



October 24, 2011

Mr. Dan Wolford, Chair  
Pacific Fishery Management Council  
7700 NE Ambassador Place, Suite 101  
Portland, OR 97220-1384

**RE: 2012 Conservation and Management Measures for Pacific Sardine**

Dear Chair Wolford and Council Members:

Thank you for the opportunity to provide public comments regarding conservation and management measures for the 2012 Pacific sardine fishery.

In the interest of preserving a sustainable Pacific sardine fishery, maintaining healthy populations of those species that depend on Pacific sardine as forage and the overall health of the California Current ecosystem, we formally request that the Pacific Fishery Management Council (Council) take the following action:

- 1) Initiate a Management Strategy Evaluation to revise the flawed parameters in the harvest control rule for Pacific sardine.
- 2) Re-evaluate and revise the assumption of a constant natural mortality rate in the stock assessment methodology for Pacific sardine, as recommended by the Council's Scientific and Statistical Committee.
- 3) Explicitly list and incorporate relevant social, economic and ecological factors into the annual specifications process for the Coastal Pelagic Species Fishery Management Plan (CPS FMP).

Taking this action will bring the fishery into compliance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and National Standard 1 (NS1) Guidelines, and will help to ensure a healthy ecosystem able to support valuable west coast fisheries and coastal economies.

During the 2011 Pacific sardine management cycle, the Pew Environment Group offered public comment to express concerns regarding the harvest control rule used to determine the annual

harvest guideline.<sup>1</sup> We have also submitted public comment on Amendment 13 to the CPS FMP to establish science based annual catch limits (ACLs) intended to prevent overfishing while achieving optimum yield from the fishery.<sup>2</sup> For the 2012 management cycle, we further wish to register our concern regarding the assumption of natural mortality in the stock assessment methodology for Pacific sardine. These concerns and our corresponding requests are summarized below.

### **Harvest Control Rule**

There are four parameters in the harvest control rule for Pacific sardine that is used to determine the annual harvest guideline for the fishery: BIOMASS, CUTOFF, FRACTION and DISTRIBUTION. While BIOMASS is determined through the annual stock assessment and update process, the CUTOFF, FRACTION and DISTRIBUTION parameters are either fixed or fixed within a range as the result of a policy determination made by the Council with advice from the relevant advisory bodies and the Council's Science and Statistical Committee (SSC). Our primary concerns with each of these parameters are described below.

#### Define a CUTOFF Parameter That Provides Sufficient Forage and Rebuilding Stock

In the harvest control rule for actively managed coastal pelagic species, the CUTOFF parameter is the biomass level below which direct harvest is not permitted. Should overfishing occur, CUTOFF is intended to set aside a buffer of spawning stock that is protected from fishing and available for use in rebuilding if the stock becomes overfished.<sup>3</sup> For Pacific sardine, the CUTOFF value is fixed at 150,000 metric tons (mt) and is subtracted off the top from the overall biomass available to the fishery. Accordingly, harvest levels determined by the rule will decline as overall biomass declines until it reaches the CUTOFF, at which point the harvest guideline would be zero.

There is a lack of transparency regarding how the CUTOFF value was derived and what its purpose is within the harvest control rule. For Pacific sardine, CUTOFF is set at three times the Minimum Stock Size Threshold (MSST) of 50,000 mt. According to the NS1 guidelines, MSST is defined as the greater of  $\frac{1}{2} B_{MSY}$  or the minimum stock size at which rebuilding to the Maximum Sustainable Yield (MSY) level would be expected to occur in 10 years if the stock was fished at the Maximum Fishing Mortality Threshold (MFMT).

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<sup>1</sup> See Pew Public Comment Letter Regarding 2011 Harvest Guideline for Pacific Sardine. (RIN 0648-XA109) Available at <http://www.pewenvironment.org/campaigns/pacific-fish-conservation-campaign/id/85899360413/resources/>

<sup>2</sup> See Pew Public Comment letter to the National Marine Fisheries Service on Amendment 13 to the Coastal Pelagic Species Fishery Management Plan. Available at <http://www.pewenvironment.org/campaigns/pacific-fish-conservation-campaign/id/85899360413/resources/>

<sup>3</sup> PPMC. Amendment 13 to the Coastal Pelagic Species FMP, Draft Environmental Assessment. Page 23.

This approach to defining MSST and therefore CUTOFF is problematic for two reasons. First, the National Marine Fisheries Service (NMFS) maintains that  $B_{MSY}$  is not used as a MSY reference point for Pacific sardine due to its cyclical nature of abundance.<sup>4</sup> This means that managers are left to define MSST according to the second option articulated in the NS1 guidelines – the minimum stock size at which rebuilding to the MSY level would be expected to occur in 10 years if the stock was fished at the MFMT. According to Amendment 13 to the CPS FMP, MFMT for Pacific sardine is not a fixed value (as is MSST and CUTOFF), but is defined as catch exceeding the Allowable Biological Catch (ABC), determined annually by the ABC control rule.<sup>5</sup> This should make establishing a value for MSST and CUTOFF an annual exercise. We therefore question why MSST is set at a fixed value of 50,000 mt and whether that is an adequate threshold for determining if the stock is overfished.

The Council should eliminate this confusion regarding how CUTOFF is defined and its purpose within the context of the harvest control rule. If CUTOFF is intended to provide a “forage set aside” as has been claimed by some observers including one of the authors of the harvest control rule,<sup>6</sup> we request that the Council transparently define a variable that both adequately accounts for rebuilding needs and provides sufficient forage for other marine species in the ecosystem by maintaining Pacific sardine’s relative contribution to the California Current forage base. We believe this can be done most effectively through a Management Strategy Evaluation for the harvest control rule and an annual specifications process that properly incorporates ecological considerations.

#### Revise FRACTION Parameter According to Stochastic $F_{MSY}$ of 12%

The FRACTION parameter in the harvest control rule is a proxy for  $F_{MSY}$ .<sup>7</sup> This parameter specifies the amount of Pacific sardine available to the fishery when BIOMASS exceeds CUTOFF and is based on average sea-surface temperature at the Scripps Pier in La Jolla, CA. A scientific study was conducted in 2010 to re-evaluate the stock-recruit and temperature-recruit relationships that are used to determine FRACTION.<sup>8</sup> This study shows that the sea-surface temperature data collected at Scripps Institute of Oceanography Pier is an unreliable predictor of sardine recruitment success. Despite this new information, the current harvest control rule continues to utilize this proxy to determine the harvest rate. Furthermore, whereas the Council established a range in harvest rate (FRACTION) of 5% - 15%, the chosen rate for the U.S. fishery

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<sup>4</sup> See Response to Public Comments. Federal Register, May 25, 2011. Vol. 76, No. 101. Final rule: Fisheries Off West Coast; Coastal Pelagic Species Fisheries, Annual Specifications. (RIN 0648-XA109)

<sup>5</sup> PFMC. Amendment 13 to the Coastal Pelagic Species FMP, Draft Environmental Assessment. Page 22.

<sup>6</sup> PFMC Agenda Item G1d. Public Comment. June 2008.

<sup>7</sup> PFMC. Amendment 13 to the Coastal Pelagic Species FMP, Draft Environmental Assessment.

<sup>8</sup> McClatchie, S., Goericke, R., Auad, G., and Hill, K. 2010. Re-assessment of the Stock-Recruit and Temperature-Recruit Relationships for Pacific Sardine (*Sardinops sagax*). 2010. Canadian Journal of Fisheries and Aquatic Sciences 67:1782-1790.

has been set at 15% since implementation of the harvest control rule began in 2000 due to relatively warm temperatures.

While an accurate and reliable replacement for this recruitment proxy may not be readily available, we believe that the National Marine Fisheries Service (NMFS) is making progress toward this end and has the tools it needs to further understand Pacific sardine recruitment. In particular, we are aware of recent studies looking at the effects of zooplankton abundance as well as mesoscale features on the spawning and recruitment variability of Pacific sardine.<sup>9</sup> We encourage continued focus on this effort. However, until the harvest control rule is corrected with an  $F_{MSY}$  proxy that accurately reflects recruitment success, we believe NMFS should act with more precaution than it currently has in determining harvest guidelines by setting a maximum harvest rate of 12%, which was determined to be the  $F_{MSY}$  (stochastic) through the analysis in Amendment 8 to the CPS FMP.<sup>10</sup>

#### Revise DISTRIBUTION Parameter to Accurately Reflect Actual Distribution of Pacific Sardine

The current Pacific sardine harvest control rule sets the portion of the fishery available in U.S. waters at 87%, implying that 13% is available in Mexican and Canadian waters. There is also broad agreement that this DISTRIBUTION parameter is inaccurate as recent catch history from Mexico and Canada show catch levels exceeding 13% of the total harvest guideline by a factor of four. In fact, landings data show that total coast-wide landings exceeded the total overfishing level in 2009.<sup>11</sup>

We request that the Council and NMFS revise this variable of the Pacific sardine harvest control rule to accurately reflect actual distribution within the fishery. We also encourage the Council, NMFS and the U.S. State Department to continue to explore avenues that will expand cooperation with Canada and Mexico on scientific research and coordinated international management of the fishery to prevent overfishing and provide sufficient forage in the ecosystem.

The current lack of coordinated transboundary management for Pacific sardine jeopardizes the long term health of the stock. Regardless of how precautionary an approach is being taken in U.S. waters, our efforts to maintain an ecologically sustainable fishery will be for naught if total exploitation rates for Pacific sardine continue to rise, as is currently the trend.

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<sup>9</sup> McClatchie, S. February 2011. Presentation on temperature-recruit relationship for Pacific sardine. Coastal Pelagic Species Management Team meeting. La Jolla, CA.

<sup>10</sup> PFMC. CPS FMP, Amendment 8, Appendix B, p. B-94. December 1998.

<sup>11</sup> Hill et al. 2010. Assessment of the Pacific sardine resource in 2010 for U.S. management in 2011. NOAA National Marine Fisheries Service Southwest Fisheries Science Center. Pacific Fishery Management Council. Agenda Item I.2.b Attachment 2. p. 7

## **Re-evaluate Assumption of Constant Natural Mortality in Stock Assessment Methodology**

Annual stock assessments and updates for Pacific sardine are conducted out of the National Marine Fisheries Service's Southwest Fisheries Science Center. The current Stock Synthesis model used to determine biomass incorporates data from several different surveys conducted within the California Current ecosystem to arrive at a statistically defensible estimate of the total harvestable biomass of Pacific Sardine. In order to conduct this assessment, several assumptions are made regarding the life history and strategy for the species. One of these assumptions is the natural mortality rate (M) experienced by Pacific sardine, which for assessment purposes is constant and set at 0.4 yr<sup>-1</sup>, meaning that 33% of the Pacific sardine stock would die of natural causes, including predation, each year if there were no fishery.<sup>12</sup>

We are concerned with the assumption of a constant natural mortality rate of 0.4 yr<sup>-1</sup> for all ages and all years. This assumption disregards studies finding that natural mortality due to predation is not only ontogenetically variable but also temporally variable, and especially for forage species, generally higher than assumed in traditional single species stock assessments.<sup>13</sup> Tyrrell et al. demonstrate that biological reference points generated by explicitly incorporating predation mortality into population dynamic models are generally more conservative (e.g., recommend higher standing biomass) than those produced using traditional assessment methods.<sup>14</sup>

Our concern over the assumed natural mortality rate utilized in the stock assessment methodology is also shared by the SSC. In its review of the 2010 Pacific sardine assessment, the SSC recommended an examination of this assumption and its appropriateness for use in the 2011 assessment.<sup>15</sup> Despite this recommendation, the assumption remains a fixed parameter in the Stock Synthesis model. As the Council endeavors to incorporate ecosystem science into the management of fisheries, the assumption of a constant natural mortality rate for critical forage species like Pacific sardine must be adapted to better account for predation mortality.

## **Explicitly Incorporate All Relevant Factors in the Determination of Optimum Yield**

The MSA mandates that Fishery Management Plans (FMPs) seek to achieve Optimum Yield (OY) in order to provide the greatest overall benefit to the Nation, particularly with respect to food

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<sup>12</sup> Hill et al. 2008. Assessment of the Pacific sardine resource in 2008 for U.S. management in 2009. NOAA National Marine Fisheries Service, Southwest Fisheries Science Center.

<sup>13</sup> Dickey-Collas, M., R.D.M Nash, T. Brunel, C.J.G. van Damme, C.T. Marshall, , M. R. Payne, A. Corten, A.J. Geffen, M.A. Peck, E.M.C. Hatfield, N.T. Hintzen, K. Enberg, L.T. Kell and E. Simmonds. 2010. Lessons learned from stock collapse and recovery of North Sea herring: a review. *ICES Journal of Marine Science* 67: 1875–1886.

<sup>14</sup> Tyrrell, M.C., J.S. Link and H. Moustahfid. 2011. The importance of including predation in fish population models: Implications for biological reference points. *Fisheries Research* 108:1-8.

<sup>15</sup> Scientific and Statistical Committee Report on Pacific sardine stock assessment and coastal pelagic species management measures for 2011. PFMC Agenda Item1.2.c. November 2010.

production, recreational opportunities and protecting marine ecosystems.<sup>16</sup> Under the MSA, OY is defined as MSY reduced by relevant social, economic and ecological factors.<sup>17</sup> The incorporation of economic and ecological factors into the determination of catch levels is thus a requirement of FMPs.<sup>18</sup> Moreover, the benefits of ecosystem protection required include “maintaining adequate forage for all components of the ecosystem.”<sup>19</sup> The revised NS1 guidelines go even further by directing that in FMPs, “consideration should be given to managing forage stocks for higher biomass than  $B_{MSY}$  to enhance and protect the marine ecosystem.”<sup>20</sup> Despite this clear mandate and specific guidelines, the CPS FMP does not explicitly incorporate any consideration of ecological factors, and the consideration of economic factors ignores the value of Pacific sardine as forage to commercially and recreationally important species.

We believe that there are practical ways to incorporate ecological and economic factors into the management of Pacific sardine and we look forward to working with the Council and relevant advisory bodies on this issue. Section 4.82 of the CPS FMP lists the various factors currently considered in making annual specifications and provides an ideal vehicle for explicitly listing economic and ecological factors.

Ecological considerations under this section should include among others: the relative contribution of each CPS (in this case Pacific sardine) to the diets of key predators in response to population trends and ocean conditions, identification of oceanographic features that correlate with high relative densities of CPS and their predators, and the results of modeling analyses to identify the potential ecological effects of alternative harvest strategies.

If managers are to maximize the economic benefit to our nation, economic considerations for Pacific sardine should include recent studies evaluating the relative economic value of forage species as forage for commercially and recreationally important marine species.<sup>21</sup> For Pacific sardine, Hannesson and Herrick find that the value of commercially caught predators and the efficiency by which they convert sardines to exploitable biomass were the most important factors in determining the viability of the sardine fishery.<sup>22</sup> Economic and social OY adjustments should also be carefully designed so that they do not overlook the possible negative impacts of forage fish depletion on commercial and recreational fisheries for marine predators in higher-trophic levels.

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<sup>16</sup> 16 U.S.C. 1851 § 301(a)(1)

<sup>17</sup> 16 U.S.C. 1802 § 3(33)(B).

<sup>18</sup> 50 C.F.R. § 600.310(e)(3)(iv)(C).

<sup>19</sup> 50 C.F.R. § 600.310(e)(3)(iii)(C).

<sup>20</sup> 50 C.F.R. § 600.310(e)(3)(iv)(C).

<sup>21</sup> Hannesson, R., & Herrick JR, S. (2010). The value of Pacific sardine as forage fish. *Marine Policy*, 34(5), 935-942. Retrieved from <http://linkinghub.elsevier.com/retrieve/pii/S0308597X10000254>

<sup>22</sup> *Ibid.*

In light of the special emphasis on OY considerations for forage stocks, and the fact that the CPS plan manages forage species, the omission of relevant ecological and economic considerations is problematic. Recently published scientific findings show that directed fishing on lower-trophic level species can have significant negative effects on the ecosystem, as well as other valuable commercial fisheries.<sup>23</sup> Because of the important role these species play in the marine ecosystem by transferring production from plankton to larger predators, removing them in large quantities from the ecosystem has disproportionate effects up and down the food web. Smith et al report that even reducing the population of important forage species by a small amount (i.e., biomass reduced by a quarter, to 75% of the biomass without fishing, B<sub>0</sub>) can have severe impacts on some predator populations, resulting in biomass declines of 60% or more for the predator.

Amendment 13 to the CPS FMP acknowledges the requirement to incorporate OY considerations through the addition of language explaining that the Council will consider ecological factors in specifying Status Determination Criteria, ACLs, and Annual Catch Targets for CPS species.<sup>24</sup> Amendment 13 also states that “the Council did not provide explicit guidance on the application of this provision,” therefore it will only be implemented through subsequent actions (e.g. annual specifications).<sup>25</sup> This is not an adequate justification for the decision to defer consideration of ecological factors to subsequent specifications packages, as outlined in the proposed changes to the FMP.<sup>26</sup> We also note that “explicit guidance” on consideration of ecological factors, while not provided by the Council, is outlined in great detail in the NS1 Guidelines.

## Conclusion

Pacific sardine is a critical forage species in the California Current ecosystem, preyed upon throughout its life cycle by a wide variety of commercially and recreationally valuable fish, domestic and migratory seabirds and marine mammals. Several of the species that depend on Pacific sardine as an important source of life sustaining protein are listed under the Endangered Species Act and are currently being managed under recovery plans.<sup>27</sup> Pacific sardine also supports a major commercial fishery on the west coast that has averaged ~85,600 mt with an

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<sup>23</sup> Smith et al. 2011. Impacts of Fishing Low-Trophic Level Species on Marine Ecosystems. *Science*. [www.sciencemag.org](http://www.sciencemag.org) July 21, 2011.

<sup>24</sup> PFMC, Amendment 13 to the Coastal Pelagic Species FMP, Draft Environmental Assessment, at 9

<sup>25</sup> Ibid, at 27

<sup>26</sup> PFMC, Coastal Pelagic Species Fishery Management Plan, as Amended Through Amendment 13, Proposed Draft, January 2011 at A-45

<sup>27</sup> For a detailed list of threatened and endangered Pacific salmon species, see <http://www.nwr.noaa.gov/ESA-Salmon-Listings/upload/1-pgr-8-11.pdf>

ex-vessel value of \$11,879,000 over the past 10 years.<sup>28</sup> As the Council sets conservation and management measures for the commercial harvest of Pacific sardine, it is essential that enough Pacific sardine is left in the ocean to maintain the ecological role they play in the California Current ecosystem to support sustainable fisheries, a productive ecosystem and strong coastal communities.

The Pew Environment Group has previously expressed concern regarding the management of forage fisheries on the west coast, including the Pacific sardine harvest control rule and Amendment 13 to the CPS FMP. We have also included in these comments our concern regarding the assumption of natural mortality used in the stock assessment. These concerns remain, and the Pacific sardine fishery continues to be managed according to the status quo. For these reasons, we request that the Council take immediate action to initiate a Management Strategy Evaluation to revise the harvest control rule, revise the assumption of a constant natural mortality rate, and explicitly incorporate the consideration of all relevant social, economic and ecological considerations in making annual specifications.

We look forward to working with the Council and all stakeholders to maintain healthy oceans and sustainable fisheries.

Sincerely,

A handwritten signature in black ink, appearing to read 'Steve Marx', written in a cursive style.

Steve Marx  
Pew Environment Group

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<sup>28</sup> Pacific Fishery Management Council. Status of the Pacific Coast Coastal Pelagic Species Fishery and Recommended Acceptable Biological Catches. Stock Assessment and Fishery Evaluation. June 2011