20. Assessment of the Shark stock complex in the Gulf of Alaska (Executive Summary)

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November 2013

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. However, for the 2013 assessment cycle, which would normally be a full assessment, a summary assessment is presented due to government shutdown and the abbreviated working period.

GOA sharks are a Tier 6 complex, however, the ABC and OFL for spiny dogfish is calculated using a Tier 5 approach with the survey biomass estimates considered a minimum estimate of biomass. The complex OFL is based on the sum of the Tier 5 and Tier 6 (average historical catch between the years 1997 - 2007) recommendations for the individual species (ABC is 75% of OFL). For this summary, we have updated the time series of catch through Oct 24, 2013 to reflect any changes that might have occurred in the Catch Accounting System (for the years 2003 – 2013). For further information regarding the assessment, please refer to last year's full stock assessment, which is available online (Tribuzio et al. 2011, http://www.afsc.noaa.gov/REFM/docs/2011/GOAshark.pdf). A full stock assessment document will be presented in next year's SAFE report.

Summary of changes in Assessment Inputs

Changes in the input data:

1. Biomass estimates were updated to include the 2013 GOA biennial trawl survey.
2. Total catch for the GOA sharks from 2003 – 2013 has been updated (as of Oct 24, 2013).

Spiny dogfish are the only species in the complex which uses the swept area biomass estimates in the ABC and OFL calculations. A Tier 5 approach is used, but the species is a Tier 6 species because the biomass estimates are considered "unreliable" and "likely a minimum biomass" estimate. This approach was adopted by the SSC in 2010 and will be reviewed in the next full assessment. Trawl survey data was updated in the Tier 5 calculations for spiny dogfish. The 2013 survey had both a reduced number of stations in all strata and the 700 – 1000 m depth stratum was not sampled. It is unlikely that the skipped depth stratum impacted the spiny dogfish biomass estimate because biomass in that stratum has always been 0 t. The 2013 survey biomass estimate (160,384 t, CV = 40%) is nearly four times greater than the 2011 biomass estimate of 41,093 t (CV = 22%); this variability is typical for spiny dogfish. The 3 – year average biomass from the trawl survey that is used in calculating the ABC and OFL declined from 79,979 t (2007, 2009 and 2011 surveys) to 76,452 t (2009, 2011 and 2013 surveys) with the inclusion of the new survey data. The 2007 survey biomass estimate (161,965 t, CV = 35%) dropped out of the calculations, but because the 2013 estimate was nearly equal to the 2007 estimate, the average had only minimal change.

Substantial changes to the observer program (referred to as "observer restructuring") likely affected the catch estimates for shark species. Smaller vessels are now subject to observer coverage, and this includes vessels fishing halibut IFQ, which were previously exempt from coverage. Due to the government shutdown, there was not sufficient time to fully examine and present the impacts of the restructuring on the shark catches in this assessment. Total shark catch in 2013 was 1,019 t, up from 634 in 2012. This is the highest since 2009, but was still below the maximum historical catch of 1,538 t in 2006 (over the years 2003 – 2012). The increase in 2013 can be attributed mostly to an increase in the catch estimate of

spiny dogfish in the Pacific halibut target fishery, which was 460 t, up ~300 t from the average catch from 2003 – 2012, but was still within the range of catches from this target group. Pacific sleeper shark catch in the halibut target group in 2013 (60 t) was significantly greater than the 2003 - 2012 average (7.4 t, SD = 18.3). An additional impact of observer restructuring was that estimated shark catches in NMFS areas 649 (Prince William Sound) and 659 (Southeast Alaska inside waters) for Pacific sleeper shark and spiny dogfish by the halibut target group in 2013 was 126 t and 52 t, respectively, whereas historically it has been small (<1 t for Pacific sleeper sharks and ~14 t average, SD = 23, for spiny dogfish). There was approximately 2 t of salmon shark and other shark estimated in these areas as well. The catch in NMFS areas 649 and 659 does not count against the federal TAC, but if it were included the total catch of sharks in 2013 would be 1,199 t, which is still below the recommended ABC for this complex. It is unknown to what extent the restructuring of the observer program in 2013 may have affected catch estimation in these fisheries; future analyses will aim to investigate shifts in observer coverage and the effects on shark catch estimation.

The catch of spiny dogfish in the rockfish target group also increased this year, which is likely not related to the observer restructuring. In 2013 the catch of spiny dogfish was 86 t, significantly greater than the historical average. (7 t, SD = 10.2). It is unknown if this increase in catch is due to a change in the fishing activity, a change in spiny dogfish abundance in the area or a factor of a patchily distributed species.

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

Summary of Results

For 2014 we recommend the maximum allowable ABC of 5,989 t and an OFL of 7,986 t for the shark complex. Catch in 2012 was 634 t and in 2013 was 1,019 t (as of October 24). The complex was not being subjected to overfishing last year. The ABC/OFL for the shark complex is the sum of the computations for the individual species. A tier 5 approach is used for calculations of spiny dogfish, where exploitable biomass (B) is equal to the average of the biomass estimates from the last three trawl surveys, 2009, 2011, 2013, OFL = M*B, and ABC = 0.75*OFL. The remaining shark species follow a traditional tier 6 approach with OFL = avg. historical catch (1997 – 2007) and ABC = 0.75*OFL.

Spiny Dogfish Quantity	As estimated or *specified last* year for: 2013	2014	As estimated or *recommended this* year for: 2014	2015
M (natural mortality rate)	0.097	0.097	0.097	0.097
Tier	6*	6	6	6
Biomass (t)				
Upper 95% Confidence Interval	NA	NA	119,277	119,277
Point Estimate	76,979	76,979	76,452	76,452
Lower 95% Confidence Interval	NA	NA	33,628	33,628
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)	7,467	7,467	**7,416**	7,416
maxABC (t)	5,600	5,600	5,562	5,562
ABC (t)	5,600	5,600	**5,562**	5,562
Status	As determined *last* year for: 2011	2012	As determined *this* year for: 2012	2013
Overfishing	No	n/a	No	n/a

*While spiny dogfish are a Tier 6 species, a Tier 5 approach is used. They are not a Tier 5 because the trawl survey biomass is not considered reliable for the species.

Pacific sleeper, salmon and other sharks **Quantity**	As estimated or *specified last* year for: 2013	2014	As estimated or *recommended this* year for: 2014	2015
Tier	6	6	6	6
OFL (t)	571	571	**571**	571
maxABC (t)	428	428	428	428
ABC (t)	428	428	**428**	428
Status	As determined *last* year for: 2011	2012	As determined *this* year for: 2012	2013
Overfishing	No	n/a	No	n/a

Summaries for Plan Team

Species	Year	Biomass[1]	OFL	ABC	TAC	Catch[2]
Shark Complex	2012	76,979	8,037	6,028	6,028	634
	2013	76,979	8,037	6,028	6,028	1,019
	2014	76,452	7,986	5,989		
	2015	76,452	7,986	5,989		

[1]Biomass is the 3 – year average biomass for spiny dogfish only. The survey biomass estimates for the remaining shark species in the complex are not used for ABC and OFL calculations.
[2]Catch as of Oct 24, 2013

SSC and Plan Team Comments on Assessments in General

"The SSC concurs with the Plan Teams' recommendation that the authors consider issues for sablefish where there may be overlap between the catch-in-areas and halibut fishery incidental catch estimation (HFICE) estimates. In general, for all species, it would be good to understand the unaccounted for catches and the degree of overlap between the CAS and HFICE estimates, and to discuss these at the Plan Team meetings next September." (SSC, December 2011)

"The Teams recommend that authors continue to include other removals in an appendix for 2013. Authors may apply those removals in estimating ABC and OFL; however, if this is done, results based on the approach used in the previous assessment must also be presented. The Teams recommend that the "other" removals data set continue to be compiled, and expanded to include all sources of removal." (Plan Team, September 2012)

"The Plan Teams recommend that assessment authors retain status quo assessment approaches for the November 2012 SAFE report but also apply the Kalman filter or random effects (trawl) survey averaging methods for Tier 5 stocks and summarize the analytical results for comparison purposes only. ADMB code for implementing the random effects method will be made available." (Plan Team, September 2012)

SSC and Plan Team Comments Specific to this Assessment

"Develop biomass indices for lowest tier species (Tier 5 for crab, Tier 6 for groundfish), such as sharks, and conduct net efficiency studies for spiny dogfish. Explore alternative methodologies for Tier 5 and 6 stocks, such as length-based methods or biomass dynamics models." (SSC, June 2012)

"The Plan Team encourages the inclusion of the HFICE data in future models, and possibly some measure of fishing effort. Also, the Team suggested that using some alternative series (e.g., the ratio estimator for the period prior to 2003) may be useful for sensitivity analysis." (Plan Team, September 2012)

"The assessment authors indicated that they intend to compare results from this demographic modeling analysis with results from planned biomass dynamic models and length-based models. The SSC encourages these efforts and urges the authors to incorporate these models into an improved stock assessment for spiny dogfish in the near future." (SSC, December 2011)

"The SSC recommends that total shark catches should be incorporated into the historical catch estimates and OFL/ABC determinations. This is an important issue, as HFICE estimates approach current ABCs." (SSC, December 2011)

CIE Review of Non-Target Assessments, comments specific to this assessment

"Until recommendation 6 is addressed (review of bottom trawl survey) the bottom trawl surveys as combined are not generally useful as an absolute estimate of stock biomass; and further should not be used for management purposes until these issues are successfully resolved."

"If using the Tier 5 methods, investigate appropriate means of converting survey biomass to absolute biomass (i.e. catchability) and alternative Fmsy proxies besides F=M."

"That all shark stocks in the BSAI/GOA area are split to have separate OFL/ABC by species and region, and that the OFL be based on the Tier 6 approach as the average catch of each species individually."

"Using the maximum or average catch for Tier 6 may not be appropriate, alternatives could be to use an upper bound of a one-sided 95% or 99% confidence interval."

*"Dogfish: Clearly, there is some connection to the stock of dogfish residing the Pacific Northwest region just to the south. The connection with the assessed unit to the south should be explored further. One method of doing so would be to simply treat the BSAI through the NWP as a single unit. In the interim, average catch in the 1997-2007 should be feasible for both components. It is recognized that the GOA dogfish uses a biomass*M approach. However, in keeping with conclusion 1 the average catch is probably a more robust measure."*

"Salmon shark: they might be better off being assessed outside of the AFMC jurisdiction as a highly migratory species. Regardless, catches and encounters with inshore fisheries needs to be addressed sooner rather than later for this stock. In the interim, average catch can serve as a good proxy, but that suggestion is made grudgingly given how litter is known about this stock."

"Pacific sleeper shark: What data are available is disturbing. While most of the individuals encountered are juvenile, the overall fishery dependent and independent data suggests a declining trend. As such, while average catch is probably the only measure available for informing an OFL, SSC and managers should be aware that more precaution is warranted until further information is gathered."

"It is appropriate to base the assessment of shark on Tier 6, and not Tier 5, since the AFSC bottom trawl surveys are directed at groundfish species. Also, the bottom trawl surveys do not necessarily cover the spatial range of many shark species as suggested by the large interannual variability in CPUEs, and therefore do not provide reliable biomass estimates."

Responses to Comments and Research Priorities

Due to the government shutdown, and hence an abbreviated working period, responses to the previously listed SSC, Plan Team, and CIE comments will be provided in next year's full stock assessment report. To address several of these comments, we plan to follow the recommendations listed in the various working group reports (e.g. the methods for averaging surveys report) submitted to the Plan Team in September 2012. Evaluation of methods to estimate model parameters, uncertainty, and recommendations or prioritizations for future research to improve the assessments will likely be part of this process.

Literature Cited

Tribuzio, C.A., K.B. Echave, C. Rodgveller, P. Hulson, and K.J. Goldman. 2011. 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. 1393 – 1446.

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