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October 20, 2017

Lara Erikson
International Pacific Halibut Commission
P.O. Box 95009
Seattle, WA 98145

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 2016 estimates of sport fishery harvest and yield by IPHC regulatory area,
2. Preliminary 2017 estimates of harvest and yield by IPHC area,
3. Final 2016 and preliminary 2017 estimates of sport fishery release mortality by IPHC area, and
4. Final 2016 and preliminary 2017 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.2017.02.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.2014.08.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)

Scott Meyer, Mike Jaenicke, Diana Tersteeg, and Martin Schuster
Fishery Biologists

Final Estimates of 2016 Sport Harvest and Yield

In November 2016 we provided preliminary estimates of the 2016 sport harvest for Areas 2C, 3A, 3B, and 4. This letter provides final estimates based on Alaska Department of Fish and Game (ADF&G) saltwater logbook data as of September 12, 2017, 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.

The Area 2C charter fishery regulations for 2016 included a one-fish daily bag limit and reverse slot (or "protected slot") limit that allowed harvest of halibut less than or equal to 43 inches and halibut greater than or equal to 80 inches. The Area 3A charter regulations included a two-fish bag limit with a maximum size on one of the fish of 28 inches, 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 Wednesdays all year, and a 4-fish annual limit with a harvest recording requirement. 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. Noncharter (or unguided) fisheries statewide were managed under a two-fish bag limit with no size limit.

Methods:

For Areas 2C and 3A, sport fishery yield was calculated separately for the charter and noncharter 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. Noncharter harvest was estimated through the SWHS. Standard errors of the SWHS estimates for the noncharter 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 estimate of charter average weight for Homer was stratified to account for differences in sizes of halibut cleaned at sea and cleaned onshore. Length measurements from sites in the Glacier Bay subarea included fish caught in Areas 3A and 2C; average weights were calculated separately for each area and sector. All noncharter 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 noncharter 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 noncharter sector because it was unaffected by size limits. Even so, use of the Kodiak average weight may bias the yield estimates for these areas. Anecdotal reports from the Dutch Harbor/Unalaska area suggest that average weight in the sport fishery is higher than at Kodiak.

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 = 126). For 2016, no harvest was estimated from Area 3A locations in Area R.

Results:

The 2016 Area 2C estimated sport harvest (excluding release mortality) was 132,861 fish, for a yield of 2.035 million pounds (Table 1). Charter yield represented 39% of the total. Average net weight was estimated at 15.32 lb overall, but was lower for the charter sector due to size limit restrictions. Average weights were based on length measurements of 5,653 charter fish and 4,984 noncharter fish.

The Area 3A estimated sport harvest was 286,794 fish, for a yield of 3.542 Mlb (Table 1). The charter sector accounted for 57% of the total yield. Average net weight was estimated at 12.35 lb overall, and was slightly higher for the charter sector. Average weight was estimated from samples of 4,435 charter halibut and 2,022 noncharter halibut.

The final estimates of charter halibut yield were about 0.4% lower than last year's preliminary estimate in Area 2C and 2.1% higher than the preliminary estimate in Area 3A. These differences were largely due to errors in estimating the proportions of harvest taken through July 31, the cutoff date for using logbook data. The final estimates of noncharter yield were 5% lower in Area 2C and <1% higher than the preliminary estimate for Area 3A. The preliminary estimates were derived from simple exponential time series forecasts (SAS ESM procedure) and large forecasting errors are expected due to high annual variability in the harvest time series.

The final harvest estimates for western areas were 581 halibut in Area 3B and 1,097 halibut in Area 4 (Table 1). Applying the Kodiak average weight of 13.26 lb resulted in yield estimates of 0.008 Mlb in Area 3B and 0.015 Mlb in Area 4. These final estimates were close to last year's preliminary estimates of 0.005 in Area 3B and 0.012 in Area 4.

Preliminary 2017 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 noncharter 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 or regulatory area.

Charter harvest for Areas 2C and 3A was projected from partial-year logbook data. Logbook data were entered and available in early October for most trips taken through July 31. Areas 2C and 3A are divided into several subareas closely corresponding to state management areas. Harvest data were adjusted upward to account for late logbook submissions and other reporting errors based on past data. These minor adjustments increased the harvest in each area by less than 1%. The harvest data were then expanded by forecasting the proportion of harvest taken through July in each subarea. Forecasts and their standard errors were obtained from a simple exponential smoother using 2006-2016 logbook data as of October 6, 2017.

Noncharter 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. Charter and noncharter yield were estimated by multiplying the subarea harvest forecasts 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 2017, so the Kodiak area average weight from the noncharter fishery was again substituted for these areas.

Results:

The preliminary estimate of 2017 sport halibut harvest (excluding release mortality) was 140,287 halibut, or 2.295 Mlb (Table 2). Charter harvest was estimated using a projection that 65% of the harvest was taken

through the end of July. Average weight was estimated at 16.36 lb. The charter average weight was more than 8 lb lower than the noncharter average weight due to the charter fishery size limit. Average weights for Area 2C were based on length measurements of 4,339 charter halibut and 4,368 noncharter halibut.

The preliminary estimate for Area 3A was 274,847 halibut, for a total sport fishery yield of 3.905 Mlb (Table 2). Charter harvest was estimated using a projection that 68% of the harvest was taken through the end of July. The estimated average weights in Area 3A was 14.21 lb overall. Average weights were estimated from samples of 3,360 charter and 1,624 noncharter halibut.

The preliminary harvests for 2017 were 540 halibut in Area 3B and 982 halibut in Area 4. Applying the noncharter average weight of 15.35 lb from Kodiak resulted in yield projections of 0.008 Mlb in Area 3B and 0.015 Mlb 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 noncharter average weight as a proxy for average weight in these areas.

Final 2016 and Preliminary 2017 Estimates of Release Mortality

Methods:

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

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

where

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

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

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

The numbers of halibut released ($\hat{N}$) in the charter sector in 2016 were based on final logbook data. The numbers of halibut released in 2017 were projected using logbook data through July 31. The projections used simple exponential forecasts of the proportion of releases through July 31 from 2006-2016 data. For the noncharter fishery, and the overall sport fisheries in Areas 3B and 4, the estimated number of fish released in each subarea in 2016 was obtained from the SWHS. The projections for 2017 were simple exponential time series forecasts using previous release numbers from the SWHS.

Assumed mortality rates (*DMRs*) were 5% for Area 3A charter-caught halibut, 6% for Area 2C charter and Area 3A noncharter, and 7% for Area 2C noncharter 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. The resulting length distributions are partitioned into U26 (<26 inch) and O26 (≥ 26 inch) components, and average weight was calculated using the IPHC length-weight relationship. The U26 and O26 separation was done for consistency with how these two size classes of waste have been handled by the IPHC.

For the Area 2C charter fishery, additional steps were needed to estimate release mortality due to the reverse slot limits in place in 2016 and 2017. In 2016, charter anglers were prohibited from harvesting fish between 43 and 80 inches in length. The protected slot was 44-80 inches in 2017. This required partitioning the released fish into size categories as follows: the 2016 size classes were U43 (≤ 43 inches), 43-80, and O80 (≥ 80 inches). The 2017 size classes were simply U44 and O44. 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 U43 (2016) and U44 (2017) size classes 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 U26 fish released but overestimate their average weight. Because the model assumes that the percent of fish kept at length never exceeds 95%, it may also overestimate the numbers of O26 fish released, but probably has little effect on their average weight.

Results:

For 2016, estimated U26 release mortality was 0.004 Mlb in Area 2C, 0.019 Mlb in Area 3A, and virtually zero in Areas 3B and 4 (Table 3). Estimated O26 release mortality was 0.067 Mlb in Area 2C, with 0.050 Mlb of that coming in the charter fishery. The size class breakdown of the Area 2C charter O26 release mortality indicated that while the majority of fish released were in the length range 26-43 inches, the poundage of release mortality was greatest in the 43-80 inch protected slot because of the higher average weight (Table 4). Estimated O26 release mortality in Area 3A was 0.037 Mlb, with 0.017 Mlb from the charter fishery (Table 3). Areas 3B and 4 each had negligible amounts of release mortality from the sport fishery.

Preliminary estimates of release mortality for 2017 were similar in magnitude to 2016 estimates. Mortality of U26 halibut was 0.004 Mlb in Area 2C, 0.019 Mlb in Area 3A, and virtually zero in Areas 3B and 4 (Table 5). Mortality of O26 releases in Area 2C was estimated at 0.055 Mlb, with 0.039 Mlb of that from the charter fishery. The O44 size category in the Area 2C charter fishery accounted for 30% of charter releases (in numbers of fish) but 72% of release mortality by weight (Table 4). Mortality of O26 releases in Area 3A was 0.033 Mlb, with most (0.019 Mlb) coming from the noncharter fishery (Table 5). The O26 release mortality was negligible in Area 3B and Area 4.

The 2016 total sport fishery removals, including harvest and all sizes of release mortality, added up to 2.106 Mlb in Area 2C and 3.598 Mlb in Area 3A. Release mortality made up 3.3% of all Area 2C removals and 1.6% of Area 3A removals. For 2017, the preliminary estimates of total sport removals are 2.354 Mlb in Area 2C and 3.957 Mlb in Area 3A. Release mortality accounted for 2.5% of Area 2C removals and 1.3% of Area 3A removals in 2017.

Sport Fishery Yield Prior to the Mean IPHC Survey Dates in 2016 and 2017 (Areas 2C and 3A only)

This information is provided to aid the IPHC's adjustment to survey CPUE that is used to apportion estimated exploitable biomass among regulatory areas. The mean survey dates for 2016 were June 25 in Area 2C and July 4 in Area 3A. The mean survey dates for 2017 were July 5 in Area 2C and July 1 in Area 3A.

Methods:

The proportions of harvest prior to the mean survey date were calculated separately for the charter and noncharter sectors. For the charter sector, the proportion of harvest taken prior to the mean survey date in 2016 was obtained from logbook harvest data. For 2017, the preliminary estimate was based on the average

proportion of logbook harvest prior to the mean survey date over the last three years. For the noncharter 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 2016 final estimated harvests or the 2017 projected harvests in each subarea to derive the overall proportions. The total sport yield taken prior to the mean survey date was calculated by multiplying the charter and noncharter proportions by their respective final or projected yields and summing.

Results:

In 2016, an estimated 0.491 Mlb of halibut were taken by the sport fishery in Area 2C prior to June 25, and an estimated 1.357 Mlb were taken in Area 3A prior to July 4. In 2017, an estimated 0.756 Mlb of halibut were harvested by the sport fishery in Area 2C prior to July 5, and about 1.368 Mlb of halibut were taken in Area 3A prior to July 1 (Table 6). The proportions of 2017 sport harvest projected to have been taken prior to the mean survey date in each area were similar – 33% in Area 2C and 35% in Area 3A. The preliminary estimates for 2017 will be updated next year once logbook data, interview data, and SWHS estimates are finalized.

Table 1. Final estimates of the 2016 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	66,147	11.93	0.789	0.770 – 0.808
	Noncharter	66,714	18.68	1.246	1.101 – 1.391
	Total	132,861	15.32	2.035	1.889 - 2.181
Area 3A	Charter	158,212	12.67	2.004	1.848 – 2.161
	Noncharter	128,582	11.96	1.538	1.350 – 1.726
	Total	286,794	12.35	3.542	3.297 – 3.787
Area 3B	Total	581	13.26[a]	0.008	NA
Area 4	Total	1,097	13.26[a]	0.015	NA

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

Table 2. Preliminary estimates of the 2017 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	71,711	12.31	0.882	0.831-0.934
	Noncharter	68,576	20.59	1.412	1.132-1.693
	Total	140,287	16.36	2.295	2.009-2.580
Area 3A	Charter	143,654	14.48	2.079	1.903-2.256
	Noncharter	131,193	13.91	1.825	1.521-2.130
	Total	274,847	14.21	3.905	3.553-4.257
Area 3B	Total	540	15.35[a]	0.008	NA
Area 4	Total	982	15.35[a]	0.015	NA

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

Table 3. Final estimates of release mortality for sport fisheries in Areas 2C, 3A, 3B, and 4 in 2016. Some columns may not appear to add correctly due to rounding.

IPHC Area	Size Class	Sector	Estimated No. Halibut Released	Assumed Mortality Rate	Number Released that Died	Estimated Average Net Weight (lb)	Release Mortality (Mlb)
Area 2C	U26	Charter	5,452	6.0%	327	3.63	0.001
		Noncharter	9,961	7.0%	697	3.39	0.002
		Total	15,413		1,024	3.47	0.004
	O26	Charter	25,805	6.0%	1,548	32.02	0.050
		Noncharter	21,652	7.0%	1,516	11.46	0.017
		Total	47,457		3,064	21.85	0.067
Area 3A	U26	Charter	66,590	5.0%	3,330	3.69	0.012
		Noncharter	33,711	6.0%	2,023	3.33	0.007
		Total	100,302		5,352	3.56	0.019
	O26	Charter	42,497	5.0%	2,125	7.96	0.017
		Noncharter	41,582	6.0%	2,495	8.08	0.020
		Total	84,079		4,620	8.03	0.037
Area 3B	U26	Total	231	6.0%	14	3.46	0.000
	O26	Total	120	6.0%	7	8.64	0.000
Area 4	U26	Total	390	6.0%	23	3.46	0.000
	O26	Total	208	6.0%	12	8.64	0.000

Table 4. Breakdown of Area 2C estimates of O26 charter release mortality by size class for 2016 (final) and 2017 (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)
2016	O26U43	18,226	6.0%	1,094	9.92	0.011
	O43U80	6,525	6.0%	391	59.40	0.023
	O80	1,054	6.0%	63	244.70	0.015
	Total O26	25,805	6.0%	1,548	32.02	0.050
2017	O26U44	17,069	6.0%	1,024	10.65	0.011
	O44	7,213	6.0%	433	64.74	0.028
	Total O26	24,281		1,457	26.72	0.039

Table 5. Preliminary estimates of release mortality for sport fisheries in Areas 2C, 3A, 3B, and 4 in 2017. Some columns may not appear to add correctly due to rounding.

IPHC Area	Size Class	Sector	Estimated No. Halibut Released	Assumed Mortality Rate	Number Released that Died	Estimated Average Net Weight (lb)	Release Mortality (Mlb)
Area 2C	U26	Charter	6,793	6.0%	408	3.54	0.001
		Noncharter	11,915	7.0%	834	3.51	0.003
		Total	18,709		1,242	3.52	0.004
	O26	Charter	24,281	6.0%	1,457	26.72	0.039
		Noncharter	20,804	7.0%	1,456	11.15	0.016
		Total	45,085		2,913	18.93	0.055
Area 3A	U26	Charter	47,164	5.0%	2,358	3.46	0.008
		Noncharter	49,441	6.0%	2,966	3.67	0.011
		Total	96,605		5,325	3.58	0.019
	O26	Charter	28,366	5.0%	1,418	9.60	0.014
		Noncharter	38,085	6.0%	2,285	8.29	0.019
		Total	66,451		3,703	8.79	0.033
Area 3B	U26	Total	175	6.0%	11	3.38	0.000
	O26	Total	105	6.0%	6	9.39	0.000
Area 4	U26	Total	574	6.0%	34	3.38	0.000
	O26	Total	318	6.0%	19	8.46	0.000

Table 6. Estimated sport harvest prior to the mean IPHC survey dates in 2016 (final) and 2017(preliminary) in Areas 2C and 3A.

			Charter		Noncharter		Total	
Year	Area	Mean Survey Date	Percent	Harvest (Mlb)	Percent	Harvest (Mlb)	Percent	Harvest (Mlb)
2016	2C	June 25	23.1%	0.182	23.6%	0.308	23.4%	0.491
	3A	July 04	33.9%	0.679	44.4%	0.678	38.4%	1.357
2017	2C	Jul7 05	33.1%	0.292	32.8%	0.464	33.0%	0.756
	3A	July 01	30.8%	0.640	39.9%	0.728	35.0%	1.368