California Wetfish Producers Association
PO Box 1951 • Buellton, CA 93427 • Office: (805) 693-5430 • Mobile: (805) 350-3231 • Fax: (805) 686-9312 • www.californiawetfish.org

June 25, 2013

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

RE: Agenda Item I.4. Adjustments to Sardine Harvest Parameters

Dear Mr. Wolford 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. I participated in the sardine harvest parameters workshop and was designated CPSAS representative at the May CPS management team meeting. We appreciate your consideration of the following points and concerns, many of them reiterated in the CPSAS report.

First, please understand the context for this discussion:

• Under the current harvest control rule (HCR), according to the 2012 stock assessment **the US sardine fishery harvested only 5 percent of a VERY conservative biomass estimate, and coast-wide exploitation was slightly over 15 percent**, while **Emsy for sardine is currently 18%.** Recent ecosystem modeling efforts (Horne et al 2010, Kaplan et al 2012) estimate **the entire CPS fishery harvest, sardines included, accounts for less than 4 percent of the planktivorous forage pool**, which is only part of the forage available overall. This harvest level is decidedly NOT overfishing, nor harming the ecosystem. In the recent district court decision re: CPS FMP Amendment 13, the judge found, based on an administrative record encompassing 291 documents and thousands of pages, **"In this case, Amend. 13 is not a mixed impact action but an action that by its very terms has no negative impacts at all."** (SF District Court Decision Case 3:11-cv-06257-EMC Document 62, page 37)

• Acoustic measurements 'drove' the 2012 stock assessment: assigned a Q of 1 meaning that acoustics 'saw' all the fish. Yet, the 2012 acoustic trawl biomass estimate for Washington-Oregon (**13,335 mt**) was far lower than actual landings made in the fishery in the same general area and time frame. OR-WA landings for the summer period totaled **48,653 mt.** Meanwhile the 2012 aerial survey estimated a biomass of **906,680 mt** for the Pacific Northwest. The 2012 assessment clearly illuminates the **significant conflict in scale** derived from various survey methods.

• **Variability characterizes all the indices** used to measure sardine. Survey timing is crucial, and each survey measures only a spot in time. **It is important to maintain multiple surveys, rather than relying on only one.** Industry continues to voice concern that acoustic methods largely miss the upper 10 meters of the water column; the vessel avoidance issue has not been resolved. Nor do current acoustic surveys capture the full extent of the nearshore area, i.e., the beach, where sardines congregate in California. We do appreciate that the SWFSC leadership acknowledges these problems and is working to resolve them.

Re: changing the environmental proxy from Scripps Pier sea surface temperature (SST) to Cal-COFI 5–15 meter temperature, which measures mid-water depths that track on average about 2 degrees colder than the surface, I'd appreciate the Council's consideration of the following points:

• While CalCOFI midwater temperatures appeared to be the best fit to the data in the recent period (1984-2008), analysis showed that "[the NOAA Extended reconstructed sea surface temperature] ERSST_T5 (i.e., a five-year running mean starting and ending two years before and after the recruitment event) was the most significant variable for recruitment and recruitment success for the entire data set [which encompassed both cold and warm periods over time (1935-63 and 1986-90)], including output from three stock assessments (i.e., Murphy, 1966; MacCall, 1979; Hill *et al.*, 2010). **ERSST_T5 and SIO_SST_T5 were the most significant variables for recruitment and recruitment success, respectively, when missing data were excluded.** " The sardine workshop report noted that new indices are under development (I.1.b_ATT1_SARDINE_WKSHP_RPT_APR2013BB) and recommended **"... that the Council consider developing procedures which allow a regular (every 5-7 years perhaps) evaluation of whether the selected environmental variable remains the best predictor of recruitment success.** " We encourage the Council to act on that recommendation.

• The sardine workshop recommended using an **annual** CalCOFI 5-15 meter temperature average as the environmental proxy, but the management team recognized that a **3-year mean** temperature is better for management because it smoothes the "ups and downs" of harvest fractions. **We agree that a three-year mean temperature parameter is best to maintain stability in the fishery. Fishery economics require the ability to forecast in business plans.**

• At the recent CPSMT meeting, discussion ensued on applying the [3-year mean] temperature to the OFL fraction vs. the HG fraction. It would be helpful to provide explicit examples illustrating harvest guidelines derived from both formulas (i.e. comparing HGs using option 6 (HG-J) vs. Option 15 (New 1), Option 16 (New 2) and Option 22 (New 8)) to determine which provides the most effective and balanced way to achieve Optimum Yield (OY).

• Again, we ask the Council to consider that achieving **OY requires balance: considering both fishery opportunity and economic stability as well as forage needs.**

With that preamble, I appreciate the Council's consideration of the following information specific to the recent harvest parameters workshop and reanalysis of the Amendment 8 HCR provided by Dr. Richard Parrish, an architect of the original sardine HCR who attended both the workshop and the CPSMT meeting. I have summarized some key points, and attached for reference his complete letter to the Council.

EXCERPTS

Letter from Richard Parrish (I.4.d, Supplemental Public Comment 2, June 2013)

(Please note that direct quotes are highlighted in italics. Emphasis added.)

<u>Comparison of Old vs. New HCR Analysis</u>

• *The stochastic proxy MSY with the new Hertado-Ferro and Punt analysis (Emsy=0.18) is* **50% higher** *than the Amendment 8 proxy (Emsy=0.12).*

In Amendment 8 of the CPS FMP, the Council adopted option J, a harvest control rule with a CUTOFF of 150,000 mt., a MAXCAT of 200,000 mt., and a FRACTION based on SST at Scripps Pier that varied from 0.05 to 0.15

• ***In the new analysis, the Option J control rule (HG J–6) is much more conservative that it was in Amendment 8.*** *For example, in Amendment 8 Emsy was 0.12 and the FRACTION extended above and below Emsy (i.e. from 0.05 to 0.15). In the new analysis Emsy is 0.18 and* ***Option HG J–6 is always below Emsy (i.e. 0.05 to 0.15). The maximum fraction in new Option HG J–6 is 17% below Emsy.***

• *In the Amendment 8 analysis, Option J had an average biomass equal to 64% of the unfished biomass.* ***In the new analysis, option HG J–6 has an average biomass equal to 79% of unfished biomass.***

<u>Stock Structure, Distribution and International Landings</u>

Dr. Parrish noted the Council's inability to regulate total coast-wide sardine landings and reported evidence presented at the sardine workshop by Tim Baumgartner, from the Mexican research institute CICESE, that *"showed that the sardine landed in Ensenada are primarily from the southern stock and that some of the sardine available in Southern California are also from the southern stock."*

• Dr. Parrish suggested: *"Instead of an assessment that includes all sardine from central Baja California to Vancouver Island, future assessments should include all sardine from the U.S.–Mexican border to Vancouver Island. This assessment would represent the sardine population off the United States and Canada and it would result in a more realistic estimate of the biomass that is actually under the control of the Council.* " [i.e. the northern stock]

He continued: *"This assessment could be assumed to result in a smaller biomass estimate than an assessment for the larger geographical area. The distribution parameter would then only apply to the Canadian landings* ***and I would recommend that the distribution fraction retain its present value."***

<u>Ecological and Economic Trade-offs with the New Sardine Analysis</u>

Dr. Parrish constructed trade-off plots to compare the various options presented in the Hertado-Ferro and Punt and Shester and Enticknap analyses; HCRs were identified by the numbers and letters used in the two reports. He noted that the newest HCR in the Hurtado-Ferro and Punt analysis (New 8, option 22) is visually indistinguishable from HG J–6 on the plots and it was therefore not plotted; the performance of option 6 in the trade-offs can be used to evaluate option 22.

• Dr. Parrish found that the average catches in the Oceana analysis are incorrect because they were calculated by omitting catch from years with no fishery. He corrected the average catch values using the percentage of years with no catch.
"The corrected value for the Oceana preferred HCR is 89.9 tmt instead of 114.2 tmt."

More summary highlights:
*The **first trade-off is between the most serious economic problem (closing the fishery) and the second-most serious ecological problem (low biomass)**. The most serious ecological problem (collapse of the population) occurred in the three policies with CUTOFF = 0.*

*• The OFL and L-Emsy HCRs have no fishery in 29% and 31% of the years, while **Oceana's preferred HCR (Oc) and the Lenfest HCR (Le) have no fishery in 20-21% of the years**. .... **Control rules Le, Oc, OFL and L-Emsy all have the fishery closed between one year in five and one year in three, and these policies do not result in an economically sustainable fishery.***

• In contrast, the three remaining control rules 6, 15, and 16, are all close variants of the original option J rule and all have no fishery in 2.8% of the years. Option 22 also is very close to 6, with no fishery in 2.7% of the years.

***The second trade-off is between mean catch and mean biomass**. The traditional reference points of deterministic MSY (4) and stochastic MSY (L-Emsy) have values in the vicinity of 40% of unfished biomass, and the rest of the policies produce average biomass levels well above these reference points.*

***• When the two sets of trade-offs are considered together, the policies that provide the best balance between ecological and economic considerations appear to be policies 6, 15, 16, 20 and 22 (with very similar performance to 6)**. Policies 6, 15, and 16 and 22 are essentially identical in the first set of trade-offs between low biomass levels and percentage of years with no catch.*

Dr. Parrish's Conclusion:

• In my opinion, HCR 16 provides the best balance between ecological and economic considerations. It has an average biomass level that is 70% of the unfished biomass and it maintains biomass above 400 tmt 93% of the time. It has an average catch of 148 tmt and maintains a fishery 97% of the time.

In comparison to HCR 16, Options 6, 15, and 22 achieve an increase of about 100 tmt in average biomass at the expense of about 40 tmt in average catch.

To demonstrate just how conservative control rules 6, 15, 16, and 22 are, a comparison with Pacific hake is useful; "the current $F_{40\%}$-40:10 management strategy with perfect knowledge of current biomass resulted in a median long-term average depletion of less than 30%" (2013 Hake Assessment p. 15).

Thank you for your attention to these comments.

Best regards,

Diane Pleschner-Steele

Diane Pleschner-Steele
Executive Director

Attachment: Assessment of Sardine Harvest Control Rules
Richard Parrish
June 16, 2013

Mr. Dan Wolford, Chair
and Members of the Pacific Fishery Management Council
7700 NE Ambassador Place #200
Portland OR 97220-1384

RE: Agenda Item I.4. Adjustments to Sardine Harvest Parameters

Dear Mr. Wolford and Council members,

As one of the developers of the Amendment 8 sardine harvest control rule, and after having participated in the sardine harvest parameters workshop in February and the recent CPS management team meeting, I prepared the following analysis for the Council's consideration regarding sardine harvest control rule options:

Assessment of Sardine Harvest Control Rules
Richard Parrish
June 20, 2013

The development of harvest control rules for sardine has evolved into a very complicated process. This analysis is an attempt to place this development in context with rules used in other fisheries, to describe the differences between the Amendment 8 harvest control rule (HCR) and newer sardine harvest policy options and to comment on trade-offs between harvest control rules that have recently been submitted to the Council.

The most common maximum sustainable yield proxy used by the Pacific Fisheries Management Council is deterministic Fmsy (or the associated Emsy). These proxies are usually derived from equilibrium-based analyses and they determine the maximum sustainable harvest (i.e OFL). The present best deterministic estimate for sardine is Emsy = 0.19.

The MSY proxy used for the Amendment 8 sardine analysis was a stochastic proxy (Emsy = 0.12). This stochastic proxy, and a very extensive series of potential harvest policies, was developed with a simulation model that had annual and decadal variation in the spawner/recruit model, based on sea surface temperature at Scripps Pier, and in addition there was extensive annual variation in the estimates of annual biomass. Hurtado-Ferro and Punt's analysis (Agenda Item I.4.b: Attachment 1: June 2013) is similar to the Amendment 8 analysis; however, it is enhanced by inclusion of a more realistic age composition and additional years of data including recent warm-water years of high sardine productivity. It also includes a new temperature index: 5-15 meter sea temperature from a grid of stations from the CalCOFI Surveys. This temperature time series has much higher statistical significance than the Scripps Pier SST time series used in Amendment 8. Maximum sustainable yield in the new analysis changes yearly and it is calculated by a polynomial equation that describes the relationship between Emsy and sea temperatures in the CalCOFI time series.

The stochastic proxy MSY with the Hertado-Ferro and Punt analysis (Emsy=0.18) is 50% higher than the Amendment 8 proxy (Emsy=0.12).

Over the range of temperatures seen in the CalCOFI time series the model produces Emsy values from 0.0 to about O.40. This range of values was apparently trimmed at the 75% quartile (i.e. 0.26) at the request of the SSC, so the Hurtado-Ferro and Punt analyses have a potential maximum Emsy of 26%, and the OFL FRACTION varies from 0 to 26%, or some smaller maximum value defined by individual HCRs. It is unclear what combination of harvest control rule parameters results in the maximum average catch (MSY) with the new analysis; although the parameters that produced the maximum average catch in the Amendment 8 analysis are included in the analysis submitted by Shester and Enticknap (i.e. option OFL in Agenda Item I.4.d: Public Comment: June 2013). Note that the Hertado-Ferro and Punt analysis and the Shester and Enticknap analysis use the same basic model.

In Amendment 8 of the CPS FMP, the Council adopted option J, a harvest control rule with a CUTOFF of 150,000 mt., a MAXCAT of 200,000 mt., and a HG FRACTION based on SST at Scripps Pier that varied from 0.05 to 0.15

In the new analysis, the Option J control rule (i.e. HG J or 6) is much more conservative that it was in Amendment 8. For example, in Amendment 8 Emsy was 0.12 and the FRACTION extended above and below Emsy (i.e. from 0.05 to 0.15). In the new analysis Emsy is 0.18 and Option HG J is always below Emsy (i.e. 0.05 to 0.15). The maximum FRACTION in the new Option HG J is 17% below Emsy.

In the Amendment 8 analysis, Option J had an average biomass equal to 64% of the unfished biomass. In the new analysis, HG J–Option 6 has an average biomass equal to 79% of unfished biomass.

Stock Structure, Distribution and International Landings.

The Council's inability to regulate total coast-wide landings of the northern stock of Pacific sardine is a continuing problem in the management of sardine. Three interrelated factors contribute to the problem.

1. The Council cannot regulate the landings in Canada and Mexico.
2. The dividing line between the northern stock and the southern (Baja) stock is not well known and it undoubted varies seasonally and annually depending upon environmental conditions
3. The international distribution of the northern stock is confounded with the stock structure problem.

Tim Baumgartner, from the Mexican research institute CICESE, presented information on sardine size structure and water mass analyses (SST and salinity) at the February 2013 sardine harvest parameters workshop at Scripps. His data showed that the sardine landed in Ensenada are primarily from the southern stock and that some of the sardine available in Southern California are also from the southern stock. Fishery scientists in Mexico are convinced that their Ensenada sardine fishery is dominated by the southern stock and it is therefore unrealistic to assume that Mexico would regulate their fishery based on U.S. biomass estimates of the northern stock.

Given the above, it appears that the pragmatic solution is to alter the way the sardine stock assessments are made. Instead of an assessment that includes all sardine from central Baja California to Vancouver Island, future assessments should include all sardine from the U.S.- Mexican border to Vancouver Island. This assessment would represent the sardine population off the United States and Canada and it would result in a more realistic estimate of the biomass that is actually under the control of the Council.

This assessment could be assumed to result in a smaller biomass estimate than an assessment for the larger geographical area. The distribution parameter would then only apply to the Canadian landings, and I would recommend that the distribution fraction retain its present value.

The only viable alternative that I can visualize is an international agreement on catch quotas between Mexico, Canada and the United States.

Ecological and Economic Trade-offs with the New Sardine Analysis.

To compare the various options presented in the Hertado-Ferro and Punt and the Shester and Enticknap analyses, I have constructed two trade-off plots using the most likely harvest control rules and the most relevant reference rules presented in the two analyses.

Note that the mean catch in the Shester and Enticknap analysis for HG J is equal to the mean catch C0 in the Hertado-Ferro and Punt analysis (i.e. 110.1) and that it is less than the latter's mean catch (i.e. 107.1). The mean catch CO value was calculated after omitting the catch in years with no fishery. The SSC noted that an earlier Hertado-Ferro and Punt analysis had this same problem (Draft April 2013 SSC Minutes: June 2012 p. 9). Therefore, it appears that all the mean catches in the Shester and Enticknap analysis are actually the mean catch when zero catches are omitted. To make the two analyses comparable I corrected the average catch values in the Shester and Enticknap analysis using the percentage of years with no catch. For example; Oceana's HC J has a listed average catch of 110.1 tmt and 2,7% of the years with no catch; its corrected average catch is the same value as the Hertado-Ferro and Punt mean catch (i.e. 110.1 * (1-0.027) = 107.1). The corrected value for the Oceana preferred HCR is 89.9 tmt instead of 114.2 tmt.

The HCRs in the plots are identified by the numbers and letters used in the two reports mentioned above (Figure 1). The original Option J is HG J– 6. Except for the MSY reference policies (4 and L-Emsy), I excluded HCRs from both reports that were poor performers in comparison to the other HCRs shown. The newest HCR in the Hurtado-Ferro and Punt analysis (New 8, option 22) is visually indistinguishable from HG J–6 on the plots and it was therefore not plotted; the performance of option 6 in the trade-offs can be used to evaluate option 22.

The first trade-off is between the most serious economic problem (closing the fishery) and the second-most serious ecological problem (low biomass). I note that the most serious ecological problem (collapse of the population) occurred in the three HCRs with CUTOFF = 0; i.e. deterministic MSY (4), and stochastic MSY (L-Emsy) and F=15% (not plotted).

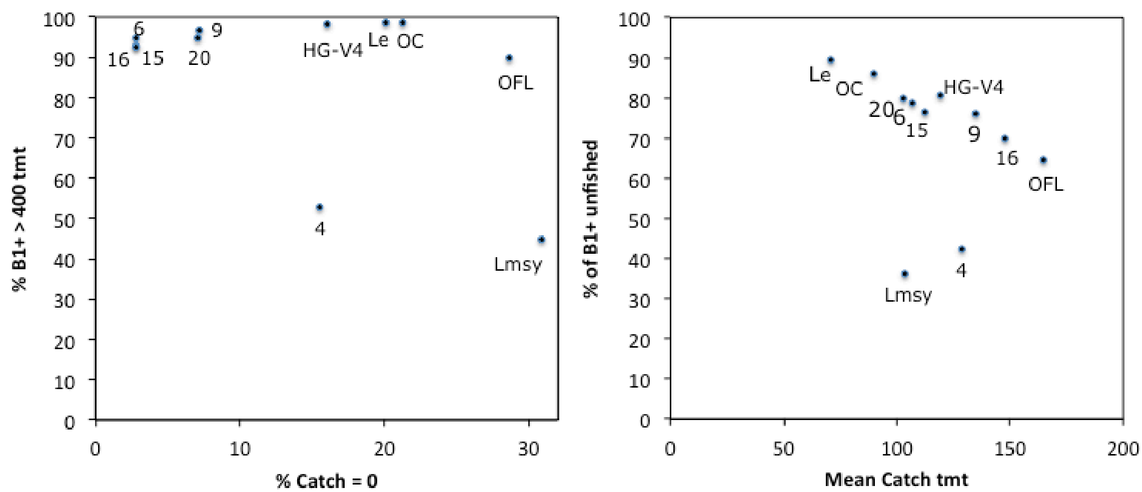

Figure 1. Trade-off plots (the percentage of years with no catch vs the percentage of years with biomass of age 1+ less than 400 tmt) and (mean catch vs mean biomass of age 1+ as a percentage of the unfished age1+ biomass).

Table 1. Performance measures in Figure 1. (mean B1+ %Bun is the mean biomass of age 1+ expressed as a percentage of the unfished mean biomass, also known as the depletion of age 1+ biomass).

Hurtado-Ferro and Punt

Control Rule	% no catch	% B1+>400	Mean catch	Mean B1+ %Bun
4	15.5	52.7%	128.3	42.3%
6	2.8	94.7%	107.1	78.8%
9	7.2	96.9%	134.9	76.0%
15	2.8	92.9%	112.1	76.5%
16	2.8	92.5%	147.8	70.0%
20	7.1	95.0%	102.5	79.9%
22	2.7	93.6%	108.0	78.0%

Shester and Enticknap

Control Rule	% no catch	% B1+>400	Mean catch	Mean B1+ %Bun
HG-V4	16.0	98.1%	119.1	80.6%
OFL	28.6	90.0%	164.9	64.5%
L Emsy	30.9	44.8%	103.1	36.2%
Oceana	21.3	98.5%	89.9	86.0%
Lenfest	20.1	98.6%	70.5	89.4%

The two MSY HCRs resulted in biomass falling lower than 400 tmt in about half of years: HCR 4 (53%) and HCR L-Emsy (45%). All of the rest of the HCRs, including the no fishing policy, have biomass remaining above the 400 tmt level in 90-99% of the years.

The differences on the other axis are more marked: the OFL and L-Emsy HCRs have no fishery in 29% and 31% of the years, while Oceana's preferred HCR (Oc) and the Lenfest HCR (Le) have no fishery in 20-21% of the years. Control rules 4 and HG-V4 have no fishery in 16% of the years, and HCRs 9 and 20 have no fishery in 7% of the years. Control rules Le, OC, OFL and L-Emsy all have the fishery closed between one year in five and one year in three, and these policies do not result in an economically sustainable fishery.

In contrast, the three remaining control rules 6, 15, and 16, are all close variants of the original option J rule and all have no fishery in 2.8% of the years. Option 22 also is very close to 6, with no fishery in 2.7% of the years. Option 6 is better than options 15 and 16 in having a slightly higher average biomass level. Option 22 biomass falls between 6 and 15-16.

The second trade-off is between mean catch and mean biomass. The traditional reference points, deterministic MSY (4) and stochastic MSY (L-Emsy), have values in the vicinity of 40% of unfished biomass, and the rest of the HCRs produce average biomass levels well above these reference HCRs.

The Lenfest and Oceana's preferred HCRs have the lowest annual catches (71 and 90 tmt) and the highest biomass levels (89% and 86% of unfished biomass). Control rules HG-V4, 20, 6, and 15 all have high average biomass levels (between 76-79% of unfished biomass) and moderate catches (i.e. between 103-119 tmt). Control rules 9, 16, and OFL have decreasing biomass and increasing catches. With the exception of the reference polices (4 and L-Emsy), the HCRs have a nearly linear relationship between biomass and catch, with the Lenfest HCR having the highest biomass (89%) and lowest catch (71 tmt) and the OFL rule having the lowest biomass (65%) and highest catch (165 tmt). However, note that the OFL rule has a biomass level (65%) well above the levels occurring with the deterministic MSY (4) and stochastic MSY (L-Emsy) reference policies. It is also well above the 40% level commonly used for groundfish species.

Average biomass vs average catch with HCRs 20, 6 and 15 are quite similar and they achieve high average biomass levels at the expense of moderate catches. Control rule 9 has considerably higher landings with essentially the same biomass levels as the other three policies. Control rule 16 achieves a high catch level while maintaining a high average biomass level (70% of unfished).

When the two sets of trade-offs are considered together, the policies that provide the best balance between ecological and economic considerations appear to be policies 6, 9, 15, 16, 20 and 22 (with very similar performance to 6). Policies 6, 15, and 16 and 22 are essentially identical in the first set of trade-offs between low biomass levels and percentage of years with no catch. Policies 9 and 20 are somewhat inferior to the other three policies in this regard.

Conclusion:

In my opinion, HCR 16 provides the best balance between ecological and economic considerations. It has an average biomass level that is 70% of the unfished biomass and it maintains biomass above 400 tmt 93% of the time. It has an average catch of 148 tmt and maintains a fishery 97% of the time.

In comparison to HCR 16, Options 6, 15, and 22 achieve an increase of about 100 tmt in average biomass at the expense of about 40 tmt in average catch. With these control rules, average biomass is 77-79% of the unfished biomass and biomass is above 400 tmt 93-94% of the time. Average landings are 107-112 tmt and the fishery is maintained 93% of the time. All three control rules have CUTOFFs of 150 tmt and MAXCATs of 200 tmt. The new HCR 22 is a very close variant of the original harvest guideline HG J - 6 and it has the added feature of a simple maximum FRACTION. Control rules 6 and 22 have slightly higher average biomass levels and HCR 15 has slightly higher catch levels.

In comparison, the stochastic (L-Emsy) control rule has an average biomass that is 36% of the unfished biomass and biomass is above 400 tmt only 55% of the time.

To demonstrate just how conservative control rules 6, 15, 16, and 22 are, a comparison with Pacific hake is useful; “the current $F_{40\%}$-40:10 management strategy with perfect knowledge of current biomass resulted in a median long-term average depletion of less than 30%” (2013 Hake Assessment p. 15).

RHParrish

Richard Parrish
Fisheries Biologist