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October 14, 2015

Ms. Dorothy Lowman, Chair
And Members of the Pacific Fishery Management Council
7700 NE Ambassador Place #101
Portland OR 97220-1384

RE: Agenda Item H.1 Sardine Distribution Report

Dear Ms. Lowman and Council members,

I am Executive Director of the California Wetfish Producers Association (CWPA), representing the majority of coastal pelagic species 'wetfish' fishermen and processors in California. CWPA, along with several CA wetfish fishermen and processors. also intervened in the Oceana v Pritzker lawsuit contesting aspects of CPS FMP Amendment 13. Settlement of Oceana's appeal of that legal challenge required the development of this report on sardine distribution. I appreciate the Council's consideration of the following recommendations, as well as my recollections as a participant in the distribution workshop.

In summary

As the report acknowledged, a lot of time-consuming work went into reanalysis of the distribution factor …

> *"… to examine potential alternative means of accounting for the fact that some portion of the U.S. stock is present and subject to harvest outside U.S. waters."*

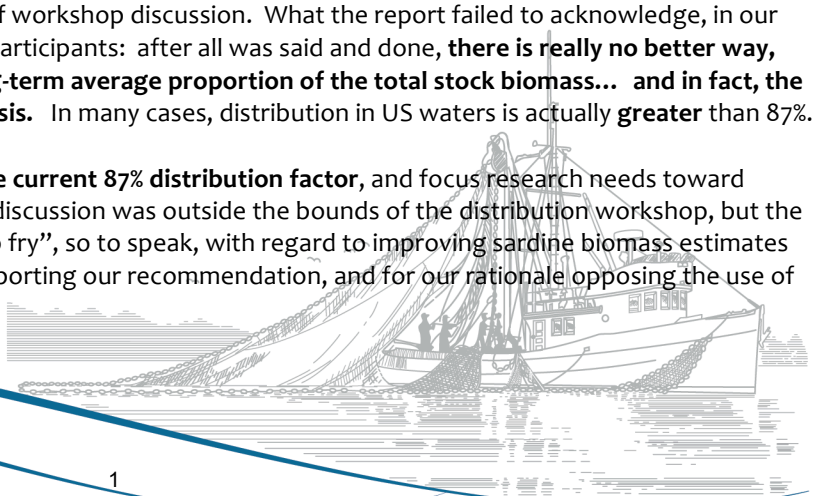
The report background stated …

> *"Distribution, as defined in the CPS FMP, is an estimate of* ***the long-term average of the portion of total stock biomass*** *of the northern subpopulation occurring in U.S. waters, and is a simple way to prorate the biomass estimate used to calculate U.S. catch limits; it is* ***not a prescription of actual catch levels*** *by the combined fishing vessels of the U.S., Canada, and Mexico in any given year****. All sardines caught in U.S. waters count against the U.S. catch limit, including those from the southern subpopulation.***

The report further noted that migratory patterns are highly variable, depending on numerous factors including oceanographic conditions. The report pointed out: ***"Amendment 8 recognized that it is impractical to accurately gauge the precise proportional distribution at any given time."***

That finding reverberated throughout the two days of workshop discussion. What the report failed to acknowledge, in our opinion, was the general conclusion of a majority of participants: after all was said and done, **there is really no better way, given existing knowledge, to estimate reliably a long-term average proportion of the total stock biomass… and in fact, the 87 percent factor actually held up well in the reanalysis.** In many cases, distribution in US waters is actually **greater** than 87%.

Therefore, **we recommend that the Council retain the current 87% distribution factor**, and focus research needs toward improving the sardine stock assessment itself. That discussion was outside the bounds of the distribution workshop, but the Council should be aware that there are bigger "fish to fry", so to speak, with regard to improving sardine biomass estimates and management. Please read on for highlights supporting our recommendation, and for our rationale opposing the use of international catches as proxy for distribution.



Excerpts recorded in my notes from workshop discussion:

Re: Differentiating northern and southern substocks

Paul Crone: The only difference is how we differentiate substocks -- earlier differentiated by port, and now differentiated by environmental parameters (i.e. SST < 17 deg. C = northern substock)

Re: Reanalysis of original 87% distribution parameter

Estimate based on original method -- 87% is robust when original data were reviewed and verified

Larry Jacobson: Bottom line: 87% appears robust

Data available for 1985-1997: Average Distribution 89%

1985-2001

Weighted average 86% – 89% if original procedure is used

Seasonal proportion weighted by positive flights – 84%

Seasonal proportion weighted by total number flights – 86%

Larry Jacobson: Distribution depends on season – depends on stock size (higher = more movement) – depends on climate, size structure of animals

Jacobson recommended that the group should not chase 2% up or down – accurate distribution parameter is hard to define, it changes by the moment, and needs to be defined more generally

The report discussed drawbacks of analysis, but also pointed out: "A strength… is that it potentially integrates estimate of Distribution parameter across the entire year, which is important given seasonal migrations."

Re: Landings Data for estimating distribution

Andre Punt: ***There is no approved global fishing fraction -- 15% F refers ONLY to the US fishery.***

Landings tell you what was killed, but not what was there…

Andre Punt: Unless effort is known, landings are not a reliable estimate of distribution.

Kevin Hill: Fishing effort is not available for any fisheries … He further noted that the US fishery was constrained by US harvest policy beginning in 2008. Catch is a function of regional abundance and effort. Economic factors need to be recognized. Weather likely affected ability to fish. **Dr. Hill is not a proponent of this method.**

The report stated: "The workshop agreed… that landings data on their own provide little information about relative abundance spatially."

After extensive discussion on the use of international catches as proxy for distribution, my notes recorded the following conclusion**: the only agreement was that landings without adjusting for other factors do not provide a reliable estimate of biomass in different regions**. This caveat was highlighted as a disadvantage in Table 1 [page 21].

As intervenors in the Oceana v. Pritzker lawsuit, we participated in settlement discussions, and we refused to sign the settlement agreement until reference to the Demer et al paper proposing to subtract international catches from the US harvest guideline was removed. When Oceana attempted to reinsert specific reference at the June Council meeting, we objected that this was a breach of good faith. Dr. McIsaac also commented on this issue, stating that use of international catches as proxy for distribution was off the table. Yet this topic, including the offending Demer et al. paper, dominated discussion at the workshop.

Our reasons for opposing further consideration of this concept begin with the NMFS statement in the preamble to the National Standard 1 guidelines Final Rule, which states [emphasis added]:

"NMFS believes that ***the intent of the [MSA Reauthorization Act] is not to unfairly penalize U.S. fishermen*** *for overfishing which is occurring predominantly at the international level. In many cases, applying [harvest] requirements to U.S. fishermen on just the U.S. portion of the catch … would not lead to ending overfishing and* ***could disadvantage U.S. fishermen****."*

74 Fed. Reg. 3178, 3199 (Jan. 16, 2009) (response to comment 78).

In the first place, the northern sardine stock is NOT overfished nor subject to overfishing [Statement from Eileen Sobeck, 2015]. The directed fishery is now closed in the US based on CPS FMP harvest policy.

The workshop report also stated [page 14] that assumptions on landings were "unlikely to be valid" and **"therefore the workshop agreed that landings data should not be used to estimate Distribution."**

Regarding the proposal to subtract foreign landings from US OFLs, ABCs and HGs, the report noted concerns that this approach "could have" severe negative implications for the US fishery, but did not analyze the impacts.

Allowing international fisheries to harvest at will, then subtracting international landings from the harvest allowance for US fishermen flies directly in the face of NS1 intent "***not to unfairly penalize U.S. fishermen***". Moreover this sets a horrible precedent. The US already imports some 90 percent of seafood consumed here, and that fraction is increasing.
As an example of the severe negative impact that this approach would inflict, consider that Canada harvested 22,000 mt in 2012, but had no fishery at all in 2013 and 2014. This demonstrates the fallacy of the assumption that future catches can be predicted from past landings.

Re: Using a Temperature-based Model to predict distribution
The workshop report reflected discussion confirming, as in Amendment 8 analyses, that distribution varies seasonally and annually. The report also acknowledged a model developed by Dr. Richard Parrish incorporating both environmental (SST) and stock size effects to predict distribution of the "northern" sardine population. Although unable to attend the second workshop, Dr. Parrish had discussed his model at the first workshop held a few years ago, where distribution was also considered, and afterward shared his paper with several people, including Tom Jagielo, SSC, who led the distribution discussion at the time.

Dr. Parrish's paper stated: *"I was amazed to find that the model resulted in an average 88% of sardine biomass in US waters; almost identical to the 87% value used in the original and current harvest guidelines …".*
This second workshop report also stated: "[Dr. Parrish's] model should be presented to the PFMC SSC for evaluation if the Council chooses to further explore the possibility of using a method that uses environmental data to estimate Distribution."

In conclusion, we again point out that this distribution workshop, despite extensive work and discussion, did not produce a "smoking gun", compelling new information that would substantially alter 87 percent as a valid long-term average for sardine distribution,. For this reason we urge the Council to maintain the status quo distribution policy, and focus research priorities on improving the sardine stock assessment itself.

We would also appreciate the Council's recognition of the continuing importance of the sardine resource to California's historic wetfish industry.

Thank you for your attention to these comments.

Best regards,

Diane Pleschner-Steele
Executive Director

October 16, 2015

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NOAA Fisheries
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RE: Agenda Items H.1, Pacific Sardine Distribution Workshop and H.3, Anchovy General Status Review

Dear Ms. Lowman and Council Members, Ms. Sobeck, and Mr. Stelle:

We the undersigned 36,820 residents of the United States (including 9,150 residents of California, Oregon, Washington, and Idaho) are greatly concerned that management of the commercial forage fish fisheries off California, Oregon and Washington is leaving ocean wildlife without enough fish to eat. Sea lions, whales, pelicans, and many other species rely on these same forage fish for a large part of their diet. Pacific sardine and Northern anchovy populations are at historically low levels and are some of the most important forage fish in the California Current ocean ecosystem. Immediate action is needed to prevent future overfishing and to help these forage fish populations rebuild to healthy and abundant levels.

This year, an unprecedented number of California sea lion pups were found stranded on beaches. Many died and many others were found underweight, dehydrated, and starving. Their mothers were not finding enough forage fish to eat. They were spending more time away from their pups foraging, farther from shore, and the nursing sea lion pups were in turn, starving to death.

Approximately three times as many sea lions washed ashore in 2015 compared to 2013, when the severity of strandings emerged as an issue of great concern. Similarly, California brown pelicans have been abandoning their nests due to the lack of forage fish. With about 90 percent of sea lion pups estimated to die this year before weaning age and complete range-wide reproductive failures in brown pelicans—only removed from the Endangered Species List a few years ago—more must be done to ensure there is adequate forage fish to support a healthy and abundant food web in the Pacific Ocean.

Never-before-seen ocean conditions combined with increasing and excessive fishing pressure have put these forage fish populations in a crisis situation. Further safeguards for these critical fish populations are

needed to help these fish rebound, to provide abundant prey for dependent predators, and to ensure long-term, ecologically sustainable fisheries into the future.

While we commend your decision to give Pacific sardines a reprieve by closing the commercial fishery last April, we need a long-term solution so that coast-wide sardine overfishing does not occur in the future. Because the United States fishes the same population of sardines as Mexico and Canada, it is critical that the current calculation used to determine how many sardines can be fished is corrected to accurately account for the sardines Canada and Mexico remove from the ocean. This will ensure the United States is taking a responsible share and not contributing to coast-wide overfishing.

Additionally, available scientific information indicates that the central sub-population of Northern anchovy (found off California) may be alarmingly low. Immediately reducing catch levels for anchovy is critical, especially given the undeniable signs of a lack of forage fish in the ecosystem. The Council and NMFS should make it a top priority to obtain a new full assessment of the anchovy population. The Council should also ensure that the calculation for determining how many anchovies can be fished accounts for how many anchovies ocean predators need to eat.

In summary, we urge you to take immediate measures to fix the Pacific sardine management framework, prevent Northern anchovy overfishing, and ensure abundant forage fish populations for dependent predators. Ocean wildlife and coastal communities don't have time to wait.

Sincerely,

36,820 residents of the United States

The full list of signers is available electronically, under H.3.b,
Public Comment Oceana, Electronic Only

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Linda	Bassett	Anchorage	AK	99515
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Jay	Casello	Anchorage	AK	99517
Amy	Cook	Anchorage	AK	99516
Erin	Crawford	Anchorage	AK	99502
Susan	Cutler	Anchorage	AK	99502
Marilyn	Dougher	anchorage	AK	99502
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Rebecca	Goodrich	Anchorage	AK	99507
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Zara	Ivanova	Anchorage	AK	99501
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Shana	Jerde	Anchorage	AK	99517
Dona	Johnson-Cuff	Anchorage	AK	99503
Rhonda	Matthews	Anchorage	AK	99515
Kimberly	McConkey	Anchorage	AK	99508
Jennifer	Meyer	Anchorage	AK	99504
Elizabeth	Mitchell	Anchorage	AK	99518
Derek	Monroe	Anchorage	AK	99501
Samuel	Ohana	Anchorage	AK	99501
Amy	Peloza	Anchorage	AK	99516
Penny	penny	ANCHORAGE	AK	99501
Gary	Pounds	Anchorage	AK	99502
Fp	romick	Anchorage	AK	99501
Carlton	Russell	Anchorage	AK	99508
shruti	somaiya	Anchorage	AK	99517
Deborah	Voves	Anchorage	AK	99516
Penelope	Wells	Anchorage	AK	99524
Paula	Williams	Anchorage	AK	99502
Debra	Wilson	Anchorage	AK	99502
Judith	Stoll	Anchorage	AK	99518
Jos	Bakker	Auke Bay	AK	99821
Sharon	Sheehan	Big Lake	AK	99652
Ann	Garrett	Bromley	AK	11111
Becky	Breeding	Chugiak	AK	99567
Shirley	Knapp	Cooper Landing	AK	99572
martin	niemi	Douglas	AK	99824
Denise	Abel	Eagle river	AK	99577
Wendy	Carrio	Eagle River	AK	99577

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Jan	Warren	Camden	ME	04843
Edward	DeRaps	Canaan	ME	04924
Carolyn	Matott	Canton	ME	04221
Barbara	Beal	Cape Elizabeth	ME	04107
Karen	Coker	Cape Elizabeth	ME	04107
Bill	Davis	Cape Elizabeth	ME	04107
Diane	nosnik	Cape neddick	ME	03902
Andrew	Levesque	Caribou	ME	04736
I	Fogg	Clinton	ME	04927
Betty	Lukich	Corinna	ME	04928
Tracy	Liberty	Cornish	ME	04020
Heather	Upton	Cumberland	ME	04021
Constance	Magistrelli	Damariscotta	ME	04543
John	Tukey	Damariscotta	ME	04543
Ann	Esten	Deer Isle	ME	04627
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Robert	Fritsch	DEXTER	ME	04930
Elizabeth	Grinnell	Dexter	ME	04930
Sadie	Salib	Dresden	ME	04342
Mary	Serina	East Boothbay	ME	04544
Kirk	Fernald	East Millinocket	ME	04430
Tita	Townsend	Edgecomb	ME	04556
Malcolm	Lincoln	Edmunds Twp	ME	04628
John	Thompson	Eustis	ME	04936
Hannah	Osborne	Fairfield	ME	04937
Gerhild	Paris	Falmouth	ME	04105
Gerhild	Paris	FALMOUTH	ME	04105
Linda	Dartt	Freedom	ME	04941
Roger	Carpentter	Freeport	ME	04032
Susan	Alexander	Friendship	ME	04547
Susan	Gerry	Friendship	ME	04547
Ruth	FISKE	GEORGETOWN	ME	04548
Susie	Dixon	Gilead	ME	04217
Robert & Colleen	MacKenzie	gorham	ME	04038
Marina	Mooney	Gouldsboro	ME	04607
Doreen	Hodsdon	Greene	ME	04236
Linda	Fortier	Guilford	ME	04443
Robert	McIntire	Hallowell	ME	04347
Flo	Wilder	Hancock	ME	04640
Jaremy	Lynch	Harpswell	ME	04079
Carolyn	LaBerta	Harrison	ME	04040
Dave	Oakes	Hope	ME	04847
Robin	Provost	Houlton	ME	04730
Pat	Redner	houlton	ME	04730
James	Taylor	Houlton	ME	04730

Patty	Daugharty	Eagle River	AK	99577	Tania	Merette	Jackman	ME	04945
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Gary	Moore	Eagle River	AK	99577	Cheryl	Gregorich	KENNEBUNK	ME	04043
Martin	Antuna	Elmendorf AFB	AK	99506	Roger	Lambert	kennebunk	ME	04043
Elizabeth	Allen	Fairbanks	AK	99709	Alex	Mendelsohn	Kennebunk	ME	04043
Sandy	Faison	FAIRBANKS	AK	99716	Vicki	DeChiazza	Kennebunkport	ME	04046
Jim	Farrell	FAIRBANKS	AK	99701	Larry	Etscovitz	Kittery	ME	03904
Adak	Island	FAIRBANKS	AK	99701	Stephanie	Hagenbuch	Lebanon	ME	04027
Judy	Jessee	Fairbanks	AK	99709	Eve	Duplissis	Lewiston	ME	04241
Jack	Jessee	Fairbanks	AK	99709	Beth	Herman	Lewiston	ME	04240
Captain	Ripple	Fairbanks	AK	99708	David	LeRoy	Lewiston	ME	04240
Barbara	Wadlinger	Fairbanks	AK	99709	karen	stickney	Lewiston	ME	04240
G.	Fries	Homer	AK	99603	Ernest	Sherman	Limerick	ME	04048
Richard & Laura	Inglima	HOMER	AK	99603	Bethany	Brown	Limington	ME	04049
Skywalker	Payne	Homer	AK	99603	Kathryn	James	Limington	ME	04049
Susan	Rennolds	Homer	AK	99603	Jane	Hardy	Lincolnville	ME	04849
Sharon	Pinsley	Jaffa/Juneau	AK	99801	John	Krumrein	Lincolnville	ME	04849
Aran	Felix	Juneau	AK	99801	Laurie	Yergin	Lisbon	ME	04250
jean	hoegler	juneau	AK	99801	Shoo	Hale	lovell	ME	04051
Jennifer	Jones	Juneau	AK	99801	Karissa	Ostheimer	Manchester	ME	04351
Art	Kolter	Juneau	AK	99801	lillian	douville	MARSHFIELD	ME	04654
Leslie	Law	Juneau	AK	99801	Alexandra	Pappano	Mattawamkeag	ME	04459
Virginia	Martin	Juneau	AK	99801	Rachael	Pappano	Mattawamkeag	ME	04459
John	Sonin	Juneau	AK	99801	Sandra	Pappano	Mattawamkeag	ME	04459
Karen	Wilson	Juneau	AK	99801	Michele	Hryc	Maxfield	ME	04453
Gerald	Brookman	Kenai	AK	99611	Wanda	Halpin	Milbridge	ME	04658
bonnie	bromley	ketchikan	AK	99901	Jeffrey	Wade	Milford	ME	04461
Olivia	Kohler	North Pole	AK	99705	Linda	Howard	Milo	ME	04463
Jef	Harvey	Palmer	AK	99645	Caren	Plank	Monroe	ME	04951
Mary	Osland	Palmer	AK	99645	Phoebe	Payne	Mount Vernon	ME	04352
Joann	Varner	palmer	AK	99645	Pamla	Thompson	Naples	ME	04055
Anne	Lee	Petersburg	AK	99833	lenore	Sivulich	New Gloucester	ME	04260
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Lynn	Wilbur	Sitka	AK	99835	Erin	Rhodes	Newcastle	ME	04553
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Luetta	Robinson	Talkeetna	AK	99501	N	Bullock	Northeast Harbor	ME	04662
Kaytlin	Crawford	Tok	AK	99780	Pat	Berger	Oakland	ME	04963
Linda	Fraley	Valdez,	AK	99686	Michelle	Harrington	Oakland	ME	04963
John	Breiby	Wasilla	AK	99654	Leslie	Holden	Old Orchard Beach	ME	04064
Edith	Crowe	Wasilla	AK	99623	Margaret	Fernald	Orland	ME	04472
Carla	Green	wasilla	AK	99654	Sandra	Joy	Orono	ME	04473
Sarah	Skow	Wasilla	AK	99654	Peri	Lanoue	Orrs island	ME	04066
Theresa	Evans	willow	AK	99688	Stella	Bartlett	Pallara	ME	04110
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October 16, 2015

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RE: Agenda Item H.1: Pacific Sardine Distribution Workshop

Dear Chair Lowman, Mr. Stelle, and Members of the Council:

Thank you for hosting the Pacific sardine Distribution workshop in La Jolla, California on August 17-19, 2015. This focused, productive workshop brought forward a variety of new tools, information, and analysis that will help the Council decide whether further action addressing the Distribution parameter is warranted. As a participant in the workshop, Oceana appreciates the opportunity to present our own proposal at the workshop, and to discuss alternative approaches that were presented by other participants. In particular, we commend workshop Chair Andre Punt for the constructive tone and open dialogue, as well as the work and analysis put in by the presenters and rapporteurs. We agree with the workshop report's recommendations for further analyses. We urge the Council to act on the recommendations and take action regarding the Distribution parameter or an alternative method for taking into account the presence of Pacific sardine coast-wide.

We submitted and presented Primary Document 5 to the workshop entitled "Problem Statement, Requests for Analysis, and Considerations for Revising the Pacific Sardine Distribution Parameter". The Document and Powerpoint Presentation summarized our concerns with the current Distribution parameter, including that it is based on outdated science, risks coastwide overfishing, risks ecosystem effects, and undermines the goals of the CPS FMP when a large proportion of the sardine population is present and fished in the Mexican and/or Canadian EEZ and U.S. Fishery managers do not adequately account for foreign catches. We are including the Document and Presentation as attachments to be considered as part of our comments on this agenda item.

As a result of the Distribution workshop, we request the Council:

- Continue the productive effort of the workshop by further evaluating and analyzing the Alternatives that emerged from the Workshop, including the "Optimized HG" methods (Alternative 2) as recommended in the Workshop Report;
- Direct the SSC to consider the alternative formulations of OFL and ABC for Pacific sardines as presented in the workshop, including the formulations proposed below in this letter;
- Send a letter to the U.S. State Department requesting initiation of international discussions of coordinated sardine management.

Comments on Workshop and Workshop Report

Several important themes and recommendations emerged from the workshop:

Further analysis of approaches are warranted to make an informed decision on the Distribution parameter

The workshop participants agreed that several of the alternative methods had merit and advantages, however, further analysis was necessary to fully evaluate how the methods compare to the status quo static Distribution parameter of 87%. For example, the workshop noted that there are tradeoffs inherent in various approaches that "would need to be fully evaluated using a management strategy evaluation (MSE)" (p.9). The Workshop Report also recommended an MSE for two methods within Alternative 3, and developing and testing approaches for Alternative 4 (p. 17). In addition, Oceana requested an analysis of the status quo using the best available information on actual catches of Mexico and Canada using the Management Strategy Evaluation methods in Hurtado & Punt 2014 (see Request # 3 in Primary Document 5). While it was agreed this was a research need, this analysis was not able to be conducted at the workshop. Therefore, the Workshop Report recommends: "The MSE analyses should be repeated using realistic models for the catches off Canada and Mexico to better understand the consequences of the fisheries in these countries not being based on the HCRs used in the U.S. Specifically, future catches for Canada (assuming that there is biomass in Canadian waters) should be based on the most recent control rule (DFO, 2014, 2015)." (p. 16) Therefore, we ask the Council to continue the excellent progress made at the workshop by conducting the workshop-recommended analyses to inform your course of action on the Distribution parameter.

The "Optimized HG" Method (Demer & Zwolinski 2014)[1] Prevents Overfishing More Effectively than the Status Quo

Owen Hamel's analysis in the Workshop Report (Figs. 2-6) and our own analysis of the method proposed in Demer & Zwolinski (2014) for optimizing U.S. harvest guidelines ("Optimized HG") demonstrate that the "Optimized HG" method would have prevented the coastwide sardine overfishing that occurred from 2010 to 2014, while maintaining generally equivalent catch levels in years prior to the recent collapse (prior to 2007). For our analysis, we used the actual harvest guidelines that were set over the full period of federal sardine management under the CPS FMP (from 2000-2015), and compared these to the "optimized harvest guidelines" that would have resulted from the Demer & Zwolinski (2014) method using parameters from the stock assessments available at the time (Fig. A), then calculated the coastwide exploitation rates under the alternative scenarios relative to the actual exploitation rates presented in Hill et al. (2015) Pacific sardine stock assessment.[2] This is similar to the analyses of "Alternative 1" conducted by Workshop Principal Participant Owen Hamel in Workshop Report Figs. 2 to 6 (described in Workshop Report Appendix E) and the results appear to be generally consistent. However, our analysis used foreign landings information from the assessments available at the time to inform the "optimized harvest guidelines", rather than landings presented in the 2015 stock assessment.

Figs B and C show the results of analysis of coastwide exploitation rates on the northern subpopulation (NSP) as reported in the 2015 stock assessment relative to the 3-year CalCOFI Emsy, which is what the SSC currently recognizes as the best available science to determine Overfishing Limits for Pacific sardine. The actual exploitations rates are from the "Exploitation Status" Table of the 2015 stock assessment (p. 10). The "Optimized HG" exploitation rates assume that the reductions in total U.S. catch are distributed evenly across southern and northern subpopulation fish.

[1] David A. Demer & Juan P. Zwolinski (2014) *Optimizing Fishing Quotas to Meet Target Fishing Fractions of an Internationally Exploited Stock of Pacific Sardine*, North American Journal of Fisheries Management, 34:6, 1119-1130.

[2] Hill, K.T., P.R. Crone, D.A. Demer, J. Zwolinski, E. Dorval, and B.J. Macewicz. 2015. Assessment of the Pacific Sardine Resource in 2015 for U.S.A. Management in 2015-16.

Fig A. Actual U.S. total catch of Pacific sardines (Hill et al. 2015) compared to what U.S. catch would have been under an "Optimized HG" from 2000-2016.

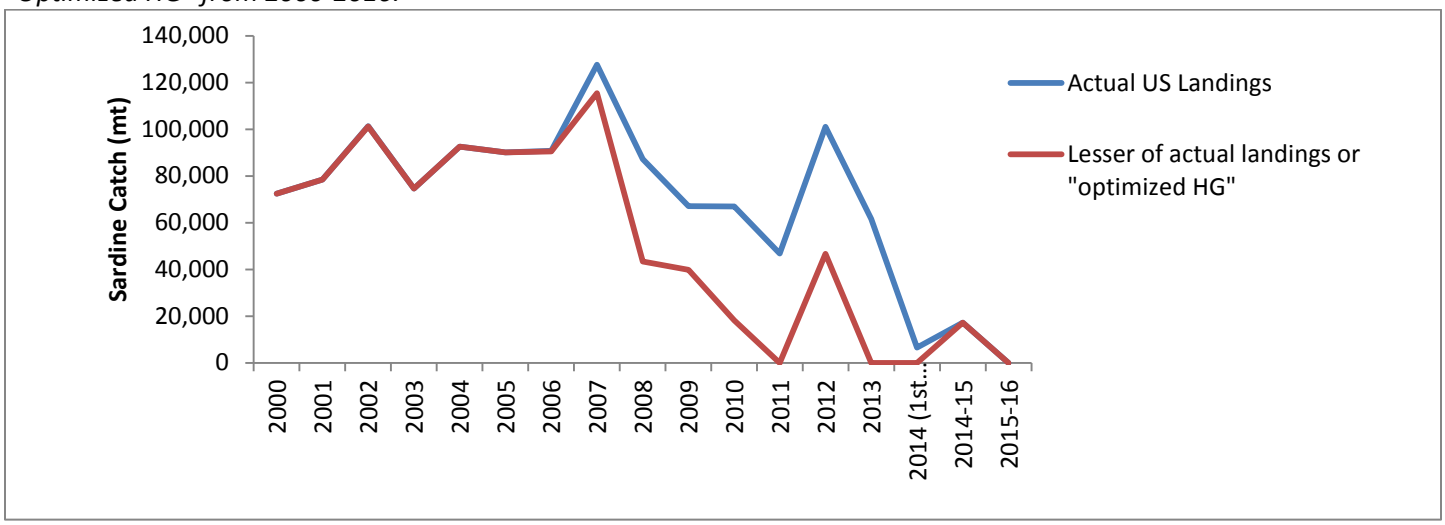


Fig B. Coastwide Exploitation Rates (Northern Subpopulation) from 2007-2014 based on data from Hill et al. (2015).

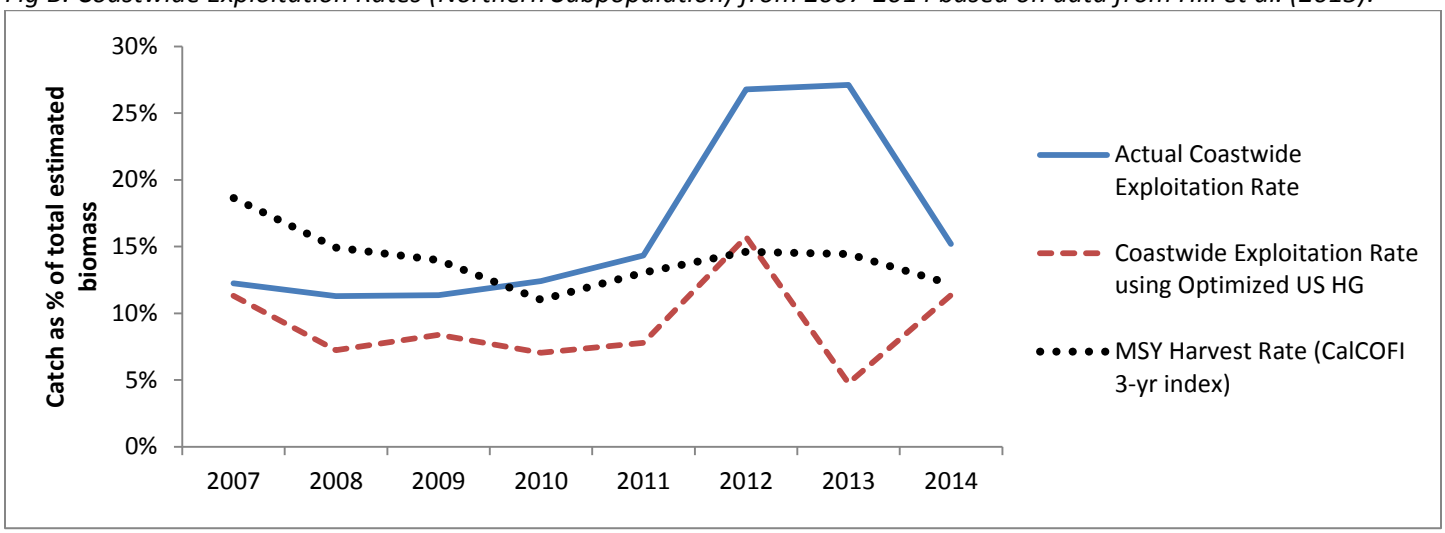
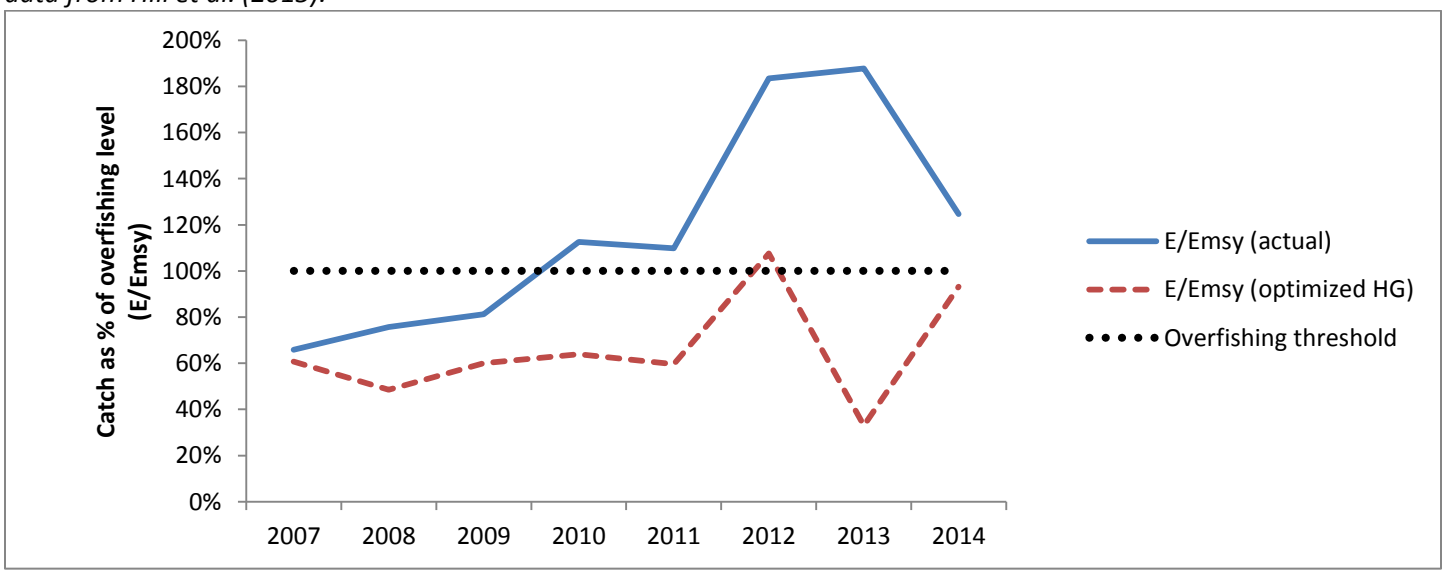


Fig. C– Fishing Rate Relative to Maximum Sustainable Yield (MSY) (Northern Subpopulation) from 2007-2014 based on data from Hill et al. (2015).



3

As indicated in Figure A, comparing the actual U.S. catches to what the HG would have been if the "Optimized HG" method had been used, it appears that in the initial years 2000-2006, it would have made little difference, as the actual US catches in those years were below both the actual HG (using a DIST of 0.87) and the "Optimized HG". However, beginning in 2007 and continuing through 2015, the "Optimized HG" would have resulted in lower U.S. catches than what was actually caught. In fact, the "Optimized HG" would have been zero in 2011, 2013, and 2014. Over the 2007-2015 decline, the mean coastwide exploitation would have been 56% lower under the "Optimized HG" ("Optimized HG" mean = 9.2%; actual mean coastwide exploitation =16.4%). According to the biomass estimates in Hill et al. (2015) and the CalCOFI 3-year index of Emsy, coastwide exploitation rate exceeded Emsy from 2010-2014 by up to 88% (Figures B and C). However, had the "Optimized HG" been in effect, coastwide fishing rates would have been below Emsy in all years except for 2012, when overfishing would have occurred by 8%. In summary, under the "Optimized HG", catch would not have been lower during the 2000-2006 period and overfishing would not have occurred during the recent 8-year period of low sardine productivity (2007-2015) where the stock declined by over 90% according to Hill et al. (2015).

The workshop concluded: "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 Zwolinksi, 2014b and Primary Document 1) than the current Distribution term. This approach appears to better meet these objectives than the current approach."

The Magnuson-Stevens Act requires the use of annual catch limits and accountability measures in federal fisheries to end and prevent overfishing. Both this analysis and the Owen Hamel analysis in Figures 2-6 indicate that that the "Optimized HG" method more effectively prevents overfishing, especially during times when there is a greater risk to the stock, while maintaining high HGs generally equivalent to the status quo HGs during times of lower risk. Finally, this analysis indicates the "Optimized HG" method would have prevented the coastwide Pacific sardine overfishing that occurred during the recent sardine collapse.

The Workshop Report recommended the following analysis: "Evaluate HCRs for the northern subpopulation of Pacific sardine that include the Demer-Zwolinski approach (Demer Zwolinski 2014b or Primary Document 1) using MSE. A key component of the MSE would be a model of how catches occur off Mexico and Canada as a function of environmental conditions and stock biomass." We ask that the Council further analyze this alternative and others as recommended in the Workshop Report.

Upcoming Revised Manuscript Relevant to "Optimized HG" Methods

We would like to bring to the Council's attention that the authors of Primary Document 1 (Demer & Zwolinski) have completed a revision to their manuscript that includes additional analyses that were recommended by the Workshop. We understand this manuscript remains in NMFS internal review, and has not been submitted publicly at the time of this letter. We encourage the Council to ensure this information is brought forward and considered so the Council can make a fully informed decision.

Request for SSC Consideration of Alternative OFL Control Rule for Pacific Sardine:

In Primary Document 5 and our presentation to the workshop, we proposed a change to Distribution in the U.S. Overfishing Limit (OFL) as follows:

Current formulations of Pacific Sardine Overfishing Limits (OFL) and Allowable Biological Catch (ABC) in CPS FMP

OFL = BIOMASS * E_{MSY} * DISTRIBUTION

ABC = BIOMASS * BUFFER * E_{MSY} * DISTRIBUTION

Proposed alternative formulations for SSC Consideration:

OFL = BIOMASS * Emsy – Lmexico – Lcanada

ABC = BIOMASS * BUFFER * E_{MSY} – Lmexico – Lcanada

where 'Lmexico' and 'Lcanada' are the previous year's landings in Mexico and Canada.

Despite being clearly within the Terms of Reference for the workshop, this proposed change to the DISTRIBUTION term in the OFL was mentioned in the Workshop Report (p. 5), but was not analyzed at the workshop or discussed in the report. However, there was discussion at the Workshop that Council's Scientific and Statistical Committee (SSC) is responsible for determining the OFL. Therefore, we request that this modified OFL equation be considered and evaluated by the SSC as an alternative to the use of a constant 87% Distribution parameter in the current formulation of the OFL.

Tri-national management as a long-term goal

One area of strong consensus among agency, scientific, conservation, and industry participants was the need to reinitiate efforts toward a tri-national management agreement among the U.S., Mexico, and Canada. As stated in the Workshop Report (p. 15): "While not examined at the workshop, workshop participants generally agreed that there would be benefit in initiating discussions with Mexico and Canada toward more coordinated management to address the transboundary nature of the stock, which would be preferable to the status quo. The workshop participants encourage the National Marine Fisheries Service and the PFMC to work with the State Department to initiate such discussions of potential tri-national management." Such an agreement could resolve many of the challenges raised with the current Distribution parameter and other approaches. We therefore suggest that the Council articulate this as a long-term management goal, write a letter to the U.S. State Department requesting initiation of international discussions of coordinated sardine management, and ensure that future steps to address the Distribution parameter move toward that consensus goal.

The Workshop illuminated new information regarding the perception of the current U.S. Distribution Parameter by Mexican scientists. The Workshop Report states "The authors of Primary Document 7 [Baumgartner et al.] stated that the value of 0.87 for Distribution in the U.S. HCR should be abandoned since it is surely almost never true (and has antagonized Mexican scientists resulting in poor binational collaboration) and suggested that the landings in Canada and Mexico should be estimated by formulating a mean or weighted value of the previous three years of landings". By unilaterally declaring that the U.S. is entitled to 87% of the resource, the implication is that Mexico is "overfishing" if they catch more than the remaining 13%. In response, it is not surprising that Mexico ignores the U.S. control rule and is hesitant to freely share information. Simply put, maintaining the status quo static Distribution of 87% runs counter to the objective of collaborative international management. By heeding the recommendations of the authors of Primary Document 7, the PFMC has the opportunity to pave the way for collaborative research and management of Pacific sardines.

Additional Comments on Workshop Report:

As additional comments, the Workshop Report Appendix D lists a number of "Primary Documents", however there is no link to those documents in the Report. It would be helpful to the public if all Primary Documents referenced in the Workshop report should be posted and included in the Council's Advanced Briefing Book under this Agenda Item.

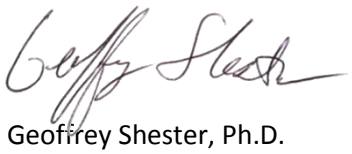
There is one major incorrect statement in the workshop report, which states : "*The workshop noted that the concept of a 'total fishing fraction' as described in Primary Document 1 does not exist in the CPS FMP."* (p.9). However, The CPS FMP states: *"In the absence of a cooperative management agreement, the default approach in the CPS FMP sets harvest levels for U.S. fisheries by prorating the* ***total target harvest level*** *according to the portion of the stock resident in U.S. waters or estimating the biomass in U.S. waters only."* (PFMC Appendix B to Amendment 8, 1998, emphasis added). In fact, past stock assessments have presented Total HG and prorated the U.S. HG by 87% (e.g., 2007 Pacific sardine assessment[3], Table 1; 2008 assessment[4]; Table 1)). Therefore, the use of a "total fishing fraction" concept has been in

[3] 2007 Pacific Sardine Assessment: http://www.pcouncil.org/bb/2007/1107/G1b_ATT1_CD_WEB.pdf
[4] 2008 Pacific Sardine Assessment: http://www.pcouncil.org/bb/2008/1108/G2b_SUP_ATT1_1108.pdf

place since CPS FMP Amendment 8 as a means to evaluate fishery performance on a coastwide scale. We ask that this statement be corrected in the Workshop Report.

Again, thank you for investing in a productive successful workshop that will build a foundation for an improved method of achieving Optimum Yield and Preventing Overfishing and achieving the goals of the CPS FMP. We look forward to working constructively through the Council process.

Sincerely,



Geoffrey Shester, Ph.D.
California Campaign Director, Oceana

Ben Enticknap
Pacific Campaign Manager and Senior Scientist

Cc. Dr. Andre Punt, Pacific Sardine Distribution Workshop Chair; Chair of SSC CPS Subcommittee
Dr. Cisco Werner, Director, NWFSC
Dr. William Satterthwaite, Interim Chair, PFMC Scientific and Statistical Committee, NMFS

Attachments:

Problem Statement, Requests for Analysis, and Considerations for Revising the Pacific Sardine Distribution Parameter (August 10, 2015)

Powerpoint Presentation by Oceana to Sardine Distribution Workshop: "Problem Statement and Considerations for Revising the Pacific Sardine Distribution Parameter" (August 18, 2015)

Problem Statement, Requests for Analysis, and Considerations for Revising the Pacific Sardine Distribution Parameter

Geoff Shester and Ben Enticknap, Oceana

Submitted to the Pacific Fishery Management Council
Pacific Sardine Distribution Workshop
August 10, 2015

The DISTRIBUTION parameter in the U.S. Pacific sardine harvest control rule is essential in determining the U.S. Pacific sardine overfishing limit (OFL), acceptable biological catch (ABC), annual catch limit (ACL), harvest guideline (HG) and annual catch target (ACT). These annually specified reference points must both prevent overfishing and achieve optimum yield. Each of these formulas incorporate the DISTRIBUTION factor, where:

$$OFL = BIOMASS * E_{MSY} * DISTRIBUTION$$
$$ABC = BIOMASS * BUFFER * E_{MSY} * DISTRIBUTION$$
$$ACL = LESS\ THAN\ OR\ EQUAL\ TO\ ABC$$
$$HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION$$
$$ACT = HG\ OR\ ACL,\ WHICHEVER\ VALUE\ IS\ LESS$$

The Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) currently defines DISTRIBUTION as "the average portion of BIOMASS assumed in U.S. waters" and it sets a fixed value for the U.S. distribution at 87% (PFMC 2011, at 39). The northern subpopulation of Pacific sardine occurs and is harvested in the waters off Mexico, the U.S., and Canada. Under its current formulation, the Pacific sardine harvest control rule operates by first determining an overall coastwide biomass of the northern subpopulation and then it uses the DISTRIBUTION parameter to unilaterally determine the portion of the coastwide catch and coastwide overfishing limits to be apportioned to the U.S. fleet.

The problems with the current definition and calculation of the DISTRIBUTION parameter and current management framework include:

1. There is no common policy for managing Pacific sardine between the U.S., Canada and Mexico, therefore no assurance that Canada and Mexico will determine catch levels according to the U.S. estimation of the portion of the stock in respective waters.
2. The current DISTRIBUTION value is based on outdated science and that science gave no consideration to the portion of the stock in Canadian waters.
3. A fixed 87% DISTRIBUTION value risks coastwide overfishing, it risks ecosystem effects, and undermines the goals of the CPS FMP when a large proportion of the population is present and fished in the Mexican and/or Canadian EEZ.

In the absence of a cooperative management agreement with Mexico and Canada, the purpose of the DISTRIBUTION factor, in part, is for the U.S. to determine responsible Pacific sardine catch levels that prevent overfishing and achieve optimum yield (OY) for the U.S. fishery (reducing catch below maximum sustainable yield [MSY] levels for social, economic and ecological factors). Use of an incorrect DISTRIBUTION factor, however, risks Pacific sardine overfishing

when the population is migrating and fished off Mexico and/or Canada. The appropriate DISTRIBUTION factor is therefore integral to determining sustainable catch levels and preventing U.S. and coastwide overfishing.

The CPS FMP Amendment 8 analysis used to determine the current U.S. sardine DISTRIBUTION value of 87% is based on summer-fall "fish spotter data from 1964 to 1992" between the U.S. and Mexico (PMFC 1998, at B-87). The Amendment 8 analysis explains that the "best" estimates of the portion of other CPS in U.S. waters during the whole year are "averages for winter through spring and the fish spotter estimates for summer though winter" but that for Pacific sardine they are based only on this fish spotter data "since the average for the fish spotter and CalCOFI (59%) seems too small for the stock as a whole under current conditions" (PFMC 1998, at B-88). The Amendment 8 analysis found that based on this data, the U.S. DISTRIBUTION should be set at 87% and Mexico sardine DISTRIBUTION should be 13% (PFMC 1998, at B-89). The analysis made no consideration for the portion of the stock in Canadian waters and did not analyze the performance of the U.S. harvest control rule if Mexican and Canadian catch deviated from the assumed 13%.

The CPS FMP adopts incorrect assumptions regarding the portion of the northern Pacific sardine stock taken by Mexico, the U.S., and Canada. Because the FMP assumes that the U.S. Pacific sardine DISTRIBUTION is 87%, the combined Canada and Mexico catch is limited to 13% of the coastwide target harvest level under U.S. management. Any greater catch risks exceeding sustainable catch levels. Moreover, if Canada and Mexico catch exceeds 13% then the U.S. OFL will allow overfishing (exceeding the scientifically determined maximum sustainable yield level) on the stock as a whole. We know, however, based on empirical data since the establishment of the U.S. harvest control rule in CPS FMP Amendment 8 that Canada and Mexico do not operate under the same assumptions. As explained by Demer and Zwolinski (2014):

> *The Pacific Sardine fishery in Canada is restricted by a 15% harvest rate for a 3-year running average of the estimated proportion of the U.S.-assessed Pacific Sardine biomass that migrates into Canadian waters (Ware 1999). In 2010, for example, the U.S. assumed that 87% of the northern stock resided within its EEZ, Canada assumed that 27.2% of the northern stock migrated into its EEZ (DFO 2011), and Mexico made no assumption in this regard. Therefore, under the current HCR, it is quite possible that the tri-national landings of the northern stock can exceed the biomass corresponding to the U.S. target F.*

In 2010, for example, Canada accounted for 23% of the actual northern subpopulation landings, Mexico 18%, and the U.S. 59% of the coastwide northern subpopulation landings (Figure 1). What is more, coastwide exploitation rates in 2010 through 2014 exceeded the CalCOFI E_{MSY} rate (Hill et al. 2015; Oceana 2015).

Because the DISTRIBUTION parameter is essential to Pacific sardine catch levels and overfishing thresholds, the assumption that 87% of the population is fixed in U.S. waters, 13% in Mexico and 0% in Canada undermines the goal of sustainable Pacific sardine management. When the actual proportion of the Northern subpopulation Pacific sardine landings in U.S. waters is less than 87%, the use of a DISTRIBUTION parameter equal to 87% systematically inflates all of these status determination criteria and harvest control rule measures, including the overfishing limit, acceptable biological catch, and annual catch limits, to be set at higher levels than they would be if the true level of the foreign sardine distribution and catch were fully taken into account. Conversely, in times when the distribution of the Pacific sardine catch is actually higher in U.S. waters, it would mean U.S. catch limits are set lower than intended. Neither case presents an optimal situation for the sustainability of the sardine population or the fishery.

The CPS FMPs suggests "[o]ther approaches that may be developed in the future are not precluded by this default [the current approach to setting a fixed DISTRIBUTION]. If the portion of the stock in U.S. waters cannot be estimated or is highly variable, then other approaches may be used. It may be more practical, for example, *to use a high CUTOFF* in the MSY control rule to compensate for stock biomass off Mexico and Canada." (PFMC 2011, at 40, emphasis added).

The current approach for setting DISTRIBUTION clearly needs to be updated with the best available scientific information and in consideration of its critical function in preventing overfishing and achieving OY. A fixed 87% DISTRIBUTION value has been incorrect in the past more often than not, it fails to consider migration into Canada, and without cooperative international management it will not protect the sardine population against coastwide overfishing let alone ensure catch levels meet the goals of the CPS FMP (such as achieving OY and providing adequate prey for dependent predators).

The CPS FMP notes that "ideally, transboundary CPS stocks would be managed cooperatively by the U.S., Canada and Mexico on the basis of common policy" (PFMC 2011 at 40). In the absence of such an agreement, alternative approaches to the DISTRIBUTION parameter should be considered such as a higher CUTOFF as suggested in the CPS FMP (and Amendment 8 analysis) and the approach described in Demer and Zwolinski (2014) on this fishery management topic (submitted with this document). An approach to setting distribution and thus U.S. catch levels that accounts for recent landings by Mexico and Canada may more optimally determine U.S. fishing levels and prevent coastwide overfishing. Furthermore, the CPS FMP currently considers Pacific sardines to comprise a single stock, yet the most recent stock assessment of Pacific sardines recognizes two separate subpopulations and provides a biomass assessment and management measures based only on the northern subpopulation (Hill et al. 2015).

Under the terms of the settlement agreement of Oceana, Inc. v. Penny Pritzker, et al.[5], the purposes of the upcoming workshop are:

> *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 the Pacific sardine stock exists and is subject to catch outside of U.S. waters.*

Workshop participants must analyze an alternative that uses "landings information from Canada and Mexico to account for catch in the waters of those nations in estimating DISTRIBUTION, using work from recently published scientific studies regarding Pacific sardine management."[6] , To inform this analysis, we request that the workshop participants also consider and analyze the following methods:

1) Considering the full suite of options and analyses presented in Demer and Zwolinski (2014), including methods to estimate DISTRIBUTION based on recent landings and alternative formulations of the U.S. harvest control rule to account for the fact that some portion of the Pacific sardine stock exists and is subject to catch outside of U.S. waters.

[5] *Oceana, Inc. v. Pritzker*, No. 13-16183 (9th Cir. 2015) (*see* Settlement Agreement, at 1, available at http://www.pcouncil.org/wp-content/uploads/2015/05/G4_Att1_Sttlmnt_Agrment_JUN2015BB.pdf

[6] Settlement Agreement at 2.

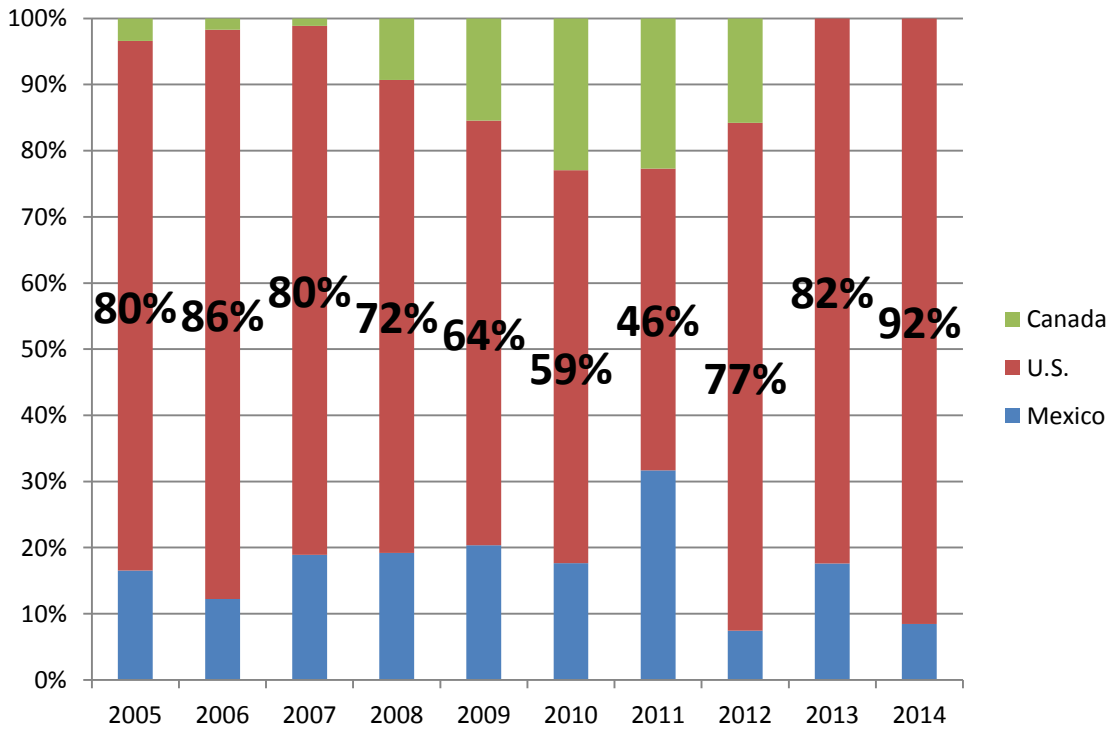
2) Addressing the international nature of the stock by increasing the CUTOFF parameter to account for Pacific sardine catch outside U.S. waters.

3) Conducting an analysis comparing performance measures (such as those presented in Hurtado-Ferro & Punt 2014) under current harvest control rule:
   a) under a scenario where Mexico and Canada are assumed to only take the remaining 13% of the coastwide catch as currently assumed.
   b) under a scenario where Mexico and Canada do not follow the U.S. control rule assumptions, and instead catch sardines at rates recently observed and reported in Demer and Zwolinski (2014) and Hill et al. (2015).

4) Examining the implications of assessing only the northern subpopulation of Pacific sardines and setting harvest measures based only on this stock, while the U.S. landings are known to include the southern subpopulation of Pacific sardine and the CPS FMP establishes management under an assumption of a single coastwide stock.

These requests for alternatives and for analysis are not meant to be exclusive to the full set of alternatives stipulated in the agreement. They are meant to help find a science-based solution to the identified problems with DISTRIBUTION and further sustainable fishery management of the transboundary Pacific sardine stock.

Figure 1. Proportion of Pacific sardine northern subpopulation landings by country (2005-2014) (NSP landings data from Hill et al. 2015). U.S. proportion displayed as percentage.



References

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PFMC (Pacific Fishery Management Council). 1998. Amendment 8, Appendix B, options and analyses for the Coastal Pelagic Species Fishery Management Plan. PFMC, Portland, Oregon.

Problem Statement and Considerations for Revising the Pacific Sardine Distribution Parameter

Geoff Shester and Ben Enticknap

August 18, 2015
Presentation to the Pacific Fishery Management Council
Workshop on Sardine Distribution, La Jolla, CA.

OCEANA

CPS FMP Objectives

- Prevent overfishing
- Achieve Optimum Yield
- Provide adequate forage for predators
- Encourage cooperative international management
  - Using biological distribution to allocate catch only works if other nations agree and abide by the allocation

OCEANA

Annually Specified Reference Points for Pacific Sardines

OFL = BIOMASS * E_{MSY} * DISTRIBUTION

ABC = BIOMASS * BUFFER * E_{MSY} * DISTRIBUTION

ACL = LESS THAN OR EQUAL TO ABC

HG = (BIOMASS – CUTOFF) * FRACTION * DISTRIBUTION

ACT = HG OR ACL, WHICHEVER VALUE IS LESS

OCEANA

Optimizing fishing quotas to meet target fishing fractions of an internationally exploited stock of Pacific sardine (*Sardinops sagax*)

***North American Journal of Fisheries Management*, 2014**

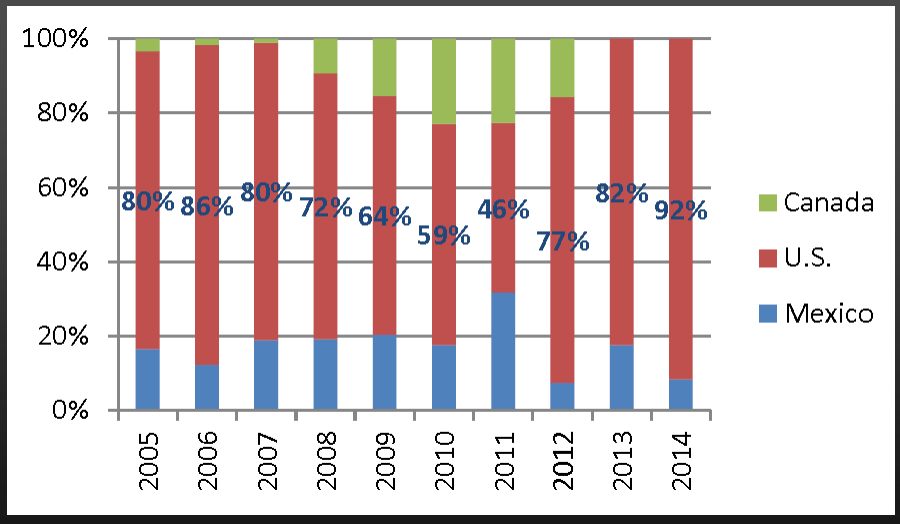
D. A. Demer and J. P. Zwolinski (NMFS/SWFSC)

"…the current harvest control rule for sardine has not consistently maintained a total fishing fraction below the US target value because the 'distribution' parameter, which is intended to account for the proportion of the stock in the US exclusive economic zone (EEZ), has **not adequately accounted for landings** of the stock at **Mexico and Canada**."

OCEANA

Landings of NSP Sardines

Based on Hill et al. 2015 Assessment



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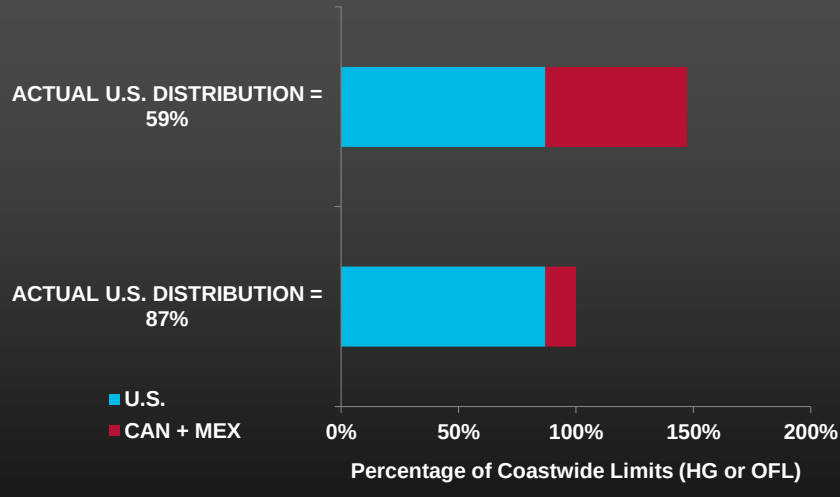
When Mex + Can Catch More than 13%



U.S. Distribution of Sardine Catch in 2010 was 59% (Hill et al. 2015)

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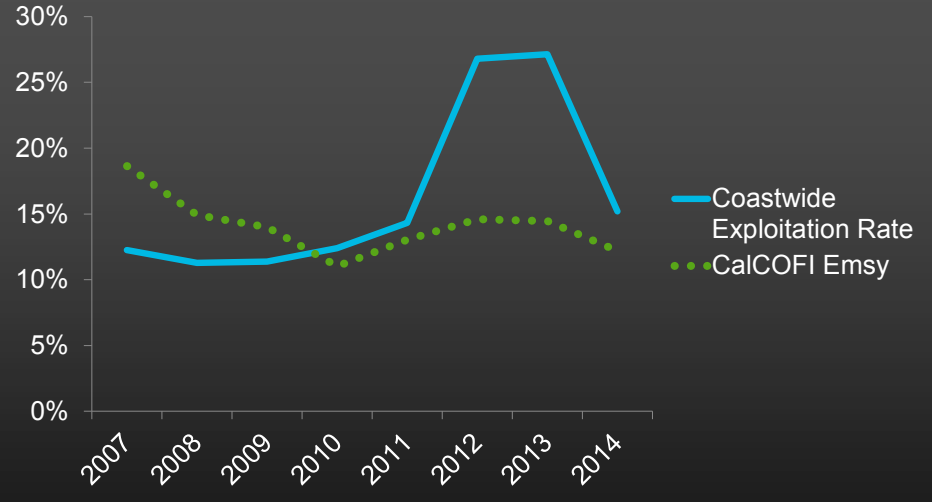
- When the actual proportion of the Northern subpopulation Pacific sardine landings in U.S. waters is less than 87%, the use of a DISTRIBUTION parameter equal to 87% systematically inflates all of major status determination criteria and harvest control rule measures, including the overfishing limit, acceptable biological catch, and annual catch limits, to be set at higher levels than they would be if the true level of the foreign sardine distribution and catch were fully taken into account.
- Conversely, in times when the distribution of the Pacific sardine catch is actually higher in U.S. waters, it would mean U.S. catch limits are set lower than intended.
- Neither case presents an optimal situation for the sustainability of the sardine population or the fishery.



Coastwide (U.S., Mexico and Canada) exploitation rate compared to the 3-year average CalCOFI E_{MSY} for the of the Northern subpopulation of Pacific sardines indicates exploitation in excess of E_{MSY} since 2010. Data from Hill et al. 2015 Assessment. E_{MSY} = Overfishing Limit

Problems with Current Formulation of Distribution

- Unilateral biomass-based definition inherently fails to prevent overfishing and achieve OY when a large proportion of the population is present and fished in the Mexican and/or Canadian EEZ.
- No assurance that Canada and Mexico will determine catch levels according to the U.S. estimation of the portion of the stock in respective waters
- Data issues:
  - Out of date (1965-1992)
  - Limited geographic range - Pacific NW or Canada omitted
  - Did not distinguish Northern and Southern Subpopulation fish

OCEANA

Setting U.S. OFL to Prevent Overfishing

"Overfishing" = Exceeding MSY

Current Overfishing Limit:

U.S. OFL = B * E_{MSY} * D

If Foreign Catch exceeds B * E_{MSY} * (1 – D), then sum of U.S. OFL + foreign catch will exceed MSY

Proposed Change to 'Distribution' in U.S. OFL:

BIOMASS * E_{MSY} - Lmexico - Lcanada

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- CPS FMP envisioned and analyzed a Target Coastwide F as the basis for the current HCR.
- Amendment 8 and 13 analyses used DISTRIBUTION = 1 assuming Mexico and Canada follow the U.S. control rule and assessed performance coastwide.

OCEANA

Performance Standards

All Model Runs Assume DISTRIBUTION = 1: Target Coastwide F Achieved

TABLE 4.2.5-1. MSY control rule options for Pacific Sardine. All options evaluated in a stochastic model.

	Option A (Status Quo)	Option B	Option C	Option D	Option E	Option F	Option G	Option H	Option I	Option J	Option K	Option L (Stochastic F_{MSY})	Option M (Determ. Equil. F_{MSY} in a Stochastic Model)
Overfishing Definitions													
Overfishing Rate	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC	Catch> ABC
Overfished Threshold (mt)	50	50	50	50	50	50	50	50	50	50	50	50	50
Control Rule Parameters													
FRACTION	20%	F_{MSY} (10-30%)	20%	F_{MSY} (10-30%)	F_{MSY} (10-30%)	F_{MSY} (5-25%)	F_{MSY} (5-15%)	F_{MSY} (5-15%)	F_{MSY} (5-25%)	F_{MSY} (5-15%)	F_{MSY} (10-30%)	12%	8.8%
CUTOFF	50	50	100	100	100	100	100	100	100	150	50	0	0
MAXCAT	400	400	400	400	300	400	400	300	300	200	200	Infinite	Infinite
Performance Measure													
Average Catch	151	159	165	171	165	177	179	169	169	145	141	180	170
Std. Dev. Catch	137	140	140	143	113	143	133	105	112	67	72	180	153
Mean Biomass	936	964	1,073	1,091	1,280	1,216	1,543	1,665	1,400	1,952	1,516	1,408	1,784
StdDev Biomass	27	27	29	28	34	32	39	42	37	49	43	39	43
Mean Log Catch	4.33	4.46	4.44	4.54	4.64	4.62	4.77	4.80	4.70	4.76	4.65	4.72	4.77
Mean Log Biom	6.24	6.37	6.50	6.59	6.75	6.74	7.06	7.15	6.89	7.34	6.87	6.89	7.24
Percent Years Biomass>400	61%	64%	70%	73%	79%	81%	90%	92%	84%	96%	79%	84%	93%
Percent Years No Catch	5%	2%	7%	4%	3%	2%	1%	0%	1%	0.5%	1%	0%	0%
Median Catch	103	104	119	121	148	131	140	156	158	182	188	128	127
Median Biomass	598	600	700	748	898	850	1,248	1,349	1,048	1,648	1,099	1,500	1,049

Amendment 8 Appendix B.

"Catches in the simulation model were determined by applying the MSY control rule to the biomass assessment. The 'quota' catch (based on the MSY control rule) was assumed to be taken exactly by U.S. and Mexican fisheries…" p. B-93

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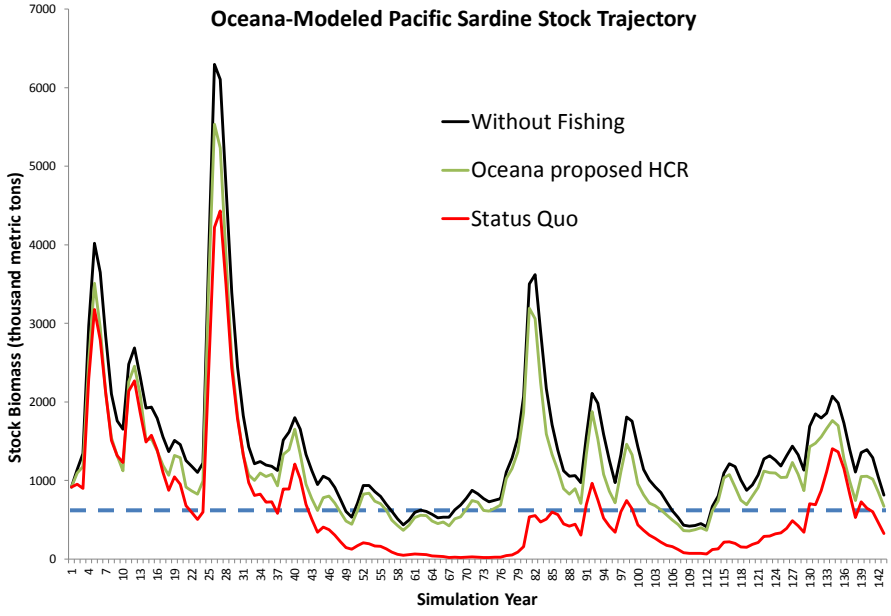
Hurtado & Punt (2014) Sensitivity Analysis:

"…the results are sensitive to Mexico and Canada not following the US control rule (case S14 in Table 6). This is the only case in which the resource is rendered extinct."

	Status quo*	Alt 2a	Alt 2b	2a (MF)*	2b(MF)**
Fraction	15%	5-15%	10-20%	5-15%	10-20%
Mean B1+ (tmt)	1208	1220	1182	**716**	**660**
Depletion	77%	78%	75%	**46%**	**42%**
Mean catch (tmt)	107	106	112	**57**	**60**

*Sensitivity Run corresponding to Alternative 2a (Sardine Fraction EA 2014) when Mexico and Canada do not follow US Harvest Control Rule, Table 6, S14, Hurtado-Ferro & Punt 2014

** Additional Sensitivity Run of Alternative 2b (Sardine Fraction EA 2014, Oceana Public Comment)



Trajectories analyzed using 2013 Hurtado & Punt model

CPS FMP on Accounting for Foreign Catch in the U.S. Harvest Guideline

- "[o]ther approaches that may be developed in the future are not precluded by this default [the current approach to setting a fixed DISTRIBUTION]. If the portion of the stock in U.S. waters cannot be estimated or is highly variable, then other approaches may be used. It may be more practical, for example, *to use a high CUTOFF* in the MSY control rule [HG] to compensate for stock biomass off Mexico and Canada." (PFMC 2011, at 40).

Current Approach: **HG = (B – C)*F*D**

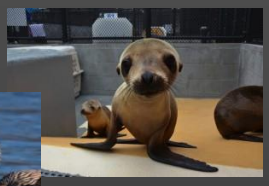
High Cutoff Approach: **HG = (B – C)*F**
where C incorporates foreign catch

3 Basic Categories of Options to Address Transboundary Issue

- Unilaterally self-proclaim a U.S. DISTRIBUTION
- Adjust U.S. landings based on actual foreign catch to achieve Target F
- International agreement upon stock biomass and catch allocation (i.e., Pacific whiting treaty)

OCEANA

Thank You



OCEANA

19 October 2015

To: Pacific Fishery Management Council, Attn: Mr. Kerry Griffin, Pfmc.comments@noaa.gov
From: Dr. 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)

Please replace the letter submitted by Drs. David Demer and Juan P. Zwolinski on 16 October 2015 with this letter 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 author.

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, I 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:

$$H = (BIOMASS - CUTOFF) * FRACTION ,$$

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 (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 $L_{\text{foreign}_{y-1}}$. 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 $L_{\text{foreign}_{y-1}}$ or "Distribution" (=$L_{\text{foreign}_{y-1}}$/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).

I 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,
Juan Pablo Zwolinski, Ph.D.

References

Demer, D.A. and J.P. Zwolinski. 2014. Optimizing fishing quotas to meet target fishing fractions of an internationally exploited stock of Pacific sardine. North American Journal of Fisheries Management 34: 1119–1130.

Demer, D.A. and J.P. Zwolinski. 2015. 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. Primary Document 1, presented at the NMFS/PMFC workshop on the Pacific sardine distribution.

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Hill, K., Crone, P. R., Lo, N. C. H., Demer, D. A., Zwolinski, J. P., and Macewicz, B. J. 2012. Assessment of the Pacific sardine resource in 2012 for U.S. Management in 2013. Pacific Sardine Assessment Update Report, Agenda Item G.3.b. Supplemental Attachment 1: 51 pp.

Hill, K. T., Crone, P. R., Dorval, E., and Macewicz, B. J. 2015. Assessment of the Pacific Sardine Resource in 2015 for U.S.A. Management in 2015-16. Agenda Item G.1.a.

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