

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF SPORT FISH

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

Dear Gregg:

This letter contains the final sport harvest estimates for 2008 and harvest projections for 2009 for areas 2C, 3A, 3B and 4 (Alaska). This is the information we typically provide for stock assessment purposes in the fall of each year. You also requested length composition data from the 2C and 3A sport fisheries – that information will be transmitted in a separate email.

Final Estimates of 2008 Sport Harvest, Areas 2C and 3A

Last November we provided end-of-season projections of the 2008 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 mean weight. These final Area 2C and 3A estimates were also presented at the North Pacific Fishery Management Council's October 2009 meeting in Anchorage.

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 the 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 2008 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.

Standard errors of the SWHS estimates were produced by bootstrapping (1,000 iterations). Standard errors of the average weight estimates were obtained assuming normal distributions. Approximate 95% confidence intervals are provided for the Area 2C and Area 3A estimates of yield (harvest in pounds) assuming they are normally distributed (± 1.96 standard errors). The harvest estimates are likely not as precise as indicated by the confidence intervals presented in this letter due to the fact that we use formulas for random sampling to estimate variance, when in fact cluster sampling is used to measure fish. A three-stage bootstrapping analysis of Area 3A charter data from 2007 indicated that, although the point estimates were unbiased, the standard error of charter average weight was at least 1.77 times as large as

estimated using formulas for random sampling. The standard error of the harvest estimate (by weight) was at least 27% larger. This analysis could not be performed on data from the private fleet because boat names were not recorded along with length data in 2008. We recorded vessel identifiers in 2C and 3A in 2009 and intend to present bootstrap variances with the final 2009 estimates.

Results:

The Area 2C sport harvest (yield) in 2008 was estimated at 3.264 million pounds (SE = 0.119). The charter harvest estimate was 1.999 M lb (SE = 0.099), and the non-charter harvest estimate was 1.265 M lb (SE = 0.082). The charter removals represented 61% of the Area 2C sport harvest. Average net weight was estimated at 19.4 lb for the charter fishery (n = 7,971), 19.1 lb for the non-charter fishery (n = 3,472), and 19.3 lb overall. The 2008 estimated charter removals were 4% higher than the 2007 estimates, and the non-charter removals were 12% higher.

The charter fishery in Area 2C was managed under a daily bag limit of two fish with a maximum length of 32 inches for one of the fish for most of 2008. The National Marine Fisheries Service implemented a one-fish bag limit June 1, but that was halted by a court injunction and the two-fish bag limit was reinstated on June 10. Despite the minimal change in regulations from 2007 to 2008, average weight increased from 17.5 lb to 19.5 lb in the charter harvest, and from 16.5 to 19.1 lb in the unguided harvest. The biggest increase in average weight was observed in the Glacier Bay charter fishery, where average weight increased from 31.5 lb to 45.3 lb. It is unknown to what degree this increase is due to highgrading versus sampling error.

The Area 3A sport harvest was estimated at 5.320 M lb (SE = 0.167). Charter harvest was estimated at 3.378 M lb (SE = 0.142), and non-charter harvest at 1.942 M lb (SE = 0.089). The charter fishery accounted for about 63% of the Area 3A sport harvest. Average net weight was estimated at 17.0 lb for the charter fishery (n = 3,805), 13.4 lb for the non-charter fishery (n = 2,222), and 15.5 lb overall. Charter removals in 2008 were down 16% and non-charter removals were down 15% relative to 2007.

The final harvest estimates for 2008 were higher than projected in Area 2C and lower than projected in Area 3A. In Area 2C, the charter harvest projection made last year was low by 4.3% and the private harvest projection was low by 7.6%. In Area 3A, the charter harvest projection was high by 6.7% and the private harvest projection was high by 4.3%.

Area 2C and 3A Sport Harvest Projections for 2009

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 or other estimates of the number of fish harvested multiplied by the recent season's estimates of average weight from length sampling. 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 did not suggest any alternate methods that can be implemented with available data. We continue efforts to improve these projections, however.

Last year, we evaluated the retrospective performance of several time series projection methods and based harvest projections on the best method. This remains the best approach for projecting the non-charter harvest. Our ability to use time series methods for charter harvest, however, is hampered by changes in regulations because the time series upon which estimates are based is inconsistent. Charter skippers and crew in Area 2C were prohibited from retaining fish in 2006-2009, which probably decreased harvest slightly. The maximum size limit (on one of two fish in the bag limit) in place in Area 2C in 2007 and most of 2008 may have affected the numbers of fish retained. A one-fish bag limit was in place in Area

2C for a small part of 2008 and most of 2009. In Area 3A, skippers and crew were prohibited from retaining fish in 2007, 2008, and 2009. All of these factors potentially affect angler effort and behavior, and confounded with changes in halibut abundance or catchability, make it very difficult to forecast harvest with a simple time series model.

We feel the best projections of charter halibut harvest would be obtained using charter logbook data from the current year. Even logbook data for part of the year should give an indication of relative changes in harvest from year to year. Therefore, charter harvest projections for 2009 were based on relative changes in reported logbook harvest from 2008 to 2009, and these changes were applied to the final 2008 SWHS estimate of charter harvest. Logbook data for trips made through July 31, 2009 were used for this analysis. The July data were estimated to be about 95% complete at the time of these projections, and were therefore expanded to represent the entire month. Charter harvest was projected separately for each SWHS area and summed to obtain the harvest projections for each regulatory area. Because the bag limit in Area 2C was reduced from two to one fish on June 5, calculations were done separately for two strata (before June 5 and from June 5 on) as follows:

$$\hat{H}_{proj} = \sum_s \sum_i r_{si} \hat{N}_{si} \bar{w}_{si},$$

where:

- \hat{H}_{proj} = the projected 2009 charter harvest by weight (lb) for Area 2C,
- r_{si} = the ratio of reported 2009/2008 logbook harvest for stratum s and SWHS area i ,
- \hat{N}_{si} = the final 2008 SWHS halibut harvest estimate, in numbers of fish, for stratum s and SWHS area i , and
- \bar{w}_{si} = the estimated mean weight of halibut harvested in stratum s and area i in 2009.

The 2008 SWHS estimates were apportioned to strata based on 2008 logbook data. This approach assumes that a constant proportion of the harvest was taken in each stratum each year. This method also assumes a consistent relationship between the SWHS and logbook estimates, which has been more the case for Area 2C in recent years than for Area 3A.

Because there were no regulation changes in Area 3A in 2009, charter harvest for Area 3A was projected using the same method as for Area 2A, but with only one stratum (the entire year); the ratios of reported 2009/2008 logbook harvest through July 31 were multiplied by the 2008 SWHS estimate for each SWHS area and summed.

Non-charter harvest was estimated by multiplying a time series projection of harvest (in numbers of fish) by the 2009 estimated average weight for each SWHS area and summing across areas. We made projections at the SWHS area level, but evaluated retrospective performance at the regulatory area level. Several methods were evaluated retrospectively for the period 2001-2008: (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. The performance criteria for the retrospective projections were mean squared deviations (MSD) and mean absolute percent error (MAPE) relative to the final SWHS estimates.

Non-charter harvest was projected for Area 2C for 2009 using double exponential projections by SWHS area. For Area 3A, single exponential projections were made by SWHS area. These methods had the lowest MSD and MAPE.

There is considerable uncertainty in these projections. In fact, we are uncertain as to how to calculate variances based on the relative changes in logbook harvest. There is also uncertainty in whether sampling

methods were representative for mean weight, and whether there is a strong relationship between the SWHS and logbook data. Therefore, we provided approximate maximum projection errors, expressed as the maximum percentage difference between retrospective projections and the SWHS estimates.

Results:

The number of halibut reported in Area 2C logbooks for trips made through July 31, 2009 was 52% below the 2008 harvest for the same period. The projected harvest biomass was 1.302 M lb ($\pm 13\%$) for the charter fishery, 1.244 M lb ($\pm 25\%$) for the non-charter fishery, and 2.546 M lb overall (Table 2, Figure 1). Even though the number of fish harvested was down 52% from 2008, projected harvest biomass only decreased about 35%. This was because decrease in numbers of fish harvested was offset by increases in average weight in all SWHS areas except Glacier Bay. The estimate of average weight for the Area 2C charter harvest was 25.0 lb, up from 19.4 lb for 2008. Estimated average weight for the non-charter fishery was 17.8 lb, down from 19.1 in 2008. The area-wide average weight estimates for 2009 are conditioned on the area projections, so they are likely to change when the estimates are finalized.

The number of halibut reported in Area 3A logbooks for trips made through July 31 was down 21% relative to 2008. Projected harvests for Area 3A were 2.564 M lb ($\pm 25\%$) for the charter fishery, 1.966 M lb ($\pm 39\%$) for the non-charter fishery and 4.531 M lb overall (Table 2, Figure 1). Preliminary estimates of average weight were 16.3 lb for the charter fishery and 13.4 lb for the non-charter fishery. The charter average weight is down from 17.0 lb, and the non-charter average weight is down slightly from 13.4 lb in 2008.

Areas 3B and 4 - Final 2008 Estimates and Projections for 2009

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 mean weight. Historically we have included in the Area 3B estimate all harvest from SWHS Area R (Alaska Peninsula and Aleutian Islands south of Cape Douglas and the Naknek River) north of the Area 3B/4 boundary. In some years, the Area 3B 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 = 111). 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 precisely apportion the Area R harvest among the charter/non-charter sectors as well as IPHC Areas 3A, 3B, and 4. This error has more impact on the Area 3B sport harvest estimate than the Area 3A estimate, but the Area 3B sport harvest is quite small and represents a very minor proportion of the total removals in that area.

Several projections 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 projections, and (4) moving averages of the previous 2, 3, 4, and 5 years. Retrospective projections were compared for the period 1998-2008 for Area 3B and 1997-2008 for Area 4. The previous year's harvest was chosen to project harvest in Area 3B because it had the lowest MAPE and nearly the lowest MSD. Single exponential projections had the best fit to Area 4 data. Harvest in both areas is highly variable from year to year with no apparent trend, except that harvest in Area 3B more than doubled from 2006 to 2007. Projection errors were calculated in a similar fashion to Areas 2C and 3A, as the maximum percentage difference between the projection and the final estimate.

Results

The final 2008 harvest estimate for Area 3B was 1,505 fish, and the final estimate for Area 4 was 2,320 fish (Table 3). The precision of estimates for areas 3B and 4 were not assessed, but the SWHS harvest estimate for Area R was relatively imprecise ($CV = 23\%$).

Harvest projections for 2009 are 1,505 fish ($\pm 120\%$) in Area 3B and 2,382 fish ($\pm 56\%$) in Area 4 (Table 3). The projection errors have been relatively large, reflecting the inherent variability in the past harvest estimates (Figure 1).

It is our understanding that the IPHC typically applies the Kodiak average weight to estimate sport harvest biomass. The estimates of average weight for the Kodiak sport fishery (charter and non-charter) were 17.3 lb in 2008 and 16.3 lb in 2009. These average weights are stratified with charter harvest making up 53% of the total harvest in 2008 and 47% in 2009 (from the projection). Anecdotal reports from Dutch Harbor/Unalaska indicate a higher average weight. Charter logbook data from Area 4 also indicate a lower percentage of charter-caught fish (about 14% of the Area 4 harvest in 2008). One possible alternative to using the Kodiak average weight might be to substitute the average weight from the IPHC survey, since survey selectivity is used to model sport harvest.

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

Sincerely;

(sent via email)

Scott Meyer, Mike Jaenicke, Barbi Failor
Fishery Biologists

Table 1. Final estimates of the 2008 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	102,965	66,296	169,261
Average Wt (lb)	19.4	19.1	19.3
Yield (M lb)	1.999	1.265	3.264
Approx. 95% CI	1.805-2.193	1.104-1.426	3.030-3.498
Area 3A			
No. Fish	198,108	145,286	343,394
Average Wt (lb)	17.0	13.4	15.5
Yield (M lb)	3.378	1.942	5.320
Approx. 95% CI	3.099-3.657	1.768-2.116	4.992-5.647

Table 2. Preliminary estimates of the 2009 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	51,972	69,949	121,921
Average Wt (lb)	25.0	17.8	20.9
Yield (M lb)	1.302	1.244	2.546
Projection Error ($\pm\%$)	13%	25%	Not est.
Area 3A			
No. Fish	157,155	147,932	305,087
Average Wt (lb)	16.3	13.3	14.8
Yield (M lb)	2.564	1.966	4.531
Projection Error ($\pm\%$)	25%	39%	Not est.

Table 3. Final 2008 harvest estimates and 2009 projections for Areas 3B and 4 (numbers of fish).

Estimate	Number of Halibut Harvested	
	Area 3B	Area 4
2008 Final	1,505	2,320
2009 Projection	1,505	2,382
Projection Error ($\pm\%$)	102%	56%

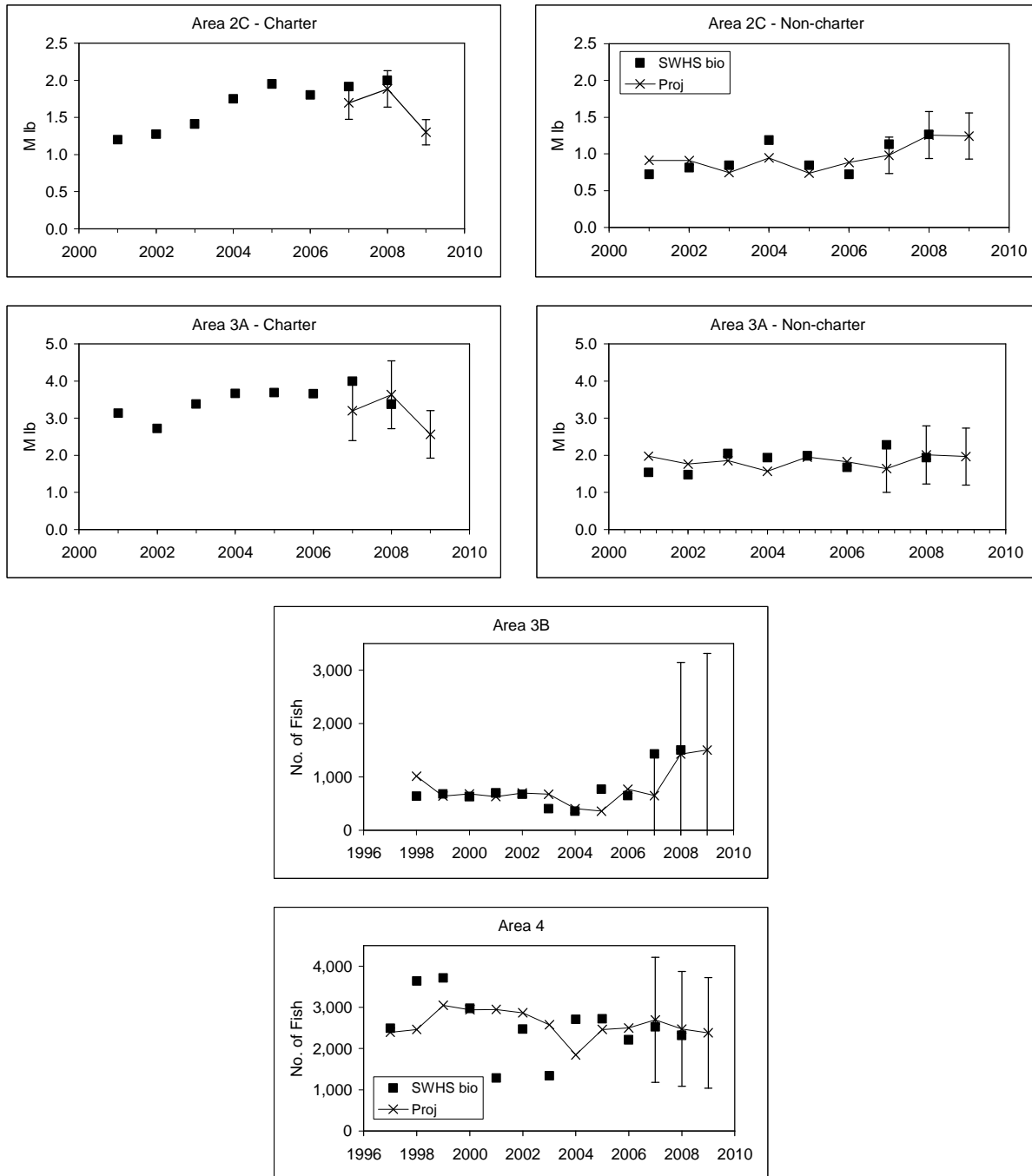


Figure 1. Comparison of final SWHS estimates and retrospective projections for areas 2C, 3A, 3B, and 4 using the methods selected for projecting harvest in 2009. Approximate error bounds are provided for the last three years (2007-2009), based on the largest percentage errors observed in retrospective projections using the methods used for 2009. Charter and non-charter projections are shown for areas 2C and 3A only. The Area 2C and 3A estimates are in pounds, and Area 3B and 4 estimates are in numbers of fish.