North Pacific Fishery Management Council

Dan Hull, Chairman
Chris Oliver, Executive Director

Telephone (907) 271-2809

605 W. 4th Avenue, Suite 306
Anchorage, AK 99501-2252

Fax (907) 271-2817

Visit our website: http://www.npfmc.org

REPORT of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
December 7th – 9th, 2015

The SSC met from December 7th through 9th at the Hilton Hotel, Anchorage, AK.

Members present were:

Farron Wallace, Chair
NOAA Fisheries—AFSC

Chris Anderson
University of Washington

Lew Coggins
U.S. Fish and Wildlife Service

Sherri Dressel
Alaska Department of Fish and Game

Kari Fenske
Washington Dept. of Fish and Wildlife

Brad Harris
Alaska Pacific University

Anne Hollowed
NOAA Fisheries—AFSC

George Hunt
University of Washington

Gordon Kruse
University of Alaska Fairbanks

Seth Macinko
University of Rhode Island

Steve Martell
Intl. Pacific Halibut Commission

Franz Mueter
University of Alaska Fairbanks

Lew Queirolo
NOAA Fisheries—Alaska Region

Matt Reimer
University of Alaska Anchorage

Alison Whitman
Oregon Dept. of Fish and Wildlife

Members absent were:

Jennifer Burns
University of Alaska Anchorage

Robert Clark
Alaska Department of Fish and Game

Terry Quinn
University of Alaska Fairbanks

Kate Reedy
Idaho State University Pocatello

C-2 BSAI and C-3 GOA specifications and SAFE report

Plan Team Membership

Diana Stram (Council staff) provided an overview on recent loss of Plan Team (PT) members that could potentially impact the level and completeness of PT document review and recommendations. This is especially concerning for the Crab Plan Team (CPT). The SSC recommends the Council complete a broad review of **all the teams for membership, evaluate needs and resources, and see where it is best to focus efforts to fill seats.**

Stock Structure workgroup report

The SSC received a summary on the Stock Structure/Spatial Management Workgroup report from Diana Stram (Council staff). The workgroup was formed and met twice since October in order to meet the Council's request that a small group comprised of PT, Council staff, NMFS RO, and SSC members discuss outstanding issues of stock structure/spatial management, make recommendations for moving forward in this cycle with BSAI blackspotted/rougheye rockfish (BS/RE), and provide clarifications of the Council's policy adopted October 2013. **The SSC further recommends that the other "strong**

concern" species complex, GOA skate, also move forward on the time schedule set by the workgroup. The SSC notes that there is already action moving forward to set MRAs for big and longnose skates. This action will likely resolve current concerns and the level of concern will be re-evaluated using the stock structure worksheet.

The workgroup discussed and made recommendations to address issues raised in the 2014 Joint PT minutes (attached). **The SSC believes the workgroup recommendations help clarify and address outstanding issues and recommends that the Council adopt all workgroup recommendations.**

The workgroup recommendations include:

1. That the Council clarify that this policy applies equally to both spatial structure/management and stock structure issues. The workgroup recommends that the Council rename the policy as the "Stock Structure and Spatial Management policy."
2. That the Joint Plan Teams revise their spatial management and stock structure policy "with the understanding that the list of alternative tools/options to be included under Step 2 of the Council process should always include separate harvest specifications at the TAC level, the ABC level, the OFL level, or all three."
3. In the definition of the concern level "Little or no concern", where no action needs to be taken,, to add the phrase, "This includes situations where information is insufficient to determine a level of concern, which may motivate additional research."
4. The Council should amend Step 2 of its policy to include "This suite of tools should always include separate harvest specifications at the TAC level, the ABC level, the OFL level, or all three."
5. The workgroup clarifies "that, from the perspective of stock structure/spatial management issues, the differences in spatial management between FMPs reflect reasonable responses to available information."
6. The Council adopt the workgroup timeframe for instituting spatial stock structure changes that are in conjunction with Step 2 of the Council's policy, with the understanding that a somewhat longer time frame may be necessary for actions involving rulemaking.
7. The Council clarify that "degree of concern" is a function of both the strength of evidence of stock structure and the extent to which the fishery is impacting that structure.

Additionally the SSC supports the workgroup recommendations that the Council provide clarification on the following points in order to move forward in 2016 for BSAI BS/RE:

1. Who should propose additional management tools and what is the role of the public in identifying them?
2. Who will evaluate the suite of tools?
3. What is (or, is there) a continued role for the workgroup in this process?

Halibut DMRs

The SSC received a presentation from Jim Armstrong (Council Staff) that included a table of JPT recommended halibut discard mortality rates (DMRs) for 2016 – 2017, a brief summary of the Halibut Ad hoc Working Group and the C-3 Halibut DMR Report. The SSC was asked to provide an evaluation of new methods that replicated previous methods that had been in effect since 1996, but did not use data from strata (Fishery/Area) where there were less than 50 observer viability samples. The calculated DMRs are intended to be the basis for recommendations to the North Pacific Fishery Management Council and the National Marine Fisheries Service for assumed rates to be used for the in-season estimation of halibut PSC mortality during the 2016-2018 groundfish fisheries off Alaska. The information provided for SSC review was insufficient to provide a technical assessment of these methods.

The SSC maintains that any new methodology include all the necessary technical background information to support evaluation. The SSC stresses that both the statistical sampling design for collecting viability information and the determination of mortality rates applied to each category should be clarified. This analysis only focuses on the proportions. The other major issue is that in cases where there are no DMR values in a specific sector, values are borrowed from another sector. For example, DMRs for longline rockfish and turbot fisheries are borrowed from the Pacific cod longline fishery. However, it is not clear whether the DMR from the source fishery is representative of DMR's in other fisheries.

Another area of concern is the sectors in which there are very low DMR's and large volumes of halibut bycatch. For example, the 2014 NMFS observer annual report states that 13,608 t of halibut PSC was taken in Alaskan hook and line fisheries (including the directed halibut fishery) in 2013. Given a 9% DMR for this sector, this translates into roughly 1,224 t net wt. of PSC mortality, while 12,383 t net wt. survived the capture process. In contrast, in the same year, estimates of non-pelagic trawl halibut bycatch were 3,961 t net wt., and assuming a DMR of 80%, the implied assumption is that 792 t net wt. survived. Because of the large volume of discard in these fisheries a small change in the DMR could result in dramatic changes in the overall assumed halibut mortality. These changes may result in potentially dramatic changes to the population dynamics, which exemplifies the importance of fully characterizing the uncertainty in the DMR values, especially for sectors with low DMRs and large volumes of PSC.

Given the overall reduction in DMR resulting from a revised method and the uncertainty in DMR calculation, there is a potential for increasing PSC while staying under the PSC limits. The SSC recommends staying with the status quo methods (in 2016) until an alternative approach is fully evaluated. The SSC emphasizes that high priority should be placed on revising DMR estimates and to fully characterize uncertainty in estimates of halibut discard mortality. This will help inform objective criteria for lumping and splitting sectors, number of years to average, length of impact time (now 3 years) and adequacy of sampling. The SSC notes that in 2016 Craig Rose will be conducting research on halibut mortality rates using satellite tags that may help inform assumptions on mortality rates of released halibut.

General Stock Assessment Comments

The SSC recommends that the bottom trawl surveys continue to sample stations to 1,000 m. These deep stations provide critical information for some stocks (e.g., thornyhead rockfishes and Dover sole). The SSC emphasizes that the continuation of the Bering Sea slope survey is also critical, particularly for Greenland turbot and skate assessments.

The SSC reminds the authors and PTs to follow the model numbering scheme adopted at the December 2014 meeting.

Many assessments are currently exploring ways to improve model performance by re-weighting historic survey data. The SSC encourages the authors and PTs to refer to the forthcoming CAPAM data-weighting workshop report.

The SSC supports the GOA PT recommendation to form a study group to explore the criteria necessary for adopting the geostatistical generalized linear mixed model approach in assessments. If this study group is formed, the SSC requests that the group be expanded to include BSAI assessment authors and members from the AFSC survey program. Among the many questions this group could address, the SSC suggests including the following questions:

1. Is the stratified random survey design used for the surveys correctly configured for application of the geostatistical approach?

2. Should the geostatistical approach be applied to all species or a select suite of species that exhibit aggregated spatial distributions and rockfish-like life histories? If application of this approach is recommended for only a subset of managed species, what life history characteristics or biological criteria would qualify a species for this approach?
3. What level of aggregation is necessary for application of the geostatistical approach?
4. If the geostatistical approach is adopted should results also be used for area apportionments?

The PT discussion relative to its choice of a preferred model for the BSAI northern rock sole assessment raised an important issue about using localized gear performance studies (e.g. Somerton and Munro 2001) to inform or fix estimates of catchability (*Q*). The PT pointed out that gear herding experiments can inform the estimation of *Q*, but support a very limited scope of inference given the broad spatial and temporal distributions of the factors influencing *Q*. Currently assessment authors are applying a variety of approaches to calculating Q including fixing the value, fitting it in the assessment model, fitting it with priors based on field studies, and estimating it as a temperature-dependent parameter. The SSC notes that *Q* relates survey abundance to stock size and fishing mortality to fishing effort for the stock area and survey or fishery time series, and as such is a direct scalar on the survey abundance estimates. Both the fish herding characteristics of the survey trawl and the timing of fish migrations (especially flatfish) impact *Q*, and these factors are known to be influenced by water temperature. The SSC recommends that assessment authors work with AFSC's survey program scientist to develop some objective criteria to inform the best approaches for calculating *Q* with respect to information provided by previous survey trawl performance studies (e.g. Somerton and Munro 2001), and fish-temperature relationships which may impact *Q*.

General SAFE Comments

The SSC reviewed the SAFE chapters and 2014 OFLs with respect to status determinations for BSAI and GOA groundfish. **The SSC accepts the status determination therein, which indicated that no stocks were subject to overfishing in 2014. Also, in reviewing the status of stocks with reliable biomass reference points (all Tier 3 and above stocks and rex sole), the SSC concurs that these stocks are not overfished or approaching an overfished condition.**

BSAI and GOA specifications

The SSC received a presentation by Grant Thompson (NMFS-AFSC) on PT recommendations for BSAI groundfish OFLs and ABCs. Jim Ianelli (NMFS-AFSC) presented the BSAI pollock stock assessment. GOA PT recommendations were summarized by Jim Ianelli (NMFS-AFSC), Jon Heifetz (NMFS-AFSC) and Jim Armstrong (NPFMC).

Table 1. SSC recommendations for BSAI groundfish OFLs and ABCs for 2016 and 2017 are shown with the 2015 OFL, ABC, TAC, and Catch amounts in metric tons (2015 catches through November 7th from AKR Catch Accounting include CDQ). None of the SSC recommendations differed from those of the BSAI Plan Team.

		2015			**2015 Catch as of**	**2016**		**2017**	
Species	**Area**	**OFL**	**ABC**	**TAC**	**11/7/15**	**OFL**	**ABC**	**OFL**	**ABC**
Pollock	EBS	3,330,000	1,637,000	1,310,000	1,318,833	3,910,000	2,090,000	3,540,000	2,019,000
	AI	36,005	29,659	19,000	916	39,075	32,227	44,455	36,664
	Bogoslof	21,200	15,900	100	733	31,800	23,850	31,800	23,850
Pacific cod	BS	346,000	255,000	240,000	202,626	390,000	255,000	412,000	255,000
	AI	23,400	17,600	9,422	9,060	23,400	17,600	23,400	17,600
Sablefish	BS	1,575	1,333	1,333	209	1,304	1,151	1,241	1,052
	AI	2,128	1,802	1,802	431	1,766	1,557	1,681	1,423
Yellowfin sole	BSAI	266,400	248,800	149,000	122,363	228,100	211,700	219,200	203,500
Greenland turbot	BSAI	3,903	3,172	2,648	2,199	4,194	3,462	7,416	6,132
	BS	n/a	2,448	2,448	2,086	n/a	2,673	n/a	4,734
	AI	n/a	724	200	113	n/a	789	n/a	1,398
Arrowtooth flounder	BSAI	93,856	80,547	22,000	11,005	94,035	80,701	84,156	72,216
Kamchatka flounder	BSAI	10,500	9,000	6,500	4,961	11,100	9,500	11,700	10,000
Northern rock sole	BSAI	187,600	181,700	69,250	45,350	165,900	161,100	149,400	145,000
Flathead sole	BSAI	79,419	66,130	24,250	10,955	79,562	66,250	77,544	64,580
Alaska plaice	BSAI	54,000	44,900	18,500	14,269	49,000	41,000	46,800	39,100
Other flatfish	BSAI	17,700	13,250	3,620	2,394	17,414	13,061	17,414	13,061
Pacific Ocean perch	BSAI	42,558	34,988	32,021	30,034	40,529	33,320	38,589	31,724
	BS	n/a	8,771	8,021	6,588	n/a	8,353	n/a	7,953
	EAI	n/a	8,312	8,000	7,861	n/a	7,916	n/a	7,537
	CAI	n/a	7,723	7,000	6,777	n/a	7,355	n/a	7,002
	WAI	n/a	10,182	9,000	8,808	n/a	9,696	n/a	9,232
Northern rockfish	BSAI	15,337	12,488	3,250	7,230	14,689	11,960	14,085	11,468
Blackspotted/ Rougheye Rockfish	BSAI	560	453	349	180	693	561	855	694
	EBS/EAI	n/a	149	149	65	n/a	179	n/a	216
	CAI/WAI	n/a	304	200	115	n/a	382	n/a	478
Shortraker rockfish	BSAI	690	518	250	149	690	518	690	518
Other rockfish	BSAI	1,667	1,250	880	683	1,667	1,250	1,667	1,250
	BS	n/a	695	325	184	n/a	695	n/a	695
	AI	n/a	555	555	499	n/a	555	n/a	555
Atka mackerel	BSAI	125,297	106,000	54,500	53,265	104,749	90,340	99,490	85,840
	EAI/BS	n/a	38,492	27,000	26,342	n/a	30,832	n/a	29,296
	CAI	n/a	33,108	17,000	16,669	n/a	27,216	n/a	25,860
	WAI	n/a	34,400	10,500	10,253	n/a	32,292	n/a	30,684
Skates	BSAI	49,575	41,658	25,700	24,886	50,215	42,134	47,674	39,943
Sculpins	BSAI	52,365	39,725	4,700	4,612	52,365	39,725	52,365	39,725
Sharks	BSAI	1,363	1,022	125	96	1,363	1,022	1,363	1,022
Squids	BSAI	2,624	1,970	400	2,360	6,912	5,184	6,912	5,184
Octopuses	BSAI	3,452	2,589	400	370	3,452	2,589	3,452	2,589
Total	BSAI	4,769,174	2,848,454	2,000,000	1,870,168	5,323,974	3,236,762	4,935,455	3,128,135

[a] The SSC recommendation for "maximum subarea species catch" of Blackspotted/Rougheye rockfish in the WAI portion of the CAI/WAI is 58 mt in 2016 and 73 mt in 2017.

Table 2. SSC recommendations for GOA groundfish OFLs and ABCs for 2016 and 2017, shown with 2015 OFL, ABC, TAC, and catch amounts in metric tons (2014 catches through November 7th, 2015 from AKR catch accounting system). Recommendations are marked in **bold** where SSC recommendations differ from those of the GOA Plan Team.

		2015				2016		2017	
Species	Area	OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	W(61)	-	31,634	31,634	28,730		56,494 [a]		55,657[a]
	C(62)	-	97,579	97,579	81,324		124,927[a]		123,078[a]
	C(63)	-	52,594	52,594	52,396		57,183 [a]		56,336[a]
	WYAK	-	4,719	4,719	250		9,348 [a]		9,209[a]
	Subtotal	256,545	191,309	186,526	162,700	322,858	254,310	289,937	250,544
	EYAK/SEO	16,833	12,625	12,625		13,226	9,920	13,226	9,920
	Total	273,378	203,934	199,151	162,700	336,084	264,230	303,163	260,464
Pacific cod	W		38,702	27,091	18,038		40,503		34,998
	C		61,320	45,990	33,372		49,312		42,610
	E		2,828	2,121	87		8,785		7,592
	Total	140,300	102,850	75,202	51,497	116,700	98,600	100,800	85,200
Sablefish	W		1,474	1,474	1,012		1,272		1,163
	C		4,658	4,658	4,570		4,023		3,678
	WYAK		1,708	1,708	1,802		1,475		1,348
	SEO		2,682	2,682	2,822		2,317		2,118
	Total	12,425	10,522	10,522	10,206	10,326	9,087	9,825	8,307
Shallow-water flatfish	W		22,074	13,250	274		20,851		19,159
	C		19,297	19,297	2,959		19,242		17,680
	WYAK		2,209	2,209	1		3,177		2,919
	EYAK/SEO		625	625	1		1,094		1,006
	Total	54,207	44,205	35,381	3,235	54,520	44,364	50,220	40,764
Deep-water flatfish	W		301	301	54		186		187
	C		3,689	3,689	183		3,495		3,516
	WYAK		5,474	5,474	2		2,997		3,015
	EYAK/SEO		3,870	3,870	3		2,548		2,563
	Total	15,993	13,334	13,334	242	11,102	9,226	11,168	9,281
Rex sole	W		1,258	1,258	76		1,315		1,318
	C		5,816	5,816	1,793		4,445		4,453
	WYAK		772	772			766		767
	EYAK/SEO		1,304	1,304			967		969
	Total	11,597	9,150	9,150	1,869	9,791	7,493	9,810	7,507
Arrowtooth flounder	W		30,752	14,500	557		28,183		28,659
	C		114,170	75,000	17,857		107,981		109,804
	WYAK		36,771	6,900	37		37,368		37,999
	EYAK/SEO		11,228	6,900	22		12,656		12,870
	Total	226,390	192,921	103,300	18,473	219,430	186,188	196,714	189,332
Flathead sole	W		12,767	8,650	199		11,027		11,080
	C		24,876	15,400	1,707		20,211		20,307
	WYAK		3,535	3,535	1		2,930		2,944
	EYAK/SEO		171	171			852		856
	Total	50,792	41,349	27,756	1,907	42,840	35,020	43,060	35,187

[a] W/C/WYAK subarea amounts for pollock are apportionments of subarea ACL that allow for regulatory reapportionment

Table 2. continued.

Species	Area	2015 OFL	2015 ABC	2015 TAC	2015 Catch	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Pacific Ocean Perch	W		2,302	2,302	2,038		2,737		2,709
	C		15,873	15,873	14,196		17,033		16,860
	WYAK		2,014	2,014	1,980		2,847		2,818
	W/C/WYAK	23,406	20,189	20,189	18,214	26,313	22,617	26,045	22,387
	SEO	954	823	823		2,118	1,820	2,096	1,802
	Total	24,360	21,012	21,012	18,214	28,431	24,437	28,141	24,189
Northern rockfish[b]	W		1,226	1,226	978		457		430
	C		3,772	3,772	2,957		3,547		3,338
	E						4*		4*
	Total	5,961	4,998	4,998	3,935	4,783	4,004	4,501	3,768
Shortraker Rockfish	W		92	92	49		38		38
	C		397	397	254		301		301
	E		834	834	264		947		947
	Total	1,764	1,323	1,323	567	1,715	1,286	1,715	1,286
Dusky Rockfish	W		296	296	183		173		159
	C		3,336	3,336	2,551		4,147		3,791
	WYAK		1,288	1,288	1		275		251
	EYAK/SEO		189	189	7		91		83
	Total	6,246	5,109	5,109	2,742	5,733	4,686	5,253	4,284
Rougheye and blackspotted rockfish	W		115	115	29		105		105
	C		632	632	345		707		705
	E		375	375	155		516		515
	Total	1,345	1,122	1,122	529	1,596	1,328	1,592	1,325
Demersal shelf rockfish	Total	438	225	225	108	364	231	364	231
Thornyhead Rockfish	W		235	235	232		291		291
	C		875	875	581		988		988
	E		731	731	211		682		682
	Total	2,454	1,841	1,841	1,024	2,615	1,961	2,615	1,961
Other rockfish (Other slope)[b]	W/C		1,031	1,031	1,041		1,534		1,534
	WYAK		580	580	34		574		574
	EYAK/SEO		2,469	200	19		3,665*		3,665*
	Total	5,347	4,080	1,811	1,094	7,424	5,773	7,424	5,773
Atka mackerel	Total	6,200	4,700	2,000	1,191	6,200	4,700	6,200	4,700
Big Skate	W		731	731	182		908		908
	C		1,257	1,257	1,173		1,850		1,850
	E		1,267	1,267	55		1,056		1,056
	Total	4,340	3,255	3,255	1,410	5,086	3,814	5,086	3,814
Longnose Skate	W		152	152	98		61		61
	C		2,090	2,090	1,055		2,513		2,513
	E		976	976	311		632		632
	Total	4,291	3,218	3,218	1,464	4,274	3,206	4,274	3,206
Other skates	Total	2,980	2,235	2,235	1,476	2,558	1,919	2,558	1,919
Sculpins	GOA-wide	7,448	5,569	5,569	941	7,338	5,591	7,338	5,591
Sharks	GOA-wide	7,986	5,989	5,989	1,306	6,020	4,514	6,020	4,514
Squids	GOA-wide	1,530	1,148	1,148	408	**1,530**	**1,148**	**1,530**	**1,148**
Octopuses	GOA-wide	2,009	1,507	1,507	909	6,504	4,878	6,504	4,878
Total		870,064	685,597	536,158	287,447	892,964	727,684	815,875	708,629

* Note that the 4 mt of EGOA northern rockfish is excluded from that stock's total as it is managed as part of the EGOA "other rockfish" category.

GOA and BSAI– Sablefish

This year's assessment was a straight forward update of the 2014 sablefish model. The new data added to the model included: relative abundance and length data from the 2015 longline survey, relative abundance and length data from the 2014 longline fishery, length data from the 2014 trawl fisheries, age data from the 2014 longline survey and 2014 fixed gear fishery, the 2015 GOA trawl survey abundance and length compositions, updated catch for 2014, and projected 2015- 2017 catches.

Only two models were brought forward – last year's model without the new data (M0) and the same model updated with the new data sources noted above (M1). The SSC accepted model M1 which included the best available data for this stock. The author reported that the Mohn's rho of 0.023 is very low (a small positive retrospective bias) relative to most assessments at the AFSC (Hanselman et al. 2013). The retrospective patterns are well within the posterior uncertainty of each assessment (Figure 3.31b). This suggests that the model is responsive to changes in the data.

The SSC agreed with the author and PT that sablefish should be managed under Tier 3 of NPFMC harvest rules and the time period used for calculating biological reference points used for management (1977-2012). The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from this assessment are 102,807 t (combined across the EBS, AI, and GOA), 0.094, and 0.112, respectively. **Projected female spawning biomass (combined areas) for 2016 is 86,471 t ($B_{34\%}$) placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3b is 0.078 and the OFL fishing mortality rate is 0.093, which translates to the 2016 ABC and OFL values listed in the proposed specifications table.** The 2016 ABC is down from the projected value made last year for 2015 and the stock is expected to decline for several years. **The SSC accepted the author and PT recommendations for OFLs and ABCs for 2016 and 2017 (see table)**.

The author and PT reviewed options for estimating area apportionments. The author reported that new tagging studies show annual movement probabilities were high, and movement probabilities were very different between areas of occupancy and moderately different between size groups. Further, the estimated annual movement of small sablefish from the central Gulf of Alaska had the reverse pattern of a previous study. A full evaluation of how movement may affect spatial abundance of sablefish and apportionment is currently underway. In the interim, the author recommended that the area apportionments are rolled over for one more year. **The SSC agrees with this approach, and accepts the PT and author recommendations for area apportionments (see table).**

The author presented an update on several areas of research that are relevant to the harvest specification process. These included continued research on new methods to incorporate whale depredation into the model (see Appendix 3C in Hanselman et al. 2014), new methods for estimating area apportionments, recruitment processes (findings from the GOA Integrated Ecosystem Research Program), and new research to identify the potential for, and implications of, skip spawning on the estimate of spawning biomass. The author reported that the sablefish assessment will undergo a CIE review in 2016 in which several of these issues will be thoroughly investigated. The SSC agrees that the research has potentially important implications for future assessments and anticipates that the author will bring forward alternative models that address some or all of the research issues for review in the fall.

In addition to the research areas noted above, the SSC recommends that the authors address the following issues:

1. **The SSC recommends that the authors consider updating the data to reflect growth in the recent period.**

2. In response to increased sperm whale depredation, the NPFMC passed a motion to allow sablefish pot fishing in the GOA (see Council Minutes April 2015). The new regulations are expected to take effect in early 2016. If a pot fishery develops in the GOA, future assessments should consider methods for estimating selectivity and catchability for this new gear/region. This will ensure that projected recommendations for ABC and OFL reflect the best available information regarding the fishery impact on the sablefish population.

3. The SSC notes that the population trends for sablefish exhibit a long slow decline in abundance interrupted by a short period of modest population increase in the late 1980s (Figure 3.13). The amplitude of strong-year classes appears to be diminished in the recent time period (Figure 3.14). The SSC requests that in preparation for the upcoming CIE review, the author carefully review the processes believed to underlie this prolonged decline in abundance.

Sablefish GOA

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Sablefish	W		1,272		1,163
	C		4,023		3,678
	WYAK		1,475		1,348
	SEO		2,317		2,118
	Total	10,326	9,087	9,825	8,307

Sablefish BSAI

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Sablefish	BS	1,304	1,151	1,241	1,052
	AI	1,766	1,557	1,681	1,423

EBS Walleye Pollock

Public testimony was provided by Ed Richardson (Pollock Conservation Cooperative) agreeing with the Tier 1 designation and felt the stock assessment model tracked the dynamics of the stock well, and the diagnostics all looked good. He also commented on the new Random Effects model for projecting uncertainty in cohort and year effects in the weight-at-age (noting that he wished for more evaluation and review).

In this year's EBS walleye pollock assessment the trawl-efficiency corrected summer bottom trawl survey biomass and abundance-at-age time series (the "Kotwicki index" as presented in last year's assessment), was used after several years of testing. Data from 2014 and 2015 acoustic vessels-of-opportunity (AVO), age-composition data from the 2014 NMFS summer acoustic trawl survey, catch-at-age and average weight-at-age from the 2014 fishery and total catches, including a preliminary estimate for 2015, were updated. The only change from the previous modeling and projection method was the approach to projecting future weight-at-age 3 based on year and cohort effects estimated in a random effects model. The SSC briefly discussed the residual patterns in the size-at-age data in the terminal year and questioned if the large negative residuals would result in any bias in the stock projections. The 2008 year class still dominates in the fisheries age-composition data, and the Bottom Trawl Survey age compositions indicate a relatively strong 2012 cohort.

EBS walleye pollock is a Tier 1 assessment, with reliable estimates of B_{MSY} and F_{MSY}. The updated estimate of B_{MSY} is 1.984 million t, and projected spawning biomass for 2016 is 3.540 million t (Tier 1a). The OFL in 2016 and 2017 are 3.910 million t and 3.540 million t, respectively. The 2017 OFL is based on a projected 2016 catch of 1.350 million t (the authors' recommended 2016 ABC). The maximum permissible ABC under the Tier 1a calculation is based on the harmonic mean of the ratio between MSY and the equilibrium biomass corresponding to MSY, which results in 3.050 million t maxABC for 2016. The assessment authors recommend setting ABCs well below the maximum permissible levels for the following reasons: the fleet was able to operate with reasonably good catch rates, and the fleet was able to maintain salmon bycatch at relatively low levels. The SSC requests that the authors explore alternative justification for setting the ABCs well below maximum permissible levels.

The PT agreed with the author that the ABC different than the max permissible ABC should be recommended for setting the 2016 and 2017 maxABCs for EBS pollock. The SSC briefly discussed the issue of using a Tier 3 approach for setting the max ABC recommendations for a Tier 1 stock and whether or not this would set some sort of precedent for other stocks. Moreover, should the EBS pollock stock decline to levels at or near B_{MSY} the question came up whether the Tier 3 rule would continue to be used. Grant Thompson noted that in years past, the Tier 3 calculations led to higher max ABC recommendations, and in that case the Tier 1 harvest control rule was adopted because it was lower and also the max permissible ABC.

Last year the SSC made the following requests for inclusion: projection graphs to better understand future responses, elaboration and justification for methods used to calculate weight-at-age used to calculate biomass from numerical abundance, environmental covariates for relative cohort strength, and temperature effects on survey catchability and/or selectivity. The SSC appreciated the new efforts that went into developing the random effects model for use in forecasting weight-at-age as it allows for uncertainty in future weight-at-age to be integrated into the stock projections. We recommend that the author undertake an evaluation of retrospective performance for this projection approach.

The SSC recommends adopting the author and PT OFL and ABC recommendation, based on the Tier 3 calculations, as summarized below.

Stock/ Assemblage	**Area**	**2016 OFL**	**2016 ABC**	**2017 OFL**	**2017 ABC**
Pollock	EBS	3,910,000	2,090,000	3,540,000	2,019,000

Aleutian Islands Walleye Pollock

The assessment for AI walleye pollock used the 2014 model, with only 2015 catch data as new information. The PT noted a difficulty in calculating the "realized" catchability due to a rescaling of the selectivity parameters. Estimates of total biomass for this stock have remained relatively stable since 2000, and recent catches remain relatively low in proportion to the ABC. The PT noted that if this trend continues, biennial assessments may be sufficient for this stock. The PT recommends examining alternative models with a higher natural mortality rate (currently M is estimated in the assessment). **The SSC recommends adopting the PT research recommendations and accepts the PT ABC and OFL recommendations as summarized below:**

Stock/ Assemblage	**Area**	**2016 OFL**	**2016 ABC**	**2017 OFL**	**2017 ABC**
AI Pollock	AI	39,075	32,227	44,455	36,664

Bogoslof Walleye Pollock

This year a random effects model was used to calculate the survey biomass index, estimates of natural mortality were based on the age-structured model, and catch specifications were based on Tier 5. Catch-at-age data is limited (one year of data) and estimating selectivity in a Tier 3 assessment would be problematic. In 2014, under Tier 5, ABC and OFL calculations were based on M = 0.2; whereas the age-structured model suggests M is actually closer to 0.3 Last year the PT and SSC recommended that this analysis be brought forward to consider whether M should be changed. This year, catch recommendations from the author and PT are based on M = 0.3. **The SSC recommends adopting the author and PT OFL and ABC recommendations**, resulting in OFL and ABC recommendations as summarized below:

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Bogoslof pollock	Bogoslof	31,800	23,850	31,800	23,850

Pacific Cod

Bering Sea:
Stock assessment results for BS cod were presented by the lead author of the assessment, Grant Thompson. Public testimony was provided by Chad See and Gerry Merrigan (Freezer Longline Coalition), who endorsed the PT recommendation and highlighted the increasing trends in survey biomass, survey abundance, and spawning stock size that are evident in survey results and model estimates as a result of recent strong year classes. They also pointed to stable or increasing trends in CPUE in the fishery and the upcoming CIE review as further reasons to stay with the status quo rather than accept a new model that would require a steep reduction in ABC.

Following PT and SSC recommendations, the author brought forward a model 14.2 (has been under development for two years), along with model 11.5 (has been used since 2011), updated with CPUE, catch at age, and catch at length data from the survey and fishery. Model 11.5 continues to use a fixed value of survey catchability that is no longer very credible and has poor retrospective performance. The author and PT agreed that model 14.2 is not yet ready for use and expressed hope that a CIE review in February 2016 will help resolve some of the issues identified with the model for next year's assessment.

Both models predict increasing biomass due to a number of strong year classes during the recent cold period. The estimated 2015 survey biomass was slightly lower than in 2014 but near the upper end of the range of values observed since 1977. The increases appear to be reliably estimated because several strong year classes are seen entering the fishery. Based on projections, biomass is expected to increase further in the near future.

The SSC is encouraged by the performance of model 14.2, with its improved retrospective performance, more credible estimates of catchability, and improved fits in most data components. However, results from this model imply a significant reduction in ABC. The SSC notes that there will be a CIE review of this assessment in February 2016. **Therefore, the SSC agrees with the author and PT to roll over the 2015 ABC, which is below maxABC estimated by the model, because of continuing concerns with the poor retrospective performance and the fixed survey catchability. The resulting OFL and ABCs are:**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Pacific cod	BS	390,000	255,000	412,000	255,000

The SSC reiterates its concerns with the current model (11.5) as summarized in our October minutes. The roll-over of the 2015 ABC is intended as an interim measure until a more thorough review of the new model (currently 14.2) by the CIE can be completed. Our expectation is that the review will help resolve some of the remaining technical concerns with the estimation of selectivity and catchability, and that it will result in an acceptable model for next year's assessment.

In addition, the SSC had several recommendations for the next assessment cycle:

- The SSC was encouraged by the author's explanation that dome-shaped selectivity may, in part, be explained by the possibility that some of older fish may be residing in the northern Bering Sea (NBS) at the time of the survey. This is supported by the size composition of the fish in the 2010 NBS trawl survey, which suggested that up to 40% of the fish in some larger size classes reside in this area, although the overall proportion in the NBS was small. The SSC encourages the author to further examine Pacific cod catches from trawl surveys conducted triennially by the National Marine Fisheries Service (NMFS) (1976-1991) and by the Alaska Department of Fish & Game (1996 to the present) to monitor the distribution and abundance of red king crab and demersal fish (see: Hamazaki, T., Fair, L., Watson, L., Brennan, E., 2005. Analyses of Bering Sea bottom-trawl surveys in Norton Sound: absence of regime shift effect on epifauna and demersal fish. ICES Journal of Marine Science 62, 1597-1602). While the 2010 bottom trawl survey in the NBS found relatively few Pacific cod (3% of total biomass), it is possible that the proportion of Pacific cod that are outside the standard survey area was higher in other years. A second possibility is that older Pacific cod migrate to nearshore areas to feed in the summer, making them unavailable to the survey.
- The SSC noted that the iteratively tuned, time-varying parameters in the model have not been updated since 2009. The author confirmed that the currently assumed standard deviations of two dev vectors (log of age-0 recruitment and a parameter corresponding to the ascending part of the selectivity curve) may no longer match the standard deviations of these vectors, which could contribute to retrospective bias. The SSC looks forward to a new paper on this issue that the author is preparing.
- While the model selection criteria proposed by the author are reasonable, we note that these criteria do not take into account the model fit itself. Model fit and retrospective performance should be more strongly considered in the selection of a final model for specifications.
- Although the SSC has repeatedly stressed the need to incrementally evaluate model changes, the SSC did not intend this to imply an automatic preference for the status quo model (as implied by the authors criterion #1) if alternatives with better performance are available.

Aleutian Islands:

The Aleutian Island Pacific cod stock has been assessed separately from Bering Sea cod since 2013, and managed separately since 2014. There has been some effort to develop an age-structured model for a Tier 3 assessment, and one candidate model is presented here (15.7). The model has troublesome retrospective patterns, as well as unrealistic selectivity patterns and the SSC agrees that it is not yet suitable for setting reference points. Therefore the stock remains in Tier 5 for assessment and management. The assessment model used last year (version 13.4) is a simple random effects model of the trawl survey biomass time series. A variant of this model was requested by the PT in September (version 15.6), which included the IPHC longline survey CPUE series in addition to the trawl survey data. The model estimates a catchability coefficient for converting the IPHC relative abundance index (in numbers of fish per effective hook) into units of area-swept biomass. The SSC had concerns with this approach of combining an index of numerical abundance with a biomass estimate without considering differences in selectivity and changes in size composition over time. **We therefore concur with the PT to use the random effects model to set OFL and ABC based on a Tier 5 approach, as summarized below.**

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Pacific cod	AI	23,400	17,600	23,400	17,600

Steller sea lion protection measures require an estimate of the proportion of the AI Pacific cod stock in Area 543 to set the harvest limit for this area. **The SSC concurs with the author's recommendation to use the most recent estimate from the accepted model 13.4 to allocate 26.3% of the overall AI ABC, after subtraction of the State GHL, to the western Aleutians (area 543)**.

We recognize that this assessment will receive a CIE review in February 2016 and look forward to the results. One additional recommendation from the SSC is to examine weights-at-age of Pacific cod by area.

BSAI Atka Mackerel

The 2015 Atka mackerel assessment consisted of a single statistical catch-at-age model identical in structure to the previous assessment. The model estimated strong 2006, 2007, and possibly 2011 brood year recruitments supporting current and future fisheries. Reference fishing mortality rates for ABC and OFL were lower than those estimated in 2014 because of increased selectivity of ages 3 and 4 in the 2014 fishery. The most recent Aleutian Islands biomass estimate from the 2014 Aleutian Islands bottom trawl survey is 723,928 t, up 161% relative to the 2012 survey estimate. The SSC appreciates the authors' responsiveness to previous SSC and PT recommendations to use the random effects procedure for setting subarea ABC allocations. **The SSC agrees that this stock is in Tier 3a and endorses the ABC, OFL, and subarea allocation of ABC recommended by the PT (in mt) in the table below.**

Stock/		2016		2017	
Assemblage	**Area**	**OFL**	**ABC**	**OFL**	**ABC**
Atka mackerel	EAI/BS		30,823		29,296
	CAI		27,216		25,860
	WAI		32,292		30,684
	Total	104,749	90,340	99,490	85,840

The SSC noted and supports the authors' intention to explore the use of spatial analyses and covariates to extract additional information from trawl surveys and to improve precision of biomass estimates. The SSC also supports the PT recommendation to explore other selectivity formulations for model projections and ABC calculations in future assessments.

BSAI Flatfish

Yellowfin Sole

The yellowfin sole stock assessment was updated with new fishery and survey data, and two changes were made to the model: (1) a new maturity schedule was included, based on an average of 1991 and 2012 maturity ogives, and (2) the weights at ages 11-20 were smoothed. These two model changes were minor and had little effect. Last year, the SSC supported the PT's recommendation to test for differences between 1992/1993 and 2012 maturity curves and to pool all maturity data for subsequent assessments if there were no significant differences. Instead the authors simply averaged the two curves, but the difference is likely trivial.

The yellowfin sole assessment remains cutting edge with the inclusion of relationships between survey catchability (q) and temperature in the assessment, as well as analyses of variability in growth, including a growth chronology. The authors proposed two possible reasons why survey biomass estimates are lower during years when bottom temperatures are low: (1) yellowfin sole may be less active when cold and less susceptible to herding, and (2) bottom temperatures may influence the timing of the inshore spawning migrations and therefore affect their availability to the survey. Indeed, there could be other reasons. Variability in survey *q*, and its potential relationships with temperature, is a topic of sustained interest for all flatfish stock assessments. Further information on the mechanism(s) behind temperature-catchability relationships for yellowfin sole may improve understanding of survey *q* for the other flatfish species (see the General Assessment Comments above).

The SSC appreciates inclusion of the retrospective plot (p. 736). Some years exhibit a successive pattern where female spawning biomass appears to be higher in more recent years than values estimated in previous assessments. In next year's assessment, the SSC would appreciate some discussion by the authors about this pattern, its significance, and probable causes.

The SSC also appreciates updated fits of Ricker stock-recruit curves for two periods (1955-2008 and 1978-2008), fits to the current preferred model, as well as the authors' discussion of the implications of the period of averaging on resultant reference points (Fig. 4.12). Yellowfin sole female spawning biomass is ~1.5 times above B_{msy}, but has been generally declining since the 1980s. This raises the question about how to determine in the future if a different productivity regime is in place and, thus, a new time period of S-R fitting is appropriate. While this question is more broadly applicable to groundfish and crab assessments, perspectives by the authors would be welcome. Given that more is known about fishery oceanography for yellowfin sole than many other species, perhaps some independent indicators (e.g., wind direction, bottom temperature) might be available.

Yellowfin sole continue to qualify for management under Tier 1a. The SSC agrees with the PT and authors' recommended OFL and ABC for 2016 and 2017.

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Yellowfin sole	BSAI	228,100	211,700	219,200	203,500

Greenland Turbot

This was to be an off-year update of the Greenland turbot stock assessment with more recent survey and fishery data. However, analyses of new size and age composition data for 2013 through 2015 exposed a conflict between shelf and slope survey data that required model re-configuration. The issue is that recent cohorts decline from the shelf survey at an unrealistic rate. The 2008 and 2009 year classes appear to have been 309% and 492% above average, respectively. Whereas increased mortality or overestimation of initial cohort size could generate such an outcome, the most plausible biological explanation is that these fish decline in availability to the shelf survey because they move to deeper slope waters. Unfortunately, biomass and size composition data are not available to confirm these strong cohorts owing to the lack of slope surveys since 2012. The 2012 EBS slope ***biomass*** estimate was lower than the 2010 estimate, but the 2012 slope survey ***abundance*** estimate was the highest population estimate since the slope survey was reinstated in 2002. The 2012 slope survey indicated a large number of small fish (30 cm and 50 cm) in the survey area. A 2016 slope survey is critical to confirming the status of the apparent strong 2008 and 2009 years classes for this stock, which is recovering from record low biomass levels.

The current stock assessment included three new models as alternatives to last year's accepted model (Model 14.0). Model 14.1 incorporates revised sample size estimates for the slope survey composition data and has re-weighted some other data. It does not use shelf survey age composition data, but does utilize the corresponding size composition data. Model 15.1 is identical to Model 14.1, except that a new "double normal" selectivity curve replaces the logistic curve for the fixed gear fishery in an attempt to account for a perceived change in fishing behavior in 2008. Model 15.1 also does not include size composition data from the trawl fishery in 2006 and 2007, owing to small sample sizes. Model 15.3 is identical to Model 15.1, except that selectivity curves are allowed to vary using a penalized random walk process.

The authors recommended, and the PT accepted, Model 15.1 for purposes of this year's catch specification process, but did not endorse the model as the new base model for this stock owing to a number of concerns. Indeed, residual patterns appear evident in model fits to the shelf survey index (Fig. 5.20), lengths from the longline survey (Fig. 5.35), and trawl fishery size composition data (Fig. 5.43). On the other hand, Model 15.3 was not selected as the preferred model, largely due to the addition of 1,037 new parameter deviations, whose influence on model results has not been adequately explored. Thus, the authors and PT recommend use of Model 15.1 for harvest specification purposes. The SSC agrees with this rationale, and looks forward to the next assessment with the existing baseline model, plus updated new alternative models generated from this year's exploration of Models 15.1 and 15.3. Addition of 2016 slope survey results should greatly help to address data conflicts and model selection.

The SSC agrees that Greenland turbot qualifies for management under Tier 3b. **The SSC agrees with the authors' and PT's ABC and OFL recommendations, their recommended area apportionment of ABCs, and their recommendation not to develop area apportionments of OFL.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Greenland turbot	BS		2,673		4,734
	AI		789		1,398
	Total	4,194	3,462	7,416	6,132

Arrowtooth Flounder

This is an off year for arrowtooth flounder in which last year's assessment model was updated with new fishery information only. During the next assessment cycle, the SSC looks forward to reviewing a new generalized assessment model that is currently under development. This stock is currently managed under Tier 3a. **The SSC agrees with the authors' and PT recommendations on ABC and OFL for 2016 and 2017.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Arrowtooth flounder	BSAI	94,035	80,701	84,156	72,216

Kamchatka Flounder

This is an off year for the Kamchatka flounder stock assessment and the projection model was simply updated with 2015 catch and projected 2016 catch. The next stock assessment will benefit from results of the 2016 slope survey. The SSC appreciates inclusion of the graph with the retrospective pattern in female spawning biomass (p. 955), and requests some discussion about this pattern and exploration of potential causes in next year's assessment. The SSC noted that retrospective bias was particularly concerning for this stock.

This stock is currently managed under Tier 3a. **The SSC agrees with the authors' and PT's recommendations for ABC and OFL for 2016 and 2017.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Kamchatka flounder	BSAI	11,100	9,500	11,700	10,000

Northern Rock Sole

There were no changes in methodology since the last full rock sole assessment in 2014. The survey biomass was down 24% from the 2014 level, the lowest biomass point estimate since 1990. The authors tested eight models (including the base model) of which four fit the survey sex ratio: Models 1, 1a, 2 and 3. Model 1 was used last year and uses Q=1.5. Model 1a changes the estimate of Q from 1.5 to 1.4, based on a result obtained by Somerton and Munro (2001, *Fishery Bulletin* 99:641-652), which lowers the estimate of population size. The author recommended Model 1a (with the lower Q) but the PT disagreed and recommended Model 1 citing the rationale for this same model choice last year. The PT noted that characteristics of the field study limit its support for asserting Q = 1.4. Specifically, the study was confined to a one-week experiment conducted in a relatively small area and thus may not be representative of full time/area of the BSAI survey (note: results were highly variable due to local factors (e.g. sand waves). Also, the Somerton and Munro study considered bridle efficiency only, and both fish abundance within the study block and net efficiency were assumed to be constant. Finally, the PT pointed out that in the 2002-2007 assessments, where Q was estimated with a prior based on the results of the Somerton and Munro study, the estimates ranged from 1.45 to 1.82, with a median of 1.52; subsequently Q has been fixed at a value of 1.5 in this assessment since 2008. As no new information was presented this year, the PT again recommended use of Model 1.

In Model 7, the authors estimated survey catchability in relation to annual bottom temperature (as is done for yellowfin sole), and it gave results similar to Model 1. Model 7 was a better fit to the survey estimates, but a worse fit to the observed age compositions compared to Model 1 and was not selected based on AIC analysis. **The SSC agrees with the PT and recommends setting catch specifications with the base model. Northern rock sole are managed in Tier 1a**.

Due to a recent period of low recruitment and the corresponding offshore advection shown in the OSCURS model, the assessment authors are collaborating with Dan Cooper to combine the OSCURS springtime wind patterns and temperature data as environmental covariates in a Ricker spawner-recruit model. These estimates of recruitment could then be used as estimates of the unobserved recruitment for ages 1-4 in the stock assessment model. **The SSC supports the author's efforts to develop a model that estimates an environmental effect on recruitment and looks forward to seeing the results of this work in the next assessment.**

The authors plotted retrospective patterns in female spawning biomass and reported Mohn's rho (-0.04654) but did not discuss the pattern. While the low value of Mohn's rho suggests that retrospective bias is not a substantial issue, **the SSC recommends including a complete retrospective analysis, including a description of the results and Mohn's rho, in the next full assessment for this stock.**

The SSC notes that Q is a direct scalar on estimates of abundance and may be influenced by the herding characteristics of the survey trawl and the migration timing of flatfish (movement in and out of the survey area). Both of these factors may be influenced by bottom water temperatures. Based on SSC and PT recommendations, the author explored including a temperature parameter in the estimate of Q (as is done for yellowfin sole). The PT discussion relative to its choice of Model 1, over the author-preferred Model 1a, raised an important issue about using localized gear performance studies (*e.g.* Somerton and Munro 2001) to inform or fix estimates of q (the trawl performance relative, herding, capture efficiency) which is only one element of the broader suite of factors influencing the spatial and temporal distributions of the factors influencing Q. **The SSC recommends that the author work with RACE Division scientists to characterize previous survey trawl performance (e.g. bridle herding) studies and propose a standardized approach to using this information to estimate Q and how this relates to the overall survey catchability estimated in the assessment.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Northern rock sole	BSAI	165,900	161,100	149,400	145,000

Flathead Sole

As it was an off-cycle year, only a projection model was run with updated catch information. Changes to input data in this analysis include updated 2014 fishery catch, and estimated 2015 and 2016 fishery catch. Age 3+ biomass is projected to continue to increase through 2017, although spawning biomass is projected to decline. The 2015 survey biomass estimate was 25% below the 2014 estimate (22% below 2013 estimate). The PT noted that correlations of biomass with surface and bottom temperatures were inconsistent this year. The SSC supports the future research and model improvement work identified by the authors to assess residual patterns in the survey length composition including examining growth estimates, assumptions about selectivity, and the estimation of an ageing error matrix.

The SSC recommends adopting the authors' and PT's ABC and OFL recommendations for 2016 and 2017 under Tier 3a.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Flathead sole	BSAI	79,562	66,250	77,544	64,580

Alaska Plaice

This is an off-cycle year and only a projection model was run with updated catch information. The 2015 survey biomass of 355,640 t, the lowest ever seen, was a 21% decrease from 2014. The population has been decreasing for the last four years. However, Alaska plaice is still at a high, stable level and is lightly exploited. The average catch from 2011 through 2015 was used to estimate the 2016 total catch. The authors' recommendation for the ABC in 2016 is a 14% decrease from the 2015 ABC, and similar to the value projected last year for 2016. Projections are slowly going down, but above $B_{40\%}$.

The SSC recommends adopting the authors' and PT's recommendations for continued management of the Alaska plaice stock under Tier 3a. The SSC agrees with the authors' and PT's recommended ABCs and OFLs for 2015 and 2016. The SSC supports the author's plans to test and consider pooling the maturity curves in the next assessment. **Also, the SSC recommends a complete retrospective analysis, including a description of the results and Mohn's rho, be included in the next full assessment for this stock.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Alaska plaice	BSAI	49,000	41,000	46,800	39,100

Other Flatfish

Other flatfish include 15 species of flatfish, with catches comprised largely of starry flounder and rex sole. The survey biomass of this group is down slightly from last year. The 2014 survey estimate was the highest level since 2007, but declined by 35% in 2015. The SSC appreciates the authors' exploration of the influence of temperature on the variances of survey catch and notes that there were no significant correlations between survey CV and bottom temperature except for Sakhalin sole.

The assessment authors and PT recommended continued management of Other Flatfish in Tier 5 based on species-specific estimates of M and biomass estimates. **The SSC recommends supporting the authors' and PT's recommendations for OFL and ABC**.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Other flatfish	BSAI	17,414	13,061	17,414	13,061

BSAI Rockfish

Pacific Ocean Perch (POP)

This is an off-year assessment presented in executive summary format where only the projection model was run with updated catches. New data in the 2015 assessment included updated 2014 catch and an estimate of 2015 catch. Projections were very similar to last year's projections because observed catches were very similar to the estimated catches used last year. ABCs were apportioned among areas by using the standard random effects survey averaging model. The SSC appreciates the preliminary responses to SSC comments from the December 2014 minutes and looks forward to additional responses in the full assessment next year.

The SSC agrees with author's and PT's OFL and ABC recommendations. This stock qualifies for management under Tier 3a and the 2016 and 2017 ABCs and OFLs are detailed below.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Pacific Ocean Perch	EBS		8,353		7,953
	EAI		7,916		7,537
	CAI		7,355		7,002
	WAI		9,696		9,232
BSAI	Total	40,529	33,320	38,589	31,724

Northern Rockfish

This is an off-year assessment presented in executive summary format where only the projection model was run with updated catches. New data in the 2015 assessment included updated 2014 catch and an estimate of 2015 catch. The 2015 catch through October 17th was approximately three times higher than the total catch from recent years and last year's estimate for the year-end 2015 catch. This caused the projections of ABC in 2015 to be a little high (about 3%). The 2016 catch was obtained from the projection model and was based on a fishing mortality rate equal to the estimated 2015 *F*.

The SSC supports the PT's recommendation that the authors examine the catch data in August 2016 and, if it appears that the catch in the Eastern AI will be much higher than what would be expected under an area-specific ABC for 2016, that the authors present a stock structure template update at the September PT meeting.

The SSC agrees with PT OFL and ABC recommendations. This stock qualifies for management under Tier 3a and the 2016 and 2017 ABCs and OFLs are below.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Northern rockfish	BSAI	14,689	11,960	14,085	11,468

The SSC appreciates the authors' research into natural mortality estimation for this stock in response to requests in 2014 PT and SSC minutes. The SSC looks forward to an exploration of the effect of using alternative priors for natural mortality in future assessments.

Shortraker Rockfish

This is an off-year assessment and was presented in executive summary format. As shortraker rockfish is assessed with Tier 5 methods, specifications are the same as last year.

The SSC agrees with PT OFL and ABC recommendations. This stock qualifies for management under Tier 5 and the 2016 and 2017 ABCs and OFLs are below.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Shortraker rockfish	BSAI	690	518	690	518

Blackspotted and Rougheye Rockfish Complex

This is an off-year assessment and was presented in executive summary format where only the projection model for the Tier 3 component of the assessment was run with updated catches. The blackspotted/rougheye complex is currently assessed by combining an age-structured population model applied to the fishery and survey data from the AI management area with a Tier 5 approach of smoothing recent survey biomass estimates with a random walk random effects model in the EBS management area. There are no new survey data, thus the EBS biomass estimate is identical to last year.

New data in the 2015 assessment included updated 2014 catch and an estimate of 2015 catch. The 2014 AI catch was 173 t, a 9.7% decrease from the estimate in the 2014 projection. The 2015 estimated AI catch of 146 t is 42% smaller than the value estimated in the 2014 projection model. Catch rates have been declining due to increased awareness of the fleet, however the maximum subarea species catch (MSSC) estimated for western AI (WAI) in 2015 was exceeded for the second year in a row.

The SSC supports the PT's area splits, ABC and OFL recommendations and that the 2016 MSSC in the WAI be set at a value of 58 mt and 324 mt for the WAI and Central AI (CAI) areas, respectively. For 2017, these are 73 mt and 405 mt in the WAI and CAI areas, respectively. This stock qualifies for management under Tier 3 due to the availability of reliable estimates for $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$.

The SSC supports the Stock Structure Working Group recommendations for moving forward with developing harvest tools to stay within the BS/RE MSSC in 2016.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Blackspotted/	EBS/EAI		179		216
rougheye	CAI/WAI		382		478
BSAI	Total	693	561	855	694

Other Rockfish Complex

An executive summary was presented for this off-year assessment and included updated catches for 2014 and 2015. **The SSC agrees with PT OFL and ABC recommendations. This stock qualifies for management under Tier 5 and the 2016 and 2017 ABCs and OFLs are below.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Other rockfish	EBS		695		695
	AI		555		555
	Total	1,667	1,250	1,667	1,250

BSAI Sharks

The BSAI shark complex includes Pacific sleeper shark, spiny dogfish, salmon shark and other/unidentified sharks. This was an off-year in the assessment cycle. This stock is managed as a Tier 6 complex, with an OFL based on maximum historical catch from 1997-2007 and ABC set at 75% of the OFL. The author included an updated catch time series and noted that the catches exceeded the TAC in 2014 and 2015. There were no changes to the proposed ABC/OFL for 2016 and 2017. **The SSC concurs with the author and PT recommended harvest specifications from the status quo approach (see table).**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Shark	BSAI	1,363	1,022	1,363	1,022

BSAI Skates

This chapter was presented in executive summary format as a scheduled off-year assessment. The model was updated with 2014 catch data and preliminary 2015 catch data. **The SSC concurs with the author and the PT that the Alaska skate stock should be managed as a Tier 3a stock and the other skates complex as a Tier 5 stock**. **The SSC accepts PT recommendations for ABC and OFL of the skate complex as a whole (see table).**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Skate	BSAI	50,215	42,134	47,674	39,943

BSAI Sculpins

The BSAI sculpin complex is assessed as a Tier 5 stock, in which a natural mortality rate is applied to a biomass estimate in order to obtain harvest reference points. For this complex, the natural mortality rate is a biomass-weighted natural mortality rate for the six most abundant sculpins. The current natural mortality estimate is M = 0.29. This was an off-year assessment and there were no changes to assessment inputs or methodology. The 2016 and 2017 OFL and ABC values are identical to those produced for last year. **The authors and PT recommend the status quo approach, and the SSC concurs.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Sculpin	BSAI	52,365	39,725	52,365	39,725

BSAI Squid

Harvest recommendations for BSAI squid have been based on the average catch from 1978 through 1995 in the past. In 2014 and 2015, substantial increases in squid catch acted as a constraint on the EBS pollock fishery. In both years, a voluntary closure was put in place to reduce squid catches, and possibly interfered with the fleet's ability to avoid salmon and herring PSC. The 2015 BSAI squid catch to date has exceeded the ABC and is approaching the OFL. The catch also approached the ABC in 2014. Given the recent high catch rates, the SSC and PT requested the author review the analytic approach and develop a set of harvest recommendations that better reflect "sustainable removal levels of squid". A large set of alternative approaches were explored that included spawning escapement approaches, alternative historical catch scenarios, and modified Tier 5 approaches using the F = M method modified with the Baranov equation to account for mortality during the year. Based on this analysis, the author recommended a change in the representative time period, from the status quo of 1978 - 1995 to 1977 - 1981. OFL is calculated as the average catch from this time period. The PT supported this approach.

The SSC appreciates the author's efforts to address the difficulties surrounding assessing BSAI squid, especially during an "off-year" assessment. These difficulties center on the concept of developing a reasonable approach that results in a sustainable catch of BSAI squid, given the available data. After some discussion, **the SSC accepted the author and PT recommended OFL and ABC (see table) for several reasons**. First, the assessment author, the PT, and the SSC are in agreement that it is highly unlikely that current catch levels or catches approaching the revised harvest specifications would result in a conservation concern for BSAI squid. Second, among the alternatives presented and explored in the past, these specifications seem reasonable given the caveats of the available data. The SSC notes that the resultant OFL and ABC are intermediate among the alternatives presented. These new specifications would allow for incidental catch, while still limiting the development of a large targeted fishery. Third, 2014 and 2015 catch levels are close to those from 2001-2008, so there is a precedent for the current catch levels. Finally, the Council is moving forward with an analysis to potentially move squid to an Ecosystem Component species, which the SSC has supported exploring in the past. The SSC believes these harvest specifications could serve as a bridge until this analysis is completed.

An important assumption for using Tier 6 methods is that the years used for calculation represent sustainable catches. The PT believed the decline in historical catches was the result of decreased effort from the foreign fleet, and not indicative of a population decline. The SSC supported the author and PT recommended Tier 6 method and time period this year, dependent upon this assumption, but would like to see the results of this examination in 2016. **The SSC supports the PT recommendation to examine the cause behind the dramatic decline in catch in the early 1980s for the 2016 assessment. The SSC supports the PT recommendation for the author to consider whether certain environmental conditions may be correlated with squid catch and abundance in the surveys.**

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Squids	BSAI	6,912	5,184	6,912	5,184

BSAI Octopus

There are seven species of octopus that are managed under the BSAI octopus complex, the most common of which is the giant Pacific octopus, which is found on the shelf and dominates the incidental catches from commercial fisheries. Catch of octopus in 2014 was relatively high (422 tons) and exceeded the TAC. Catch so far in 2015 is 335 tons. BSAI trawl surveys produce biomass estimates but these are highly variable and there are continued concerns that the surveys do not adequately sample octopus. Bering Sea shelf survey biomass estimates were low in 2014 (2,351 tons) but 2015 estimates are much higher (5,363 tons). The catches in 2014 and 2015 were well under the ABC.

BSAI octopus was pulled out of the "Other species" complex in 2010. Catch limits in 2011 and 2012 were set using Tier 6 methods based on the maximum historical incidental catch. In 2012, a new methodology was developed to set harvest specifications based on the consumption of octopus by Pacific cod. The geometric mean of all annual estimates of predation mortality by Bering Sea cod on octopus is used as an estimate of total natural mortality (N), and is combined with the general logistic fisheries model to set OFL=N and ABC=0.75*OFL. This method was accepted and has been used to set harvest specifications from 2013 – 2015 as an alternative Tier 6 method. The authors and the PT continue to recommend the use of the consumption model for the 2016 and 2017 harvest specifications, and **the SSC agrees with this approach (see table for harvest specifications)**. Authors also plan to reevaluate the methodology for the full 2016 assessment, and the SSC supports these efforts.

Stock/		2016		2017	
Assemblage	**Area**	**OFL**	**ABC**	**OFL**	**ABC**
Octopus	BSAI	3,452	2,589	3,452	2,589

GOA Walleye Pollock

This year's assessment included new data from the summer acoustic survey conducted in 2013 and 2015, and last year's assessment model was modified to include these new data. In addition, the assessment model was modified to include an additional power parameter for age-1 winter acoustic catchability, and revision of the Shelikof Strait acoustic survey estimates for net selectivity. Due to the addition of new data, iterative re-weighting procedures were conducted after a new base model was identified. The relative abundance index for the ADF&G trawl survey was very low this year (decreased by 58%); this decrease is inconsistent with observed trends in other abundance indices, and historically the ADF&G trawl survey generally tracked other indices.

The PT made a number of recommendations and the SSC supports these recommendations. Specifically, further exploration, documentation and vetting of the net selectivity corrections for the Shelikof Strait acoustic survey; further exploration of hypotheses regarding temperature and fish distribution that may relate to the low abundance index in the ADF&G trawl survey; and re-evaluating the form of the selectivity curve used for the summer acoustic trawl survey in the next assessment.

Area apportionments were updated based on the most recent survey data available within each season. The NMFS bottom trawl survey was considered the most appropriate survey time-series for apportioning the TAC for summer C and D seasons. In 2014, the assessment authors adopted the use of the random effects model for smoothing biomass trends in each management area. This year the PT requested that the authors average the results of the random effects model along with the spatial distribution of the 2015 NMFS summer acoustic trawl survey for spatial C and D season apportionments. **The SSC recommends adopting the PT recommendations for 2016 apportionment as a one-time approach for summer apportionment until a more comprehensive method that combines the bottom trawl and acoustic estimates is developed in the future.**

Projected estimates of spawning biomass for 2016 are above the B40% reference point, resulting in a Tier 3a assessment for this stock. **The SSC recommends adopting PT recommendations for OFL and ABC settings (see table).**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Pollock	W (61)		56,494[a]		55,657[a]
	C (62)		124,927[a]		123,078[a]
	C (63)		57,183[a]		56,336[a]
	WYAK		9,348[a]		9,209[a]
	Subtotal	322,858	254,310	289,973	250,544
	EYAK/SEO	13,226	9,920	13,226	9,920
	Total	336,084	264,230	303,163	260,464

[a] W/C/WYAK subarea amounts for pollock are apportionments of subarea ACL that allow for regulatory reapportionment

GOA Pacific cod

Public testimony was provided by Kiril Basagir (Commercial fishermen, Wild Legacy Seafoods). Mr. Basagir noted a concern about potential high grading of Pacific cod because processors will not buy small Pacific cod.

This year's assessment evaluated two models in addition to last year's models, with two variants each. All input data were updated through 2014 alternative fishery size compositions, with preliminary data for 2015. The new models (2&3) included a number of improvements over the previous model (now model 1). New features include the use of only the 27 cm plus trawl survey abundance, length- and age-composition data, and changes to survey selectivity and likelihood weights for fishery length compositions. Model 3 differed from Model 2 by including an additional block for all but one fishery selectivity-at-length curves for 2013 through 2015 to account for possible changes after the fishery observer program was restructured in 2013. Other changes explored in both models include lowering the weights for fishery length compositions, which account for a very large proportion of the overall likelihood because of the large number of fisheries (gear-season combinations) that are tracked in the model.

The SSC notes that the survey biomass for this stock has shown a declining trend from the highest estimate of the available time series in 2009 with a 50% decline between the 2013 and 2015 estimates. In contrast, the models estimate an increase in the 27 cm biomass (Models 2, 3) or in the total biomass (Model 1). The new models with reduced weights on the size composition likelihood components fit the recent trend better than model 1. The author and PT recommended Model 3 with likelihood weights reduced from 1 to 0.25, because of the improved fit to trawl survey abundances and biomass. **The SSC concurs with the PT recommendations on setting OFL and area-specific ABCs using the established approach for area apportionments, which results in the values summarized below.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Pacific cod	W		40,503		34,998
	C		49,312		42,610
	E		8,785		7,592
	Total	116,700	98,600	100,800	85,200

The SSC discussed several issues, in particular the introduction of a new block for selectivity and the lowered weights for likelihood components relating to length compositions, and had the following comments:

- While the added selectivity block for years after 2013 has a solid rationale in that changes in selectivity might be expected as a result of changes to the observer program in 2013, it is unclear what these changes reflect. The SSC accepts the new selectivity block used in Model 3 but encourages a more thorough evaluation of the estimated changes in selectivity to determine whether they reflect a change in data collection or true changes in selectivity. The SSC concurs with the PT recommendations in this regard.
- We agree with the author and PT that lower weights for the length composition likelihoods are reasonable and appropriate because of the large number of gear-season combinations, but note that the reductions are arbitrary. Appropriate weights for multiple likelihood components is an ongoing issue in many of our assessments and we request that relevant recommendations and lessons from the soon-to-be-released report from the CAPAM data weighting workshop be applied in the next assessment to strengthen the rationale for weights used in the model.
- Although we agree with the reduced weights, we note that the rationale provided for model 3 is circular because reducing weights on some likelihood components (length composition data) will generally improve the fit to other data components (survey biomass). Therefore the better fit to the survey biomass series is not in itself a rationale for selecting Model 3. Rather, the rationale is simply a desire for the survey, which we believe to be reliable for Pacific cod, to receive more weight relative to the fishery length composition data.
- The review of data weighting should also address and justify using a larger variance on the most recent recruitments (‘sigmaR’ multiplier of 4)

GOA Atka Mackerel

Gulf of Alaska Atka mackerel have been managed under Tier 6 specifications since 1996 because a reliable biomass estimate is not available. The Tier 6 reference period is unchanged in this assessment so the author recommended OFL and ABC are also unchanged from the previous assessment. T**he SSC endorses the Plan Team recommended OFL and ABC.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Atka mackerel	GOA-wide	6,200	4,700	6,200	4,700

GOA Flatfish

<u>Shallow-water Flatfish Complex</u>

The shallow-water flatfish complex includes northern and southern rock sole, yellowfin sole, starry flounder, butter sole, English sole, Alaska plaice and sand sole. Rock soles comprise ~80% of the shallow water flatfish catch. An age-structured assessment model is used to assess rock sole (discussed in the next section), whereas the other species are assessed by a random effects model based on NMFS bottom trawl surveys. Random effects modeling includes area apportionment of the ABC, as well as estimation of the percentage of each species in the total biomass for species-specific ABCs.

The stock assessment model for northern and southern rock sole is implemented in Stock Synthesis that was presented in 2014. The SSC appreciates that many previous comments by the PT and SSC have been addressed. For instance, concerns over recruitment estimates (e.g., large value for 2011) were addressed by changing the weighting on recent fishery length composition and survey age and length composition data, thus stabilizing recent recruitment estimates. However, some SSC and PT recommendations remain to be addressed; the author indicated that they will be addressed in 2016. For instance, last year, the SSC noted the need for the assessment document to be edited to improve specificity and clarity. Clarity has been improved, however some additional editing is still necessary. For instance, some figures and tables are not cited at all in the document and labeling of some figures can be improved. In addition, the SSC requests the assessment authors to explain the increase in the 95% asymptotic intervals in age-0 recruitment estimates since 2010 compared to the 1990s and 2000s in Fig. 4.1.51 on p. 539. Overall, good progress has been made with this stock assessment. From 2014 to 2015, model estimates of southern rock sole increased while model estimates of northern rock sole decreased.

This assessment poses some unusual challenges owing to the coexistence of two closely related species, which are not easy to identify without training. Most of the biomass in the western GOA is believed to be northern rock sole biomass, whereas southern rock sole are more widely distributed and predominate in the eastern GOA. The assessment is complicated by the fact that northern and southern rock sole species were not differentiated in survey data until 1996 and fishery observer data were not differentiated until 1997. However, even today, much of the shoreside landings (caught by unobserved vessels) are reported as undifferentiated rock sole. Thus, there is considerable uncertainty about the proportions of the two species in the catch. Given these data limitations, the SSC agrees with the authors' and PT's recommendation that it is prudent to continue with the approach to conduct separate analyses of northern rock sole, southern rock sole, and undifferentiated rock sole.

Given the lack of a directed fishery for this complex, the PT raised the question about the frequency needed for this stock assessment. It was pointed out that the AFSC plans to conduct a workshop to develop a stock assessment prioritization plan in February 2016. Conduct of management strategy evaluations will evaluate the tradeoffs and risks associated with less frequent stock assessments for this and other stocks. Decisions about frequency of this stock assessment should await results of the stock assessment prioritization plan.

Northern and southern rock sole are managed under Tier 3a, whereas the other species in this complex are managed under Tier 5. The SSC agrees with both the PT's and authors' recommended ABCs and OFLs for the shallow water flatfish complex for 2016 and 2017. **The SSC also agrees with their recommended ABC apportionment percentages based on the random effects model applied to survey biomass estimates**.

Deepwater Flatfish Complex

The deepwater flatfish complex includes Dover sole, Greenland turbot, and deepsea sole (Tier 6). Dover sole is managed under Tier 3a, using an age- and sex-structured statistical catch-at-age model implemented with Stock Synthesis. The Dover sole stock assessment model was updated with recent survey and fishery data and several modeling changes were made since the 2013 assessment. First, length and age composition data were iteratively re-weighted using a new methodology. Second, effective sample sizes were changed to equal the number of hauls from which samples were taken. And third, fishery selectivity was estimated using an asymptotic rather than dome-shaped curve. Greenland turbot and deepsea sole are Tier 6 species for which ABCs and OFLs are based on historical average catches over 1978–1995, which are not updated.

As pointed out by the PT, the model fits the relatively trendless biomass index reasonably well, except for the low survey biomass in 2015. The SSC noted that the model fit the low 1984 and 1987 estimates poorly, as well. It was pointed out that surveys in 1984 and 1987 were conducted by Japanese vessels fishing trawls equipped with roller gear to fish over rough bottoms. This raises the question whether catchability is comparable for these survey years and whether these data should be included in the stock assessment. The SSC requests the authors to consider whether survey data from 1984 and 1987 are comparable or whether they should be removed from the analysis. If the survey biomass data are deemed incomparable, then further consideration should be given to the utility of size/age composition data from these early years. This question about the utility of the 1984 and 1987 survey data should be addressed by other affected flatfish stock assessments, as well.

The SSC also asks the assessment authors to look into the decline in survey biomass in 2015. Given longevity and natural mortality rate of these flatfish species, the SSC questions whether such a decline is biologically reasonable, given relatively low fishery catches in recent years. As part of a broader analysis for all flatfish species, the SSC requests the assessment authors to consider whether a factor, such as temperature, could have negatively affected survey catchability for some flatfishes in 2015.

Finally, the SSC noted some odd selectivity curves for the full coverage survey (Fig. 10, p. 604). The authors are requested to consider the validity of a selectivity curve that appears asymptotic on the left-hand side of the curve, but drops precipitously to zero on the right-hand side of the curve. Is the right-hand side of the relationship informed by convincing data or should a straightforward asymptotic selectivity curve be assumed?

Spawning biomass of Dover sole is estimated to be well above $B_{40\%}$ in 2016 and to remain stable in 2017. **The SSC agrees with the PT's and authors' recommendations for ABC and OFL for this deepwater flatfish complex in 2016 and 2017. Moreover, the SSC supports their recommended area apportionments**. The Dover sole apportionment was based on the random effects model, which included the bottom trawl survey biomass distributions for 2015, whereas the Greenland turbot and deepsea sole apportionments were based on their historical survey biomass distributions.

Rex Sole

This year the author completed the conversion of the assessment model (a split sex, age-structured statistical catch-at-age model) to SS3 (Stock Synthesis version 3.24u) and used the random effects model for determining sub-area apportionment. The SSC reviewed and approved this structural change in October 2015. The last full Rex Sole assessment was conducted in 2011 so all model comparisons in this assessment were relative to the 2011 model. In this year's assessment, three models configurations were presented: 1) a SS3 model that mimics the 2011 model, 2) a 2011 SS3 model with updated input data, and 3) the author-recommended 2015 alternative SS3 model that uses effective sample sizes for length and age compositions equal the number of hauls that samples were taken from based on methods described in McAllister and Ianelli (1997). Model fit to length compositions from the survey and fishery were good and fits to the survey age compositions appeared reasonable. **The new model application was a clear improvement and the SSC joins the PT in commending the author**.

Rex sole is managed under Tier 5 of the FMP with the age-structured model used to provide an estimate of adult mature biomass. Model-based reference fishing mortality rates, e.g., $F_{40\%}$ have always been estimated to be unreasonably high, precluding management in Tier 3. Apportionments were computed using the random effects model and included the 2015 NMFS bottom trawl survey biomass distributions. **The SSC agrees with the PT ABC, OFL, and area apportionment recommendations and commends the author's improvements to this assessment.**

The SSC agrees with the PT recommendation to examine rex sole age, growth, and maturity information and updating the growth data used in the model as it currently only includes data up to 1996.

The rex sole fishery is primarily a bycatch fishery that takes mainly older, larger fish. Current estimates of optimum harvest levels based on Tier 3 calculations (e.g., at $F_{40\%}$ harvest rates) are very large but highly uncertain. The rex sole fishery should continue to be monitored to assess whether a directed rex sole fishery has developed; quantities such as $F_{40\%}$ ($=F_{ABC}$ in Tier 3a) will be sensitive to the characteristics of the resulting fishery selectivity curves. **The SSC concurs with the PT and author recommendation that more information should be collected on fishery size and age compositions to inform selectivity parameters and potentially improve estimates of harvest rates.**

The SSC noted the predicted mode of young fish in the survey age composition during 2013 and apparent in Figure 13 and requests that future assessments evaluate whether the corresponding strong recruitment events are informed by observed data.

The assessment is now conducted using Stock Synthesis (SS3), which will allow for further exploration of alternative selectivity formulations, stock-recruit curves, time-varying effects, and spatial effects. Inclusion of additional data sources could be explored, such as fishery age composition data, which may better inform estimation of reference points. The ADF&G small mesh survey could be included as well, and an ageing error matrix could be developed.

The author notes that size increments appear to show two different growth patterns for the same sex, age and year. **The SSC concurs that further research on genetics and growth should be conducted to explore these two growth patterns seen on the otoliths.**

Arrowtooth Flounder

The arrowtooth flounder assessment was implemented as a generalized arrowtooth model for use in both the GOA and BSAI. The fishery length composition data were updated for all years from 1977-2015, which included adding the previously missing length compositions for 1982 and 1983. Model changes included development of a common ADMB model to be used for both the BSAI and GOA arrowtooth flounder assessments. This resulted in the modeled ages for the GOA arrowtooth flounder changing from 3-15+ to 1-21+, with selectivity estimated non-parametrically for ages 1-19. Several model runs were evaluated to determine the effects of the various data and model changes; these iterations had little effect on the time series of estimated total and spawning biomass. The generalized model (with an age range of 3-15+) and the 2013 model produce very similar results when applied to a given dataset. The age at 50% maturity was slightly decreased in the new maturity ogive, but the female size was slightly larger for a number of ages, and these two factors offset each other to produce nearly identical $F_{SPR\%}$ rates.

The SSC agrees with the PT's ABC, OFL, and area apportionment recommendations and commends the author's improvements to the arrowtooth flounder assessment.

The SSC supports the PT's recommendations that future arrowtooth flounder assessments consider the following:

1. Fit growth curves and age-length transition matrix such that the effect of length-stratified otolith sampling on estimated size at age is removed.
2. Weight-at-age appears to be decreasing over time for most male and females between 1 and 10. Evaluate models which allow time-varying size at age.
3. The design-based variances may be underestimates, evaluate additional variance components.
4. Use the IPHC longline survey data as an additional tuning index.
5. Examine potential for iteratively reweighting age and length composition data, potentially with one of the methods described in Francis (2011).
6. Re-evaluate sex ratios and sex-specific natural mortality rates. The natural mortality for one sex could be fixed and the other estimated (similar to NRS).
7. The hypothesis that males are in deeper water and thus less available to the survey and fishery should be re-examined.

The SSC supports the PT's recommendation to evaluate standardizing the surveys from the 1960s and 1970s with the more recent NMFS trawl survey estimates or, alternatively, removing the older surveys from the model. The trawl survey biomass estimates are obtained from several sources, including IPHC surveys in the 1960s and exploratory NMFS surveys in the 1970s. The estimated variances for several survey biomass estimates appear to be small.

The SSC echoes the PT and encourages analysis of the previous herding and escapement studies for arrowtooth for the purpose of justifying/improving estimates of selectivity and catchability. Further, a correlation between bottom temperatures and catchability has been observed in BSAI arrowtooth flounder and other flatfish. A similar relationship may exist for GOA arrowtooth flounder and should be investigated to provide information for the estimation of catchability. These issues are highly relevant to the SSC's general recommendation for a focused workshop on estimates of catchability.

Flathead Sole

The flathead sole stock assessment was conducted using Stock Synthesis version 3.24u (SS3). SSC and PT recommendations are still being explored and will be presented in future assessments. In the previous assessment the SSC noted extreme patterns in early recruitment deviations. These were not evident in the 2015 assessment. Three models were presented: 1) the 2013 model; 2) the author-recommended 2015 model with no new data, and 3) the author recommended 2015 model with new data. The author recommended using the 2015 model updated with most recent data and applying alternative compositional data weighting methods. The effective sample sizes for length and age composition data were changed to equal the number of hauls that samples were taken from, following McAllister and Ianelli (1997).

The majority of bottom trawl survey flathead sole catch is in the Western and Central GOA. Survey biomass was up slightly in 2015 compared to 2013. Model fits to length compositions are reasonable but poor in early years for both fishery and survey. Fits to the survey biomass index and resulting estimates of spawning stock biomass over time are similar among the three model runs in recent years. Biomass estimates prior to 2000 were higher for the 2015 model with and without new data, suggesting that differences in estimated biomass fits can be attributed to changes in the effective sample sizes and methods for data weighting among data sources. In addition, the 2015 model without new data fit the survey biomass index slightly better than the 2013 model, and the 2015 model does not require a constraint on peak female fishery selectivity.

Spawning biomass appears to be stable and relatively high. Estimated fishing mortality appears to have been low. Apportionments were computed using the random effects model and included the 2015 NMFS bottom trawl survey biomass distributions. This results in a decrease in ABC in the Southeast Outside District of the Eastern GOA but is generally similar to previous apportionments. **The SSC agrees with the PT ABC, OFL, and area apportionment recommendations and commends the author's improvements to this assessment.**

The 2013 and 2015 stock assessments incorporated ageing error by using an existing ageing error matrix for BSAI flathead sole. **The SSC concurs with the PT and author that a priority for future assessments is to analyze ageing error data for GOA flathead sole using methods described in Punt et al. (2008) and to incorporate a resulting ageing error matrix into the assessment.** In addition, the **SSC supports the PT and author's recommendations that future analyses should explore the relationship between natural mortality and catchability in the model, alternative parameter values, and the effects of these parameters on estimation of selectivity and other parameters. Finally, the SSC encourages the author to explore ways to better account for scientific uncertainty, especially uncertainty associated with parameters that are currently fixed in the model.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Shallow-water flatfish	W		20,851		19,159
	C		19,242		17,680
	WYAK		3,177		2,919
	EYAK/SEO		1,094		1,006
	Total	54,520	44,364	50,220	40,764
Deep-water flatfish	W		186		187
	C		3,496		3,516
	WYAK		2,997		3,015
	EYAK/SEO		2,548		2,563
	Total	11,102	9,226	11,168	9,281
Rex sole	W		1,315		1,318
	C		4,445		4,453
	WYAK		766		767
	EYAK/SEO		967		969
	Total	9,791	7,493	9,810	7,507
Arrowtooth flounder	W		28,183		28,659
	C		107,981		109,804
	WYAK		37,368		37,999
	EYAK/SEO		12,656		12,870
	Total	219,430	186,188	196,714	189,332
Flathead sole	W		11,027		11,080
	C		20,211		20,307
	WYAK		2,930		2,944
	EYAK/SEO		852		856
	Total	42,840	35,020	43,060	35,187

GOA Rockfish

Pacific Ocean Perch

Pacific Ocean Perch (POP) had a full assessment this year, with updated data and two model structure changes. The first change was to include a new method for estimating growth which accounts for the fact that ages are collected under a length-stratified sampling design. This resulted in a small reduction in model likelihood, and had a small impact on spawning biomass. This change was in response to the 2013 CIE review. The second model change was the addition of an extended, updated ageing error matrix. The new ageing error matrix was extended so multiple ages are accounted for in the plus group, though the model plus group of ages 25+ did not change. The extended ageing error matrix improved age composition fits. These model changes were recommendations from the September 2014 PT meeting. The SSC would like to commend the authors on a clear write up of model changes and support the model changes.

Apportionment for POP was estimated using a random effects model, which was recommended by the SSC in December 2014 and divides ABC into West, Central, and East GOA. The East GOA is sub-apportioned into West Yakutat (WYAK) and East Yakutat/Southeast Outside (EYAK/SEO) management areas using the same method recommended by the SSC for the 2014 assessment. However, the author and PT noted that the apportionment model could produce catches in WYAK that are not proportional to biomass. The SSC concurs with the PT recommendation to evaluate harvest rates in WYAK for comparison to F_{ABC} rates.

The SSC endorses the author and PT recommended model changes and resulting ABC and OFL values, which are shown below. **This is a Tier 3 harvest rule recommendation.**

In September, the PT and SSC recommended evaluating data weighting for fishery and survey age and length compositions with respect to estimates of recruitment and age compositions. The authors note that this issue pertains to all GOA rockfish assessments and plan to do a more thorough evaluation of this issue for future assessments. The SSC agrees and would recommend a broader look at the issue across all GOA rockfish species, and to consider relevant recommendations from the 2015 CAPAM workshop on data weighting. Further, the SSC concurs with the PT recommendations for the next full POP assessment to investigate 1) increasing the plus group for length compositions to evaluate model performance, 2) using an alternate trawl survey index, 3) using alternative length bins, 4) including sample sizes for composition data, and 5) relating fishery selectivity to average depth fished.

Stock/		**2016**		**2017**	
Assemblage	**Area**	**OFL**	**ABC**	**OFL**	**ABC**
Pacific	W		2,737		2,709
ocean	C		17,033		16,860
perch	WYAK		2,847		2,818
	W/C/WYAK	23,313	22,617	26,045	22,387
	SEO	2,118	1,820	2,096	1,802
	Total	28,431	24,437	28,141	24,189

<u>Northern Rockfish</u>

The 2015 assessment for Northern Rockfish (NR) was a full assessment with updated data and three model changes. There were 5 models presented in the assessment report and model M4, which incorporated all the model changes, was recommended by the authors and PT. The model changes included a new method for estimating growth that accounts for the length stratified age sampling, an extension of the ageing error matrix, and a new model plus group age for age composition (now 45+, was 33+).

The GOA NR assessment indicates a slow declining trend in total and spawning biomass as older large year classes move through the population and recent recruitment has been lower than average. The trawl survey biomass estimates for NR are highly variable and likely do notcapture NR population dynamics given the NR life history and relatively minor fishery.

Past SSC and PT recommendations have been to use a random effects model for apportionment and this recommendation has been completed for 2015. The authors were responsive to a PT recommendation about sensitivity runs with length composition data and to CIE review comments regarding use of geostatistical GLMM for survey biomass. The SSC recommended in October that the authors explore the usefulness of delay-difference models as a way to model the plus group. The authors noted that with the changes made in how plus groups are modeled, the delay-difference method is not needed.

Based on the model changes made for 2015, the PT recommended further examination of how the definition of the length composition plus group and alternative data-weighting methods affect model performance. They also expressed concern about the high inter-annual variation for survey biomass, and recommended the authors continue to evaluate geostatistical estimators of survey biomass for future assessments. Length bins for fishery length compositions have not been examined, but the authors plan to continue exploring this for the next full assessment. A past recommendation from the SSC and assessment authors was to investigate maturity and the potential for time-dependent changes in maturity, and the authors note that they are working on a sampling project proposal that would collect the data necessary to evaluate this research priority. The SSC agrees that these remaining issues are still applicable and recommend that the authors continue investigations into these issues, particularly the explorations of geostatistical GLMM for the survey biomass estimates, given the high variability in the survey biomass estimates. **The SSC recommends the ABCs and OFLs provided below. This is a Tier 3a harvest rule recommendation.**

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Northern rockfish	W		457		430
	C		3,547		3,338
	E		4*		4*
	Total	4,783	4,004	4,501	3,768

* Note that the 4 t of EGOA northern rockfish is excluded from that stock's total as it is managed as part of the EGOA "other rockfish" category.

Shortraker Rockfish

The shortraker rockfish (SR) assessment included new data and new methodology. A random effects model was used for estimating trawl survey biomass, as previously recommended by the SSC and PT for all Tier 5 species. GOA SR exploitable biomass is down slightly from the previous assessment in 2011. Biomass estimates from the random effects model are 12.6% lower than the biomass estimates from the previous method (average biomass estimates from the last three trawl surveys). The PT expressed concern about a high bycatch of SR in 2010 and requested the authors examine the sources of bycatch data as well as present gear specific catches by region. The SSC supports these requests. The PT and SSC note that SR will likely be on Prohibited Species Catch (PSC) status in the WGOAbecause the 2016 ABC for WGOA is 38t, and 2015 catches in that region have already exceeded 47 t.

The SSC approved the model and apportionment methodology and resulting ABC and OFL values, which are provided below.

The SSC supports the author's and PT's suggestion to explore incorporating the longline survey relative population weight as an additional index for future apportionment. This was suggested because the trawl survey may not cover the entire range of SR habitat and the longline survey may be able to provide additional information or be a better index. The SSC also supports the PT recommendation for exploring the geostatistical GLMM estimator used in this year's dusky rockfish assessment as an alternative method for estimating regional and overall biomass.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Shortraker rockfish	W		38		38
	C		301		301
	E		947		947
	Total	1,715	1,286	1,715	1,286

Other Rockfish (Combination of Slope Rockfish and Pelagic Shelf Complex Species)

For the 2015 Other Rockfish (OR) assessment, new data were added and new model methodology proposed. The ABC and OFL for OR were previously based on Tier 4 and 5 methods, however catches of seven OR species were counted towards OFL but were not individually assessed. These seven species (canary, China, copper, quillback, rosethorn, tiger, and yelloweye rockfish) are managed in the OR complex in the western and central GOA and as part of the Demersal Shelf Rockfish (DSR) complex in EYAK/SEO. The authors have proposed Tier 6 methods for these previously unassessed species which are caught mostly by longline and poorly sampled by trawl survey. For each of these species the author- and PT-recommended OFL was based on maximum historical catch for that species for 2013-2014. The authors recommended using the 2013-2014 years because there were differences in discard rates before and after observer restructuring for these species in the Demersal Shelf Rockfish complex. For the Tier 4/5 species, a random effects model was used for estimating biomass and apportionment, and the ABC for the western and central GOA was combined for management. There was concern from the SSC about recent ABC overages in the western GOA. The authors and PT have stated that overages were largely due to harlequin rockfish, which are primarily associated with untrawlable habitat and poorly sampled by the trawl survey and, therefore likely underestimated. The authors and PT also noted that catches remain below OFL.

The SSC approves the new Tier 4/5/6 methods and apportionment for the OR complex and commends the authors and analysis team for their considerable effort in examining models and stock structure for this complex and DSR. The SSC concurs with the recommendation to combine the western and central GOA ABC for OR management and approves the ABC and OFL values in the table below for management. The SSC joins the PT in suggesting caution regarding use of maximum catch for OFL for the Tier 6 species in this complex going forward, as OFL could only remain static or increase.

The SSC recommends work continue on the following as indicated by the PT and authors: 1) verifying that species in this complex are more similar to each other than to other complexes using ANOVA or similar techniques, 2) investigating whether there should be a correction factor for NMFS trawl data for those species not well sampled by trawl, and 3) investigating how to incorporate IPHC index into assessment for the 5 species that the IHPC surveys well.

Assemblage /Stock	**Area**	**2016 OFL**	**2016 ABC**	**2017 OFL**	**2017 ABC**
Other Rockfish	W/C		1,534		1,534
	WYAK		574		574
	EYAK/SEO		3,665*		3,665*
	Total	7,424	5,773	7,424	5,773

Dusky Rockfish

As in previous years, the author utilized the Generic rockfish model (developed in 2001) as modified for applications for dusky rockfish. Five hierarchical models were considered with Model 0 being the most recently accepted 2013 model configuration. As noted in the chapter, four additional models included the following changes:

- M1: incorporated updated data sources and thus represents the best available data;
- M2: corrected growth estimates for the length stratified sampling design of the survey;
- M3: extended the number of ages in model, which resulted in improvements to the fit of the age composition datasets;
- M4: applied the GOA PTs recommendation for defining the first age of the plus group. Setting the plus age group to 25+ allows for a manageable proportion of fish within the plus age group to be modeled;
- M5: used a geostatistical generalized linear mixed model for biomass estimates, in response to 2014 CIE review. The GOA PT reviewed this approach in September. The method was developed by Dr. James Thorson (NWFSC, see Thorson et al 2015, ICES J. Mar. Sci.) and is currently being used in west coast rockfish assessments.

The SSC discussed the proposed changes to the model and data inputs and recommended the changes recommended in models M1 – M4.

The SSC spent time considering the implications of adoption of M5, with the initial implementation of the geostatistical model. The 2015 bottom trawl biomass estimate was the 3rd lowest on record (32,786 t), which represented a substantial drop from the 2011 estimate (99,170 t). Although the fishery and survey age compositions indicate an extended period of poor recruitment, the abrupt decline is unexpected for a relatively long-lived species. Retrospective review of past surveys reveals that dusky rockfish are patchily distributed and survey biomass estimates consistently exhibit a high CV. The geostatistical approach was developed for stocks that exhibit highly aggregated spatial distributions. The author noted that review of the performance of M5 showed that there are two main benefits of this new approach:

1. The geostatistical model-based trawl survey biomass index reduces variability both across and within years when compared to the design-based trawl survey biomass index, and
2. Using the geostatistical model-based trawl survey index improves the retrospective pattern found within this assessment.

Updated input data include geostatistical model-based trawl survey biomass estimates for the years 1984-2015. After discussion**, the SSC ultimately accepted the PT and author's recommendation to adopt M5 as the base model for this year's cycle.** The SSC recommends management of dusky rockfish as a Tier 3 species. **Based on the results of model M5, the SSC accepts the PT and author's recommended ABCs and OFLs for 2016 and 2017 (see table).** The author recommended using the random effects smoothing model applied to the design-based survey biomass estimates to estimate the area apportionments. **The SSC accepted this interim approach for 2016 and the associated proposed apportionments of ABC**: 173 t for the Western area, 4,147 t for the Central area, 275 t for the West Yakutat area, and 91 t for the Southeast/Outside area. However, the SSC agreed with the PT recommendation to explore using the geostatistical model-based area-specific biomass estimates for area apportionments in future assessments. The SSC notes that application of the stock structure template in 2011 revealed a lack of significant stock structure.

Assemblage /Stock	**Area**	**2016 OFL**	**2016 ABC**	**2017 OFL**	**2017 ABC**
Dusky rockfish	W		173		159
	C		4,147		3,791
	WYAK		275		251
	EYAK/SEO		91		83
	Total	5,733	4,686	5,253	4,284

Rougheye and Blackspotted Rockfish

This year the RE/BS rockfish assessment was updated with several new sources of data including:
1.) Updated catch estimate for 2014, new catch estimates for 2015-2017
2.) New fishery ages for 2010, new fishery lengths for 2013
3.) New trawl survey estimate for 2015, new trawl survey ages for 2013
4.) New longline survey relative population number (RPN) for 2015, and new longline survey lengths for 2015.

The trawl survey data are adjusted for species visual misidentification rates to compute species specific biomass estimates and age compositions. For the 2009 survey the adjusted data indicated that 47%, 51%, and 2% of the estimated biomass was comprised of rougheye, blackspotted, and hybrids, respectively. Prior to this adjustment the estimated biomass was 63% rougheye and 37% blackspotted rockfish. Given the importance of these adjustments on the assessment, the SSC requests that the authors fully evaluate how changes in the misidentification rate would impact the historical estimates of species composition in the survey.

This RE/BS assessment incorporates both longline and trawl survey as indicators of stock trend and abundance. Using the most recent model configuration (the 2014 accepted model, M0), the author explored six alternative models.

Model 1 (M1) Same as M0 but incorporates all new and updated data and thus reflects the best available information regarding the stock.

Model 2 (M2) Same as M1 but with new length-stratified growth and updated ageing error conversion matrix. This improvement to growth estimation was more consistent with the survey sampling design.

Model 3a (M3a) Same as M2 but uses 3rd differences (non-parametric high penalty) trawl survey selectivity and new plus age at 42

Model 3b (M3b) Same as M2 but with 3rd differences (non-parametric high penalty) trawl survey selectivity and new plus age at 53

Model 4a (M4a) Same as M2 but uses the gamma function for trawl survey selectivity and new plus age at 42.

Model 4b (M4b) Same as M2 but uses the gamma function for trawl survey selectivity and new plus age at 53.

The sub-models under M3 and M4 were introduced to address two issues. The notation "a" and "b" for each model referred to different 1st ages for the plus group (either 42 or 53). The change to the age of the plus group produced an improvement in fit to the age bins adjacent to the plus group. Models M3 and M4 were included to explore sensitivity of the trawl survey selectivity functional form and the associated interaction with the age composition plus group. The SSC agrees with the author and the GPT on the merits of selecting Model 4a for the purposes of setting harvest specifications. The retrospective pattern for M4a is poor (Mohn's ρ = -0.371) and the SSC requests that the author explores the reason for this result.

Based on results from Model 4a, the estimated female spawning biomass for 2016 was above B40%. This places this stock in Tier 3a. The SSC accepted the author's and PT's estimates of the maximum permissible fishing mortality for ABC and the fishing mortality for OFL as well as the associated estimates of ABC and OFL (See Summary Table).

In response to SSC and PT recommended methods, the author estimated area apportionments using both the random effects model and the previous method of 4:6:9. The author noted that methods have not been established for applying the random effects model in assessments that utilize multiple survey indicators. The SSC recognizes that this is an important area of research that will impact other assessments (e.g., GOA pollock). **The SSC agrees with the author that the 4:6:9 survey weighting approach should be used for area apportionments in the interim** until the analysts have selected a preferred method for estimating area apportionments using the random effects model.

As in previous years, the SSC encourages the author to explore methods to improve species identification in the fishery. The observed differences in spatial distributions and growth suggest that these rougheye and blackspotted rockfish should be assessed separately once the information is sufficient to make this change. With this in mind, the **SSC requests that the author evaluate the available information to separately assess the two stocks and where there are data gaps.**

Assemblage /Stock	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Rougheye/blackspotted Rockfish	W		105		105
	C		707		705
	E		516		515
	Total	1,596	1,328	1,592	1,325

Demersal Shelf Rockfish (DSR)
The 2015 assessment included updated catch and survey data. The catch time series included directed catch and other removals (subsistence, recreational, and research catch). In the past, the primary fishery independent survey for yelloweye rockfish was a line transect survey conducted using a submersible. In 2012, ADF&G transitioned from submersibles to Remotely Operated Vehicles (ROVs) equipped with stereo cameras. ROV surveys have been conducted in the following regions and years: 2012 - Central Southeast Outside (CSEO), 2013 - Southern Southeast Outside (SSEO), and 2015 – East Yakutat (EYKT). In 2015, the ROV was fit with an additional bottom focused camera, however, review of the data revealed that the forward focused stereo cameras provided the most accurate information for the analysis. SSC is relieved to see the continuation of the ADF&G yelloweye rockfish survey because the information derived from these surveys is a critical component of the yelloweye assessment. The ROV-based yelloweye rockfish density estimate for 2012 was comparable to previous submersible estimates with a similar magnitude (Figure 3).

The author applied the random effects survey averaging model to survey biomass estimates as an alternative biomass time series, in addition to the current estimation method based on yelloweye densities from the submersible and ROV surveys. The authors don't recommend the use of the random effects model biomass estimates due to the limited amount of time available to evaluate this change. **The SSC concurs with this decision in the interim but encourages the authors to continue to pursue application of this model in future assessments, in agreement with the PT**.

The DSR complex is managed under Tier 4 based on results of the survey for yelloweye rockfish. As in previous years the author recommended and used a harvest rate lower than the maximum allowed under Tier 4 in recognition of the vulnerable life history of this species complex. The lower 90% confidence interval of the biomass estimate was used as in previous years.

The author included a new method for calculating non-yelloweye DSR biomass using Tier 6 calculations with catch data from 2010 to 2014 for recreational, commercial and subsistence fisheries. The SSC noted that this estimate is based on a very short time period and encouraged the author to continue explore alternative methods for estimating Tier 6 limits. **In the interim, the SSC agreed with the PT and author that the Tier 6 approach for the non-yelloweye component provided reasonable harvest specifications.**

The SSC agreed with the author and PT recommendation to use the combined estimates for yelloweye rockfish (based on a reduced fishing mortality rate) plus the Tier 6 estimate of non-yelloweye rockfish (see table below). The SSC also supports the reduction from the maximum permissible ABC for this stock complex.

The author reported that ADF&G plans to conduct additional ROV surveys in the Central Southeast (CSEO), Northern Southeast (NSEO), and Southern Southeast (SSEO) Outside areas in 2016. **The SSC**

agrees with the PT recommendation that a high priority be placed on combining areas and indices so that a region-wide assessment of yelloweye rockfish can be evaluated.

Dr. Kray Van Kirk provided an updated version of to the age-structured stock assessment in an appendix. The SSC reviewed the recommendations of the PT and agrees that the following suggested model changes should be considered.

1. Rescale CPUE data to avoid possible numerical issues with catchability estimates,
2. Modifying the terminal plus-class,
3. Estimating a single natural mortality under the new likelihood/penalty formats (the random walk part was interesting but may be misleading given the level of uncertainty associated with these assessments)
4. Evaluate using the lower 90% confidence interval as is done with the status quo assessment.

The SSC anticipates that this model will be brought forward as a candidate for use in the 2016 assessment cycle, if the authors are able to complete suggested model changes and the PT recommend it for SSC review.

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Demersal rockfish	Total	346	231	346	231

Thornyhead Rockfish

The assessment incorporated the following new sources of information:

1. Total catch weight for GOA thornyheads is updated with partial 2015 data through 13 October 2015.
2. Length compositions from the 2012, 2013, 2014, and 2015 longline and trawl fisheries were added.
3. Biomass and length composition information for GOA thornyheads are updated with 2015 GOA bottom trawl survey data.
4. Relative population numbers and weights and size compositions for GOA thornyheads from the AFSC annual longline surveys are updated with 2012, 2013, and 2014 and 2015 data (Table 15-5).

The author noted that shortspine thornyhead length frequencies derived from the longline and trawl survey indicated the two surveys sampled different demographic groups within the population.

The SSC supports the author's plan to explore the feasibility of incorporating longline survey abundance indices for use in estimating biological reference points and possibly area apportionments. If the longline survey is added to the assessment, the SSC and the PT notes that methods will need to be developed to estimate area apportionments for assessments that utilize more than one survey.

In response to PT requests, the author estimated biomass using the random effects model. The random effects model was applied to biomass estimates by area and depth subareas to account for missing data, with the total biomass estimate obtained from summing the subarea model runs. SSC agrees with the author and GOA PT recommendation to use estimates based on the random effects model as well as area apportionments of the ABC.

The SSC recommends that this stock continue to be managed as a Tier 5 stock complex. The SSC supports the author's recommended ABC and OFL estimates based on the results of the random effects model applied to the bottom trawl biomass estimates, as well as the associated area apportionments (see table).

The PT noted the high discard rates for thornyheads over the last four years and requested the author investigate these. The PT also recommended that the author examine the tagging data. The SSC concurs with these suggestions.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Thornyhead Rockfish	W		291		291
	C		988		988
	E		682		682
	Total	2,615	1,961	2,615	1,961

GOA Sharks

The GOA shark complex (spiny dogfish, Pacific sleeper shark, salmon shark and other/unidentified sharks) is assessed on a biennial schedule with a full assessment presented in 2015. GOA sharks are a Tier 6 complex, with the harvest specifications for spiny dogfish calculated using a Tier 5 approach. All other species in the complex are Tier 6 with harvest specifications set using the average historical catch between the years 1997-2007. The complex OFL is based on the sum of the Tier 5 and Tier 6 recommendations for the individual species. Data updates included an updated catch time series from 2003 – 2015, updated NMFS bottom trawl, NMFS longline, and IPHC survey data, and the addition of ADF&G trawl and longline survey indices for the first time. Finally, a new biomass time series is presented based on the random effects (RE) approach to survey averaging for spiny dogfish. Changes to model methodology include the application of the RE model biomass time series for spiny dogfish, F_{OFL}=F_{max} from a demographic model, and the status quo F_{OFL} = M.

The SSC appreciates the responsiveness of the assessment authors to SSC and PT requests. This includes the implementation of the random effects model, development of the demographic model, investigations into the use of length-based methods and biomass dynamics models, and presentation of alternative Tier 6 options. The SSC requests that the average, maximum and median catches of the current time period be brought forward in the next assessment, with confidence intervals around the average catch alternative.

There were four options presented for spiny dogfish harvest specifications this year, including two methods to estimate biomass (the three-survey average method used in previous assessments and the random effects model-based estimates) and two options for natural mortality (the status quo M and the F_{max} from a demographic model). **The author and PT recommended the use of the random effects model estimates of biomass for harvest specifications, and the SSC concurs.** The author recommended delaying implementation of the F_{max} from the demographic model until concerns over the trawl survey gear efficiency can be addressed in the next assessment. The SSC and PT agreed with this delay and look forward to seeing it again at that time. The SSC requests the author bring the status quo methodology forward, in addition to F_{max} from the demographic model, next year and to include the methodology for the demographic model in an appendix. **The SSC agrees with the use of M=0.097 for the Tier 5 harvest specifications for the interim.** Tier 6 harvest specifications for shark species other than spiny dogfish remain unchanged from the last assessment. These specifications are detailed in the table. The SSC notes that this ABC is a 25% reduction from previous years, due to the implementation of the random effects model.

There was public testimony given by Karil Basargen (representing self) regarding the opposite abundance trends of Pacific cod and sharks. He suggested that in the Seward area, Pacific cod declined in the late 1990s and, as a result, shark catches increased. He noted that there could potentially be a market for sharks if a fishery was allowable.

The SSC asks the authors to follow up on the following outstanding issues in future assessments:

- Incorporation of a net efficiency study (Hulson et al., in review) that uses tag data to estimate survey catchability,
- The SSC requested a comparison of CAS and HFICE estimates in 2014, and notes the authors plan to revisit this issue for the 2016 assessment cycle, as indicated in the assessment.
- The SSC appreciates the inclusion of catches for areas 649 and 659 in the document, but not including them in the assessment until biomass estimates are available for State waters. The SSC continues to recommend the author explore potential sources of estimating biomass in State waters if sharks are believed to be a single population in state and federal waters.

There were three focuses for future shark research priorities that are currently underway that the SSC would like to recognize: 1) the accuracy of catch for sleeper shark due to difficulty obtaining weights, 2) stock structure and migration patterns of spiny dogfish from satellite tagging, and 3) population genetics and life history of sleeper shark, and specifically the exploration of aging methods.

Stock/		**2016**		**2017**	
Assemblage	**Area**	**OFL**	**ABC**	**OFL**	**ABC**
Sharks	GOA-wide	6,020	4,514	6,020	4,514

GOA Skates

The GOA skate complex is managed as three stock groups. Big skates (*Raja binoculata*) and longnose skates (*Raja rhina*) each have separate harvest specifications, with a GOA-wide OFL and ABCs specified for each GOA regulatory area (western, central, and eastern). “Other skates” have a gulf-wide OFL and ABC. All are managed under Tier 5 with harvest specifications based on the product of survey biomass estimates and a natural mortality estimate.

The 2015 survey big skate biomass estimate increased substantially, primarily in the CGOA, reversing a decline that began in 2003. Big skate biomass declined slightly in EGOA, but these tend to be younger and immature individuals, suggestive of recruitment from EGOA to a segment of the population in the CGOA. GOA-wide biomass estimates for longnose and other skates decreased slightly from 2013 but have been stable since 2000. The distribution of longnose biomass shifted among regulation areas. Biomass increased in CGOA but declined in WGOA and EGOA.

Directed fishing is prohibited for GOA skates. Recent catches of all skate groups were substantially lower in 2014 and 2015 than 2009-2013, likely due to prohibitions on retention of big skates in CGOA that began in 2013, which discouraged topping-off behavior that resulted in higher catch levels. Longnose skate retention is still high. The SSC noted that the sub-area ABCs have been exceeded a number of times in the past. Big skate ABC in the CGOA was exceeded in 2010-2013 and was closed early in 2014 to prevent exceeding the ABC. Longnose ABC in the WGOA has been exceeded four times since 2005.

The random effects model survey averaging approach was introduced for GOA skates in 2014. There was a slight change to the application of the random effects model in 2015. Instead of a GOA-wide random effects run, there was a separate run for each of three groups for each area. **The SSC supports these method changes and further accepts the associated harvest specifications for each of the three species groups, as detailed in the tables, for 2016 and 2017.**

Currently, skate catches from areas 649 and 659 in State waters represents skates outside of the assessed region and are not counted against the EGOA ABC or TAC. The SSC appreciates the author including a table with state catches separated from those in federal waters. The SSC reiterates its request that the author investigate whether there is information to support that skates in areas 649 and 659 are part of the GOA population and, if so, how to estimate skate biomass in these areas.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Big skate	W		908		908
	C		1,850		1,850
	E		1,056		1,056
	Total	5,086	3,814	5,086	3,814
Longnose skate	W		61		61
	C		2,513		2,513
	E		632		632
	Total	4,274	3,206	4,274	3,206
Other skates	GOA-wide	2,558	1,919	2,558	1,919

GOA Sculpins

Sculpins in the GOA are managed under Tier 5, where the OFL is the product of M and a biomass estimate. For this 2015 full assessment, the sculpin catch data have been updated. There were also changes to the methodology based on past recommendations from both the PT and the SSC. The random effects (RE) survey averaging model has been applied to survey biomass estimates to determine the biomass of the complex. The proportion of each species, as determined by a separate RE model run to determine biomass was recommended by the author to determine biomass-weighted natural mortality estimates. Total biomass is the sum of the species-specific biomasses from the RE model. **The SSC agrees with the PT recommendations for harvest specifications, specifically the use of the RE model biomass time series and the biomass-weighted natural mortality (M = 0.222).** These result in the harvest specifications in the table below. We also agree with the PT in requesting possible explanations for the decline of bigmouth sculpin since the 1980s, including, but not limited, to low fecundity of bigmouth sculpin and fishing mortality. The SSC would also like to note the decline in survey biomass of the plain sculpin. We also suggest that investigations into the maximum age and natural mortality of the four primary sculpin species in this complex be added to research priorities.

Stock/ Assemblage	Area	2016 OFL	2016 ABC	2017 OFL	2017 ABC
Sculpins	GOA-wide	7,338	5,591	7,338	5,591

GOA Squid

GOA squid is a stock complex of 15 species that is managed under Tier 6. Catches have been low in recent years (an average of 187 tons from 2010-2014) and are primarily incidental catches from the GOA pollock fishery. The 2015 GOA bottom trawl survey biomass estimate was the highest on record, though there is a general consensus that the trawl survey does not provide reliable information on squid. Prior to this assessment, specifications were set using the maximum historical catch from 1997 – 2007. For this assessment, new approaches were reviewed for both the BSAI and GOA squid and a new approach was recommended for GOA by the author.

The author-recommended approach was a Tier 6 approach, similar to Tier 5, where an OFL is the product of a biomass estimate and fishing mortality (F), which is set equal to natural mortality (M). In this particular case, the F_{OFL} = M = 1.0, where F has been modified using the Baranov catch equation in an attempt to account for squid life history. Given the short life span of most squid species (< 1 year), the high natural mortality is reasonable. The author used a long-term average of the survey biomass to determine a biomass value. An application of the random effects model was inappropriate in this case, as was noted by the author, due to the biology of squid. This approach resulted in a much larger recommended OFL and ABC than in past years. The PT recommended this approach after much discussion, and noted the continued lack of information on biomass and mortality of squid in the GOA. There was also a general consensus among the PT that historic catch is not an appropriate method to set harvest specifications, and the PT found the larger harvest specifications acceptable while squid is evaluated as an ecosystem component species in an analysis forthcoming in 2016.

The SSC did not agree with the PT's and author's recommendation for harvest specifications. While the recommended approach has a great deal of merit in its application of a more appropriate exploitation rate, bottom trawl survey biomass estimates are inherently unreliable and extremely variable for squid. As a Tier 6 species, the use of the survey biomass estimates has been consistently rejected in the past for setting harvest specifications for squid. The surveys in the GOA also tend to catch smaller, likely immature, squid than those captured in the BSAI surveys, and are consequently less representative of the spawning population size. The SSC notes that even less is known regarding the population status or ecological significance of squid in the GOA than in the BSAI, yet harvest specifications in the BSAI are set using historic catch. While the SSC agrees that, in general, it is not ideal to set harvest specifications based on historic catch, Tier 6 species lack reliable estimates of biomass and historic catch is the best available information to act as a proxy for MSY. Also, catches in the GOA have not been approaching the ABC in recent years, so there is no management conflict. Finally, there will be a great deal of new information that will be presented as a part of the future ecosystem component analysis that could provide inspiration for alternative approaches to harvest specifications, if those are needed in the future. **For these reasons, the SSC recommended the status quo approach for setting 2016/2017 harvest specifications (see table).**

Stock/		**2016**		**2017**	
Assemblage	**Area**	**OFL**	**ABC**	**OFL**	**ABC**
Squid	GOA-wide	1,530	1,148	1,530	1,148

GOA Octopus

There are seven species of octopus that are managed under the GOA octopus complex. Octopuses are taken as incidental catch in the trawl, longline and pot fisheries, with the highest catch rates in the Pacific cod pot fisheries in the central and western GOA. The octopus catch in the 2015 AFSC bottom trawl survey was unusually large, and biomass was estimated at 12,990 tons, an order of magnitude larger than in previous years. Total commercial catch has been higher in recent years, though not approaching the ABCs. Total catch in 2014 was 1298 tons, the highest on record, and is over 800 tons so far in 2015

GOA octopus is managed as a Tier 6 complex. A consumption model of octopus by Pacific cod is used for setting harvest specifications for octopus in the Bering Sea, and in 2012, this method was brought forward but rejected for use in the GOA. Since then, methods for setting specifications have focused on a "minimum biomass estimate." Catch limits for this stock complex for 2011 – 2014 have been set using the average of the last 3 survey biomass estimates and the application of a natural mortality estimate. This natural mortality rate is estimated from age at maturity (M = 0.53), as there are no direct measurements of natural mortality for octopus species in the GOA. **The SSC recommends that estimation of octopus natural mortality be added to its research priorities list.**

For 2015 and 2016, two methods were presented for development of harvest specifications, including the status quo and the application of the random effects model to survey biomass estimates. Both methods provide similar results. **The SSC agrees with the author and PT that the biomass estimates produced from the random effects model should be used to set harvest specifications, within the status quo**

methodology. A CIE review of non-target species in 2013 also preferred the application of the random effects model for setting harvest specifications, as opposed to the status quo, for GOA octopus.

The SSC noted that survey biomass and incidental catches both increased in the western and central regions, though not in the eastern GOA, suggesting there is a degree of spatial structure in octopus stocks. In agreement with PT recommendations, the SSC looks forward to the presentation of the stock structure template for octopus in 2016. Further, the PT and SSC look forward to the presentation of the size-based stage model in 2016 as well.

Recent research includes studies of delayed mortality of discarded octopus and development of octopus-specific fishing gear for possible scientific catches.

Stock/		2016		2017	
Assemblage	Area	OFL	ABC	OFL	ABC
Octopus	GOA-wide	6,504	4,878	6,504	4,878

Groundfish SAFE Appendices

Ecosystem Considerations

The SSC received a review of the Ecosystem Considerations from Stephani Zador, ASFSC.

As in the past, the Ecosystem Considerations Chapter of the SAFE documents is well written, informative, and continues to improve. The Editor and authors are to be congratulated on an excellent presentation covering a great deal of complex and important information. Perhaps most exciting are the efforts to develop prediction capacity. The Chapter is moving toward providing the sort of information that will allow the use of environmental information to predict future fish recruitment. The predictions may still be preliminary and qualitative, but it is great to see the attempt to go beyond recounting what has passed.

The SSC was very pleased to see the first edition of the GOA report card. We commended the effort to develop a broader base for the process for selecting the list of indicators and we support the effort to continue to refine this list. The SSC appreciates having a Mobile Epifauna Biomass Index for the GOA. However, given the use of survey trawls with roller gear in the GOA that do not track as close to the bottom as the EBS trawl gear, consideration should be given as to whether this index is reliable. For instance, GOA trawl catches of crabs and scallops have been used as indices of presence/absence but generally not as a quantitative index of abundance. If the Mobile Epifauna Biomass Index is deemed reliable in the GOA, the SSC supports its continued inclusion in the report card.

The SSC looks forward to continued development of the Arctic assessment and report card, as this will be critical to our overall understanding of the resources there and how they may best be managed.

The Editor and authors have been very responsive to the past comments of the SSC. The SSC notes the welcome addition of the section on Disease Ecology and the expanded information on the status of zooplankton in the EBS and GOA. The SSC found the ongoing effort to develop alternate sampling methods or platforms to provide information on forage fish trends very helpful. The SSC echoes the concerns of the PT regarding the ecosystem indicator that describes the trawl disturbance area. As currently estimated, there is potential for underestimating reductions in trawl effort and the SSC supports the PT recommendation that alternatives to this index be investigated.

The EBS bottom temperature information and the OSCURS model results for 2014 and 2015 corroborate the BSAI stock authors' and GPT's concerns/ discussions regarding the impacts of temperatures and advection on flatfish migration and behavioral responses to the survey trawl, both of which impact Q.

The SSC notes that there is a lack of attention to humans in the Ecosystem Considerations chapter. While there are historical reasons that partially explain this—the ecosystem SAFE was conceived after the treatment of *some* economic and social issues had been assigned to a separate economic SAFE—the SSC believes this separation should not continue. At a fundamental level, the subject of interest is how humans are contributing to changes in the ecosystems of which they are part, and how they are reacting to these changes. The SSC suggests that it is time to rethink how the human component is incorporated into the SAFE process. As a specific example of how the current approach is deficient, the SSC notes that fisheries policy stands virtually alone, compared to other industry/policy settings, in the total absence of attention to the carbon footprint of commercial fishing and the influence of policy on that footprint.

The document has grown over the years and the increasing length in some ways makes it difficult for the reader, despite the useful Report Card and Hot Topics sections. Not all parts are of equal value. It would be nice if the meat of the document were tightened up so that the important parts totaled 100 to 150 pages. That might help the reader to absorb more of the critical material. It might be useful to have a sub-committee try to sort out which, if any, indices might be dropped. For example, there are a number of indices or reports on herring. We recognize the importance of information on the status of the Togiak Bay (Bering Sea) spawning run, but perhaps the considerable set of reports on herring in Southeast Alaska (Gulf of Alaska) could consolidated into a broader overview of southeast regional trends.

Many of the individual Index Reports miss the opportunity to draw comparisons among regions (EBS, GOA, etc.), species, and other indices. Such integration would help the authors and readers see the "big picture". The Editor attempts to do this in the introductory portions of the Chapter, but if the Index Reports come in at the last moment, it is hard for the Editor to integrate them.

It would be helpful to group indices by region- EBS, AI, GOA, then, within region by species or species group. Again, that would aid the reader in seeing the connections among indices.

As in the past, a number of indices were not updated for this year's Ecosystem Considerations Chapter. If these indices are important for management, then they should be updated in a timely fashion. If not important, they can be dropped. For example, the EBS Sea Ice Index analysis was not updated, nor were the indices on the western sub-population of the Steller Sea Lion. Both would seem important.

In the discussion of jellyfish (Page 141), we learn for the first time that the BASIS Surveys have been shifted to alternate years. Since the BASIS survey has been of considerable importance in developing and testing of our understanding of the EBS, it would seem that this important change ought to be highlighted up front. The SSC is surprised and disappointed that this was not discussed with the Council before being implemented.

C-4 GOA Chinook Salmon PSC
The SSC received a presentation from Sam Cunningham (NPFMC). Public testimony was offered by Paul Wilson (Boat Company).

The SSC appreciates the considerable effort evidenced by the draft presented to us. The task before the SSC on this agenda item is to advise the Council as to whether the analysis is sufficiently complete to inform the public and provide the Council with the basis for making an informed choice between the competing alternatives, options, and sub-options identified in the proposed action. It is the SSC's judgment that this document is deficient in several critical respects. **The SSC recommendation is that**

the analysis is not sufficiently complete to support a decision on this action. The deficiencies can be grouped under the following categories:

- The RIR does not provide the necessary comparative analyses with which to meaningfully differentiate among each of the potential combinations of alternatives, options, and suboptions. Absent actual impact analyses, no meaningful way exists to select objectively among the choices presented.
- The document fails to provide a balanced characterization of all those users and uses with a legitimate interest in the Chinook PSC removal debate. The analysis is deficient by limiting any meaningful consideration of benefits and costs to the GOA groundfish segment of this Chinook PSC distributional issue. The SSC believes consideration of the programmatic implications of 'double-jeopardy' for 'saved' Chinook PSC has merit. Many of the underlying economic arguments associated with Chinook PSC management are predicated upon the concept of "a salmon avoided" in PSC accounting is "a salmon saved". But if "a salmon avoided" by the original recipient of the PSC allowance is transferred into the supplemental allowance of a second groundfish trawl sector – after that second sector has exceeded its own allowance – the salmon saved is placed at risk of PSC loss a second time. Two possible problems emerge from this. First, the public was informed that PSC allowances, with avoidance incentives, would be expected to yield Chinook salmon "savings". The RIR states that "a modest increase in Chinook PSC is anticipated" under the proposed action alternative, negating the promised savings and redistributing the "value" of the avoided Chinook from competing users and uses to the GOA groundfish industry.
- Second, following from the previous bullet, there needs to be an analysis of the possibility that the availability of Chinook PSC amounts, in addition to the initial cap, will diminish incentives to avoid salmon PSC. That is, by providing a mechanism to reapportion Chinook PSC allowance amounts from a groundfish sector that has successfully avoid Chinook PSC, to a sector that has exceeded its own PSC allowance could introduce a perverse economic incentive structure, whereby the sector that fails to avoid Chinook PSC is "rewarded" for the successful efforts of the other sector, from which the PSC allowance is reapportioned. Making additional Chinook PSC allowance available to a sector that has failed to avoid its own cap risks dis-incentivizing avoidance efforts, undermining the Council's intent for PSC reduction. Treatment of this contrary PSC management outcome is necessary.
- The analysis would benefit from an examination of the role Chinook PSC in the GOA may play in ESA considerations. The ESA listed salmon stocks are an obvious topic of concern. Additionally, however, Chinook salmon from PNW stocks are a "primary consistent element" under the critical habitat designation for the ESA-listed Southern Resident Orca found in the Puget Sound. Removals, through PSC interception in the GOA, may represent a significant risk of "adverse modification."
- The RIR suffers from an inappropriate "Alaska-centric" frame of reference. Despite repeated suggestions to the contrary within the draft, this is not a State of Alaska regulatory action. The document mischaracterizes the obligation the Council and NMFS have to manage these Federal resources, within the Federal EEZ, for the "net benefit of the Nation". Failure to correctly frame the proposal as a Federal regulatory action leads the authors to dismiss Chinook PSC losses accruing to any but Alaska stocks as unimportant. The stock-of-origin data presented in the draft reveal that upwards of 60% of the sampled Chinook PSC in GOA groundfish fisheries originate in the PNW, while perhaps as few as 10% are attributed to Alaska stocks. This finding was presented with expressions of relief, implying, with only 10% PSC loss at risk, concern was minimal.

D-7 Bristol Bay RKC Savings Area EFP

The SSC received a presentation on a proposed Exempted Fishing Permit (EFP) by John Gauvin, Alaska Seafood Cooperative (ASC). Public testimony was provided by Doug Wells and Frank Kelty of the Bering Sea Fisheries Research Foundation, Jon Warrenchuk of Oceana, and commercial fisherman Kiril Basardgin. Written testimony was provided by Ruth Christiansen of Alaska Bering Sea Crabbers.

The SSC appreciates the opportunity to review this EFP. The EFP proposes to allow 5 ASC-member (Amendment 80) trawl catcher-processor vessels to conduct test fishing inside and outside of two areas currently closed to trawl fishing: Area 516 and the Bristol Bay Red King Crab Savings Area (RKCSA). These vessels primarily target flatfish. Catches and prohibited species catches (PSC) would accrue toward existing vessel catch and PSC limits. The main objective of the EFP is "to evaluate whether flatfish and other groundfish trawling in the above-mentioned closed areas … would increase or decrease bycatch rates and the overall catch of managed crab species in the status quo fishery." From a practical standpoint, the EFP would allow the ASC members to determine whether the trawl closure areas would be desirable areas for future fishing and to inform future investigations regarding the efficacy of the RKCSA. If approved, the EFP would allow fishing in these areas during February 1 through May 15, 2016, and January 20 through May 15, 2017.

It is common in Alaska and elsewhere that fishery management actions are taken without subsequent analysis to revisit whether the stated objectives are being attained. The Bristol Bay trawl closures for red king crab have been in place since the 1990s, so an investigation into the efficacy of these closures is overdue. The SSC is very supportive of such efforts, but feels that given the importance of their conclusions for evaluation of management alternatives such studies should be scientifically credible. The tension between the need for research on the efficacy of the Bristol Bay closures and crab PSC in the flatfish fishery in general and the lack of scientific rigor in the proposed EFP resulted in considerable SSC discussion. A list of EFP strengths, concerns/limitations and recommended revisions/modifications with the current EFP are provided below summarizing SSC discussions. A number of important aspects of, and motivations for, the proposed work only became apparent during the author's presentation and testimony, but were absent from or difficult to discern in the EFP document. Several key factors (e.g. the approximate number of tows the EFP permitted) were not presented in the document or the presentation and were not apparent until SSC questioning.

Strengths

1. This EFP initiates a pilot study aimed at an important and often overlooked aspect of fisheries management; the trade-off between protections provided by time-area closures and the benefits of flexibility for fleets to move with fish to maximize CPUE. This is particularly relevant under rationalized fishing with PSC limits. This EFP will provide data on the performance of real fishing activities under these constraints, however there are substantial limitations as listed below.

2. One goal of the trawl industry is to lower crab PSC when targeting flatfish.. It is hypothesized that mature yellowfin sole migrate from the shelf break in winter eastward to the inner shelf (<50 m) for spawning in summer. NMFS summer trawl surveys show yellowfin sole concentrations on the inner shelf from Bristol Bay in the south to just past Nunivak Island in the north. The southern portion of this seasonal inshore migration is thought to pass through existing trawl closure areas in Bristol Bay.

3. The trawl fleet would like to test the hypothesis that high density aggregations of yellowfin sole migrate through the closed area, and if targeted, can be fished without high incidence of red king crab. If the EFP is successful, the trawl industry expressed support for additional, costly efforts for a more thorough and scientifically valid assessment of the closure area in Bristol Bay for its ability to conserve red king crab stocks while maximizing yield of flatfish species and king crab.

4. The closure area probably protects some of the spawning stock of red king crab but may not adequately account for stock movements due to environmental conditions such as habitat change, temperature, and currents which shift with cold and warm periods. While noting that a complete survey design over the entire closure area would be preferable (see May 2014 CPT minutes

p. 16), the CPT recognized that information on what crab are bycaught during targeted flatfish trawls could potentially provide initial data to assess the use and importance of the closure area to red king crab. It was recognized that a full survey would ultimately need to be conducted for it to fully benefit management.

5. The development of this EFP proposal over the past several years has occurred with considerable input from the CPT (two rounds of review) and with Dr. Bob Foy (NOAA Fisheries), and has required substantial collaboration between the ASC trawl fleet and the crab industry (see written testimony - Ruth Christiansen of Alaska Bering Sea Crabbers). The SSC greatly appreciates these cooperative efforts for improved understanding of fishery resources in the Bering Sea

Concerns/Limitations

1. The proposal is vague in a number of regards (e.g., how each objective will be met, duties of the observers versus sea samplers, time sequence of all sampling), and the oral presentation and testimony provided additional clarifying information that was missing from the written proposal. Rather, the document should provide a clear and comprehensive “statement of work” of all important aspects of the proposed EFP.

2. The proposal includes no study design and statistical analyses were not described either in the written proposal or in testimony. Instead, it includes rather vague indications about how participating vessels will go about their fishing operations. Given these vagaries, some of which are elaborated below, it is not possible for the SSC to evaluate whether EFP results will be statistically credible and thus whether the results will be meaningful.

3. The manner in which EFP fishing is conducted can bias the outcomes. For instance, if all participating vessels began operating under the EFP inside closed areas and then moved outside of closed areas toward the end of the project, there would be a strong potential for biased fish and crab catch rates if fish and/or crab migrate seasonally through the area. Such migrations are consistent with current understanding of flatfish and crab life history. The SSC notes that this bias impacts inference about the true crab catch rates inside versus outside of the closures but does provide important data for characterizing rates associated with real CPUE-maximizing fishing behavior.

4. Testimony indicated that tows will be selected for inclusion in the analysis after fishing is conducted. Such after-the-fact selection can bias results.

   As noted above, the proposed level of fishing within and outside the trawl closure areas was not articulated in the EFP, but in oral testimony the author stated that a total of 1,250-1,500 tows (5 vessels x 50-60 days of fishing x 5 tows per day) would be conducted under the EFP in some unspecified manner inside and outside of closed areas but with the expectation that about half of the tows would be inside the closed areas. The EFP does not provide information to justify this sample size as sufficient to achieve the primary stated objective of the EFP. The number of tows required to detect a difference in catch rates inside versus outside the closed areas can be estimated using power analysis. The SSC acknowledges that estimated variability of crab PSC catch rates under current commercial fishing would include the variability associated with observer sampling of crab PSC, as opposed to the full census of crabs proposed in the EFP, and therefore might not provide a representative variance for use in the power analysis. However, including sea samplers (for a full census of crabs) on commercial vessels outside the closed areas could provide data for a representative power analysis. Therefore, including samplers on vessels during commercial fishing operations outside the closed areas is recommended below as the first step in a two-step EFP.

5. After implementation of the closures in 1996, abundance of legal-sized males increased by 58%, that of mature males doubled, and mature female abundance and effective spawning biomass tripled through 2008 (Kruse et al. 2010; ICES J. Mar. Sci. 67: 1866-1874). However, it was not possible to discern the relative conservation benefits of trawl area closures versus reduced harvest rates in the directed fishery and new PSC limits on the trawl fishery, which were also implemented at the same time. More recently, the Bristol Bay red king crab stock has been undergoing a slow decline associated with a string of years of poor recruitment since the last good year class recruited to the assessed stock in 2005 (2015 crab SAFE). Similar conditions led to the formation of the closed areas.

6. In selecting its preferred alternative for year-round closure, rather than seasonal closure, of the RKCSA in 1996, the Council noted *"An extended duration of the closure period provides for increased protection of adult red king crab and their habitat"* (EA/RIR/FRFA, Amendment 37 to BSAI Groundfish FMP, p. 8). The area has likely experienced habitat recovery from 20 years of closure to trawling. A trawl impact study in the Crab and Halibut Protection Zone 1 (Area 512, an area now largely been superseded by the Nearshore Bristol Bay Closure) conducted by McConnaughey et al. (2000; ICES J. Mar. Sci. 57: 1377-1388) found that stalked, encrusting and attached organisms were greater in the closed area than in areas open to fishing. Several crab species were also more abundant in the closed area, including red king crab. If crab-habitat associations are to be considered in future evaluations of the efficacy of the RKCSA, opening the closed areas to trawling could compromise the potential for trawl impact studies. This potential impact could be mitigated by identifying some portion(s) of the closed areas that would be "off limits" to EFP trawling.

7. If there is any local residency of flatfish stocks in the fishery closure areas, then fishery CPUE and associated crab PSC rates during a short test fishery may yield optimistic expectations about long-term results after flatfish stocks become locally reduced by fishing effort.

8. It is critical that geo-location of trawl tracks are collected for each tow. This was not addressed in the EFP proposal, but oral testimony indicated that plotter data would be obtained. This information should be required of each vessel operating under the EFP to clearly ascertain the location of each tow with respect to area closure boundaries.

9. The SSC expressed a few additional concerns about the utility of information collected, including:
    a. The sea sampler must go through crab observer training or receive training from a qualified observer trainer. For instance, it is critical that crab shell condition is accurately determined. The proposal acknowledges female molting and mating are likely to begin in May. However, males molt in late winter/early spring and a comprehensive review of survey and fishery data found that *"Various size-sex-maturity groups that have been vulnerable to trawling or other commercial fishing gear have been found in the process of molting or in a soft shell condition from the last week of January to the end of June"* (EA/RIR/FRFA, Amendment 37 to BSAI Groundfish FMP, p. 11). Encounters with shoftshell crabs, if any, need to be accurately documented. Misrepresentation of softshell crabs as newshell crabs would underestimate their vulnerability to trawling in the closed areas.
    b. As suggested in public testimony, the use of video cameras should be attempted on some tows. The ability to see crabs and structural habitat in the trawl path (as opposed to those caught in the nets) in areas outside and inside closure areas would be invaluable. The

SSC understands that water clarity and the height of the trawl opening may limit the utility of cameras.

The SSC feels that significant progress towards the main goal of this study can be achieved with existing data and new information collected outside the closure areas. These include:

a. Maps of fishery CPUE that show monthly geographic distributions of flatfish catches. For example, in Fig. 4.4 on pages 798 and 799 of the BSAI yellowfin sole SAFE chapter, the only month in which the trawl closure areas appear to restrict attainment of good CPUE appears to be May, a month that is in question owing to mating/molting that may occur that month. The case for the EFP would be strengthened if it could be demonstrated that high flatfish CPUEs are constrained by the boundaries of the closure areas. Biweekly maps may provide higher resolution of temporal changes in the distribution of flatfish CPUE.
b. Existing fishery and observer data could potentially be used to demonstrate whether commercial tows with high flatfish CPUE are associated with reduced crab PSC rates.

SSC recommends revising the EFP to accommodate a two-step process over three years. The first step would be to collect and analyze information on fishery CPUE and crab PSC rates in areas outside of the trawl closure areas. This would entail analyses of existing survey and commercial fishery data, and a further refinement of the second stage of the EFP (test fishing inside and outside of the trawl closure areas). If results from the first stage (first year) are promising, then the second stage (revision of the current EFP) would be justifiable in the second and third year. The SSC offers some recommendation in support of this two-stage, three-year EFP approach:

1. First year goals
    a. Power analysis to inform what level of fishing (number of tows or tow hours) would be required to make statistical comparisons of catch rates inside and outside the no-trawl zone in the second year. Steps necessary to achieve this goal include,
        i. Samplers on commercial vessels for full census of crabs caught in commercial fishing tows outside the no-trawl zone
        ii. Estimate variances of PSC catch rates
    b. Retrospective data analysis to determine if there are high levels of yellowfin sole in the no-trawl zone during the timeframe of the proposed EFP. One example would be to examine monthly distributions of yellowfin sole catch in 2015 to see if high CPUE rates get interrupted by the closure areas. See pages 798 and 799 of the BSAI yellowfin sole chapter.
    c. Retrospective data analysis to determine if crab PSC rates are low in areas where there is a high biomass of yellowfin sole
    d. Further refinement of the EFP request. This should include, at minimum,
        i. Updated goals and objectives of the EFP,
        ii. More complete description of the methods to be employed during comparative fishing, including justification of the number of tows inside and outside the closed areas,
        iii. Description of statistical analyses to be conducted in the comparisons, and
        iv. Description and justification of what tows or what areas will be included in the comparisons (e.g. will all tows outside the closed areas be included in the analysis or specific subsets?).
2. Second year goals
    a. First season of data collection and comparisons inside and outside the closed areas
    b. Analysis and report of first year's results

    c. Evaluation of whether fleet members have further interest in trawling in the closed areas
3. Third year goals
    a. Second season of data collection and comparisons inside and outside the closed areas
    b. Analysis and report of first and second year's results

It is important to bear in mind that a successful test fishery executed under an EFP would provide interesting and useful information, but EFP results will be insufficient to make informed management decisions. For example, the EFP will not estimate and compare crab densities, habitat attributes, or other features inside and outside the closure areas that may be critical to potential management actions that would open existing closed areas to routine trawling. Rather, follow-up scientific studies will be required. The SSC notes that the EFP author acknowledged these limitations.