Pacific Council Definitions of Optimum Yield

The Pacific Council has some variability within its four Fishery Management Plans (FMPs) on how Optimum Yield (OY) is defined. Some are rather general due to the complexities of stocks, species, management objectives, and jurisdictions. Others are relative straight forward, being based on ACLs for individual stocks or management units. The following are excerpts from the Pacific Councils four FMPs:

Groundfish FMP
In establishing OYs for west coast groundfish, this FMP uses the interim step of calculating OFLs, acceptable biological catch (ABC), and ACLs for major stocks or management units (groups of species). OFL is the MSY harvest level associated with the current stock abundance. Over the long term, if OFLs are fully harvested, the average of the OFLs would be MSY. ABC is a threshold below the OFL, which accounts for scientific uncertainty in the estimate of OFL. ACL is a harvest specification set at or below ABC and is intended to prevent overfishing. The ACLs are established to achieve OY in the fishery. The OY for a stock or stock complex is the long-term average of the stock or stock complexes ACLs.

The FMP authorizes establishment of a numerical or non-numerical OY for any groundfish species or species group and lays out the procedures the Council will follow in determining appropriate numerical OY values. An OY may be specified for the fishery management area as a whole or for specific subareas.

Those species without a specified OY and not included in a multi-species OY will be included in a non-numerical OY, which is defined as all the fish that can be taken under the regulations, specifications, and management measures authorized by the FMP and promulgated by the U.S. Secretary of Commerce. This non-numerical OY is not a predetermined numerical value, but rather the harvest that results from regulations, specifications, and management measures as they are changed in response to changes in the resource and the fishery. In many cases, the absence of a numerical specification reflects the absence of basic management information, such as abundance estimates and catch statistics. The non-numerical OY concept allows for a variable amount of groundfish to be harvested annually, limited by such constraints as gear restrictions, management measures for other species, and/or absence of consumer acceptance or demand.

ACLs, OYs ACTs, and HGs or quotas may be established and adjusted inseason (1) for resource conservation through the "points of concern" framework described in Section 6.2.2; (2) in response to a technical correction to OFL described above; or, (3) under the socioeconomic framework described in Section 6.2.3.

Salmon FMP
The optimum yield to be achieved for species covered by this plan is the total salmon catch and mortality (expressed in numbers of fish) resulting from fisheries within the EEZ adjacent to the States of Washington, Oregon, and California, and in the waters of those states (including internal

waters), and Idaho, that, to the greatest practical extent within pertinent legal constraints, fulfill the plan's conservation and harvest objectives. On an annual basis, the Council recommends management measures to comply with annual catch limits (ACLs) and to achieve the stock conservation objectives for each stock or stock complex, based on the estimated MSY, MSY proxy, maximum sustainable production (MSP), rebuilding schedule, or ESA consultation standard, while simultaneously seeking to fulfill, to the extent practicable, the harvest and allocation objectives that reflect the Council's social and economic considerations. The subsequent catch and mortality resulting under the Council's management recommendations will embody the optimum yield. The level of total allowable harvest, the relative harvest levels in various management areas, and the species and stock composition of optimum yield will vary annually, depending on the relative abundance and distribution of the various stocks and contingencies in allocation formulas.

In Council management of naturally spawning salmon stocks, MSY is usually approached in terms of the number of adult spawners associated with this goal (S_{MSY}). Often, data are insufficient to directly estimate S_{MSY}. In these cases, the Council may use MSY proxies derived from more general estimates of productive capacity and implement harvest strategies that may be expected to result in a long-term average catch approximating MSY.

Coastal Pelagic Species FMP
OY for a CPS stock is defined to be the level of harvest which is less than or equal to ABC estimated using an ABC control rule, consistent with the goals and objectives of this FMP, and used by the Council to manage the stock. The ABC is a harvest specification of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL (MSY or MSY proxy) and any other scientific uncertainty, and should be based on the ABC control rule. The ABC control rule specifies an approach to setting ABC for a stock or stock complex as a function of the scientific uncertainty in the estimate of OFL and any other scientific uncertainty. In practice, OY will be determined with reference to ABC. Harvest control rules and other OY considerations (economic, social, and ecological) will be used to set ACLs, ACTs, and/or HGs on an annual or multi-year basis. In particular, OY will be set less than OFL/ABC to the degree required to prevent overfishing.

Highly Migratory Species FMP

As a default control rule, OY(proxy) = equals MSY or MSY(proxy) is used for species not considered vulnerable. Since the management unit species vary from vulnerable to very productive an alternative OY specification may be considered for vulnerable species. In this FMP, where OY is not determined analytically, an OY or OY proxy may be defined according to vulnerability, starting with consideration of a value of 0.75*(MSY or MSY(proxy).

Normally, OY should not be greater than the ABC or ACL, if identified. However, since OY is a long-term average and ABCs and ACLs are set annually there may be instances where the ABC or ACL could exceed the OY on a short-term basis. The OY specifications shall remain in effect until changed by recommendation of the Council.

Table 4–3. Stockwide and regional (CA, OR, WA) catches in thousand (K) mt for management unit species at the time of FMP adoption, with respect to MSY, sustainability, and regional harvest guidelines.

Species (Stock)	MSY (or proxy)	OY (or proxy)	Catches (K mt round wgt, 1995-99 period)			Status		Harvest Guideline
				Regional		Regional Catch		
			Stock-wide	Comm'l	Rec'l	Fract'n	Sust'l?	
1. TUNAS								
Albacore (NP)	120[1]	(120)	67-128[2]	10-18	<0.05-1.31	0.16	Y	
Bluefin (NP)	(20)[3]	(15)	13-24[4]	<1-5	<0.05	0.10	Y	
Bigeye (EPO)	79[5]	(79)	64-94[4]	#0.1		<0.01	Y	
Yellowfin (EPO)	270[6]	(270)	244-306[4]	1-6	0.12-0.84	0.01	Y	
Skipjack (EPO)	(190)[3]	(190)	137-295[4]	4-7	<0.1	0.03	Y	
2. BILLFISHES								
Str. Marlin (EPO)	4.5[7]	(3.4)	2-4[7]	<0.02	0.03	0.01	Y	
Swordfish (EPO)	(12.5)[8]	(12.5)	8-15[4]	1-2	<0.01	0.12	Y	
3. SHARKS								
Cm Thresher(Reg'l)	(0.45)[9]	(0.34)	Unkn	0.27-0.33	0.01-0.06	?	Y	0.34[10]
Pl Thresher(Reg'l)	(0.020)[11]	(0.015)	Unkn	0.004 [12]		?	y	
BE Thresher(Reg'l)	(0.04)[13]	(0.03)	Unkn	0.01-0.03		?	y	
Mako/Bonito(Reg'l)	(0.20)[14]	(0.15)	Unkn	0.06-0.13	0.01-0.08	?	Y	0.15[10]
Blue (NP)	~120[15]	(90)	>50[16]	0.08-0.17[17]	<0.03	<0.01	Y	
4. OTHER								
Dorado (EPO)	(0.45)[3]	(0.45)	0.22-0.56[18]	<0.01-0.04	<0.01-0.08	0.04	Y	

MSY: from catch-effort relationships, unless a proxy. **Proxy MSY:** average stock-wide catches over appropriate years or (minimal) local (West Coast) MSYs (LMSY) including local average levels of catch. **OY:** equal to MSY or to 0.75MSY (bluefin tuna, str. marlin, sharks). **Stock-wide Catch:** 1995-99 catches. **Regional Commercial Catches:** 1995-99 West Coast catches from PacFIN data base (Table 2-1); also drift gillnet catches (str. marlin, blue shark) extrapolated from SWFSC Observer Records, 1995-99. Except for albacore, these catches are mainly from within the EEZ. **Regional Recreational Catch:** CPFV (Table 2-57) and RECFIN (Table 2-58) data, and assuming 12.9kg/bluefin, 7.1kg/yellowfin, 2.4kg/skipjack, 7.3kg/albacore, 6.5kg/dorado,113kg/swordfish, 16.7kg/mako, and 28.1kg/thresher; also, assuming 59kg/str. marlin, 300 sport-caught fish/yr. **Status:** Less certain Y/N is y/n re sustainability. **Harvest Guideline:** for shark species of regional/local concern; equal to the OY proxy.

Footnotes
1. Average MSY over low and high productivity periods (Bartoo and Shiohama 1985, NPALW 2000). See text.
2. NPALW 2000
3. Mean of 1995-99 stock-wide catches.
4. IATTC 2001
5. MSY between 66 and 92 K mt from production models (IATTC 2000).
6. From production model (Tomlinson 2001, IATTC 2000).
7. MSY and catches from Hinton and Bayliff (2002a).
8. Average of 1995-99 catches; an analytically derived MSY is pending.
9. LMSY proxy by Population Growth Rate (PGR) method; is a minimal estimate of MSY (see text).
10. The OY proxy = 0.75MSY.
11. LMSY proxy as average catch during strong El Niño years (here 1983, 1984, and 1997) when species presence became significant.
12. Average catch 1995-99 excluding 1997 (strong El Niño year).
13. Average catch 1982-99.
14. LMSY proxy as average 1981-1999 regional catch; is a minimal estimate of MSY (see text).
15. After Kleiber et al. (see text).
16. Estimated N. Pacific catches after Nakano and Seki (MS) (see text).
17. Catches from SWFSC DGN observer data base, plus other fisheries landings (Tables 2-1,2-40, 2-42). No data on LL bycatches.
18. FAO Area 77 catches.

Figure 4–1. General model of maximum sustainable yield and optimum yield control rules, according to Restrepo et al. (1998).