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October 25, 2021

Lara Erikson
International Pacific Halibut Commission
2320 West Commodore Way
Salmon Bay, Suite 300
Seattle, WA 98199-1287

Dear Ms. Erikson:

This letter represents our report on the Alaska recreational halibut fishery in support of the annual IPHC stock assessment. This year's letter provides:

1. Final 2020 estimates of sport fishery harvest and yield by IPHC regulatory area,
2. Preliminary 2021 estimates of harvest and yield by IPHC area,
3. Final 2020 and preliminary 2021 estimates of sport fishery release mortality by IPHC area, and
4. Updated 2018 and 2019 and Final 2020 estimates of sport fishery yield prior to the mean IPHC longline survey date in Areas 2C and 3A.

Each section includes a summary of the methods used and basic results. More detailed information on methods can be found in the following project operational plans:

Southeast Region creel sampling: <http://www.adfg.alaska.gov/FedAidPDFs/ROP.SF.1J.2019.05.pdf>

Southcentral Region creel sampling: <http://www.adfg.alaska.gov/FedAidPDFs/ROP.SF.2A.2016.20.pdf>

Statewide halibut estimation: <http://www.adfg.alaska.gov/FedAidPDFs/ROP.SF.4A.2020.04.pdf>

We hope this information satisfies the IPHC's needs. Please feel free to contact us if you require clarification or additional information.

Sincerely;

(sent via email)

Sarah Webster, Mike Jaenicke, Diana Tersteeg, Martin Schuster, and Marian Ford
Fishery Biologists

Final Estimates of 2020 Sport Harvest and Yield

In Fall 2020 we provided preliminary estimates of the 2020 sport harvest for Areas 2C, 3A, 3B, and 4. This letter provides final estimates of the 2020 sport harvest based on Alaska Department of Fish and Game (ADF&G) saltwater logbook data as of October 08, 2021, and final estimates from the ADF&G Statewide Harvest Survey (SWHS). The final estimates for Area 2C and 3A will also be posted on the North Pacific Fishery Management Council web site.

Due to the anticipated decline in charter effort in 2020 resulting from the COVID-19 pandemic, regulations for the Area 2C and Area 3A charter fisheries were adjusted on June 15th to provide additional harvest opportunities to charter halibut businesses and recreational anglers. The Area 2C charter fishery regulations for 2020 included a one-fish daily bag limit and reverse slot (or “protected slot”) limit that allowed harvest of halibut less than or equal to 40 inches and halibut greater than or equal to 80 inches prior to June 15th, and less than or equal to 45 inches and greater than or equal to 80 inches thereafter. The Area 3A charter regulations included a two-fish bag limit with a maximum size on one of the fish of 26 inches prior to June 15th and of 32 inches thereafter, a limit of one trip per charter vessel per day (on which halibut are harvested), a limit of one trip per Charter Halibut Permit (CHP) per day, a closure of halibut retention on Tuesdays and Wednesdays prior to June 15th and no closure days thereafter, and a 4-fish annual limit with a harvest recording requirement prior to June 15th and no annual limit thereafter. Charter captains and crew were not allowed to retain halibut while guiding clients in Area 2C or Area 3A under regulations of the North Pacific Fishery Management Council’s Catch Sharing Plan (CSP) for these Areas. Charter fishery regulations in the remainder of the state included a daily bag limit of two fish of any size, and there was no prohibition on retention of halibut by captains or crew. Unguided fisheries statewide were managed under a bag limit of two fish of any size.

Methods:

For Areas 2C and 3A, sport fishery yield was calculated separately for the charter and unguided sectors as the product of the number of fish harvested and average weight of harvested halibut. Yield estimates do not include release mortality (provided later in this document). Estimates were done for six subareas in Area 2C and eight subareas in Area 3A and summed. Charter harvest was based entirely on logbook data, per the provisions of the CSP. Unguided harvest was estimated through the SWHS. Standard errors of the SWHS estimates for the unguided sector were obtained by bootstrapping. Average net weight was estimated by applying the IPHC length-weight relationship to length measurements of harvested halibut sampled at major ports in Areas 2C and 3A. All fish from each vessel-trip selected for sampling were measured. Bootstrapping was used to estimate the standard errors of average weight. The estimates of charter average weight for Homer, Seward, and Whittier were stratified to account for differences in sizes of halibut cleaned at sea and cleaned in port in 2020. There were no samples from the charter sector in the 3A portion of the Glacier Bay area (SWHS Area G) due to the absence of a port sampler in Elfin Cove in 2020, so the Yakutat area (SWHS Area H) average weight from the charter fishery was substituted for this area; Yakutat was the nearest port in Area 3A from which samples were obtained. All unguided harvest in the Glacier Bay subarea was assumed to have occurred in Area 2C. Charter-caught halibut taken under a Guided Angler Fish (GAF) permit from the National Marine Fisheries Service were not included in charter harvest calculations because the CSP specifies that this harvest accrues toward the commercial catch limit.

Final estimates of sport fishery yield for Areas 3B and 4 are for the charter and unguided sectors combined and are based entirely on the SWHS. Because ADF&G does not sample the sport harvest in these areas, we followed past practices of the IPHC and used the average weight of Kodiak sport harvest as a proxy for average weight in Areas 3B and 4. Specifically, we used the average weight from the unguided sector because it was unaffected by size limits. Even so, use of the Kodiak average weight may bias the yield estimates for these Areas.

As has been done historically, harvest from SWHS Area R (Alaska Peninsula and Aleutian Islands south of Cape Douglas) was apportioned to IPHC Areas 3B and 4 using specific locations reported in the survey. In

some years, Area R harvest estimates have included harvests for sites that are actually in Area 3A. Since 1991, the estimated harvest of Area 3A halibut included in Area 3B estimates has ranged from 0 to 728 fish per year (average = 112). In 2020, no halibut were estimated from Area 3A locations in Area R.

Results:

The 2020 Area 2C estimated sport harvest (excluding release mortality) was 83,471 fish, for a yield of 1.334 million pounds (Table 1). Charter yield represented 35% of the total. Average net weight was estimated at 15.99 lb overall and was lower for the charter sector due to size limit restrictions. Average weight was estimated from samples of 2,272 charter halibut and 3,553 unguided halibut.

The Area 3A estimated sport harvest was 197,355 fish, for a yield of 2.971 Mlb (Table 1). The charter sector accounted for 52% of the total yield. Average net weight was estimated at 15.06 lb overall and was slightly lower for the charter sector. Average weight was estimated from samples of 4,663 charter halibut and 1,888 unguided halibut.

The final estimates of charter halibut yield were about 3.4% lower than last year's preliminary estimate in Area 2C and 1.8% lower in Area 3A. These differences were largely due to errors in estimating harvest using incomplete logbook data. The final estimates of unguided yield were 6.4% lower than the mid-point of low and standard preliminary estimates in Area 2C and 5.8% lower in Area 3A. The standard preliminary estimates were derived from simple exponential time series forecasts (SAS ESM procedure) for the entire unguided sector; the low preliminary estimate was derived from simple exponential time series forecasts by residency status and assumed that reductions in non-resident harvest in the unguided sector would mirror non-resident effort reductions seen in the charter sector due to the COVID-19 pandemic. Large forecasting errors were expected due to high annual variability in the harvest time series and uncertainty due to the pandemic.

The final harvest estimates for western areas were 402 halibut in Area 3B and 549 halibut in Area 4 (Table 1). Applying the Kodiak unguided average weight of 18.40 lb resulted in yield estimates of 0.007 Mlb in Area 3B and 0.010 Mlb in Area 4. These final estimates were down from last year's preliminary estimates of 0.010 in Area 3B and 0.016 in Area 4.

Preliminary 2021 Estimates of Harvest and Yield

Methods:

Sport charter fishery mortality for Areas 2C and 3A is based on numbers of halibut reported harvested and released in ADF&G mandatory charter logbooks. Harvest and release estimates from the SWHS are still used for all unguided fishery estimates as well as total sport fishery estimates for Areas 3B and 4. Neither complete logbook data nor SWHS estimates are available yet for the current year, and creel sampling is not designed to produce estimates of harvest. A variety of methods were used to provide preliminary estimates of the numbers of fish harvested by each sector and Regulatory Area.

Electronic logbooks (eLogbooks) were mandatory throughout 2C in 2021. As such, harvest reported in eLogbooks through October 19th is reported herein and considered the preliminary total harvest for 2C. It is expected that this number will change slightly when final harvest is available due to data cleaning that still needs to occur and submission of late pages. From 2017 – 2019 there was no charter harvest in 2C after October 15th; it is anticipated that late season harvest in 2021 will not have a substantial effect on total harvest. Charter harvest for 3A was projected from partial-year logbook data. The majority of operators in 3A still use paper logbooks and there was no mandate to use eLogbook in most of 3A in 2021. Logbook data were entered and available in mid-October for most trips taken through August 31 and this was used to project harvest for the year in 3A. Harvest data were corrected to account for late logbook submissions and other reporting errors based on past data. This adjusted the harvest in each area by less than 3%. The harvest data were then expanded by forecasting the proportion of harvest taken through August in each subarea. Forecasts and their standard errors were obtained from a simple exponential smoother using 2006-2019 logbook data as of October 19, 2021. Data from 2020 were omitted from forecasts due to the unusual timing

of the fishery caused by the COVID-19 pandemic. Preliminary data suggest that the 2021 fishery was similar to pre-pandemic conditions.

Unguided harvest in Areas 2C and 3A, and overall sport harvests for Areas 3B and 4 were projected from the existing time series of SWHS estimates using simple exponential smoother forecasts. Data from 2020 were omitted from unguided forecasts in 2C and 3A due to the reduced effort caused by the COVID-19 pandemic in those Areas in 2020. Preliminary data and information from managers suggest that the 2021 unguided fishery was similar to pre-pandemic conditions in those Areas.

For both sectors in Areas 2C and 3A, preliminary harvest at the subarea level was used to estimate yield. Charter and unguided yield were estimated by multiplying the subarea harvest by the corresponding estimates of average weight. Average weights were estimated by applying the IPHC length-weight relationship to length measurements of harvested halibut obtained through sampling of the recreational harvest. No sampling was conducted in Areas 3B or 4 in 2021, so the Kodiak area average weight from the unguided fishery was again substituted for these Areas.

Results:

The preliminary estimate of 2021 sport halibut harvest in Area 2C (excluding release mortality) was 139,268 halibut, or 2.191 Milb (Table 2). Average weight was estimated at 15.73 lb. The charter average weight was 2.8 lbs lower than the unguided average weight due to the charter fishery size limit. Average weights for Area 2C were estimated from samples of 3,870 charter halibut and 3,484 unguided halibut.

The preliminary estimate for Area 3A was 293,458 halibut, for a total sport fishery yield of 3.988 Milb (Table 2). Charter harvest was estimated using a projection that 94% of the harvest was taken through the end of August. The estimated average weights in Area 3A was 13.59 lb overall. Average weights were estimated from samples of 4,634 charter and 1,659 unguided halibut.

The preliminary harvest estimates for 2021 were 452 halibut in Area 3B and 761 halibut in Area 4. Applying the unguided average weight of 14.23 lb from Kodiak resulted in yield projections of 0.006 Milb in Area 3B and 0.011 Milb in Area 4 (Table 2). Although the levels of sport harvest are low, there is large uncertainty in the time series forecasts as well as use of the Kodiak unguided average weight as a proxy for average weight in these areas.

Final 2020 and Preliminary 2021 Estimates of Release Mortality

Methods:

Release mortality (R) was calculated in pounds net weight for each subarea of Areas 2C and 3A as:

$$R = \hat{N} \cdot DMR \cdot \hat{w}$$

where

\hat{N} = the number of fish released,

DMR = the assumed short-term discard mortality rate due to capture, handling, and release, and

\hat{w} = the estimated average net weight (in pounds) of released fish.

The numbers of halibut released (\hat{N}) in the charter sector in 2020 were based on final logbook data. The numbers of halibut released in 2021 used eLogbook data through October 19th in 2C and were projected using logbook data through August 31 in 3A. The projections used simple exponential forecasts of the proportion of releases through August 31 from 2006-2019 data. For the unguided fishery, and the overall sport fisheries in Areas 3B and 4, the estimated number of fish released in each subarea in 2020 was obtained from the SWHS. The projections for 2021 were simple exponential time series forecasts using previous release numbers from the SWHS and did not include 2020 data.

Assumed mortality rates (*DMRs*) were 5% for Area 3A charter-caught halibut, 6% for Area 2C charter and Area 3A unguided, and 7% for Area 2C unguided halibut. These rates were developed by assuming a 3.5% mortality rate for halibut released on circle hooks and a 10% mortality rate for halibut released on all other hook types. The hook type data were collected in 2007 and 2008 in Area 2C, and every year since 2007 in Area 3A. These rates were applied to the reported number of fish released on each hook type to calculate a weighted mean mortality rate for each user group in each subarea. These weighted mean rates were then rounded up to the next whole percentage point to address uncertainty and account for possible cumulative effects of multiple recaptures. A discard mortality rate of 6% was assumed for Areas 3B and 4, as no data on hook use were collected.

For most IPHC regulatory areas, the average weights of released fish in each subarea were estimated using a logistic model of the proportion of catch retained at length, as described in the operational plan for statewide halibut estimation (see cover page for link). The model uses the length composition of the retained fish to infer the length distribution of released fish and average weight was calculated using the IPHC length-weight relationship.

For the Area 2C charter fishery, additional steps were needed to estimate release mortality due to the reverse slot limits in place in 2020 and 2021. This required partitioning the released fish into size categories as follows: the 2020 size classes were U45 (≤ 45 inches), 45-80, and O80 (≥ 80 inches); the 2021 size classes were U50 (≤ 50 inches), 50-72, and O72 (≥ 72 inches)). The proportions of fish in each size class were obtained from creel survey interviews where anglers were asked to report the numbers of released fish by size class. The average weight of released fish in the U45 (2020) or U50 (2021) size class was estimated using the model described above. The average weights of released fish in the protected slot and above the upper limit were estimated as the average weight of fish in these size ranges in 2010, the most recent year without a charter size limit.

The North Pacific Fishery Management Council's Scientific and Statistical Committee reviewed the logistic modeling approach in 2007 and concluded that it provided "reasonable" estimates of average weight given the lack of data. One problem inherent in this method is that the size distribution of released fish is truncated at the size of the smallest fish measured in the harvest sample. It is likely that some halibut are released that are smaller than the smallest halibut retained and measured. Therefore, the method may in effect underestimate the numbers of small fish released but overestimate average weight. Because the model assumes that the percent of fish kept at length never exceeds 95%, it may also overestimate the numbers of large fish released, but probably has little effect on their average weight.

Results:

For 2020, estimated release mortality was 0.034 Milb in Area 2C, with 0.022 Milb from the charter fishery (Table 3). The size class breakdown of the Area 2C charter release mortality indicated that while the majority of fish released were in the U45 length range, the poundage of release mortality was greatest in the O45-U80 range because of the higher average weight (Table 4). Estimated release mortality in Area 3A was 0.032 Milb, with 0.013 Milb from the charter fishery (Table 3). Areas 3B and 4 each had negligible amounts of release mortality from the sport fishery.

For 2021, estimated release mortality was 0.052 Milb in Area 2C, 0.043 Milb in Area 3A, and virtually zero in Areas 3B and 4 (Table 5). The size class breakdown of the Area 2C charter release mortality indicated that the majority of fish released were in the U50 length range and the poundage of release mortality was greatest in the U50 size range (Table 4).

The 2020 total sport fishery removals, including harvest and all sizes of release mortality, was 1.369 Milb in Area 2C and 3.004 Milb in Area 3A. Release mortality made up 2.5% of all Area 2C removals and 1.1% of Area 3A removals in 2020. For 2021, the preliminary estimates of total sport removals are 2.243 Milb in Area 2C and 4.031 Milb in Area 3A. Release mortality accounted for 2.3% of Area 2C removals and 1.1% of Area 3A removals in 2021.

Update to Sport Fishery Yield Prior to the Mean IPHC Survey Dates in 2018 and 2019 (Areas 2C and 3A only) and Final Sport Fishery Yield Prior to the Mean IPHC Survey Dates in 2020

This information is provided to aid the IPHC's adjustment to the Fishery Independent Setline Survey CPUE that is used to apportion estimated exploitable biomass among regulatory areas. The mean survey dates for 2018 were July 20 in Area 2C and June 29 in Area 3A. The mean survey dates for 2019 were July 11 in 2C and July 1 in 3A. An error was noted in estimates for these two years, notably in the proportion of unguided harvest taken prior to the mean survey dates, so updates are provided herein. The mean survey dates for 2020 were July 31 in Area 2C and July 27 in Area 3A.

Methods:

The proportions of harvest prior to the mean survey date were calculated separately for the charter and unguided sectors. For the charter sector, the proportion of harvest taken prior to the mean survey date was obtained from logbook harvest data. For the unguided sector, the proportions were calculated based on harvest reported in dockside interviews. These proportions were calculated separately for each subarea of Area 2C and 3A and weighted by the final estimated harvests in each subarea to derive the overall proportions. In 2020, there were no dockside interviews in Elfin Cove or Central Cook Inlet due to the COVID-19 pandemic and no early season interviews in Kodiak due to a vacancy, so the average proportion from ports with interview data was used as a proxy. The total sport yield taken prior to the mean survey date was calculated by multiplying the charter and unguided proportions by their respective final yields and summing.

Results:

In 2018, an estimated 0.962 Milb of halibut were taken by the sport fishery in Area 2C prior to July 20 and an estimated 0.953 Milb were taken in Area 3A prior to June 29 (Table 6). This is an increase of 0.032 Milb in 2C and an increase of 0.073 Milb in 3A relative to original estimates.

In 2019, an estimated 0.745 Milb of halibut were taken by the sport fishery in Area 2C prior to July 11 and an estimated 1.457 Milb were taken in Area 3A prior to July 1 (Table 7). The estimate in 2C remains unchanged and in 3A increased by 0.133 Milb from the original estimate.

In 2020, an estimated 0.789 Milb of halibut were taken by the sport fishery in Area 2C prior to July 31, and an estimated 1.866 Milb were taken in Area 3A prior to July 27 (Table 8).

Table 1. Final estimates of the 2020 sport halibut harvest (numbers of fish), average net weight (pounds), and yield (millions of pounds net weight) in Areas 2C, 3A, 3B, and 4. “NA” indicates no estimate is available.

IPHC Area	Sector	Harvest (no. fish)	Average Net Wt. (lb)	Yield (Mlb)	95% CI for Yield (Mlb)
Area 2C	Charter	36,100	12.77	0.461	0.424 – 0.497
	Unguided	47,371	18.44	0.873	0.751 – 0.995
	Total	83,471	15.99	1.334	1.207 – 1.462
Area 3A	Charter	106,589	14.58	1.554	1.467 – 1.641
	Unguided	90,766	15.62	1.418	1.252 – 1.583
	Total	197,355	15.06	2.971	2.785 – 3.158
Area 3B	Total	402	18.40 ^a	0.007	NA
Area 4	Total	549	18.40 ^a	0.010	NA

^a – No size data were available from Areas 3B and 4, so the unguided average weight from Kodiak was substituted.

Table 2. Preliminary estimates of the 2021 sport halibut harvest (numbers of fish), average net weight (pounds), and yield (millions of pounds net weight) in Areas 2C, 3A, 3B, and 4. “NA” indicates no estimate is available.

IPHC Area	Sector	Harvest (no. fish)	Average Net Wt. (lb)	Yield (Mlb)	95% CI for Yield (Mlb)
Area 2C	Charter	77,287	14.48	1.119	1.048 – 1.191
	Unguided	61,981	17.29	1.071	0.823 – 1.320
	Total	139,268	15.73	2.191	1.932 – 2.450
Area 3A	Charter	184,160	13.23	2.437	2.265 – 2.609
	Unguided	109,298	14.20	1.552	1.183 – 1.920
	Total	293,458	13.59	3.988	3.582 – 4.395
Area 3B	Total	452	14.23 ^a	0.006	NA
Area 4	Total	761	14.23 ^a	0.011	NA

^a – No size data were available from Areas 3B and 4, so the unguided average weight from Kodiak was substituted.

Table 3. Final estimates of release mortality for sport fisheries in Areas 2C, 3A, 3B, and 4 in 2020. Some columns may not appear to add correctly due to rounding.

IPHC Area	Sector	Estimated No. Halibut Released	Assumed Mortality Rate	Number Released that Died	Estimated Average Net Weight (lb)	Release Mortality (Mlb)
Area 2C	Charter	20,711	6.0%	1,243	18.05	0.022
	Unguided	24,774	7.0%	1,734	6.95	0.012
	Total	45,485		2,977	11.58	0.034
Area 3A	Charter	36,168	5.0%	1,808	7.35	0.013
	Unguided	47,502	6.0%	2,850	6.71	0.019
	Total	83,670		4,659	6.96	0.032
Area 3B	Total	89	6.0%	5	9.09	0.000
Area 4	Total	539	6.0%	32	7.27	0.000

Table 4. Breakdown of Area 2C estimates of charter release mortality by size class for 2020 (final) and 2021 (preliminary). Some columns may not appear to add correctly due to rounding.

Year	Size Class (inches)	Estimated No. Halibut Released	Assumed Mortality Rate	Number Released that Died	Estimated Average Net Weight (lb)	Release Mortality (Mlb)
2020	U45	17,712	6.0%	1,063	8.43	0.009
	O45U80	2,798	6.0%	168	62.63	0.011
	O80	202	6.0%	12	244.70	0.003
	Total	20,711	6.0%	1,243	18.05	0.022
2021	U50	31,694	6.0%	1,902	9.29	0.018
	O50U72	3,019	6.0%	181	72.55	0.013
	O72	320	6.0%	19	204.94	0.004
	Total	35,033	6.0%	2,102	16.53	0.035

Table 5. Preliminary estimates of release mortality for sport fisheries in Areas 2C, 3A, 3B, and 4 in 2021. Some columns may not appear to add correctly due to rounding.

IPHC Area	Sector	Estimated No. Halibut Released	Assumed Mortality Rate	Number Released that Died	Estimated Average Net Weight (lb)	Release Mortality (Mlb)
Area 2C	Charter	35,033	6.0%	2,102	16.53	0.035
	Unguided	30,454	7.0%	2,132	8.28	0.018
	Total	65,487		4,234	12.37	0.052
Area 3A	Charter	52,726	5.0%	2,636	6.68	0.018
	Unguided	66,621	6.0%	3,997	6.27	0.025
	Total	119,347		6,634	6.43	0.043
Area 3B	Total	520	6.0%	31	6.58	0.000
Area 4	Total	557	6.0%	33	6.05	0.000

Table 6. Updated estimated sport harvest prior to the mean IPHC survey dates in 2018 in Areas 2C and 3A.

Area	Mean Survey Date	Charter		Unguided		Total	
		Percent	Harvest (Mlb)	Percent	Harvest (Mlb)	Percent	Harvest (Mlb)
2C	July 20	51.3%	0.337	51.4%	0.626	51.4%	0.962
3A	June 29	28.8%	0.539	26.6%	0.413	27.8%	0.953

Table 7. Updated estimated sport harvest prior to the mean IPHC survey dates in 2019 in Areas 2C and 3A.

Area	Mean Survey Date	Charter		Unguided		Total	
		Percent	Harvest (Mlb)	Percent	Harvest (Mlb)	Percent	Harvest (Mlb)
2C	July 11	36.3%	0.241	43.2%	0.504	40.7%	0.745
3A	July 1	31.4%	0.638	48.6%	0.818	39.2%	1.457

Table 8. Final estimated sport harvest prior to the mean IPHC survey dates in 2020 in Areas 2C and 3A.

Area	Mean Survey Date	Charter		Unguided		Total	
		Percent	Harvest (Mlb)	Percent	Harvest (Mlb)	Percent	Harvest (Mlb)
2C	July 31	54.4%	0.251	61.6%	0.538	59.1%	0.789
3A	July 27	56.0%	0.870	70.2%	0.996	62.8%	1.866