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SCIENTIFIC AND STATISTICAL COMMITTEE
REPORT TO THE
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
December 3rd – 5th, 2018

The SSC met from December 3rd through 5th at the Hilton Hotel, Anchorage, AK.

Members present were:

Anne Hollowed, Co-Chair *NOAA Fisheries—AFSC*	Gordon Kruse, Co-Chair *University of Alaska Fairbanks*	Sherri Dressel, Vice Chair *Alaska Dept. of Fish and Game*
Chris Anderson *University of Washington*	Amy Bishop *Alaska Sea Life Center*	Robert Clark *Alaska Dept. of Fish and Game*
Mike Downs *Northern Economics*	Ron Felthoven *NOAA Fisheries—AFSC*	Jason Gasper *NOAA Fisheries – Alaska Region*
Dana Hanselman *NOAA Fisheries—AFSC*	Brad Harris *Alaska Pacific University*	George Hunt *University of Washington*
Dayv Lowry *Washington Dept. of Fish and Wildlife*	Franz Mueter *University of Alaska Fairbanks*	Terry Quinn *University of Alaska Fairbanks*
Kate Reedy *Idaho State University Pocatello*	Heather Renner *U.S. Fish and Wildlife Service*	Ian Stewart *Intl. Pacific Halibut Commission*
Alison Whitman *Oregon Dept. of Fish and Wildlife*		

B-1 Plan and Planning Team Nominations

The SSC reviewed the nominations of Andrew Kingham (NMFS-AFSC) to the BSAI Groundfish Plan Team, Anne Marie Eich (NOAA-Alaska Region) to the Bering Sea Fishery Ecosystem Plan Team, and James Fall (Alaska Department of Fish and Game) to the Social Science Planning Team. The SSC finds these nominees to be well qualified, with appropriate expertise that will assist the Plan and Planning Teams. **The SSC recommends that the Council approve these nominations.**

With respect to the questions posed on pages 2 and 3 of agenda item D-8 SSPT Minutes regarding the SSC process for review of October 2018 SSPT nominees, all nominees were considered based on the nominee's expertise with respect to the specifications in the call for nominations, regardless of affiliation. Additionally, the October 2018 SSC minutes should have listed Tribal agencies along with state and federal agencies, reflecting the sovereign status of Tribes.

General Comments

The SSC wishes to acknowledge and express its appreciation to Robert Clark, for his 11 years of service on the SSC, including five years as Vice Chair; to Diana Stram, for her many years of service on the Groundfish Plan Teams; and to James Armstrong for his years of service on the Groundfish Plan Team.

General Stock Assessment Comments

Funding for surveys

As mentioned in section *B-1 Subcommittee on AFSC Surveys* of the October 2018 SSC minutes, **the SSC wishes to re-emphasize that surveys are a very high priority, currently designated as *Critical* Ongoing Monitoring in the Council's Research Priorities, and reiterates that securing funding for a full complement of five vessels to conduct annual bottom trawl surveys in the eastern Bering Sea shelf, Gulf of Alaska, Aleutian Islands, northern Bering Sea, and Bering Sea slope is fundamental to successful fisheries management in the North Pacific.** In addition to the direct connection between assessment surveys and annual catch specifications, surveys yield other important data on species distribution, life history, and biology, information needed for high-quality determinations of essential fish habitat and many other purposes that contribute directly and indirectly to sustainable fishery management.

Economic Status of the Groundfish Fisheries Off Alaska, 2017

Per the Action Memos for both C2 (GOA Groundfish Specifications) and C3 (BSAI Groundfish Specifications), the Council will review and adopt the full SAFE report at this meeting. The SAFE links referenced for this meeting included one to the Economic Status of the Groundfish Fisheries Off Alaska, 2017. While that portion of the SAFE is not due for a formal review until the February 2019 Council meeting, the SSC would like to acknowledge the revisions that have already been made to Chapter 9, Community Participation in North Pacific Groundfish Fisheries, in response to February 2018 SSC comments. Additional input based on an informal review of the current version of the community participation analysis will be provided directly to the authors.

Joint Plan Team Report

Reductions to the maximum ABC

The SSC received a presentation from Martin Dorn and Stephani Zador (AFSC), as well as comments from the PTs during the GOA and BSAI reports, on the topic of reductions from the maximum permissible ABC. Public comment was provided by Julie Bonney (Alaska Groundfish Data Bank), Ruth Christiansen (United Catcher Boats), Chad See (Freezer Longline Coalition), and Jon Warrenchuk (Oceana).

The SSC discussed this topic at length prior to reviewing the GOA and BSAI groundfish specifications for 2019-2020, and then revisited the topic after those specifications in order to ensure all comments and aspects of the issue were fully explored. Recalling the October 2018 report on this topic, the SSC reiterated that reductions from the maximum ABC are intended to be an infrequent action to respond to substantial unquantified risk. Adjustments from the maximum ABC are used to address uncertainty and risk that is not already accounted for via the Tier system and associated harvest control rules. Unique environmental or ecosystem conditions, anomalous population dynamics, or unquantified uncertainties in the assessment could all lead to reductions. A low stock status may not necessarily warrant a reduction from the maximum ABC, as the harvest control rule will have already reduced the fishing mortality limit. It is important to note that the SSC did not request this approach in order to add new reasons for adjusting from the maximum ABC, but to better describe the rationale when such changes are warranted.

The SSC considers the risk table approach an efficient method to organize and report this information and worthy of further investigation. The risk table approach used in 2018 includes four increasing levels of concern crossed with three types of contributing factors: assessment, population dynamics, and ecosystem. **The SSC recommends that one additional column be added to include concerns related to fishery/resource-use performance and behavior, considering commercial as well as local/traditional knowledge for a broader set of observations.** This additional column should not include socio-economic considerations, but rather indications of concern such as inability to catch the TAC, or dramatic changes in spatial or temporal distribution that could indicate anomalous biological conditions. **The SSC requests that all authors fill out the risk table in 2019, and that the PTs provide comment on the author's results in any cases where a reduction to the ABC may be warranted (concern levels 2-4).** The author and PT do not have to recommend a specific ABC reduction, but should provide a complete evaluation to allow for the SSC to come up with a recommendation if they should choose not to do so. The SSC emphasizes that the table should be used to reach a decision, not to justify a decision made *a priori*.

Reductions from the maximum ABC are made in response to factors not included in the Tier system. Therefore, the most preferable solution to avoid invoking this tool is to find quantitative ways to include these uncertainties in the assessment analyses. The recent experience with GOA Pacific cod and the addition of variable rates of natural mortality is a successful example of this. Ensemble modelling may also provide a tool for this task.

Where uncertainties cannot be included directly in the quantitative analyses, it is desirable to base the range of ABC reductions on expected risk reduction performance. Although helpful in developing this process so far, further summary of historical ABC reductions is likely not the best avenue for development of ranges of ABC reduction appropriate for each of the three concern levels. **Instead, the SSC requests that the work group explore methods for informing ranges of reduction based on simulated performance of ABC reductions under different conditions. This effort should be reported at the fall 2019 PT and SSC meetings.** The SSC is interested in whether performance is improved in simulations that could have some generality and represent cases where reductions to the maximum ABC have and have not been applied. These could include atypical recruitment conditions: a prolonged gap in recruitment success, spawning biomass dominated by a single year-class, or a very large year class moving into the exploitable and spawning biomass at different rates, or other simulations that the working group identifies as relevant. **The SSC also recommends careful tracking of the use of the risk table, the reductions made (or not) and the result on estimated stock trajectory and fishing mortality (perhaps through phase plots), so that we may continue to learn as we move forward.** It would be helpful to track each of the four levels of concern along with the percent of ABC reduction. The SSC anticipates that the use of the risk table will continue to evolve and recognizes that case-specific considerations may not lead to consistency in percentage reductions among all species within each level of concern.

For the 2019-20 specifications, the SSC acknowledged that reductions from the maximum ABC were discussed for five of the most important groundfish stock assessments in response to concerns not captured by the Tier system or harvest control rules designed for these species. This is atypically broad-reaching and reflects important scientific uncertainties in the current year's analyses.

General guidance on development of ensembles

In response to the PT's request for guidance on model averaging and the development of ensembles, the SSC offers the following general recommendations:

- Progress on this effort will require an example to work through both expected and unanticipated details of how this process may work. The SSC requests again for 2019 that one or more assessments bring forward an ensemble of models.
- The combining of model output should occur on the basic estimates from the assessment (biomass, F, etc.) and not the reference points themselves.
- Where variance estimates among models differ appreciably, it may be more appropriate to combine the posterior distribution functions from each model than to average the expectations.
- It will be difficult for the PTs to combine model results without the author's assistance. Such an approach should only be attempted in unique cases, and it is preferable for the author to identify the intention to bring forward an ensemble in September and perform the analysis before the November PT meetings.

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

The SSC received a presentation by Jim Ianelli (NMFS-AFSC) on the November 2018 GOA Plan Team meeting and on GOA groundfish OFL and ABC recommendations. Steve Barbeaux presented the GOA Pacific cod stock assessment. Grant Thompson (NMFS-AFSC) and Diana Stram (NPFMC) gave an overview of the November 2018 Joint and BSAI Plan Team meetings and on recommendations for BSAI groundfish OFLs and ABCs. Jim Ianelli (NMFS-AFSC) presented the EBS pollock stock assessment and Grant Thompson presented the BS and AI Pacific cod assessments.

The SSC reviewed the SAFE chapters and 2018 OFLs with respect to status determinations for GOA and BSAI groundfish. **The SSC-approved models indicated that no stocks were subject to overfishing in 2018. 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.**

In an effort to streamline and simplify the SSC report our recommended ABC/OFL’s and area apportionments are summarized exclusively in Table 1 (GOA) and Table 2 (BSAI). Recommendations that differ from Plan Team(s) are marked in **bold**.

Table 1. SSC recommendations for GOA groundfish OFLs and ABCs for 2019 and 2020, shown with 2018 OFL, ABC, TAC, and catch amounts in metric tons (2018 catches through November 8th, 2018 from AKR catch accounting system). None of the SSC recommendations differed from those of the GOA Plan Team.

Species	Area	2018 OFL	2018 ABC	2018 TAC	Catch 11/8/2018	2019 OFL	2019 ABC	2020 OFL	2020 ABC
Pollock	State GHL	n/a	4,037	-		n/a	3,396	n/a	2,722
	W (610)	n/a	30,188	30,188	30,676	n/a	24,875	n/a	19,939
	C (620)	n/a	79,495	79,495	79,974	n/a	71,459	n/a	57,279
	C (630)	n/a	40,939	40,939	39,511	n/a	30,372	n/a	24,345
	WYAK	n/a	6,833	6,833	4,125	n/a	5,748	n/a	4,607
	Subtotal	187,059	161,492	157,455	154,286	194,230	135,850	148,968	108,892
	EYAK/SEO	11,697	8,773	8,773	-	11,697	8,773	11,697	8,773
	Total	198,756	170,265	166,228	154,286	205,927	144,623	160,665	117,665
Pacific Cod	W	n/a	8,082	5,657	4,374	n/a	7,633	n/a	9,695
	C	n/a	8,118	6,089	5,120	n/a	7,667	n/a	9,738
	E	n/a	1,800	1,350	101	n/a	1,700	n/a	2,159
	Total	23,565	18,000	13,096	9,595	23,669	17,000	26,078	21,592
Sablefish	W	n/a	1,544	1,544	1,351	n/a	1,581	n/a	2,105
	C	n/a	5,158	5,158	5,617	n/a	5,178	n/a	6,931
	WYAK	n/a	1,829	1,829	1,804	n/a	1,828	n/a	2,433
	SEO	n/a	2,974	2,974	2,944	n/a	2,984	n/a	3,993
	Total	22,703	11,505	11,505	11,716	25,227	11,571	34,782	15,462
Shallow-Water Flatfish	W	n/a	25,206	13,250	56	n/a	25,620	n/a	25,952
	C	n/a	25,315	25,315	2,664	n/a	25,731	n/a	26,065
	WYAK	n/a	2,242	2,242	1	n/a	2,279	n/a	2,308
	EYAK/SEO	n/a	1,925	1,925	1	n/a	1,957	n/a	1,983
	Total	67,240	54,688	42,732	2,722	68,309	55,587	69,167	56,308
Deep-Water Flatfish	W	n/a	413	413	3	n/a	416	n/a	420
	C	n/a	3,400	3,400	181	n/a	3,443	n/a	3,488
	WYAK	n/a	3,239	3,239	6	n/a	3,280	n/a	3,323
	EYAK/SEO	n/a	2,332	2,332	5	n/a	2,362	n/a	2,393
	Total	11,294	9,385	9,385	195	11,434	9,501	11,581	9,624
Rex Sole	W	n/a	3,086	3,086	83	n/a	2,951	n/a	2,956
	C	n/a	8,739	8,739	1,553	n/a	8,357	n/a	8,371
	WYAK	n/a	1,737	1,737	2	n/a	1,657	n/a	1,664
	EYAK/SEO	n/a	1,811	1,811	-	n/a	1,727	n/a	1,734
	Total	18,706	15,373	15,373	1,638	17,889	14,692	17,942	14,725
Arrowtooth Flounder	W	n/a	37,253	14,500	1,043	n/a	35,994	n/a	34,765
	C	n/a	73,480	48,000	16,391	n/a	70,995	n/a	68,575
	WYAK	n/a	16,468	6,900	39	n/a	15,911	n/a	15,368
	EYAK/SEO	n/a	23,744	6,900	25	n/a	22,941	n/a	22,157
	Total	180,697	150,945	76,300	17,498	174,598	145,841	168,634	140,865
Flathead Sole	W	n/a	12,690	8,650	151	n/a	13,234	n/a	13,771
	C	n/a	20,238	15,400	1,894	n/a	21,109	n/a	21,965
	WYAK	n/a	1,932	1,932	-	n/a	2,016	n/a	2,097
	S	n/a	406	406	-	n/a	423	n/a	440
	Total	43,011	35,266	26,388	2,045	44,865	36,782	46,666	38,273

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

Table 1. continued.

Species	Area	2018 OFL	2018 ABC	2018 TAC	Catch as of 11/8/18	2019 OFL	2019 ABC	2020 OFL	2020 ABC
Pacific ocean perch	W	n/a	3,312	3,312	3,225	n/a	3,227	n/a	3,125
	C	n/a	20,112	20,112	17,644	n/a	19,646	n/a	19,024
	WYAK	n/a	3,371	3,371	3,352	n/a	3,296	n/a	3,192
	W/C/WYAK	31,860	26,795	26,795	24,221	31,113	26,169	30,128	25,341
	SEO	2,902	2,441	2,441	-	2,838	2,386	2,748	2,311
	Total	34,762	29,236	29,236	24,221	33,951	28,555	32,876	27,652
Northern Rockfish	W	n/a	420	420	297	n/a	1,190	n/a	1,122
	C	n/a	3,261	3,261	2,047	n/a	3,338	n/a	3,147
	E	n/a	4	-	-	n/a	1	n/a	1
	Total	4,380	3,685	3,681	2,344	5,402	4,529	5,093	4,270
Shortraker Rockfish	W	n/a	44	44	38	n/a	44	n/a	44
	C	n/a	305	305	315	n/a	305	n/a	305
	E	n/a	514	514	402	n/a	514	n/a	514
	Total	1,151	863	863	755	1,151	863	1,151	863
Dusky Rockfish	W	n/a	146	146	50	n/a	781	n/a	774
	C	n/a	3,502	3,502	2,831	n/a	2,764	n/a	2,742
	WYAK	n/a	232	232	11	n/a	95	n/a	94
	EYAK/SEO	n/a	77	77	7	n/a	60	n/a	60
	Total	4,841	3,957	3,957	2,899	4,521	3,700	4,484	3,670
Rougheye and Blackspotted Rockfish	W	n/a	176	176	79	n/a	174	n/a	172
	C	n/a	556	556	434	n/a	550	n/a	545
	E	n/a	712	712	203	n/a	704	n/a	697
	Total	1,735	1,444	1,444	716	1,715	1,428	1,699	1,414
Demersal shelf rockfish	Total	394	250	250	133	411	261	411	261
Thornyhead Rockfish	W	n/a	344	344	160	n/a	326	n/a	326
	C	n/a	921	921	665	n/a	911	n/a	911
	E	n/a	773	773	325	n/a	779	n/a	779
	Total	2,717	2,038	2,038	1,150	2,688	2,016	2,688	2,016
Other Rockfish	W/C	n/a	1,737	1,737	1,030	n/a	1,737	n/a	1,737
	WYAK	n/a	368	368	126	n/a	368	n/a	368
	EYAK/SEO	n/a	3,489	200	51	n/a	3,489	n/a	3,489
	Total	7,356	5,594	2,305	1,207	7,356	5,594	7,356	5,594
Atka mackerel	Total	6,200	4,700	3,000	1,431	6,200	4,700	6,200	4,700
Big Skate	W	n/a	504	504	312	n/a	504	n/a	504
	C	n/a	1,774	1,774	880	n/a	1,774	n/a	1,774
	E	n/a	570	570	70	n/a	570	n/a	570
	Total	3,797	2,848	2,848	1,262	3,797	2,848	3,797	2,848
Longnose Skate	W	n/a	149	149	58	n/a	149	n/a	149
	C	n/a	2,804	2,804	553	n/a	2,804	n/a	2,804
	E	n/a	619	619	232	n/a	619	n/a	619
	Total	4,763	3,572	3,572	843	4,763	3,572	4,763	3,572
Other Skates	GOA-wide	1,845	1,384	1,384	681	1,845	1,384	1,845	1,384
Sculpins	GOA-wide	6,958	5,301	5,301	550	6,958	5,301	6,958	5,301
Sharks	GOA-wide	6,020	4,514	4,514	2,886	10,913	8,184	10,913	8,184
Squids	GOA-wide	1,516	1,137	1,137	41	-	-	-	-
Octopuses	GOA-wide	1,300	975	975	139	1,300	975	1,300	975
TOTAL		655,707	536,921	427,512	240,955	664,889	509,507	627,049	487,218

* 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.

Table 2. SSC recommendations for BSAI groundfish OFLs and ABCs for 2019 and 2020 are shown with the 2018 OFL, ABC, TAC, and Catch amounts in metric tons (2018 catches through November 3rd from AKR Catch Accounting include CDQ). Recommendations are marked in **bold** where SSC recommendations differ from those of the BSAI Plan Team.

		2018			Catch as of	2019		2020	
Species	**Area**	**OFL**	**ABC**	**TAC**	**11/3/2018**	**OFL**	**ABC**	**OFL**	**ABC**
Pollock	EBS	4,797,000	2,592,000	1,364,341	1,376,730	3,914,000	2,163,000	3,082,000	1,792,000
	AI	49,289	40,788	19,000	1,805	64,240	52,887	66,981	55,125
	Bogoslof	130,428	60,800	450	9	183,080	137,310	183,080	137,310
Pacific cod	BS	238,000	201,000	188,136	168,962	216,000	181,000	183,000	137,000
	AI	28,700	21,500	15,695	14,549	27,400	20,600	27,400	20,600
Sablefish	BS	2,887	1,464	1,464	1,573	3,221	1,489	4,441	1,994
	AI	3,917	1,988	1,988	644	4,350	2,008	5,997	2,688
Yellowfin sole	BSAI	306,700	277,500	154,000	124,519	290,000	263,200	284,000	257,800
Greenland turbot	BSAI	13,148	11,132	5,294	1,825	11,362	9,658	10,476	8,908
	BS	n/a	9,718	5,125	1,664	n/a	8,431	n/a	7,777
	AI	n/a	1,414	169	161	n/a	1,227	n/a	1,131
Arrowtooth flounder	BSAI	76,757	65,932	13,621	6,506	82,939	70,673	83,814	71,411
Kamchatka flounder	BSAI	11,347	9,737	5,000	3,053	10,965	9,260	11,260	9,509
Northern rock sole	BSAI	147,300	143,100	47,100	28,219	122,000	118,900	147,500	143,700
Flathead sole	BSAI	79,862	66,773	14,500	10,649	80,918	66,625	83,190	68,448
Alaska plaice	BSAI	41,170	34,590	16,100	23,028	39,880	33,600	37,860	31,900
Other flatfish	BSAI	17,591	13,193	4,000	5,974	21,824	16,368	21,824	16,368
Pacific Ocean perch	BSAI	51,675	42,509	37,361	33,506	61,067	50,594	59,396	49,211
	BS	n/a	11,861	11,861	9,272		14,675		14,274
	EAI	n/a	10,021	9,000	8,067		11,459		11,146
	CAI	n/a	7,787	7,500	7,312		8,435		8,205
	WAI	n/a	12,840	9,000	8,855		16,025		15,586
Northern rockfish	BSAI	15,888	12,975	6,100	5,730	15,507	12,664	15,180	12,396
Blackspotted/ Rougheye rockfish	BSAI	749	613	225	226	676	555	868	715
	EBS/EAI	n/a	374	75	54	n/a	351	n/a	448
	CAI/WAI	n/a	239	150	172	n/a	204	n/a	267
Shortraker rockfish	BSAI	666	499	150	238	722	541	722	541
Other rockfish	BSAI	1,816	1,362	845	944	1,793	1,344	1,793	1,344
	BS	n/a	791	275	201		956		956
	AI	n/a	571	570	743		388		388
Atka mackerel	BSAI	108,600	92,000	71,000	67,954	79,200	68,500	73,400	63,400
	EAI/BS	n/a	36,820	36,500	33,646		23,970		22,190
	CAI	n/a	32,000	21,000	20,889		14,390		13,310
	WAI	n/a	23,180	13,500	13,419		30,140		27,900
Skates	BSAI	46,668	39,082	27,000	27,815	51,152	42,714	48,944	40,813
Sculpins	BSAI	53,201	39,995	5,000	4,882	53,201	39,995	53,201	39,995
Sharks	BSAI	689	517	180	96	689	517	689	517
Squids	BSAI	6,912	5,184	1,200	1,731	n/a	n/a	n/a	n/a
Octopuses	BSAI	4,769	3,576	250	270	4,769	3,576	4,769	3,576
Total	BSAI	6,235,729	3,779,809	2,000,000	1,911,437	5,340,955	3,367,578	4,491,785	2,967,269

[a] The SSC recommendation for "maximum subarea species catch" of blackspotted/rougheye rockfish in the WAI portion of the CAI/WAI is 37 mt in 2019 and 48 mt in 2020.

GOA – BSAI Sablefish

The SSC received a presentation on the sablefish stock assessment as part of the GOA PT report. Public comment was provided in written form from Linda Behnken (Alaska Longline Fishermen's Association) and Malcolm Milne (North Pacific Fisheries Association), and through direct testimony from Julie Bonney (Alaska Groundfish Data Bank).

The SSC commends the assessment authors for a well-written assessment and thoroughly documented analyses. No changes were made to the assessment model from last year, other than adding updated data. There was a notable 19% increase in the estimate of $B_{100\%}$, as the 2014 year-class was included in the average recruitment calculation, despite a 30% reduction in the magnitude of the 2014 year-class estimate. The stock therefore still falls into Tier 3b, despite the expectation in last year's projections that it would be elevated to Tier 3a. The SSC noted that both of these patterns could occur again in the near future. **The SSC endorsed the use of this model for management.**

The SSC recognized the author's use of the risk matrix for determining concerns that might indicate a reduction from the maximum ABC. The author and PT agreed on a Level 2 concern for assessment-related considerations, Level 4 for population dynamics-related considerations, and a Level 2 concern for ecosystem considerations. **The SSC agreed that these concerns warranted a 45% reduction to the maximum ABC.** Specifically, there were three particularly important concerns not explicitly included in the Tier-system calculation of maximum ABC: 1) uncertainty about the size of the 2014 year class, 2) potential effects of increased exploitation on the spawning biomass older than age-4 due to increased ABC, and 3) environmental conditions related to the recent 'heat wave' in the GOA. Uncertainty in the 2014 year class is not adequately propagated into the projected maximum ABC because the projection tools employed do not fully account for parameter uncertainty. There are currently very few older fish in the stock. The assessment makes the strong assumption that selectivity has not shifted to avoid small sablefish, but if such a shift has occurred the actual fishing mortality rate on the older fish may be very high currently and through 2020. The warm conditions in the GOA have led to apparent increased mortality for Pacific cod and birds; although its effect on sablefish remains unknown, it currently represents a serious concern.

The SSC noted that the adjustment to the maximum ABC to account for predicted whale depredation is now an established method that does not rely on the risk table, and should be considered a separate exercise and a standard practice moving forward. There was some discussion that the state fisheries, recreational catch and research removals have recently been of similar magnitude to the predicted whale depredation and could be considered for inclusion into the mortality used in the assessment and ABC considerations, as is the case for several other assessments, in the future.

The SSC highlighted the importance of how selectivity and natural mortality are treated in this assessment to both the scale of the estimates as well as the stability of the model. **The SSC requests that the authors continue to address lack-of-fit to compositional data in this assessment through exploration of alternative selectivity approaches including time-varying methods. In addition, the uncertainty described by the prior developed for natural mortality, but not included in the assessment, remains an important avenue for development. The SSC looks forward to seeing models in 2019 that continue to explore both of these issues. If individual models that include the uncertainty in these processes simultaneously remain unstable, then ensemble approaches including models representing alternative hypotheses may be an alternative solution.**

The SSC continues to request that a new apportionment approach be presented next year, noting that the percentages have now been static for many years. The potential for changes in distribution in the fishery and/or the population may become more pronounced with the increasing contribution of the 2014 year class.

Previous studies investigating the relationship between recruitment and environmental processes may need to be updated in light of the 2014 year class, as it may add a highly influential observation for such analyses. On page 40 of the document, results of a recruitment study by Shotwell et al. (2014) are cited in which the best model suggested that colder than average wintertime sea surface temperatures in the central North Pacific represent oceanic conditions that create positive recruitment events for sablefish in their early life history. Given that the large 2014 year class resulted from very warm conditions during early life, it could be informative to update this analysis. Moreover, given the recent finding of genetic similarity of sablefish along the entire west coast and given the concurrent large 2014 year class in the California Current system, it may be appropriate to examine environmental conditions beyond the central North Pacific for a common mechanism(s) for sablefish recruitment success along their full geographic distribution. Schirripa and Colbert (2005; Fisheries Oceanography 15: 25-36) found evidence that northward Ekman transport, eastward Ekman transport, and sea level could explain ~70% of the variability in sablefish recruitment in the California Current between 1974 and 2000. It would be interesting to know if that model continues to hold and whether a unified model can be developed to explain sablefish recruitment strength throughout their full geographic range.

In light of the most recent genetic research suggesting no population structure throughout the species range in the NE Pacific, the SSC strongly encourages the collaborative work with Canadian and West coast scientists on a combined stock assessment. Comparisons of recruitment among regions could also add information on the distribution and coherence of the 2014 year class.

C-2 GOA SAFE and Harvest Specifications for 2019/20

GOA Walleye Pollock

<u>W/C/WYAK Gulf of Alaska</u>

This assessment was presented by Jim Ianelli (AFSC) with clarifications provided by the lead stock assessment scientist, Martin Dorn (AFSC). Public testimony was provided by Julie Bonney (Alaska Groundfish Data Bank), who questioned the rationale for the buffer used to reduce ABC from the maximum permissible value, noting that fishery performance was excellent this year.

This year's assessment is a routine update with new data from 2016 and 2017 based on several sources of new information from 2017 and 2018. The current conflict between the hydroacoustic and bottom trawl surveys continued with the new data, with the two most recent data points in the hydroacoustic survey being extremely high and the most recent data points in the NMFS and ADF&G bottom trawl surveys being near their historic lows. The spatial distribution of pollock appeared to be much more compressed compared to distributions in the recent past. Another concern is the current heatwave, which may result in poor prey quality for pollock in the next year.

The focus of this assessment was the utilization of newly-available net-selectivity corrected acoustic estimates, starting in 2008. Use of these estimates resulted in increased estimates of age-1 and -2 abundance and slightly reduced estimates of older ages. Three new models were considered, using corrected estimates for the Shelikof survey, the Shumagin survey, or both, and were compared to last year's selected Model 17.2 without the corrected estimates. **The SSC concurred with the choice by the PT and authors of Model 18.3, which uses the longest available time series from only the Shelikof survey and omits a power term deemed no longer necessary.**

Results from the stock assessment show the fishery relies primarily on a single strong 2012 year-class, because more recent year-classes appear to be weak. Projected spawning biomass shows a decline in 2019 as the 2012 year-class will play a smaller role as it ages.

The stock is in Tier 3a as female spawning biomass is above $B_{40\%}$. The use of Model 18.3 resulted in a substantially higher value for max ABC in 2019 (158,518 t) than was projected last year (113,513 t). The authors used the risk table approach and concluded that a substantially increased level of concern is warranted. Consequently, they proposed a 15% buffer to obtain the ABC for 2019. The PT avoided the risk table approach and recommended a two-year stair-step by averaging the projected maxABC from last year's assessment with the maxABC from this year's assessment. The resulting ABC is 14.2% below maxABC from this year's assessment. **The SSC recommends adopting the PT's recommendations for ABC, due to concerns about reliance on a single year-class, poor recent recruitments, poor model fit to recent survey data, unassessed trends in natural mortality and anticipated poor prey quality related to warm ocean temperatures, and the most recent bottom trawl surveys resulting in biomass estimates near historic lows. The SSC also agrees with the authors' and PT's standard determination of OFL.**

East Yakutat/Southeastern Alaska

For East Yakutat and Southeastern Alaska, Tier 5 calculations are done with the random effects model applied to bottom trawl survey data and remain unchanged from last year. The SSC agrees with the authors and PT to use this approach to estimate current biomass.

Area apportionment

Area apportionments were updated, using the same approach as in recent assessments. The SSC concurs.

Recommendations

The SSC concurred with the following PT recommendations from October 2018:

1. Examine trawl catchability in relation to the age-structure of the population.
2. Continue to investigate alternative data weighting procedures.
3. Attempt to construct a weighted availability index by depth.
4. Explore environmental covariates in the delta-GLM analysis of survey abundance.

The SSC also agreed with two additional recommendations of the PT at this meeting:

5. Attempt to estimate maturity-at-age within the stock assessment.
6. Conduct a sensitivity study to the effect of survey indices on the stock assessment model.

GOA Pacific cod

The SSC received a presentation on the 2018 Gulf of Alaska Pacific cod stock assessment and received public testimony from Chad See (Freezer Longline Coalition). The Pacific cod stock in the Gulf of Alaska experienced a drastic decline in biomass and abundance since 2015, first reported in October following the 2017 bottom trawl survey. As detailed in the Ecosystem Status Report, the Gulf of Alaska experienced anomalous warm conditions throughout the water column starting in 2014 and extending through 2016 (a warm event known as 'The Blob', but now characterized in this assessment as 'marine heat waves'). This unusual warm event apparently affected the entire ecosystem and, in particular, affected prey availability for upper trophic level predators as was evident in a number of ecosystem indicators including the poor condition of Pacific cod in recent years. These factors led to the current suite of models, which include environmental factors in the assessment including a brief period of high natural mortality (*M*) and catchability of a survey that is related to a temperature index.

Eight model alternatives were presented for consideration. In each model, the rapid decline in abundance and biomass continued from 2017 to 2018. This decline was reinforced by the AFSC longline survey

Relative Population Number (RPN) index that declined from 2017 to 2018, with the 2018 value being the lowest in the time-series.

The new data used in the assessment this year included 2012-2017 fishery age composition data (which have not been previously available). The author found that through multiple reader tests, there was ageing-error bias in otoliths aged prior to 2007. By the time of this discovery, it was not yet possible to correct for this effect in any of the assessment models.

Model alternatives presented included:

1. Expanding the heatwave natural mortality block to include 2014
2. Using the marine heatwave index as a predictor of natural mortality
3. Using less constraining priors on natural mortality
4. Excluding all age composition data, or just the biased pre-2007 data
5. Using length- rather than age-based maturity, because of age-reading bias
7. Using new von Bertalanffy growth parameters generated from post-2007 survey age data

In the author's recommended model (18.10.44) there have been some substantial structural and data changes since last year's model. These include length-based maturity, extending the marine heat wave natural mortality to 2014 – 2016, the prior CVs on natural mortality were increased, the von Bertalanffy growth parameters were updated, and with the discovery of biased ages, removing age data prior to 2007. It also has an improvement in some of the fits to the data and model parameters are better estimated. The retrospective pattern has improved. **The SSC concurred with the authors' recommended model.**

For the 2019 projected ABC, the author recommended a decrease from the maximum permissible ABC. The authors filled out the new risk matrix framework in which the overall level that was recommended was 4 (extreme concern) based on population dynamics considerations, as the spawning biomass is at its lowest point in the 41-year history of the assessment. However, the levels of ecosystem and assessment considerations were only rated at Level 2. Overall, the ABC that was recommended (17,000 t) resulted in a 13.6% reduction from the maximum permissible ABC. This reduction was determined based on catch projections that resulted in the spawning biomass estimate being above 20% of unfished levels through 2020. Since the stock is already below $B_{40\%}$, the SSC noted that the ABC reduction of 13.6% is in addition to the buffer incorporated by the sloping harvest control rule which results in a total buffer of 59% from $F_{40\%}$. Because of this, the SSC considered that perhaps the population dynamics score could be reduced to Level 2 because most of the consideration was based on stock status and much of that was already built into the harvest control rule.

The SSC supports this reduction in ABC and highlights the substantial risk implied in these projections that Pacific cod biomass will continue to decline and could soon approach the overfished level given the uncertainty of the projections. The SSC was hesitant to endorse the $B_{20\%}$ rationale as an ABC consideration, and preferred the rationale of stability in future levels of spawning biomass.

The SSC is concerned about the way the projection model is being used for this assessment. Using the recruitment estimates from a model variant that does not include the differential M for the marine heat wave is something that needs to be considered carefully because it affects recruitments outside of the marine heat wave period. Thus, the reference points are dependent on this assumption. This becomes especially important as the stock is close to a crucial management and biological thresholds ($B_{20\%}$ and $B_{17.5\%}$) and improved estimates of the probability of breaching these thresholds in the future could better inform the Council's decisions. The SSC would like the authors to evaluate the standard projection model and compare with projections generated within the SS model under different assumptions about natural mortality (perhaps time or age-varying) and recruitment.

Length composition data for Pacific cod is now available for the IPHC setline survey. Although length data is only available starting in 2018, the SSC agrees with the GPT that the authors should explore a model that includes the IPHC survey. This additional survey is an annual survey that could provide valuable information during off years for the bottom trawl survey in depths and areas not covered by the AFSC longline survey. Examination of the 2018 length composition may provide sufficient information on whether a selectivity curve from another survey or fishery may be a good approximation for the IPHC survey selectivity in order to avoid estimating an IPHC-specific selectivity curve.

The SSC supports the PT recommendation to investigate the role that fishery catch has had on the decline in abundance. That is, project estimated historical recruits forward without fishing mortality.

The SSC is strongly concerned about removing age data from the model. However, the authors had insufficient time to incorporate the new information in this assessment model. The SSC recommends prioritizing the incorporation of ageing bias and aging error in the model for future model alternatives.

In 2017 the author, PT and SSC accepted the use of temperature-dependent time-varying catchability for the AFSC longline survey. The SSC would appreciate more information in the SAFE on the mechanism of the CFSR temperature index on longline catchability. The authors could evaluate if this effect would be different across sizes of fish and if this might be more appropriately handled with time-varying selectivity instead of catchability.

The SSC discussed that the length at 50% maturity changed from the original Stark study based on additional data. The previous value was 50 cm, the text states it is now 57 cm and Figure 2.59 says it is 53 cm. The SSC requests that the authors provide more information how the new length-at-maturity parameters were derived and which data were included.

The SSC was concerned by how much the reference point values of F changed when it appeared at least qualitatively that selectivity had not changed much and stock status was similar. The SSC would like clarification if these F values are based on combining selectivities from gear types with maximum selectivities at different ages, or if this was a result of changing to a new maturity ogive. In cases where multiple fleets with differing and domed selectivity curves are estimated, it may be more informative to consider an average F across a range of ages than the raw sum of apical Fs.

GOA Atka Mackerel

No stock assessment was conducted this year, so OFLs and ABCs are rollovers from the previous stock assessment.

GOA Flatfish

Shallow-water Flatfish Complex

The complex is on a 4-year assessment cycle and the last the last full assessment done in 2017. This year a partial assessment was done.

In this complex, northern and southern rock sole are Tier 3a species and are assessed separately from the other shallow-water flatfish. For northern and southern rock sole, no changes were made to the assessment model inputs and no changes were made to the assessment model. However, new data added to the projection model included updated 2017 catch and catch estimates for 2018 and 2019. Other shallow-water flatfish are assessed in Tier 5. No changes were made to the input data or the random effects model, so the OFL and ABC for the other shallow-water flatfish species are the same as those recommended last year. For the full shallow-water flatfish complex, the 2019 maximum allowable ABC is a 2% increase from the specified 2018 ABC and is less than 1% larger than the project 2019 ABC from last year. The author's suggested apportionment from the random effects model was the same as 2018, with most of the ABC going to the Western and Central GOA.

The SSC concurs with the author's and PT's recommended OFL and ABC for GOA shallow-water flatfish as shown in Table 1.

Deepwater Flatfish Complex

A partial assessment was completed for GOA deepwater flatfish . The complex is on a 4-year assessment cycle and was last assessed in 2015. The deep-water flatfish complex consists of Dover sole (Tier 3a), Greenland turbot and deepsea sole (Tier 6).

The age-structured model for Dover sole was run using parameter values from the accepted 2015 Dover sole assessment model. New information for this assessment includes updated 2017 and estimated 2018 catch. The 2019 and 2020 catch was projected using the 2013-2017 average catch for Dover sole. The new Tier 3a OFL and ABC are similar to those from last year's projection model. The Tier 6 OFLs and ABC for Greenland turbot and deepsea sole are the same as last year. So the overall recommended OFL and ABC for the deepwater flatfish complex in 2019 and 2020 are very similar to those of 2018.

Area apportionment for deepwater flatfish was based on the PT's recommended method from 2016. For Dover sole area apportionment, a random effects model was used to smooth survey biomass estimates and fill in gaps in depth/area strata. The resulting proportions of predicted biomass by area were used as the basis for the 2019 and 2020 apportionments for the Dover sole component of the deepwater flatfish complex. Greenland turbot and deepsea sole area apportionments are based on average survey biomass for each species, 2001-2017.

The SSC concurs with the author's and PT's recommended OFLs and ABCs for GOA deepwater flatfish as shown in Table 1.

Rex Sole

A partial assessment was presented for GOA rex sole. GOA rex sole is assessed every four years and was last assessed in 2017. Rex sole is assessed using an age-structured model in two distinct areas (Western-Central GOA and Eastern GOA) and falls under Tier 3a. New data for this year's assessment included updated catch information for 2017-2018. The single-species projection model was run separately for the two areas and the GOA-wide ABC and OFL are a sum of the two areas. The resulting OFL and ABC for the Eastern GOA are exactly the same as those projected in 2018 and the OFL and ABC for the Western-Central GOA varied little from those projected in 2018. The ABCs calculated for the Western-Central area, and likewise for the Eastern area, were apportioned based on random effects model predictions of the proportion of survey biomass among areas.

The SSC concurs with the author's and PT's recommended OFL and ABC for GOA rex sole as shown in Table 1.

Arrowtooth Flounder

A partial assessment was presented this year for GOA arrowtooth flounder. GOA arrowtooth flounder is assessed on a biennial basis and is managed in Tier 3a. The last full assessment was in 2017. New input data for the projection model included updated catch for 2017 and estimated catch for 2018-2019. The OFL and ABC recommendations for 2019 are very similar to what was projected with the 2017 full assessment model. Area apportionments were based on the proportion of survey biomass projected for each area using the survey averaging random effects model.

The SSC concurs with the author's and PT's recommended OFL and ABC for GOA arrowtooth flounder as shown in Table 1.

Flathead Sole

A partial assessment was presented this year for GOA flathead sole. GOA flathead sole is assessed every four years with an age-structured assessment model and is managed in Tier 3a. The last full assessment was in 2017. New input data for the projection model included updated catch for 2017 and estimated catch for 2018-2020. The new OFL and ABC recommendations for 2019 are very similar to what was projected with the 2017 full assessment model. Catches are well below maximum ABC.

Area apportionments were based on the proportion of survey biomass projected for each area using the survey averaging random effects model. The ABC area-apportionment percentages are identical to last year because the last GOA groundfish survey was conducted in 2017.

The SSC concurs with the author's and PT's recommended OFL and ABC for GOA flathead sole as shown in Table 1.

GOA Rockfish

Pacific Ocean Perch

A partial assessment was presented this year for Pacific ocean perch (POP). POP is assessed every two years with an age-structured assessment model and is managed in Tier 3a. The last full assessment was in 2017. New input data for the projection model included updated catch for 2017 and estimated catch for 2018-2020. The new OFL and ABC recommendations for 2019 are very similar to what was projected with the 2017 full assessment model. The ABC area apportionment was calculated with a random-effects model and percentages are identical to last year.

The SSC appreciates the authors replies to SSC comments. Authors examined the Ecosystem Status Report for indications of an impending severe decline for POP and none were found. An indicator of fish condition was the second lowest on record for POP in 2017 but it is unclear if this indicator has a strong relationship with population abundance, thus a reduced fish condition may not indicate an impending decline.

The SSC concurs with the author's and PT's recommended OFL and ABC for GOA POP as shown in Table 1.

The SSC supports the author's and PT's suggestions to investigate the following topics in the next CIE review for GOA rockfish (scheduled for spring 2019):

- incorporating hydroacoustic information into the assessment as the species are regularly found throughout the water column
- examining fishery-dependent information, e.g., how age samples are being collected
- examining catchability, which has been an ongoing issue for POP and other rockfish species, coupled with selectivity (a manuscript is currently in preparation to inform priors)
- examining the VAST model for POP, and possibly dusky and northern rockfish

Northern Rockfish

A full assessment was provided of the GOA northern rockfish stock in 2018. Changes to the accepted model from the 2015 assessment consisted of incorporating new data from multiple sources, including survey biomass estimates, catches from 2015 – 2017, estimated catch from 2018, fishery size compositions, and survey and fishery age compositions. There were also changes to the methodology utilized, including employing a model-based approach to estimating survey biomass and a rescaling of the likelihood weight of this index.

Authors provided a clear and thorough stepwise approach to incorporating changes in a series of three models. The previously accepted model (15.4) was modified by the addition of the new data. Model 18.1 was identical to Model 15.4 with the updated data and included the VAST model-based estimates of survey biomass, but maintained the negative log-likelihood weight of 1.0. Finally, the author and PT's recommended model (18.2) was identical to Model 18.1 but reduced the negative log-likelihood weight of the survey index to 0.25 to account for the increase in precision of the model-based survey estimates.

The SSC supports the use of Model 18.2 for the development of harvest specifications for 2019 and 2020. The SSC concurs with the recommendation to use the VAST model-based approach and agrees that the model-based survey biomass estimates obtained are likely more reasonable given the inherent patchiness and the observed spatial correlation of survey observations of northern rockfish. The inclusion of the VAST survey time series was a novel approach for northern rockfish and, as with other assessments, the model-based estimates were shown to reduce interannual variability in survey biomass and increase precision in those estimates compared to design-based estimates by accounting for spatial autocorrelation on the survey. Finally, this model also produces parameter estimates that are more biologically plausible than Model 18.1, where the weight of the negative log-likelihood of the survey index was not reduced, and are more consistent with the previously accepted model. All models evaluated struggle to fit the largest survey biomass estimates seen in the 2000s.

For this cycle, the SSC also agrees with the author's justification for the adjustment of the likelihood weight of the survey index to utilize this new time series more appropriately. Comparisons between the two models (Model 18.1 and 18.2) suggest relative insensitivity to the alternate weighting schemes. **However, the SSC questioned whether this rescaling is the most appropriate method to address the reduction in variability resulting from the use of the VAST model in estimating biomass.** The SSC suggested that this be a topic of discussion for the Joint PT, given the number of stocks that are currently using or planning to implement this methodology, and notes that there is an upcoming CIE review that will include discussions of the VAST model application for both northern and dusky rockfish that may provide some guidance as well. The PT suggested that the author could examine the approach by survey strata, though given the large number of potential strata, the SSC suggests that the use of depth and management areas as density covariates might be another approach.

Northern rockfish is managed under Tier 3a, as the estimated female spawning biomass (36,365 t) is above $B_{40\%}$ (30,480 t). **The SSC agrees with the recommended OFL and ABC, which is the maximum permissible, as detailed in Table 1.**

Area apportionments for each of the three GOA management regions are produced by the random effects model fit to the design-based survey biomass estimates, which represents a change in apportionment methodology. Previous assessments have used the average area-specific proportion from the three most recent GOA trawl surveys. The SSC agrees with the recommendation to use the random effects model for area apportionment and supports the new apportionments, noting that the eastern GOA apportionment for northern rockfish is included in the West Yakutat ABC for "other slope rockfish", as has occurred since 1999.

Finally, the SSC notes the increasing proportion of fish in the fishery length composition plus-group and looks forward to seeing the results of the ongoing investigations into alternative length composition bin structures. The SSC also agrees with the high priority placed on improving maturity-at-age information for northern rockfish.

Shortraker Rockfish

No stock assessment was conducted this year, so OFLs, ABCs, and apportionments are rollovers from the previous stock assessment.

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

No stock assessment was conducted this year, so OFLs, ABCs and apportionments are rollovers from the previous stock assessment.

Dusky Rockfish

A full assessment was presented for dusky rockfish in 2018. No major changes to the assessment methodology were proposed. Only a single model was presented. The accepted 2015 assessment model (15.5 – 2015) was updated with recent data, and identified as Model 15.5 (2018). Updated data included 2015 and 2017 survey age compositions, catch from 2015 – 2017 with estimated 2018 catch, fishery length compositions from 2015 and 2017, and fishery age compositions from 2014 and 2016.

Additionally, the model-based survey biomass estimates were also updated through 2017. The author notes that the methodology behind the model-based biomass estimates has evolved from a delta-GLMM utilized in 2015 into the GLMM as implemented within the VAST framework that has now been applied to several stocks. The authors assert that the results are similar, but do produce slightly different estimates, most notably in 1990 and in the most recent few years.

The SSC accepts the recommended Model 15.5 (2018) and the harvest specifications based on these model results (Table 1), including the use of the maximum permissible ABC. Dusky rockfish is managed under Tier 3a. Area apportionments for the Gulf-wide ABC are based on the application of the random effects model to design-based survey biomass estimates. **The SSC accepts these area apportionments and notes the shift of ABC to the Western region from the last assessment**, which is attributable to the increased magnitude of the survey catch near the Shumagin Islands. The Eastern GOA apportionment is further divided between the Western Yakutat and Eastern Yakutat/Southeast Outside based on the upper 95% confidence interval of the weighted average of the estimated proportion of biomass in the Western Yakutat area. For 2018, this proportion is 0.61.

The SSC supports the recommendations from the PT regarding the survey data from the 1980s, and continued investigations into the use of VAST model estimates, as will be explored in the upcoming CIE review that includes a focus on models for northern and dusky rockfishes, and for apportionment specifically in the dusky rockfish assessment.

Rougheye and Blackspotted Rockfish

A partial assessment was presented this year for the GOA rougheye and blackspotted (RE/BS) complex. The complex is assessed every two years with an age-structured assessment model and is managed in Tier 3a. The last full assessment was in 2017.

Catches were less than 50% of ABCs in 2017 and 2018, but catches increased in 2018 in all areas. Catches in 2018 remain within the range of the time series. Significant catch occurs in non-directed fisheries relative to the directed fishery. The increase in 2018 is consistent across gear types with one-third taken in longline fisheries and two-thirds taken in trawl fisheries. The majority of the RE/BS rockfish catch remains in the rockfish and sablefish fisheries, with some increase in the flatfish fisheries.
New input data for the projection model included updated catch for 2017 and estimated catch for 2018-2020. The new OFL and ABC recommendations for 2019 are very similar to what was projected with the 2017 full assessment model. The ABC area apportionment is calculated with a three-survey weighted average method and was identical to last year.

The SSC concurs with the author's and PT's recommended OFL and ABC for GOA RE/BS rockfish as shown in Table 1.

The SSC appreciates the authors' replies to SSC suggestions. Authors examined the Ecosystem Status Report concerning indicators for RE/BS and, based on that information, do not anticipate an impending severe decline in biomass for RE/BS rockfish in the GOA.

As part of the next full assessment, authors are planning to include a summary report on the estimated proportion of RE and BS in the commercial harvest and will examine multiple survey apportionment options. With regard to the estimated proportion of RE and BS in the commercial harvest, in the last full assessment, authors considered "worst-case" scenarios for RE/BS using a Tier 5 approach and the genetic identification rates for RE/BS rockfish. Results of that analysis indicated that it if every fish caught by the fishery were BS, harvest could exceed Tier 5 OFLs. Since the last assessment, the authors conducted a study on the fishery ages for RE/BS rockfish using otolith morphology and growth characteristics to distinguish the two species. That study has enabled the historical reconstruction of species composition in the fishery. The results suggest that two-thirds of the RE/BS catch is blackspotted rockfish. However, given that catches are low relative to total biomass (on the order of 0.6% to 2%), it was noted that presently there does not appear to be a conservation concern.

Demersal Shelf Rockfish (DSR)

A full assessment of the demersal shelf rockfish (DSR) complex was presented. The dominant component of this complex is yelloweye rockfish, which is assessed as a Tier 4 stock and accounts for greater than 95% of the total DSR catch in recent years. Other species include quillback, copper, rosethorn, canary, China and tiger rockfishes, which are assessed in aggregate as a Tier 6 stock complex. Primary sources of commercial catch include incidental catch in the halibut longline fisheries, and if sufficient quota is available, a limited directed fishery. Sport and subsistence catch are also included in this assessment. The SSC requests that the subsistence catch data, which has not been updated since 2015, be updated as soon as possible.

Harvest specifications for the complex are calculated as the sum of the OFL and ABC from both the yelloweye and non-yelloweye components. This assessment is based on relative abundance estimates from submersible (1998 – 2009) and ROV surveys (2012 – present) in four management areas in the Southeast Outside subdistrict in the eastern GOA.

There were no changes to the assessment methodology in 2018. Catch information and weight of sampled yelloweye rockfish from the commercial fishery were updated. Harvest specifications for yelloweye rockfish are based on the most recent density estimates from ROV surveys in each management area. These four areas, including east Yakutat (EYAK), Northern Southeast Outside (NSEO), Central Southeast Outside (CSEO), and Southern Southeast Outside (NSEO), are typically surveyed on rotating quadrennial cycle, such that 4-6 years may lapse between surveys of any single location. The SSC notes that three of the four management areas were surveyed in 2018 and, though these data were not available for this assessment due to the time necessary to review video recordings, commends ADF&G for their efforts to develop a more comprehensive biomass estimate.

Density estimates from 2017 in EYAK, from 2016 in CSEO and NSEO, and 2013 from SSEO were utilized in the 2018 assessment. In recent years, ROV density estimates have declined in each of the four management areas, with the exception of CSEO in 2016. From 2018 to 2019, yelloweye rockfish biomass increased from 11,508 t to 12,029 t, primarily driven by an increase in the average weight of commercially-caught fish in the CSEO and NSEO management areas.

The authors recommend an ABC reduced from the maximum permissible, using a Tier 5 approach of F = M = 0.02, as in previous years. This reduction was motivated by the uncertainty in biomass estimates and a general concern with the vulnerability of yelloweye rockfish given its life history. In order to account for uncertainty in the habitat area estimation, the lower 90% confidence interval of the biomass estimate is used to calculate the ABC. A habitat suitability model is under development, and the SSC suggests that further refinement of the area to which to apply density estimates may negate the use of this reduced biomass estimate in the future. There is also no explanation in the assessment as to why this particular reduction is used (i.e. lower 90% CI) or when it has been used in the past, though the staff presentation clarified that this is a standard approach that has been used for "many" years.

Despite the PT questioning the rationale of the author's precautionary approaches, they ultimately agreed with the author's recommended specifications. **The SSC accepts the assessment methodology for the use of the 2019 harvest specifications and agrees with the recommended OFL (Table 1). The SSC also requests further clarification on the authors' reasons for the reduction from maximum ABC.** The use of the risk table, as suggested by the PT, may inform whether a reduction from maximum ABC is warranted in the future. In the context of the risk table, the SSC discussed why a buffer larger than maximum ABC was being applied even though some aspects of the uncertainty described in the assessment could be considered "normal" (i.e. Level 1) for this stock and, thus, accounted for by the tier or model. The SSC also requests the authors present assessment results using the biomass point estimate, which would allow for comparison with the current methodology of using the lower 90% interval of the biomass estimate.

The SSC agrees with the ABC lower than the maximum permissible as recommended by the author and PT as an interim measure (Table 1). However, the SSC's motivation for the reduction is due to continued concerns regarding the long-term trend of this complex and in particular, the infrequency and irregularity of the surveys that provide biomass estimates. The decline in density estimates among multiple management areas is concerning and the overall decline in biomass estimates since the mid-90s (Figure 14.6), with the exception of the slight increase in biomass over the most recent two years, is notable. **As noted in previous years, the SSC looks forward to seeing developments on the age-structured assessment model**, recognizing that the introduction of this ASA model may not address all of the uncertainty issues with this assessment. For the Tier 6 non-yelloweye DSR species, the maximum catch from the years 2010 – 2014 are used for harvest specifications, as these are the only years with commercial, sport and subsistence catch estimates. The SSC requests the authors explore data- limited methods, beyond catch-based approaches, that may better reflect the species population dynamics.

Thornyhead Rockfish

A full assessment of the thornyhead complex was presented. The thornyhead complex is a Tier 5 assessment and includes three species of thornyheads, but focuses on shortspine thornyhead. Recent assessments have used the random effects model fitted to AFSC bottom trawl survey data to produce estimates of exploitable biomass, due to difficulties aging thornyhead. **The SSC continues to encourage research geared towards aging shortspine thornyheads in order to move to an age-structured assessment.** Shortspine thornyhead are primarily encountered in the central GOA, but appear to be distributed relatively evenly throughout the GOA. Major sources of GOA fishery catches include sablefish and rockfish fisheries, where shortspine thornyhead are taken incidentally but typically retained. In recent years, discard rates have increased, though the authors suggest this is the result of regulatory discards resulting from low sablefish catches.

In addition to updates to various data sources, the assessment authors responded directly to several comments made by the PT and the SSC regarding accommodation of multiple indices in the RE model. Authors included three model alternatives. Model 15.1 is the last accepted assessment model updated with 2018 data. Model 15.1a is identical to 15.1 but with bottom trawl biomass summed from 0 to 500m, which reduced the number of depth strata within each region fit by the RE model. Finally, Model 18.1 uses the same depth strata as Model 15.1a but also includes the AFSC longline survey Relative Population Weights (RPWs). The addition of a second observation error component of the longline survey to the total model likelihood allows the model to react to changes in both the longline and the trawl survey. Exploration of the model fits to each of the surveys illustrates how Model 18.1 moderates the response of the model to the bottom trawl survey. This increases stability of biomass estimates over time and provides more consistent apportionment across management areas over time as well. For this reason, Model 18.1 is the recommended model for both the authors and the PT, and the SSC commends the authors for their work to include this second data series.

The SSC accepts Model 18.1 for setting harvest specifications for shortspine thornyhead in 2019. The SSC endorses the new methodology to include the longline survey as an additional index in the RE model for this species, and further notes, as the authors do, that this approach may be applicable to other species encountered by more than one survey. Thornyheads are assessed as a Tier 5 complex, and the SSC agrees with the recommended harvest specifications, including the maximum permissible ABC, as detailed in Table 1. Apportionment by area is determined by the proportion of the total biomass within each region applied to the ABC. The SSC notes that the use of Model 18.1 results in an apportionment scheme that is also responsive to both bottom trawl and longline surveys. The percentages of the exploitable biomass in each of the regions are 16.2% in the western GOA, 45.2% in the central GOA and 38.6% in the eastern GOA, resulting in area-specific apportionments shown in Table 1.

GOA Sharks

A full assessment with updated survey catch data was provided for the GOA sharks complex, which consists of spiny dogfish, Pacific sleeper shark, salmon shark, and all other species of shark. Though the assessment was initially scheduled for 2017, it was delayed until this year to allow simultaneous assessment with the BSAI sharks complex. Since 2011 sharks in the GOA have been assessed as a Tier 6 complex, but OFL and ABC values for spiny dogfish are calculated using Tier 5 criteria with the survey biomass estimates, as estimated with a random effects model, considered a minimum estimate of biomass. In this new assessment, a catchability parameter based on tagging data is applied to the survey-based biomass for spiny dogfish to account for the proportion of the population not accessible to the survey, elevating the assessment to Tier 5 for this species. For all other shark species specifications continue to be set based on average historical catch from 1997-2007 (i.e., Tier 6, model 11.0). The aggregate OFL and ABC specifications for the complex are then calculated by summing OFLs and ABCs across assessments.

A single new model is presented for spiny dogfish. Acknowledging that previously reported dogfish abundance figures are likely underestimates because individuals are known to spend considerable time off the bottom, this model (model 15.3a) uses recent depth distribution data from satellite tags to quantify the proportion of the population susceptible to survey gear (bottom trawl and longline). A catchability (q) value of 0.21 was then applied to convert survey biomass into an estimate of total population size across the whole of the survey time series. For other shark species historic catch data continues to be utilized, though efforts are under way to apply various data poor stock assessment methods in an effort to obtain more realistic biomass estimates.

Harvest specifications generated by applying the new model for spiny dogfish represent an 81% increase from OFL and ABC values used in 2018. While this represents a substantial change in OFL and ABC for a complex of long-lived, generally slow-growing species that are not prone to rapid population fluctuations, it is believed to more accurately reflects population abundance and **the SSC supports use of the authors' recommended models for spiny dogfish (model 15.3a) and other sharks (model 11.0), and the resulting OFL and ABC (Table 1).** There were insufficient data to determine if the shark complex is in an overfished condition, but overfishing is not occurring for the GOA sharks complex.

While the SSC supports the authors' recommended models and specifications, we also note that the large increase in complex-wide ABC is driven entirely by model changes for spiny dogfish. This inadvertently opens other shark species to the possibility of additional exploitation risk despite a lack of evidence regarding whether this is sustainable. As the authors note, Ormseth and Spencer (2011) evaluated the vulnerability of groundfish species occurring in Alaska and found Pacific sleeper shark to be *the most vulnerable* of all species assessed. While no species of shark is currently targeted by existing fisheries in the GOA, the SSC notes the need to carefully track future landings of other sharks to ensure that unintended consequences of model improvements do not develop. As the assessment for spiny dogfish diverges further from the Tier 6 methods used for other sharks the authors should consider whether separation of the complex is warranted.

The SSC commends the authors on their novel use of q, informed by field studies, which is expected to make abundance indices from surveys more representative of true abundance. **The SSC recommends that authors of other Tier 5 assessments consider similar options to bolster confidence in biomass time series that appear to inadequately sample stock abundance because of issues with gear selectivity, or other biases.**

The SSC also recommends that:

- Authors continue exploration of spatiotemporal models, such as VAST, for spiny dogfish and various data limited assessment techniques for other sharks
- Uncertainty in the estimate of q be included in future assessments, perhaps by bootstrapping data used to derive q and performing a number of model runs using a plausible range of q values to evaluate model sensitivity
- Authors continue efforts to estimate biomass in NMFS areas 649 and 659, and that steps be taken to ensure future shark catches in Federal fisheries in 649 and 659 be fully accounted for in reporting
- A small working group examine estimation approaches for 649/659 Federal fisheries catches and how they should be accounted within federal assessments, as recommended by the PT.

GOA Skates

No stock assessment was conducted this year, so OFLs and ABCs are rollovers from the previous stock assessment.

GOA Sculpins

No stock assessment was conducted this year, so OFLs and ABCs are rollovers from the previous stock assessment.

GOA Octopus

No stock assessment was conducted this year, so OFLs and ABCs rollovers from those adopted by the SSC for 2018.

GOA Ecosystem Chapter

<u>General comments for all Ecosystem Status Report sections</u>

This year, as in the past, the Ecosystem Status Reports (ESRs) are insightful, well-written, and well-edited. All three chapters were helpful in providing a context within which to assess the stocks of commercially harvested fish in Federal waters of Alaska. The editors and authors have been very responsive to the comments and suggestions provided by the SSC in 2017. In 2016, the SSC raised the question as to whether sufficient resources were being devoted to the compilation and editing of the Ecosystem Considerations chapters. The SSC recognizes that this year, as was the case last year, NOAA provided sufficient additional resources to sustain the improvement of these documents. These additional resources allowed for more in-depth analyses of recent environmental changes, such as the examination of the reappearance of the heatwave in 2018 in the Gulf of Alaska, and the extraordinary conditions in the northern Bering Sea in 2018.

Now that the ESRs are providing a very quick turn around on the occurrence of unusual events that are likely to affect the setting of ABCs, there needs to be a mechanism in place for determining the likely impact of an event on management and a protocol of how to use the data effectively in a precautionary approach. This need is particularly acute for instances when an event occurs in a year when there was no survey of a region.

The SSC commends the ongoing efforts to expand the treatment of the Human Dimensions portion of the ESRs. In particular, a number of new indicators have been incorporated. The SSC notes that development of indicators on the health of fishing communities lags behind that of indicators for the health of the fish stocks and that the latter were developed and refined over a long time period. **The SSC encourages the continued development of these Human Dimensions sections and, in particular, the development of indicators on which the Council might be able to act in the advent of evidence of a problem**. Specific to the human population indicators, regional characterizations mask rural trends relative to urban centers, and it is good to see that efforts have been made to identify changes in the smaller communities. Now, there is need to develop "implications" sections that go beyond stating all the factors that might be responsible for the trends and to suggest, however tentatively, what these trends imply about the futures of the communities described.

Last year the SSC again raised the issue of how well report authors have managed to address the implications of their indicator findings for the current year. Overall, there appears to be improvement with respect to this issue, though room for further improvement remains. As indicated last year, the purpose of the ESR chapters is to provide the Council with information that may be relevant for adjusting the coming years' harvest specifications or biological reference points. Thus, the indices and their implications that are most valuable will be those that provide information that inform Council decisions.

Last year, the editors raised the question as to the possibility of a change in the organization of the ESR chapters and the SSC is pleased that the editors decided to maintain the present organization based on trophic-level.

The Introduction lists four ecosystem-based management goals of the NPFMC. These are not the same as the six goals listed on page 21 of the Fishery Ecosystem Plan; the two documents should be consistent.

There was a discussion on ways to reduce the overall document length and duplication. One example is the Executive Summary not having a bullet for every single contribution but instead only indicators that are outside of "normal" limits. This, in combination with the table of contents and a list of figures creates essentially three lists of all the indicators and really fattens up the document. Another simple reduction could be accomplishing by removing all but the first sentences out of the Table of Figures. If retained, the List of Figures should be written with captions that stand alone. **The SSC suggests authors explore these and other organization structures that reduce duplication in the documents.**

The SSC recommends more specific methods descriptions for the report card indicators. It was not always possible to tell what was being plotted and there are few specifics in the text of report (e.g., how means, standard deviations and trends were calculated). A stand-alone methods section (potentially hot-linked) could be a useful addition to the report.

The descriptions of report-card indicators do not discuss implications to fishery management although other indicators later in the report do. The SSC encourages the authors to work towards a discussion section of how or whether the 10 indicators are expected to be related to federally-managed stocks. The SSC recognizes that much of this will be stock-specific and ultimately go in ESP's.

Comments Specific to the GOA

The SSC heard a report by Stephani Zador and Ellen Yasumiishi of the AFSC on the 2018 ESR for the Gulf of Alaska. There were no public comments provided.

The ESR for the Gulf of Alaska is still expanding and developing, and the SSC wishes to recognize the hard work of the editors and the contributors in developing this valuable management product. The SSC looks forward to further development of the GOA chapter, including the development of additional indicators. The need remains to finalize indicators for the GOA report card and to make progress in the development of predictive capacity, as in the EBS Ecosystem report.

The Noteworthy Observations section was buried on page 37. When these are red-flag alert issues, it would seem that they should be moved forward, perhaps to page 5, right after the report card. If the "Noteworthy Observations" is a catch-all section for information that did not fit as standard indicators, perhaps renaming would clarify that and it should stay where it is.

In the present case, there is still considerable concern about the return of unusually warm waters. Indicators of bottom-up productivity were mixed. Positive indicators included the increase in both large and small zooplankton along the Seward Line, and the breeding success of pursuit-diving seabirds at Middleton Island and of piscivorous seabirds at the Semidi Islands was high. However, throughout both the eastern and western GOA, there were many indicators that pointed to a Gulf-wide decrease in secondary (zooplankton) productivity and a bottom-up limitation on fish stocks. This limitation will impact stocks over the next few years as the fish that were juveniles in 2017 and 2018 were of smaller size. These indicators included:

1. poor reproductive success for parakeet auklets in the Semidi Islands
2. record low marine survival for Auke Bay coho salmon that out-migrated in 2018 and 2017
3. record low marine survival for pink salmon in 2018

The mix of results on zooplankton and forage fish, with some down in abundance and others up, warrants concern regarding whether the Gulf's ability to support the usually large biomasses of fish is compromised. The poor returns of salmon do not inspire confidence that all is well. Evidence from murres, humpback whales, and sea lions all suggest population-level, long-term impacts of the heat wave. There was no quick rebound in 2018, as might have been expected if individuals had moved away and returned after the heat wave.

The SSC suggests that, if similar situations occur in the future, the authors attempt to pull together in a prominent, succinct section the most relevant indicators to aid the Council in evaluating the likely impacts on fish stocks. The effort to analyze the "blob" in the 2017 ESR was an excellent example of what is needed.

Organization and Clarity

There is a need to define what is large versus small zooplankton, and to provide this information in the descriptions of the pertinent indicators (e.g., see page 35). This may resolve the confusion in indicator descriptions noted above.

The bullets describing the report card are somewhat confusing because they appear to be a single bullet for each indicator time series, but they do not always reflect what is seen in the corresponding figure. If the report card indicator was not updated in the current year, the text could either state "no new data were available since the last report" or else clarify that background data were derived from alternate sources. Currently the text is a mix of descriptions for current years, previous years, and current years from alternate data. This may be all that is possible, but it is confusing to read. For example, bullet 2 is about freshwater input and describes conditions in the current year, but the Fresh Water Input indicator has not been updated in the last 5 years. The information that backed up this description was not presented. The SSC suggests that the text could be clarified by stating "although the FW input index was not updated recently, we learned from xx that runoff was enhanced (see Bond page…)".

The 3rd and 4th bullet statements (zooplankton) apparently conflict. The mesozooplankton biomass suggests plentiful but smaller zooplankton. The copepod community size statement says there were more large species available. It is not clear how these are related.

The 5th bullet (motile epifauna) was confusing because there are no data for 2018 in the graph. The bullet statement sounds current but does not specify a year, so one cannot tell if this is a statement about biomass in an earlier year or is current year data derived from a different source.

In regard to climate indicators, although all the report cards have a climate index selected (NPI or PDO), the main interest is likely sea temperature and a summary of that would be useful.

Throughout the report, there is a wide range in what "baseline" various statements are comparing to. They may be change since 2017, since the last time indicator was updated, since the heat wave period, deviations from the long term mean (taken over widely varying dates), or since a time previously thought to be significant. Although the SSC recognizes the reasons for reporting in this context, interpretation is challenging, especially since it is not always clear whether the current year is within or outside "normal" limits. **The SSC encourages standardizing reporting relative to a consistent baseline when possible, and otherwise being clear on the time frame of reference.**

There may be a problem with eliminating chicks with non-linear growth from the calculations, as this can skew the measure upwards. One should include all chicks weighed between the ages when the growth rate is linear in healthy chicks (see page 36).

The SSC welcomes the additional computation of Annual Surplus Production with and without the inclusion of pollock.

There should be concern about the low graduation rates of students in some schools. Is there anything that the Council or Industry could do to help bring these up by offering incentives?

Western Gulf

By late 2018, water temperatures had increased sufficiently to be considered a renewed heat wave in the western GOA, although not as severe as the heat wave of 2014-16 (the "blob"). If this new heatwave continues it may have a negative impact on fish stocks.

Earlier in 2018, there were some positive indicators, such as increases in zooplankton and increases in the abundance of large zooplankton. The 2017 shift toward larger zooplankton is likely good for groundfish, seabirds and baleen whales. However, indications that capelin abundance may be low is potentially of concern given their importance as prey of groundfish, as well as for seabirds and marine mammals. Capelin prefer cold water, and may be slow to recover as long as water temperatures remain high.

The decline in octopus catches is potentially of concern.

Eastern Gulf
Although there were more zooplankton in Icy Strait, most were small, with the abundance of large species decreasing. This does not suggest improved foraging conditions for marine birds and mammals or for fish.

The continuing decrease in herring is of concern given their role as forage fish.

The failure of rhinoceros auklet breeding in 2018 points to a low abundance of forage fish, as does the decline in non-pup counts of Steller Sea Lions. The most recent diet data for Steller sea lions in the Gulf are from 1999-2009 (west) and 1997-1999 (east). The SSC suggests the authors explore if there are more recent data available on Steller sea lion diets to understand the mechanism(s) behind recent pup-declines and if the diets changed with the heatwave.

C-3 BSAI SAFE and Harvest Specifications for 2019/20

EBS Walleye Pollock

The SSC requests that the author uses the model numbering convention in future assessments.

This is a mature assessment done annually with new catch, survey, and composition information. The base age-structured assessment model, labeled Model 0, was the preferred Model 16.1 from last year without new data. The inclusion of the new data in the Model 16.1, labeled Model 1, resulted in a 2017 biomass estimate that was similar to last year and a lower 2018 biomass estimate. Model 2 included data from the northern Bering Sea (NBS) and used the VAST model to account for spatiotemporal correlations and missing data (due to no surveys in many years in the NBS). Model 3 was the same as Model 1 but reduced the coefficients of variation in the most recent year as a sensitivity study of data variability versus structural uncertainty. Model 4 was the same as Model 1 but adjusted the steepness prior for recruitment to examine the effect on the spawner-recruit relationship, making it more like a Beverton-Holt asymptotic relationship instead of the standard Ricker dome-shaped relationship.

Model 1 (with the new data) produced biomass estimates that were very similar to the base Model 0 from last year. Surprisingly, inclusion of the NBS data in Model 2 also produced similar recent biomass estimates. Model 3 with reduced coefficients of variation produced slightly lower biomass estimates; this was due to the increased weighting of the survey data, which had declines in survey abundance from 2017 to 2018. Regardless of the model, the estimated 2012 and 2013 year-classes are strong; later year-classes appear weak to average. Estimated spawning biomass is well above Bmsy and B40%.

EBS pollock has been placed in Tier 1 for years, because there exists a reliable probability density function for Fmsy; the analysis of Model 4 reaffirms this placement. **Because of the small differences among Models 1 – 3, the SSC concurs with the authors and the PT to select Model 1 as the preferred model and to set maximum ABCs and OFLs for 2019 and 2020 using standard Tier 1a formulae.** Also, as has been done since at least 2014, 2018 and 2019 ABCs are calculated using the Tier 3a formula for conservatism. The SSC looks forward to an explicit set of concerns that explain the ABC adjustment in the next assessment. In addition, the SSC commends the authors for providing a detailed decision table, showing several metrics of risk for harvest at a variety of levels.

The Plan Team minutes contain several useful suggestions for future work, which the authors should consider carefully. In light of discussions at the PT and SSC meetings about Tier 1 and Tier 3 placements, the need to periodically review and update understanding of the underlying dynamics that determine stock productivity has become apparent. Therefore the SSC encourages the authors and PT to continue examinations of the determinants of stock productivity, including environmental and density-dependent effects that underpin stock status.

Aleutian Islands Walleye Pollock

This is a “full” assessment with new catch, survey, and composition information. The 2018 acoustic-trawl survey provided a large increase in survey biomass that was then used in the age-structured assessment model. Consequently, estimated spawning and total biomass increased as well. This assessment moved AI pollock from Tier 3b to Tier 3a because the estimated 2019 spawning biomass is above B40%. **The SSC concurs with the authors and the PT to use maximum ABC for 2019 and 2020 ABCs and to calculate OFLs using the standard Tier 3a formulae.** The SAFE contains descriptions of considerable assessment uncertainties and of significant research priorities that are needed to reduce those uncertainties.

The SSC recommends that the authors reconsider the time period over which recruitment estimates are used to estimate biological reference points. As shown in Figure 1A.20, recruitment estimates are included since the late 1970s, a time period that may no longer indicate current productivity levels. It has previously been suggested that some of the large year-classes in the late 1970s and early 1980s may have originated from areas outside the Aleutian Islands.

Bogoslof Walleye Pollock

New information included the 2018 acoustic-trawl survey biomass estimate and corresponding age data, which indicated a large increase in pollock biomass and the first significant recruitment event(s) in more than 30 years. The age-structured assessment model shows high recruitments in 2009, 2010, and 2012. The magnitude of the survey estimate in 2018 was similar to that in 2016, increasing confidence that the increase in biomass will persist.

This stock is managed as a Tier 5 stock using survey biomass, and a random effects approach has been applied in the past. The SSC agrees with the authors and PT to use this approach again this year. There is a substantial increase in the resulting 2019 and 2020 ABCs and OFLs. Given that both regional and international interest is likely to return owing to the implications of the Bogoslof pollock assessment on fishery management of pollock in the Bering Sea Donut Hole, the SSC recommends that a genetics study be done to further investigate the uncertain stock structure of these fish (AI, EBS, separate stock, WBS).

BSAI Pacific Cod

Bering Sea

The SSC received a presentation on the PT report from Diana Stram and a summary of the Pacific cod stock assessment from Grant Thompson (AFSC). Public comment Chad See (Freezer Longline Coalition), and Richard Thummel (Alaskan Leader Fisheries).

The SSC thanks the author for his excellent work on this assessment again this year; the document provided extensive detail on 8 models brought forward for consideration, which included the 6 PT and SSC requests.

The recent trend and magnitude of the stock estimates differ appreciably among the 8 models with total biomass ranging by almost a factor of two. This is a reflection of the recurrent and considerable uncertainty in this assessment; however, this isn’t a shortcoming of the assessment, but a credit to the efforts made to explore alternative models. Despite the differences, the recruitment deviation estimates are very similar across all 8 models and all show very low values from 2014 to 2017. **The SSC highlights that these low recruitments are important and represent a clear signal that is driving the short-term projections of decreased yield.**

The SSC supported the author- and PT-recommended model, 16.6i, as the best option currently available based on its fit to the data, retrospective behavior, and explicit use of the Northern Bering Sea information. This model relies on a strong assumption about cod distribution in years without a Northern Bering Sea survey – that there were very few cod in that region. It also assumes that the cod in the Northern Bering Sea will continue to be a functional part of the spawning stock and will not experience some type of additional mortality related to their current distribution.

This year, assessment development efforts were appropriately focused on dealing with the major change in cod distribution. The SSC recommends that future efforts focus on treatment of the Northern Bering Sea data prior to adding to the assessment – via summation of the components (as in model 16.6i) or through model-based approaches that can estimate contributions of unsampled areas (such as developed for EBS walleye pollock). However, the SSC noted that many requested changes made in development of the 17.x and 18.x series of models represent improvements over the 16.x models. These improvements include inclusion of fishery age composition data, the prior on natural mortality, composition data weighted by the number of hauls, and harmonic mean composition weights. Other changes continue to be worthy of evaluation, but may not be clear improvements, such as time-varying selectivity and catchability. **The SSC recommends bringing these branched model series back together either in the form of one model, or an ensemble of models for 2019.**

The SSC had an extensive deliberation regarding an ABC reduction from the maximum. Concerns outlined by the PT included the potential for distribution-related mortality, uncertainty in model scale and trend, as well as recent and projected anomalous environmental conditions in the Bering Sea. These concerns were taken seriously. The greatest concern identified by the SSC was the future survival and contribution to the greater cod stock of the fish observed in the Northern Bering Sea (over half of the total biomass) in 2018. **The SSC reiterated its recommendation from October that in-season reporting of fishery performance be used to track the presence and/or success of these fish into next spring.** The SSC agreed with both the PT and the author that recent poor recruitment is a concern, but concluded that this source of risk is captured by the recommended assessment model, and is therefore included in the calculation of maximum ABC and did not warrant an additional reduction at this time. **Ultimately, the SSC supported the author's recommendation to accept the maximum ABC with no additional reduction.** However, the stock is projected to decline substantially in 2020 with associated declines in the ABC and OFL

The SSC agreed with PT recommendations for additional work on:

- Resolving issues with ageing methods and historical age data, following the issues raised in the GOA Pacific cod assessment which may be applicable in the Bering Sea.
- Use of a model-based method for developing a survey abundance estimate for the entire Bering Sea.
- The critical importance of a Northern Bering Sea survey in 2019.

The SSC strongly supported the PT approach of organizing alternative models around explicit hypotheses regarding the assessment structure or population dynamics. This approach was very helpful to make clear where the need for additional research was most important, and also provided a logical framework for developing an ensemble of models corresponding to each hypothesis. Moving forward, weighting of models for an ensemble may be developed based on the relative plausibility of each model hypothesis. **The SSC recommends further efforts in developing this approach.**

The SSC supports tagging, which may be helpful for understanding connectivity among areas of the greater Bering Sea.

The SSC noted that although enumerating a stock of fish that is actively migrating could produce a biased survey result, this issue is not isolated to the Northern Bering Sea and could apply to other existing survey time-series.

The SSC supported the use of projections integrated with the assessment analysis and the use of fixed catches (rather than fishing mortality rates) in these projections. This approach provided for more realistic projections that included uncertainty in the fishing mortality rate, parameter uncertainty, and allowed for the explicit calculation of the probability of exceeding the overfishing limit. **The SSC suggest that this method be explored in other assessments and considered for routine use.**

The SSC also encouraged additional work to investigate recent and historical fishery catch in the Northern Bering Sea as there were a number questions regarding reports of fishery activity, but only a small amount of fishing identified by the author.

<u>Aleutian Islands</u>

The SSC received a presentation from Grant Thompson for Aleutian Islands Pacific cod. Survey estimates decreased from 2016 to 2018, and the OFL and ABC projected for 2019 and 2020 was lower than that from the previous assessment. **The SSC supported the author's and PT's recommendation for a Tier 5 status determination and the associated ABC as well as the use of the random ffects model for apportionment, noting that the output would be smoother than using the raw data.** The SSC noted that there may be other methods if smoother outcomes are desirable such as multiple survey averaging or the use of the VAST model.

The SSC agreed with the PT's recommendation to revisit the sources of information determining natural mortality in this assessment since genetic studies do not suggest that cod in the AI are similar to the BS, which is the source of the current value for natural mortality. Further, the general priors developed for both the BS and GOA Pacific cod stocks suggest a much higher value of M.

The SSC encouraged the author to explore the VAST model as an alternative for future apportionment calculations, noting potential issues with estimating spatial processes around a chain of islands.

The SSC disagreed with the PT recommendation to continue to delay new modelling efforts for the AI, and instead requests that an age-structured model be developed.

BSAI Atka Mackerel

The SSC commends the stock assessment authors for producing a document that clearly describes the history of assessments, fisheries, historical management actions including those associated with Steller sea lions, and the current stock assessment modeling approach. Also, the SSC appreciates the authors' concise and informative responses to all eight SSC and PT recommendations in the current assessment.

The Atka mackerel assessment includes no new models for 2018. Last year's base model (16.0b) was used with updated data on catches, age composition, and the Aleutian Islands trawl survey in 2018. Model 16.0b continues to fit the data well. **The SSC agrees with the authors and PT to use Model 16.0b for deriving the Aleutian Islands Atka mackerel OFLs and ABCs for 2019 and 2020 (Table 2).**

In Appendix 17C the assessment authors evaluated various aspects of the base model data, including an analysis that led to the decision to remove the 1986 survey age composition data, consistent with previous suggestions by the PT and SSC. The SSC agrees with the decision to drop the 1986 survey age composition data and appreciates the authors' treatment of the other recommendations from the SSC's December 2017 report.

The 2018 survey indicated a 21% decrease in biomass for the overall survey area since 2016, including an 80% drop in biomass for the Central Aleutian Islands (Central AI). The updated Model 16.0b indicates an ongoing decline in spawning biomass from a peak in 2005 associated with poor to average year class strengths since 2007. The spawning biomass for 2019 is now projected to be 106,800 t ($B_{38\%}$), just above $B_{35\%}$, placing the stock into Tier 3b and subject to a sloping control rule.

The authors applied the risk table to the Atka mackerel stock assessment. They expressed some concerns about assessment-related uncertainty, particularly in regard to the survey data. Stock trends are expected given the stock dynamics, and recent recruitment is within the lower end of the normal range. Finally, limited ecosystem information indicates no immediate concerns. As a result, the authors categorized the risks as Level 1 for all three categories and **recommended applying maximum ABC for this stock. The PT agreed with this risk assessment and maximum ABC determination. The SSC concurs.**

Since 2015, a random effects model has been fit to the bottom trawl survey to determine apportionments for the three Aleutian Islands areas. Given the drop in survey biomass for the Central AI, continued use of this method would have resulted in changes in apportionment such that the share for the Central AI would have been reduced from 34.78% in 2018 to 10% for 2019. The authors investigated the survey and fishery data to try to uncover reasons for this apparent decline in this area. There were no apparent changes in survey protocols, nor any environmental conditions that could explain the survey result. Fishery data indicated steady CPUE in the Central AI with no obvious differences in catch rates or fishing locations. As evidenced by Figure 17.6, Atka mackerel can be very patchily distributed, leading to large variability in the estimated proportion of biomass in each subarea.

Fishery data were not consistent with a major change in fish distribution in the Central AI and the assessment authors chose to drop the random effects model for this year's apportionment recommendations and instead returned, at least temporarily, to the pre-2015 method of a weighted average of the previous four surveys. This provides values that are intermediate from the two recent random effects model results and dampens the change between assessments. This approach resulted in a smaller drop from 34.78% in 2018 to 21% (instead of a drop to 10%) in 2019 in the Central AI. Resulting allocations in the Eastern AI/Southern Bering Sea area and Western AI were 35% and 44%, respectively. **The PT agreed with, and the SSC supports, a return to this allocation approach for now, but the SSC notes that having an apportionment method that is robust to large deviations in regional survey biomass estimates is critical.**

SSC recommendations:

- The PT recommended additional research to develop appropriate apportionment methods for this stock in the future, with an emphasis on investigating the application and validation of the autoregressive spatio-temporal modeling approach developed in the VAST modeling framework for such purposes. The SSC supports additional research into a more robust allocation method.
- Given the differences between the survey and fishery trends in the Central AI, the SSC recommends giving further consideration to the connections between temperature and Atka mackerel responses and availability to the survey. The SSC supports the idea of using habitat-based covariates and recognizes that the survey is a major source of uncertainty in this assessment.
- The SSC supports reporting fish condition in the assessment and suggests that this metric be reported at smaller spatial scales than in the ESR. The assessment noted that trends in condition differ across the AI.
- The SSC commends the expanded effort to collect >1,000 otoliths from the 2018 AI survey and suggests that these should be a priority for aging.
- Continue to include the risk table, as it was quite useful with the expanded discussion of the uncertainties and concerns related to each of the categories of information.

BSAI Flatfish

Yellowfin Sole

This is a Tier 1 assessment and the assessment model was updated with new information including estimates of discards and retained portions of the 2017 fishery catch, survey and fishery age composition for 2017, estimates of trawl survey biomass and standard error for 2018, and estimates of total catch through the end of 2018.

The base model for this assessment was first developed in 2014 (Model 14.1). A new base model (18.1) and several variants were introduced this year, motivated in part by an unexpected 32% decrease in the survey biomass. The new model includes the survey mean bottom temperature across stations < 100m as a covariate on survey catchability, as in the old model, but adds survey start date as an additional covariate within the model, based on a recent study by Nichol et al. (2018). Natural mortality remains fixed at 0.12 for both sexes in the new model. The model resulted in substantial improvements to the likelihood and AIC, and both the author and PT recommend model 18.1. **The SSC agreed with the choice of model 18.1 to set the ABC and OFL for 2019/2020**.

Although total biomass and spawning biomass have been declining slowly since 1994, spawning biomass estimated by the new model remains high at 1.85 * B_{MSY}. Therefore, yellowfin sole continues to qualify for management under Tier 1a. As in recent years, the 1978-2012 age-1 recruitments and the corresponding spawning biomass estimates were used to determine the Tier 1 harvest recommendations. **The SSC supports this time period for determining stock productivity and agrees with the authors' and PT's recommendations for ABC and OFL under Tier 1a.**

The SSC appreciates the author's responsiveness to last year's requests, in particular to concerns over a strong retrospective pattern in female spawning biomass, whereby more recent assessments tended to yield higher biomass estimates. The author showed, using the previous base model (14.1) that spawning biomass estimates from a parameterization that reduced retrospective patterns (M = 0.09 and q = 1) were largely consistent with the corresponding estimates from model 14.1 (i.e. within confidence intervals from that model) and used this to justify the continued use of a fixed natural mortality at M=0.12 as it provided a better model fit.

The SSC had the following recommendations for the author:

- The SSC encourages further exploration of the way mortality is handled in the model, for example through the use of sex-specific or time-varying mortality and the authors noted that they may be able to explore this more fully in 2019.
- Given recent changes in the distribution of other species, the SSC encourages authors to explore variability over time in the proportion of the stock that occurs in the Northern Bering Sea. While the model may account for this portion of the stock through the catchability parameter this assumes that the fraction of the biomass occurring in the NBS has not changed substantially. There is little evidence for a change in the NBS biomass within the area that was surveyed in all three years, but this does not account for the possibly large fraction of yellowfin sole in nearshore areas that were not surveyed in 2018. The SSC suggests a few avenues to explore possible changes in distribution of yellowfin sole, including a comparison of the full NBS survey area between 2010 and 2017, the application of the VAST model to estimate the proportion of yellowfin sole in the NBS over time, and an examination of other available data sources, in particular the ADF&G survey in Norton Sound that has been conducted triennially since 1978 and annually since 2017. The SSC encourages the authors to consider approaches for including the substantial biomass of NBS yellowfin sole in the model, with the expectations that NBS surveys will be conducted regularly in the future.

Greenland Turbot

The base model for the assessment was the same as the one used in 2016, but the Auke Bay Laboratory (ABL) longline survey catchability is now estimated within the model as requested by the SSC to improve model stability issues (model 16.1b). Updated data for this year's assessment included catch data for 2017 and projected 2018 catches; age compositions and size-at-age data for the 2017 EBS shelf survey; size composition data for the 2018 fishery, 2018 shelf trawl survey and 2018 ABL longline survey; and estimated biomass or abundance indices for the shelf trawl survey and ABL longline survey in 2018.

In addition to the (modified) base model 16.1b, a model linking an environmental index to recruitment (R_0) was explored (model 16.1c). The model allowed R_0 to differ between cold years (temperatures more than 1 standard deviation below the 1982-2016 mean, or PDO < 0 in earlier years without temperature estimates) and warmer years. The additional parameter resulted in a considerable improvement in the recruitment component of the likelihood, but there was a trade-off in the fit to the longline and slope surveys. Therefore, the author and PT recommended model 16.1b for stock status determinations. **The SSC agrees with the authors' and PT's recommendations for ABC and OFL under Tier 3a (Table 2)**.

The SSC agrees that the inclusion of an environmental effect on recruitment is promising and warrants further examination, but without a better understanding of the underlying mechanisms it is premature to include this environmental relationship in the assessment. This is especially true because the effect is largely based on the observation of single period of recent strong recruitments (2007-2009) that coincided with a period of cold years (2007-2013).

The SSC agrees with PT and author recommendations regarding further improvements to the model. Specifically, we encourage the author to investigate (1) the use of selectivity blocks if an appropriate rationale can be developed for these time blocks, (2) spatial distribution and migration to better understand changes in the proportion of the stock extending into Russian waters, and (3) approaches to incorporating Russian catches into the assessment.

Arrowtooth Flounder

A full assessment was presented for arrowtooth flounder in the BSAI in 2018. Arrowtooth flounder in the BSAI are lightly exploited, largely as an incidental species and primarily by the flatfish fisheries with trawl gear. In the past, arrowtooth was assessed along with Greenland turbot, and more recently, as a complex with Kamchatka flounder. However, in 2010, Kamchatka and arrowtooth flounders began to be assessed separately due to the development of a directed fishery for Kamchatka flounder.

Arrowtooth flounder are encountered in the EBS bottom trawl shelf survey, the EBS slope survey, and the AI bottom trawl survey. Updated data sources include new biomass estimates and length- and age-compositions from the EBS and AI surveys, updated catches and new estimated catches for 2018 – 2020, and fishery size compositions from 2017 and 2018 as well. The recommended model also excluded the early years of the EBS slope survey, but retained surveys from 2002 forward.

Authors presented five models that explored three main changes in methodology based on recommendations from the PT and the SSC in recent years. The base model, 15.1b, is the accepted model from the 2016 assessment updated with 2018 data. Model 15.1c is identical to 15.1b by adding a smoothed length-age conversion matrix. Both Model 18.3 and 18.6 build upon Model 15.1c. Model 18.3 also incorporates an aging error matrix to account for known aging disagreement, and Model 18.6 uses length-based survey selectivity that is converted back to age-based selectivity using a length-age matrix. This exploration was motivated by some selectivity parameters hitting bounds in the last full assessment. Finally, Model 18.9 is identical to Model 18.3 but removes the early years of the EBS slope bottom trawl survey from 1979 – 1991 due to concerns regarding the standardization of the gear and survey area.

The author and PT recommended Model 18.9 for several reasons. While the incorporation of the smoothed length-age conversion matrix did not improve overall model fit, it was considered a necessary change by both the author and PT. The incorporation of the aging error matrix did improve model fit, particularly fits to multiple sources of composition data. Finally, the removal of the early years of the EBS slope data improved fits to all three of the survey biomass estimates. Model 18.9 included all of these changes and had the lowest negative log-likelihood score of all the models explored.

The SSC concurs with the recommended Model 18.9 for use in setting 2019 and 2020 harvest specifications for the reasons specified by the author and PT. Female spawning biomass is estimated to be greater than $B_{40\%}$, and therefore arrowtooth flounder are defined as a Tier 3a stock**. The SSC agrees with the author and PT recommended OFL and the maximum permissible ABC for 2019 (Table 2).**

The SSC has several recommendations regarding speciation of the survey and catch data being used in the assessment model. The SSC notes that the reliability of species composition information for survey data prior to 1991 may also be an issue for the non-slope surveys, and the SSC requests additional information on this topic. In addition, the SSC notes the observer program began speciating Kamchatka/arrowtooth flounder in 1995, and requests the author investigate whether observer data could be used to speciate the catch data.

Kamchatka Flounder

A full assessment was presented for Kamchatka flounder in the BSAI. This full assessment includes only updates to data inputs, and includes two models considered for harvest specifications based on the accepted model from the 2016 assessment (Model 16.0). Model 16.0a includes updated data through 2018, including catch, survey and fishery length-compositions, and biomass estimates from the surveys. Notably, length compositions in the 2016 assessment from the AI survey and the fishery previously included lengths from arrowtooth flounder samples, which was corrected in Model 16.0a. Model 16.0b included the updated 2018 data, but also updated sex-specific length-age transition matrices. A retrospective analysis was completed by incrementally removing each of the last seven years (2011 – 2018), since the length-age transition matrices include data from 2010.

Historically, Kamchatka flounder were a relatively small portion of combined catches with arrowtooth flounder and Greenland turbot. Harvest increased dramatically in 2008 when a directed fishery for Kamchatka developed. Observer data from 2007 – 2010 show a marked increase in the proportion of Kamchatka flounder in combined catches with arrowtooth.

Results from the two models under consideration were similar, though a trade-off in the model fits was apparent between the two models. For example, Model 16.0b consistently fit the survey indices better and Model 16.0a fit the age-compositions better. The author and PT recommended Model 16.0a for two reasons. First, there was an overall impression that Model 16.0a better fit the data and second, there was a reduced retrospective bias when compared to Model 16.0b.

The SSC concurs with the use of Model 16.0a for harvest specifications for 2019 for the reasons identified by the PT and author, which included the reduced retrospective bias and the general fit (a slightly smaller negative log-likelihood). This places Kamchatka flounder in Tier 3a, as the projected spawning biomass for 2019 (54,779 t) is above the estimate of $B_{40\%}$ (43,069 t). **The SSC agrees with the use of the maximum permissible ABC and the OFL (Table 2) based on the Tier 3a control rules.**

The SSC had some further comments for the assessment author. First, the SSC would encourage examination of the relationship between temperature and catchability, as suggested by the author. Author responses to general assessment comments were missing in the SAFE document, though the assessment does include a retrospective analysis as noted in the comments. The SSC supports the PT recommendations that the age-length transition matrix be re-examined in the next full assessment and a re-evaluation of the assumptions made regarding historical species compositions between arrowtooth and Kamchatka flounders. Finally, the SSC suggests that the author explore incorporating aging error into the assessment given the improvements seen in arrowtooth flounder.

Northern Rock Sole

This is a Tier 1 assessment and the assessment model was updated with new information including estimated catches for 2017 and 2018, estimated discards and retained portions of the 2017 catch, survey and fishery age composition for 2016 and 2017, and estimated trawl survey biomasses and standard errors for 2017 and 2018. The survey biomass in 2018 declined 21% from 2017 and was the lowest since 1985. Four new models (18.1-4) were introduced this year in addition to the base model that has been in use since 2006 (15.1). The new models all estimated separate natural mortality rates for males. Model 18.2 estimates survey catchability in addition to male M and model 18.3 adds an offset for male selectivity in the fishery (allowing the asymptote to differ from females) based on earlier recommendations to address sex-specific targeting in the fishery. Model 18.4 was an equally weighted ensemble of the other four models. This model was included in response to an SSC request in October to pursue ensemble modeling in this assessment.

While the models resulted in considerable differences in spawning stock biomass, the resulting reference points differed little among models. Model 15.1 provided a better fit to the survey sex ratios and survey age composition. Therefore, and because the other models were not presented in September, the PT recommended model 15.1 but noted that model 18.3 was a good candidate for future assessments. **The SSC agrees with the authors' and PT's recommendations regarding model choice and for setting ABC and OFL under Tier 1a (Table 2).**

The SSC reiterates its support for using this stock assessment as a test case for the use of an ensemble model in the specification process. The fact that there was no appreciable change in the size of the buffer from OFL to ABC, despite accounting for increased structural uncertainty, is not in itself a justification for rejecting the ensemble model. However, the current ensemble used a default equal weighting scheme and the authors should carefully consider these or alternative weights to develop a sound rationale for the weights used in the ensemble. The SSC agrees with the PT recommendation to continue exploration of model 18.3 or similar models individually and as part of an ensemble, as there is some evidence and a good rationale for sex-specific differences in both M and fishery selectivity.

The SSC notes and expresses its appreciation for the authors attempts to use bottom temperatures to inform survey catchability. Unlike for yellowfin sole, they did not find a relationship between bottom temperature and catchability. The SSC also notes the efforts to use environmental covariates to estimate recruitment deviations for Northern Rock Sole (Appendix). Results suggested that the size of the cold pool, which may restrict spawning habitat, had some predictive power. However, we note that ice extent is expected to diminish further, therefore limiting the usefulness of this index in the future.

Flathead Sole

A full assessment was presented for BSAI flathead sole, a complex that includes two species. True flathead sole overlap with a morphologically similar species, Bering flounder, at the northern end of their range. However, flathead sole represents approximately 97% of the combined biomass of the two species from the EBS bottom trawl surveys, and therefore, the assessment focuses on this species within the complex. In addition to a large number of data input additions and changes, the major methodological change in this assessment is a transition to a Stock Synthesis framework (SS3). This transition is described in detail in Appendix B, and as in October 2018, the SSC commends the assessment author for an extremely thorough and comprehensive approach to this transition.

Additional model alternatives and changes included the addition of an age-length matrix, the use of a conditional age-at-length approach, various explorations of fishery selectivity, and the use of the number of hauls as effective sample sizes. In previous assessments, bottom temperatures were used as a covariate in survey catchability, but in preliminary model runs in 2018, this relationship broke down and was subsequently removed from the candidate models. The author notes that average summer bottom temperature may not be adequate to describe the relationship among the environmental drivers of flathead sole stock distribution and behavior. The SSC recommends that this continue to be explored. The SSC notes that this relationship is still included in the description of the model on page 7 and should be removed.

The majority of the catch of flathead sole occurs with non-pelagic trawl gear. The average catches following the implementation of Amendment 80 decreased substantially from the 1988 – 2007 period, and retention rates increased from approximately 30% to over 80% on average. The assessment uses a single biomass index that combines biomass estimates from both the EBS and the AI bottom trawl surveys. A linear regression relationship between the two surveys is used to fill in the missing years in the AI bottom trawl survey.

All models from 2018 were completed in SS3 and included some changes. Recruitment deviations from 1963 – 1972 were estimated separately from a main recruitment period of 1973 – 2014. Recruitment from 2015 forward were fixed at the mean recruitment during the main period, due to a lack of data informing recruitment in the last three years of the assessment. Survey selectivity was changed to a sex-specific and age-based, and used a double-normal asymptotic curve. Fishery selectivity was also changed to be sex-specific. Growth was estimated within the assessment model by estimating parameters for a von-Bertalanffy curve with CVs in length-at-age, creating a conditional age-at-length approach. Finally, the 2018 models also used the number of hauls as the input sample sizes, rather than setting a fixed value.

Alternative models included:

- Model 18.0 and Model 18.0b – both of these models estimate growth outside of the model and include an input sample size of 200 for the composition data.
    - Model 18.0 uses time-invariant sex-specific fishery selectivity curves
    - Model 18.0b used time blocks to estimate separate fishery selectivity curves (1964 – 1987, 1988 – 2007, and 2008 – present).
- Model 18.1 and Model 18.1b – these models are identical to 18.0 and 18.0b except that the conditional age-at-length approach is used.
- Model 18.2 and 18.2b – identical to 18.0 and 18.0b but with the input sample sizes for the composition data changed to the number of hauls.
- Model 18.2c extends the Model 18.2 series but with two time blocks (1964 -1987 and 1988 – present) for fishery selectivity as opposed to time-invariant (18.2) or three time blocks (18.2b).

Key model results were relatively similar across between the 18.0 series and the 18.1 series, suggesting that changes to input sample sizes did not have a significant impact on model fits. Further, the estimation of growth internal to the assessment model was necessary in order to best match the previously accepted assessment model with the new model from the SS3 framework. The author concluded that these were changes with a relatively minor impact and necessary methodological improvements, and chose to focus on the changes to fishery selectivity among the 18.2 model series. The two models with time blocks for fishery selectivity produced very different curves during the early time period in the model, which lead to fairly large differences in fishery mortality in the 1964 -1987 time period. Models 18.2b and 18.2c also resolve a troubling residual pattern in the fishery length composition data from this early time period as well. These two model resulted in very similar estimates and fits, with almost identical likelihood values and therefore, Model 18.2c was selected as the more parsimonious model for the author's preferred model. The PT concurred.

The SSC further commends the assessment author for the clear assessment document, particularly the description and results of the alternative models. **The SSC concurs with the use of Model 18.2c for harvest specifications, and the resultant Tier status and harvest specifications (Table 2).** Estimated spawning biomass in 2019 (153,203 t) is greater than the estimate of $B_{35\%}$ (74,221 t), therefore flathead sole is defined as in Tier 3a. No reduction from the maximum permissible ABC is recommended.

The SSC recommends the author investigate Northern Bering Sea survey data for Bering flounder, in particular.

Alaska Plaice

An off-year partial assessment was completed for Alaska plaice that includes an updated projection model with updates to 2017 and 2018 catch estimates. It is notable that the catch in 2018, as of October 13, is well above the long-term average catch, though less than the ABC. The 2018 shelf survey biomass estimates for Alaska plaice continues a slow decline, with a 15% reduction from the 2017 estimate. Exploitation rates average approximately 3%, though they spike to nearly 10% in the late 1980s. **The SSC agrees with the results and recommended harvest specifications from this partial assessment (Table 2).**

The SSC notes that the ABC and OFL values stated in the paragraph under the "Summary of Results" (pg. 1) are erroneous. The SSC agrees with the PT recommendation to examine data from the Northern Bering Sea survey in the next full assessment.

Other Flatfish

A partial assessment was completed for the other flatfish complex, which includes rex sole, Dover sole, and six other flatfishes. This complex is assessed as a Tier 5 stock, and during this off-year assessment, the random effects model was updated with new survey biomass estimates. Mortality rates are applied for Dover sole (0.085), rex sole (0.17) and for other species (0.15) to the biomass estimate from the random effects model and summed. Results indicate that the other flatfish complex are at a relatively high biomass level and are lightly exploited, as seen in the summary of the annual exploitation rate in the partial assessment. **The SSC agrees with the results and recommended harvest specifications from this partial assessment (Table 2).**

BSAI Rockfish

Pacific Ocean Perch (POP)

This year's analysis represents a full assessment, following an "off-year" executive summary in 2017. All previously included data sources were updated with new data since the last full assessment. In addition to new data, the length-at-age, weights-at-age, and age-to-length conversion matrix were updated based on data from the NMFS AI trawl survey beginning in 1991, and the weights for the age and length composition data were reweighted using the McAllister-Ianelli iterative reweighting procedure. Catches were updated through 2017 and projected for 2018 and 2019.

The model recommended by the author (16.3a) revised the number of year nodes for the fishery selectivity spline from 4 to 5 to account for additional years since the 2014 stock assessment, when this spline was implemented. The additional node had minimal impact on fishery selectivity or model results.

The SSC agrees with the authors' and PT's BSAI total OFL and ABCs (Table 2). Based on current status, this stock qualifies for management under Tier 3a for the 2019 and 2020 ABCs and OFLs.

The SSC appreciates the work addressing several SSC comments from past reports, particularly investigating the poor retrospective pattern provided in the appendix. The appendix showed that various aspects of time-varying survey catchability helped alleviate the retrospective pattern, but time-varying catchability seems an unlikely prospect given the near fixed-station nature of the AI survey. Even when the retrospective pattern was lessened, the unusual fit to the survey biomass, particularly at the end of the time series, still occurs. **The SSC encourages the author to look at sequentially removing data sources to see what data source may be causing the poor fit and residual pattern for the AI survey**, which may also contribute to the retrospective pattern. Also, the SSC suggests ensuring that the non-estimated recruitments at the end of the model are using the mean recruitment, and not just the exponentiated log mean recruitment parameter. Additionally, allowing survey selectivity to be a little more flexible in shape may be worth exploration. The SSC also supports the PT's recommendation to further investigate natural mortality and consider alternative priors.

Northern Rockfish

The projection model was run using updated 2017 catch and new estimated total year catches for 2018-2019. Northern rockfish are determined to be in Tier 3a. As this is an off-cycle year, only an executive summary was provided. **The SSC supports the authors' and PT's recommendations for ABC and OFL, and area apportionments for 2019 and 2020.**

Shortraker Rockfish

Shortraker rockfish was a full assessment in 2018. New data included:

- Updated catch data through 2018
- Biomass and variance estimates from the 2018 Aleutian Islands (AI) bottom trawl survey

There were no changes in the assessment methodology since the last full assessment. The random effects model was applied to survey biomass estimates and used a natural mortality estimate of 0.03. The 2018 AI survey biomass was up 74% since 2016, but the random effects model did not fit this point well as the estimates were uncertain. Thus, the recommended ABC did not increase appreciably. Catch has generally decreased over time since 2013 and typically below TAC. Since 2015, TAC has been set below ABC, and catch and TAC are considerably lower than OFL.

The SSC has previously determined that reliable estimates of only biomass and natural mortality exist for shortraker rockfish, qualifying the species for management under Tier 5. **The SSC agrees with the PT's recommendation for basing the biomass estimate on the random effects model and setting F_{ABC} at the maximum permissible level under Tier 5, which is 75% of M. The SSC accepts the ABC and OFL estimates for 2019 and 2020 recommended by the author and PT.**

Blackspotted and Rougheye Rockfish Complex

This year's analysis represents a full assessment, following an "off-year" executive summary in 2017. All previously included data sources were routinely updated with recent years' information. Length-at-age, weight-at-length, and age-to-length conversion matrices were recalculated based on data from the AI trawl survey from 1991 onward. Catches were updated through 2017 and projected for 2018 and 2019.

Although the SSC originally asked for a combined BS/AI age-structured model, which we were provided in 2016, the authors and PT concluded that the conflicting data from the different areas were not fitting either area's data well. The authors thus recommended an AI-only age-structured model and a Tier 5 model for the BS portion of the stock. Three models were presented this assessment: the old combined area model (16.5), and two new ones (18.1 and 18.2). 18.1 was the former base model (16.5) with the BS data removed. Models 16.5 and 18.1 use weighting of compositional data based on the harmonic mean method. This choice was deemed to produce a better fit to the data than other candidate models in the previous assessment, when Francis weightings were explored.

The rationale for changing to 18.2 in the assessment was that examining catch curves for old cohorts resulted in high exploitation rates, yet the Francis method severely downweights the age data and degrades their fit, while providing little improvement to the fit to the survey index. It is circular to point out that the age data suggests higher mortality, and then avoid fitting those same data. The harmonic mean weighting seemed better for all three BSAI age-structured rockfish models in 2016 and continues to be used for POP and northern rockfish, so the SSC found the rationale for this change to be inconsistent.

Unfortunately, the SAFE did not provide adequate documentation to evaluate whether there were improvements to warrant a change to 18.2. Comparing the results from model 16.5 in the 2016 assessment, showed that the fit to the age data was much better, despite simultaneously fitting the BS data. The SSC supports a change to 18.1 because it is sufficiently similar to the previously accepted model, and the model better reflects blackspotted rockfish population dynamics given that the AI area is almost exclusively blackspotted rockfish, whereas the BS contains a mixture of both species with different demographic patterns.

Therefore, the SSC disagrees with the authors' choice of Model 18.2 and the Plan Team's recommended BSAI total OFL and ABCs, that were derived from averaging the reference points from Models 18.1 and 18.2. The SSC did not think that the approach of a simple average of the reference points from two models was appropriate as they were not introduced as a set of models to be averaged and, given the issues described above, the model may not represent an appropriate ensemble. **The SSC recommends that the ABC and OFLs for 2019 and 2020 be derived from Model 18.1 which is the AI-only version of the base model from 2016.**

The SSC noted the very large retrospective pattern observed in this assessment and recommends continued investigation to try to reduce or at least better understand this problem. It seems there is a conflict between the age and length data, and the SSC recommends the author bring forward a model without any length data, which may provide more consistent fits to the remaining data than can not be attained by only adjusting weights, along with an updated ageing error matrix to aid in recruitment estimation.

The SSC noted that the maturity-at-age estimates are converted from maturity-at-length from an older study in the Gulf of Alaska in the 1990s. These estimates were most likely a mixture of blackspotted and rougheye rockfish. A recent paper by Dr. Christina Conrath provides new estimates for maturity-at-age for both rougheye and blackspotted rockfish. The study suggests that the maturity-at-age is older for blackspotted rockfish (than rougheye) and may have an effect on reference points for this assessment. However, it is the understanding of the SSC that these specimens were not genetically ID-ed so there is some uncertainty. **The SSC recommends that the authors explore whether these new maturity results should be used in this assessment.**

The SSC also supports the PT recommendations for evaluating dome-shaped selectivity for the survey to better account for difficulty in sampling large/old fish accurately, examining larger bounds on M, applying a more rigorous prior on M, and investigating the profile of M.

The SSC had a discussion regarding the use and overages of recent and future MSSCs. The utility of an ABC for WAI may not be helpful as it may not reduce catch and would increase discards given the continued increase of POP in the area. **The SSC recommends that the MSSC continue to be used as a means to monitor and give industry a target maximum catch, but do not request any further analysis. However, the SSC remains concerned about the MSSC overages, and continues to request this information be highlighted in the assessment.**

Other Rockfish Complex

A full stock assessment was conducted in 2018. The "other rockfish" complex is a combination of 24 rockfish species not in other rockfish categories. This complex is dominated by shortspine thornyhead (SST, *Sebastolobus alascanus*). There are many years in the EBS survey for which the biomass estimate of the non-SST portion of the complex is zero (with standard errors also equaling zero), which makes modeling the complex challenging.

New data in the 2018 assessment included updated catch and fishery lengths for 2017 and 2018. Biomass estimates, CPUE, and length frequency compositions were also included from the 2018 Aleutian Island trawl survey and the 2017 and 2018 Bering Sea shelf survey.

The SSC agrees with the PT's recommended approach of setting F_{ABC} at the maximum allowable under Tier 5 (F_{ABC} = 0.75M). The accepted values of M for species in this complex are 0.03 for SST and 0.09 for all other species. Multiplying these rates by the best biomass estimates of SST, and other rockfish species in the "other rockfish" category, yields the 2019 and 2020 OFL and ABCs.

The SSC recommends that the authors explore aggregating the non-SST and the SST portions of the stock for use in the random effects models to avoid the problem of zeros and models that cannot estimate the process error. This would require some assumption about aggregate M to be used which could be based on the average ratio of survey biomasses.

BSAI Sharks

A full Tier 6 assessment with updated harvest data was provided for the GOA sharks complex, which consists of spiny dogfish, Pacific sleeper shark, salmon shark, and all other species of shark. The model presented did not deviate from that used since 2016 (Model 16.0), which uses average catch data from 2003-15. **The SSC supports the assessment model used and the resulting OFL and ABC values as presented in Table 2.** Shark catches in the BSAI have been well below ABC for many years because TAC is set low to accommodate demand for more profitable species under the region-wide harvest cap.

The authors note that catch rates for Pacific sleeper sharks have been progressively declining in the BSAI for several years. It is unclear whether this represents avoidance of sharks by the fleet, avoidance of gear by sharks, a decline in shark abundance, or a redistribution of shark abundance. The SSC looks forward to hearing updates on continued monitoring of this situation.

For the next full assessment in 2020, the SSC looks forward to the authors' new analysis with a greatly expanded set of data-limited methods. Also for the next assessment, the SSC suggests using the 5th and 95th percentile of catches as an alternative for confidence intervals to avoid the issue that catches are not normally distributed.

BSAI Skates

A full assessment based on a model used since 2014 was provided for the BSAI skates complex, which consists of 15 species but is dominated by Alaska skate. Alaska skate are assessed using an age-structured model (Tier 3) and all other skates are assessed using Tier 5 methods. The aggregate specifications for the complex are then calculated by summing OFL and ABC values across assessments. In addition to updating catch and survey data through 2018, new model inputs included new times series of species-specific catch and exploitation rates, and inclusion of abundance estimates from the AFSC longline survey.

A single model (14.2) was presented for Alaska skate. While the structure of the model was the same as that used since 2014, a new approach was used to generate catch estimates and exploitation rates based on species composition data for the subset of skates positively identified by observers. Aggregate skate catch was then partitioned according to this species composition to approximate historic catch, for which composition data is largely absent. Additionally, the authors added an abundance estimate data series from the AFSC longline survey. For other skate species the authors used the same catch composition partitioning method to obtain species-specific harvest trends and then used a random effects (RE) model to estimate biomass. Though past practice was to run the RE model for all “other skates” combined, this year the model was run for each species independently and then biomass estimates were summed. For rare species, combination was still required prior to running the RE model.

Alaska skate generally make up over 90% of skate catch in the BSAI and results from their assessment similarly dominate OFL and ABC for the complex. Despite the new method for estimating catch and exploitation rate, as well the use of updated data, harvest recommendations for the skate complex changed very little from 2018. **The SSC supports use of the authors’ recommended models for the skate complex and accepts the resulting OFL and ABC for 2019 (Table 2).**

The SSC commends the authors for their work to incorporate new data and improve inputs to the model. The SSC also concurs with the authors that while exploitation rates for many skate species are low relative to natural mortality, there is **continued concern about the lack of reliable species composition data from fisheries, which may contribute to local depletion of species that concentrate at localized hotspots.**

The SSC recommended that:

- The authors continue to explore the implications of using an RE model for collections of species with very different vital parameters
- Authors fill out/or update a stock-structure template for the skate complex
- Consideration be given to whether splitting Alaska skate out of the complex is warranted to avoid undue exploitation potential for other skate species
- Authors work to integrate IPHC longline data into future assessments
- The Bering Slope survey continue to be recognized as Critical Ongoing Monitoring and performed as scheduled, as both skate biomass and diversity are highest in this area and any assessment of the complex without adequate data from this region is flawed.

BSAI Sculpins

No stock assessment was conducted this year, so OFLs and ABCs are rollovers from the previous stock assessment (Table 2). A partial assessment incorporating new survey data was conducted in 2017 and the last full assessment for BSAI sculpin was in 2016.

BSAI Squid

SSC appreciated receiving the report on squid and supports the PT recommendation to combine the squid report with the forage fish to create a single forage species report. The SSC continues to support the ongoing review of time trends in squid catch and population dynamics.

BSAI Octopus

A full assessment was presented for the octopus complex this year. There are seven species of octopus managed under the BSAI octopus complex, but the giant Pacific octopus dominates incidental catches from commercial fisheries. Most of this catch occurs in the vicinity of Unimak Pass. Since 2012, BSAI octopus harvest specifications have been based on the consumption of octopus by Pacific cod.

There were no changes to this Tier 6 alternative consumption method. New data included in this analysis were 2017 and 2018 ESB shelf survey data, 2018 AI survey data, and incidental catch data through November of 2018. The authors and the PT continue to recommend use of this alternative Tier 6 method and **the SSC agrees with this approach and approves the associated ABC and OFL recommendations**

(Table 2). The SSC looks forward to seeing the results of Pacific cod diet information from 2012 and 2013 used in the consumption model.

EBS Ecosystem Chapter

General comments for all Ecosystem Status Report sections

Please see the GOA Ecosystem Chapter section of this document.

Comments Specific to the Eastern Bering Sea Ecosystem Status Report

The SSC heard a report on the Ecosystem Status Report for the Bering Sea from Elizabeth Siddon and Stephani Zador. There were no public comments.

This year's assessment highlighted ecosystem conditions and responses in the northern Bering Sea (NBS) and southeastern Bering Sea (SEBS) independently, but noted that species responses to recent conditions (i.e., sea ice, cold pool extent, water temperatures) have emphasized the connectedness of the two regions and that they function as one ecosystem.

2018 was extraordinarily different in the NBS than in the past experience of scientists visiting the region or in the oral histories of local residents. 2018 marks the lowest ice year on record for the eastern Bering Sea while the Chukchi Sea was the warmest on record. Bottom temperatures in the NBS were 1^{0}C to 2^{0}C rather than <-1^{0}C, and no cold pool formed. The lack of salinity structure resulted in weaker vertical stratification, and a well-mixed water column. The near-complete lack of sea ice over the NBS shelf created an absence of ice algae to `seed' productivity. Zooplankton abundance was overall low although it increased with latitude. In addition, lipid content of large copepods and euphausiids was low, with large copepods dominated by lipid-poor *Eucalanus bungii*. Adult Pollock biomass declined, ice seals were unusually scarce, and pups were in poor condition. Finally, seabird reproductive failures and a broad-scale die-off event were observed.

In the SEBS, 2018 was fairly typical of a low-ice year, exhibiting reduced stratification and a weak, delayed bloom. Zooplankton were low in abundance and quality. Although larval fish production was relatively high, juvenile survival is predicted to be low. Adult pollock biomass was low, while Pacific cod surveys indicated fewer, larger fish. Seabirds at the Pribilof Islands nested late and had low reproductive success, and fur seal pup production continued a long-term decline at St. Paul. Community members, subsistence and commercial fishers from Bristol Bay reported unusual behavior of adult pollock and high numbers of pollock washing ashore dead.

The SSC was pleased to see that all 10 Report Card Indicators were updated in 2018. In general, the SSC appreciates the huge number of indicators that turn around and get current-year data in fast. This has been a tremendous effort and is paying off to make the Ecosystem Reports relevant in real time.

Several indicators were greater than one standard deviation below the long term mean in 2018, although only two were when averaged over the last 5 years. The only biological indicator *above* the long term mean was motile epifauna biomass. North Pacific Index was also high for the 2018 datapoint only. The SSC notes that it would be helpful if all indicators included a statement about their relevance to fishery management; it is not clear if positive values in indicators are always related to "ok-ness". In general, more details in the Descriptions of Report Card Indicators would help. Especially important would be information on the schedule for data collection (time of year), and a statement on the expected relevance to fishery management.

The introduction indicates that the list of 10 Report Card indicators will be updated as part of Fishery Ecosystem Plan currently being developed. That plan has been released and there are several places this is discussed (either in the action module or as a task for core FEP team). Overall the SSC supports this list being updated, although the process is not entirely clear in the Fishery Ecosystem Plan. Ideally the three ESR's would be treated holistically and the Aleutian Island FEP team could re-evaluate the indicators for that ecosystem.

The SSC recognizes sea temperatures as a primary environmental indicator of interest. Of note, the Bering Sea ESR discussions are largely framed around "warm years" and "cold years", and the 2015-2016 marine "heatwave" was repeatedly referred to in the Gulf of Alaska ESR. **The SSC encourages the authors to strive for a consistent way of discussing sea temperature in terms of anomalies, heat waves etc.** A brief definition of 'heatwave' when the term is first used would be helpful. The SSC appreciated the "Noteworthy" contribution about the current heatwave in the Gulf of Alaska, but notes that model predictions (Fig. 11) indicate larger sea-surface temperature (SST) anomalies in the EBS, suggesting a heatwave in that region as well. The SSC noted that recent SST increases in the Northern and Eastern Bering Seas exceed increases observed during the 1976-1977 regime shift, suggesting the potential for similarly large ecosystem implications. Further, we note that recent annually averaged SSTs in the NBS in 2017 and 2018 are approximately the same as average SSTs in the SEBS over the last 30 years.

Kudos to the authors and other collaborators on an August workshop and efforts to provide early information on anomalous conditions in the NBS in 2018. This information is extremely valuable and the assessment did a good job of articulating which events were "unprecedented" versus which ones were just unusual. **The SSC strongly supports continuing to conduct the NBS survey.**

In the Ecosystem Assessment section and throughout, the SSC encourages the authors to clarify in what months various datasets are collected. Data presented apparently cover a wide range of seasons from 2017 through September 2018, but readers not familiar with all the surveys often cannot tell what time period is being discussed.

The new section in the Ecosystem Assessment of Local and Traditional knowledge is an excellent and robust addition. The information from this source, especially with regards to the northern Bering Sea, is an important addition to the report. The SSC looks forward to its continuation and expansion as appropriate; However the SSC suggests it not be separated from the rest of the summary. Those pieces of information would easily add to the weight of evidence with the rest of the data. A concern is that it would lose visibility, but ideally it is treated as a regular part of evidence. **The SSC encourages a continued search for other options for this kind of information and ways to incorporate the long-term information from these sources as a direct indicator.**

The SSC appreciated the evaluation of index/indicators and their use at forecasting or predicting (examples were for Pacific cod and pollock and lack of prediction of NPI for cod) and supports further expansion of these types of implications. We need to have these assessments to understand how to apply the indicators we're looking at in terms of fisheries management decisions. The SSC recognizes that the pollock recruitment prediction information will be moved to ESP's. The SSC will provide the authors some suggestions for text clarification in this section.

Nine indicators were added or substantially updated in 2018, and the SSC applauds the authors on the continued efforts to curate this report. Of particular note was a new indicator of the annual run size of Bristol Bay sockeye salmon, where 2018 had the largest run on record since 1963. The SSC appreciates the efforts to include many new human dimensions indicators. Many unfortunately only had updates available for 2016 or 2017. The SSC appreciates the editors' responsiveness to the request, but these may not be useful if not able to be current.

The authors reported that there was evidence of unusual distributions, poor condition and strandings of marine mammals in the Bering Sea in 2018. Data from the NMFS Marine Mammal Laboratory (NMML) suggests this may be associated with lack of sea ice. As spotted seals' diet includes several commercially important species including pollock and other forage species, the SSC supports continuing to include information on this trend as an indicator of forage species and Pollock availability in the ecosystem. With surveys conducted by NMML occurring infrequently, this indicator could be an avenue for direct incorporation of LTK. For example, long-term observations of seal—body condition could be provided by subsistence hunters. The SSC recommends exploring options for incorporating this information, and suggests potentially reaching out to NOAA co-management Alaska Native Organizations like the Ice Seal Committee.

The SSC notes that a benthic infauna indicator is lacking and encourages the authors to reach out to Jackie Grebmeier for an option.

The SSC was pleased to see the inclusion of rat invasion on St. Paul in the "Noteworthy" section as a topic of concern for the Council. This highlights a real risk to communities and wildlife resources that is directly related to fishery activity.

Last year (2017) the editors indicated that they were working with the AFSC communications staff to produce a "public-friendly" version of the Bering Sea ESR. The authors provided the initial version of this document to the SSC. **The SSC welcomed this excellent outreach product and congratulated the authors on this new development. The SSC encourages the authors to share this with the communities that provided data.**

Comments Specific to the Aleutian Islands Ecosystem Status Report

The SSC heard a report on the Ecosystem Status report for the Aleutian Islands from Stephani Zador and Elizabeth Siddon. There were no public comments.

The ESR was well written and the SSC understands the lack of data for the region and commends the authors on their efforts considering these limitations (e.g., in the Central Aleutian region, only 4 of the Report Card time series were updated).

There continue to be concerns about the western region of the Aleutian Islands. It would seem prudent to assemble the full range of information on this region to explore the reason(s) for the population declines of harbor seals, Steller sea lions and seabirds (cormorants). Data of interest could be eddy activity, sea water temperatures, zooplankton abundance, forage species abundances, and fish condition and abundance.

The SSC suggests exploring the reproductive success of tufted puffins in the eastern Aleutian Islands as a measure of forage fish abundance.

This report might benefit from expansion of LTK to provide indicators. The SSC supports the efforts to explore the use of the LEO Network. However, only 7 observations (all from one community) were reported through that system in 2018. The SSC supports the efforts to reach out to community members on specific ecological questions that might fill in data gaps about long-term trends in the ecosystem.

The SSC encourages the authors, if possible, to decide on a consistent time period of change that is meaningful. Report card graphs seem to have settled on 5-year window, which has a lot of pluses to it. However descriptions go back and forth between reporting change since time series was last updated (is this meaningful change or just normal variability) and long term change (which has a widely varying number of years considered, confounding interpretation).

The SSC noted that the different time scale of the beginnings of the datasets makes the discussion of their long term trends awkward. It would be most helpful to discuss long term trends in indicators across a consistent time period if possible (the period in which all of them can be discussed unless there's a strong biological reason not to). In "Current and Recent Ecosystem State", the SSC encourages discussion of temperatures quantitatively relative to long term mean. It is hard to tell which years are anomalies, and which are change from some recent relevant event, and which are significant.

In case of sea lions, the entire time series is driven by changes occurring before 1990. If more recent trends are thought to be relevant, it should be plotted differently.

The SSC noted that the Kasatochi auklet time series should be dropped as an indicator, as the volcanic eruption and subsequent substrate changes will preclude a monitoring program there for quite some time. If retained, the text in the description needs some updating – auklets have actually been breeding on Kasatochi since the year after it erupted although monitoring of reproductive success has not taken place. In description of indicators, the SSC encourages additional explanation to be added for indicators that were not updated recently (e.g., marine mammals), to clarify whether these surveys are ongoing and on what schedule.

The SSC notes that oceanographic variables (e.g., temperature) are reported as indicators in the Western Aleutians and feels that these would be useful in the other ecoregions (Central and Eastern Aleutians) as well.

The SSC encourages the authors to consider whether new data could be collected that could serve as indicators to fill gaps (e.g., plankton). Some parties working regularly in the region could and would be potentially willing to collect low-cost datasets if the usefulness was fleshed out. The SSC notes that datalogger-derived datasets of sea surface temperature are available at several sites since 1997 from the Alaska Maritime National Wildlife Refuge.

For the Sea Surface Temperature indicator (p.41), it would help if discussion was focused specifically on the Aleutian Islands – there are very broad descriptors – the "regional highlights" in the previous indicator (NPI) would be valuable. Same comment for climate indices and seasonal projections.

The SSC is pleased to see new ecosystem indicators including the size and lifespan of groundfish.

C-4 Bering Sea Fishery Ecosystem Plan

The SSC heard a presentation of the revised Eastern Bering Sea Fishery Ecosystem Plan (EBS FEP) by Diana Evans, Council staff, and Stephani Zador, AFSC. Public comment was provided by Lauren Divine (on behalf of the Aleut Community of St. Paul Island). A letter of support for the FEP was submitted by Julie Raymond-Yakoubian, on behalf of Kawerak.

The BS FEP has improved remarkably since the last version was submitted to the SSC for review at the October SSC meeting. **The SSC recommends the Council move forward with adopting the BS FEP, with the accommodation of the following comments and recommendations as the document moves forward**.

The program that is proposed is very ambitious, and likely to demand considerable resources if it is to be fully implemented. Although there are a few paragraphs at the end concerning the resources that will be needed, **the SSC is concerned that the authors underestimate the resources needed to fully implement the proposed FEP**.

Although there still remains some odd verbiage at the front and some of the illustrations remain problematic, the bulk of the FEP document is well written, comprehensive, and will provide a useful starting point for the proposed endeavor. Chapter 7, on the Council process could well be a standalone document used to orient new Council family members to the way the Council works and the regulatory framework within which it functions. There are a couple of place holders (Section 7.5.4; Chapter 8) that will require fleshing out before the document is released.

The SSC appreciated the responsiveness of the authors to comments provided by the SSC in October 2018. There are sections in the document that address specific comments, including the "Changes Since September 2018" section in the executive summary (perhaps this should be removed before posting as it is primarily a response to the SSC), and sections describing the role of the BS FEP team, the concept of a North Pacific FEP team, and how the FEP team will interact with other teams and committees. All of these are additions that clarify the role of the BS FEP team. Connections with existing processes, particularly the Ecosystem Status Report, have been enhanced. The SSC feels that the connection with the research priorities could still be enhanced, though having the BS FEP team provide research priorities for SSC review, as per the existing process, was considered very appropriate.

While addressed throughout the revised document, the SSC suggests another careful review of the wording to continue to clarify the scope and role of the FEP. There are still statements that can be misinterpreted to inflate the role of the FEP, particularly in the executive summary, but were noted throughout the document. The SSC cautions the authors to maintain the intent of the FEP through word choices like "inform" as opposed to "guide" fisheries management, or "provide a framework" as opposed to "coordinate".

Several of the figures suggest an outsized role for the FEP. This is conveyed in Figs. ES-1, 2-2, 3-1, 3-2, 3-5 (over-size circle for the FEP), ES-2, 3-3 (ideas for modules originate with the FEP- with no apparent acknowledgment that research modules can originate anywhere). It would be good to redraw these to show that the Council is central, and that all teams operate under and report to the Council. Likewise, it will be important for the FEP Team to focus on strategic issues for the NPFMC and that it is not intended to replace existing EBFM practices noted in section 7.5. Inclusion of a statement to this effect would be appropriate. Likewise, there needs to be a statement acknowledging that the ESR contributes to both strategic and tactical science-based decision making by the NPFMC and thus, no single PT will be solely responsible for review of its content.

The SSC had a few comments regarding process. For future initial FEP development, it would be helpful to include the SSC more fully. Also, given that the FEP will function as a living document, the SSC applauds the website platform for the continued implementation of the FEP. However, the SSC suggests that a periodic review process be outlined specifically for the Core FEP, recognizing that it may also be informed by results from the Action Modules.

Additional comments:

- Throughout the document the following appears: "annual Ecosystem Status Report (or Ecosystem Considerations Report)". The name Ecosystem Status Report has been adopted. It would be useful to relate these two names once, early on, and then just stick to the one in use (Ecosystem Status Report).
- Page 11, section 2 bullet 3: Is this an implied order of the review process?
- Page 12, Introduction: Does the FEP set goals or identify possible goals for the Council's consideration and implementation?
- Page 13, middle: Does the FEP coordinate the science or provide a framework for it?

- Page 21, Section 2.3, Objectives: How does the FEP task of setting objective for scientific research relate to the SSC's job of developing the annual Research Priorities for the Council?
- Figure 2-2: What happened to the SSC’s role in setting research priorities?
- Page 23, Process Objectives # 7: This seems to duplicate the SSC’s job in identifying and prioritizing research needs.
- Page 24, Research Objectives: #2 seems duplicative of work ongoing at the AFSC and in academia.
- Ecosystem Goal 2.3.3: Ecosystem Goal 3: If we are taking a fresh look at the management of the EBS, why assume that the 2 million metric ton cap is locked in stone? As the ecosystem changes, this too may need to change.
- Page 27: Why set up a new pathway for the development of indicators? The indicators are developed through consultations with appropriate scientists as well as with the SSC. What is being added here?
- Page 34: The FEP document puts admirable emphasis on the importance of TK and LK, and working with the communities.
- Page 35, Research Priorities: “It is anticipated that the BS FEP Team will similarly identify top research priorities for the Bering Sea ecosystem, likely linked to the Council’s prioritized Action Modules, for the SSC to assimilate.” This sounds appropriate, and may provide a different perspective than the other plan teams.
- Page 36, 3.5.5: “**Inputs directly to the Council:** Ecosystem considerations report, recommendations for amendments to the FMPs, guidance on setting TACs relative to ABCs, spatial closures, identification of thresholds for management action, information/ideas/concerns posed by members of the public during staff tasking (e.g., LK and TK holders), etc.” These seem to be bypassing the SSC. Is that intended?
- Page 38, 3.6.1: These are all good points. But it is not clear how the FEP will manage to accomplish the goals listed here.
- Page 39: The LMEs are possibly less stable than might be desired. It may be better to focus on management regions, writ large, e.g., Eastern Bering Sea.
- Page 39: The funding for the EBS IERP may have ended, but the work is far from complete. The end of the Program did not mean that it is time to move on.
- Page 42, Section 3.7, end: “Early considerations of partnerships have not only included larger organizations. Engagement early in the process is also highly encouraged to increase the potential window for collaboration.” It is not clear what is being said here.
- **3.8 Tracking and feedback mechanisms: bullet 3:** The volume of hits and numbers of mentions are not very good measures of the usefulness of the FEP’s work. On CAN get bad press, too.

Specifically relating to Section 4:

- The example Action Modules addressed in this section are as follows:
- Gap analysis of Bering Sea management with EBFM best practices - Could be useful.
- Interdisciplinary conceptual models for the Bering Sea ecosystem - Already underway but consider what will the FEP add? Be specific.

- Evaluate short- and long-term effects of climate change on fish and fisheries, and develop management considerations - Already under way. What will the FEP add or change?
- Develop protocols for using LK and TK in management and understanding impacts of Council decisions on subsistence use - Could be useful.
- Align and track Council priorities with research funding opportunities. This is counter-productive. The Council should not tailor its research priorities to what they think the donors will support. Rather, the Council should identify the most important research to support its mission, and then seek to convince the agencies that the required research should be funded.
- Page 45. "Purpose it will achieve, including relationship to BS FEP objective" - The important issue is the relationship of the research to the Council's objectives.
- Section 4.3. 1: why only the AFSC? There are other models and approaches beyond those at the AFSC.

Specifically relating to Section 6:

- Pg. 76 (Figure 6-15, continued) Distribution of Bering Sea processors (count of processors)
    - The graphic illustrating the count of processors by location could be usefully supplemented with a parallel graphic illustrating first wholesale value of processing by location as disaggregated as data confidentiality restrictions will allow.
    - Differentiating between values from federal and state managed fisheries would also be informative.
- Pg. 78 (Figure 6-17) data presented on exports
    - Data in the graphic are not legible at this scale; is this just intended to be a pointer to the website?
    - Same problem occurs with Figures 6-18 and 6-19 (posters on subsistence and climate change)
- Pg. 87 (Recreational fisheries)
    - Text notes these fisheries are "currently not a significant factor in the Bering Sea ecosystem, due to the relative remoteness of ports" and mentions halibut removals only.
    - In some remote communities where all sources of income and employment are important, fishing lodges/guided recreational salmon fisheries have been important sources of both.
    - Small scale guided fishing has episodically been a focus of effort in other communities (e.g., Unalaska/Dutch Harbor).
    - Logistical support of hunting (e.g., use of small commercial fishing vessels to support remote hunting camps) has similarly provided additional small-scale income opportunities in some communities.

- Pg. 92 (Non-consumptive activities)
    - Characterizing those outside the region that value ecosystem health as “armchair tourists” is not useful.
    - **The SSC suggests rewording the first two sentences** as follows: “Many residents in other parts of the country appreciate the “existence value” of the Bering Sea ecosystem. People who may never directly interact with the ecosystem often still share the intrinsic value of a healthy Bering Sea marine ecosystem.”
- Pg 140 (CPK graphic)
    - Not clear how decolonization would be operationalized as a process.
- Various pages throughout:
    - Suggested edits for clarity throughout the document have been provided in electronic form to the authors.

C-6 Bering Sea Snow Crab PSC Limits

The SSC received public testimony from John Gauvin (Alaska Seafood Cooperative) and Gretar Gadmundssen (Alaska Bering Sea Crabbers).

The SSC does not recommend the document be advanced for public review. Further SSC review of the analysis will be needed following revisions made to address the following concerns.

The SSC appreciates the work undertaken to explain the proposed alternatives for applying C. opilio crab model estimates to set new PSC limits for the C. Opilio Bycatch Limitation Zone (COBLZ). **The SSC believes the analysis could be improved by clarifying the units specified for crab in various figures and tables**, whether it be counts or tons, and by using a consistent unit throughout, if possible. It would also be very useful to add a discussion of the different treatment of undersized crab that are included in the modeled biomass estimates versus those that show up in the survey estimates currently used to set PSC limits (as the former is likely to exceed the latter). Specifically, careful consideration should be given to the change in resulting PSC limits when one is calculated conditional on the of size distribution and selectivity of the crab survey, whereas the new proposed method is based upon total crab biomass across all sizes.

This analysis concludes that none of the alternatives are likely to result in PSC limits being reached as a result of alternative adoption, and that no significant impacts on the human environment, groundfish catch, or costs of fishery participants should occur. However, part of the rationale for why the limit would not be reached is that vessels would be diligent in avoiding them, which implies there may be an opportunity cost of PSC avoidance. The magnitude of additional costs incurred from bycatch avoidance by the fleet as they approach the cap is unclear, and movement outside of the COBLZ could lead to increased (yet uncounted) C. opilio bycatch, or more likely, increased bycatch of other PSC species, including Pacific halibut, as reported in public testimony. Even if new closures are purported to be unlikely, the absence of a spatial catch reprojection analysis and associated estimates of economic impacts from vessels fishing outside the COBLZ by choice or by regulation, is needed.

The SSC recommends adding a section on community impacts to the RIR to allow an analysis of the differential distribution of risk of foregone catch and/or increased operational costs among fishing communities that are substantially engaged in or dependent upon the fishery, and the risk to sustained participation of those communities, consistent with National Standard 8. This section should include time series information on community of ownership of catcher vessels and LLPs referenced in Section 4.5.4 Potentially Affected Small Entities, as well as the operational location of relevant processors.

C-7 GOA Pollock and Cod Allocations

The SSC supports release of this document for public review, after the incorporation of revisions made in response to comments provided.

The SSC believes this analysis provides a clear and concise discussion of the impacts of potential modifications to the seasonal allocation of pollock and Pacific cod total allowable catch (TAC) in the Central and Western Gulf of Alaska. The analysis demonstrates that the options to modify the seasons or seasonal allocations of pollock and Pacific cod could allow the fisheries to more fully harvest the TAC, increase management flexibility and potentially decrease prohibited species catch, and as such are likely to reduce potential inefficiencies for fishery participants. Examples are provided showing instances in which past seasonal gaps could have been avoided and vessels could have remained on the grounds rather than returning to port and heading out to fish just days or weeks later; this could have had concomitant benefits for processing plants as well.

The authors did a good job of assessing the potential negative impacts to Steller sea lions associated with Alternative 2 and 3 and highlighted that there may be potential impacts if there are spatio-temporal changes to fishing, particularly in early winter. The extent of these impacts would be further reviewed as per the ESA. One note in this section: Table 3-11 uses population trends from 2003-2016 (Sweeney et al. 2016) and indicates that in that time-frame, all regions of the GOA have positive population trends. **The SSC recommends including the most up-to-date data which, as referenced in the new Ecosystem Status Reports, is Sweeney et al. 2017**. This report suggests preliminary estimates show declines in the number of non-pups in the Cook Inlet, Kodiak, and Semidi area from 2015-2017. Concurrently, 2017 pup counts in the Eastern and Central GOA declined from 2015 counts by 33% and 18%, respectively. The SSC reiterates that two years do not make a trend and that more years of data are necessary to distinguish these changes from potential declines. However, updating Table 3-11 or noting these preliminary data provides important information in light of the recent marine heat-wave impacts on the GOA ecosystem.

The SSC recommends that the following components of the analysis be added or expanded. The authors should add a row to Table 2-7 summarizing, or cross-referencing, other sections that address the social and economic impacts of the proposed actions. The authors should also provide more quantitative time series information on community engagement in and dependency on these fisheries, which could be done through relatively simple tabular presentation of a few metrics, such as annual participation by active CVs and CPs by community of ownership, and shore-based processors by community of operation, which would show continuity and intensity of engagement over time. This information could then be used to help understand how this action could affect the sustained participation of communities substantially engaged in or dependent on these fisheries, consistent with the requirements of National Standard 8. Information on subsistence fisheries should be added if changes in prohibited species catch or target catch may affect subsistence harvests. If no impacts to subsistence are reasonably foreseeable, this should be stated. The SSC notes that the Subsistence Division of ADFG may have recently updated some the information relevant to this proposed action. Finally, a summary of potential impacts of this action on safety of human life at sea should also be added, as per National Standard 10 requirements.

The SSC would also like to acknowledge that in Section 4.5.1.1 Vessel Participation, the authors compiled "typical" fishing plans for three types of vessels based in each of three different regions that are useful for understanding the annual rounds and different decision-making processes that not only shape current fishery engagement but that will also likely influence how a common fishery management action would produce different outcomes based on regional and vessel class differences. The SSC encourages the continued development and use of this type of information. Similarly, in Section 4.5.2 Processor and Community

Participation, the authors have utilized some of the processing worker count and wage data collected through annual Economic Data Reports, and this inclusion of these relatively newly collected data is appreciated and encouraged in future analyses.

D-1 Exempted Fishing Permits

Adak pollock

The SSC received a presentation on a proposed Exempted Fishing Permit (EFP) from Sara Cleaver (NPFMC) and Dave Fraser (Adak Community Development Corporation). There was no public testimony. Written public comment supporting the proposed EFP was provided by Jason Ogilvie (Golden Harvest Alaska Seafood).

The SSC appreciates the opportunity to review this EFP. The EFP proposes to allow three American Fisheries Act (AFA) vessels and two under 60' LOA catcher vessels fishing the Aleut Corporation's Directed Fishery Allocation (DFA) of AI pollock to be exempted from the Maximum Retainable Amount (MRA) for Pacific Ocean Perch (POP) and the Prohibited Species Catch (PSC) limit for Pacific Halibut applicable for directed fishing for POP in the AI pollock fishery. This EFP is specific to the area north of Atka Island in area 541 and the Kanaga Sound portion of area 542 east of 170 west longitude during the AI pollock winter "A" season in 2019 and 2020.

The issue being addressed by the EFP is the inability to more fully prosecute the DFA for AI pollock due to regulations that limit the MRA for POP to 5% per landing, which makes fishing both economically unviable and substantially more dangerous (when deck sorting in inclement weather because POP are present at levels potentially above the MRA). This issue has been exacerbated by recent increases in POP abundance concomitant with declines in pollock. By allowing for a small POP hard cap allocation in this fishery (500 t) that also meets the overall MRA limit of 5%, the fishery may be able to more fully harvest its allocation of AI pollock while exploring approaches to reduce bycatch of POP in the future.

Specifically, the experimental design of the EFP involves the collection of environmental and fishing configuration data from each vessel, as well as perceptions on the potential POP bycatch rate and actual bycatch rate of each haul made by vessels participating in the EFP. Analysis will seek to determine factors that contribute to high POP bycatch, as well as the efficacy of tools available to captains to avoid POP in real time, in an effort to avoid future bycatch through modified fishing practices and management guidelines.

The SSC supports the proposed experimental design, appreciates the dedicated effort to reduce PSC of POP, and supports approval of the proposed EFP as an important step toward realizing the intent of the DFA of fostering the prosecution of an economically viable AI pollock fishery for the benefit of the community of Adak. This is a well-written proposal to address a "management engineering" problem. It clearly explains the problem being addressed, hypotheses to be tested, overall goal and specific objectives, and the proposed approach. The SSC also notes that comments from NMFS FMA also need to be addressed in the EFP. The SSC offers the following suggested improvements that include additional data collection, additional hypotheses associated with stated goals, and explanation of statistical tests needed to test hypotheses:

- Data to be collected:
    - Clarify the weather and tidal conditions to be recorded for each haul (e.g., wind speed/direction, wave height, tide stage?)
    - Each skipper should describe gear configuration (include measurements) at the beginning of the season and note the time and date of any changes made throughout the season
    - Collect time of haul set and haul retrieval

        - Time is necessary to test hypothesis 1 that POP bycatch increases at night compared to day
        - Time is also necessary to test hypothesis 2 that POP bycatch increases with strong tidal current ebb and flow
    - Record tow speed
    - Record depths of top and bottom of pollock distribution in water column
    - Record depth of tow – including initial depth and any depth adjustments made throughout the tow
    - Record any use of net sounder, or other, data used to make tow adjustments
- The experimental design could be improved by describing how each of the three hypotheses will be tested. For example, hypothesis 1 could have the following:
    - Test for differences in POP bycatch rates during nighttime versus daytime tows
    - Test for differences in daytime and nighttime depth distributions of estimated POP and pollock distributions as determined by skippers' interpretations from echo sounders/sonar and any other evaluation tools/methods used
    - Hypothesis 2 - test for differences in POP bycatch as a function of tidal cycle and tidal range.
    - Hypothesis 3 - test for differences in POP bycatch when fishing the upper X% or Y m of the pollock depth distribution versus the lower X% or Y m.
- The third goal is to improve safety at sea by reducing the time to stow gear after each tow by eliminating the need to sort POP on deck. The EFP may be better able to meet this goal, if this can be stated as a hypothesis and if data can be collected to test for improved safety or reduces sorting times. This may include evaluating the frequency of at-sea injuries during years in which deck sorting was required, versus years in which the EFP is in place. Documenting the frequency of landings in EFP years that exceeded the MRA and would otherwise have been sorted will also be key to demonstrating risk reduction.
- The fourth goal is to evaluate timing and location of POP bycatch to determine means to reduce bycatch. The SSC recommends adding hypotheses associated with this goal. For instance: "POP bycatch varies with calendar day" and "POP bycatch varies with location." The subsequent analysis would need to choose an appropriate location metric, such as distance from nearest canyon, ADF&G stat area, bottom depth, or something else.

While the SSC is supportive of this EFP and the attempt to address the specific management issues offered by the proposers, we also note that the problem of achieving MRAs while maintaining a safe and viable fishery is a more global problem that needs to be addressed comprehensively rather than in a piecemeal fashion.

Amendment 80 Red King Crab

The SSC also received a presentation on a proposed EFP by Cory Lescher (Alaska Pacific University M.S. Student) and Sara Cleaver (NPFMC). Public testimony in support of the EFP was provided by John Gauvin (Alaska Seafood Cooperative). There was no written public comment.

The EFP proposes to allow 5 Amendment 80 factory trawl vessels to conduct two concurrent studies of red king crab (RKC) Prohibited Species Catch (PSC) during fisheries targeting flatfish. The first study will compare whole haul counts of RKC with estimates of RKC PSC made from observer subsamples. The second study will hold bycaught RKC for 72 hrs in tanks on deck to ascertain whether vitality metrics can be used to predict delayed mortality rate. The exemption would allow participating permit holders, vessel owners, and operators to pre-sort RKC catch and account for RKC catch through alternative methods; and hold RKC for up to 72 hours rather than the requirement to return all RKC immediately to the sea. These studies would occur during the 2019 BSAI flatfish fisheries “A” season.

The EFP attempts to address two issues of importance to the SSC as stated in prior minutes: inherent variability in estimation of RKC PSC through subsampling conducted by the observer program, and more accurate estimation of discard mortality rates of RKC PSC.

The SSC supports the proposed experimental designs, appreciates the collaborative nature of the experiments, and supports approval of the proposed EFP. The SSC offers the following suggested improvements:

- Provide objective criteria relevant to the objective of biological sampling of all RKC and a plan for subsampling if numbers of crab encountered are too large to practically census catch.
- A specific hypothesis should be stated for selection of crab for vitality measurements. This would provide additional clarity to the sample selection process and the analysis of these measurement data, and facilitate successful identification of factors affecting delayed mortality by reducing the number of factors under consideration.
- The SSC, and the proposer, note that the vitality experiment is a pilot study and due to the limited holding duration for crab and period of the experiment, estimates of mortality rates from the study would likely not represent the entire extent of delayed mortality encountered by RKC discarded during normal fishing operations.
- Record old versus fresh injuries of each sampled RKC to ascertain whether injuries were sustained prior to or during the fishing experiment.
- Attempt to use video cameras to verify whether all live and dead RKC encountered during the haul are actually collected by the crew for accounting in the whole haul census.
- Record deck time (time since the haul was retrieved) for each set of vitality measurements to ascertain the actual time elapsed prior to sampling for vitality, as time that crabs are exposed to deck conditions may vary widely for the first versus the last crab sampled from large king crab catches.

D-6 BSAI Pacific Cod Allocation Review Workplan

The SSC received a presentation on the work plan for the BSAI Cod Allocation Review by Jon McCracken (NPFMC).

The SSC notes this the first significant independent allocation review in the North Pacific, and perhaps nationally, so it will require consideration of both depth and scope of contents. The SSC appreciates that the work plan reflects thoughtful discussion of issues raised in the SSC discussion of the allocation review included in the GOA rockfish catch share review. In particular, this work plan clarifies that the scope of the allocations to be considered is across the range of groups that utilize allocated TACs. It also clarifies that allocation reviews are intended to illuminate differences in how different groups utilize their allocation, rather than to evaluate a specific policy or amendment proposal.

Among the relatively long table of contents provided in the work plan, the key new requirement of the allocation review lives in the second and later bullets of Section 3, where measures of performance are reported for each fleet. **The SSC recommends that the allocation review be approached as an exercise**

in developing dashboard indicators, separately tracked for each group; indicator sets for each group will reflect the primary mechanisms by which the group uses the allocations to obtain the goals of the FMP. The burden of developing the review may then be minimized by building the balance of the report around 1) presenting the methods, data, and general management measures necessary to explain how the dashboard measures were developed and 2) interpreting indicator performance levels relative to the FMP goals.

The SSC discussed the work plan from the perspective of developing the structure of this dashboard. This has two key elements. First, the list of groups to be included, to ensure it encompasses those affected by the allocated TAC. Second, the specific measures, or variables, to be reported to represent performance of each group on the FMP objectives. **The SSC recommends using the analyst's planned list of groups, including the State of Alaska GHL fishery, as appropriate for inclusion in the allocation review.** However, the current work plan is not specific about the measures that will be used to track all proposed outcomes, or which FMP objectives will be tracked for each fleet. Considering the historical period, and intervals, for presenting these calculations is also an important decision point. **The SSC recommends that a draft of the dashboard framework—with identified groups and specific quantitative outcome measures for each, but unpopulated with data—be brought forward for SSC discussion at the February meeting, before the major data exercise and analysis begins.**

In developing the variables used to assess how each group contributes to FMP objectives, the SSC suggests evaluating specific measures of the size of the allocation; allocation utilization rates (and variation); revenue from catching the allocation; revenue from catching jointly harvested species; the number of vessels; number of vessel owners; and number of US and foreign crew members. Further, measures of ecological fishing impacts (which may vary with gear impact or age-length profiles targeted; protected species interactions) and impacts on substantially engaged or dependent communities need to be developed. AFSC's ongoing community and economic time series indicators may be a useful source in identifying readily available data reflecting both fishery group effects, and overall regional trends.