STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF SPORT FISH

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~~November 4, 2011~~
Revised November 11, 2011

Gregg Williams
International Pacific Halibut Commission
P.O. Box 95009
Seattle, WA 98145

Dear Mr. Williams:

This letter presents Pacific halibut sport fishery information typically provided to the IPHC in the fall of each year in support of the IPHC annual stock assessment. This year's letter provides (1) revised estimates of 2009 sport harvest for Area 2C, (2) final harvest estimates for 2010 for Areas 2C and 3A, (3) harvest projections for 2011 for Areas 2C and 3A, (4) estimates of sport harvest taken prior to the mean IPHC longline survey date in Areas 2C and 3A in 2011, and (5) final estimates of 2010 harvest and projections of 2011 harvest for IPHC Areas 3B and 4.

Area 2C - Revised Estimates of 2009 Sport Harvest

Earlier this summer we discovered some length data from creel surveys in Southeast that were inadvertently omitted in the calculation of average net weight ("average weight" hereafter) of charter and non-charter halibut harvest at some ports in Area 2C. Inclusion of these data resulted in small changes in the estimates of average weight as well as harvest biomass, but we felt that these revisions were worthwhile. The vast majority of missing data were from Ketchikan. Inclusion of these data raised the total Ketchikan sample size from 455 to 1,016 length measurements. The charter average weight for Ketchikan was revised from about 21.3 lb to 22.0 lb, and the non-charter average weight was revised from 14.3 lb to 15.1 lb. The effect of these revisions on the Area 2C estimate of harvest biomass was relatively small. Charter harvest biomass for all of Area 2C was revised from 1.245 million pounds to 1.249 million pounds, and non-charter harvest was revised from 1.123 M lb to 1.133 M lb. (Table 1).

The standard errors of the average weight estimates were calculated using bootstrapping last year. During the revision process, we discovered that there were a large number of length data that could not be assigned to a particular vessel trip. Because this gap compromised the accuracy of bootstrap estimates, the standard errors of average weight for each subarea were calculated using methods for simple random sampling even though data were collected through cluster sampling. As a result, the standard errors for average weight and harvest biomass for Area 2C are probably underestimated. This issue was corrected in the 2010 final estimates.

Areas 2C and 3A - Final Estimates of 2010 Sport Harvest

In November 2010 we provided projections of the 2010 sport harvest for Areas 2C and 3A. This letter provides updated estimates based on final statewide harvest survey (SWHS) estimates (in numbers of

fish) and final estimates of average weight. These final Area 2C and 3A estimates were also posted on the North Pacific Fishery Management Council's web site in October of this year.

Methods:

For Area 2C and Area 3A, sport fishery harvest (pounds net weight) was calculated separately for the charter and non-charter (unguided) fisheries as the product of the number of fish and average weight of harvested halibut. Estimates of the number of fish harvested were provided by the ADF&G statewide harvest survey (SWHS). The SWHS is currently the preferred method for estimating charter harvest and the only method available for estimating non-charter harvest. Average net weight was estimated from length measurements of halibut harvested at representative ports in Areas 2C and 3A. Ports sampled in Area 2C in 2010 included Ketchikan, Craig, Klawock, Petersburg, Wrangell, Juneau, Sitka, Gustavus, and Elfin Cove. Ports sampled in Area 3A included Yakutat, Valdez, Whittier, Seward, Homer, Deep Creek, Anchor Point, and Kodiak. The estimate of charter average weight for Homer was stratified to account for differences in sizes of halibut cleaned at sea versus cleaned onshore. Bootstrapping was used to estimate standard errors of harvest (in number of fish) and average weight.

Results:

The Area 2C overall sport harvest biomass (yield) in 2010 was estimated at 1.971 million pounds (Table 2). The charter harvest estimate was 1.086 M lb and the non-charter harvest estimate was 0.885 M lb. Charter harvest accounted for 55% of the Area 2C sport harvest by weight. Average net weight was estimated at 26.4 lb in the charter harvest, 16.7 lb for the non-charter harvest, and 20.9 lb overall. Sample sizes for estimation of average weight were 3,291 for the charter fishery and 3,047 for the non-charter fishery.

The 2010 estimated charter yield in Area 2C was down 13 percent from 2009. Although the charter average weight increased 13%, the number of fish harvested decreased by 23%. The non-charter removal was down 22 percent, the result of a 3% drop in average weight combined with a 19% drop in the number of fish harvested. The reasons for the declines in harvest are unknown, but probably due mostly to the economic recession. There were no changes to fishery regulations in 2010; the bag limit was one halibut of any size for the charter fishery and two fish of any size for the non-charter fishery. Charter captains and crew were not allowed to retain fish in Area 2C.

The Area 3A sport harvest was estimated at 4.285 M lb. Charter harvest was estimated at 2.698 M lb and non-charter harvest at 1.587 M lb (Table 2). The charter fishery accounted for about 63% of the Area 3A sport harvest. Average net weight was estimated at 15.2 lb for the charter fishery, 12.8 lb for the non-charter fishery, and 14.2 lb overall. Average weight was estimated from samples of 3,391 charter halibut and 2,396 non-charter halibut.

The estimated Area 3A charter yield was down about 1% from 2009, the net result of a 1.1 lb decrease in average weight combined with a 6% increase in the number of fish harvested. The non-charter yield was down 22%. Average weight in the non-charter harvest declined only about 0.7 lb, but the number of fish harvested declined 17%. There were no regulation changes in 2010. The daily bag limit was two halibut of any size for all sport anglers.

The 2010 final harvest estimates were considerably lower than the projections made last year for the charter and non-charter fisheries in both areas. Last year's projections were too high by about 18% for the 2C charter fishery, 43% for the 2C non-charter fishery, 11% for the 3A charter fishery, and 31% for the 3A non-charter fishery. The discrepancies in charter projections are explained largely by variation in the relationship between SWHS estimates and reported logbook harvest. The magnitude of projection errors for the non-charter fisheries is not surprising given the high variation in harvest from year to year.

Areas 2C and 3A - 2011 Harvest Projections

Methods:

Final harvest estimates are typically not available from the SWHS until September of the year following harvest. Therefore, ADF&G provides preliminary estimates of the most recent season's harvest using projections of the number of fish harvested, multiplied by the recent season's estimates of average weight from dockside sampling of lengths. These preliminary estimates have been a focus of attention by the North Pacific Fishery Management Council (NPFMC) and have been incorporated in decisions regarding allocation of halibut between the sport charter and commercial sectors, despite their limited accuracy. The NPFMC Scientific and Statistical Committee (SSC) reviewed ADF&G's projection methods in October 2007 and February 2009 and concluded that the projection methods are suitable given current data limitations.

Charter harvest projections for 2011 were again based on relative changes in reported logbook harvest from the previous year to the current year. The relative changes were applied to the final 2010 SWHS estimates of charter harvest. This method has been used to project charter harvests since 2008. Logbook data for trips made through July 31 or 2010 and 2011 were used for this analysis. Charter harvest was projected separately for each SWHS area and summed to obtain the harvest projections for each regulatory area as follows:

$$\widehat{H}_{proj} = \sum_i r_i \, \widehat{H}_i \widehat{\bar{w}}_i$$

where:

$\widehat{H}_{proj}$ = the projected 2011 charter harvest by weight (lb) for the IPHC regulatory area,

r_i = the ratio of reported 2011/2010 logbook harvest through July 31, for SWHS area *i*,

$\widehat{H}_i$ = the final 2010 SWHS halibut harvest estimate, in numbers of fish, for SWHS area *i*, and

$\widehat{\bar{w}}_i$ = the estimated average net weight of halibut harvested in SWHS area *i* in 2011.

Because this projection method is based on relative changes from year to year in the logbook harvest taken through July, this method assumes that the proportion of overall harvest through July was the same as the previous year. Logbook harvest reported through July ranged from 62% to 66% of the yearly total for Area 2C during the years 2006-2010. In Area 3A, the fraction of harvest through July declined from about 75% in 2006 to 68% in 2010. In both areas, however, the percentage of harvest taken through July was practically unchanged from 2009 to 2010.

Non-charter harvest was estimated by multiplying a time series forecast of harvest (in numbers of fish) by the 2011 estimated average weight for each SWHS area and summing across areas. Several methods were evaluated retrospectively for the period 2001-2010: (1) using the previous year's harvest, (2) linear trend projections based on the previous 2-6 years, and (3) single and double exponential projections by SWHS area and by IPHC regulatory area. Single and double exponential projections were made with Minitab® software, using the default smoothing parameters. Performance of the various projection methods was evaluated using the mean squared deviations (MSD) from the final SWHS estimates. The single-exponential method had the lowest MSDs and was selected for projecting 2011 non-charter harvest in both areas.

For the first time, we projected charter harvest separately for the Area 2C and 3A portions of the Glacier Bay SWHS area (Area G). In past years, the entire Area G estimated harvest from the SWHS was

attributed to IPHC Area 2C. Fish from Area 3A made up less than 1% of the Area G charter harvest (in numbers) in 2006 and 2007, 3% in 2008 and 2009, and 2% in 2010. In 2011, however, the Area 3A share of harvest in Area G increased to nearly 12% for trips reported through July. Given that Area G charter operators were fishing in Area 3A to avoid the one fish bag limit and 37-inch maximum size limit, it was prudent to calculate the 2C and 3A harvests for this area separately.

There is no straightforward method for calculating confidence intervals for the charter projections because of differences in the SWHS and logbook harvests. The logbook numbers through July 2011 will undergo error checking and editing. In addition, it is possible that some logbook records will be submitted late for this period. The relationship between logbook data and SWHS estimates is stronger for Area 2C than for Area 3A. Despite these issues, the logbook data represent the best index of changes in charter harvest from year to year and are superior to time series methods for projecting harvest. Private harvest is highly variable from year to year, which is problematic for time series projections. We characterized uncertainty in the projections by describing the range of retrospective projection errors using the method selected for this year's projections.

Results:

The number of halibut reported harvested by charter anglers in Area 2C through July 31, 2011 was about 1% higher than for the same period in 2010. Average weight in the charter fishery was down 64% because of the 37-inch maximum size limit imposed in 2011. The projected Area 2C charter yield for 2011 was 0.388 M lb (Table 3), and the preliminary estimate of average net weight was 9.4 lb. Retrospective charter harvest projections for 2008-2010 ranged from -4% to +18% of the final SWHS estimates for those years, with an average projection error of +6% (Figure 1). The projected yield for the non-charter fleet was 0.925 M lb, up slightly from last year's harvest estimate. Average weight of the non-charter harvest was 16.4 lb. This fishery was not constrained by a maximum size limit. Retrospective non-charter harvest projections for 2001-2010 using the single exponential method ranged from -16% to +27% of the final SWHS estimates, and averaged +4%. The overall projected sport fishery yield for Area 2C (charter and non-charter) was 1.313 M lb.

The reported charter harvest through July 2011 in Area 3A was up about 5% from the same period in 2010, and average weight was practically unchanged. The projected charter yield for Area 3A was ~~2.810~~ **2.837** M lb, and the average net weight was estimated at ~~15.1~~ **15.3** lb (Table 3). The errors in similar projections of Area 3A charter harvest for 2008-2010 ranged from -6% to +11%, with an average of +4%. The projected non-charter yield was 1.704 M lb, with an estimated average weight of 12.6 lb. Errors in projected non-charter harvest for the period 2001-2010 ranged from -28% to +28%, with an average of +2%. The overall projected sport fishery yield for Area 3A was ~~4.514~~ **4.541** M lb.

Areas 2C and 3A – Sport Harvest Prior to the Mean IPHC Survey Date

This information is provided as part of the IPHC's adjustment to survey CPUE that is used to apportion estimated exploitable biomass among regulatory areas. The mean survey dates for 2011 were July 4 in Area 2C and June 24 in Area 3A.

Methods:

Charter logbook data are not yet complete for the 2011 season. Therefore, the proportion of charter harvest taken prior to the mean survey date was estimated from a logistic model fit to the cumulative charter harvest (logbook data) through the last day of each month, averaged over the previous three years. The proportion of non-charter harvest taken prior to the mean survey date was based on harvest reported in dockside interviews. These proportions were calculated separately for each SWHS area and weighted by the 2011 projected number of fish harvested to derive the overall proportion for the non-charter fishery. The total sport harvest biomass taken prior to the mean survey date was calculated by multiplying the charter and non-charter proportions by their respective projected harvest biomass and summing.

Results:

For Area 2C, about 30.0% of charter harvest and 38.6% of non-charter harvest was taken prior to the mean survey date (Table 4). This resulted in an estimated 0.473 M lb of sport harvest taken prior to the mean survey date. In Area 3A, an estimate 24.6% of charter harvest and 28.0% of non-charter harvest was taken prior to the mean survey date. The total sport harvest taken prior to the mean date of the Area 3A survey was estimated at ~~1.169~~ **1.175** M lb.

Areas 3B and 4 - Final 2010 Harvest Estimates and 2011 Projections

Methods:

For Area 3B and Area 4, the final SWHS estimates are provided in numbers of fish only. We do not conduct any sampling in these areas for average weight. As has been done historically, we included all harvest from SWHS Area R (Alaska Peninsula and Aleutian Islands south of Cape Douglas and the Naknek River) in the Area 3B estimate. In some years, Area R harvest estimates have included small harvests for sites that are actually in Area 3A. Since 1991, the estimated harvest of Area 3A halibut reported in Area 3B has ranged from 0 to 728 fish (average = 133). These harvests are not large, and it is more convenient to continue reporting these Area 3A harvests in Area 3B because the number of survey responses are not sufficient to apportion the harvest precisely among the charter and non-charter sectors. This error has more impact on the Area 3B sport harvest estimate than the Area 3A estimate, but the Area 3B sport harvest represents less than 0.5% of the total removals in that area.

Several projection methods were evaluated for these areas using retrospective analyses. For each area we evaluated (1) using the previous year's harvest, (2) linear trend projections based on the previous 2, 3, 4, 5, and 6 years, (3) single and double exponential time series forecasts, and (4) moving averages of the previous 2, 3, 4, and-5 years. Retrospective projections were compared for the period 1998-2010 for Area 3B and 1997-2010 for Area 4. Two-year moving averages had the lowest MSD values for both areas. Harvest in both areas has been highly variable, with a sharp upward trend in recent years in Area 3B. This variability makes it difficult to fit time series projections with much accuracy, and the choice of best method has sometimes changed from year to year. Retrospective projection errors are described for the 2-year moving average as an indication of the uncertainty inherent in these projections.

Results:

The final 2010 harvest estimate for Area 3B was 1,416 fish, and the final estimate for Area 4 was 936 fish (Table 5). We were not able to assess the precision of estimates for areas 3B and 4. However, the coefficient of variation for the SWHS harvest estimate for Area R (areas 3B and 4 combined) was 18%.

Harvest projections for 2011 are 1,630 fish in Area 3B and 1,196 fish in Area 4 (Table 4). Retrospective projection errors for the years 1993-2010 ranged from -51% to +70% in Area 3B (average = +2%) and from -34% to +159% in Area 4 (average = +18%) (Figure 1).

It is our understanding that the IPHC typically applies the Kodiak average weight to estimate sport harvest biomass in Area 3B and Area 4. The estimated average weights of the overall Kodiak sport harvest (charter and non-charter) were 16.7 lb for 2010 and 15.2 lb for 2011. Anecdotal reports from Dutch Harbor/Unalaska suggest a higher average weight, but we cannot provide any data specific to that area.

Feel free to contact us if you require clarification or additional information.

Sincerely;

(sent via email)

Scott Meyer, Mike Jaenicke, Diana Tersteeg, Barbi Failor
Fishery Biologists

Table 1. Revised estimates of the 2009 sport halibut harvest (numbers of fish), average net weight (pounds), and yield (millions of pounds net weight) in Area 2C.

Area and Estimate	Charter	Non-Charter	Total
Area 2C			
No. Fish	53,602	65,549	119,151
Average Net Wt (lb)	23.3	17.3	20.0
Yield (M lb)	1.249	1.133	2.383
95% CI (M lb)	1.111–1.388	0.992–1.275	2.208–2.558

Table 2. Final estimates of the 2010 sport halibut harvest (numbers of fish), average net weight (pounds), and yield (millions of pounds net weight) in Areas 2C and 3A.

Area and Estimate	Charter	Non-Charter	Total
Area 2C			
No. Fish	41,202	52,896	94,098
Average Net Wt (lb)	26.4	16.7	20.9
Yield (M lb)	1.086	0.885	1.971
95% CI (M lb)	0.935–1.237	0.769–1.000	1.796–2.145
Area 3A			
No. Fish	177,460	124,088	301,548
Average Net Wt (lb)	15.2	12.8	14.2
Yield (M lb)	2.698	1.587	4.285
95% CI (M lb)	2.470–2.925	1.395–1.779	3.987–4.582

Table 3. Preliminary estimates of the 2011 sport halibut harvest (numbers of fish), average net weight (pounds), and harvest biomass (millions of pounds net weight) in Areas 2C and 3A.

Area and Estimate	Charter	Non-Charter	Total
Area 2C			
No. Fish	41,209	56,354	97,563
Average Net Wt (lb)	9.4	16.4	13.5
Yield (M lb)	0.388	0.925	1.313
Projection Error Range	-4% to +18%	-16% to +27%	-4% to +22%
Area 3A			
No. Fish	185,691	134,724	320,415
Average Net Wt (lb)	~~15.1~~ **15.3**	12.6	~~14.1~~ **14.2**
Yield (M lb)	~~2.810~~ **2.837**	1.704	~~4.514~~ **4.541**
Projection Error Range	-6% to +11%	-28% to +28%	-5% to +14%

Table 4. Estimated sport harvest prior to the mean IPHC survey date in Areas 2C and 3A.

Area	Mean Survey Date	User group	Harvest Prior to mean Survey Date: Proportion of Harvest	Harvest Prior to mean Survey Date: Harvest (M lb)
Area 2C	July 4	Charter	30.0%	0.116
		Non-charter	38.6%	0.357
		Total	36.0%	0.473
Area 3A	June 24	Charter	24.6%	~~0.692~~ **0.698**
		Non-charter	28.0%	0.477
		Total	25.9%	~~1.169~~ **1.175**

Table 5. Final 2010 harvest estimates and 2011 projections for Areas 3B and 4 (numbers of fish).

Area	Number of Halibut Harvested: Final 2010	Number of Halibut Harvested: Projected 2011	Number of Halibut Harvested: Projection Error Range
Area 3B	1,416	1,630	-51% to +70%
Area 4	936	1,196	-34% to +159%

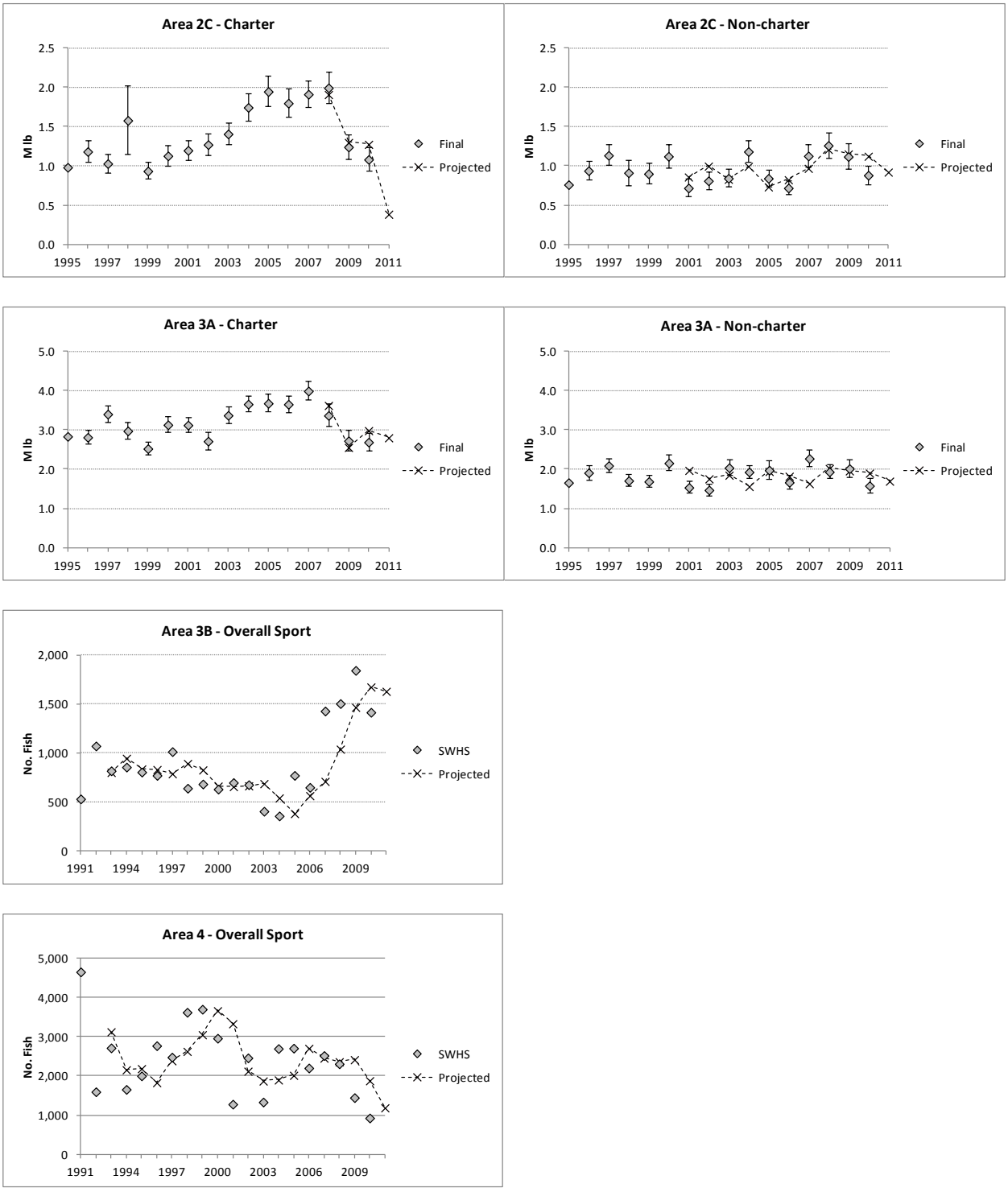

Figure 1. Comparison of final SWHS estimates and retrospective projections for IPHC Areas 2C, 3A, 3B, and 4 using the methods selected for projecting harvest in 2011. The Area 2C and 3A final harvest estimates include 95% confidence intervals. Estimates for Area 2C and 3A are presented by sector (charter, non-charter) and are in pounds net weight. Estimates for Areas 3B and 4 are for the overall sport fishery and are expressed in numbers of fish.