



THE STATE  
of **ALASKA**  
GOVERNOR SEAN PARNELL

Department of  
Fish and Game

DIVISION OF SPORT FISH

3298 Douglas Place  
Homer, AK 99603  
Main: 907-235-8191  
Fax: 907-235-2448

P.O. Box 110024  
Juneau, AK 99811-0024  
Main: 907-465-4270  
Fax: 907-465-2034

November 5, 2012

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. Final 2011 sport fishery harvest estimates for Areas 2C, 3A, 3B, and 4,
2. Preliminary 2012 harvest estimates (projections) for Areas 2C, 3A, 3B, and 4, and
3. Estimates of 2012 sport harvest prior to the mean IPHC longline survey date in Areas 2C and 3A.

In an April 20, 2012 letter, Commissioner Campbell stated that we anticipated providing estimates of release mortality along with this information. The analysis of release mortality is ongoing and we anticipate providing these estimates later this month.

### **Final Estimates of 2011 Sport Harvest**

In November 2011, we provided projections of the 2011 sport harvest for Areas 2C, 3A, 3B, and 4. This letter provides updated estimates based on final ADF&G statewide harvest survey (SWHS) estimates (in numbers of fish) and final estimates of average weight. The final Area 2C and 3A estimates were also posted on the North Pacific Fishery Management Council's web site prior to the October meeting.

The Area 2C charter fishery regulations for 2011 included a one-fish daily bag limit and maximum size limit of 37 inches. Charter captains and crew were not allowed to retain fish in Area 2C. In all other areas, the charter fishery was managed under a two-fish daily bag limit and charter captains and crew were allowed to retain halibut. Noncharter fisheries statewide were managed under a two-fish bag limit with no size limit.

### Methods:

For Area 2C and Area 3A, sport fishery yield (pounds net weight) was calculated separately for the charter and noncharter (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 SWHS. Standard errors of the SWHS estimates were obtained by bootstrapping. The SWHS is currently the preferred method for estimating charter harvest and the only method available for estimating noncharter harvest. Average net weight was estimated by applying the IPHC length-weight relationship to length measurements of halibut harvested at major ports in Areas 2C and 3A. Ports sampled in Area 2C in 2011 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. Sampling followed a cluster design, where all fish from each cluster (vessel-trip) were measured. Two-stage bootstrapping was used to estimate the standard error of average weight for Area 3A. Program code is still being developed for a closed-form variance of average weight from cluster sampling in Area 2C. In the interim, standard errors for average weight from simple random sampling equations were inflated by a factor of two to provide preliminary standard errors for 2011. The inflation factor was based on the comparison of standard errors from simple random sampling and two-stage bootstraps for each subarea of Area 2C using 2010 data. Inflation by a factor of two was felt to be conservative; the average inflation factor was about 1.6 for charter average weight and 1.5 for noncharter average weight.

For Area 3B and Area 4, we present only the final SWHS estimates of the number taken by charter and noncharter anglers combined. 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 included in Area 3B estimates has ranged from 0 to 728 fish (average = 128). We continue to report these harvests in Area 3B because they are too small to apportion to the charter and noncharter sectors in Area 3A. This approach has more impact on the Area 3B sport harvest estimate than the Area 3A estimate, but the Area 3B sport harvest typically represents less than 0.5% of the total removals in that area.

#### Results:

The Area 2C overall sport yield (harvest biomass) in 2011 was estimated at 1.029 million pounds (Table 1). The charter yield estimate was 0.344 M lb and the noncharter yield was 0.685 M lb. The charter sector accounted for 33% of the Area 2C sport yield by weight. Average net weight was estimated at 9.4 lb in the charter harvest, 16.2 lb for the noncharter harvest, and 13.1 lb overall. Average weights were based on sample sizes of 4,442 charter fish and 4,514 noncharter fish.

Total sport yield in Area 2C was down in 2011 compared to 2010. The 68% decrease in charter yield was due primarily to a 64% reduction in average weight that resulted from imposition of the 37-inch maximum size limit. The noncharter yield was down about 23%, similar to the 22% decline from 2009 to 2010. The decrease was due to a 20% decrease in the number of fish harvested and a 0.5 lb decrease in average weight.

The Area 3A overall sport yield was estimated at 4.408 M lb, with 2.793 M lb from the charter sector and 1.615 M lb from the noncharter sector (Table 1). The charter fishery accounted for about 63% of the Area 3A sport yield. Average net weight was estimated at 15.2 lb for the charter fishery, 12.6 lb for the noncharter fishery, and 14.1 lb overall. Average weight was estimated from length samples of 5,128 charter halibut and 2,413 noncharter halibut.

Total yield and harvest in Area 3A were up slightly from 2010. The charter harvest estimate was up about 4% while average weight was unchanged. The noncharter harvest was also up about 4%, and average weight was down about 0.2 lb.

The 2011 final harvest estimates were lower than the projections made last year for the charter and noncharter sectors in 2C and 3A. Last year's projections were high by 12.9% for the Area 2C charter fishery, 34.9% for the 2C noncharter fishery, 1.6% for the 3A charter fishery, and 5.5% for the 3A noncharter fishery. The discrepancies in charter projections are likely due to uncertainty in the relationship between SWHS estimates and reported logbook harvest. Larger projection errors are to be expected for the noncharter fisheries because those projections are made using time series methods and the forecasts are based on fairly short and variable time series of harvest.

Area 3B sport harvest (charter and noncharter combined) was estimated at 932 halibut, and Area 4 harvest was estimated at 1,135 halibut (Table 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 net weight

for sport harvest at Kodiak (charter and noncharter combined) was 15.1 lb. Anecdotal reports from Dutch Harbor/Unalaska suggest a higher average weight, but we cannot provide any data specific to that area.

### **Preliminary 2012 Harvest Estimates**

#### 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 for length measurements. These preliminary estimates are updated once the final SWHS estimates become available. 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 were suitable given current data limitations. The SSC again reviewed the time series forecasting methods in October 2012 and made several suggestions. These suggestions were incorporated in current projections.

Separate methods are used to project charter and noncharter harvest. In recent years, charter harvest has been projected using partial-year data from the charter logbook. Specifically, the relative change in charter harvest through July from the previous year to the current year was applied to the previous year's SWHS estimate. This was done for each subarea because of differences in harvest trends and fish size. This method was an improvement over time series forecasts used earlier, but it assumed a perfect relationship between the logbook and SWHS, which is not the case. As a result, the projections and final estimates sometimes moved in opposite directions from year to year.

This year, charter harvest for Areas 2C and 3A was projected for each subarea using regression of SWHS estimates on logbook data through July 31 for the years 2006-2011. This method takes into account uncertainty in the relationship between logbook data and SWHS estimates and allows for estimation of confidence intervals for the charter harvest projections. Regression through the origin was used because it was felt to be conceptually realistic and because some subareas (especially in Area 3A) had little contrast in the data. Plots of data from areas with good contrast indicated that the intercept was close to zero. The harvest projections were multiplied by estimates of average weight from dockside sampling in 2012.

The charter harvest projections for the Glacier Bay subarea (Area G) were apportioned between Areas 2C and 3A to account for recent increases in charter harvest in the Area 3A portion. Before 2011, the entire Area G estimated harvest from the SWHS was attributed to Area 2C. Logbook data indicate that halibut from Area 3A accounted for less than 1% of the Area G charter halibut 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 likely fishing in Area 3A to avoid the one-fish bag limit and 37-inch maximum size limit, it was prudent to apportion the historical SWHS estimates using logbook data and provide separate regression estimates for the 2C and 3A harvests from Area G.

Noncharter harvest in Areas 2C and 3A, and overall sport harvests for Areas 3B and 4 were projected using time series methods. Following a suggestion from the SSC, appropriate time series models were identified using the Box and Jenkins<sup>1</sup> procedure for auto-regressive integrated moving average (ARIMA) models. Models were chosen for each subarea based on Akaike's Information Criteria corrected for small sample sizes (AICc<sup>2</sup>). In addition to the various ARIMA models considered, simple 2-year, 3-year, and 4-year moving averages of harvest estimates were also evaluated using root mean squared error.

Noncharter yield was estimated by multiplying the forecasts for each subarea by average weights from dockside sampling, and summing over all subareas. Unlike the Glacier Bay charter harvest that was

---

<sup>1</sup> Box, G. E. P. and G. M. Jenkins. 1976. Time series analysis: forecasting and control. Holden-Day, San Francisco.

<sup>2</sup> Anderson, D. R. 2008. Model based inference in the life sciences – a primer on evidence. Springer, New York.

apportioned to Areas 2C and 3A, all Glacier Bay noncharter harvest was assumed to be taken in Area 2C. As was the case in 2011, there were no average weight data from Areas 3B or 4 for 2012.

### Results:

The preliminary 2012 halibut harvest projections for Area 2C were 0.645 M lb for the charter sector and 0.761 M lb for the noncharter sector, for a total sport harvest of 1.405 M lb (Table 2). Average weights were 14.6 lb for the charter sector, 17.2 lb for the noncharter sector, and 15.9 lb overall. The average weights and projected harvests were both up from 2011 in Area 2C, likely due to relaxation of size limits from the 37-inch maximum size limit in 2011 to the U45O68 reverse slot limit in 2012.

Projected halibut harvests in Area 3A were 2.375 M lb for the charter sector, 1.563 M lb for the noncharter sector, and 3.938 M lb overall (Table 2). Average weights in Area 3A were 13.3 lb for the charter harvest and 11.9 lb for the noncharter harvest, and 12.7 lb overall. These are the lowest estimated average weights for Area 3A since ADF&G began monitoring charter harvests in the early 1990s. Average weight for both sectors was lowest in Cook Inlet and highest at Yakutat and in the Area 3A portion of the Glacier Bay subarea.

The 2012 projected harvest for Area 3B was 932 halibut, with a 95% confidence interval (CI) of 315-1,549 (Table 2). The projected harvest for Area 4 was 1,135 halibut, with 95% CI of 0-3,248. Should the IPHC again wish to use the Kodiak average weight to project yield for these areas, the estimated average weight for charter and noncharter sectors combined for 2012 was 13.7 lb.

ARIMA modeling provided an effective framework for time series forecasts of noncharter harvest in Areas 2C and 3A and total harvest in Areas 3B and 4. The naïve model, where the forecast equals the previous year's harvest, was selected for noncharter harvest in seven of the subareas as well as for total sport harvest in Areas 3B and 4. A single-exponential model without a constant term was selected for three subareas, and a two-year and three-year moving average were selected for one subarea each. In one subarea, the best model was simply the average harvest. Harvest forecasts and 95% confidence intervals are plotted along with the time series of harvests in Figure 1.

### **Sport Harvest Prior to the Mean IPHC Survey Date: Areas 2C and 3A**

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 2012 were June 22 in Area 2C and July 12 in Area 3A.

### Methods:

Separate methods were used to estimate charter and noncharter harvest prior to the mean survey date. The proportion of charter harvest taken prior to the mean survey date was averaged using logbook harvest data from the previous three years. The proportion of noncharter harvest taken prior to the mean survey date was based on harvest reported in dockside interviews. These proportions were calculated separately for each subarea of Area 2C and 3A and weighted by the 2012 projected number of fish harvested to derive the overall proportion for the noncharter fishery. The total sport yield taken prior to the mean survey date was calculated by multiplying the charter and noncharter proportions by their respective projected yields for 2012 and summing.

### Results:

An estimated 0.216 M lb of halibut were taken by the sport fishery in Area 2C prior to June 22, and about 1.996 M lb of halibut were taken in Area 3A prior to July 12 (Table 3). About 18.0% of charter harvest and 13.2% of noncharter harvest was taken prior to the middle of the survey in Area 2C. Likewise, about 44.3% of charter harvest and 60.4% of noncharter harvest was taken prior to the middle of the survey in Area 3A.

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, Barbi Failor

Fishery Biologists

Table 1. Final estimates of the 2011 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 (M lb)	95% CI for Yield (M lb)
Area 2C	Charter	36,545	9.4	0.344	0.315 - 0.372
	Noncharter	42,202	16.2	0.685	0.595 - 0.775
	Total	78,747	13.1	1.029	0.929 - 1.129
Area 3A	Charter	184,293	15.2	2.793	2.542 - 3.045
	Noncharter	128,464	12.6	1.615	1.436 - 1.793
	Total	312,757	14.1	4.408	4.099 - 4.717
Area 3B	Total	932	NA	NA	NA
Area 4	Total	1,135	NA	NA	NA

Table 2. Preliminary estimates of the 2012 sport halibut harvest (numbers of fish), average net weight (pounds), and harvest biomass (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 (M lb)	95% CI for Yield (M lb)
Area 2C	Charter	44,311	14.6	0.645	0.482 - 0.808
	Noncharter	44,203	17.2	0.761	0.486 - 1.035
	Total	88,514	15.9	1.405	1.086 - 1.725
Area 3A	Charter	178,268	13.3	2.375	2.060 - 2.690
	Noncharter	131,104	11.9	1.563	1.281 - 1.845
	Total	309,372	12.7	3.938	3.515 - 4.361
Area 3B	Total	932	NA	NA	NA
Area 4	Total	1,135	NA	NA	NA

Table 3. Estimated sport harvest prior to the mean IPHC survey date in 2012 in Areas 2C and 3A.

Area	Mean Survey Date	User group	Harvest Prior to mean Survey Date	
			Percent of Harvest	Harvest (M lb)
Area 2C	June 22	Charter	18.0%	0.116
		Noncharter	13.2%	0.100
		Total	15.4%	0.216
Area 3A	July 12	Charter	44.3%	1.052
		Noncharter	60.4%	0.944
		Total	50.7%	1.996

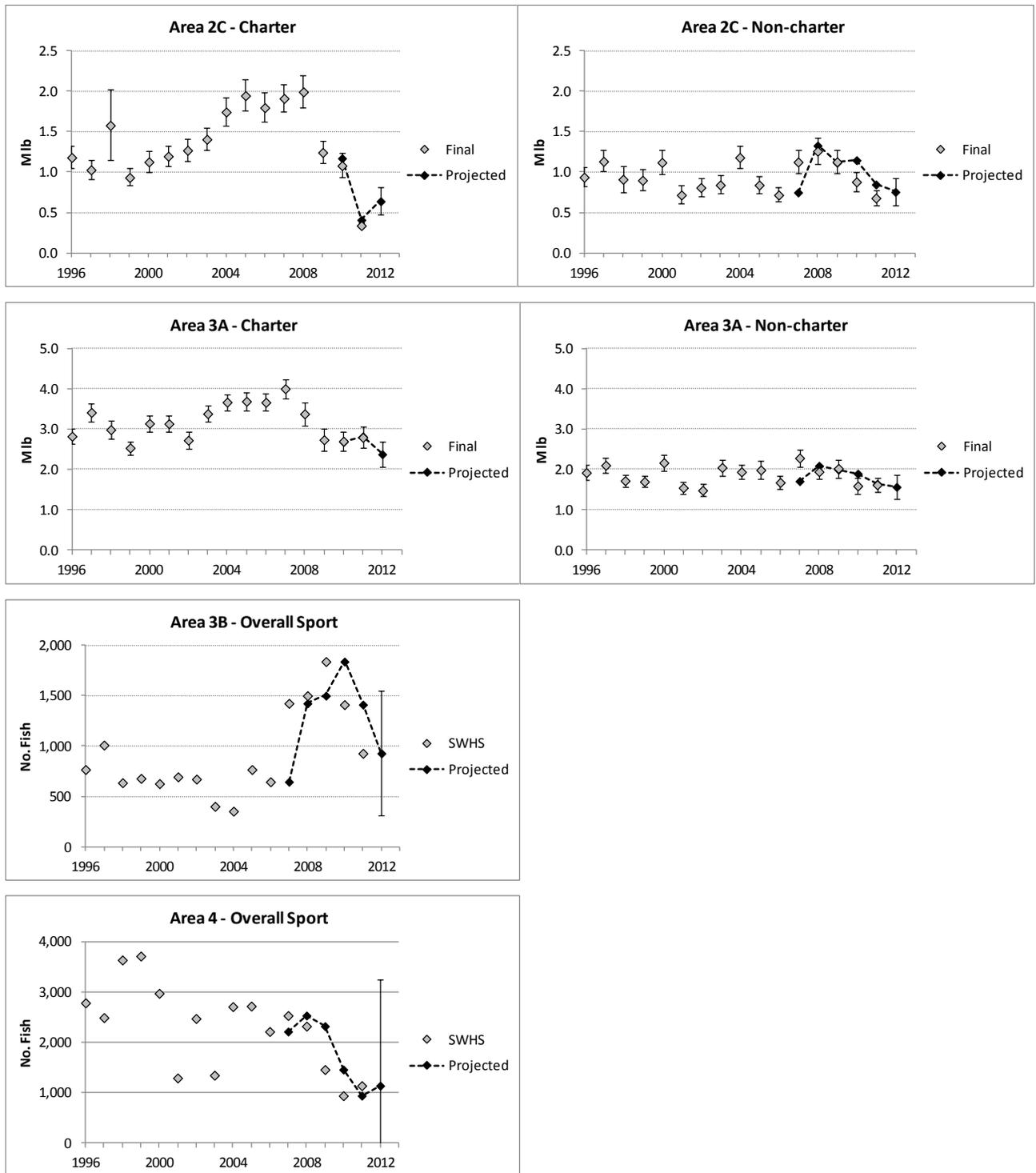


Figure 1. Comparison of final sport harvest estimates through 2011 for Areas 2C, 3A, 3B, and 4, and projections of sport harvest for recent years using the method selected for 2012 projections. The final estimates are from the ADF&G Statewide Harvest Survey (SWHS) and include 95% confidence intervals for Areas 2C and 3A. The 95% confidence intervals are also shown for 2012 projections.