Report of the National Marine Fisheries Service/Pacific Fishery Management Council Workshop on Pacific Sardine Distribution

The Role of Distribution in the Harvest Control Rules for Pacific Sardine

Distribution forms one term in the OFL, ABC, and HG control rules for the Northern Subpopulation (NSP) of Pacific Sardine

OFL = Biomass * Fraction * Distribution

ABC = Biomass * Fraction * Distribution *$Buffer_{pstar}$

HG = (Biomass – Cutoff) * Fraction * Distribution

Distribution is currently set at 0.87, a constant selected when Amendment 8 was adopted.

Overall Objective

Rationale and Objectives

One part of the settlement agreement related to *Oceana, Inc. v. Penny Pritzker, et al*. (Ninth Circuit No. 13-16183; District Court No. C-11-6257 EMC (N.D. Cal.)):

To examine and discuss the DISTRIBUTION parameter in the Pacific sardine harvest control rule used in setting management reference points to account for the presence of sardine in the waters of the United States, Mexico, and Canada. Workshop participants are expected to compile the best available scientific information on the distribution of Pacific sardines along the North American Pacific coast as well as examine potential alternative means of accounting for the fact that some portion of Pacific sardine stock exists and is subject to catch outside of U.S. waters.

Participants

Principal Participants:

- Andre Punt (Chair, SSC)
- Tom Jagielo (SSC)
- Owen Hamel (SSC)
- Cleridy Lennert-Cody (IATTC)
- Cyreis Schmitt (ODFW/CPSMT)
- Kirk Lynn (CDFW/CPSMT)
- Alan Sarich (Quinault Indian Nation/CPSMT)
- Sam McClatchie (SWFSC)
- Kevin Hill (SWFSC)
- David Demer (SWFSC)
- Nancy Lo (SWFSC, retired)
- Larry Jacobson (NEFSC)

Invited Participants:

- Mike Okoniewski (CPSAS)
- Diane Pleschner-Steele (CWPA)
- Geoff Shester (Oceana)
- David Crabbe (Council member)
- Corey Niles (Council member, WDFW)
- Linnea Flostrand (Canada DFO)
- Tim Baumgartner (CICESE, Mexico)
- Frank Lockhart (Council Member, NMFS WCR)

Coordinators:

- Josh Lindsay (NMFS WCR)
- Dale Sweetnam (SWFSC)
- Mike Burner (PFMC)
- Kerry Griffin (PFMC)

Terms of Reference

ALTERNATIVES CONSIDERED

- Setting the value for the Distribution parameter annually as part of the specifications process based on the most recent data on the actual mean distribution of the Pacific sardine stock in U.S. waters.
- Using landings information from Canada and Mexico to account for catch in the waters of those nations in estimating the Distribution parameter in the HCR, using work from recently published scientific studies regarding Pacific sardine management.
- Estimating the stock biomass in U.S. waters only, instead of the total sardine biomass, in the stock assessment.
- Using a numerical-based Distribution parameter as an alternative to the existing percent-based Distribution parameter.
- Using a temperature-based model to predict the proportion of Pacific sardines in U.S. waters for a particular year.

PLUS

- Considerations for revising the Pacific Sardine Distribution Parameter (proposed by Oceana)

Alt 1: Setting Distribution Annually (Data Sources)

Spotter data

- The basis for the 0.87 currently used for Distribution
- **Key assumptions / issues:**
  - No data since 2001 or from the Pacific Northwest
  - No allocation of sardine to the northern and southern subpopulations
  - No data from “high abundance years”
- **Research and Analysis Recommendations:**
  - Re-analyse the whole data set using standard linear regression methods

Acoustic trawl data

- Collected with the intent to survey the entire stock
- **Key assumptions / issues:**
  - Only collected in spring and summer
  - No data from “very low abundance years”
  - Mexican and US surveys have yet to be make comparable.
- **Research and Analysis Recommendations:**
  - Make the US and Mexican acoustic trawl survey comparable to allow additional comparisons to be made.

Alt 1: Setting Distribution Annually (Data Sources)

Ichthyoplankton data

- Data are available for many years and for Mexico and the US
- **Key assumptions / issues:**
  - Spatial coverage of the data has reduced over time (no CalCOFI data from Mexico or north of Point Conception)
  - Data relate to spawning fish, not fishable fish
  - No allocation of sardine to the northern and southern subpopulations
- **Research and Analysis Recommendations:**
  - Conduct additional comparisons between Mexico and Canada, and develop a time-series of values for Distribution as a function of year, environmental conditions, etc.

Alt 1: Overall Conclusions

There is NO data set that

- provides full spatial coverage of the range of the northern subpopulation of Pacific sardine
- provides data for multiple seasons throughout the year (spring, summer, fall, winter)
- is available for “very low,” “low”, “high” and “very high” abundance periods.

Some of the data sets could be improved and used to identify periods / factors which would lead to different values for Distribution:

- Abundance
- Presence in Canada (and Mexico)
- Environmental conditions

Alt 2: Using landings data to estimate distribution

Landings data

- Landings data are available for many years and can be assigned to the northern and southern subpopulations
- **Key assumptions / issues:**
  - catches are generally a poor reflection of abundance;
  - factors impacting catches include effort, management regulations, and economic factors; and
  - estimates of Distribution based on catches differ quite substantially from 0.87 in some years, but whether this reflects abundance is unclear.

Alt 2: Using landings data to estimate distribution

- The issue:
  - The OFL control rule (less Distribution) was developed to maximize yield.
  - Canadian and Mexican catches of sardine do not need to follow the US control rules.
  - Catches (in total) could exceed the output of the OFL control rule (less Distribution).

- A potential solution:
  - The US HG be set as the output of the HG control rule (ignoring distribution), with a prediction of the Mexican and Canadian catch in the upcoming fishing year removed. If well estimated, this should improve the ability to avoid catches exceeding “implied OFLs”.

Alt 2: Using landings data to estimate distribution

- Research and Analysis Recommendations
  - Alternative approaches to predicting foreign catches could be investigated
  - A full evaluation of this solution would require an MSE (to assess its implications on the US fishery). This analysis should also account for the variability of the population, of the foreign fishery, and of the assessment process.

Alt 3: Estimating the stock biomass in U.S. waters only

- Conducting assessments that estimate biomass in US waters:
  - While possible in principle, the data are not available to apply spatially-structured assessment models
  - Conducting assessments in which data from Mexico and Canada are ignored would lead to biased estimates (and would not be best practice)
- Basing the OFL, ABC and HG on the estimates of biomass from the acoustic trawl surveys:
  - This type of approach is used elsewhere in the world.
  - Adoption of this approach could occur only following further analysis
- Research and Analysis Recommendations:
  - Conduct an MSE to evaluate the implications in terms of achieving management goals.
  - Conduct tagging of Pacific sardine to support a “US waters only” spatial assessment model.

Alt 4: Using a numerical Distribution parameter

This would entail modifying the HG control to:

HG = {(Biomass – Cutoff) – Distribution}*Fraction

where distribution is tonnage.

- The workshop considered various options, in particular, related to catches, for how to define “Distribution” in this case, but no specific suggestions were raised during the workshop.

Alt 5: Using a temperature-based model to predict distribution

- Models exist that predict “potential sardine habitat” and these are used to allocate catches between the southern and northern subpopulations.
- “Potential habitat” need not correlate well with distribution, especially when abundance is low.
- Using an environmental based model to predict habitat to predict Distribution does not appear a promising approach, especially at low abundance.

Other issues

The Workshop made several additional research recommendations and suggestions:

- How to refine the method used to allocate catches to the northern and southern subpopulations
- An MSE could be conducted to more fully understand the consequences of catches off Canada and Mexico not following the US control rules.
- There would be benefit to establishing a joint management regime with Mexico and Canada.

Acknowledgements and thanks

- There was little lead time before the workshop, but the work presented to the workshop was of a very high standard.

- The SWFSC and PFMC staff provided excellent support to the participants.