C2 ABM DEIS SUPPLEMENTAL SLIDES FOR AP

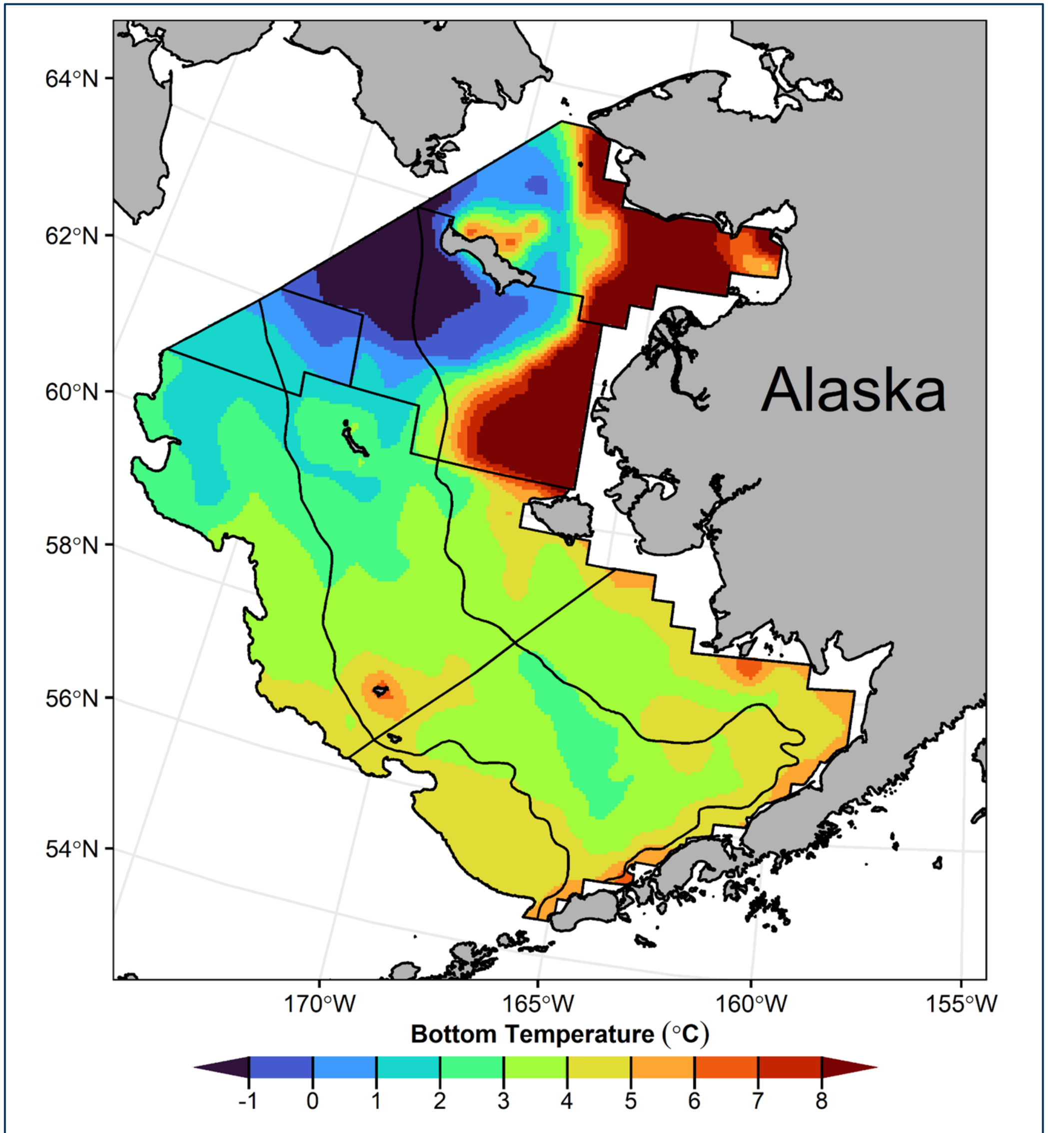
12/3/2021

OUTLINE

1. Brief overview of environmental conditions in the Bering Sea based on surveys and modeling
2. Review of PSC catch, mortality, and survey indices
3. Relative uncertainties in halibut population dynamics that contribute to output of the DEIS; treatment of O26 and U26
4. Directed commercial fishery sex ratios
5. Distribution of TCEY to directed halibut fishery users in Area 4
6. Groundfish revenue impacts review
7. Percentage of Halibut QS unit Ownership, IFQ halibut fishery, by Area 4 Region, by State, 2020
8. Net benefits to the nation
9. Wrap up and next steps

2021 bottom temperatures

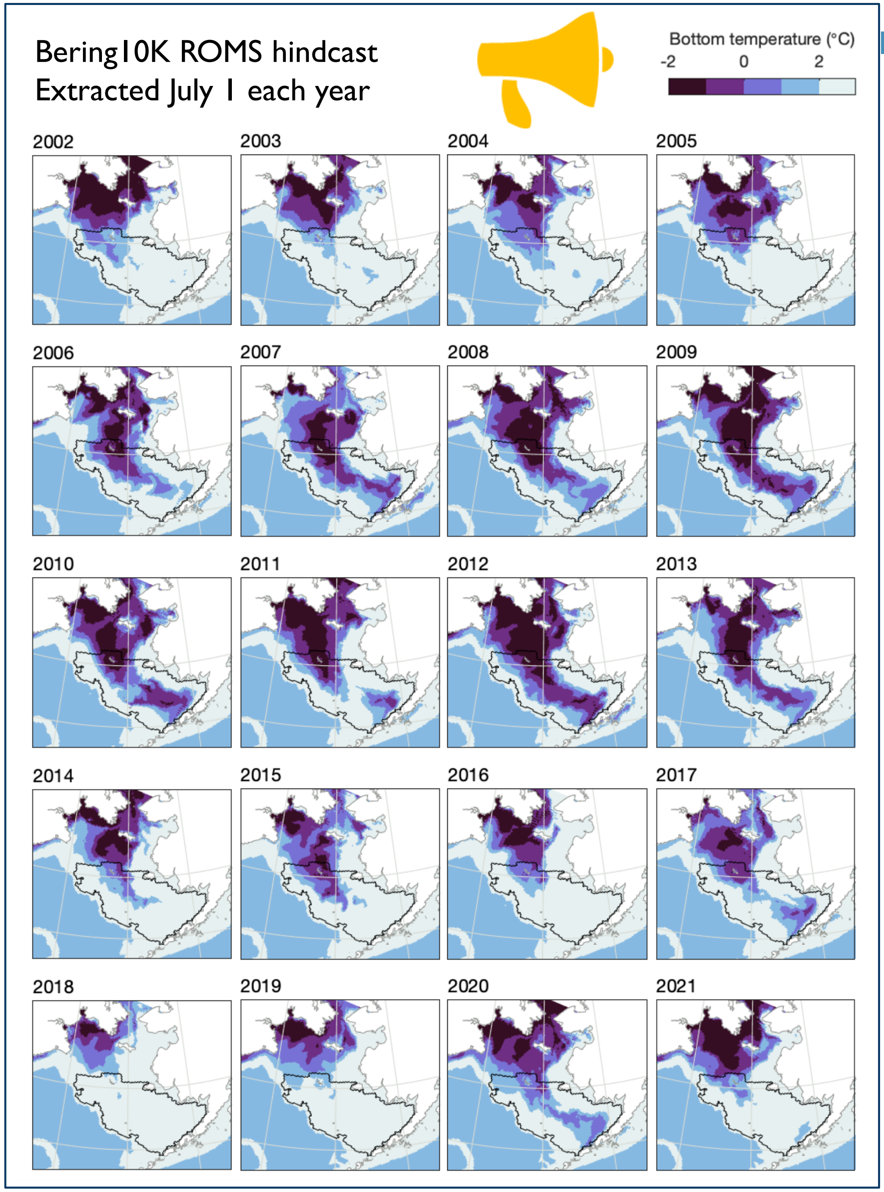
Rohan & Barnett

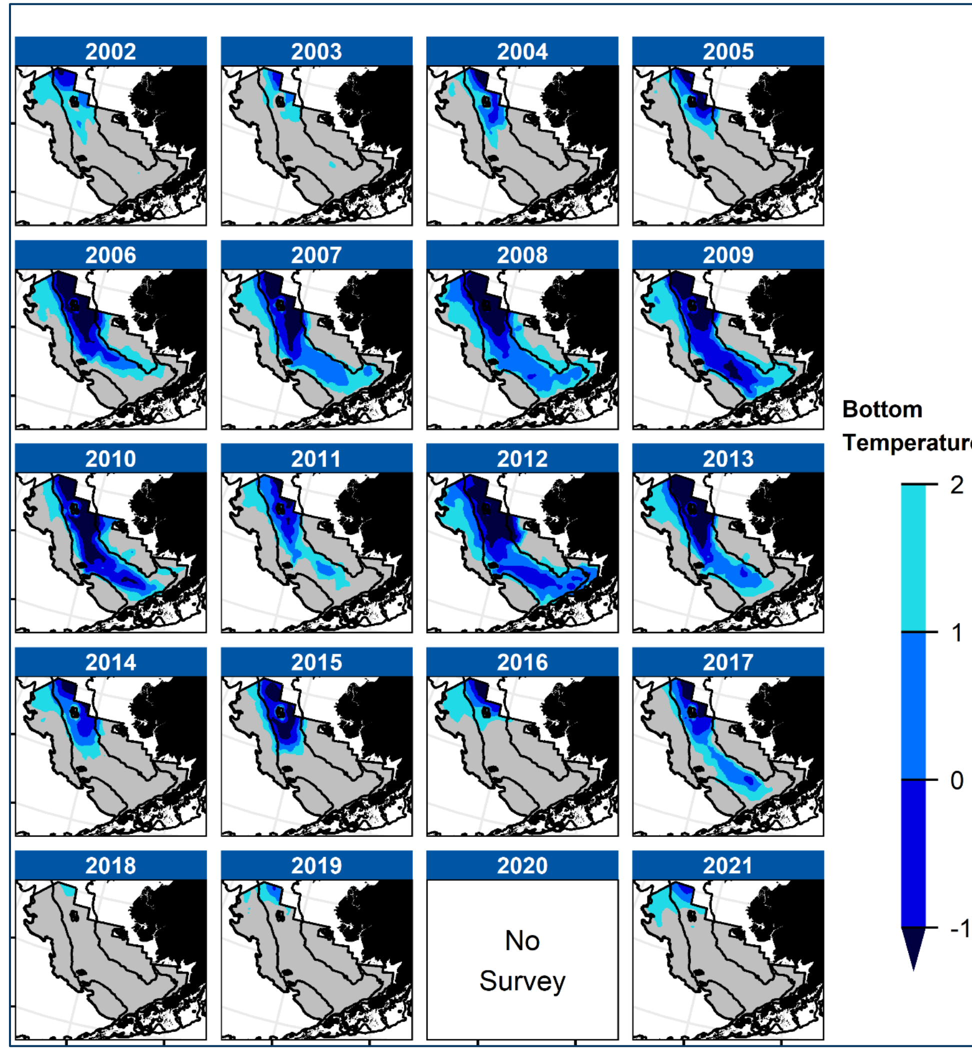


- Cold pool restricted to northwest of survey area
  - May have imposed some barrier to migration
- Extremely warm bottom waters on the northern inner shelf
  - Partially due to survey timing

2021 cold pool

Kearney, Rohan & Barnett





- 2021 resembles 1982 and 2004
- Warmer than average, but not extreme

- 2021 cold pool was 4th lowest on record
- >1SD below the time series mean

PURPOSE AND NEED FOR FOCUS ON A80 SECTOR

- *“The Amendment 80 sector is accountable for the majority of the annual halibut PSC mortality in the BSAI groundfish fisheries. While the Amendment 80 fleet has reduced halibut mortality in recent years, continued decline in the halibut stock requires consideration of additional measures for management of halibut PSC in the Amendment 80 fisheries.”*

Table 3-18 Proportion of Pacific halibut mortality by BSAI groundfish sectors (2010 through 2019)

A80	TLAS	HALCP	CDQ	HALCV	*POT**	*AFA**
60.3%	16.1%	11.1%	6.9%	0.1%	*0.1%*	*6.3%*

* The Pot and AFA sectors' halibut mortality does not accrue to annual PSC limits.

Table 3-19 Bycatch of Pacific halibut by year and sector by estimated catch (mt) and PSC mortality (mt)

Year	Measure	A80	TLAS	HALCP	CDQ	HALCV	Total
2010	Catch	**2,808**	399	4,814	837	37	8,895
	Mortality	**2,243**	286	482	151	4	3,166
2011	Catch	**2,277**	469	4,698	844	22	8,310
	Mortality	**1,810**	346	470	203	2	2,831
2012	Catch	**2,469**	824	5,380	796	20	9,489
	Mortality	**1,944**	606	538	258	2	3,348
2013	Catch	**2,676**	669	5,280	817	40	9,482
	Mortality	**2,165**	503	476	253	4	3,401
2014	Catch	**2,667**	673	4,523	604	74	8,541
	Mortality	**2,178**	508	407	224	7	3,324
2015	Catch	**1,719**	508	3,313	339	20	5,899
	Mortality	**1,638**	381	299	122	2	2,200
2016	Catch	**1,965**	689	2,192	451	1	5,298
	Mortality	**1,412**	488	198	165	0	2,263
2017	Catch	**1,976**	654	2,133	436	5	5,204
	Mortality	**1,167**	394	171	147	1	1,880
2018	Catch	**2,556**	649	1,440	412	25	5,082
	Mortality	**1,343**	412	115	148	4	2,022
2019	Catch	**3,067**	880	975	418	39	5,379
	Mortality	**1,461**	539	78	189	2	2,270

FIGURE 3-25 A80 HALIBUT PSC LIMIT, CATCH, AND MORTALITY, 2010 THROUGH 2020

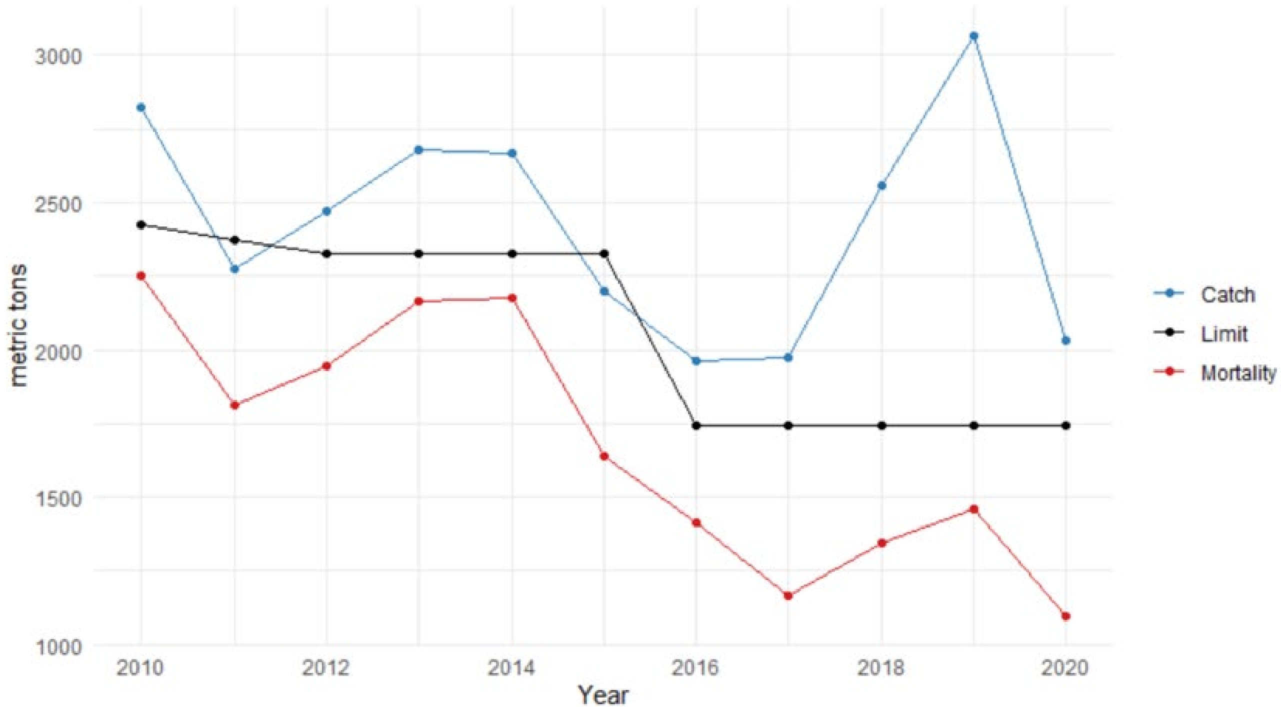


Figure 3-25 A80 halibut PSC limit, catch, and mortality, 2010 through 2020

FIGURE 3-39 A80 HALIBUT CATCH AND MORTALITY (TOP PANELS) AND SETLINE AND TRAWL SURVEY INDICES (BOTTOM PANELS), 2010 THROUGH 2019

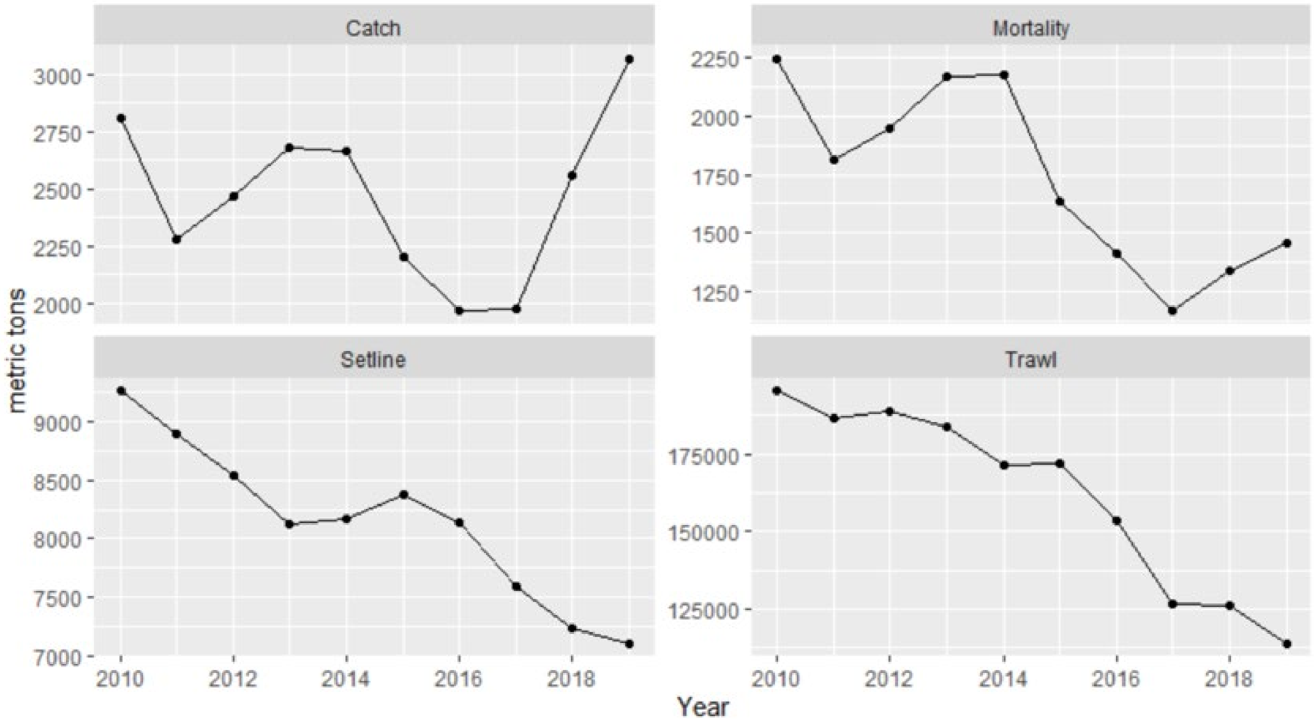


Figure 3-39 A80 halibut catch and mortality (top panels) and setline and trawl survey indices (bottom panels), 2010 through 2019

FIGURE 3-40 PLOT OF ANNUAL HALIBUT CATCH AND MORTALITY AGAINST SETLINE AND TRAWL SURVEY INDICES 2010-2019.

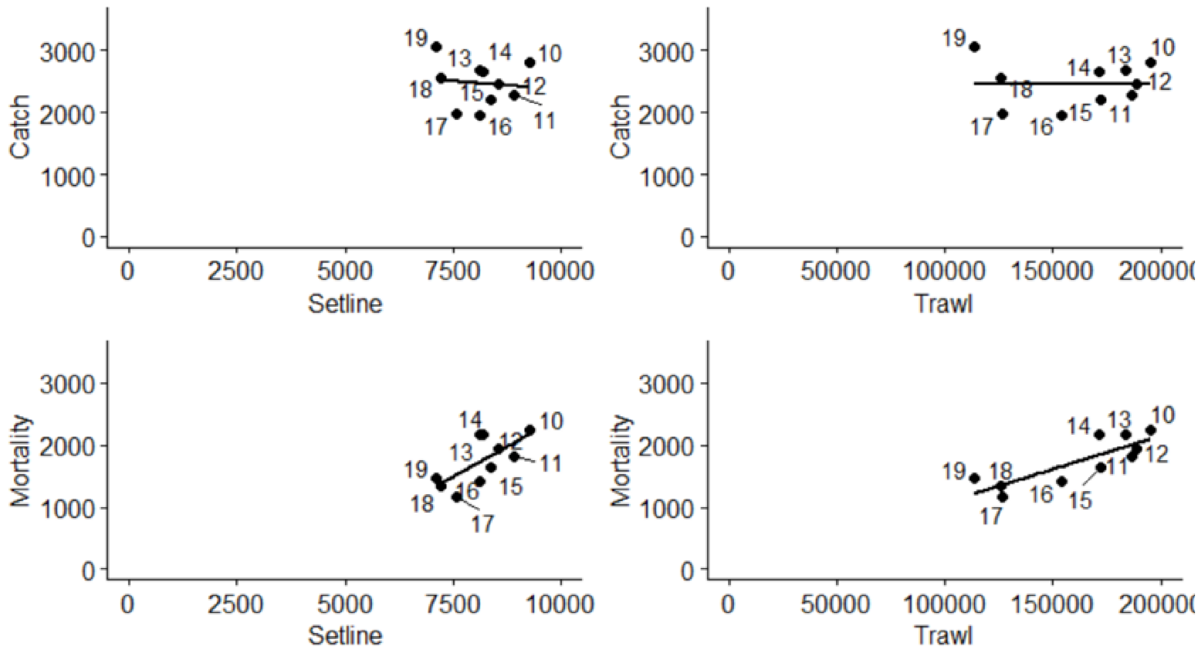


Figure 3-40 Plot of annual halibut catch and mortality against setline and trawl survey indices 2010-2019.

FIGURE 3-28 A80 SECTOR BYCATCH OF PACIFIC HALIBUT (MT) VERSUS GROUNDFISH CATCH BY TARGET SPECIES, 2010 THROUGH 2019.

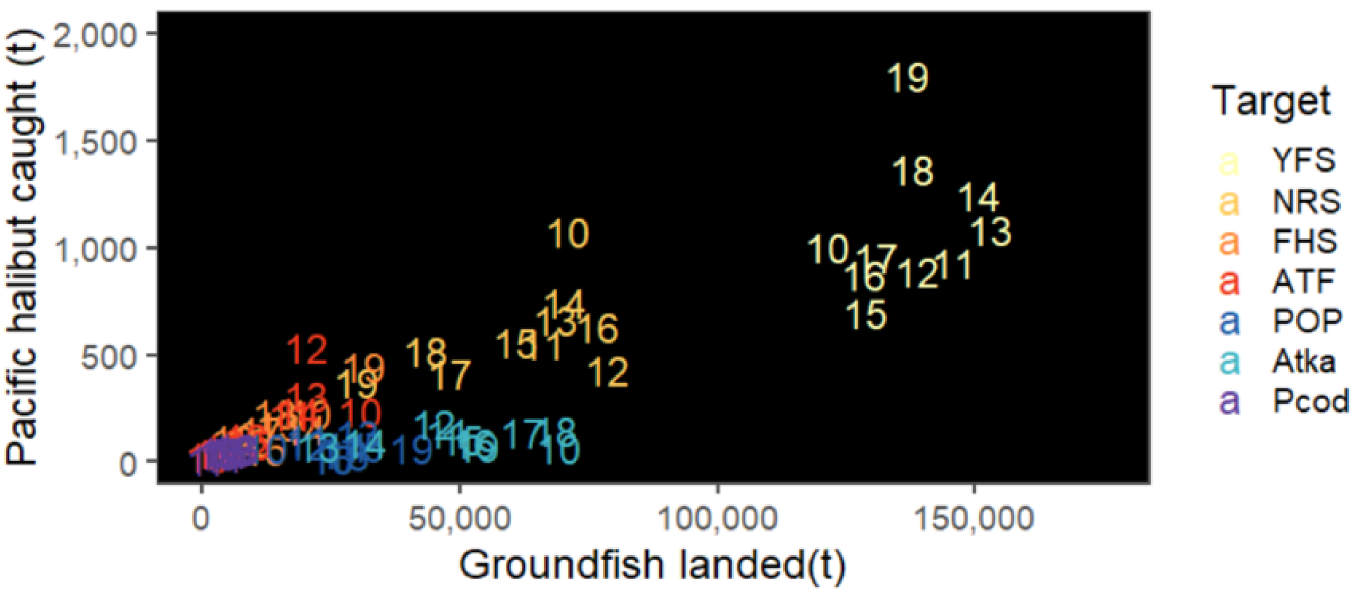


Figure 3-28 **A80 sector bycatch of Pacific halibut (mt) versus groundfish catch by target species, 2010 through 2019.**

FIGURE 3-38 ADF&G STATISTICAL AREAS WHERE HALIBUT PSC OCCURRED IN THE A80 FISHERY (RED) OVERLAID ON AREAS WHERE THE EBS TRAWL SURVEY (EBS) ENCOUNTERED HALIBUT, 2017 THROUGH 2019.

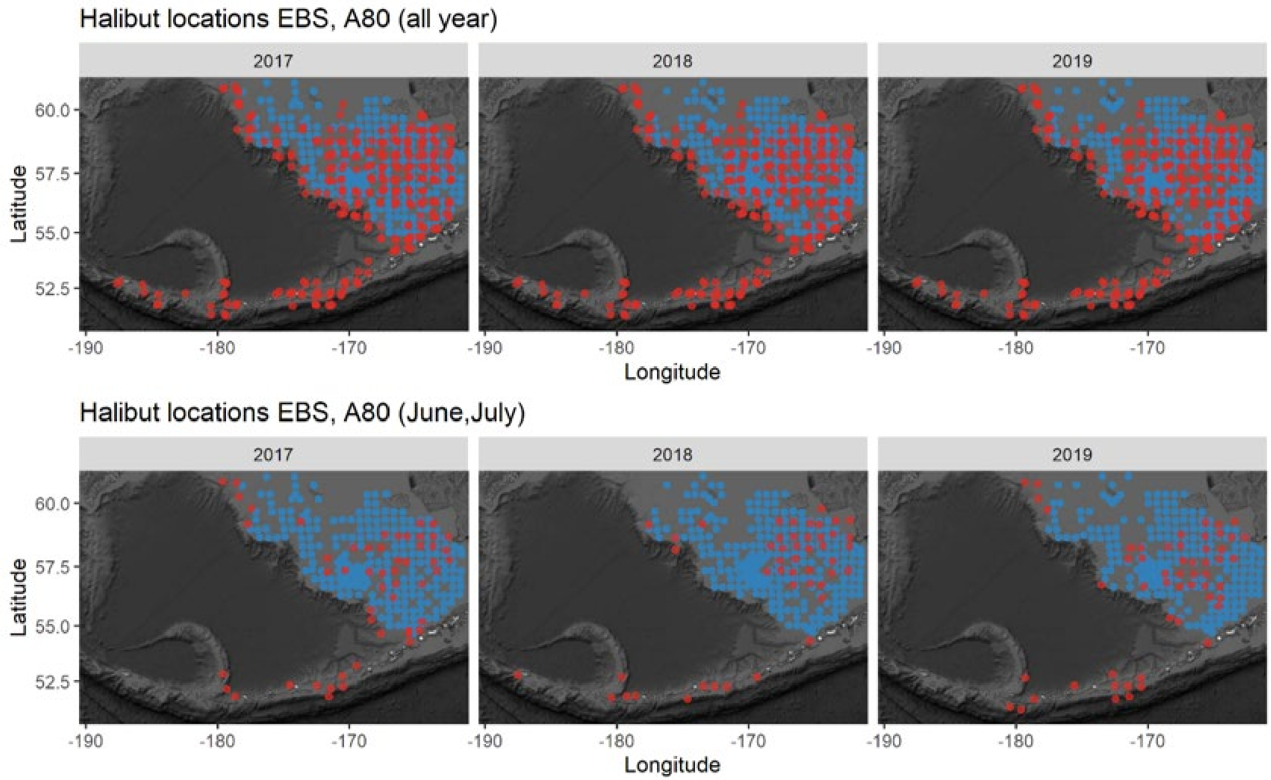


Figure 3-38 ADF&G statistical areas where halibut PSC occurred in the A80 fishery overlaid on areas where the EBS trawl survey (EBS) encountered halibut, 2017 through 2019. Top panel shows areas with A80 halibut catch throughout the year; bottom panel show areas with A80 halibut catch for the months during which the EBS trawl survey typically occurs.

RELATIVE UNCERTAINTIES IN HALIBUT POPULATION DYNAMICS THAT CONTRIBUTE TO THE OUTPUTS IN THE DEIS

Many aspects of the process and halibut population were difficult to assess in this analysis. These include both varying authorities process and jurisdiction. For management agencies this includes:

- The IPHC decision-making process occurs annually and may deviate from a defined procedure
  - deciding coastwide catches and how much is allocated to BSAI- socioeconomic factors are considered on a year-to-year basis
- The two management agencies (IPHC and NMFS) have different spatial area boundaries and any examination of limits set by these two agencies will require some simplification of the boundaries.

RELATIVE UNCERTAINTIES IN HALIBUT POPULATION DYNAMICS THAT CONTRIBUTE TO THE OUTPUTS OF THE DEIS

For halibut there are substantial uncertainties that complicate estimation of future impacts:

- The variability of recruitment and weight-at-age for Pacific halibut is substantial and are major components of future uncertainty.
- The relationship between PSC limits and realized PSC (usage) under future conditions is highly uncertain, especially when PSC limits are projected outside of the historical range.
- The dynamics of halibut movement into and out of the BSAI are variable and uncertain; BSAI survey abundance data and results from analyses using the IPHC tagging data are inconsistent.
- Additional sources of uncertainty include variability in the PSC selectivity from trawl gear in the BSAI which creates differences in age-specific mortality and causes variability in downstream impacts to the directed fishery.

Table 5-13 Three-year average percentage of O26 Amendment 80 halibut PSC by weight from observer data as calculated by weighted average based on sampling hierarchy, 2010-2020. These results include data from deck sorting (2016 through 2020). No DMRs are applied.

Year	% O26 bycatch by weight
2010	34.2%
2011	43.0%
2012	50.9%
2013	52.4%
2014	51.5%
2015	38.4%
2016	28.2%
2017	46.3%
2018	49.6%
2019	60.6%
2020	41.5%
Average 2010-20	45.1%

RELATIVE UNCERTAINTIES IN HALIBUT POPULATION DYNAMICS THAT CONTRIBUTE TO THE OUTPUTS OF THE DEIS

- The relationship between PSC limits and realized PSC (usage) under future conditions is highly uncertain, especially when PSC limits are projected outside of the historical range.
- The dynamics of halibut movement into a f the ance
- as ability in downstream impacts to the directed fis

Table created for discussion paper in October 2020 when a performance standard based on %O26 was being considered. Now included as background information but not for impact estimation

- **Consideration of impacts due to U26 mortality can be done with a complex model, but the SSC recommended a simplified impact approach, which is provided in the DEIS**

Table 5-13 Three-year average percentage of O26 Amendment 80 halibut PSC by weight from observer data as calculated by weighted average based on sampling hierarchy, 2010-2020. These results include data from deck sorting (2016 through 2020). No DMRs are applied.

Year	% O26 bycatch by weight
2010	34.2%
2011	43.0%
2012	50.9%
2013	52.4%
2014	51.5%
2015	38.4%
2016	28.2%
2017	46.3%
2018	49.6%
2019	60.6%
2020	41.5%
Average 2010-20	45.1%

SSC MINUTES APRIL 2021

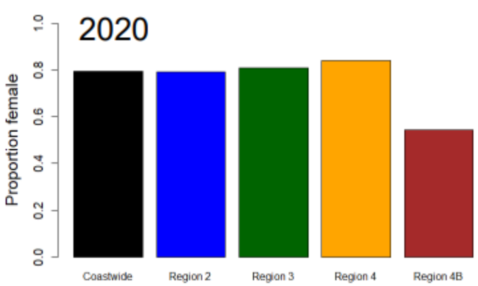
- The SSC recognizes that actual ratios of change in PSC to change in halibut fishery limits will be variable over time, reflecting changing fishery selectivity (e.g., relative fraction of O26 vs. U26 in the PSC) and biological processes.
- Through several iterations of the ABM analysis, these factors, and the variability inherent in them, have become more clear. This variability suggests that a single most likely value cannot represent the year-to-year differences in the relationship between these two sources of fishing mortality.
- For this reason, the SSC recommends that the Council compare alternatives based on a range of plausible ratios (0.0-1.0) without an implicit or explicit likelihood assigned to each.
- The SSC suggests that since O26 is deducted at a rate of 1.0 in the annual halibut calculations, this would be a logical upper bound in the case that all PSC in a particular year was O26.
- U26, calculated to have an effect on halibut yield that is greater than 1.0 is deducted from individual IPHC areas in proportion to stock abundance, for which recent historical values have been in the range of 20% for the sum of the BSAI areas.
- Thus, ratios from 0.0-1.0 should logically encompass a sufficiently broad enough range for comparison of the alternatives that is consistent with recent management.

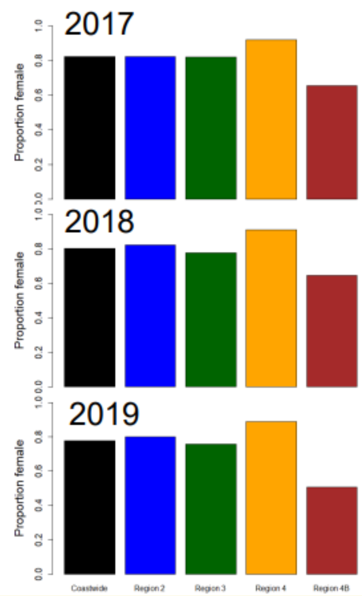
PACIFIC HALIBUT DIRECTED COMMERCIAL FISHERY SEX RATIOS

Preliminary data updates

Commercial sex-ratios

	Coastwide % female	Region 2	Region 3	Region 4	Region 4B
2017	82%	82%	82%	92%	65%
2018	80%	82%	78%	91%	65%
2019	78%	80%	76%	89%	51%
2020	80%	79%	81%	84%	54%





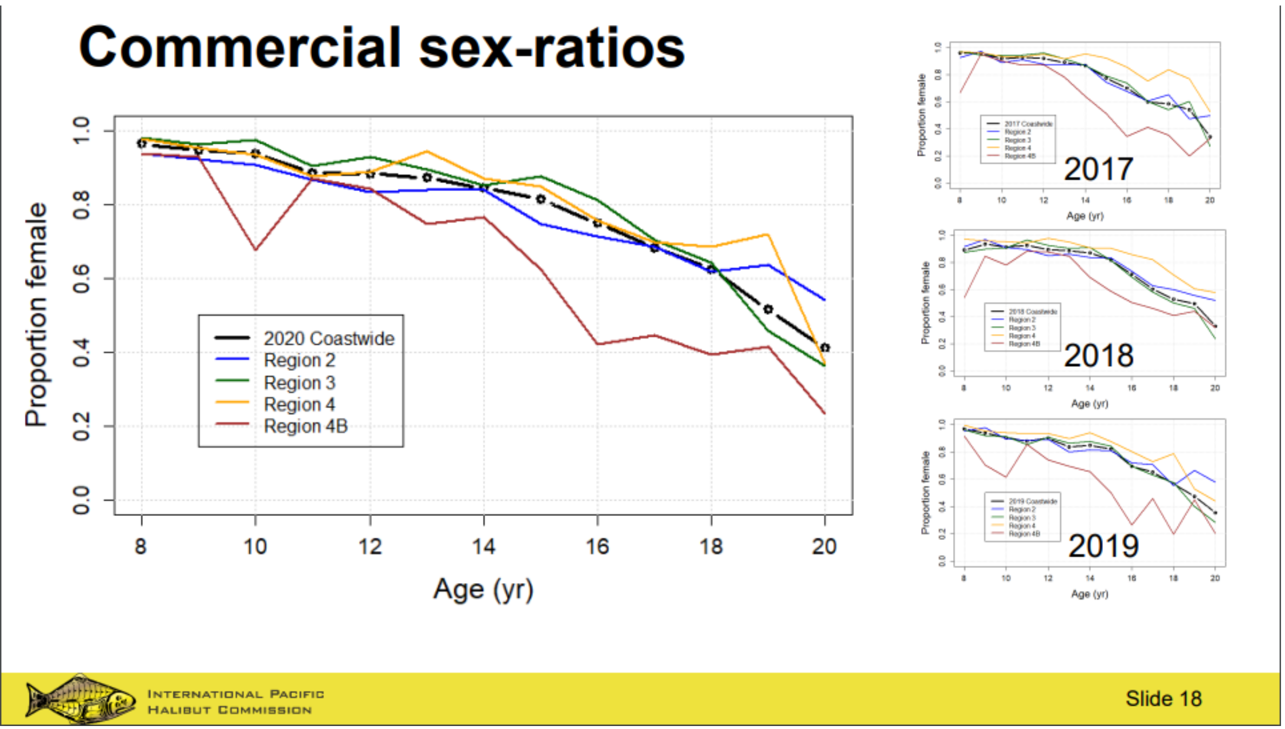
INTERNATIONAL PACIFIC HALIBUT COMMISSION

Slide 17

- High percentage of Pacific halibut caught in directed commercial fisheries are female
- Region 4 (4A and 4CDE) has the highest percentage

IPHC-2021-SRB019-06-p

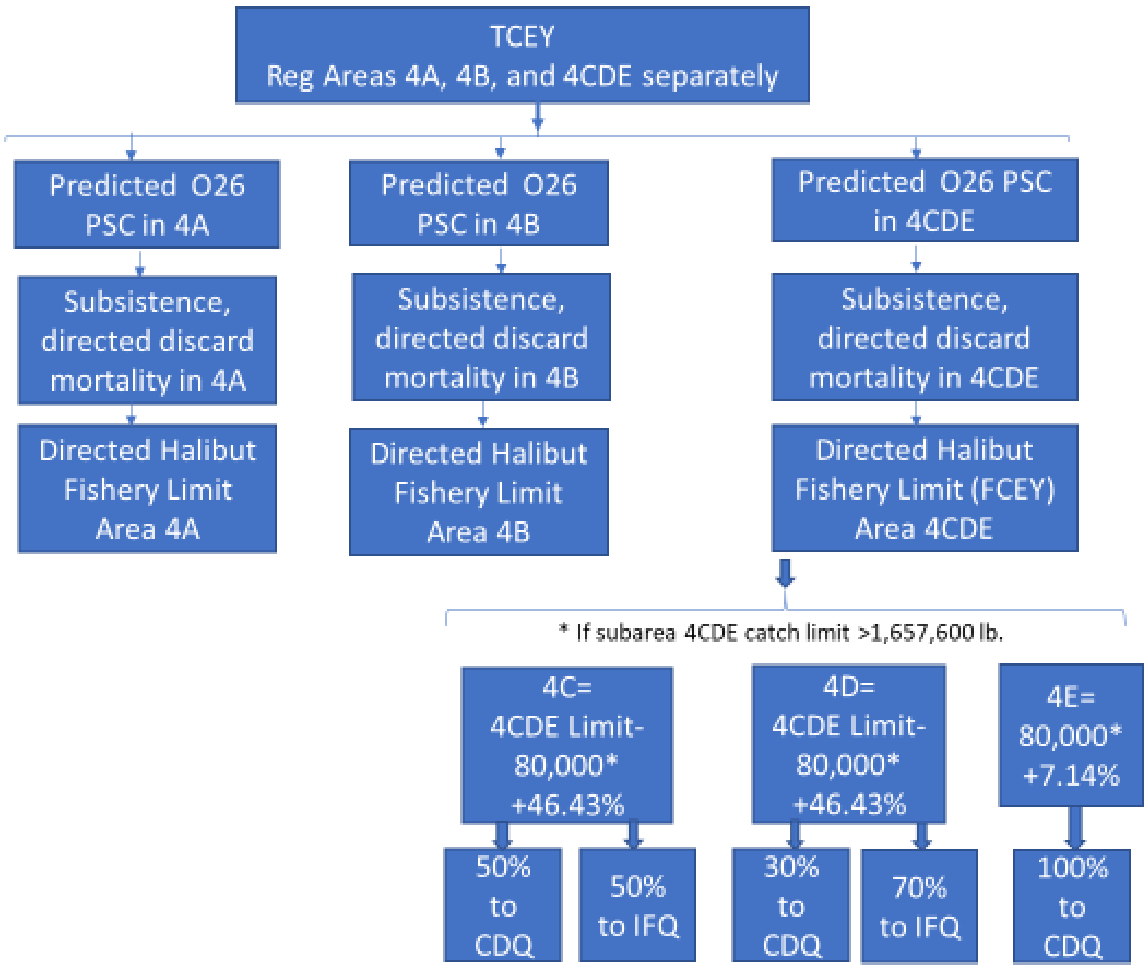
PACIFIC HALIBUT DIRECTED COMMERCIAL FISHERY SEX RATIOS



IPHC-2021-SRB019-06-p

- Dimorphic growth contributes to sex ratios (females grow bigger)
- Older fish have smaller percentage of females
- However, catch of very young fish (e.g. age 3-5) are probably close to 50% females (need observations)

FIGURE 4-5 DISTRIBUTION OF TCEY TO DIRECTED FISHERY USERS IN IPHC AREA 4



GROUNDFISH REVENUE IMPACT ESTIMATION

General approach

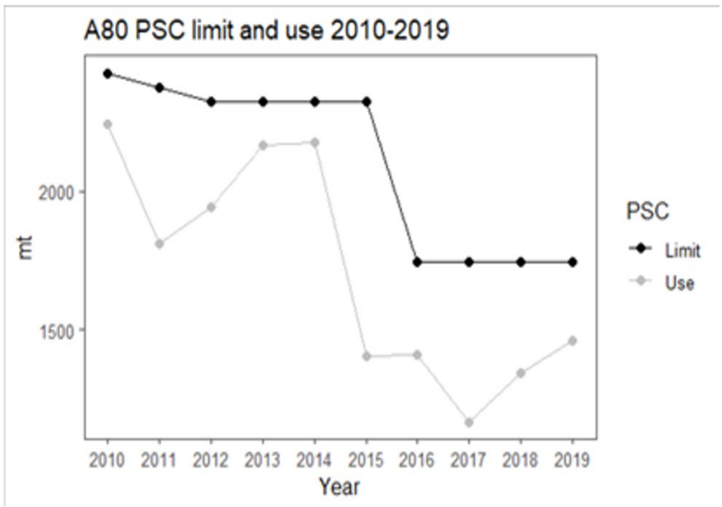
- A80 haul level data (PSC, groundfish catch, wholesale value)
- Resample hauls without replacement until reaching PSC limit or groundfish catch limit
- Separate runs with 2 groundfish catch limits
  - 310,000 mt (maximum all years)
  - 290,000 mt (maximum in most recent years)
- Sum wholesale values to estimate annual revenue
- Random and Stratified random resampling

GROUNDFISH REVENUE IMPACT ESTIMATION

General approach

- A80 haul level data (PSC, groundfish catch, wholesale value)
- Resample hauls without replacement until reaching PSC limit or groundfish catch limit
- Separate runs with 2 groundfish catch limits
  - 310,000 mt (maximum all years)
  - 290,000 mt (maximum in most recent years)
- Sum wholesale values to estimate annual revenue
- Random and Stratified random resampling

- PSC limits and use varied over the last 10 years



PSC limits and PSC use (in metric tons) for the A80 sector 2010-2019.

GROUNDFISH REVENUE IMPACT ESTIMATION

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- A80 haul level data (PSC, groundfish catch, wholesale value)
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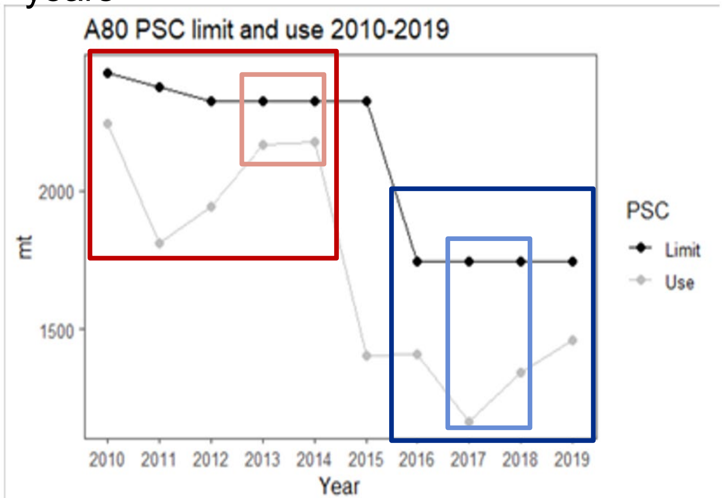

PSC limits and PSC use (in metric tons) for the A80 sector 2010-2019.

- Subset into 5 datasets
  - Higher PSC use (2013-14)
  - High PSC use years (2010-2014)
  - all years (2010-2019, excluding 2015)
  - Low PSC use years (2016-2019)
  - Lower PSC use (2017-18)

GROUNDFISH REVENUE IMPACT ESTIMATION

- Each PSC limit has 16 revenue estimates based on "scenarios" defined by combination of
  - Groundfish limit (290,000t or 310,000t)
  - Dataset used (years of data included)
  - Sampling method (random or stratified and ordered by month)

Table 5-5 **Estimated revenue (million wholesale $2018) by PSC limit and Alternative using different estimation methods. Green shading indicates the results were constrained by the PSC limit, blue shading indicates the results were constrained by the groundfish limit (290,000 or 3310,000 t).**

Estimation	PSC limit	960		1047		1222		1309		1396		1483		1571		1745		2007	
	Alternative(s)	4		4		3		3		2,3,4		2		2		1,2,3,4		3	
	GF limit (1,000 mt)	290	310	290	310	290	310	290	310	290	310	290	310	290	310	290	310	290	310
Random	2010-14	160.582	160.815	174.982	175.215	204.050	204.313	219.181	218.550	233.493	233.235	248.384	247.668	262.813	262.705	291.338	291.603	327.968	335.497
	2010-19	189.686	190.121	207.396	206.935	241.993	241.715	259.314	258.923	276.215	276.468	293.723	293.380	310.690	310.046	335.887	345.264	335.937	359.123
	2016-19	246.206	246.385	268.807	268.887	313.489	313.519	335.524	335.829	346.417	358.232	346.366	370.300	346.425	370.269	346.417	370.311	346.454	370.271
	2013-14	137.994	138.184	150.453	150.591	175.812	175.384	187.950	187.992	200.795	200.295	213.141	213.202	225.934	225.979	251.137	251.123	288.273	288.545
	2017-18	282.581	282.479	307.928	308.073	359.795	359.146	376.517	385.223	376.582	402.458	376.509	402.584	376.623	402.591	376.558	402.546	376.604	402.554
Stratified	2010-14	182.258	182.272	195.088	195.065	216.307	216.059	227.666	227.668	246.072	246.276	268.338	267.997	283.966	283.479	313.799	313.520	327.054	349.666
	2010-19	202.931	202.828	216.382	216.445	242.752	242.719	255.780	256.090	277.083	277.964	305.385	305.515	326.047	326.307	336.782	360.053	336.793	360.511
	2016-19	218.741	218.978	253.143	253.251	319.090	318.907	341.704	341.720	349.070	366.178	349.027	372.528	349.165	372.536	349.034	372.499	349.147	372.479

GROUNDFISH REVENUE IMPACT ESTIMATION

Table 5-3 Average estimated groundfish catch (1,000 mt) by PSC limit and Alternative using different estimation methods. Green shading indicates the results were constrained by the PSC limit, blue shading indicates the results were constrained by the groundfish limit (290,000 or 310,000 mt).

Estimation method	PSC limit	960		1047		1222		1309		1396		1483		1571		1745		2007	
	Alternative(s)	4		4		3		3		2,3,4		2		2		1,2,3,4		3	
	GF limit (1,000 mt)	290	310	290	310	290	310	290	310	290	310	290	310	290	310	290	310	290	310
Random	2010-14	141.87	142.08	154.64	154.84	180.30	180.60	193.62	193.18	206.31	206.06	219.45	218.93	232.20	232.01	257.39	257.73	289.83	296.41
	2010-19	163.68	164.03	178.98	178.64	208.84	208.68	223.74	223.47	238.37	238.53	253.43	253.17	268.16	267.55	289.89	297.92	289.98	309.98
	2016-19	206.15	206.20	225.00	225.06	262.45	262.51	280.97	281.14	289.99	299.95	289.98	309.98	289.99	309.99	289.99	309.99	289.99	309.99
	2013-14	135.87	135.96	148.12	148.27	173.09	172.68	185.01	185.05	197.65	197.23	209.83	209.77	222.39	222.41	247.19	247.13	283.86	283.97
	2017-18	217.60	217.53	237.19	237.22	277.07	276.67	289.96	296.63	289.99	309.97	289.99	309.99	289.99	309.99	289.99	309.99	289.99	309.99
Stratified	2010-14	167.26	167.25	179.74	179.73	199.56	199.38	209.93	209.99	223.89	224.00	240.13	239.85	252.87	252.54	278.24	278.01	289.98	309.98
	2010-19	179.03	178.93	191.50	191.57	214.87	214.88	226.38	226.65	243.07	243.71	264.26	264.35	281.00	281.28	289.98	309.59	289.98	309.98
	2016-19	184.07	184.22	210.79	210.86	264.14	264.04	283.60	283.57	289.99	304.60	289.99	309.98	289.99	309.98	289.99	309.99	289.99	309.98

GROUNDFISH REVENUE IMPACT ESTIMATION

- Revenue estimates should be read for comparison across alternatives
  - Results are not stand-alone predictions of future A80 revenue under each PSC limit. Harvesters are expected to make strategic choices that are different from the randomized selection of hauls used in this analysis.
- Results are aggregated at the A80 sector level
  - The distribution of impacts across companies and vessels will differ based on many factors, most notably fishing portfolio
- Estimates are based on actual fishery data
  - Only reflects the environmental conditions and fishing behavior that occurred during the past 10 years
  - Does not estimate outcomes under a changed environment or management regime, future TACs or market conditions, or incorporate potential future fishing adaptations or operational changes
- No predetermined relationship between PSC use and PSC limit
  - Implicit assumption that 100% of PSC use is possible (and is reached unless groundfish limit is reached first)
- Random selection of hauls
  - Hauls are selected based on their prevalence in the underlying distribution
  - Less likely to include the most extreme examples such as a year in which the fleet has difficulty avoiding halibut and accumulates PSC at a more rapid rate
  - Results center around the mean
  - Does not assume specific fishing strategy or operational response

GROUNDFISH REVENUE IMPACT ESTIMATION

- Generally, lower PSC limits tend to result in reduced groundfish revenue
- Revenue constrained by PSC at low PSC limits (shaded green in table)
  - Similar revenue estimates under both groundfish limits
- Revenue constrained by groundfish limits at higher PSC limits (shaded blue in table)
  - Revenue estimates vary with groundfish limit
- Revenue estimates are lower under the high PSC use and higher under low PSC use datasets
  - Large range of potential revenue for each PSC limit based on high or low PSC use
- The range of estimates under each dataset (years sampled) should be considered when comparing alternatives
- Given reductions in PSC limits and operational changes such as increased deck sorting, it is most likely that future PSC use will be similar to what has been seen in the years since 2015 (estimates using 2016-19 or 2017-18 data are most likely).
- However, it is possible that estimates using the earlier, higher PSC-use datasets may be representative if encounter rates were to increase and efforts to reduce mortality became less effective.

SIA TABLE 69. PERCENTAGE OF HALIBUT QS UNIT OWNERSHIP, IFQ HALIBUT FISHERY, BY AREA 4 REGION, BY STATE, 2020

Table 69. Percentage of Halibut QS Ownership by Area 4 Region, by State, 2020

Ownership Address State	IPHC Regulatory Area				
	4A	4B	4C	4D	4E
Alaska	61.6%	50.8%	55.8%	42.2%	84.3%
Washington	24.8%	38.2%	24.1%	37.8%	15.5%
Oregon and Other States	13.6%	10.9%	20.1%	20.0%	0.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: https://www.fisheries.noaa.gov/alaska/commercial-fishing/permits-and-licenses-issued-alaska accessed 10/24/2020.

5.6 NET BENEFITS TO THE NATION

- The analysis in this section is qualitative and based on the calculation of net benefits (change in produce and consumer surplus) and not welfare economics.
- It is anticipated that, depending on the size of the halibut PSC mortality limit reduction to the A80 sector, the proposed action is expected to:
  - Negatively affect producer surplus (dependent on the preferred alternative chosen and unknown future conditions)
    - the expected reductions in the A80 producer surpluses and importers of A80 species are not offset by increases in producer surpluses generated by harvesters, processors, and sellers of any increased catch in the directed halibut fisheries. Quantitative estimates are not provide based on direction from the SSC not to compare the quantitative estimates of gross revenue changes between the A80 and directed halibut fishery.
  - Consumer surplus will be little changed and will depend on the relative cost and availability of substitutes in the world whitefish market.
- Overall, net benefits to the Nation are expected to be negative.
- The magnitude cannot be quantified and is expected to be more negative as the mortality limit reduces the amount of A80 species catch taken on an annual basis and increases costs associated with the harvest of those species.

WRAP UP AND NEXT STEPS

SELECTING A PREFERRED ALTERNATIVE

Selecting a Preferred Alternative

Step 1:
Select overall Alternative

- Alt 1
- Alt 2
- Alt 3
- Alt 4

Step 2:
Select options (not mandatory)

- Option 1
- Option 2*
- Option 3

*for first year of implementation only

Step 3:
Select sub-options (if applicable)

- Option 2*: Sub 1: $\leq$10%; Sub 2: $\leq$15%
- Option 3: Sub 1: A.L.80%; Sub 2: A.L.90%

ADDITIONAL ITEMS FOR CLARIFICATION

- What to do in the case of a missing survey value (as with 2020 or in the case of reduced survey effort)? This is particularly important for the EBS trawl survey
- Any clarifications to option 3?
  - Confirm that it is the Council's intent that the annual limit is not retained as a hard cap in subsequent years
  - Consider modifying the evaluation of an overage based on rolling multi-year basis rather than within a single-year only
- Implementation considerations: Option 2 vs some other method to set Year 1 limit

BALANCING THE NATIONAL STANDARDS: POLICY TRADE-OFFS

National Standard 9:
Balance between allowing A80 to flexibility to achieve TAC and to minimizing bycatch to extent practicable

Policy Considerations

National Standards 4 and 8:
Consider indexing a fishing allocation or privilege (PSC limit) to abundance to promote conservation in a fair and equitable manner; Consider beneficial and adverse direct and indirect impacts to groundfish- and halibut-dependent fishing communities.