20. Assessment of the Shark stock complex in the Gulf of Alaska

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November 2016

Executive Summary

The shark complex (spiny dogfish, Pacific sleeper shark, salmon shark and other/unidentified sharks) in the Gulf of Alaska (GOA) is assessed on a biennial stock assessment schedule that coincides with the availability of new trawl survey biomass estimates. In alternate (even) years we present an executive summary to recommend harvest levels for the next two years. For detailed information regarding the assessment, please refer to the last full stock assessment, which is available online (Tribuzio et al. 2015, http://www.afsc.noaa.gov/REFM/Docs/2015/GOAshark.pdf). A full stock assessment document will be presented in next year's SAFE report.

The complex acceptable biological catch (ABC) and overfishing level (OFL) are based on the sum of the ABC and OFL calculations for the individual species. For an off-cycle year, there is no new survey information for the shark stock complex; therefore, the 2015 estimates are used in 2016 assessment.

Summary of Changes in Assessment Inputs

Changes in the input data: There were no changes made to the assessment inputs because this was an off-cycle year.

Changes in assessment methodology: There were no changes in assessment methodology.

Summary of Results

There is no evidence to suggest that overfishing is occurring for any shark species in the GOA because the OFL has not been exceeded. Total shark catch in 2015 was 1,414 t and catch in 2016 was 1,329 t as of October 3, 2016 for GOA waters. While catch resulting from federal fisheries in NMFS areas 649 and 659 (Prince William Sound and inside Southeast Alaska, respectively, combined termed "Inside waters") does not count against the federal TAC, nor is it in the calculation of ABC and OFL, we track catch in those areas in the assessment because a substantial portion of the shark catch occurs in those areas. The combined catch in these inside waters was 154 t in 2015 and 172 t in 2016 as of October 3, 2016. We continue the recommendations from last year's full assessment. **The recommended ABC for 2017 and 2018 is 4,514 t and the OFL is 6,020 t for the shark complex combined.** There are currently no directed commercial fisheries for shark species in federally or state managed waters of the GOA, and most incidental catch is not retained.

ABC and OFL Calculations and Tier 6* recommendations for spiny dogfish for 2017-2018.

Spiny Dogfish Quantity	As estimated or *specified last* year for: 2016	2017	As estimated or *recommended this* year for: 2017	2018
M (natural mortality rate)	0.097	0.097	0.097	0.097
Tier	6*	6*	6*	6*
Biomass (t)	56,181	56,181	56,181	56,181
F_{OFL}	0.097	0.097	0.097	0.097
$maxF_{ABC}$	0.073	0.073	0.073	0.073
F_{ABC}	0.073	0.073	0.073	0.073
OFL (t)	5,450	5,450	**5,450**	5,450
maxABC (t)	4,087	4,087	4,087	4,087
ABC (t)	4,087	4,087	**4,087**	4,087
Status	As determined *last* year for: 2014	2015	As determined *this* year for: 2015	2016
Overfishing		n/a		n/a

The shark complex is Tier 6, however, spiny dogfish ABC and OFL are calculated using a Tier 5 approach. It is termed a modified Tier 6 (or Tier 6) because the estimate of biomass is not considered reliable for the species.

ABC and OFL Calculations and Tier 6 recommendations for Pacific sleeper sharks, salmon sharks and other sharks for 2017-2018.

Pacific sleeper, salmon and other sharks Quantity	As estimated or *specified last* year for: 2016	2017	As estimated or *recommended this* year for: 2017	2018
Tier	6	6	6	6
OFL (t)	570	570	**570**	570
maxABC (t)	427	427	427	427
ABC (t)	427	427	**427**	427
Status	As determined *last* year for: 2014	2015	As determined *this* year for: 2015	2016
Overfishing		n/a		n/a

Summaries for Plan Team

Species	Year	Biomass[1]	OFL[2]	ABC[2]	TAC	Catch[3]
Shark Complex	2015	76,452	7,986	5,989	5,989	1,414
	2016	56,181	6,020	4,514	4,514	1,329
	2017	56,181	6,020	4,514		
	2018	56,181	6,020	4,514		

[1]This is spiny dogfish biomass only, because the biomass estimates for the remaining shark species in the complex are not used for ABC and OFL calculations (they are estimated using average catch). The biomass used for the spiny dogfish ABC and OFL calculations for 2016 - 2017 is the estimated biomass from the random effects approach to survey averaging.
[2]ABC and OFL are the sum of the individual species recommendations, Tier 6 (avg catch 1997-2007) for Pacific sleeper shark, salmon shark, and other/unidentified sharks and a modified Tier 6 (biomass * F_{max}) for spiny dogfish.
[3]Catch as of October 3, 2016.

Responses to Comments and Research Priorities

Responses to the below listed SSC and Plan Team Comments will be provided in the next full stock assessment report, unless otherwise noted.

SSC and Plan Team Comments on Assessments in General

"…Secondly, a few assessments incorporate multiple indices that could also be used for apportionment. The Team recommends an evaluation on how best to tailor the RE model to accommodate multiple indices." (Plan Team, November 2015)

"…Finally, an area apportionment approach using the RE model which specifies a common "process error" has been developed and should be considered. This may help in some situations where observation errors are particularly high and/or vary between regions." (Plan Team, November 2015)

"The SSC requests that stock assessment authors bookmark their assessment documents and commends those that have already adopted this practice." (SSC, October 2016)

SSC and Plan Team Comments Specific to this Assessment

"The Team recommended that the authors incorporate the "shared process error" code that has been developed by ABL staff, which may improve the process used for area distribution (see section at the beginning of GOA minutes on general groundfish assessment issues)." (Plan Team, November 2015)

"The PT also noted that it continues to endorse the $F_{OFL}=F_{max}$ *rate for the spiny dogfish ABC/OFL calculations as opposed to* $F_{OFL}=M$*."* (Plan Team, November 2015)

"The SSC appreciates the responsiveness of the assessment author to SSC and GPT requests. This includes the implementation of the random effects model, development of the demographic model, investigations into the use of length based methods and biomass dynamics models, and presentation of alternative Tier 6 options. The SSC appreciates these efforts and requests that the average, maximum and median catches of the current time period be brought forward in the next assessment, with confidence intervals around the average catch alternative." (SSC, December 2016)

"The author recommended delaying implementation of the F_{max} *from the demographic model until concerns over the trawl survey gear efficiency can be addressed in the next assessment. The SSC and GPT agreed with this delay and we look forward to seeing it again at that time. The SSC requests the author bring the status quo methodology forward, in addition to* F_{max} *from the demographic model next year, and to include the methodology for the demographic model in an appendix."* (SSC, December 2016)
A presentation explaining the demographic methods was made to the GOA Plan Team at the September 2016 meeting and subsequently presented to the SSC in October 2016. We plan to include the methodology in an appendix for the next full assessment along with any further work on improving biomass estimates.

"The SSC asks the author to follow up on these outstanding issues for in future assessments:

- *Incorporation of a net efficiency study (Hulson et al in review) that uses tag data to estimate survey catchability*
- *The SSC requested a comparison of CAS and HFICE estimates in 2014, and notes the authors plan to revisit this issue for the 2016 assessment cycle, as indicated in the assessment.*
- *The SSC appreciates the inclusion of catches for areas 649 and 659 in the document, but not including them in the assessment until biomass estimates are available for State waters. The SSC continue to recommend the author explore potential sources of estimating biomass in State*

waters if sharks are believed to be a single population in state and federal waters." (SSC, December 2015)

With regards to the second bullet, a comparison between CAS and HFICE was presented to the Joint Groundfish Plan Teams at the September 2016 meeting, which was subsequently presented to the SSC during the October 2016 meeting. The Joint Plan Teams recommended that HFICE not be used for catch reconstruction, there were no further comments from the SSC.

"The Plan Team recommended continuation of research on this issue (i.e., using tag data to address catchability), and specifically recommended binning tag data into the depth strata from the survey. This may help homogenize the results from the two methods." (Plan Team, September 2016)

"The Team recommended continued work on this alternative approach to developing an F recommendation (demographic model) as well as continued work on improving biomass estimates to be considered during the 2017 cycle (this will be presented at the September 2017 Team meeting)." (Plan Team, September 2016)

"The SSC agrees with PT recommended binning tag data by depth into the bins used for the survey, possibly homogenizing the results from the two methods. The SSC recommends that the precision of satellite derived locations and its implications on inferred depth should be further considered in future analyses." (SSC, October 2016)

"The assessment author suggested that the maximum F from the demographic model could be used as an alternative to the status quo (F=M) in the 2017 cycle. The PT recommended continued work on this alternative approach for estimating F for the next cycle and noted that improvements to the biomass estimate are also needed, as the survey likely underestimates dogfish biomass The SSC concurs with these recommendations." (SSC, October 2016)

Literature Cited

Tribuzio, C.A., C. Rodgveller, K.B. Echave, and P-J. Hulson. 2015. Assessment of the Shark Stock Complex in the Gulf of Alaska. *In* Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska for 2011. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306, Anchorage, AK 99501. Pgs. 1569 – 1642.