Longspine Thornyhead

Stock Assessment Review (STAR) Panel Report

NOAA Fisheries
Northwest Fisheries Science Center
2725 Montlake Blvd.
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STAR Panel Members

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Overview

A draft assessment of the longspine thornyhead (*Sebastolobus altivelis*) off the U.S. west coast was reviewed by the STAR panel during July 22-26, 2013. This assessment was presented to the STAR Panel by Dr. Andi Stephens (lead STAT author) and used the Stock Synthesis platform (version 3.24o). The last full assessment of longspine thornyhead was conducted in 2005 (Fay 2005). This Panel also reviewed the shortspine thornyhead assessment during the same week (see separate Shortspine Thornyhead STAR Panel Report) and to the extent possible, strove to ensure a consistent treatment of the catch data, influence of fishery regulations, and population vital rates.

Longspine thornyhead occur from the southern tip of Baja, California, to the Aleutian Islands. There appears to be no distinct geographic breaks in stock abundance along the west coast. Adult longspine thornyhead are bottom dwellers, and inhabit the deep waters of the continental slope throughout their range. They are associated with Dover sole, sablefish and shortspine thornyhead.

Dr. Stephens reviewed the fisheries and the data used in the analysis. Following the initial presentation and discussion of the assessment, the Panel made written requests to the STAT for additional analyses. Upon completion, the STAT presented the results to the Panel which in turn, made additional requests related to the questions and issues arising from the new material. This process was repeated four times during the week until a base case was achieved and the uncertainty was fully characterized, to the extent possible given the time available.

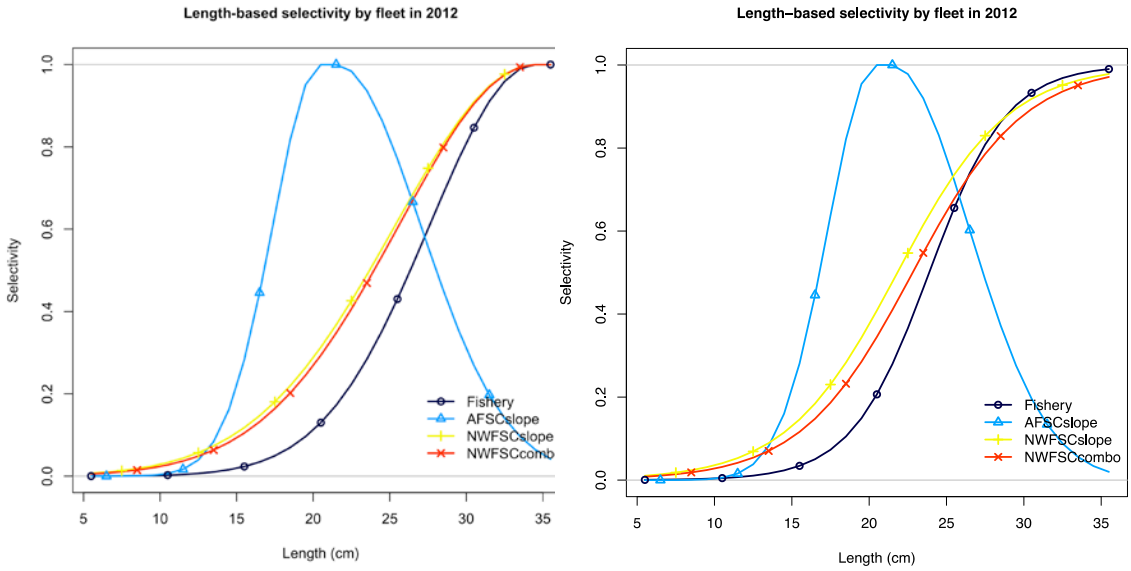
Stock depletion in 2013 (SSB_{2013}/SSB_0) is estimated to be 0.752 with an increasing trend in SSB during recent years. The stock status appears to be healthy and robust to the data and modeling scenarios explored by the Panel. Recent fishing mortality rates are less than the F_{MSY} proxy and recent SSB are well above the target and limit reference points. However, important fishery data (historical catches and discards) and key population vital rates (maturity, age and growth) are particularly lacking for longspine thornyhead, making the stock assessment only marginally sufficient to estimate the status of the resource. In particular, although the SSB trend is fairly robust, the data and modeling are not informative as to the scale of SSB. R_0 is used as a proxy to bracket the uncertainty in the decision table.

The STAR panel thanks the STAT for their willingness to respond to panel requests. The STAR panel would also like to thank the contributions from the GMT and GAP Advisors. The STAR panel concluded that the longspine thornyhead assessment was based on the best available data, and that this new assessment constitutes the best available information on longspine thornyhead off the U.S. west coast.

Discussion and Additional Analyses Requested by the STAR Panel

STAR Panel Requests

1. Reformulate the selectivities for the 2 NWFSC surveys and the fishery using a logistic selectivity function (keep double normal for AFSC slope survey). Fix or put a strong prior for hitting selectivity of 1 in the range of the observations. *Rationale: This would give a selectivity that is more intuitive with the data and may help reduce the catchability (q) estimates that are currently greater than 1. [The selectivity parameters were hitting bounds.]*
   Response: The selectivity patterns look similar with the normal distribution curve, and the posterior of the size at 50% selectivity is far greater than the mean of the prior. These changes were in the right direction with a higher selection of observed lengths and *q* for the surveys decreased. The STAR panel recommended logistic curves be used for the fishery and the 2 NWFSC surveys.



2. Slide 19 of the presentation – the variability in growth for males and females are different. Need to explain why there is a difference. *Rationale: These were expected to be the same as growth parameters were fixed at the same values for both genders (offsets set to zero). The male 95% CIs were slightly larger than the female.*
   Response: There was a mis-setting in the offset for male growth CV. This was corrected.

3. Calculate gender ratio for NWFSC combo survey. *Rationale: To validate model assumption of 1:1 gender ratio by length.*
   Response: The ratios were randomly varying around 1:1.

4. Estimate growth parameter K instead of fixing it. *Rationale: Growth does not reach asymptote until well after the assumed maximum age of 45. This may have an influence on selectivity and catchability (q).*
   Response: Estimating K provided more intuitive growth curves. Visually there were some differences observed in the estimated selectivity for the fishery and the 3 surveys. The estimated *q* for all 3 surveys doubled, which implied that the estimated biomass would be 50% of the model fixing K if other parameters didn't change.

5. Slide 50 of the presentation - in the likelihood profile, clarify if "discards" are for discards rates or discard length composition? *Rationale: For clarification of the results.*
   Response: Discard rates are used.

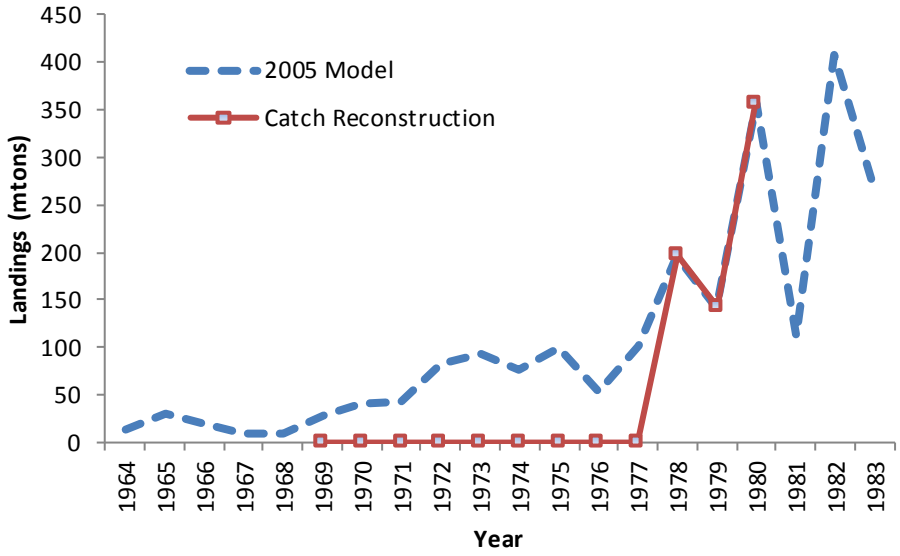
6. Implement the selectivity change (logistic except for AFSC slope survey) and estimate K. *Rationale: To compare these changes with original base case results. (This is a followup from #1 and #4 above – combining the two.)*
   Response: STAT provided corresponding results for further diagnostics. The estimated biomass was about 10% lower although *q* doubled, which can be explained by a higher % of selectivity for both the fishery and the 2 NWFSC surveys. This new model indicated an improvement in the size of selected fish and expected growth patterns.

	Base Model			**New Model**		
Estimated	Ln(R0)	LRef2		Ln(R0)	LRef2	K
Selectivities	Double-Normal			Double-Normal and Logistic		
Likelihood	135.26			126.21		
K	0.064			0.106		
L Ref2	27.01			27.8		
LN(R0)	12.73			11.85		
Q	1.44	2.32	4.03	3.29	3.01	4.77
Depletion	0.8			0.7		
SPB	45065			40194		
Gradient	2.5 e -04			3.8 e -04		

7. Blocks for retention curve: 1964-2006, 2007-2010, from 2011 onward. *Rationale: There are no obvious reasons to have 7 blocks. This suggestion is based on the comments from panel members and the GMT and GAP advisors.*
   Response: The results of retention and estimated discard fractions were compared with the original 7 blocks and the sensitivity run in Request 8. The discard fraction appeared more reasonable through time with less blocking.

8. Sensitivity to #7 block retention: 1964-1991, 1992-2006, 2007-2010, from 2011 onward. *Rationale: Add a block to consider the change in mesh size beginning in 1992. Minimum mesh size changed from 3 to 4.5".*
   Response: This blocking scheme is recommended to be used in the base model. 4 blocks (over the 3 block scenario) provided a better fit, with reasonable time blocking, and lower *q*s.

9. Use historical catch reconstruction estimates with the addition of the foreign fleet catch from the 2005 assessment. *Rationale: To be consistent with the request for shortspine thornyheads, as well as with other stock assessments. Efforts were made to improve historical catch estimates for stock assessments and the comparison needs to be evaluated.*
   Response: The reconstructed catches from the 1969-1977 time period were extremely low and impractical. The GMT and GAP advisors discussed the port sampling and market category problems. However, this doesn't influence the results. The STAR panel suggested that the 2005 stock assessment catch reconstruction be used until there is a better understanding of how species compositions were applied for the thornyhead market category in the earlier years.



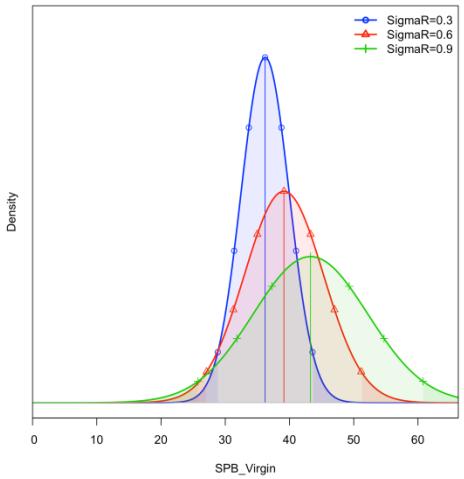
   The STAT team provided one extra sensitivity run involving turning off the recruitment deviations. It turns out that the estimated biomass is 3 times of that with recruitment deviation.

10. Sensitivity: If blocking retention curves does not reduce discard rates in 1964-1988, assume smaller discard rates (25% rather than 50%) for 1964-1988. This will imply changing the retention function. *Rationale: Investigate how the estimated discarding rate, which seemed high to the GAP and GMT advisors, in the earlier years influence the results.*

Response: The new blocking retention curves (requests 7 & 8) did reduce the discard rate.

11. Show the retention curves and estimated discard rates for new base, 3 blocks and 4 blocks? *Rationale: To determine an appropriate retention time blocking.*
Response: 4 blocks were suggested after balancing model fits, differences among retention curves and fishery history. [Already concluded in request 8.]

12. Sensitivity to sigmaR that is fixed at 0.6, for the values of 0.3 and 0.9. *Rationale: Investigate the influence of using fixed sigmaR.*
Response: The results were sensitive to sigmaR as to both the mean and the uncertainty of the SSB.



13. Compare actual biomass (SSB) estimates to the 2005 stock assessment. *Rationale: Scales of the results changed largely among different model/data runs.*
Response: The scales of the SSB were very different with the SSB in 1964 from this assessment estimated at 45,523 mt compared to 105,157 mt from the 2005 assessment. The overall trends of the two assessments were generally the same. Reasons were not explored because of time limitations.

14. Do the retrospective analysis with the new base case, and jitter. *Rationale: These are standard model diagnostics.*
Response: Nothing unusual; results were very stable, with data being removed one year at a time, back to 2007. The jitter runs indicated model stability and good convergence.

15. Show profiles on R_0, M and h, with SSB and depletion presented across different parameter values. *Rationale: Further to justify parameter values to be fixed or estimated, and help identify critical parameters to bracket uncertainty.*
Response: M=0.06 resulted in a likelihood profile with the lowest position. The STAT felt this did not reflect the life history of longspine thornyhead according to

the maximum age observed. The conclusion was to use 0.111 (the mean of the prior developed by Hamel 2013) and not to use M to bracket uncertainty. The model has no information to estimate M and the scale of biomass led to more focus on the R_0 profile. The profile on *h* reached 1 for the best estimate. Ln(R_0) likelihood profile was provided, and the results indicated that this parameter is more appropriate to be used to bracket uncertainty. The longspine thornyhead assessment did not have quite the scaling problem, compared to the shortspine thornyhead assessment.

Description of Base Model and Alternative Models Used to Bracket Uncertainty

The changes made to the 2005 assessment, prior to this STAR were as follows: fisheries are grouped into one fleet because the non-trawl fishery component is minimal; the estimate of M was changed from 0.06 (estimated in the 2005 model) to 0.111313 (fixed at the mean of the prior developed by Hamel 2013); and steepness (*h*) was changed from 0.75 to 0.6.

Data used in the base model:

- Full catch history (with discard estimates) from 1964-2012 and fishery length frequency data (as available).
- Three surveys along with their respective length frequency data:
    - AFSC Slope: 1997, 1999-2001
    - NWFSC Slope: 1998-2002
    - NWFSC Shelf/Slope Combo: 2003-2012

Model structure:

- Single stock in USA waters – Canadian border to Mexican border
- One fishery (trawl and non-trawl combined)
- Begin model in 1964
- Recruitment deviations estimated from 1944+
- Beverton-Holt stock recruit relationship
- M = 0.111 fixed
- h = 0.6 fixed
- sigma-R = 0.6 fixed
- K and L at A_{max} growth parameters estimated
- Ln(R_0) estimated
- Selectivities estimated for all fisheries and surveys

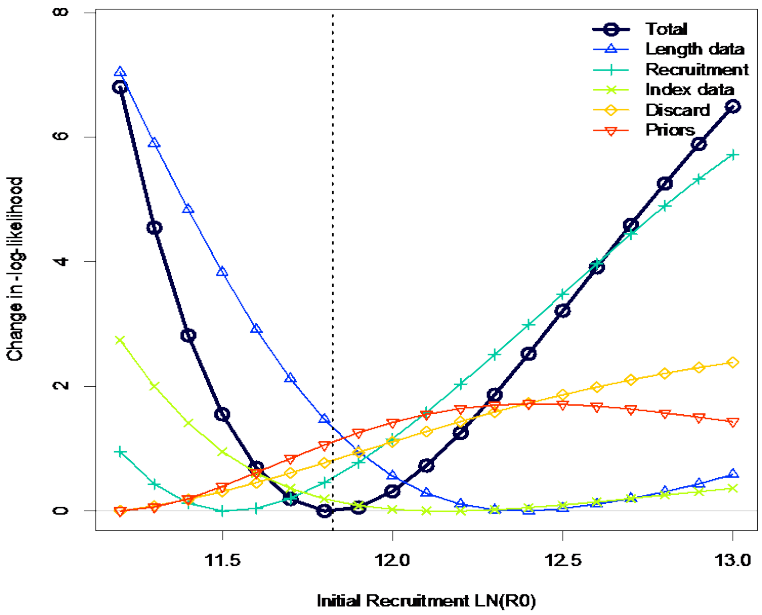
Starting with the model configuration described in the draft assessment document, the following changes were made to create a new base case:

- Errors were corrected (offset for male growth CV).
- Selectivities of the fishery and the 2 NWFSC surveys were changed to logistic instead of double normal.
- Growth parameter K was estimated instead of being fixed.

- Retention blocking: 1964-1991, 1992-2006, 2007-2010, from 2011 onward instead of 7 time blocks.

Uncertainty boundaries (low and high states of nature) were determined as follows:

a. Take the 12.5% quantile in 2013 spawning biomass estimate from the base model as the low state of nature (from the Delta Method normal approximation of variance).
b. Calculate the approximate R_0 value associated with it from the likelihood profile on R_0.
c. Determine the change in likelihood at the alternative R_0 value.
d. Add the change in the likelihood to the base model to determine the upper R_0 value from the likelihood profile to get the high state of nature. If the upper state of nature is over the largest reasonable value from sensitivity runs, then instead choose an R_0 value that represents a change in likelihood of 1.2 units from the low state of nature (the distance in log likelihood space from the 12.5% to 87.5% quantiles).



Comments on the Technical Merits of the Assessment

The STAR panel agreed that this stock assessment is based on the best available data and best available science. However, important fishery data (historical catches and discards) and key population vital rates (maturity, age and growth) are particularly lacking for longspine thornyhead, making the stock assessment only marginally sufficient to estimate the status of the resource.

This Panel suggests not conducting another full stock assessment on this stock until pertinent information is available for improvement. In the meantime, using an index of abundance (ie. NWFSC Combo Survey) to detect trends should be sufficient.

Areas of Disagreement

There were no areas of disagreement among the Panel members nor between the Panel and the STAT.

Unsolved Problems and Major Uncertainties

The STAT and the STAR Panel were not able to conclude whether the historical catch reconstruction is correct or not. Further investigation on how the species compositions were applied to the thornyhead market category in earlier years needs to be evaluated and documented.

The validation of the scale of the SSB is difficult, and the scale of SSB is sensitive to minor changes in re-parameterization and data scenarios.

Concerns Raised by the GMT and GAP Advisors During the Meeting

The GMT and GAP Advisors expressed many of the same concerns over the historical catch, estimating discards in the model, and the retention and selectivity curves that were raised and described in this STAR Panel's report for Shortspine Thornyhead. In particular for Longspine, the GAP Advisor highlighted that the differences in the survey and the fishery selectivity do not match expectations. Both advisors were satisfied with the Panel and STAT's exploration of these issues and believe the sensitivity and uncertainty in model results were adequately captured in the Decision Table's states of nature.

Research Recommendations

1. Investigate historical catch reconstruction for thornyheads. Potentially have a workshop to sort out the catch histories for longspine and shortspine thornyheads. Washington also needs to complete their historical catch reconstruction so there is a move in a forward direction for formally reviewing all of the west coast estimates.
2. Evaluate the influence of the fixed parameters by providing likelihood profiles for these parameters for different values, or release some of the fixed parameters step by step to investigate the influence of each.
3. Ageing method validation and further otolith reading.
4. Use simpler methods of providing management advice based on the estimated biomass from the NWFSC combo survey.

References

Ralston, S., D.E. Pearson, J.C. Field, and M. Key. 2010. Documentation of the California catch reconstruction project. NOAA Technical Memorandum. NMFS, NOAA-TM-NMFS-SWFSC-461.