

Agenda Item F.2



NATIONAL COALITION FOR MARINE CONSERVATION
4 Royal Street, S.E., Leesburg, VA 20175

May 26, 2010

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

RE: CPS Fishery Management Plan Amendment 13--Annual Catch Limits and Accountability Measures

Dear Council Members,

The National Coalition for Marine Conservation (NCMC) is dedicated to conserving and managing marine fisheries through an ecosystem-based approach, one that considers and respects the broader food web each species is a part of. Coastal Pelagic Species, including sardine, mackerel and squid among others, are not only important to west coast-based fisheries, they are critical forage for numerous predators in the California Current ecosystem. As such, they must be managed in a manner that balances their contribution to both fisheries and predator needs.

We appreciate the Pacific Council's work in developing Amendment 13 to the Coastal Pelagic Species (CPS) Fishery Management Plan, which integrates new provisions of the Magnuson-Stevens Act National Standard 1 Guidelines into CPS management.

Our comments on the proposed alternatives in draft Amendment 13 deal specifically with those provisions of the NS1 Guidelines that require catch limits to maintain adequate forage for all components of the ecosystem¹; stipulate that the catch specification process must explicitly address impacts of fishing on forage fish stocks and predator-prey interactions²; and recommend the adoption of more conservative and precautionary harvest guidelines for forage species "to enhance and protect the marine ecosystem"³.

¹ 50 CFR § 600.310(e)(3)(iii)(c)

² Id. at § 600.310(3)(iv)

³ Id. at § 600.310(e)(3)(iv)(C)

Our recommendations are to include in the CPS FMP, through Amendment 13:

1. The addition of other forage species important to the west coast marine ecosystem for the purpose of monitoring and assessing the health of the overall forage base; and,
2. New harvest guidelines that explicitly account for the needs of the ecosystem, with emphasis on maintaining adequate forage for predators.

1. Adopt Stock Classification Alternative 3

The actively managed (and monitored) species in the CPS FMP are part of a larger California Current forage base. The NS1 objective of maintaining adequate forage for all components of the ecosystem underscores the need to consider, not only the status of the target fish, but the status of the forage base as a whole when setting catch limits for any single species. That is why we urge the Council to adopt Alternative 3 and add other important forage species not currently in the FMP as Ecosystem Component species, a designation the National Marine Fisheries Service (NMFS) included in the NS1 Guidelines to encourage the councils to take an ecosystem approach to fisheries.

There are many small pelagic species that are critical to the ecosystem as forage but which are not currently the target of commercial fisheries off the west coast. We strongly support adding these species to the CPS FMP as EC species, for the simple reason that information on the role of these species in the food web, on their population status and on trends in their status, considered within the context of gauging the health of the overall forage base, would greatly enhance CPS management and eventually lead to an ecosystem approach to managing west coast forage fisheries.

The CPS Advisory Subpanel agrees that additional forage species should be monitored to inform and improve ecosystem-based management.⁴ The CPSAS, however, thinks it more appropriate to do this through the Ecosystem FMP, which is currently in the earliest stages of development. We would agree that these kinds of food web linkages and trophic level assessments should be a principal component of the council's E-FMP. However, given that this plan will be years in the making, and that management decisions regarding safe and sustainable catch levels for forage fisheries will continue to be made under the CPS FMP, we believe interim action is necessary. The inclusion of EC species in the CPS FMP is an interim measure, in that it is the first step in developing a framework for linking the monitoring and management of forage species to maintain an adequate biomass of forage in the California Current ecosystem.

⁴ Supplemental CPSAS Report, March 2010.

Another interim measure we strongly recommend the council enact an explicit prohibition on the development of any new fisheries for EC species until such time as the E-FMP is adopted and regulatory measures, if appropriate, are implemented through the CPS FMP. The council has already taken similar action, for the sake of the forage base and dependent predators, to prevent the development of a commercial fishery for krill, as has the North Pacific Fishery Management Council with regard to a number of forage species including krill, sand lance and smelts.

2. Revise the Harvest Control Rules to Maintain Adequate Forage for the Ecosystem

In March, the council directed the CPS management team (CPSMT) and the Scientific and Statistical Committee (SSC) to conduct further analyses on the alternatives for overfishing levels (OFLs), acceptable biological catches (ABCs) and annual catch limits (ACLs) included in draft Amendment 13. In our testimony at the March meeting, we asked the council to more fully evaluate CPS harvest control rules for compliance with the new NS1 Guidelines and to make this analysis available for public review before considering final action on Amendment 13 in June.

We had requested a review of the CPS control rules in writing a little over a year ago⁵, shortly after publication of the NS1 Guidelines, noting that the current harvest control rules do not conform to the NMFS guidance because the forage needs of the ecosystem are not explicitly taken into account in the specification of OFL, ABC or ACL. The alternatives presented in draft Amendment 13 still do not specify where ecosystem needs, specifically the maintenance of a healthy forage base, are accounted for, or how. That is the analysis we've requested, and as of this writing we have yet to see it. Until an analysis of where and how the control rule alternatives address ecosystem needs is complete and available for review, it is impossible for us to support any of the proposed alternatives.

We reiterate our concerns. Alternatives employing the CUTOFF value as a buffer against scientific uncertainty and/or to address ecological issues are inherently problematic – regardless of whether CUTOFF is used in specifying the ABC (Alt. 1) or the ACL (Alt. 2) - since this value was determined as a minimum stock size threshold for rebuilding the spawning stock if the stock becomes overfished. Changing its stated purpose without re-determining its value is smoke and mirrors.

Alternative 2, which adds a buffer for scientific uncertainty in designating the ABC (with a P* value selected by the council according to its risk policy), is conceptually much better than the *status quo* (Alt. 1). However, this buffer only addresses uncertainty in the estimate of biomass. Uncertainties in the other components of the rule, including management uncertainty and ecosystem needs,

⁵ NCMC Letter to the Pacific Council, May 27, 2009

are not considered. Instead, CUTOFF is used to reduce ABC to ACL addressing economic and ecological considerations (?).

Unfortunately, the revised Alt. 2 suggested by the CPSMT in March⁶ only further confuses the issue. In this version, the ABC is reduced by scientific uncertainty. The ACL does not account for scientific uncertainty, but instead substitutes CUTOFF (again, posing as unspecified OY considerations). Then the council would go with whichever is lower; which is a given, since the ACL cannot exceed the ABC by statute. The rationale provided by the CPSMT as to what will determine which value will be lower, ABC or ACL, in the case of sardine and Pacific mackerel (biomass, temperature and P* policy) makes it clear that a buffer for ecological purposes does not figure into either equation.

Buffers used in the harvest control rules, no matter what they are called or where they are inserted, should specify how they address ecological needs, as the NS1 Guidelines require, and the council should state explicitly that these buffers are a set-aside for the ecosystem.

Thank you for considering our comments. We will be attending the June 9th CPS meeting and look forward to discussing this amendment further at that time.

Sincerely,

A handwritten signature in black ink that reads "Ken Hinman". The signature is written in a cursive, slightly slanted style.

Ken Hinman
President

⁶ Supplemental CPSMT Report 2, March 2010



May 26, 2010

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

RE: F.2 Coastal Pelagic Species Fishery Management Plan Amendment 13

Dear Mr. Ortmann and Council Members:

The conservation and management of forage species in the Coastal Pelagic Species Fishery Management Plan (CPS FMP) is of great importance to the long-term sustainability of commercial and recreational fisheries and the health and biodiversity of the California Current ecosystem. Forage species like those identified in the CPS fishery and those under consideration as ecosystem component species, play a critical ecological role as prey for other commercially and recreationally important fishes like tunas and salmon, non-target fish, and the many whales, dolphins, seals, sea lions, and seabirds living and feeding in the California Current ecosystem. As the Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS) amend the Coastal Pelagic Species Fishery Management Plan (CPS FMP) to comply with the Magnuson Stevens Act (MSA) and the new implementing regulations in the National Standard One (NS1) guidelines, we request that you adopt approaches to protect the food web and ensure the health of the California Current ocean ecosystem and related fisheries.

We appreciate working with the Council and understand the importance of complying with the MSA and NS1 by addressing the following actions:

1. Include additional forage species as **ecosystem component species** and prohibit commercial harvest of those species unless and until the Council's Ecosystem Fishery Management Plan can address forage species conservation issues and be finalized.
2. Implement **maximum catch limits** for those species that are in the fishery, as is currently done for sardine.
3. **Account for ecosystem needs** both in the harvest control rule for determining Allowable Biological Catch and in the determination of Optimum Yield harvest levels.
4. Identify and evaluate all required **Status Determination Criteria** and **Accountability Measures** for stocks in the fishery.
5. Minimize the risk of overfishing all forage species stocks by **setting buffers** that fully and accurately account for **scientific uncertainty** in the determination of Allowable Biological Catch and **management uncertainty** in Annual Catch Limits.

It would be premature, if not illegal, to close this amendment process without addressing these forage species issues. The NS1 guidelines clearly state what Councils "must" include in the FMP because they are "requirements of the Magnuson-Stevens Act" and "logical extensions thereof"¹ and what the Councils

¹ 74 FR 11 at 3203 (January 16, 2009).

“may” do to advance single-species and ecosystem-based approaches. We believe that in either case, the guidelines provide the Council the opportunity to advance the conservation and management of sustainable fisheries and the ecological services they provide, including ecosystem health, productivity and resilience.

As we have previously mentioned, the FMP amendment process requires NMFS to follow the environmental review provisions of NEPA. In this instance, the Council made a preliminary decision on the FMP amendment in March based on an incomplete analysis that was not in form of a draft Environmental Assessment (EA) or Environmental Impact Statement (EIS). The PFMC is now scheduled to take final action on June 15, 2010, and a draft EA or EIS with a full range of alternatives and complete analyses of existing alternatives has yet to be provided to the public. We believe that more alternatives should be analyzed and therefore request that the Council not select any preferred alternatives until a draft environmental analysis can be prepared that fully informs the decisions that are to be made and allowing for meaningful public review and comment.

1. Designate other forage species as ecosystem component species.

We support adding forage species not currently managed under an existing FMP or “in the fishery” to the CPS FMP as Ecosystem Component (EC) species (Table 1). The NS1 guidelines encourage fishery management councils to incorporate ecosystem considerations into management and to protect marine ecosystems. The rule states that

*[t]he benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining adequate forage for all components of the ecosystem...*²

To achieve this, NMFS encourages the designation of EC species:

*While EC species are not explicitly provided in the MSA, in the MSRA, Congress acknowledged that certain Councils have made significant progress in integrating ecosystem considerations, and also included new provisions to support such efforts (e.g., MSA section 303(b)(12)). As noted in the preamble of this action, **NMFS wants to continue to encourage Councils to incorporate ecosystem considerations**, and having classifications for “stocks in the fishery” versus “ecosystem component species” could be helpful in this regard.*³

The Council has made progress in integrating ecosystem considerations and is continuing to do so. Amendment 12 to the CPS FMP prohibited the harvest of krill and is an excellent example. In designating krill as a prohibited species, the Council and NMFS articulated these very reasons.

The final rule stated that

protecting krill will help to maintain . . . important ecological relationships and to ensure the long-term health and productivity of the West Coast ecosystem . . .

² 74 FR 11 at 3207 (January 16, 2009).

³ Id. at 3185 [emphasis added].

*NMFS believes it is critical to take preventive action at this time to ensure that a krill fishery will not develop that could potentially harm krill stocks, and in turn harm other fish and non-fish stocks.*⁴

We request that similar to krill, other non-target forage species are added to the FMP as EC species and measures are taken to prohibit directed commercial harvest *unless and until there is a plan in place that shows any such fishing can be conducted without harming the health of the marine ecosystem*, including the Ecosystem Fishery Management Plan, stock assessments, and a FMP amendment defining appropriate Annual Catch Limits and Accountability Measures. We stress that krill should retain its prohibited status, placed within the CPS FMP EC category. The below table modifies table 3.1-1 of the preliminary draft of Amendment 13, to list important forage species not already managed in an existing FMP, that we recommend be included in the EC category. We support adding these species to the CPS FMP as EC species.

Common Name	Scientific Name
Euphausiid (krill)	<i>Euphausiidae</i>
Neon flying squid	<i>Ommastrephes bartramii</i>
Boreal clubhook squid	<i>Onychoteuthis borealijaponica</i>
American shad	<i>Alosa sapidissima</i>
Pacific herring	<i>Clupea pallasii</i>
Smelts	<i>Osmeridae</i>
Surf smelt	<i>Hypomesus pretiosus</i>
Night smelt	<i>Spirinchus starksi</i>
Longfin smelt	<i>Spirinchus thaleichthys</i>
Eulachon	<i>Thaleichthys pacificus</i>
Whitebait smelt	<i>Allosmerus elongatus</i>
Topsmelt	<i>Atherinops affinis</i>
Jacksmelt	<i>Atherinops californiensis</i>
Lantern fish	<i>Myctophidae</i>
Pacific suary	<i>Cololabis saira</i>
Pacific sandlance	<i>Ammodytes hexapterus</i>

Table 1. List of important forage species for designation as Ecosystem Component species in CPS FMP (modified from Table 3.1-1, CPS Amendment 13 – Preliminary, February 2010 to exclude species that are “in the fishery” or in another FMP).

The Council has already demonstrated it has the authority and responsibility to take such actions and this authority is clearly stated in the NS1 Final Rule.⁵ The final rule also reiterates that management of EC species can be undertaken in order to meet obligations to minimize bycatch and protect ecosystem health.⁶ As with the management of krill, prohibiting directed commercial harvest of all EC species in table one would achieve these mandates.

⁴ 74 FR 132 at 33372-33373 (July 13, 2009).

⁵ Prohibition on directed catch and/or retention can be applied to either a stock that is “in the fishery” or an “ecosystem component” species. 74 FR 11at 3186 (January 16, 2009).

⁶ Id. at 3205.

2. Include Control Measures that set a Maximum Catch Limit for targeted species.

An important element of harvest control for commercially harvested CPS is a maximum catch threshold (MAXCAT). The Pacific sardine control rule currently employs a maximum catch threshold of 200,000 metric tons but other targeted CPS do not have this control in place. We request MAXCAT threshold be adopted for other CPS that are “in the fishery”, specifically anchovy and jack mackerel. This would provide an important control where stock assessments are either nonexistent or highly uncertain.

The CPS FMP states:

In addition to the CUTOFF and FRACTION parameters, it may be advisable to define a maximum harvest level parameter (MAXCAT) so that total harvest specified by the harvest formula never exceeds MAXCAT. The MAXCAT is used to guard against extremely high catch levels due to errors in estimating biomass, to reduce year-to-year variation in catch levels, and to avoid overcapitalization during short term periods of high biomass and high harvest. MAXCAT also prevents the catch from exceeding MSY at high stock levels and spreads the catch from strong year classes over a wider range of fishing seasons.⁷

3. Account for ecosystem needs in the determination of ABC and OY.

The Magnuson-Stevens Act mandates that catch levels be set in a manner that protects marine ecosystems. Fisheries are to be managed at Optimum Yield, defined as the amount of fish which ‘will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems.’⁸ OY is prescribed as Maximum Sustainable Yield ‘as reduced by any relevant economic, social, or ecological factor.’⁹ The National Standard guidelines address ecological factors in several areas, including in the determination of the greatest benefit to the nation, the setting of Maximum Sustainable Yield, and the specification of Optimum Yield.

a. Account for ecological factors within the harvest control rule for all stocks that are in the fishery.

In the NS1 guidelines, NMFS encourages the Councils to account for ecosystem needs in the determination of MSY, stating:

“NMFS agrees that ecological conditions and ecosystem factors should be taken into account when specifying MSY and has added additional language to § 600.310(e)(1)(iv) of the final action to highlight this point. Such factors might include establishing a higher target level of biomass than normally associated with the specific stock’s Bmsy.”

We agree that in the MSY control rule for sardine, there are some ecological factors considered, specifically sea surface temperatures, but it is entirely unclear as to the appropriateness of those

⁷ Coastal Pelagic Species Fishery Management Plan. (Amendment 8 to the Northern Anchovy Fishery Management Plan) December 1998, at 4-3.

⁸ 16 USC 1802 Sec. 3(33)(A).

⁹ 16 USC 1802 Sec. 3(33)(B).

considerations.¹⁰ At times of low biomass, for both sardine and pacific mackerel, it is especially unclear what is set aside for ecosystem needs, if anything, versus strictly for rebuilding the stock. In the MSY control rule, the FRACTION is considered “approximately equal to F_{msy} ”.¹¹ The CUTOFF value in the MSY control rule appears to only provide a buffer of spawning stock to allow for rebuilding, not for ecosystem needs.¹² DISTRIBUTION is simply the proportion of the stock considered to be in U.S. waters, which is also highly uncertain.

We have repeatedly requested analysis of the harvest control rule for sardine and Pacific mackerel to determine whether or not the MSY control rule addresses ecosystem needs including the consumption needs of key predators and other commercially and recreationally important species. These should not just be assumed, especially at times of low stock abundance. What is more, for species in the fishery without stock assessments, like anchovy and jack mackerel, it is obvious that there are no ecosystem considerations given when determining catch levels. It remains our view that the MSY control rule does not explicitly account for the needs of the ecosystem. This must be true given the CPS FMP statement for why OY should not be set equal to MSY, as “this would prevent the Council from reducing harvest levels to accommodate ecological or economic factors not included in the MSY control rule used to calculate ABC.”¹³

For forage species, we believe we should be fishing at an Ecologically Sustainable Yield (ESY) rather than MSY, and that such an ESY is in fact what is intended by the MSA definition of OY. ESY is the yield an ecosystem can sustain without shifting to an undesirable state.¹⁴ This requires consideration of the impacts of all harvested forage species on the ecosystem and quantifying important qualities such as community stability and resilience.¹⁵

b. The FMP must address ecological factors used to establish Optimum Yield.

The preliminary draft Amendment 13 fails to specify and evaluate the ecological factors that must be addressed in determining Optimum Yield (OY). The final rule states that

*[a]n FMP must contain an assessment and specification of OY, including a summary of information utilized in making such specification, consistent with requirements of section 303(a)(3) of the Magnuson-Stevens Act. A Council must identify those economic, social, and ecological factors relevant to management of a particular stock, stock complex, or fishery, and then evaluate them to determine OY.*¹⁶

Addressing ecological factors in the FMP is of specific importance, especially given the need to manage forage fish stocks for a higher biomass than B_{msy} ¹⁷ and to enhance and protect the marine ecosystem.¹⁸ It is clear that ecological factors must be specified in the FMP and evaluated in determining OY.

¹⁰ We note that: “The SSC would also like to see a critical examination of the SST dependent FMSY function.” Agenda Item H.2.b Supplemental SSC Report, March 2010.

¹¹ CPS FMP Amendment 8, at B-84

¹² CPS FMP Amendment 8, at B-84

¹³ CPS FMP Amendment 8, at B-79

¹⁴ Zabel, W.R., C.J. Harvey, S.L. Katz, T.P. Good, and P.S. Levin. 2003. Ecologically Sustainable Yield. American Scientists Volume 91.

¹⁵ Ibid.

¹⁶ 74 FR 11 3178, at 3207 (January 16, 2009)

¹⁷ 74 FR 11 3178, at 3208 (January 16, 2009)

¹⁸ 74 FR 11 3178, at 3207 (January 16, 2009)

Currently, a wealth of existing data and analytical methods are available to address ecological factors relevant to the harvest strategy of CPS. Diet information, which indicates the existence and strength of predator-prey relationships has been published by NOAA for West Coast species.¹⁹ In addition, food web models of the California Current have been published, including mass balance models (i.e., EcoPath with EcoSim)²⁰ and spatially-explicit dynamic models (i.e., Atlantis)²¹. These models provide the ability to qualitatively and quantitatively describe potential impacts of target species removals on other marine species as well as on ecosystem attributes such as mean trophic level, food web resilience, and biodiversity.

For example, Samhouri et al. (2009)²² identified the effects of fishing rates on 22 ecological attributes of several ecosystem models, including some from the California Current marine ecosystem (a list of all 22 attributes can be found in Attachment 2). Such an approach could readily be applied to evaluate the effects of alternative harvest strategies for CPS species. These are precisely the “relevant ecological factors” that must be considered in any Fishery Management Plan. Claiming that such tools are unavailable or that these factors are not relevant can simply no longer be justified given the state of existing science, including the aforementioned work by NOAA.

Therefore, to comply with the MSA, Amendment 13 to the CPS FMP must list the relevant ecological factors, analyze how the control rules affect these ecological factors, and describe how these factors will reduce MSY to achieve appropriate OYs. Accordingly, the corresponding SAFE documents must include appropriate analyses of the impacts of specified ABC values on ecosystem attributes, other species, and other ecological factors to inform OYs set by the Council.

Attached is a suggested amendment to the CPS FMP section 4.82, “Factors Considered” to clearly identify the ecological factors that will be considered in setting OY, in addition to the social, economic and biological factors. These factors can be evaluated in the ecosystem chapter of the annual CPS SAFE document, and possibly later through the Ecosystem Fishery Management Plan, when the EFMP is finalized.

4. Status Determination Criteria alternatives must be expanded to include alternative criteria, including analyses of other Minimum Stock Size Thresholds.

Status determination criteria (SDC) are quantifiable factors, including Maximum Fishing Mortality Threshold (MFMT), Overfishing Limit (OFL), and Minimum Stock Size Threshold (MSST), or their proxies, that are used to determine if overfishing has occurred, or if the stock or stock complex is overfished. These are required reference points for stocks in the fishery.

The preliminary draft Amendment 13 document contains only two alternatives for status determination criteria—status quo and status quo plus an MSY proxy for the Northern subpopulation of Northern anchovy. Status quo MSST for Pacific mackerel and Pacific sardine is not sufficient, and alternative

¹⁹ Dufault et al., November 2009. NOAA Technical Memorandum NMFS-NWFSC-103. A synthesis of diets and trophic overlap of marine species in the California Current.

²⁰ Field et al. 2006. Top-down modeling and bottom-up dynamics: linking a fisheries-based ecosystem model with climate hypotheses in the Northern California Current. *Prog Oceanography* 68:238-70.

²¹ Horne et al. January 2010. NOAA Technical Memorandum NMFS-NWFSC-104. Design and Parameterization of a Spatially Explicit Ecosystem Model of the Central California Current.

²² Samhouri, J., Levin, P., and Harvey, C. 2009. Quantitative Evaluation of Marine Ecosystem Indicator Performance Using Food Web Models. *Ecosystems* 12: 1283-1298.

MSST thresholds must be analyzed and considered.²³ MSST or a reasonable proxy must be determined for other stocks in the fishery, including anchovy, jack mackerel and market squid.²⁴

5. Amendment 13 to the CPS FMP must address fundamental flaws in the proposed approach to setting scientific and management buffers.

We are concerned that the Council's approach to setting buffers to incorporate uncertainty is incomplete and not compliant with the reauthorized Magnuson-Stevens Act new requirements to prevent overfishing. As the SSC has repeatedly stated, many major uncertainties in the overfishing limit and ABC have not been incorporated into the Council's scientific buffers including uncertainty in the optimal harvest rate, the effects of climate, and ecosystem interactions. Furthermore, the Council's preliminary P* values are unacceptably high and not based on a formal risk analysis. We request that the Council address these other important sources of uncertainty and adopt a precautionary P* value that recognizes the probability of overfishing, both from a single species and an ecosystem context.

In closing, action by the PFMC that builds upon the foundation established with the management of krill and the promulgation of the new National Standard 1 guidelines can successfully advance the long-term conservation of both the California Current ecosystem and the fisheries that depend upon a healthy ecosystem. It is imperative that the PFMC take the time to address outstanding issues and chart a clear path to implementing the mandates of the MSA, the NS1 guidelines, and NEPA. Doing this the right way and legally is far superior to doing it the wrong way based on the argument of timeliness. Done the right way, this CPS amendment can provide a foundation upon which the Council and its ecosystem committees can build in meeting NEPA's broader programmatic requirements and the MSA's goals of ensuring the conservation of our national ocean resources.

We look forward to continuing to work with you on this important matter.

Sincerely,

Ben Enticknap
Pacific Project Manager
Oceana

Kenneth Stump
Policy Director
Marine Fish Conservation Network

Attachments:

- 1) Proposed CPS FMP amendment to identify Optimum Yield considerations.
- 2) Ecosystem attributes which could be used to measure the ecological impacts of CPS harvest strategies within existing models of the California Current Marine Ecosystem

²³ 74 FR 11 3178, at 3206 (January 16, 2009) ("MSST or reasonable proxy must be expressed in terms of spawning biomass or other measure of reproductive potential. To the extent possible, the MSST should equal whichever is greater: One-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years...")

²⁴ While market squid is exempt from ACL and AM requirements because of its life history characteristics, "FMPs or FMP amendments for these stocks must have SDC, OY, ABC, and an ABC control rule." 74 FR 11 at 3210 (January 16, 2009).

Attachment 1.

PROPOSED CPS FMP AMENDMENT TO IDENTIFY OPTIMUM YIELD CONSIDERATIONS
(Proposed language in *italics*)

Section 4.82 FACTORS CONSIDERED

The following factors will be considered when making the annual specifications:

Biological

- The current estimated biomass and any other biological information.
- The MSY control rule described in the FMP, which is specified for each [delete: actively] managed species *in the fishery*.
- *Evaluation of localized depletion, if any.*
- *Identification of key spawning areas and other biologically important areas for CPS species.*

Economic

- Results of comments of domestic processors and joint ventures operations about processing capacity and planned utilization.
- Results of any analysis of fishing capacity and planned utilization of recent years modified by new information and comments by the fishing industry.
- *Economic value of CPS as forage to other commercially and recreationally important species, including value of fisheries and tourism value associated with wildlife viewing.*

Social

- *Results of comments from the public.*
- Any relevant historical information on utilization of CPS resources.

Ecological

- *Contribution of CPS to diets and consumption levels of key predators (e.g. marine mammals, threatened and endangered species, birds and fishes).*
- *Population trends of key CPS predators (e.g. marine mammals, threatened and endangered species, birds and fishes).*
- *Spatial and temporal interactions, including consistent foraging grounds for key CPS predators.*
- *Sea surface temperature and other oceanographic conditions.*
- *Results of analyses from California Current ecosystem models (e.g. Ecopath, Atlantis, etc.) and Integrated Ecosystem Assessments in terms of effects of alternative harvest rates of CPS species on ecosystem attributes (e.g., resilience, mean trophic level, biodiversity, net primary productivity).*
- *The interaction strengths between CPS and key members of the food web, as determined from California Current ecosystem models.*

All data used to make annual specifications will be available for public inspection [delete: during normal business hours at the Southwest Regional Office NMFS] *and evaluated in annual SAFE documents.*

Attachment 2.

Ecosystem attributes which could be used to measure the ecological impacts of CPS harvest strategies within existing models of the California Current Marine Ecosystem (from Samhuri et al. 2009).

Table 2. Descriptions of Ecosystem Attributes Measured in the Ecopath with Ecosim Models, Along with Their Expected States When Unstressed

Attribute	Definition	Unstressed state	Reference
Diversity ¹	Both the number of species and the evenness of biomass distribution among species	High	Odum (1985)
Consumption ²	The sum of somatic and gonadal growth, metabolic costs, and waste products for all species in the ecosystem	High	Odum (1985), Christensen and others (2005)
Net primary production (NPP) ²	The sum of biomass produced by autotrophs	High	Odum (1985), Christensen and others (2005)
Production ²	The sum of biomass accumulation, biomass lost to mortality, and biomass lost to migration for all species in the ecosystem	High	Odum (1985), Christensen and others (2005)
Respiration ²	The portion of consumed energy that is not used for production or recycled as feces or urine	Low	Odum (1985), Christensen and others (2005)
NPP/Biomass ²	The ratio of total autotrophic biomass production to total biomass abundance in the ecosystem	Low	Odum (1985)
NPP/Respiration ²	The ratio of total autotrophic biomass production to total metabolic (or maintenance) costs in the ecosystem	Low	Odum (1985), Christensen and others (2005)
Respiration/Biomass ²	The ratio of total metabolic (or maintenance) costs to total biomass abundance in the ecosystem	Low	Odum (1985), Christensen and others (2005)
Mean trophic level ³	Biomass-weighted average trophic level of all species in the ecosystem	High	de Mutsert and others (2008)
Total biomass ³	The biomass abundance of all functional groups in the ecosystem	High	
Target group biomass ³	The biomass abundance of functional groups targeted by fisheries	High	
Path length ⁴	The average number of functional groups that a unit of energy flows through in the system before being lost	High	Finn (1980), Christensen and others (2005)
Finn's cycling index ⁴	The fraction of all flows in the ecosystem that is recycled	High	Finn (1976), Christensen and others (2005)
Predator cycling index ⁴	The fraction of all flows in the ecosystem recycled through non-detrital paths	High	Christensen and others (2005)
Resilience ⁵	The capacity of an ecosystem or foraging guild to absorb perturbations while retaining its essential structure and function, including the identities of the component species. (see equations 1 and 2)	High ($C \rightarrow 0$ or $R \rightarrow 0$)	Folke and others (2004)

The diversity attribute was calculated using the Shannon, Simpson, and Kempton's Q indices. Resilience was calculated as the average relative change in biomass for all functional groups (see equation 1), and as five different reorganization indices (ecosystem, piscivorous fish, zooplanktivorous fish, invertivore, and herbivore; see equation 2). The category of each ecosystem attribute: ¹Diversity, ²Community energetics, ³Food web structure, ⁴Energy recycling, ⁵Resilience.