Review of the NPFMC approach for setting ABC and OFL levels

Amendment 56 to the GOA Groundfish FMP, approved by the Council in June 1998, defines ABC and OFL for the GOA groundfish fisheries. The definitions are shown below, where the fishing mortality rate is denoted F, stock biomass (or spawning stock biomass, as appropriate) is denoted B, and the F and B levels corresponding to MSY are denoted F_{MSY} and B_{MSY} respectively. The conditions for determining the fishing mortality rate under the amended FMP is shown in Box 1 below.

<u>Acceptable Biological Catch</u> is a preliminary description of the acceptable harvest (or range of harvests) for a given stock or stock complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is capped as described under "overfishing" below.

Overfishing is defined as any amount of fishing in excess of a prescribed maximum allowable rate. This maximum allowable rate is prescribed through a set of six tiers which are listed below in descending order of preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is reliable for the purpose of this definition, and may use either objective or subjective criteria in making such determinations. For tier (1), a pdf refers to a probability density function. For tiers (1-2), if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For tiers (1-5), if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For tiers (1-3), the coefficient α is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers (2-4), a designation of the form " $F_{X_{0}}$ " refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to X% of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For tier (3), the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

In summary, Figure 1 shows a schematic of how harvest rates are adjusted depending on the current stock size. In this illustration, the MSST represents the minimum stock-size threshold, which for pollock occurs at 50% of the "target" biomass of $B_{40\%}$. Note that due to ecosystem concerns and Steller sea lion prey, the fishing mortalities will be specified to be zero should the stock drop below the MSST. This is further illustrated in a simulation showing catch and fishing mortality for a simple age-structured model result for Bogoslof pollock (Fig. 2). In practice, these harvest control rules have properties that enhance the likelihood that the stock will increase to above the target SSB when it drops below. At the other extremes (when stocks are at high levels), over-arching OY principles (e.g., bycatch constraints, 2 million t cap on all groundfish quotas) play a large role in preventing over-capitalization and thereby relieves some economic pressures when quotas are required to be reduced.





Box 1. Conditions for fishing mortality rates under the current (2004) Tier system used under amendment 56 to the FMP for North Pacific groundfish fisheries.

1a) Stock status: $B/B_{MSY} > 1$ $F_{FAL} = \mu_A$, the arithmetic mean of the pdf $F_{ABC} < \mu_A$, the harmonic mean of the pdf $F_{ABC} < \mu_A$, the harmonic mean of the pdf $F_{ABC} < \mu_A$, the harmonic mean of the pdf $F_{ABC} = \mu_A < tB/B_{MSY} < 0/(1 - \alpha)$ $F_{ABC} = \mu_A < tB/B_{MSY} < \alpha/(1 - \alpha)$ 1c) Stock status: $B/B_{MSY} < \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$ 2) Information available: Reliable point estimates of B, B_{MSY} , F_{MSY} , F_{3556} , and F_{4056} . 2a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = F_{MSY} < tB/B_{MSY} < f / 1 - \alpha$ 2b) Stock status: $B/B_{MSY} < \alpha/(1 - \alpha)$ $F_{ABC} < F_{MSY} < tB/B_{MSY} < \alpha/(1 - \alpha)$ $F_{ABC} < F_{MSY} < tB/B_{MSY} < \alpha/(1 - \alpha)$ 2c) Stock status: $B/B_{MSY} < \alpha/(1 - \alpha)$ $F_{ABC} < F_{MSY} < tB/B_{MSY} < \alpha/(1 - \alpha)$ 2c) Stock status: $B/B_{MSY} < \alpha$ $F_{OFL} = 0$ $F_{ABC} < 0$ 3) Information available: Reliable point estimates of B, B_{4076} , F_{3556} , and F_{4076} . 3a) Stock status: $B/B_{MSY} < \alpha/(1 - \alpha)$ $F_{ABC} < F_{MSY} < tB/B_{MSY} < \alpha$ $F_{OFL} = 0$ $F_{ABC} < 0$ 3) Information available: $Reliable point estimates of B, B_{4076}, F_{3556}, and F_{4076}.3a) Stock status: \alpha < B/B_{4076} < 1F_{OFL} = F_{S558} < tB/B_{4076} < \alphaF_{OFL} = 0F_{ABC} = 04) Information available: Reliable point estimates of B, F_{3556}, and F_{4076}.F_{OFL} = F_{5578} < tB/B_{4076} < \alphaF_{OFL} = 0F_{ABC} = 04) Information available: Reliable point estimates of B, F_{3556}, and F_{4076}.F_{OFL} = F_{5578} < F_{4076} < B/B_{4076} < \alphaF_{OFL} = 0F_{ABC} = 0(4) Information available: Reliable point estimates of B and natural mortality rate M.F_{OFL} = MF_{ABC} < F_{4075}(5) Information available: Reliable point estimates of B and natural mortality rate M.F_{OFL} = MF_{ABC} < F_{4075}(6) Information available: Reliable catch history from 1978 through 1995.OFL = the average catch from 1978 through 1995. unless an alternative value is established by the SSC on the basis of the best a$	Tier	1)	Information available: Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY} .
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$\begin{aligned} F_{OFL} &= F_{MSY} \\ F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \\ \text{2b) Stock status: } &\alpha < B/B_{MSY} < 1 \\ F_{OFL} &= F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha) \\ F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha) \\ \text{2c) Stock status: } &B/B_{MSY} \leq \alpha \\ F_{OFL} &= 0 \\ \text{3) Information available: Reliable point estimates of B, B_{40\%}, F_{35\%}, and F_{40\%}. \\ \text{3a) Stock status: } &B/B_{40\%} > 1 \\ F_{OFL} &= F_{35\%} \\ F_{ABC} \leq F_{40\%} \\ \text{3b) Stock status: } &\alpha < B/B_{40\%} < 1 \\ F_{OFL} &= F_{35\%} \times (B/B_{40\%} < \alpha)/(1 - \alpha) \\ F_{ABC} \leq F_{40\%} \times (B/B_{40\%} < \alpha)/(1 - \alpha) \\ 3c) Stock status: B/B_{40\%} < \alpha \\ F_{OFL} &= 0 \\ \text{4) Information available: Reliable point estimates of B, F_{35\%}, and F_{40\%}. \\ F_{OFL} &= F_{35\%} \times (B/B_{40\%} < \alpha)/(1 - \alpha) \\ F_{ABC} &\leq F_{40\%} \times (B/B_{40\%} < \alpha)/(1 - \alpha) \\ F_{ABC} &\leq F_{40\%} \times (B/B_{40\%} < \alpha) \\ F_{OFL} &= 0 \\ \text{4) Information available: Reliable point estimates of B, F_{35\%}, and F_{40\%}. \\ F_{OFL} &= F_{55\%} \\ F_{ABC} &\leq 0 \\ 5) Information available: Reliable point estimates of B, IS and IS a$			2a) Stock status: $B/B_{MSY} > I$
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 6) Information available: Reliable catch history from 1978 through 1995. 6) OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information 			$F_{OFL} = M$ $F_{OFL} = 0.75 \dots M$
OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information		6)	$F_{ABC} \leq 0.75 \times M$
SSC on the basis of the best available scientific information		0)	OFL = the average catch from 1078 through 1005 unless an alternative value is established by the
SSC on the basis of the best available scientific information			SSC on the basis of the best available scientific information
$ABC < 0.75 \times OFL$			ABC < 0.75 × OFL



Figure 1. General schematic of harvest control rule used for N. Pacific groundfish stocks.



Figure 2. Simulation results showing harvest control rule in effect for Bogoslof pollock where the $B_{40\%}$ level is about 130,000 t of female spawning biomass and the MSST is about 65,000 t. The catch is shown by the band of points and the fishing mortalities by the straight line segments.

ABC, OFL, and TAC levels set for 2005 and 2006

In order to follow the administrative procedures act and follow the guidelines for environmental assessments of actions (including fishing), the NPFMC and NMFS now require estimates of ABC and OFLs (and preliminary TACs) projected for two years. The result of these projections are shown in the table below as published in the Federal Register.

	Fe	dera	al	Re	gi	ste	r/	Vc	ol.	70),	No).	36	3/'	Th	iui	rso	lay	y,	Fe	bı	rua	ry	2	4,	2	00	5/	Ru	les	anc	1 F	Reg	ıla	tio	ns
	CDQ ³	148,776	1,900	14.625	87	47	4,725 563	2.663	1,500	6,750	3,150	263	75		1,500	225	750	945	105	231	228	100	45	17	29	35	44	2,190	Ĩ	187,350	a includes the	aner me sub-	ve for use by	rected pollock		.((III)(
	ITAC ²	1,338,980	17,100	165.750	982	527	53,550 6 375	30,175	17,000	76,500	35,700	2,975	2, 123 R50	10 200	17,000	2,550	8,500	10,710	1,190	2,618	2,580	1 250	507	190	893	391	502	24.820		1,772,778	a (BS) subare		a CDQ resei	sector for a di)(a)nz.e/oß e	
2006	TAC	1,487,756	19,000	195.000	2,310	2,480	63,000	35,500	20,000	90,000	42,000	3,500	2,300	12,000	20,000	3,000	10,000	12,600	1,400	3,080	3,035 F 085	2,000 E 000	596	223	1,050	460	590	6/21	222	2,000,000	the Bering Sea	Is the remaind	designated as	r allocated by	ck fishery.	arricipants (see ka plaice.	
	ABC	1,617,000	29,400	195.000	2,310	2,480	107,000	45.580	40,230	114,000	122,000	3,600	1 100	R8 400	48,400	21,400	109,000	14,600	2,920	3,210	3,165 5 305	0000	596	223	1,400	810	590	57.870		2,547,259	specifications,	each species	of the TACs, is	ercent, is furthe	a directed pollo	ed for use by CDQ part th flounder and Alaska	
	OFL	1,944,000	39,100 30,600	226,000	2,690	2,880	127,000			133,000	145,000	11,100		103 000	56,100	28,500	115,000	17,408				00100	794	298	1,870		0000	87.920		3,093,360	these harvest		r 7.5 percent o	e ICA—3.35 pe	orporation for a	Is reserved for arrowtooth flou	sgory.
	CDQ ³	147,850	1,900	15.450	336	442	4,725 563	2.663	1,500	6,801	3,113	263	507 Ug	000	1,463	263	600	945	105	231	228	276	45	17	62	35	44	2.175)]	186,608	the purpose of	LINIO A reserve	d in reserve, o	percent and the ^I uld be effective w I to the Aleut Corp	d to trawl gear yellowfin sole,	theye rockfish. In species" cate	
ric tons]	ITAC ²	1,330,650	17,100	175,100	2,013	2,129	53,550 6 375	30,175	17,000	77,083	35,275	2,975	2,290 680	10.200	16,575	2,975	6,800	10,710	1,190	2,618	2,580	1 250	507	190	893	391	502	24.650	2222	1,774,719	ollock, and for		he TACs place	allowance—10	Id be allocated	h I AU allocated thot, rock sole,	raker, and roug
2005	TAC	1,478,500	19,000	206.000	2,440	2,620	63,000	35,500	20,000	90,686	41,500	3,500	2,700 800	12 000	19,500	3,500	8,000	12,600	1,400	3,080	3,035 5 085	0,000 E 000	596	223	1,050	460	590 1 07F	000.62	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2,000,000	exception of p		he amount of t	irected fishing	-2,000 mt, wou	-2,000 mt, woulk of the sablefish , Greenland turb	northern, short , are not incluc
Inome	ABC	1,960,000	29,400 0,570	206,000	2,440	2,620	124,000 24 660	52.830	46,620	124,000	132,000	3,930	1 210	108,000	58,500	21,400	189,000	14,600	2,920	3,210	3,165 5 305	0,000	596	223	1,400	810	1 020	53.860	2	3,044,769	cified. With the	and pot gear,	h, one half of t	n for the CDQ div ships—10 percen	second the ICA	ing /.5 percent s), flathead sole	c ocean perch, fined at §679.2
	OFL	2,100,000	39,100 30,600	265,000	2,950	3,170	147,000			148,000	157,000	19,200		132 000	70,200	28,500	237,000	17,300				010 0	794	298	1,870		00000	87.920	2	3,509,332	otherwise spe	o nook-and-line	ion of sabletish, fter subtraction fo	percent and se	ar or pot gear a ohibited species	except for Pacifi rage fish, as de	
	Area	BS ²	AI ²	BSAI	BS	AI	BSAI	CAL	WAI	BSAI	BSAI	BSAI	D3	BSAI	BSAI	BSAI	BSAI	BSAI	BS	EAI	CAI		BSAI	BSAI	BSAI	BS		BSAI			ent area unless	AU allocated to	pot gear alloca	a pollock TAC a	or—40 percent; a allowance—10 pei sk-and-line gear oi r halibut (a prohibi		<i>lobus</i> species e nd octopus. For
	Species	Pollock ⁴		Pacific cod	Sablefish ⁵		Atka mackerel			Yellowfin sole	Rock sole	Greenland turbot		Arrowtooth flouinder	Flathead sole	Other flatfish ⁶	Alaska plaice	Pacific ocean perch	_			Northorn rootfich	Shortraker rockfish	Rougheye rockfish	Other rockfish ⁷			oquid		Total	¹ These amounts apply to the entire BSAI managemt Bogoslof District.	 Except for pollock and the portion of the sabletish I traction of these reserves. 	³ Except for pollock, squid and the hook-and-line or p CDO participants (see \$\$679 20(h)(1)(iii) and 679 31)	Under §679.20(a)(5)(i)(A)(1), the annual Bering Sea athenvis follows: inshore –50 percent: catcher/proceed	TAC, after first subtracting for the CDQ directed fishing	⁶ "Other flatfish" includes all flatfish species, except for	7"Other rockfish" includes all Sebastes and Sebastol 8"Other species" includes sculpins, sharks, skates ar