

To: Pacific Fishery Management Council, Attn: Mr. Kerry Griffin, Pfmc.comments@noaa.gov
From: Drs. David A. Demer and Juan P. Zwolinski

Re: Comments on the Report of the National Marine Fisheries Service/Pacific Fishery Management Council Workshop on Pacific Sardine Distribution (hereafter, the Report)

The following letter is to be included in the advance briefing book materials for consideration by the Pacific Fishery Management Council at its November 2015 meeting in Garden Grove, California, 15 November. The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the authors and do not necessarily reflect the views of NOAA or the Department of Commerce.

At the 2015 Pacific Sardine Distribution Workshop, held 17-19, August 2015 at the Southwest Fisheries Science Center (SWFSC), Dr. David Demer, SWFSC, presented “Variations in the spatial distribution of an internationally exploited migrating stock of Pacific sardine (*Sardinops sagax*) for consideration in the U.S. Harvest Control Rule,” Demer and Zwolinski (2015). This paper (identified as Principal Document 1 in the Report and "Using Landing Data to Estimate Distribution II - Demer-Zwolinski.pdf" on the Council's ftp site) shows that the method proposed by Demer and Zwolinski (2014) would serve to annually optimize the harvest quota to better achieve the ‘target total fishing fraction’, defined in the CPS FMP (PFMC, 1998). Demer and Zwolinski (2015) add a foreign-landings estimation-error term and demonstrate the efficacy of their refined method using 1994-2014 landings data and estimates of the northern-stock sardine biomass from the 2015 sardine stock assessment (Hill et al., 2015). A workshop member noted that the method could also be evaluated using the biomass estimates that were used each year of the federal management period (2001-2015). Responsive to this suggestion, Demer and Zwolinski (*in review*) show, as in their previous works, that irrespective of the biomass time-series used, accounting for annual landings at Ensenada and Vancouver Island stabilizes the total fishing fraction about the target total fishing fraction. Whether the U.S. sardine harvest is annually optimized by subtracting the expected foreign landings from the target total harvest, or the distribution parameter is annually adjusted to achieve an equivalent result, the method proposed by Demer and Zwolinski (2014, 2015, *in review*) appears to be compatible with the PFMC's present approach to accounting for multi-national fishing.

In the following, we comment (paragraphs in bold) on sections in the Report (quoted) related to the methods and results in Demer and Zwolinski (2014 and 2015), presented at the Distribution Workshop.

1. TOTAL FISHING FRACTION IS DEFINED IN THE CPS FMP

"The workshop noted that the concept of a 'total fishing fraction' as described in Primary Document 1 does not exist in the CPS FMP."

Amendment 8 to the CPS management plan (PFMC, 1998) states that "In the absence of a cooperative management agreement [for a transboundary stock], the default approach in the CPS FMP sets harvest levels for U.S. fisheries by prorating the total harvest level according to the portion of the stock resident in U.S. waters...". "Total harvest level" refers to parameter H in the general form of the MSY control rule:

$$\mathbf{H = (BIOMASS-CUTOFF)*FRACTION ,}$$

and therefore FRACTION is the total fishing fraction.

2. DISTRIBUTION PARAMETER INTENDED TO ACHIEVE THE TARGET FISHING RATE

"The approach for accounting for the transboundary nature of the stock by subtracting foreign landings from U.S. OFLs, U.S. ABCs., and U.S. HGs aims to achieve different objectives (to prevent coastwide overfishing and achieve a target coastwide fishing rate; Demer and Zwolinski, 2014b and Primary Document 1) than the current Distribution term."

The above statement contradicts the following statement in the Report:

"Josh Lindsay stated that although the Magnuson-Stevens Act (MSA) does not mandate a harvest reduction to account for fishing on the same stocks by fisheries beyond the jurisdiction of the U.S., for stocks such as Pacific sardine for which there is no international management, if the stock becomes "...overfished, or is approaching a condition of being overfished due to excessive international fishing pressure, ... then the Secretary and/or the appropriate Council shall take certain actions..." (Section 304(i) of the MSA). Such actions include the Secretary or appropriate Council developing recommendations to end overfishing and/or to rebuild the stock, taking into account the relative impacts of the U.S. fishery. For Pacific sardine, he stated that this would likely look something like what is already done under the CPS FMP using the Distribution parameter to unilaterally reduce the level of U.S. fishing".

As explained, when there is a need to account for international fishing, prevent overfishing, and/or promote rebuilding of the stock, the “Distribution parameter” is used unilaterally to limit U.S. fishing.

3. DEMER AND ZWOLINSKI’S METHOD IS DERIVED INDEPENDENTLY

“Under this scenario, an estimate of the proportion of stock biomass off the U.S. would no longer be used in the various control rules; instead, an amount of biomass would just be subtracted from the total biomass. For instance, as it relates to the current sardine HG control rule, this would likely not involve increasing or modifying the existing Cutoff in the control rule that has its own explicit function, but may look something like the re-construction of the control rule shown below:

$$HG = \{(Biomass - Cutoff) - Distribution\} * Fraction \quad (2)$$

Here, Distribution becomes some amount of biomass that is subtracted from the total biomass before applying the applicable harvest rate for setting U.S. catch levels. No suggestions for how to compute Distribution in Equation 2 were included in the primary documents and presentations to the workshop”

Eq. (2) in the Report is the algebraic equivalent of Eq. (11) in Demer and Zwolinski (2014) and Eq. (2) in Demer and Zwolinski (2015), where “Distribution”*F = Demer and Zwolinski’s $L_{foreign,y-1}$.

Although, “Distribution” in Eq. (2) above has units of biomass (t) and does not represent the proportion of sardine biomass in U.S. waters as defined by the CPS FMP (PFMC, 1998), Dr. Demer’s presentation and Demer and Zwolinski (2014 and 2015) propose practical methods for computing $L_{foreign,y-1}$ or “Distribution” ($=L_{foreign,y-1}/F$).

4. DEMER AND ZWOLINSKI’S METHOD IS EFFECTIVE USING ANY BIOMASS SERIES

"Testing of the methods in Primary Document 1 assumed perfect knowledge of the population status in every year based on the 2012 (Demer and Zwolinski, 2014) or the 2015 (Demer and Zwolinski, 2015) assessment." ... "This leads to an implication of great improvement in results with the “optimal” method, when, in fact, the gain is certainly almost entirely due to the assumption of perfect knowledge of the stock biomass."

The methods presented in Demer and Zwolinski (2014, 2015, and *in review*) for optimizing U.S. quotas to better match the target total fishing fraction are applicable to any time series of biomass and landings. To demonstrate this, Demer and Zwolinski (*in review*) apply the optimization

methods to data from the 2000 – 2015 assessments, and the 2015 assessment. Both analyses confirm the original conclusions in Demer and Zwolinski (2014 and 2015).

5. DEMER AND ZWOLINSKI'S METHOD IS INCORRECTLY EVALUATED

“A more correct application of the method to the actual time series of quotas and landings (see Appendix E for technical details) would have led to alternative U.S. quotas, total catch streams, and exploitation rates (Figs 2-3; Figs 4-5, assuming the biomass time series estimates from the 2015 assessment; and Fig 6, assuming the biomass time series estimates from the 2012 assessment). This approach provides the appropriate comparison, but does not account for changes in stock status due to the alternative catch streams... Those calculations also showed that this approach does not keep exploitation rates at the values used to calculate ‘total’ or ‘coastwide’ HGs and OFLs, given updated retrospective information on population biomasses (Figs 4-6).”

In the Report, Appendix E and Figures 2-5 are misleading because the analysis does not conform to the methods in Demer and Zwolinski (2014 and 2015). Total fishing fractions were calculated using harvest quotas derived from non-differentiated (northern- and southern-stock) biomasses, divided by either non-differentiated biomasses (Hill et al., 2012) or northern-stock biomasses (Hill et al. 2015) from a different assessment. This approach convolutes landings and biomasses from two stocks, and does not account for uncertainty in the assessed biomasses. Consequently, the calculations described in Appendix E result in unrealistically high exploitation rates values as seen in Figures 4-5. Demer and Zwolinski (2015) correctly apply their methods to landings and biomass time series from the 2015 assessment; and Demer and Zwolinski (*in review*) correctly apply their method to time series of historical landings and assessment biomasses. The results of both analyses confirm the original conclusions in Demer and Zwolinski (2014).

We respectfully request that the PFMC consider these clarifications of Demer and Zwolinski's work when it discusses the Report of the National Marine Fisheries Service/Pacific Fishery Management Council Workshop on Pacific Sardine Distribution.

Sincerely,

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References

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