



CALIFORNIA WETFISH PRODUCERS ASSOCIATION

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March 15, 2018

Mr. Phil Anderson, Chair
And Members of the Pacific Fishery Management Council
7700 NE Ambassador Place #200
Portland OR 97220-1384

RE: Agenda Item C.5. Pacific Sardine Assessment, Harvest Specifications, and Management

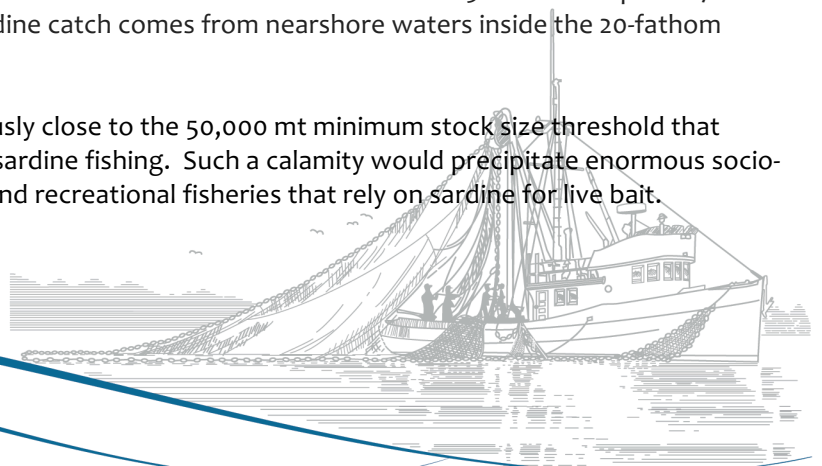
Dear Mr. Anderson and Council Members,

As Executive Director of the California Wetfish Producers Association (CWPA), I represent the majority of coastal pelagic species 'wetfish' fishermen and processors in California. Until recent years, California's wetfish industry has contributed 80 percent or more of total commercial fishery landings in the Golden State, representing close to 40 percent of dockside value statewide. Sardine has been the foundation of this industry since historic times, and fishermen and markets alike had been hoping the abundance that fishermen have been seeing the past few years would translate into harvest opportunity.

We all were shocked to learn that the 2018 update assessment has somehow lost another 34,521 mt of biomass! This is despite the record observations of both sardine and anchovy pelagic juveniles in the 2015 juvenile rockfish survey, the large catch of small sardines in the 2015 summer Acoustic Trawl cruise (which were omitted from the model because adding the length comps. essentially blew it up to "unreasonable" heights), and despite the fourfold increase observed in the 2016 ATM survey.

How did this happen? The 2018 update assessment is based mainly on the 2017 summer acoustic trawl cruise that ran from British Columbia to Morro Bay, CA, but did not include the area south to Pt. Conception or Southern California where fishermen have reported very large schools of sardines for the past three years. In part, this is because the acoustic trawl surveys cannot gather data in nearshore waters inside about 50 meters depth – 27 fathoms. But 70 to 80 percent of California's sardine catch comes from nearshore waters inside the 20-fathom curve.

This update estimate of only 52,065 mt, is perilously close to the 50,000 mt minimum stock size threshold that under current policy would preempt virtually all sardine fishing. Such a calamity would precipitate enormous socio-economic impacts both to our wetfish industry and recreational fisheries that rely on sardine for live bait.



The elephantine problem with this update assessment is that it belies reality: fishermen are seeing more sardines, not less, especially in nearshore waters in California where the NOAA acoustic surveys conducted to assess coastal pelagic species do not go. The 2018 update assessment of 52,000 tons, down from 86,586 tons in 2017 and 106,100 tons the year before, is based on a model that was characterized as the “least worst” option in the 2017 STAR Panel review, and included a change in methods and assumptions in estimating population size.

The 2017 sardine STAR Panel report noted that **the results are generally robust to assuming that selectivity is a logistic function of length (but that implies that some age-1+ animals are not available to the ATM survey)**

Scientists acknowledge that assuming the acoustic survey ‘sees’ all the fish leads to lower biomass estimates. Yet the STAR Panel report also stated this: **The estimate of age 1+ biomass is less than the estimate of age 1+ biomass on 1 July 2016 from the 2016 stock assessment (106,137t). This is a consequence of the change in assessment methodology, in particular that selectivity for the ATM survey is assumed to be uniform for fish aged 1 and older (assuming that selectivity is logistic in model ALT increases the estimate of 1+ biomass from 86,586t to 153,020t).**

It is obvious to fishermen that the survey selectivity is not uniform! The survey missed a lot of fish, yet Model Alt estimated a Q of 1.15 in the 2018 update assessment, notwithstanding the 2017 sardine STAR panel review statement that a Q of 1.1 was “unlikely”. (Please also see our comments re: Agenda Item C.3.b. the ATM Methods Review). In fact, with different assumptions, the 2017 biomass estimate would increase from 86,586 tons to 153,020 tons.

We ask the Council to ask the stock assessment team to rerun the model with the assumption that selectivity is logistic. It would be interesting to learn what that biomass estimate would be.

Given these concerns, coupled with the concerns expressed in both the 2017 sardine STAR panel review and the recent ATM methods review regarding current assessment methodology, and in light of the inflexibility in the current Terms of Reference for stock assessments, preventing the use of “best available common sense” in these flawed situations, **we respectfully request another sardine STAR panel review as soon as possible, including consideration of all available indices, such as the juvenile rockfish survey and the CDFW/CWPA aerial survey.**

In light of the uncertainty in this update stock assessment, we also recommend the following:

- **The update specifies ABC for Tier 1 as 10,823 mt. We recommend readopting the management measures approved in 2017, including the addition of a research set aside as part of the ACL to allow both the PNW and CA EFP research.**
- We note that the fishery start date was changed only a few years ago because the stock assessment team (STAT) complained they did not have time to process and analyze data in time for a January 1 start date. **We do not support changing the start date back to January, because we do not support moving to a survey-based assessment, in light of all the concerns expressed.**
- We also note that the assumed birthdate for sardine is July 1. If the start date reverted to January 1, the STAT would still need to project biomass, so similar issues would prevail.
- Another issue that I noted in my CPSAS statement in the STAR panel report: Assigning July 1 as the standardized birth date for sardine also presents problems, particularly in light of recent year ocean conditions that have precipitated sardine spawning earlier in the year, too early to be observed in April DEPM surveys, and producing age-0 fish assumed too small to be captured in ATM surveys. Yet an abundance of small fish exists!

I’m attaching for your review a summary of key points from the 2017 sardine STAR panel review, and my comments as CPSAS representative.

I appreciate your consideration of our deep concern with the 2018 sardine update stock assessment and our request to approve a new STAR panel review as soon as possible.

Thank you.

Best regards,



Diane Pleschner-Steele
Executive Director

EXCERPTS FROM SARDINE STAR PANEL MEETING REPORT
(Agenda Item G.5.a, April 2017)

3) Technical Merits and/or Deficiencies of the Assessment

Alternative assessment approaches

The Panel considered four ways to estimate age 1+ biomass on 1 July 2017: (a) use the estimate of biomass from the summer 2016 ATM survey, (b) project the estimate of biomass from the summer 2016 ATM survey to 1 July 2017 using the 'survey projection' model (or an alternative approach), (c) model ALT, and (d) the model on which the 2014-16 assessments were based. **The Panel had concerns with, and comments on, all of these methods:**

- Assuming that the 1 July 2017 biomass equals the estimate of biomass from the summer 2016 ATM survey ignores mortality (from natural causes and from fishing), growth and recruitment from July 2016 to July 2017. However, this method is simple to implement because it does not rely on a model, nor does it rely on estimates of age composition for which sample sizes are low.
- Projecting the biomass from the 2016 ATM survey to 1 July 2017 accounts for mortality, growth and recruitment from July 2016 to July 2017. **However, the approach used to convert from length composition to age composition is incorrect, and the method used to derive the CV of age 2+ biomass does not allow for uncertainty in population age composition, projected weight-at-age and maturity-at-age.** In addition, the method relies heavily on model ALT because approximately half of the age 1+ biomass on 1 July 2017 consists of age-1 animals, i.e. the estimate of this biomass is based to a substantial extent on the stock-recruitment function from model ALT. Finally, the value for M of 0.6yr^{-1} has no clear justification. The version of the projection model provided initially to the Panel did not account for catches so it could not be applied were the targeted sardine fishery to be re-opened, and does not account for the limited catches during 2016.
- **Model ALT has several of the problems associated with the 'survey projection' model, i.e. the age-composition data are based on a year-invariant age-length key, and the basis for $M=0.6\text{yr}^{-1}$ lacks strong empirical justification (and indeed likelihood profiles indicate some support for lower M than the value adopted for model ALT). In addition, the model presented to the Panel predicted age-0 catch in the ATM survey even though it is assumed that age-0 animals are not selected during the ATM survey.** It appears that the model predictions of age-0 animals in the ATM survey are actually model-predicted numbers of age-1 animals that are predicted to be mis-read as age-0 animals. However, examination of the ATM survey length-frequencies suggests that that some age-0 animals (or animals that were spawning earlier in the year) are encountered during the surveys (Fig. 5). **Model ALT estimates Q to be 1.1, which is unlikely given some sardine are not available to the survey owing to being inshore of the survey area.**

- The model on which the 2014-16 assessments were based was approved for management by the 2014 STAR Panel. However, **that assessment had some undesirable features, including extreme sensitivity to the occurrence of small (<~15cm fish) in the ATM surveys, poor fits to the length-composition and survey data, and sensitivity to the initial values for the parameters** (i.e. local minima). These sensitivities and the resultant high uncertainty about population scale were noted in previous reviews.

The Panel explored alternatives to the current selectivity formulation to better understand why model ALT was predicting age-0 catch when selectivity for age-0 fish was set to zero. **It was noted that the results are generally robust to assuming that selectivity is a logistic function of length (but that implies that some age-1+ animals are not available to the ATM survey)**, allowing for time-varying age-0 selectivity, and estimating a separate selectivity pattern for ATM survey age-composition data.

The Panel noted that the 'survey projection' model and model ALT **both rely on the samples from the ATM surveys to compute weight-at-age and survey age-composition data. The samples sizes for age from each survey are very small (16 – 1,051), which means that estimates of, for example, weight-at-age are highly uncertain.** The procedure of ensuring that weight-at-age for a cohort does not decline over time seems intuitively correct. However, if the estimated mean weight of young fish in a cohort is anomalously high or low due to sampling errors (owing to small samples), it can impact the weight-at-age of that cohort for all subsequent ages.

Given the current management approach that requires an estimate of age-1 biomass at the start of July, the Panel and STAT agreed that model ALT was the best approach at present for conducting an assessment for the northern subpopulation of Pacific sardine, notwithstanding the concerns listed above. The results from the assessment are robust to changes to how selectivity is modelled, the value for steepness and data weighting, **but there were several concerns with this model that could not be resolved during the Panel meeting. Assuming uniform selectivity leads to lower estimates of current 1+ biomass, but this assumption reflects the expectation that all fish in the survey area are vulnerable to detection during an acoustic survey.**

The estimate of age 1+ biomass on 1 July 2017 from model ALT is 86,586t (CV 0.363). Model ALT indicates that age 1+ biomass has rebuilt close to that in 2014, owing to a substantial increase in biomass based on the indices from the survey (Fig. 6). **The estimate of age 1+ biomass is less than the estimate of age 1+ biomass on 1 July 2016 from the 2016 stock assessment (106,137t). This is a consequence of the change in assessment methodology, in particular that selectivity for the ATM survey is assumed to be uniform for fish aged 1 and older (assuming that selectivity is logistic in model ALT increases the estimate of 1+ biomass from 86,586t to 153,020t).**

5) Unresolved Problems and Major Uncertainties

The core issues for stock assessments continue to be related to the temporal and spatial scale of the surveys and **insufficient sample sizes of age-length for sardine in the ATM survey.** The ability of a single boat following fixed transects along the entire sardine NSP region over a single period to sufficiently observe and sample a highly mobile schooling fish that exhibits high variability in recruitment, migratory patterns and timing, school structure, and depth distribution remains a core challenge. The relatively small sample size of sardine for biological analysis remains a concern related to acoustic expansions, population model estimates, and projection forecasts that depend on age composition and size-at-age information. A solution may require more resources than SWFSC has at its disposal so that will require Council action; resolution of this issue is outside of the ability of the Panel to address.

The Panel identified concerns with all of the proposed assessment approaches as highlighted in Section 3 of this report. **In relation to model ALT, the Panel was unable to fully resolve the issue of observations of age-0 animals in the ATM survey age compositions, and how to compute age-composition and weight-at-age for the ATM survey.**

EXCERPT FROM CPSAS STATEMENT
SARDINE STAR PANEL REVIEW 2017

The CPSAS representative commends the Panel and STAT for their extensive and thoughtful body of work throughout the 2017 sardine STAR panel. Unfortunately, the 2017 sardine assessment again encountered the same difficulties observed in previous STAR panels. **Most of the unresolved problems and major uncertainties listed in the 2011 and 2014 STAR panel reports still exist.**

Earlier panels pointed out significant scaling issues. The 2017 assessment also encountered issues with ageing, notably an **age-length key that was deemed incorrect**. One persistent problem is the very small sample size for biological composition data obtained during ATM surveys and other sampling; another is the high variability in length-at-age observed in sardine year-to-year. As pointed out during the meeting, an age/length key averaged over seasons is not valid; it ignores differential cohort strengths. This presents a major problem in model projections, and adds another layer of uncertainty considering the current time lag between field surveys and the development of either ATM survey-based or model-based management advice for the fishery.

Assigning July 1 as the standardized birth date for sardine also presents problems, particularly in light of recent year ocean conditions that have precipitated sardine spawning earlier in the year, too early to be observed in April DEPM surveys, and producing age-0 fish assumed too small to be captured in ATM surveys. Yet an abundance of small fish exists! In fact, the 2015 summer ATM survey did encounter a spike of very small fish. A record number of pelagic juvenile sardines (and anchovies) also was found in the 2015 juvenile rockfish cruise. However, the length-composition data for the small fish were omitted from the assessment model in 2015 because the biomass estimate produced was “unrealistic.”

Ironically, none of the approaches considered at this STAR panel meeting found adequate evidence of recruitment in 2016 to boost the stock assessment “number” in 2017. In fact, the projected biomass estimate for 2017 is lower than 2016 at a time that sardines are increasing in abundance, apparently coast-wide, but certainly in California. The current report attributed this to a change in assessment methodology.

Fishermen from the Pacific Northwest and California who attended the STAR panel meeting reported that they have observed an abundance of 3-6 inch fish for the past couple of years, particularly in live bait catches. California fishermen delivered samples of these fish to the SWFSC and California Department of Fish and Wildlife (CDFW). But while the 2016 draft stock assessment did include a small number of live bait catches (now the only active non-treaty fishery for sardine on the West Coast), the corresponding biological-composition data were not aged and hence included in the assessment.

In the opinion of the fishermen, an opinion shared by this CPSAS representative, **none of the four approaches considered during the panel meeting accurately reflect the biomass of sardine now in the ocean.** The Panel also voiced concerns with all the methods presented; those concerns are reflected in the body of this report under **Technical Merits and/or Deficiencies of the assessment.**

The CPSAS representative highlights major concerns, including:

- The STAT now recommends the ATM survey as the most objective survey method. However, ATM surveys at present do not capture fish in the upper water column, nor a large biomass of young fish (sizes 3 inches and up) that fishermen have observed in nearshore waters since late 2014; this biomass is largely inside ATM survey tracks. But the ATM survey is assigned a catchability quotient (Q) of 1 nonetheless, meaning it “sees” all the fish. The Q for Model ALT, which is based largely on ATM survey data, is estimated at 1.1, which the STAR Panel report calls into question, given for example the unquantified volume of fish in nearshore waters.
- **The summer 2016 ATM survey reported a fourfold increase in age 1+ biomass, but the biomass estimate produced is substantially lower than the estimate used for management in 2016. The STAR panel found fault with the methodology used to project the 2016 biomass to 2017. So do we – but using the 2016 ATM biomass estimate without adjusting for recruitment ignores reality.**

- In addition, the proposal to simply use the biomass estimate from the summer ATM survey directly, to avoid uncertainty in model assumptions, could bypass surveying a substantial portion of the biomass if/when cruises are shortened, or disrupted. For example, the 2017 summer survey schedule is only 50 days, down from 80 days in 2016. This means the survey may not extend much below San Francisco, which will miss a substantial portion of California's historical fishing grounds.
- Also, a proposal to change the fishing season start date to more closely follow the survey, thus avoiding the need to project recruitment, is not as simple as it sounds. The current seasonal structure is tied to an allocation framework that would require serious discussion and analysis before any change could be implemented.
- At the end of the day, **the STAR panel cautiously recommended proceeding with Model ALT, as the "least-worst" way to produce the age 1+ biomass estimate and CV required for management in 2017.** The CPSAS hopes the SSC and Council will acknowledge all the caveats, and recognize that this is a "stop-gap" approach until the ATM methodology review can be accomplished in 2018, along with further review and improvement of Model ALT input and assumptions and potential review of other assessment indices.
- **The CPSAS representative again voices concern that stock assessments appear to be gravitating toward one independent index measuring one point in time, based on ATM surveys. We strongly encourage a continuation of multiple surveys as each survey type has strengths and weaknesses.** Other fishery-independent research, i.e. the juvenile rockfish survey, was informative in 2016 and should be approved to provide information for future sardine stock assessments, as this could serve as another indicator of recruitment.
- **Clearly the small sample size and inadequate biological composition data are causing serious problems in assessing the sardine (and anchovy) resource. Industry has offered to help collect data, and we hope this offer will be acted upon in a way that such information can be incorporated into future stock assessments.**
- As we have noted in the past, industry wants to see a sustainable resource (to the degree that environmental conditions will allow) that is in no danger of being overfished. Current sardine stock assessments and harvest policy are very precautionary. We sincerely hope that going forward we can develop a truly collaborative research program for the CPS complex.

Other recommendations:

- Please work collaboratively with industry to resolve persistent data deficiencies, including assessing the nearshore, upper water column, and the need for substantial increase in sample size and biological composition data for sardine (and other CPS), particularly ageing.
- Recognize that the 2017 assessment is "déjà vu all over again" and most of the unresolved problems and major uncertainties listed in the 2011 and 2014 STAR panel reports still exist.
- Prior panel, SSC, CPSMT and CPSAS reports have recommended a methods review of the ATM survey ASAP as a high priority research and data need. We continue to emphasize this need, and further recommend that such review also encompass review of Model ALT and other potential data collection options, including the juvenile rockfish survey, CDFW/CWPA aerial survey and any other promising data collection prospects available by the time of the scheduled ATM review in January 2018.
- We also support the STAT high-priority recommendation to address: *"technical issues related to echosounder deployment and associated signal interpretation (e.g., uncertainty surrounding species-specific target strength [TS], sonar bias related to backscatter uncertainty, and areas of the upper water column that potentially are not capable of being surveyed)."*

Finally, the CPSAS representative points out that improving survey and assessment methodology to accurately reflect abundance of sardine (and other CPS) is absolutely essential: the future of the industry hangs in the balance.