Agenda Item H.6.a
GMT Report 1
November 2019

GROUNDFISH MANAGEMENT TEAM REPORT ON PROPOSED SHORT-TERM IMPROVEMENTS TO SABLEFISH ACL APPORTIONMENT METHODS

Overview

At the September 2019 meeting, the Pacific Fishery Management Council (Council) asked the Scientific and Statistical Committee (SSC) to review a proposal by the Groundfish Management Team (GMT) which could revise the methods used to apportion sablefish annual catch limits (ACLs) north and south of the 36° N. lat. management line. If endorsed by the SSC, the new ACL apportionment method would be reflected in two alternative allowable biological catch (ABC) limits being considered for the 2021-22 management cycle (i.e., P* of 0.40 and P* of 0.45). **At this meeting, the GMT requests the SSC endorse one of the two methods for apportioning sablefish ACLs.** The resulting area-specific ACLs will be used to analyze the sablefish harvest specifications for the 2021-22 management cycle.

A delay in selecting an apportionment method would jeopardize the GMT's ability to maintain the overwinter analysis schedule to support implementation of the new harvest specifications by January 1, 2021. The GMT notes that the apportionment method considered would no longer be needed if future assessments use an area-specific biomass estimation, as was suggested at the 2019 assessment. We support the area-specific biomass approach as being the best long-term approach for establishing area-specific ACLs for sablefish management.

Background

The 2019 sablefish stock assessment (Agenda Item H.5, Attachment 7, September 2019) is a coastwide assessment that produces coastwide overfishing limit (OFL) and ABC projections. As described in the Regional Management Considerations section of the assessment, the coastwide ABC can then be apportioned north and south of 36° N. lat. to determine ACLs for each management area. The status quo method apportions the ACLs based on the long-term (2003-2018) average ratio between the two areas of swept-area biomass estimates as calculated from the annual trawl survey, which we hereafter refer to as the survey distributions. There was insufficient time at the 2019 sablefish stock assessment review (STAR) panel to discuss apportionment, however, the stock assessors provided a table of the annual survey ratios that the GMT uses as a basis for alternative apportionment methods (Table 1 below, duplicating Table 29 from the 2019 assessment).

The GMT notes that this has been a topic of interest for scientists, managers, and industry, as shown by discussion during the Five-Year Review and the creation of the Sablefish Management and Trawl Allocation Attainment Committee (SaMTAAC). To address these concerns, the GMT proposes two methods for ACL apportionment for SSC review. Below, we discuss the scientific pros and cons of the currently used and the potential alternative method. The GMT notes that no method will completely capture spatial and temporal differences in age-structure or population dynamics, nor capture the movement of fish into the US California Current from the north; this is discussed more in the "Limitations for all methods" section below.

Table 1. Annual ratios of estimated survey biomass in the south and north of 36° N. lat. management line, which are the basis of Methods 1 and 2 (described below). Difference (error) is calculated as the difference in percentage points between the apportionment results and the respective survey estimates in the given year and area. The apportionment results calculated for 2019, which would be used for the 2021-22 harvest specifications, are shaded.

Survey biomass estimate ratios (Table 29 of 2019 asmt)			**Method 1 apport. results (long-term avg)**				**Method 2 apport. results (5-year rolling avg)**			
Year	**% S**	**% N**	**% S**	**% S Diff**	**% N**	**% N Diff**	**% S**	**% S Diff**	**% N**	**% N Diff**
2003	24%	76%	---		---	---	---		---	---
2004	26%	74%	24.0%	-2.0%	76.0%	+2.0%	---		---	---
2005	32%	68%	29.0%	-3.0%	71.0%	+3.0%	---		---	---
2006	29%	71%	29.0%	0.0%	71.0%	0.0%	---		---	---
2007	35%	65%	27.8%	-7.2%	72.3%	+7.3%	---		---	---
2008	31%	69%	29.2%	-1.8%	70.8%	+1.8%	29.2%	-1.8%	70.8%	+1.8%
2009	32%	68%	29.5%	-2.5%	70.5%	+2.5%	30.6%	-1.4%	69.4%	+1.4%
2010	27%	73%	29.9%	+2.9%	70.1%	-2.9%	31.8%	+4.8%	68.2%	-4.8%
2011	25%	75%	29.5%	+4.5%	70.5%	-4.5%	30.8%	+5.8%	69.2%	-5.8%
2012	23%	77%	29.0%	+6.0%	71.0%	-6.0%	30.0%	+7.0%	70.0%	-7.0%
2013	30%	70%	28.4%	-1.6%	71.6%	+1.6%	27.6%	-2.4%	72.4%	+2.4%
2014	23%	77%	28.5%	+5.5%	71.5%	-5.5%	27.4%	+4.4%	72.6%	-4.4%
2015	22%	78%	28.1%	+6.1%	71.9%	-6.1%	25.6%	+3.6%	74.4%	-3.6%
2016	22%	78%	27.6%	+5.6%	72.4%	-5.6%	24.6%	+2.6%	75.4%	-2.6%
2017	21%	79%	27.2%	+6.2%	72.8%	-6.2%	24.0%	+3.0%	76.0%	-3.0%
2018	20%	80%	26.8%	+6.8%	73.2%	-6.8%	23.6%	+3.6%	76.4%	-3.6%
2019	---	---	26.4%	---	73.6%	---	21.6%		78.4%	---

Method 1: Long-term average from bottom trawl survey biomass estimates

Background:

Method 1 is the status quo ACL apportionment option that is based on the long-term (2003-2018) average survey distributions. Method 1 was established in the 2011 sablefish assessment and has since been the basis for ACL apportionments.

Pros:

Method 1 utilizes a long time series and thus incorporates long-term variability in sablefish distributions, which respond to environmental metrics, fishing pressure, and other variables. This increases the ability of apportionment to reflect the overall signal rather than chasing the noise of an individual year. This method is easy to apply and not computationally intensive.

Cons:

Method 1 appears appropriate for the average survey distributions from 2003-2010 in the years before Method 1 was established in 2011 (Figure 1). Since then, however, there has been a fairly constant linear increase in the survey distribution to the north and a matching linear decrease in the south. These long-term averages can hinder the ability of the area ACLs to track recent observations in survey distributions.

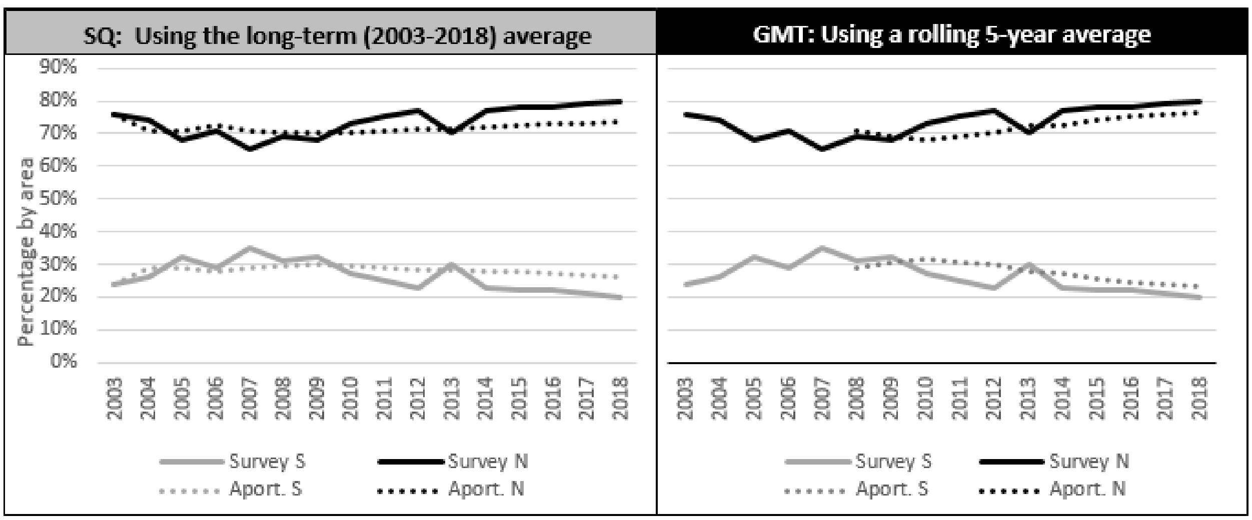

Figure 1. Sablefish ACL apportionment Methods 1 and 2 compared to the ratio observed in annual trawl survey estimated biomass distributions.

Method 2: 5-year rolling average from bottom trawl survey biomass estimates

Background:

Method 2 would use a 5-year rolling average rather than all years of data to apportion the ACLs.

Pros:

Rolling averages tend to be more responsive to both near- and long-term changes in survey distributions than a long-term average. As shown in Table 1, the 5-year rolling average results more closely align with the survey biomass distributions each year from 2014-2018 (Table 1; Figure 1).

Cons:

Although Method 2 would be more responsive to changes in future survey distribution, there would be a lag if the direction and/or slope of the distributions changed. A shorter, 3-year rolling average could be more responsive to changes in future distributions, but would be more highly influenced by outliers (e.g., 2013) in annual survey distributions that may result from the random survey design rather than reflecting relative abundance. For that reason, the GMT elected not to propose a 3-year rolling average for SSC consideration.

Limitations for both methods

Neither of the methods address the time-series nature of these data, because both treat each annual proportion as temporally and spatially independent. The use of an Autoregressive Integrated Moving Average (ARIMA) model was explored, which would allow for forecasting future values based on trends in previous year's data and could be used to determine management proportions. The error distribution for proportional data would be expected to be non-normally distributed and could be corrected by a logit transformation to fit the expectations of an ARIMA model. However, based on initial explorations, the short time-series data (e.g., 16 data points by area) did not appear to be informative regarding trends and correlations between data points. Additionally, treating the proportional data, which are model output, as data is problematic. An integrated approach currently under development within the spatial-temporal delta-generalized linear mixed effects model (VAST) used to estimate survey biomass trends for West Coast groundfish stocks could allow for forecasting future data based upon temporal and spatial patterns and account for uncertainty, but at this time this feature has not been adequately tested to understand the performance of this potential approach. If the next sablefish assessment is an update of the current single area model, using VAST forecasting should be explored for providing allocation guidance between the north and south areas.

In addition to the inability to address the lack of independence between data points, both Methods 1 and 2 face common limitations and constraints, primarily related to lack of information on international migration and spatial bias associated with the areas inaccessible to the trawl survey. The Regional Management Considerations section of the assessment notes that fish from more northerly regions may be migrating into US West Coast waters. This could be biasing survey estimates of the regional distribution of sablefish, so average estimated differences should be interpreted with caution. Further, this uncertainty leads to concerns that a higher ACL apportionment to the north could result in localized depletion, as Dr. Melissa Haltuch (lead STAT, Northwest Fisheries Science Center) discussed with the SaMTAAC. Dr. Haltuch indicated that removals off Washington and Oregon have been higher than the relative proportion of the coastwide survey estimated biomass in that area (Figure 2, from the Analysis of Sablefish Management and Trawl Allocation Attainment Issues. Agenda Item Att1, May 2019). However, this risk cannot currently be quantified due to the lack of certainty in the magnitude of sablefish migration, particularly from more northerly regions into the US portion of the California Current.

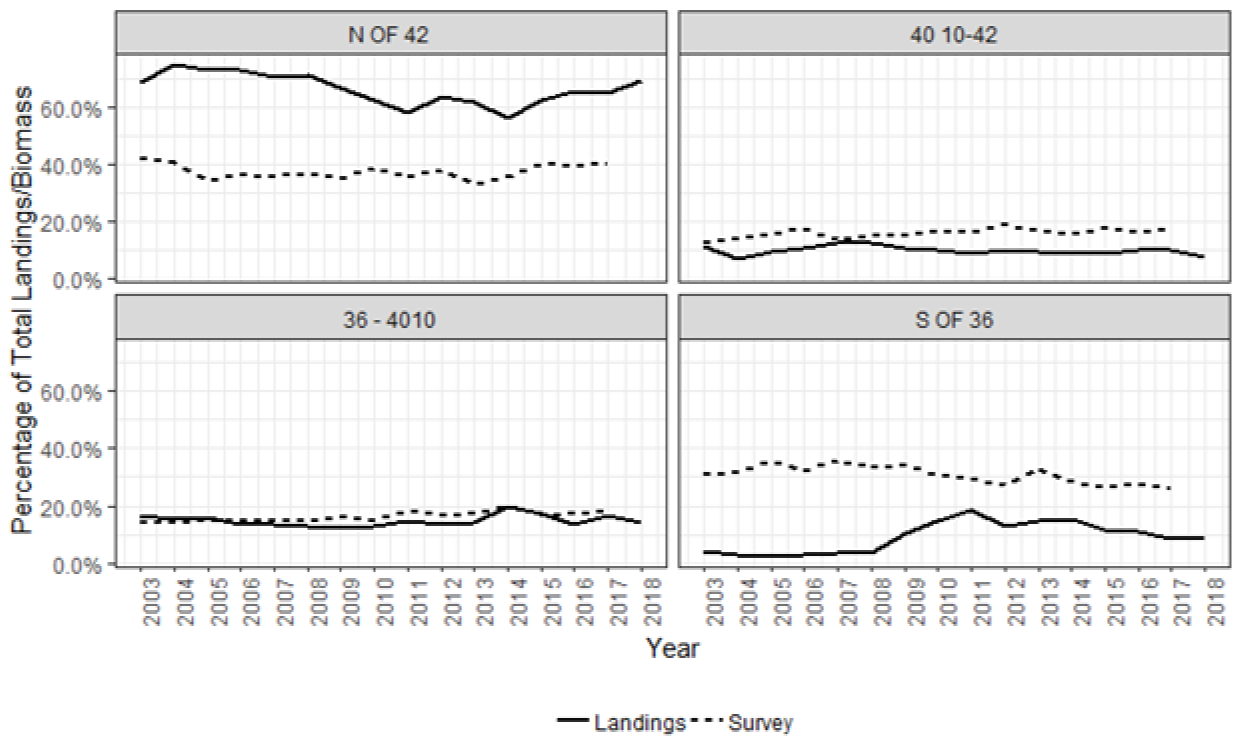

Figure 2. Percentage of total coastwide landings and trawl survey biomass estimates by area, 2003-2018. 46.9 mt of sablefish landings from 2003-2018 is not included because no spatial information was associated with the catch. Shoreside landings were queried from PacFIN on 04/24/2019; At-Sea catch was queried from NPAC 04/24/2019. Tribal and non-tribal data are included, but minor recreational discards are excluded.

The trawl survey's inability to access all habitat equally results in additional, area-specific uncertainties within the trawl survey data. For example, the survey is unable to access non-trawlable habitat in both the north and the south areas, such as bottom trawl essential fish habitat closure areas and the Western Cowcod Conservation Area. The 2011 assessment emphasized this by cautioning that using trawl survey estimates should be considered a "rough approximation" of the distribution of the sablefish stock.

Either of the two methods discussed here will need to consider how these uncertainties impact the apportionment of sablefish ACLs along the west coast. Although these unknown variables may not be fully quantifiable, they can help to inform the selection of the most appropriate method to use moving forward.