

1. Estimation of discards in the recreational fisheries should be explored. The large estimates of fish caught recreationally but released alive means that these discards have the potential to be a large source of mortality. Factors to consider are the survival rate of discards and the age (or size) distribution of these discarded fish.
2. Observer data from the commercial fisheries should be used to estimate discards for this sector, and survival rates applied to the discards.
3. Appropriate biological parameters should be applied to the corresponding stock, particularly growth, mortality and fecundity. Data to support these estimates should be collected for both LCN and LCS.

4. Emphasis of collecting biological data should be placed on improving fishery age, length, and sex sample sizes and geographical coverage in both areas.
5. Check the validity of the early age composition data, which was inconsistent with later age composition data and could not be fitted by any model.
6. Indices should have year estimated as a factor, instead of smoothed, when GLM or GAM methods are applied.
7. Commercial trawl logbook CPUE data should be examined for trends in targeting or area fished to ensure the change in percent positive tows reflects change in population abundance. Investigate potential to develop a new index of abundance starting in 1998 using commercial logbook data.
8. Fishery independent information needs to be collected in the large areas that have recently been closed to both commercial and recreational fishing in order to document population level changes in abundance.
9. More frequent and synoptic fishery independent surveys should be conducted in both regions to aid in determination of stock status and recent recruitment. Surveys including nontrawlable areas should be conducted to address the issue of the habitat bias in trawl surveys.
10. The Panel endorsed the suggestion for a workshop to understand, analyze and interpret recreational CPUE data for all recreationally important species.
11. The Panel notes the importance of intercalibration of the NMFS triennial surveys conducted by the AFSC with the new NWFSC survey to ensure consistency in indices. This should be done before the next stock assessment.

Modelling and assessment issues

12. Changes from previous assessments in terms of data and model structure should be documented and attempts made to link the two results such that a clear understanding of the factors causing change in management parameters is apparent.
13. Determine reasonable expectations for the selectivity patterns in the commercial and recreational fisheries, through direct experimentation if possible, to reduce the large uncertainty in these parameters.
14. Do not use estimated CV for logbook CPUE index. The estimated coefficients of variation were thought to be unrealistically small (<6%) for use in assessment modeling and would impose too much emphasis on this index if used in the model. A better approach would be to estimate a factor that multiplies the estimated CVs so that a correct magnitude of uncertainty is used but year-to-year differences remain.
15. Projections should as far as practicable include all levels of uncertainty. The Panel agreed that the major uncertainties would be covered by projections of the base case (steepness of 0.9) and a sensitivity analysis using steepness set at 0.7.
16. Add recent management measures in the report. This information provides a context for understanding recent trends in catches and indices.

17. The Panel recommended that further exploration of the spatial structure of this fishery be undertaken, and that consideration be given in the future to the use of spatially explicit models.
18. The Panel recommended reporting convergence and other diagnostics on model runs as a matter of course and the reporting of CVs on management performance statistics.

Table 1. Data presented to the STAR Panel Meeting. Highlighted years are the data used in the base case. (*: Exclude water hauls; **: GLM is used to analyze this data; ***: Refer to STAT report)

LINGCOD	Northern Stock	Southern Stock
Catch Data		
	1973-2002	1973-2002
	1973-2002	1973-2002
Abundance Indices		
	1977-2001	1977-2001
	1986-1992	None
	1976-1997	1978-1997
Catch at Age		
	1979-2002	1992-1998; 2000-2002
	1980; 1986-2002	1992-1998; 2000-2002
	1992, 1995, 1998, 2001	1995, 1998, 2001
	1994-1997	None
Catch at Length		
	1975-1978	None
	1981-1983	None
	1986, 1989	None
	1986-1993	None
Data Presented but Not Used* **		
Catch data	1935-1972	1916-1972
WA-OSP CPUE	1990-2002	None
RecFIN CPUE: OR	1980-1989; 1993-2002	None
N. CA	None	1980-1989; 1996-2002
S. CA	None	1980-1981; 1983-1985; 1988-1989; 1994; 1996; 1998-2002