

Analysis of Management Options for the Area 2C Charter Halibut Fishery for 2012

A Report to the North Pacific Fishery Management Council, December 2012

Scott Meyer, Alaska Department of Fish and Game
November 28, 2011

Background

The North Pacific Fishery Management Council's Charter Implementation Committee met October 26, 2011 and requested that the Alaska Department of Fish and Game (ADF&G) analyze the following options for management measures for the Area 2C charter halibut fishery for 2012:

1. Maximum size limits,
2. Reverse slot limits, and
3. Closures on selected days of the week.

These management measures were analyzed with the goal of identifying choices under each option that would constrain the Area 2C charter harvest to within the guideline harvest level (GHL) defined in 50 CFR §300.65. Under this rule the GHL is specified based on the level of the Constant Exploitation Yield (CEY), which in turn is determined through the International Pacific Halibut Commission (IPHC) annual stock assessment. The CEY for 2012 is unknown at the time of this analysis. Because the Area 2C GHL is now set at its lowest possible level, viable options were identified for the current GHL of 788,000 lb as well as the next higher GHL of 931,000 lb. All analyses were done assuming a daily bag limit of one halibut.

Methods

2012 Harvest Forecast

The first step in the analysis was to forecast the number of halibut that will be harvested in each subarea of Area 2C in 2012, where the subareas are ADF&G Statewide Harvest Survey (SWHS) reporting areas. Harvest in Area 2C increased rather steadily through 2008 and then dropped abruptly in 2009 due to implementation of a one-fish bag limit and an economic slowdown (Figure 1). A suite of forecasting models were fit retrospectively to the time series of SWHS estimates for each subarea to see which method performed best over time. Two-year forecasts were initially done because the most recent final SWHS estimate was for 2010. No one method performed particularly well; all lagged about two years behind the trend and overshot the harvest substantially when it dropped in 2009. Given the recent dramatic shift in the charter harvest trajectory, it was decided instead to project 2012 harvest using simple methods that place more emphasis on the most recent years (since 2009). Two forecast options are provided for the 2012 charter harvest in each subarea of Area 2C: the first equals the 2011 projection, and the second is the average of the 2009-2010 final SWHS estimates and 2011 projection. Details of the 2011 charter harvest projection method are described in the November 11, 2011 ADF&G letter to the International Pacific Halibut Commission (IPHC). Logbook data indicate that harvest through July 2011 was similar to the same period in 2010, but there is a possibility that it might have been higher without the 37-inch maximum size limit. However, there is no way to know whether this is true, or how much higher it might have been. The 2011 projection is the most recent estimate of harvest and the three-year average reflects what appears to be relative stabilization at recent levels. These two forecasts were used as the basis of further calculations associated with size limits and closures on selected days of the week.

Maximum Size Limit

At the request of the committee, options for a maximum size limit were analyzed using the “hybrid method” described in a paper presented to the Council in June 2011 (Meyer 2011). At that meeting the Council approved a motion to recommend to the National Marine Fisheries Service that this method be used to set maximum size limits under the Catch Sharing Plan. This approach estimates the average weights associated with various maximum size limits using observed length frequency distributions of sport harvest. Length data for each subarea (Statewide Harvest Survey reporting area) from 2010 were used for this analysis. This is the most recent year in which there was no size limit in the charter halibut fishery. Use of 2010 data assumes that there has been no substantial change in the size structure of the population or charter fishery selectivity since then. The length frequency distributions of charter harvest were similar in 2009 and 2010, but substantially different in 2011 due to the imposition of a 37-inch maximum size limit (Figure 2).

The hybrid method assumes that the proportion of harvest below the size limit being analyzed will be the same as in the year upon which the data are based (2010), and that all fish above the maximum size limit will be replaced in the harvest with fish exactly at the maximum size limit. Because it is unlikely that such a large portion of the harvest will be exactly at the size limit, this method is conservative, i.e., it over-estimates the average weight. For example, the preliminary estimate of average length of the charter harvest in 2011 under the 37-inch size limit was only 30.5 inches (Figure 2). The hybrid method would have predicted an average net weight of 13.2 lb for the Area 2C harvest in 2011, but the preliminary estimate for 2011 was only 9.4 lb.

Once the average weights were determined for each subarea and size limit, they were multiplied by the projected harvest (in number) and summed to determine the Area 2C charter yield in pounds under each option. This approach assumed that the various maximum lengths considered will have no effect on the number of fish harvested. Although it is possible that size limits could affect effort and the number of fish harvested, there were insufficient data to attempt to model these relationships.

Reverse Slot Limit

A reverse slot limit is one in which harvest is allowed for fish under a relatively small maximum size limit and for fish over a relatively high minimum size limit. Analysis of reverse slot limits was also based on length-frequency data from the sport harvest in 2010. The average weight associated with each prospective length limit was calculated for each subarea of Area 2C as:

$$\hat{w} = \left(\hat{p}_L \hat{w}_L \right) + \left(h \hat{p}_U \hat{w}_U \right) + \left(\frac{\hat{p}_L}{\hat{p}_T} \hat{p}_C \hat{w}_L \right) + \left(\frac{h \hat{p}_U}{\hat{p}_T} \hat{p}_C \hat{w}_U \right)$$

where

\hat{p}_L = proportion of harvest (in numbers) \leq the lower maximum length limit,

\hat{w}_L = the estimated average weight of fish \leq the lower maximum length limit,

\hat{p}_U = proportion of harvest (in numbers) \geq the upper minimum length limit,

h = a multiplier to specify the degree of high-grading above the upper limit,

\hat{w}_U = the estimated average weight of fish \geq the upper minimum length limit,

\hat{p}_T = the total proportion of harvest \leq the lower maximum length limit and \geq the upper minimum length limit, or $\hat{p}_L + h \hat{p}_U$, and

\hat{p}_C = the proportion of harvest in the center of the distribution between the lower length limit and the upper length limit, or $1 - \hat{p}_T$.

Charter yield in pounds under each prospective slot limit was estimated by multiplying the average weight by the projected number of fish harvested in each subarea. This was done for both projected harvest levels described above.

This approach assumes that the proportions of harvest above or below the prospective upper and lower size limits will be the same as they were in 2010. It further assumes that there will be no decrease in harvest; all fish caught between the upper and lower size limits will be released and replaced in the harvest by fish above or below the size limits. With a high-grading multiplier of 1.0, the harvest between the limits is redistributed to the upper and lower tails proportional to their relative proportions of the harvest in 2010. It is possible that, under a reverse slot limit, anglers will have added incentive to harvest a large halibut that is above the upper minimum size limit. Therefore, results were also calculated with a high-grading multiplier of 1.2, which inflates the proportion of harvest in the upper tail, making it 20% higher than it was in 2010. The choice of 20% was arbitrary, chosen only to illustrate the sensitivity of the results to additional high-grading. There is no information to suggest that high-grading will occur specifically at this level. The high-grading multiplier could also be interpreted to reflect a change in the numbers of large fish available in the stock that might result in an increase in average weight in the harvest.

Day of the Week Closures

The effect of closing selected days of the week was examined using charter logbook data from the entire years 2008-2010. The average proportion of the harvest (numbers of fish) was calculated for each day of the week, and these proportions were added to estimate the harvest reductions associated with various combinations of two or three days closed per week. On the suggestion of Charter Implementation Committee members, the combinations of closed days were chosen to be non-consecutive to minimize rescheduling of charter trips to avoid the harvest restriction.

Results and Discussion

Harvest Projections

The Area 2C charter harvest projections for 2012 are 41,209 fish (equal to the 2011 projection) and 45,338 fish based on the recent 3-year average (Table 1). The Sitka area made up the highest percentage of harvest, followed by Prince of Wales and then Glacier Bay. The percentage of harvest in the Sitka area is about 6.5% higher in the 2011 projection than in the recent three year average, while the percentages in all other areas are slightly lower.

The harvest projection for 2011 was practically identical to the final SWHS estimate for 2010, due to the fact that there was no significant change in harvest reported in logbooks through July of 2011 compared to the same period in 2010. There is no way to know whether harvest in 2011 would have been higher without the 37-inch size limit.

Maximum Size Limit

The hybrid method predicts that if harvest in 2012 was similar in magnitude and distribution to 2011, the highest maximum size limit that would constrain charter harvest to the 788,000 lb GHLL would be 47 inches (Table 2). At this harvest level, the highest size limit that would keep the harvest below the 931,000 lb GHLL would be 55 inches. Under the higher harvest projection, the maximum size limits would have to be lowered to 44 inches for the 788,000 lb GHLL and 49 inches for the 931,000 lb GHLL.

As noted previously, the method used here is conservative in that it is likely to overestimate the average weight under each maximum size limit. Uncertainty in the choice of a size limit is therefore mainly a

function of the assumed level of harvest in each area and whether the 2010 length compositions are representative of harvest in 2012.

Potential effects of a maximum size limit are as follows:

- A maximum size limit is a fairly simple regulation and is effective at constraining the average weight. It requires a companion regulation to require that halibut are either landed whole or the carcass (frame) is retained as proof of size.
- Under a maximum size limit, anglers that catch trophy fish, including state or world records, are not legally able to retain those fish. This was the case in Area 2C in 2011.
- Anglers are not allowed to keep the larger fish, which may reduce angler demand in areas where large halibut are more abundant (e.g., Glacier Bay, Petersburg). A maximum size limit would be expected to have a relatively small effect on harvest in areas where a small fraction of the harvest was over the maximum size limit (e.g., Prince of Wales, Juneau).
- There may be additional incentive to target larger fish under higher maximum size limits due to the larger difference in weight for a given difference in length. Therefore, there may be additional handling and release mortality associated with higher size limits. At higher maximum sizes, it may become more difficult for anglers to measure fish to determine if they are legal. For example, a 49-inch halibut has an average round weight of over 56 lb. Fish near this size may experience rough handling in an attempt to bring them aboard a small boat to be measured precisely.

Reverse Slot Limit

Average weights and yield were calculated for a combination of prospective lower limits ranging from 35 inches to 45 inches (U35-U45), and upper limits in 2-inch increments ranging from 50 to 76 inches (O50-O76). The lower length limits of 35-45 inches correspond to round weights of 19-43 lb, and the upper limits of 50-76 inches correspond to round weights of 60-234 lb (Table 3).

In the first scenario with no additional high-grading, and using the lower harvest projection, a wide range of reverse slot limits with upper minimums ranging from 64 to 66 inches would constrain the harvest to less than a 788,000 lb GHL (Table 4). The upper minimums could be lowered to a range of 58 to 64 inches to stay within a 931,000 lb GHL. Using the higher harvest projection, acceptable upper limits range from 70 to 72 inches for a 788,000 lb GHL and 64 to 68 inches for a 931,000 lb GHL.

In the second scenario, where anglers would harvest 20% more fish above the upper limit, and under the lower harvest projection, viable upper minimum size limits range from 66 to 70 inches for a 788,000 lb GHL and 62 to 66 inches for a 931,000 lb GHL (Table 4). At the higher harvest projection, viable upper limits range from 72 to 74 inches for a 788,000 lb GHL and 64 to 70 inches for a 931,000 lb GHL.

Potential effects of a reverse slot limit include:

- Reverse slot limits allow anglers the opportunity to harvest exceptionally large fish. It is generally believed that this improves the charter industry's ability to market some types of charter trips, such as lodge stays or multi-day trips with an emphasis on larger fish. This regulation would also require retention of whole fish or carcasses to verify length.
- Because reverse slot limits provide opportunity to harvest exceptionally large fish, there may be some increase in the numbers of fish released that are below the upper minimum size limit. This could result in increased handling and release mortality.
- It may be challenging for charter operators to determine whether large fish near the upper size limit can be legally retained. Operators may need to buy or manufacture measuring devices that work outboard of the vessel in order to identify legal fish and release sublegal-size fish with

minimal handling. Fish that are very close to the upper minimum size limit may need to be brought aboard for a precise length measurement.

Day of the Week Closures

Without a size limit, the average weight in the charter harvest could be about 26.4 lb (net weight), based on the 2010 length distribution. This translates to a charter yield of 1.088 M lb under the lower harvest projection and 1.197 M lb under the higher harvest projection. Therefore, using the lower harvest projection, harvest would have to be reduced 28% percent to stay within a 788,000 lb GHL and 14% to stay within a 931,000 b GHL. Using the higher harvest projection, harvest would have to be reduced 34% percent to stay within a 788,000 lb GHL and 22% to stay within a 931,000 b GHL.

The average percentage of harvest on any day of the week during the years 2008-2010 ranged from 12.5% to 15.2% (Table 5). The lowest percentages tended to fall on weekends. Using the lower harvest projection, a single weekday (Mon-Fri) closure could potentially achieve the 14% reduction needed for a 931,000 lb GHL (Table 5). A two-day closure could potentially achieve the 28% reduction needed to stay within the 788,000 lb GHL (Table 6). Using the higher harvest projection, a two-day closure could potentially reduce harvest by at least 22% in order to stay within the 931,000 lb GHL, but a three-day closure would be required to reduce harvest by at least 34% to stay within a 788,000 lb GHL. (Table 6).

Potential effects of daily closures include:

- The regulation is straightforward and easy to understand. It would not be expected to result in additional high-grading. The lack of a size limit may encourage more cleaning at sea, which increases the potential for bias in estimates of average weight.
- Daily closures may be difficult to enforce. Boats in the Glacier Bay, Juneau, or Sitka areas that hold Area 3A permits would continue to fish that area. In this instance it may be difficult for enforcement personnel to verify the area of capture. It may also be difficult to verify the date of capture for fish taken on multi-day charters.
- The projected effect of daily closures may be overestimated to the degree that charter anglers can rebook to avoid the closures. If multiple day closures are needed, it may be more difficult for charter businesses to avoid closures if the closures are implemented on non-consecutive days.

Summary

Two alternative charter harvest projections were provided for Area 2C for 2012. The lower level projection of 41,209 fish was equal to the preliminary harvest projection for 2011. The higher projection of 45,338 fish was the average of the 2009, 2010, and projected 2011 harvest.

Three management measures were analyzed for the Area 2C charter fishery at the request of the Council's Charter Implementation Committee: (1) maximum size limits, (2) reverse slot limits, and (3) closures on selected days of the week. These options were analyzed assuming the length-frequency distributions from the 2010 charter harvest would be representative of the harvest distributions in 2012 in the absence of a size limit. All options were analyzed assuming a charter daily bag limit of one halibut. A further assumption in analysis of size limits was that the number of fish harvested was independent of the management measure, or that fish of a prohibited length would be replaced in the harvest by fish of a legal size.

For each management measure, a wide range of options restricted the charter yield to a level that was less than or equal to a GHL of either 788,000 lb or 931,000 lb. The least restrictive size limits or daily closures that achieved that objective are listed in Table 7. Viable measures are listed for both projected harvest levels and for both potential GHLs.

Maximum size limits were calculated with a method that assumes that all fish of a prohibited length will be replaced by fish equal to the lower size limit. Therefore, the maximum size limits corresponding to each harvest level are felt to be conservative. Reverse slot limits were calculated by replacing harvest between the upper and lower limits with legal-size fish above the upper limit and below the lower limit, in proportion to their occurrence in the harvest. Reverse slot limits were also calculated assuming 20% more fish would be harvested in the upper legal size range. The 20% figure was chosen arbitrarily to show the effect on the results, rather than to suggest that this specific level of high-grading might occur.

References

Meyer, S. C. 2011. Methods for establishing maximum size limits for the charter fishery under the halibut catch sharing plan. A report to the North Pacific Fishery Management Council, June 2011. Alaska Department of Fish and Game, Anchorage.

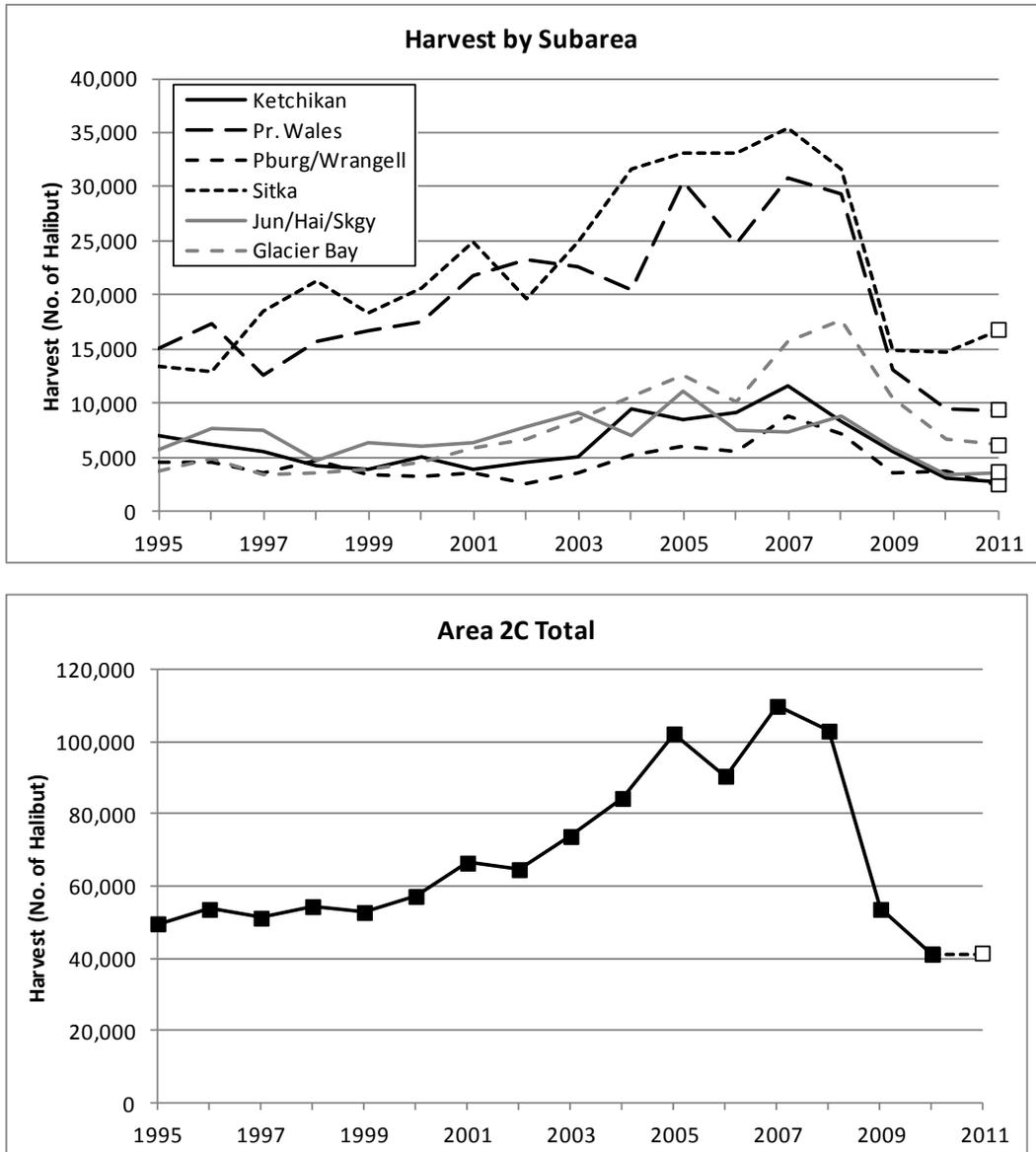


Figure 1. Estimated number of halibut harvested by charter anglers in Area 2C, 1995-2011. All estimates are final estimates from the ADF&G Statewide Harvest Survey except 2011, which are projections based on the change in charter harvest reported in logbooks through July from 2010 to 2011 (open squares).

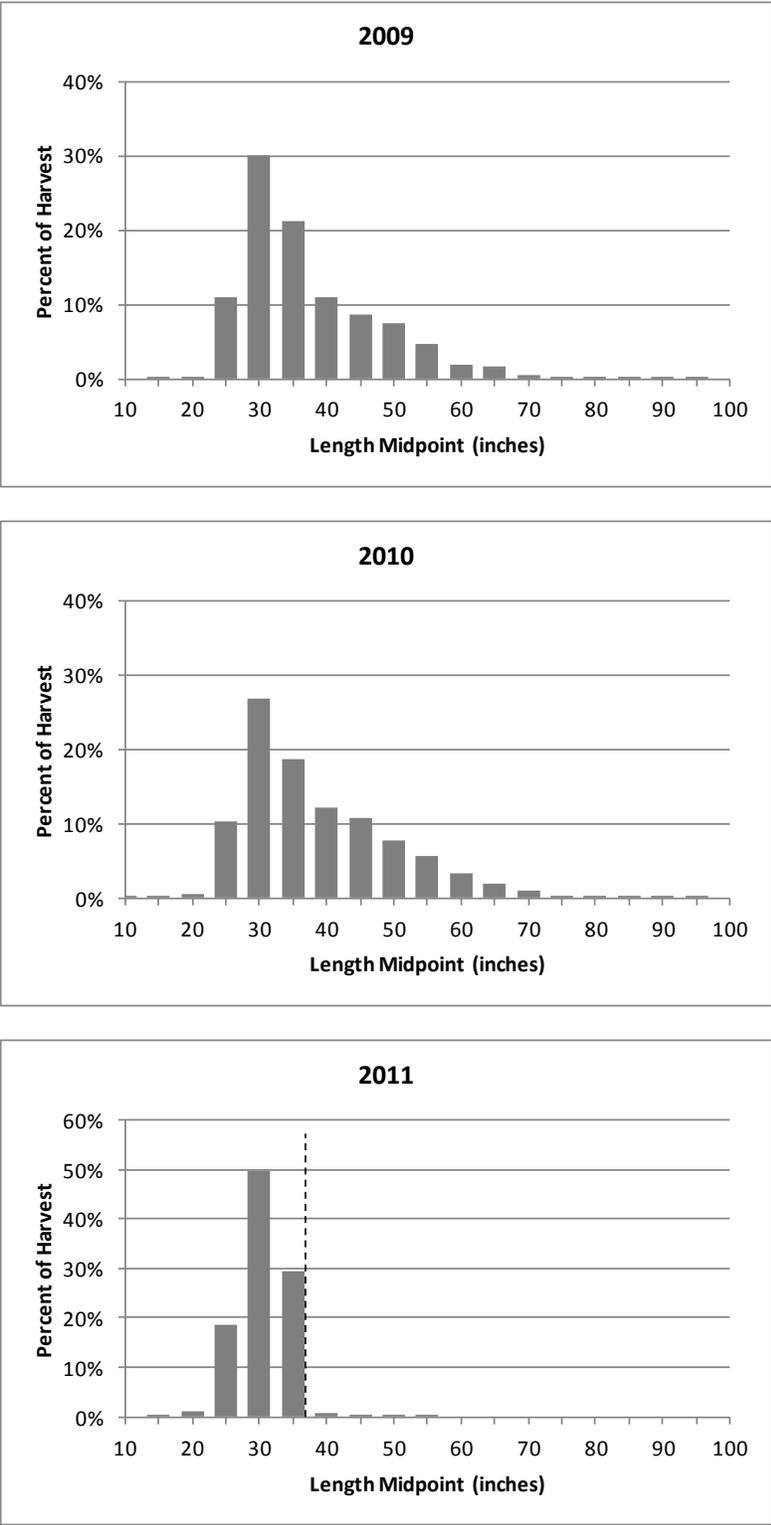


Figure 2. Comparison of estimated length-frequency distributions of charter halibut harvest in Area 2C, 2009-2011. The vertical dashed line references the 37-inch maximum size limit in place in 2011.

Table 1. Two alternative projections of charter halibut harvest (number of fish) by subarea for Area 2C in 2012.

Subarea	2011 Logbook Projection		Average of 2009-2011 Harvest	
	Harvest	Percent	Harvest	Percent
Ketchikan	2,832	6.9%	3,858	8.5%
Prince of Wales Island	9,356	22.7%	10,658	23.5%
Petersburg/Wrangell	2,459	6.0%	3,266	7.2%
Sitka	16,723	40.6%	15,468	34.1%
Juneau/Haines/Skagway	3,665	8.9%	4,304	9.5%
Glacier Bay	6,174	15.0%	7,784	17.2%
Total	41,209		45,338	

Table 2. Projected charter yield of halibut in Area 2C under various maximum size limits, calculated using the “hybrid” method applied to the length composition of the charter halibut harvest in 2010. Yield was calculated for harvest levels of 41,209 fish (2011 logbook-based projection) and 45,338 fish (2009-2011 average). Shaded cells indicate the largest maximum size limit for which the yield is less than a 788,000 lb GHL (shading) or less than a 931,000 lb GHL (boxes).

Maximum Size Limit (in)	Yield (M lb) when Harvest is:	
	41,209 fish	45,338 fish
37	0.530	0.586
38	0.557	0.616
39	0.583	0.645
40	0.609	0.675
41	0.634	0.703
42	0.660	0.731
43	0.684	0.759
44	0.709	0.787
45	0.732	0.813
46	0.755	0.838
47	0.777	0.863
48	0.798	0.887
49	0.818	0.910
50	0.838	0.932
51	0.857	0.953
52	0.875	0.972
53	0.891	0.991
54	0.907	1.008
55	0.921	1.025
56	0.935	1.040
57	0.947	1.054
58	0.959	1.067

Table 3. Average net weight (headed and gutted) and round weight associated with various lengths of Pacific halibut, based on the IPHC length-weight relationship.

Length (in)	Net Weight (lb)	Round weight (lb)
35	14	19
36	16	21
37	17	23
38	19	25
39	20	27
40	22	29
41	24	32
42	26	34
43	28	37
44	30	40
45	32	43
46	35	46
47	37	49
48	40	53
49	42	56
50	45	60
51	48	64
52	51	68
53	55	73
54	58	77
55	62	82
56	65	87
57	69	92
58	73	98
59	78	103
60	82	109
61	86	115
62	91	121
63	96	128
64	101	134
65	106	141
66	111	148
67	117	156
68	123	163
69	129	171
70	135	179
71	141	188
72	148	197
73	155	206
74	161	215
75	169	224
76	176	234

Table 4. Projected charter yield of halibut in Area 2C under various reverse slot length limits. Results are shown for two scenarios: one in which there is no additional high-grading, or targeting of halibut above the upper size limit, and one in which high-grading results in a 20% increase in harvest above the upper size limit. Results are also shown for harvest levels of 45,338 fish (2009-2011 average) and 41,209 fish (2011 logbook-based projection). Shaded cells indicate the largest maximum size limit for which the yield is less than a 788,000 lb GHJ (shading) or less than a 931,000 lb GHJ (boxes).

Scenario – No high-grading

Harvest Level = 41,209

Upper (minimum) Size Limit (in)	Lower (maximum) Size Limit (in)										
	35	36	37	38	39	40	41	42	43	44	45
50	1.200	1.156	1.132	1.104	1.092	1.074	1.061	1.051	1.045	1.042	1.044
52	1.186	1.137	1.111	1.081	1.067	1.048	1.033	1.022	1.016	1.015	1.017
54	1.159	1.108	1.080	1.049	1.035	1.016	1.002	0.991	0.986	0.985	0.989
56	1.113	1.061	1.035	1.004	0.991	0.972	0.959	0.949	0.945	0.946	0.951
58	1.073	1.021	0.994	0.963	0.952	0.934	0.922	0.913	0.910	0.912	0.918
60	1.035	0.982	0.955	0.925	0.915	0.898	0.887	0.880	0.877	0.881	0.888
62	0.971	0.923	0.897	0.869	0.861	0.847	0.837	0.831	0.831	0.836	0.845
64	0.882	0.840	0.818	0.795	0.790	0.781	0.775	0.773	0.775	0.782	0.794
66	0.826	0.790	0.771	0.752	0.750	0.743	0.739	0.739	0.742	0.751	0.765
68	0.763	0.737	0.721	0.707	0.709	0.706	0.706	0.707	0.713	0.724	0.739
70	0.706	0.687	0.675	0.666	0.669	0.670	0.672	0.676	0.683	0.696	0.711
72	0.663	0.652	0.642	0.637	0.643	0.646	0.650	0.655	0.663	0.677	0.693
74	0.602	0.603	0.597	0.598	0.607	0.613	0.620	0.627	0.637	0.652	0.670
76	0.573	0.576	0.573	0.576	0.586	0.594	0.602	0.610	0.621	0.636	0.655

Harvest Level = 45,338

Upper (minimum) Size Limit (in)	Lower (maximum) Size Limit (in)										
	35	36	37	38	39	40	41	42	43	44	45
50	1.361	1.310	1.282	1.249	1.233	1.211	1.194	1.181	1.173	1.169	1.170
52	1.351	1.294	1.262	1.225	1.208	1.184	1.165	1.151	1.143	1.140	1.141
54	1.326	1.265	1.232	1.193	1.176	1.151	1.132	1.118	1.110	1.108	1.111
56	1.281	1.219	1.186	1.146	1.130	1.106	1.088	1.075	1.068	1.067	1.071
58	1.241	1.177	1.143	1.103	1.088	1.065	1.048	1.036	1.030	1.031	1.037
60	1.198	1.133	1.099	1.060	1.045	1.024	1.008	0.998	0.993	0.996	1.003
62	1.129	1.067	1.034	0.998	0.985	0.966	0.953	0.944	0.942	0.946	0.955
64	1.027	0.973	0.944	0.913	0.905	0.892	0.883	0.878	0.879	0.886	0.898
66	0.966	0.918	0.892	0.865	0.861	0.850	0.844	0.841	0.844	0.853	0.866
68	0.888	0.852	0.830	0.811	0.810	0.805	0.803	0.803	0.808	0.820	0.835
70	0.818	0.791	0.774	0.760	0.763	0.762	0.763	0.765	0.773	0.786	0.802
72	0.769	0.752	0.737	0.728	0.733	0.735	0.738	0.742	0.751	0.765	0.783
74	0.696	0.694	0.684	0.682	0.691	0.697	0.704	0.710	0.721	0.737	0.756
76	0.660	0.661	0.654	0.655	0.665	0.673	0.682	0.689	0.701	0.718	0.738

(continued)

Table 4. Continued (2 of 2).

Scenario – 20% high-grading

Harvest Level = 41209

Upper (minimum) Size Limit (in)	Lower (maximum) Size Limit (in)										
	35	36	37	38	39	40	41	42	43	44	45
50	1.280	1.234	1.208	1.179	1.165	1.147	1.132	1.120	1.113	1.109	1.109
52	1.269	1.218	1.190	1.158	1.142	1.121	1.105	1.093	1.085	1.081	1.082
54	1.244	1.189	1.160	1.126	1.110	1.089	1.072	1.060	1.052	1.050	1.051
56	1.196	1.141	1.112	1.078	1.063	1.042	1.026	1.014	1.008	1.006	1.009
58	1.156	1.100	1.070	1.036	1.022	1.001	0.986	0.975	0.969	0.969	0.974
60	1.118	1.060	1.030	0.996	0.982	0.963	0.948	0.938	0.934	0.935	0.941
62	1.050	0.996	0.967	0.934	0.923	0.905	0.892	0.884	0.881	0.884	0.892
64	0.955	0.906	0.880	0.852	0.845	0.832	0.823	0.817	0.817	0.823	0.833
66	0.893	0.850	0.827	0.803	0.798	0.788	0.781	0.778	0.780	0.787	0.799
68	0.824	0.791	0.771	0.753	0.752	0.746	0.743	0.742	0.746	0.755	0.769
70	0.760	0.735	0.719	0.705	0.707	0.705	0.704	0.706	0.711	0.722	0.737
72	0.711	0.695	0.682	0.672	0.676	0.676	0.678	0.681	0.688	0.700	0.716
74	0.640	0.637	0.629	0.626	0.633	0.638	0.643	0.648	0.657	0.671	0.688
76	0.607	0.607	0.601	0.600	0.609	0.615	0.622	0.628	0.638	0.653	0.670

Harvest Level = 45,338

Upper (minimum) Size Limit (in)	Lower (maximum) Size Limit (in)										
	35	36	37	38	39	40	41	42	43	44	45
50	1.447	1.395	1.366	1.331	1.314	1.291	1.273	1.258	1.249	1.243	1.242
52	1.442	1.383	1.350	1.311	1.292	1.266	1.245	1.229	1.219	1.214	1.213
54	1.420	1.356	1.321	1.279	1.260	1.233	1.211	1.195	1.185	1.181	1.181
56	1.374	1.308	1.273	1.231	1.212	1.184	1.163	1.148	1.139	1.136	1.138
58	1.336	1.267	1.230	1.187	1.168	1.141	1.121	1.106	1.098	1.097	1.100
60	1.294	1.223	1.185	1.141	1.123	1.098	1.079	1.065	1.058	1.058	1.063
62	1.221	1.152	1.116	1.073	1.058	1.034	1.017	1.005	1.000	1.002	1.009
64	1.114	1.051	1.018	0.981	0.969	0.951	0.938	0.930	0.929	0.934	0.944
66	1.046	0.990	0.959	0.927	0.918	0.904	0.894	0.888	0.888	0.895	0.907
68	0.961	0.917	0.891	0.865	0.862	0.853	0.847	0.844	0.847	0.857	0.871
70	0.884	0.850	0.827	0.808	0.808	0.803	0.801	0.801	0.806	0.818	0.833
72	0.827	0.804	0.785	0.771	0.773	0.772	0.772	0.774	0.781	0.793	0.810
74	0.743	0.736	0.723	0.717	0.724	0.728	0.732	0.736	0.746	0.760	0.779
76	0.702	0.699	0.688	0.685	0.694	0.700	0.706	0.712	0.722	0.738	0.757

Table 5. Proportion of Area 2C charter halibut harvest by day of the week, 2008-2010 (ADF&G charter logbook data).

Year	Percent of the Number of Fish Harvested						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
2008	14.7%	14.5%	15.4%	14.9%	13.8%	13.0%	13.8%
2009	14.4%	15.7%	15.5%	14.5%	14.7%	12.6%	12.6%
2010	15.3%	15.3%	14.2%	15.2%	15.1%	11.9%	13.1%
Average	14.8%	15.2%	15.1%	14.9%	14.5%	12.5%	13.1%

Table 6. Harvest reductions associated with closures of the Area 2C charter halibut fishery for two days per week (A), and for all possible combinations of three days per week in which no two days are consecutive (B).

A. Reductions associated with combinations of two days.

	Mon	Tue	Wed	Thu	Fri	Sat
Mon	--	--	--	--	--	--
Tue	30%	--	--	--	--	--
Wed	30%	30%	--	--	--	--
Thu	30%	30%	30%	--	--	--
Fri	29%	30%	30%	29%	--	--
Sat	27%	28%	28%	27%	27%	--
Sun	28%	28%	28%	28%	28%	26%

B. Reductions associated with all possible combinations of 3 days (without consecutive days).

Closure	Harvest Reduction
Mon-Wed-Fri	44%
Mon-Wed-Sat	42%
Mon-Thu-Sat	42%
Tue-Thu-Sat	42%
Tue-Thu-Sun	43%
Tue-Fri-Sun	43%
Wed-Fri-Sun	43%

Table 7. Summary of the least restrictive size limits and daily closures that are projected to result in charter harvests that are under the Area 2C guideline harvest level (GHL) for two projected levels of harvest.

Projected Harvest (number of fish)	Management Measure Combined with 1-Fish Daily Bag Limit	Potential Area 2C Charter GHL (depends on outcome of IPHC stock assessment)	
		GHL = 788,000 lb	GHL = 931,000 lb
41,209 (2011 projection)	Maximum Size Limit	47 inches	55 inches
	Reverse Slot Limit (no additional high-grading)	U35-36/O68	U35/O64
		U37-39/O66	U36-37/O62
		U40-44/O64 U45/O66	U38-40/O60 U41-45/O58
Reverse Slot Limit (with 20% additional high-grading)	U35-36/O70 U37-39/O68 U40-44/O66 U45/O68	U35/O66 U36-38/O64 U39-45/O62	
Day of the Week Closure (no size limit)	Close 2 days	Close 1 weekday	
45,338 (2009-2011 average)	Maximum Size Limit	44 inches	49 inches
	Reverse Slot Limit (no additional high-grading)	U35-36/O72	U35/O68
		U37-44/O70	U36-37/O66
		U45/O72	U38-45/O64
Reverse Slot Limit (with 20% additional high-grading)	U35-36/O74 U37-43/O72 U44-45/O74	U35/O70 U36-37/O68 U38-41/O66 U42-43/O64 U44-45/O66	
Day of the Week Closure (no size limit)	Close 3 days	Close 2 days	