Public Comment on Draft Amendment 9 to the CPS FMP

Jon Brodziak, 6/29/00.

CALCULATING AREA-BASED MARKET SQUID MSY PROXY - ALTERNATIVES AND ANALYSES

The Council has directed the Coastal Pelagic Species Management Team (CPSMT) to provide alternatives for determining and designating a Maximum Sustainable Yield (MSY) proxy for squid for Amendment 9 of the Coastal Pelagic Species Fishery Management Plan (CPS-FMP). As biological information is lacking, the CPSMT followed federal guidelines for determining MSY in data poor situations by using landings data as an indicator of abundance, and put forth three options for consideration. The Council then directed the team to provide an option which expands those values to account for areas that are unfished. The following series of options presented provide several alternatives that employ an area-based approach for calculating an MSY proxy, all which show an increased MSY value over using catch information alone.

Given the lack of information on market squid abundance along the west coast, it is imperative that you provide measures of uncertainty for long-term potential yield calculations (LTPY - I would not recommend using the term 'maximum sustainable yield', it's a perjorative term and has been roundly criticized in the fisheries literature. It would be more accurate to use 'maximum expected yield' or LTPY, IMO). Providing a probability distribution for LTPY, with a mean (or median or mode) and measure of dispersion, is the best way to give an indication of the reality of what bounds can be provided for this target. Providing a single value will only be misleading and will misrepresent the true uncertainty that exists. It will also downplay the importance of continued research and monitoring, which is essential if the uncertainty is to be reduced.

1. Inflate catch values to account for all potential *fishing* areas that are not fished each year but have been fished historically. Currently, CDFG commercial catch information is available by location for the time period 1981 through 1999. Location information is recorded by fishing block, which encompasses a 10 by 10 nm area. Over that time period, 262 unique blocks have been recorded on Department landing receipts. This number may be used to represent the total available fishing area in the range of the California fishery. In keeping with expansion of the fishery over this time period, the number of blocks fished has generally increased since 1981. By scaling the catch in any given season to account for what might have been caught in that season were all the blocks utilized, a proxy MSY for that year may be determined.

This approach requires that squid density is equal in each block and that fishery catchability is equal in each block, through time. The 1st part, equal density across blocks through time seems very unlikely to be even approximately true. The 2nd part, that the fishery can operate similarly across blocks, is also probably not true. The available information I am aware of on squid spatial densities indicates that squid distribution can shift dramatically in space and time in response to squid population density, environmental change, and prey availability (note: these are not mutually exclusive and likely operate in concert). Regardless of the cause, the assumption of areal expansion at this broad spatial aggregation seems too broad brush. It would be more useful to look at the productivity of individual blocks and their variability in production through time. More on this below.

Table 1

Fishing Season (Apr-Mar)	Landings (ST)	Blocks Utilized	% Fishing Area Utilized	MSY Proxy
1980	5768	26	0.10	58126
1981	25851	52	0.20	130251
1982	13213	43	0.16	80507
1983	1087	27	0.10	10549
1984	1354	33	0.13	10746
1985	14376	41	0.16	91863
1986	25603	40	0.15	167696
1987	25214	36	0.14	183498
1988	48195	31	0.12	407327
1989	33051	30	0.11	288648
1990	32472	38	0.15	223888
1991	38666	56	0.21	180902
1992	18793	45	0.17	109419
1993	54452	67	0.26	212933
1994	63592	114	0.44	146149
1995	93833	105	0.40	234137
1996	124309	105	0.40	310181
1997	10898	47	0.18	60750
1998	11727	67	0.26	45858
1999	91065	95	0.36	251147

The data in Table 1 exclude information on market conditions. The fishery system for market squid has apparently changed substaintially since 1980. The point is made in Voykavich (1998) that the fishery switched from brail to roundhaul gear during 1976-1984. The information on potential yield should be logically split if these gears operate differently, e.g., brail gear is substantially less effective/efficient. This is a judgment call, however, for the CPSMT. I believe that the information prior to 1984 provides useful information on what a lower bound on LTPY from the areas fished may be, taking into account inter-annual variability, and also shows the effect of a very strong El Nino on production per block. A key piece of information missing from Table 1 is the price incentive for fishers. To understand the amount of potential yield from this system, one is going to need to have an understanding of the market dynamics, and this should relate to the inflation-adjusted price for the yield through time. Add the column of average price adjusted for CPI-U, or CPI-P, to give an indication of how the market changed, if at all. Also add in the number of vessels participating.

The approach in option 1 can be modified to account for lack of knowledge of what potential yields may be possible from unfished blocks. In the attached Excel spreadsheet, I have outlined a way to use the variability in production per block, given the data in table 1, to provide scenarios for long-term sustainable yields. This is not the best way to do it, IMO, but it does account for some of the apparent variability in productivity per block, whether this is due to inherent variability in the distribution and abundance of squid or the fishers' choices or market effects or El Nino perturbations. Regardless, of how you go forward with the LTPY calculation excercise, it is very important that the fishers and managers be shown the productivity drop-off during El Nino (Of course, this is already known) and the frequency of these low production periods, e.g. 5 out of 20 years. This El Nino frequency is unknown, of course, but we have a short-term estimate of about 1/4. This empirical frequency can be used to divide the long-term potential yield calculation into high and low productivity parts, with high productivity 3/4 of the time and low productivity 1/4 of the time.

Using this approach also emphasizes the need to consider maximizing expected yield versus the static MSY concept. The California Current is a dynamic system and LTPY calculations should account for this behavior, else they are misleading.

2. Inflate catch values to account for all potential fishing areas that are not fished each year but have been fished historically, as well as inflate values to reflect spawning that has occured beyond the range of the fishery. As the above estimates represent only information available in California waters, scale up the MSY values calculated above in Table 1 to reflect additional unfished areas based on observed midwater trawl tow data. This analysis can be performed in several ways which involve several assumptions, resulting in highly variable results. Using information on squid density and proportion positive in the Pacific northwest, California and Mexico (assuming all tows are equal and not accounting for year effects), the portion of squid found in California to the coastwide total equals approximately 71 percent. Scaling the above MSY proxy values upward accordingly, coastwide MSY proxy values may be estimated.

I would recommend using the data source separately to give a categorization of density by broad geographic region. Then use the categories (high, medium, low based on third quartiles, or perhaps based on quintiles) to map relative density by data source. If summaries of several years can be made breaking out the El Nino events, this would be more informative as well. Then make some assumption (e.g. a distribution, perhaps uniform or lognormal) about the productivity of each broad region relative to your regions where you have data (from Table 1 or better yet more detailed spatial summaries). One rational basis for stratification would be the differences in upwelling by broad-scale regions along the Pacific coast. GLOBEC has put forward a number of publications that classify the California Current system into 4 broad regions. It may be possible to use these, with the help of some oceanographic insight, to give relative measures of upwelling and potential squid productivity. This is, of course, one idea that focuses on energy flow of prey and not other important features of habitat, like the potential for larval retention and suitable bottom-type. There may be some hints of preferred bottom type in the triennial survey data and this provides another way to attempt to stratify the unfished portions of the Pacific coast. In the absence of stratification, the uncertainty bounds in any expansion from the California fishery to the rest of the coast must logically be wide. One can account for the lack of knowledge of relative productivities of other unfished regions by using potential habitat expasion factors below, e.g., 71% for California, along with a distributional assumption about the scalar for relative productivity outside California. For example. If the mean of the LTPY distribution was 100 kt for California, the mean for the whole coast could be calculated as (100 kt/0.71)*the expected ratio of productivity outside of California waters to within California waters.

Table 2

Location	Tows	Positive Tows	Total Squid Caught	Squid per Positive Tow	PropPos	Ratio	**Portion in Range**
Pacific Northwest	419	111	4955	44.64	0.265	11.826	**0.19**
California	6009	1553	270837	174.40	0.258	45.072	**0.71**
Mexico	1410	152	8697	57.22	0.108	6.168	**0.10**
Total	7838	1816	284489			63.066	

Year	Landings (mt)	Area Fished (km2)	Productivity (mt) Per Unit Area	Blocks	Productivity (mt) Per Block
1980	5232.6	8918	0.59	26	201.3
1981	23451.5	17836	1.31	52	451.0
1982	11986.6	14749	0.81	43	278.8
1983	986.1	9261	0.11	27	36.5
1984	1228.3	11319	0.11	33	37.2
1985	13041.6	14063	0.93	41	318.1
1986	23226.5	13720	1.69	40	580.7
1987	22873.6	12348	1.85	36	635.4
1988	43721.5	10633	4.11	31	1410.4
1989	29983.2	10290	2.91	30	999.4
1990	29457.9	13034	2.26	38	775.2
1991	35077.0	19208	1.83	56	626.4
1992	17048.6	15435	1.10	45	378.9
1993	49397.8	22981	2.15	67	737.3
1994	57689.4	39102	1.48	114	506.0
1995	85123.4	36015	2.36	105	810.7
1996	112770.6	36015	3.13	105	1074.0
1997	9886.4	16121	0.61	47	210.3
1998	10638.5	22981	0.46	67	158.8
1999	82612.3	32585	2.54	95	869.6

	Landings (mt)	Area Fished (km2)	Productivity (mt) Per Unit Area	Blocks	Productivity (mt) Per Block	Crude Bounds for Fished Areas	Mean Relative Productivity of Unfished Areas		Lower Bound Relative Productivity of Unfished Areas	Upper Bound Relative Productivity of Unfished Areas
MAX	112771	39102	4.11	114	1410.4	160782	0.2		0.01	0.99
MIN	986	8918	0.11	26	36.5	950				

Time Period Scenario for Fishery System	Landings (mt)	Area Fished (km2)	Productivity (mt) Per Unit Area	Blocks	Productivity (mt) Per Block	Fished Areas Potential Yield (mt)	Unfished Areas Potential Yield (mt)	Longterm Potential Yield All Areas (mt)	Lower Bound Unfished Areas Potential Yield (mt)	Upper Bound Unfished Areas Potential Yield (mt)
MEAN 1980-99	33272	18831	1.62	55	554.8	30458	22980	53438	1149	113749
STDERR					82.3	4516				
MEDIAN 1980-99	23339	15092	1.58	44	543.4	23908	23690	47598	1185	117267
MEAN 1995-99	60206	28743	1.82	84	624.7	52349	22264	74613	1113	110206
STDERR					185.1	15511				
MEAN 1990-99	48970	25348	1.79	74	614.7	45428	23126	68554	1156	114473
STDERR					93.9	6941				
MEAN 1985-99	41503	20969	1.96	61	672.7	41127	27026	68153	1351	133780
STDERR					87.7	5360				
MEAN EL NINO YEARS	6945	14886	0.42	43	144.3	6264	6310	12574	315	31234
STDERR					47.8	2075				
MEAN NON-EL NINO	42047	20146	2.02	59	691.6	40621	28117	68738	1406	139177
STDERR					70.8	4157				

Farallon Island Station
In Cooperation with
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Palomarin Field Station
Point Reyes Bird Observatory

August 22, 2000

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Donald O. McIsaac, Executive Director
Jim Lone, Chairman
Pacific Fishery Management Council
2130 SW Fifth Avenue, Suite 224
Portland, Oregon 97201

Dear Mr. McIsaac & Mr. Lone:

We are writing regarding the review draft of Amendment 9 to the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP). We would like to comment on the first two sections of the amendment, namely, the alternatives for minimizing and accounting for bycatch in CPS fisheries, and the alternatives for determining a maximum sustainable yield (MSY) proxy and allowable biological catch (ABC) for market squid.

The definition of bycatch includes "fishing mortality resulting from the encounter with fishing gear that does not result in capture." Techniques employed for squid capture include bright night lighting which may negatively impact seabirds and marine mammals. Even if not labeled "bycatch", regulations of the squid fishery should address effects on seabirds and pinnipeds breeding and feeding on and around islands or other coastal locations where squid fishing is regularly practiced. In particular, breeding colonies of endangered Brown Pelicans and a candidate for the endangered species list, Xantus' Murrelets, on Santa Barbara and other Channel Islands are regularly affected by squid boats' bright night lighting. This could result in increased predation, altered behavior such as reduced parental provisioning or colony attendance, or nest abandonment.

Amendment 9 states that the attempt to establish a scientifically sound MSY for squid has failed for lack of data. Furthermore, regarding alternative calculations of proxy MSY and ABC for squid, the council has admitted that the sole use of historic squid landings off the coast of California for these calculations is inadequate, given that the fishery is volatile and reliant on the market. As squid abundance and distribution appear to be highly variable between years, we believe that environmental and seasonal variability should be incorporated into the quota system for squid harvest. Additionally, most upper trophic level predators in the California Current marine ecosystem depend on squid for all or some portion of their diet, which should also be addressed when calculating the proxy MSY. Data on diet of certain seabird and pinniped species exists and needs to be compiled and summarized. Where data does not exist, efforts need to be made to extend our understanding of the effects of this fishery on top predators in the food chain.

In terms of environmental consequences, the present harvest strategy and expansion of the squid fishery does appear to have a direct effect on certain ocean and coastal or island habitat, and may pose significant threats to populations of endangered Brown Pelicans, Xantus' Murrelets, and other sensitive seabirds and marine mammals occurring in the vicinity of the fishery. Please contact us at the phone number below with any questions.

Sincerely,

Julie A. Thayer, Marine Division Biologist

Ellie Cohen, Executive Director

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