

Analysis of Management Options for the Area 2C and 3A Charter Halibut Fisheries for 2020

A Report to the North Pacific Fishery Management Council

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1.0 Introduction

The International Pacific Halibut Commission (IPHC) approves catch limits for Pacific halibut each year for regulatory areas in Alaska. In IPHC regulatory areas 2C and 3A, which roughly correspond with Southeast and Southcentral Alaska, these catch limits are allocated between the commercial longline fishery and the sport charter fishery. The allocations are specified in the North Pacific Fishery Management Council's Halibut Catch Sharing Plan (CSP) for Areas 2C and 3A¹. The allocations vary with the magnitude of the overall catch limit, such that the percentage allocated to the charter sector increases slightly as catch limits decrease. The CSP also specifies that "wastage" or discard mortality will count toward each sector's allocation. The CSP further specifies that, effective in 2014, charter harvest accounting will be based on numbers of halibut reported harvested in Alaska Department of Fish and Game (ADF&G) saltwater guide logbooks.

The charter fishery in Areas 2C and 3A is managed under regulations reviewed and recommended each year by the North Pacific Fishery Management Council, and approved and published by the IPHC as annual management measures. As the first step in this process, the Council's Charter Halibut Management Committee met October 29, 2019, to develop alternative management measures to be analyzed by the ADF&G for the 2020 season. ADF&G staff provided preliminary estimates of charter harvest and release mortality for the 2019 season to committee members prior to the meeting. The preliminary estimates were based on logbook data for trips through July 31, 2019 and will be finalized once all logbook data are received, entered, and edited.

In Area 2C, the 2019 preliminary harvest estimate for the charter fishery was 67,529 halibut with an average weight of 9.39 lb (Webster et al. 2019). The number of halibut harvested was 11.1% lower than the harvest forecast of 75,988 and average weight was 6.6% lower than the predicted average weight of 10.06 lb. The Area 2C preliminary estimate of charter removals was 0.665 million pounds (Mlb), including an estimated 0.031 Mlb of release mortality. The preliminary estimate of charter removals was 20.1% less than the 0.833 Mlb removal predicted for 2019, and was under the 0.820 Mlb allocation by 18.9%.

In Area 3A, an estimated 137,731 halibut were harvested with an average weight of 14.52 lb (Webster et al. 2019). The number of fish harvested was 5.0% higher than the forecast of 131,223, and average weight was 2.7% higher than the predicted average weight of 14.13 lb. The preliminary estimate of charter removals for Area 3A was 2.012 Mlb, including 0.013 Mlb of release mortality. The preliminary estimate was 6.9% greater than the predicted removal of 1.882 Mlb and 6.5% greater than the allocation of 1.890 Mlb.

The charter committee considered the performance of last year's measures, and in light of recent trends in effort, number of halibut harvested by charter anglers, average weight of halibut, halibut abundance, and economic considerations, identified the following measures for analysis for 2020:

¹ Catch Sharing Plan regulations are at: <https://www.federalregister.gov/documents/2013/12/12/2013-29598/pacific-halibut-fisheries-catch-sharing-plan-for-guided-sport-and-commercial-fisheries-in-alaska>

Area 2C (all options include a one-fish bag limit):

- 1) Status quo (reverse slot limit allowing the harvest of a fish less than or equal to 38 inches or greater than or equal to 80 inches).
- 2) Additional reverse slot limits, with lower limits of the protected slot ranging from 35 to 50 inches and upper limits ranging from 50 to 80 inches.
- 3) Additional reverse slot limits (option 2) with annual limits of 1 – 4 fish.
- 4) Reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays or Sundays closed throughout the season, or a Wednesday or Sunday closure for the entire year.
- 5) Reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays or Sundays closed throughout the season, or a Wednesday or Sunday closure for the entire year combined with an annual limit of 3 or 4 fish.
- 6) Reverse slot limits with a lower limit ranging from 40 – 50 inches and an upper limit of 80 inches through July 1, July 15, or August 1, and a reverse slot limit with a lower limit ranging from 35 – 50 inches and an upper limit of 80 inches beginning July 1, July 15, or August 1, respectively.

Area 3A (all options include, unless otherwise noted, the status quo two-fish bag limit with 28-inch maximum size limit on one fish, 4-fish annual limit, one trip per vessel and one trip per permit per day, Wednesday closure all year, closure of five Tuesdays in July and August):

- 1) Status quo.
- 2) Fewer or additional Tuesday closures throughout the year.
- 3) Opening all Tuesdays and opening some Wednesdays throughout the year.

This analysis provides information to stakeholders and the Council to assist them in selecting management measures that are likely to keep total charter removals within their allocations. The allocations are derived from catch limits determined by the IPHC at their annual meeting in February 2020. The charter allocations will not be known when the Council is expected to make its recommendations in December 2019. However, the Council may base recommendations on the allocations determined from the charter catch limits associated with maintaining the IPHC’s reference level of spawning potential ratio (SPR) and reference distributed mortality limits (“interim management strategy”, Stewart et al. 2019) or based on other scenarios for coastwide allocation and distributed mortality limits. It is recommended that the Council include contingencies to accommodate adoption of a range of catch limits.

At the Interim Meeting on November 25, 2019, the IPHC secretariat staff presented results from the 2019 stock assessment, including the Regulatory Area TCEYs under the interim management procedure. Results presented here are within the context of two possible scenarios. The first scenario is consistent with the interim management strategy and uses a TCEY at the reference level (SPR_{46%}) of 31.9 Milb; distributed mortality limits using a fixed TCEY for 2A (Washington, Oregon, California); a TCEY for 2B (British Columbia) based on a formula set forth at the 2019 IPHC annual meeting and an additional adjustment to the 2B TCEY for U26 bycatch mitigation; and the Space Time Model proportional distribution for all areas in Alaska. The second scenario uses the status quo TCEY of 38.6 Milb (equating to an SPR_{40%}) and the same distribution procedures set forth in the previous scenario.

Regulatory Area	Charter Allocation (Milb) ^a	
	Reference TCEY	Status Quo TCEY
2C	0.60	0.80
3A	1.24	1.66

^aThe Reference TCEY uses SPR_{46%} and is 31.9 Milb. The status quo TCEY (2019) uses SPR_{40%} and is 38.6 Milb.

This analysis projects total charter fishery removals (harvest plus release mortality) under the status quo (2019) charter fishery regulations in each regulatory area. As shown below, the projected charter removal for Area 2C in 2020 under status quo measures is 0.73 Mlb; this is above the catch limit based on the IPHC’s interim management strategy and below the catch limit based on the status quo coastwide TCEY with updated coastwide distribution. The projected removal for Area 3A under status quo measures is 1.94 Mlb; this is above both the reference and status quo catch limits and would require more restrictive management measures under either scenario.

Area	Projected Status Quo Charter Removals (Mlb)	Reference TCEY Difference (Mlb) (Allocation – Projection)	Status Quo TCEY Difference (Mlb) (Allocation – Projection)
2C	0.73	-0.13	+0.07
3A	1.94	-0.70	-0.28

This analysis also projects charter removals over a range of proposed alternative management measures. For consistency with recent years’ analyses, the analyses included in this report generally follow previously reported methods (Meyer and Powers 2014, 2015, 2016, and 2017; Webster and Powers 2018). The analysis covers a range of alternatives or combinations of measures as proposed by the Charter Halibut Management Committee to allow stakeholders, the Council, and the IPHC to select the desired measures to meet management targets for each area. Where applicable, results will reference candidate measures that result in projected charter removals that are within the two allocation scenarios. However, the IPHC is not limited to these options when setting catch limits. The Council recommendation for each area should include contingencies for higher or lower catch limits and may include buffers for uncertainty in the projected harvests.

2.0 General Methods

2.1 Definitions and Basic Calculations

Throughout this analysis, the term “harvest” means the number of halibut killed and landed in the charter fishery. “Yield” is the harvest expressed in units of weight. “Release mortality” or “discard mortality” refer to halibut that die as a result of stress or injury following release in the fishery, and is expressed in units of weight. Finally, “removals” refers to all halibut killed in the sport fishery, including harvest and release mortality, and is measured in units of weight. Removals are generally projected from harvest, average weight, and release mortality as follows:

$$Harvest(no. fish) = Effort (angler trips) \times HPUE (harvest per angler trip),$$

$$Yield(lb) = Harvest \times AverageWeight(lb), \text{ and}$$

$$Removals (lb) = Yield(lb) \times r$$

where r is the release mortality inflation factor. In IPHC Area 2C the release mortality inflation factor is a function of the reverse slot limit and for 2020 is calculated as:

$$r = 1 + [-0.003 * (Reverse Slot Limit) + 0.1833]$$

and in IPHC Area 3A is the release mortality is calculated using past data as:

$$r = 1 + [ReleaseMortality(lb)/Yield (lb)]$$

and for 2020 is 1.011.

Average net weight (headed and gutted) is estimated for the harvest from length measurements using the current IPHC length-weight relationship (Clark 1992). Although all calculations and results in this report

are in net weight, a table is provided for conversion to round weights, which is how anglers tend to regard halibut harvested in the sport fishery (Table 1).

2.2 Calculations by Subarea

All calculations for Area 2C and Area 3A were done by subarea and then summed to obtain yield estimates for each regulatory area. Analyses were done at the subarea level because many of the variables analyzed (harvest, effort, average weight, etc.) vary substantially by subarea.

There are six subareas in Area 2C and eight subareas in Area 3A (Table 2, Figure 1). With few exceptions, the subareas correspond to ADF&G sport fishery management areas as well as the reporting areas used for the ADF&G statewide mail survey of sport fishing (Statewide Harvest Survey; SWHS). The Juneau and Haines/Skagway areas were combined because the Haines/Skagway area is not sampled for average weight and harvests are quite small. The SWHS Area J is split into three subareas: Eastern Prince William Sound (EPWS), Western Prince William Sound (WPWS), and the North Gulf Coast (NG). Likewise, Cook Inlet (SWHS Area P) is split into Central Cook Inlet (CCI) and Lower Cook Inlet (LCI) subareas. These SWHS areas were split into subareas such that the landings in each subarea could be matched to estimates of average weight from port sampling. ADF&G obtained length measurements from harvested halibut and interviewed anglers and charter captains in at least one port in each subarea. In addition, SWHS Area G (Glacier Bay) is divided into the 2C and 3A portions of that area using statistical areas reported during biological sampling and in saltwater guide logbooks.

2.3 Harvest Forecasts

Simple time series methods are used to forecast effort, harvest per unit effort (HPUE), and other components of the harvest forecasts under certain situations. Effort is measured in angler days; any day in which a halibut was harvested or bottomfish hours were recorded in the logbook are considered days with halibut effort. Time series forecasts are inherently uncertain because they rely only on past data, which are not necessarily indicative of future trends. They can't be used in all instances because they assume that the same underlying processes are in place as those that generated the historical estimates. Therefore, recent regulation changes may bias a forecast, or render it unsuitable for other regulatory scenarios. Time series methods used in this report include simple and double exponential smoothing models using SAS/ETS^{TM2} software. Simple exponential models have a single parameter representing the level of the estimates and typically fit best to data without a clear trend. Double exponential models have a parameter for level and a parameter for trend, and typically fit best to data with a trend. Both models contain a smoothing weight, the value of which determines how much weight is given to more recent observations. The smoothing weights are optimized to minimize one-step-ahead prediction errors over the entire time series. Generally, the stronger the trend and lower the variability, the higher the smoothing weight and the more emphasis is placed on recent observations. Both simple and double exponentials were run for each time series, and the forecasts with the smallest AICc value (Akaike Information Criterion, corrected for small sample size) were selected.

For Area 2C, the 2020 harvest forecasts were calculated for each subarea as the product of the effort and HPUE forecasts. Simple exponential and double exponential forecasts were generated for effort and HPUE using logbook data for 2009-2019 (Table 3, Figure 2). Although logbook data are available since 2006, the first three years were excluded because the bag limit was changed from two to one fish in 2009, causing poor fit of projections to the time series. Exclusion of the earlier data had little effect on the simple or double exponential forecasts, but did affect the fit of past forecasts, which determined type of forecast selected. Time series forecasts were considered suitable for Area 2C because the small changes in size limits made in recent years were unlikely to have a significant effect on trends in effort or HPUE.

² SAS/ETSTM software, Version 9.4, SAS System for Windows, Copyright © (2002-2012), SAS Institute, Inc.

In Area 3A, on the other hand, there were substantial and incremental changes in regulations over the last five years that appear to have influenced effort and HPUE. In 2014, a limit of one trip per charter vessel was put into place, along with a maximum size limit of 29 inches on one fish under a two-fish bag limit. In 2015, additional restrictions included closing one day per week from June 15 through August 31 and a five-fish annual limit per angler. In 2016, each halibut permit was limited to one trip per day, the maximum size limit on one fish was decreased to 28 inches, the closure day changed to Wednesday and was extended throughout the season, and the annual limit was reduced to four fish per angler. In 2017 – 2019 all regulations remained the same as 2016, except three, six, and five closed Tuesdays, respectively, were added to regulations. There was an immediate decline in effort in 2014, especially in Central Cook Inlet, the subarea where it was most common for charter boats to make two trips per day (Table 4, Figure 3). If the decline in effort in recent years is due to incremental changes in regulations, the exponential smoothing forecasts may overestimate the decline due to changes in the underlying process. Therefore, the 2019 preliminary estimate of effort in 3A was assumed as the status quo effort level for 2020.

In addition, implementation of the first size limits in Area 3A in 2014 resulted in a marked decline in the proportion of the charter halibut harvest made up of second fish in the bag limit (Figure 4). The largest decreases were in subareas with the highest average weights (Glacier Bay and Yakutat). In other words, at ports with large halibut available, fewer anglers harvested a second fish, preferring instead to focus on harvesting one large fish. The decrease in retention of a second fish by anglers caused HPUE to decline as well (Table 4, Figure 3). However, the proportion of second fish retained continued to decline every year through 2019, even though changes in size limits and annual limits were quite minor (no change to either since 2016). It appears the decrease in the proportion of second fish is more related to the presence of maximum size limits and annual limits than to what those limits are. Therefore, exponential smoothing models were used to forecast HPUE for 2020 to capture the declining trend.

2.4 Accounting for Release Mortality of Halibut

Under the CSP, the charter halibut allocation includes total removals by the charter sector, including directed harvest and estimated release mortality. The CSP rule is vague with respect to sizes of fish to include in this waste. For consistency with past years, only the release mortality of halibut ≥ 26 inches in length (O26) is included in projected removals. For reference, the U26 discard mortality in 2019 was estimated to be .002 Mlb in 2C and .005 Mlb in 3A. All sizes of release mortality (U26, O26) have been estimated for 2013-2019 for inclusion in the IPHC annual stock assessment as part of sport fishery removals. Estimation methods are documented in Meyer (2014) and in ADF&G's annual reports to the IPHC³.

The numbers and average weight of released fish are expected to vary with the types of size limits or bag limits implemented. For example, anglers would be expected to release more fish under a one-fish bag limit than a two-fish bag limit as they search for the largest fish possible to retain. The average weight of released fish would be expected to be higher under maximum size limits or reverse slot limits than under a minimum size limit, because most or all of the released fish would be larger than the retained fish. On the other hand, the number of fish released is likely to be higher under a minimum than maximum size limit because smaller fish are relatively more abundant and more likely to be caught. Under reverse slot limits, the amount of release mortality would be expected to vary with the sizes and range of the protected slot. A wide protected slot would likely result in more released fish than a narrow slot, and a higher protected slot would result in a higher average weight of released fish. Under annual limits, both the number of fish and average weight of released fish would be likely to increase as annual limits are made more restrictive.

³ The ADF&G annual reports to the IPHC are available for download at <https://www.npfmc.org/halibut-charter-management>. For example, the October 2019 report is available under the “ADF&G Guided Sport Data” section at: <https://www.npfmc.org/halibut-charter-management/>

In Area 2C, under reverse slot limits, the ratio of release mortality to charter yield (in pounds) is correlated to the lower bound of the reverse slot limit. Due to the correlation between the lower bound of the slot limit and release mortality, a linear regression model was used for the 2019 and 2020 projections. Under status quo regulations, the predicted 2020 ratio of release mortality to harvested halibut is 0.069.

In Area 3A, the ratio of release mortality to charter yield has generally decreased over time, mostly due to a decrease in the number of released fish rather than to changes in the average weight of released fish. The ratio was 0.018 in 2013, and then decreased steadily from 0.015 in 2014 to 0.006 in 2019. For 2020 projections, the 7-year average of 0.011 was applied to yield to account for release mortality under the status quo management measures of two-fish bag limit with maximum size limit on one fish, and for the same measures with additional closed days or changes in the maximum size of the second fish.

3.0 Area 2C Management Measures

3.1 Status Quo Forecast of the Number of Fish Harvested

Status quo measures for Area 2C include a one-fish bag limit and U38O80 reverse slot size limit. There were upward trends in angler effort in four of the six subareas of Area 2C in recent years, however, 2019 preliminary estimates of effort indicate a decrease from 2018 in all areas (Table 3, Figure 1). Recent trends in HPUE were variable across subareas with little overall trend. The 2019 status quo effort forecast for Area 2C is 104,795 angler-trips, the weighted average HPUE forecast is 0.66 halibut per angler-trip, and the harvest forecast is 68,737 halibut, with a 95% margin of error (± 2 standard errors) of ± 3171 (Table 5). This is a slight increase from the preliminary harvest estimate for 2019 of 67,529 halibut.

3.2 Reverse Slot Limit

3.2.1 Approach

Reverse slot size limits have been used to manage the Area 2C charter fishery since 2012. The goal of the reverse slot limit is to control the average weight of the harvest by requiring retained fish to be either below a lower size limit or above an upper size limit. The reverse slot size limit functions mostly as a maximum size limit, while still preserving the opportunity for anglers to retain exceptionally large fish. The charter industry and the Council have recommended reverse slot size limits because they effectively control average weight without severely impacting angler demand under a one-fish bag limit, thus preserving charter revenues in the face of restrictions.

Average weight under reverse slot limits was predicted using the same algorithm used to analyze management measures for 2014-2019. Briefly, this procedure fixes the proportion of harvest above the upper size limit equal to the proportion in 2010, the last year without a size limit. The proportion of harvest below the lower size limit is assigned the remainder. Average weight is then estimated as a weighted mean of the average weight of fish above and below the upper and lower limits in 2010, where the weighting factors are the respective proportions of harvest above and below those limits.

Average weights estimated from the fishery in 2012-2019 were compared to the algorithm-predicted average weights for the size limits that were in place at the time. The average weights estimated from the fishery included any illegally harvested fish in the protected size slot between the lower and upper size limits (illegal-size fish made up an estimated 0.6% to 1.6% of the Area 2C harvest each year). Errors in predicted average weights ranged from -13% to +59% for individual subareas, and from +5% to +17% for Area 2C overall (average = 12%). Predicted average weight errors were highly variable among years and among subareas. Correction factors were developed for the algorithm-predicted average weights for each subarea. The correction factors were based on the average ratio of the predicted and observed average weights from 2015 – 2019, the most recent 5 years and all with the same upper slot limit, and ranged from 0.72 to 1.03 among subareas. To test the correction factors, the projection algorithm was applied to the final harvest estimates for 2018 and preliminary harvest estimates for 2019. Under the 2020 harvest scenario, the projected charter removal for 2019 was 0.735 Milb, above the 0.665 Milb preliminary

estimate, and the projected charter removal for 2018 was 0.741 Milb, slightly above the 0.728 Milb final estimate.

Total charter removals were projected for a range of reverse slot limits with lower limits ranging from 35 to 50 inches and upper limits ranging from 50 to 80 inches. Tables of projected total removals were generated for 2020 harvest forecasts (Table 6). Projections of charter removals include the correction factors for bias in estimation of average weight as well an inflation factor for predicted release mortality based on the lower slot limit. For reference, the most liberal combinations of size limits for which the projected removals are within the two allocation scenarios are highlighted in Table 6.

3.2.2 Results

The projected charter removal under the status quo size limit of U38O80 is 0.726 Milb (Table 6). Under the reference coastwide TCEY allocation, the Area 2C charter fishery no reverse slots analyzed are projected to keep the charter sector within their allocation. Under the status quo coastwide TCEY allocation, slot limits ranging from U35O64 to U41O80 could be used to stay within the Area 2C charter allocation.

3.3 Reverse Slot Limit with Various Annual Limits

3.3.1 Approach

The effects of various annual limits on harvest in 2C were estimated using charter logbook data that summarized the distribution of annual harvests by individual licensed anglers using 2018 as the base year. This is the most recent year with complete data. Calculations of annual harvests could not be done for youth anglers (under 16 years old for nonresidents and under 18 years old for residents) because they are not required to be licensed, and therefore harvest cannot be assigned to individuals. Youth accounted for 4.1% – 4.7% (average 4.3%) of charter effort in Area 2C during the years 2011-2018. Because the proportion of youth effort was steady and relatively low, we assume that leaving youth anglers out of the calculations did not significantly bias estimates of the effects of implementing annual limits.

For each subarea, harvests under each proposed annual limit were estimated by truncating the annual harvest of each angler during the base year at the annual limit. For example, if 500 anglers harvested five fish each in the base year (2,500 fish total), then under an annual limit of four fish, that group of 500 anglers would only harvest 2,000 fish. The number of anglers that would be affected by each annual limit was calculated as the number of anglers that harvested more than the annual limit in the base year. In the example above, all 500 anglers harvested more than four fish and would be affected by a four-fish annual limit, but anglers that harvested four or fewer fish would be unaffected. Using this approach, the annual harvest by licensed anglers was calculated over a range of annual limits and the percentage reduction in harvest was calculated by comparison to their total harvest without an annual limit. All calculations were done by subarea and summed to obtain the harvests under each annual limit in Areas 2C.

Doing the calculations by subarea slightly underestimates the harvest reductions associated with annual limits because some anglers fish in multiple subareas within a year. For example, if an individual angler caught four fish in each of two subareas in the base year, the analysis by subarea would indicate that a four-fish annual limit would have no effect on that angler's annual harvest in either subarea. In reality, the limit would cut that angler's annual harvest by 50 percent. The degree of underestimation depends on how many anglers fished multiple subareas in a year. The magnitude of this error was evaluated by comparing the percentage harvest reductions estimated from subarea and areawide data. For Area 2C, the estimated reductions in harvest based on subarea data were underestimated by 0.1% to 0.8% for annual limits from 1 to 4 fish; therefore, the underestimation caused by anglers fishing multiple areas was considered to be negligible and may provide a slightly conservative estimate.

Harvests were projected under annual limits ranging from 1 to 4 halibut in Area 2C. The areawide estimated harvest reductions associated with annual limits range from about 49% under an annual limit of

one fish to less than 2% under an annual limit of four fish (Table 7). A three-fish annual limit would decrease harvest by about 7%, while a two-fish annual limit would decrease harvest by about 22%.

Total charter removals were projected for a range of 1 – 4 fish annual limits under a range of reverse slot limits with lower limits ranging from 35 to 50 inches and upper limits ranging from 50 to 80 inches. Tables of projected total removals were generated for 2020 harvest forecast with annual limits (Table 8a-d). A single level of harvest is associated with each sub-table of Table 7 because it was assumed that the size limits by themselves have no effect on the number of fish harvested. Projections of charter removals include the correction factors for bias in estimation of average weight as well as an inflation factor for predicted release mortality based on the lower slot limit. For reference, the most liberal combinations of size limits and annual limits for which the projected removals are within two allocation scenarios are highlighted in Table 8a-d.

3.3.2 Results

The projected charter removal under the status quo size limit of U38O80 and no annual limit is 0.726 Mlb (Table 6). Under the reference coastwide TCEY allocation, no reverse slot limits analyzed could be used to bring the Area 2C charter removals under their allocation; a three-fish limit could be used with a reverse slot of U35O78. Under the status quo coastwide TCEY allocation, implementation of an annual limit of four fish would allow for reverse slot limits ranging from U35O64 to U42O80, while a three fish limit could be used with reverse slot limits from U35O62 to U43O76. More options are available for both scenarios as annual limits are reduced.

3.4 Reverse Slot Limit with Day of the Week Closures

3.4.1 Approach

Harvests were projected with day of the week closures in Area 2C with reverse slot limits ranging from a lower limit of 35 to 50 inches and with the upper limit fixed at 80 inches. The potential effect of closing 1 – 17 Wednesdays or Sundays throughout the season, or Wednesdays or Sundays for the entire year was estimated. The analysis relied on complete logbook data for 2018. Generally speaking, the analysis proceeded by estimating the proportional effect of Wednesdays or Sundays in 2018 and applying those proportional effects to the harvest forecast for 2020.

The first step was to identify the dates of specific Wednesdays or Sundays that would be closed in 2020 under each possible number of closed days. Specific days were selected such that, for each scenario, 60-75% of the closed days would fall before August 1 (specific dates identified for closures are found in Tables 9 and 11, Figure 5). The proportion of harvest occurring before August is an important value that is used to make preliminary estimates of charter harvest each year using incomplete logbook data. When preliminary harvest is estimated, only data through July 31 are available and a time series model is used to forecast harvest for the remainder of the year based on the proportion of harvest occurring through July 31 in previous years. The proportion of annual charter harvest occurring through July has averaged 65% since 2006. If daily closures were implemented in a manner that caused that proportion to vary significantly from its recent average, it could bias future preliminary harvest estimates. Once the specific closed dates for each scenario were identified, the corresponding Wednesdays and Sundays to each of those dates was identified from the historic data set for analyses. There was a three-day difference dates from 2018 to 2020.

The analysis assumed that the proportions of harvest occurring on each day in 2018 would be eliminated if those days were closed. In other words, the harvest that occurred on those days represented the potential change in harvest if those days were closed. All analyses were done by subarea to account for differences in the structure of the charter fleet among areas. The total annual harvest under each scenario of closed days was compared to the harvest scenario of no closed days (2019 status quo) to estimate the proportional change in harvest for 2020.

A day of the week closure would be unlikely to achieve the estimated maximum reductions in halibut harvest because of the potential for displaced clients to book alternate dates either on the same vessel or another vessel with available space. There is a substantial amount of latent capacity on charter vessels in Area 2C (Marrinan and Fey 2017). A day of the week closure would be most effective for reducing harvest by boats at remote lodges, where clients have fewer options for dates and vessels. In summary, we do not have sufficient information to accurately estimate the effect of a day of the week closure, but can only say that it would reduce halibut harvest by no more than the presented maximum reductions, and that the reduction would likely be less.

Total charter removals with day of the week closures were projected for a range of reverse slot limits following the procedures for annual limits, but with all upper slot limits fixed at 80 inches (Tables 9- 12, procedures for reverse slot limits outlined in section 3.2.1). For reference, the most liberal combinations of size limits and day of the week closures for which the projected removals are within the two allocation scenarios are highlighted in Tables 10 and 12.

3.4.2 Results

Implementation of a daily closure could be used to bring the projected removals within the allocation under both allocation scenarios. In general, Wednesday closures are projected to result in slightly lower removals and under some numbers of days closed may allow for slightly more relaxed reverse slot limits. Under the reference coastwide TCEY allocation scenario, 4 or 5 closed days (Wednesday or Sunday, respectively) could bring the reverse slot limit to U35O80 while 13 or 17 closed days would allow for a reverse slot of U37O80. Under the status quo coastwide TCEY allocation scenario, the maximum reverse slot is U47O80, with 15 Wednesday closures; many additional options are available ranging reverse slots of U42O80 to U46O80 depending on which day is selected and the number of days closed.

3.5 Reverse Slot Limit with Annual Limits Combine with Day of the Week Closures

3.5.1 Approach

Harvest was projected in Area 2C under reverse slot limits with lower limits of 35 to 50 inches and an upper limit of 80 inches with a combination of annual limits of 3 or 4 fish and 1 – 17 Wednesday or Sunday closures, or Wednesday or Sunday closures for the entire year. The same protocols were used for this analysis as the analyses for annual limits and day of the week closures, outlined above. Annual limits were applied to harvest estimates prior to day of the week closure reductions because they have a more definitive effect on overall harvest.

As with day of the week closures alone, these estimates should be considered maximum reductions in harvest relative to annual limits alone because we do not know how many people might be able to rebook on alternate days of the week and still harvest their annual limit. The actual reductions achieved from this management alternative will be somewhere between those reductions from a reverse slot limit with annual limits alone and the maximum reductions presented in tables 13 - 20. For reference, the most liberal combinations of size limits and annual limits for which the projected removals are within the two allocation scenarios are highlighted in Tables 14, 16, 18, and 20.

3.5.2 Results

Implementation of an annual limit combined with a daily closure could be used to bring the projected removals within either allocation under more liberal reverse slot limits than daily closures alone. Overall, fewer days would need to be closed to stay within allocations if annual limits were implemented. For example, under the reference coastwide TCEY allocation scenario 10 Wednesday closures would be required in addition to a 3 fish annual limit to keep the Area 2C charter sector within their allocation at the status quo reverse slot limit of U38O80. Under the status quo coastwide TCEY allocation scenario, 16 Wednesday closures would allow for a maximum reverse slot limit of U50O80.

3.6 Mid-season Change in Lower Limit of Reverse Slot Limit

3.6.1 Approach

The Charter Halibut Management committee requested analysis of reverse slot limits with a lower limit ranging from 40 – 50 inches and an upper limit of 80 inches through July 1, July 15, or August 1, and a reverse slot limit with a lower limit ranging from 35 – 50 inches and an upper limit of 80 inches beginning July 1, July 15, or August 1, respectively.

Available data sources were explored to determine the feasibility of this analysis. After thorough exploration, it was determined that the requested analysis will not provide reasonably accurate estimates with the data that are available. Good information on the effort and/or proportion of harvest before and after the “switch date” is integral to a robust analysis. Such a management measure would almost undoubtedly have an impact on the effort and proportion of harvest before and after the switch date and the scale of this shift cannot be predicted with available data. Because such a shift is anticipated, historical data could not be used in this analysis as these data are unlikely to reflect reality.

Furthermore, the effect of these management measures would be unknown when preliminary harvest estimates need to be done next year. The proportion of harvest occurring before August is an important value that is used to make preliminary estimates of charter harvest each year using incomplete logbook data. The proportion of annual charter harvest occurring through July has averaged 65% since 2006. Any shift in effort to the early part of the season that caused that proportion to vary significantly from its recent average could bias future preliminary harvest estimates. Should effort shift to the early part of the season as might be expected with more liberal size limits, this would result in an overestimation of harvest for the year. The overestimation of harvest would then carry through the 2021 harvest forecasts when charter halibut management measures are evaluated next fall; this would result in more restrictive management measures in 2021 than would be needed to stay within a given allocation.

4.0 Area 3A Management Measures

4.1 Status Quo Harvest Forecast of the Number of Fish Harvested

The status quo measures for Area 3A included a two-fish bag limit with a maximum size limit of 28 inches on one of the fish, an annual limit of four halibut per angler, limits of one trip per vessel and one trip per charter halibut permit per day, no retention of halibut on Wednesdays year-round, and no retention on five Tuesdays in July and August. As explained earlier, the status quo effort forecast was equal to the 2019 preliminary estimate. All subareas had declining trends in HPUE in recent years, though HPUE increased in 6 of 8 subareas in 2019 (Table 4, Figure 3). The status quo effort forecast for Area 3A for 2020 is 106,872 angler-trips, and the harvest forecast is 132,453 halibut with a 95% margin of error (\pm 2 standard errors) of 4,037 fish (Table 21). The status quo harvest forecast is 3.8% lower than the 2019 preliminary harvest estimate of 137,731 due to the forecasted decline in HPUE. The weighted average HPUE forecast for Area 3A overall is 1.24 halibut per angler-trip. Glacier Bay, Yakutat, North Gulf Coast, and Kodiak subareas had HPUEs of less than 1.00 halibut per angler-trip, reflecting the lower retention of second fish in the bag limit in those areas.

4.2 Status Quo Harvest Forecast of the Average Weight in each Subarea

Average weight was calculated as a weighted mean of the fish of any size and the fish subject to a maximum size limit. The average weight for the fish of any size was assumed to be the overall average weight in 2013, the last year without a size limit in Area 3A. The average weight for size-restricted fish was calculated as the average weight of fish less than or equal to the specified size limit in 2013. These average weights were then weighted by the 2020 projected proportions of harvest made up of “first” and “second” fish in angler’s bag limits. These terms do not refer to the order in which the fish were caught, but rather to whether the fish came from limits of one or two fish. For example, if an angler kept only one halibut on a trip, the fish was designated a “first” fish. If an angler kept two halibut, one was designated

“first” and the other “second.” The proportions of “second” fish in the harvest were forecasted for 2020 from 2010-2019 logbook data using the exponentially-weighted time series models described in Section 2.3. These forecasted proportions ranged from 42-44% in Cook Inlet down to 4-9% in the Glacier Bay and Yakutat subareas, with a weighted average of 36% for Area 3A overall (Figure 4).

The average weights predicted using this method for each size limit differed from average weights observed under those size limits in past years. Factors contributing to those differences include changes since 2013 in the size distribution of the population, changes in the sizes of fish anglers are willing to keep given annual limits, and changes in the proportions of first and second fish in the harvest. Therefore, the predicted average weights were corrected, or adjusted to match current average weights. Corrections were based on the difference between predicted and estimated (observed) average weights for 2017-2019. Predicted average weights for past years tended to be underestimated for all subareas, ranging from 52% below to 7% above observed values across all subareas and years, and from 29% to 16% below observed values across years for Area 3A overall. Correction factors, based on the average ratio of the predicted and observed average weights, ranged from 1.00 to 1.98 among subareas.

The status quo forecast of average weight in 3A is 14.48 lbs. Status quo is based on a two fish bag limit with one fish of any size and a maximum size limit of 28 inches on one fish. This is very similar to the 2019 preliminary average weight estimate of 14.52 lbs.

4.3 Status Quo with Changes in Tuesday Closures

4.3.1 Approach

Status quo regulations in Area 3A included a year-round closure of the charter fishery on Wednesdays, as well as five Tuesdays closed (three in July and two in August). The potential effect of opening or closing Tuesdays was estimated for the months June-August and for the entire years. The analysis for opening Tuesdays relied on complete logbook data for 2016, the last year in which the fishery was open on all Tuesdays and closed on Wednesdays, while the analysis for closing Tuesdays relied on complete logbook data from 2017, a year in which the fishery was closed on Wednesdays and three Tuesdays. Generally speaking, the analysis proceeded by estimating the proportional effect of Tuesdays in 2016 or 2017 and applying those proportional effects to the harvest forecast for 2020.

The first step was to identify the dates of specific Tuesdays that would be closed in 2020 under each possible number of closed days. Specific Tuesdays were selected such that, for each scenario, 60-75% of the closed days would fall before August 1 (specific dates identified for Tuesday closures are found in Table 22, Figure 6). The proportion of harvest occurring before August is an important value that is used to make preliminary estimates of charter harvest each year using incomplete logbook data. The proportion of annual charter harvest occurring through July has averaged 69% since 2014. If daily closures were implemented in a manner that caused that proportion to vary significantly from its recent average, it could bias future preliminary harvest estimates.

There are a total of 13 Tuesdays during the period June-August, 2020, and 48 Tuesdays from February – December, 2020. Once the specific closed Tuesdays for each scenario were identified, the corresponding Tuesday to each of those dates was identified from the historic data sets for analyses. There was a two-day difference in the date of each Tuesday from 2016 to 2020 and a three-day difference from 2017 to 2020. Closing all Tuesdays beyond the June-August period would only reduce harvest another 2%, reflecting the relatively low levels of harvest in the shoulder seasons.

The analysis assumed that the proportions of harvest occurring on each Tuesday in 2016 or 2017 would be added or eliminated if those days were opened or closed, respectively. In other words, the harvest that occurred on those days represented the potential change in harvest if those days were opened or closed. The total annual harvest under each scenario of opened or closed Tuesdays was compared to the harvest scenario of five closed Tuesdays (2019 status quo) to estimate the proportional change for 2020. As outlined in the 2C analysis of daily closures, the harvest reductions under each scenario represent the

maximum expected reduction in the number of fish harvested. A day of the week closure would be unlikely to achieve the maximum reduction in halibut harvest because of the potential for displaced anglers to book alternate dates either on the same vessel or another vessel with available space. There is a substantial amount of latent capacity on charter vessels in Area 3A (Marrinan and Fey 2017).

4.3.2 Results

Under status quo regulations, which include five Tuesday closures, the projected average weight was 14.48 lb and projected removal was 1.938 Milb (Table 22). The potential additional harvest ranged from 1.6% for one less closed Tuesday (4 total closed Tuesdays) to 7.5% for zero closed Tuesdays; reductions in harvest ranged from 1.6% for one additional closed Tuesday (6 closed) to 7.6% for 8 additional closed Tuesdays (13 total) and 9.5% should Tuesdays be closed for the entire year. The projected removals associated with these scenarios ranged from 2.083 to 1.754 Milb. Under both allocation scenarios, all Tuesdays must be closed with projected removals still exceeding both the reference and status quo TCEY allocation scenarios.

4.4 Status Quo with Changes in Wednesday Closures

4.4.1 Approach

Status quo regulations in Area 3A included a year-round closure of the charter fishery on Wednesdays, as well as five Tuesdays closed (three in July and two in August). The potential effect of opening all Tuesdays and various numbers of Wednesdays was estimated. The analysis for opening Wednesdays relied on complete logbook data for 2014, the last year in which the fishery did not have any daily closures. Generally speaking, the analysis proceeded by estimating the proportional effect of Wednesdays in 2014 and applying those proportional effects to the harvest forecast for 2020.

The first step was to identify the dates of specific Wednesdays that would be opened in 2020 under each possible number of closed days. Specific Wednesdays were selected such that, for each scenario, 60-75% of the opened days would fall before August 1 (specific dates identified for Tuesday closures are found in Figure 4), as outlined above.

There are a total of 13 Wednesdays during the period June–August, 2020, and 48 Wednesdays from February – December, 2020. Once the specific Wednesdays for each scenario were identified, the corresponding Wednesday to each of those dates was identified from the historic data set for analysis. There was a one-day difference in the date of each Wednesday from 2014 to 2020.

The analysis assumed that the proportions of harvest occurring on each Wednesday in 2014 would be added if those days were opened in 2020. In other words, the harvest that occurred on those days in 2014 represented the potential change in harvest if those days were opened in 2020. The total annual harvest under each scenario of opened Wednesdays was compared to the harvest scenario of five closed Tuesdays (2019 status quo) to estimate the proportional change for 2020. As outlined in the above, the harvest addition under each scenario represent the maximum expected addition in the number of fish harvested. Opening of Wednesdays would be unlikely to achieve the maximum addition in halibut harvest because presumably some of the anglers who would have fished on a closed Wednesday are already fishing on other days.

4.4.2 Results

The potential additional harvest relative to status quo from opening Wednesdays (in addition to opening all Tuesdays) ranged from 9.5% for opening Wednesdays in the fringe season (February – May and September – December) to 26.8% for all days open (Table 23). The projected removals associated with these scenarios ranged from 2.123 to 2.461 Milb. Under both catch allocation scenarios, all Wednesday must remain closed.

5.0 Implementation Considerations

5.1 Size Limits

There are no anticipated problems associated with implementation of a reverse slot limit or maximum size limit in Area 2C or Area 3A, respectively. Size limits have been used successfully in both regulatory areas for several years. Maximum size limits and reverse slot limits are implemented for the charter halibut fishery to control the average weight of harvested fish. This type of regulation increases the number of fish discarded thereby increasing removals associated with discard mortality. Not only do these size limits generate additional regulatory (versus voluntary) discards, they also increase the average weight of released fish. The relative impact of size limits, in terms of release mortality and angler satisfaction, is expected to vary by subarea due to variation in the availability of large fish in the catch. For example, clients fishing in subareas where large fish are commonly caught would likely end up releasing relatively more fish above the maximum size limit or in the protected slot, and those fish would likely be larger. Although release mortality is higher under size limits, it is included in the estimates of removals, and is accounted for in the charter sector allocation.

5.2 Annual Limits

Annual limits were implemented in Area 3A in 2015 (5 fish) and 2016 – 2019 (4 fish). If annual limits are recommended for the charter fishery in either area, it is crucial for enforcement purposes to ensure that the regulation be accompanied by a recording requirement similar to that implemented in recent years. Specifically, immediately upon retaining a halibut, charter anglers must record, in ink, the date, location (IPHC area), and species (halibut) on their harvest record. The harvest record is located on the back of the State of Alaska fishing license. For anglers not required to have an annual license, a harvest card can be obtained from the ADF&G website⁴ or from local offices. Enforcement of the annual limit consists of checking anglers with halibut to make sure the harvest is recorded. It is expected that Guided Angler Fish (GAF) taken under the CSP would be exempt from the recording requirement as these harvests accrue toward the IFQ fishery allocation. Under the CSP, GAF must be recorded in the logbook immediately upon retention. When checking anglers at sea or dockside, enforcement personnel should be able to deduct GAF from fish that count toward an angler's annual limit.

The license or harvest card is not submitted at the end of the year. Halibut harvest accounting by individual anglers would continue to be implemented through ADF&G charter logbooks. Logbooks require reporting of the number of halibut kept and released by individual angler, as well as the angler's name and fishing license number. For anglers fishing under the authority of an ADF&G Permanent Identification (PID) or Disabled American Veteran (DAV) card, the PID or DAV number must be recorded. No number can be recorded for youth anglers not required to be licensed. Under the CSP, all anglers (including youth) are required to certify in the logbook that the reported number of halibut kept and released is correct.

Concerns have been expressed in previous years regarding effective enforcement and compliance with halibut annual limits. A chief concern is that unscrupulous anglers will obtain duplicate or multiple licenses. Once a harvest record is full, these anglers could print another copy of their license and thereby comply with the reporting requirement yet still violate the annual limit. However, ADF&G can merge licensing and logbook data to examine the number of fish harvested by individual anglers, regardless of the number of licenses, duplicates, PIDs, or DAVs they may have held. Although ADF&G is not responsible for enforcement of the annual limit, this capability allows us to evaluate and report on compliance with halibut annual limits to the Council or to enforcement agencies.

The 5-fish annual limit in 2015 was implemented without a recording requirement. Beginning in 2016, the annual limit was decreased to 4 fish and a recording requirement was implemented. Table 24 includes

⁴ http://www.adfg.alaska.gov/static/license/sportlicense/pdf/sf_harvest_record_card.pdf

information on the number of unique licensed anglers, anglers with limit violations, total harvest by licensed anglers, and number of excess halibut harvested. Since 2015, 0.2% - 1.0% of licensed anglers have exceeded the annual limit, accounting for 0.2% - 0.6% of harvest by licensed anglers. In 2018, 65,587 licensed anglers harvested 128,830 halibut in 3A. Of those, 201 (0.3%) violated the annual limit and harvested 296 fish in excess of the annual limit which represented 0.2% of the total harvest by licensed anglers. Anglers in Lower Cook Inlet accounted for the majority of the fish over their annual limit (171), followed by Central Cook Inlet (49).

Another concern with annual limits is that compliance may be low among youth anglers. Youth anglers are not required to be licensed, but are still required to complete a harvest record upon harvesting a halibut. Although enforcement in the field would be no different for youth anglers, their annual harvests cannot be evaluated post-season using logbook data. However, youth anglers have made up only 4-6% of angler-trips in Areas 2C and 3A in recent years. As stated earlier, all unlicensed youth anglers would be required to report each halibut on a harvest record. Youth typically fish on charter boats with parents or other adults, who, along with the guide or deck hand, would be expected to remind them of recording requirements. It is likely the proportion of youth that violate annual limits is small.

5.3 Daily Closures

As mentioned earlier, the primary issue with daily closures is that the effect cannot be accurately predicted or evaluated. Daily closures are expected to reduce effort, and therefore their effect is confounded with any factors that affect effort (e.g., trip limits, economic trends). This analysis could only estimate the maximum potential reduction in halibut harvest but cannot predict possible changes in angler behavior, such as anglers booking alternate days. In 3A, with Wednesdays closed all year and five Tuesdays closed during the peak season, closure of additional days during the peak season (June through August) may be more effective than closure of a day or two here and there. With each additional day closed, there would be fewer days available to rebook and fewer charters available to take the displaced anglers. The effectiveness of day of the week closures in 2C is expected to be similar to those seen in 3A. However, differences in business models and angler behavior between the areas may impact the effectiveness of this management measure.

Another impact of daily closures is the potential increase in the harvest of state-managed species such as salmon, rockfishes, sablefish, and lingcod. Some charter businesses are able to book anglers to catch other species, particularly salmon. Increases in harvest will likely intensify conservation concerns for these stocks.

Another consideration for daily closures is the potential effect on estimation of the current year's halibut harvest. Daily closures for a portion of the year may alter the distribution of harvest within the year. The preliminary estimates of harvest for the current year are based on logbook data for trips through July 31. The harvest through that date is expanded using the proportion of harvest through that date in prior years, around 63-67% in 2C and 67 - 75% in 3A. If daily closures are selected that reduce harvest in a manner that is not proportional to harvest over the season, future preliminary harvest estimates could be biased. We recommend that if daily closures are implemented in 2C or amended for 3A, that they be structured around the dates listed Figures 5 and 6.

5.4 Mid-season Changes

As mentioned in section 3.6, good information on the effort throughout the season is integral to our ability to provide preliminary harvest estimates and to forecast harvest for the proceeding year, given the necessity to use partial year logbook data when these analyses are done. Any management measure that leads to a substantial change in effort for a portion of the season will negatively impact our ability to estimate preliminary harvest and forecast harvest for the upcoming season, leading to additional uncertainty in these numbers. Any mid-season change in management measures would therefore need to be fully vetted to assure that proportional effort before and after July 31 is not affected. Should changes

be made to the logbook program such that full season data are available at the time analyses are done, this necessity would become obsolete.

6.0 References

- Clark, W. G. 1992. Validation of the IPHC length-weight relationship for halibut. International Pacific Halibut Commission, Report of Research and Assessment Activities 1991, pp. 113-116.
<http://www.iphc.int/publications/rara/1991rara/1991rara03.pdf>
- Marrinan, S. and M. Fey. 2017. Charter Halibut Permit Latency Discussion Paper. Unpublished discussion paper presented to the North Pacific Fishery Management Council in December 2017.
<https://npfmc.legistar.com/LegislationDetail.aspx?ID=3205273&GUID=24B349B0-A8E5-4671-B5FB-8C43284E1922>
- Meyer, S. and R. Powers 2015. Analysis of management options for the Area 2C and 3A charter halibut fisheries for 2016: A report to the North Pacific Fishery Management Council, December 2015.
Alaska Department of Fish and Game. Unpublished.
npfmc.legistar.com/gateway.aspx?M=F&ID=395e0f70-9f6d-41cd-bc16-2bd800648d2d.pdf
- Meyer, S. and R. Powers 2016. Analysis of management options for the Area 2C and 3A charter halibut fisheries for 2017: A report to the North Pacific Fishery Management Council, December 2016.
Alaska Department of Fish and Game. Unpublished.
<http://npfmc.legistar.com/gateway.aspx?M=F&ID=c4d10d23-75b1-4d61-930e-892f6a8a8d53.pdf>
- Meyer, S. and R. Powers 2017. Analysis of management options for the Area 2C and 3A charter halibut fisheries for 2018: A report to the North Pacific Fishery Management Council, December 2017.
Alaska Department of Fish and Game. Unpublished.
npfmc.legistar.com/gateway.aspx?M=F&ID=fef2951a-8a6c-46b0-af91-2d95e32cadd8.pdf
- Meyer, S. C. 2014. Estimation and projection of statewide recreational halibut harvest. Alaska Department of Fish and Game, Regional Operational Plan SF.4A.2014.08.
<http://www.adfg.alaska.gov/FedAidPDFs/ROP.SF.4A.2014.08.pdf>
- Stewart, I., A. Hicks, R. Webster, and D. Wilson. 2019. Summary of the data, stock assessment, and harvest decisions table for the Pacific halibut (*Hippoglossus stenolepis*) at the end of 2019. Report for the 2019 Interim Meeting of the International Pacific Halibut Commission, November 25-26, 2019, IPHC-2019-IM095-09 Rev_1.
- Webster, S., M. Jaenicke, D. Tersteeg, M. Ford, and M. Schuster. 2019. Letter from ADF&G to IPHC reporting final 2018 and preliminary 2019 sport halibut harvest estimates, Oct 28, 2019.
- Webster, S. and R. Powers 2018. Analysis of management options for the Area 2C and 3A charter halibut fisheries for 2019: A report to the North Pacific Fishery Management Council, December 2018.
Alaska Department of Fish and Game. Unpublished.
https://www.npfmc.org/wp-content/PDFdocuments/halibut/Charter/2018/2019_Mgt_Analysis.pdf

Table 1. Estimated average net weight (headed and gutted) and round weight of Pacific halibut by length. Estimates are based on the current International Pacific Halibut Commission length-weight relationships⁵.

Length (Inches)	Net Weight (lb)	Round Weight (lb)	Length (Inches)	Net Weight (lb)	Round Weight (lb)
20	2.3	3.1	51	48.3	64.3
21	2.7	3.6	52	51.5	68.5
22	3.2	4.2	53	54.8	72.8
23	3.7	4.9	54	58.2	77.4
24	4.2	5.6	55	61.7	82.1
25	4.8	6.4	56	65.5	87.1
26	5.4	7.2	57	69.3	92.2
27	6.2	8.2	58	73.3	97.5
28	6.9	9.2	59	77.5	103.1
29	7.8	10.3	60	81.9	108.9
30	8.7	11.5	61	86.4	114.9
31	9.6	12.8	62	91.0	121.1
32	10.7	14.2	63	95.9	127.5
33	11.8	15.7	64	100.9	134.2
34	13.0	17.3	65	106.1	141.1
35	14.3	19.0	66	111.5	148.3
36	15.6	20.8	67	117.0	155.7
37	17.1	22.7	68	122.8	163.3
38	18.6	24.8	69	128.7	171.2
39	20.3	27.0	70	134.9	179.4
40	22.0	29.3	71	141.2	187.8
41	23.8	31.7	72	147.8	196.5
42	25.8	34.3	73	154.5	205.5
43	27.8	37.0	74	161.5	214.8
44	30.0	39.9	75	168.7	224.3
45	32.2	42.9	76	176.1	234.2
46	34.6	46.0	77	183.7	244.3
47	37.1	49.3	78	191.5	254.7
48	39.7	52.8	79	199.6	265.5
49	42.5	56.5	80	207.9	276.5
50	45.3	60.3			

(continued at right)

⁵ IPHC length-weight relationships are $NetWt(lb) = 6.921 \times 10^{-6} ForkLength(cm)^{3.24}$ and $RndWt(lb) = 9.205 \times 10^{-6} ForkLength(cm)^{3.24}$ from Clark (1992).

Table 2. Subareas of IPHC Areas 2C and 3A, ports where ADF&G creel surveys and halibut sampling occur, and subarea abbreviations used in tables and figures in this report.

IPHC Area	Subarea	Ports With Sampling and Angler Interviews	Abbreviations
2C	Ketchikan	Ketchikan	Ketch, A
	Prince of Wales Island	Craig, Klawock	PWalesI, PWI, B
	Petersburg/Wrangell	Petersburg, Wrangell	Pburg, C
	Sitka	Sitka	D
	Juneau, Haines, Skagway	Juneau	Jun, E, EF
	Glacier Bay (2C portion)	Gustavus, Elfin Cove	GlacB, GlacB-2C, G2C
3A	Glacier Bay (3A portion)	Gustavus, Elfin Cove	GlacB, GlacB-3A, G3A
	Yakutat	Yakutat	Yak, H
	Eastern Prince William Sound	Valdez	EPWS
	Western Prince William Sound	Whittier	WPWS
	North Gulf	Seward	NGulf, NGC
	Lower Cook Inlet	Homer	LCI
	Central Cook Inlet	Anchor Point, Deep Creek	CCI
	Kodiak/Alaska Peninsula	Kodiak	Kod, QR

Table 3. Charter logbook effort, harvest per unit effort, and harvest of halibut in IPHC Area 2C, 2006-2019. Estimates for 2019 are preliminary, based on logbook data for charter trips through July 31, 2019, entered as of November 07, 2019.

Year	Subarea						Total 2C
	Ketch	PWI	Pburg	Sitka	Jun	GlacB-2C	
Effort (angler-trips)^a							
2006	11,148	26,409	4,441	34,298	8,445	12,499	97,240
2007	13,359	27,906	4,754	36,066	7,990	15,912	105,987
2008	11,672	27,369	4,528	33,928	7,766	18,002	103,265
2009	10,283	17,273	3,489	22,883	7,314	13,186	74,428
2010	10,595	17,981	3,283	24,027	8,472	13,625	77,983
2011	10,552	16,015	2,257	24,038	8,771	11,301	72,934
2012	11,886	18,242	2,675	24,881	7,803	9,976	75,463
2013	13,582	20,180	3,029	24,470	9,288	11,206	81,755
2014	14,680	21,491	2,839	28,638	10,375	12,390	90,413
2015	16,685	21,931	3,071	31,113	11,391	10,613	94,804
2016	16,595	23,440	3,373	31,093	12,069	9,694	96,264
2017	18,686	25,466	3,133	33,481	13,729	9,786	104,281
2018	21,671	25,708	3,538	32,394	13,993	11,396	108,700
2019	20,902	22,647	2,964	31,399	13,814	10,686	102,412
Halibut Harvest per Angler-Trip (HPUE)							
2006	0.981	1.441	1.240	1.004	1.121	0.998	1.140
2007	0.877	1.507	1.244	0.944	1.167	1.084	1.135
2008	0.736	1.390	1.204	0.868	1.031	0.945	1.032
2009	0.435	0.758	0.644	0.695	0.666	0.791	0.685
2010	0.408	0.690	0.651	0.583	0.596	0.705	0.610
2011	0.355	0.752	0.640	0.667	0.613	0.829	0.658
2012	0.440	0.767	0.653	0.672	0.628	0.819	0.673
2013	0.494	0.833	0.696	0.706	0.698	0.792	0.713
2014	0.486	0.801	0.729	0.761	0.678	0.789	0.719
2015	0.465	0.744	0.691	0.759	0.675	0.768	0.693
2016	0.507	0.725	0.621	0.789	0.633	0.667	0.687
2017	0.460	0.753	0.630	0.777	0.592	0.692	0.677
2018	0.440	0.729	0.606	0.751	0.572	0.637	0.644
2019	0.419	0.728	0.562	0.765	0.655	0.708	0.659
Harvest (number of halibut)^b							
2006	10,933	38,053	5,505	34,430	9,471	12,468	110,860
2007	11,719	42,044	5,912	34,056	9,325	17,251	120,307
2008	8,595	38,047	5,452	29,465	8,004	17,016	106,579
2009	4,471	13,097	2,246	15,896	4,873	10,433	51,016
2010	4,322	12,403	2,138	14,010	5,051	9,612	47,536
2011	3,746	12,045	1,444	16,022	5,377	9,365	47,999
2012	5,234	13,985	1,748	16,711	4,903	8,175	50,756
2013	6,711	16,810	2,107	17,265	6,487	8,880	58,260
2014	7,138	17,214	2,071	21,798	7,034	9,781	65,036
2015	7,762	16,322	2,121	23,611	7,687	8,153	65,656
2016	8,414	16,999	2,095	24,528	7,642	6,469	66,147
2017	8,590	19,172	1,974	26,019	8,123	6,769	70,647
2018	9,538	18,731	2,143	24,327	7,998	7,255	69,992
2019	8,753	16,491	1,667	24,007	9,045	7,566	67,529

^a – Effort is defined as angler-trips with recorded bottomfish hours or harvest of at least one halibut. All effort is client-only except 2014-2019 data includes any reported effort by crew that retained halibut.

^b – Harvest is client-only except 2014-2019 data which includes all reported crew harvest even though prohibited.

Table 4. Charter logbook effort, harvest per unit effort, and harvest of halibut in IPHC Area 3A, 2006-2019. Estimates for 2019 are preliminary, based on logbook data through July 31, 2019, entered as of November 7, 2019.

Year	Subarea								Tot 3A
	GlacB-3A	Yak	EPWS	WPWS	NGulf	CCI	LCI	Kod	
Effort (angler-trips)^a									
2006	91	3,164	6,571	2,939	30,381	34,915	50,850	12,030	140,941
2007	137	2,996	6,692	3,326	35,359	36,870	52,301	13,965	151,646
2008	413	3,156	5,414	3,642	32,945	34,013	45,495	12,574	137,652
2009	220	2,201	5,134	3,364	25,591	27,516	36,801	10,059	110,886
2010	161	2,449	5,156	3,753	28,431	27,824	40,573	10,084	118,431
2011	922	2,485	3,855	3,020	27,848	27,565	41,634	10,481	117,810
2012	1,030	2,681	3,440	3,507	30,154	26,238	40,561	10,036	117,647
2013	1,264	2,919	3,618	3,736	29,872	27,741	40,615	9,313	119,078
2014	1,424	3,315	3,576	3,435	29,613	20,633	37,111	9,927	109,034
2015	1,852	3,323	3,638	3,616	32,276	19,994	33,467	9,308	107,474
2016	1,891	3,507	4,207	4,238	34,492	17,027	37,548	9,032	111,942
2017	2,216	3,494	3,650	3,791	29,626	17,500	36,206	8,798	105,281
2018	2,750	4,666	4,172	4,093	30,046	17,121	34,885	9,554	107,287
2019	2,158	4,156	4,626	5,092	31,901	15,401	33,683	9,856	106,872
Halibut Harvest per Angler-Trip (HPUE)									
2006	0.945	1.032	1.396	1.326	1.478	1.889	1.842	1.382	1.685
2007	1.095	1.011	1.387	1.105	1.530	1.891	1.888	1.393	1.702
2008	1.194	1.081	1.299	1.254	1.533	1.890	1.828	1.417	1.680
2009	1.273	1.382	1.376	1.254	1.569	1.915	1.885	1.385	1.720
2010	0.882	1.371	1.400	1.290	1.587	1.907	1.873	1.331	1.715
2011	1.054	1.107	1.537	1.326	1.639	1.919	1.887	1.377	1.742
2012	1.262	1.279	1.440	1.359	1.495	1.916	1.883	1.334	1.697
2013	1.132	1.301	1.506	1.524	1.488	1.878	1.851	1.328	1.684
2014	0.791	1.034	1.225	1.314	1.430	1.866	1.824	1.245	1.599
2015	0.746	0.966	1.181	1.282	1.435	1.792	1.766	0.950	1.523
2016	0.755	0.929	1.127	1.059	1.239	1.688	1.715	0.934	1.413
2017	0.726	0.915	1.121	0.986	1.100	1.649	1.681	0.882	1.355
2018	0.685	0.926	1.151	1.051	0.967	1.646	1.613	0.784	1.271
2019	0.757	0.966	1.024	1.030	1.044	1.661	1.644	0.794	1.289
Harvest (number of halibut)^b									
2006	86	3,266	9,176	3,896	44,888	65,958	93,652	16,624	237,546
2007	150	3,028	9,284	3,674	54,109	69,708	98,730	19,452	258,135
2008	493	3,413	7,032	4,567	50,508	64,277	83,165	17,822	231,277
2009	280	3,042	7,066	4,220	40,165	52,704	69,361	13,934	190,772
2010	142	3,357	7,219	4,843	45,116	53,074	75,986	13,418	203,155
2011	972	2,751	5,925	4,006	45,635	52,904	78,572	14,437	205,202
2012	1,300	3,430	4,954	4,766	45,094	50,281	76,381	13,388	199,594
2013	1,431	3,798	5,450	5,695	44,447	52,107	75,181	12,370	200,479
2014	1,126	3,429	4,379	4,514	42,337	38,504	67,701	12,358	174,348
2015	1,381	3,210	4,296	4,635	46,321	35,834	59,110	8,845	163,632
2016	1,428	3,259	4,742	4,487	42,721	28,747	64,392	8,438	158,214
2017	1,609	3,196	4,090	3,737	32,576	28,850	60,845	7,761	142,664
2018	1,884	4,322	4,803	4,302	29,068	28,183	56,262	7,488	136,312
2019	1,634	4,016	4,736	5,245	33,316	25,575	55,381	7,828	137,731

^a – Effort is defined as angler-trips with bottomfish effort or harvest of at least one halibut. All effort is client-only except 2014-2019 data includes any reported effort by crew that retained halibut.

^b – Harvest is client-only except 2014-2019 data which includes all reported crew harvest even though prohibited.

Table 5. Forecasts of effort, halibut harvest per unit effort (HPUE), and harvest (numbers of halibut) for Area 2C in 2020 under status quo regulations, with associated standard errors. Status quo regulations include a one-fish bag limit and U38O80 reverse slot size limit.

Subarea	Effort		HPUE	Std Error	Harvest	
	(angler-trips)	Std Error			(no. halibut)	Std Error
Ketch	22,507	1,274	0.42	0.044	9,451	1,116
PWI	22,650	1,755	0.75	0.041	16,952	1,603
Pburg	3,006	387	0.56	0.035	1,691	241
Sitka	31,400	1,832	0.76	0.048	23,955	2,055
Jun	14,508	931	0.64	0.043	9,295	859
GlacB-2C	10,724	1,311	0.69	0.060	7,393	1,104
Area 2C	104,795	3,286	0.66	NA	68,737	3,171

Table 6. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits ranging from U35O50 to U50O80 with a 1-fish bag limit. All reverse slot limits exceeded the reference coastwide TCEY allocation scenario of 0.60 Mlb. Shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Harvest = 68,737

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
35	1.227	1.145	1.082	1.013	0.962	0.917	0.853	0.792	0.757	0.730	0.702	0.684	0.658	0.644	0.642	0.631
36	1.257	1.177	1.116	1.047	0.997	0.952	0.890	0.829	0.794	0.767	0.740	0.721	0.696	0.682	0.680	0.669
37	1.274	1.195	1.134	1.066	1.017	0.973	0.911	0.851	0.816	0.789	0.762	0.744	0.719	0.705	0.703	0.692
38	1.301	1.223	1.164	1.097	1.048	1.005	0.943	0.884	0.850	0.823	0.796	0.778	0.753	0.739	0.737	0.726
39	1.320	1.244	1.185	1.119	1.071	1.027	0.967	0.908	0.874	0.847	0.820	0.802	0.778	0.764	0.762	0.751
40	1.335	1.260	1.202	1.137	1.089	1.046	0.986	0.928	0.894	0.868	0.841	0.823	0.799	0.785	0.783	0.772
41	1.354	1.280	1.224	1.159	1.112	1.070	1.010	0.952	0.919	0.893	0.866	0.849	0.824	0.810	0.809	0.798
42	1.365	1.293	1.237	1.173	1.126	1.085	1.025	0.968	0.935	0.909	0.883	0.865	0.841	0.827	0.826	0.815
43	1.378	1.307	1.252	1.189	1.143	1.101	1.043	0.986	0.953	0.927	0.901	0.884	0.860	0.846	0.844	0.834
44	1.398	1.328	1.274	1.211	1.166	1.125	1.067	1.011	0.978	0.953	0.927	0.909	0.886	0.872	0.870	0.860
45	1.419	1.351	1.298	1.236	1.192	1.151	1.094	1.038	1.006	0.981	0.955	0.938	0.914	0.901	0.899	0.888
46	1.432	1.365	1.313	1.252	1.208	1.168	1.111	1.056	1.024	0.999	0.973	0.956	0.933	0.919	0.918	0.907
47	1.451	1.386	1.334	1.274	1.231	1.191	1.135	1.081	1.049	1.024	0.999	0.982	0.958	0.945	0.943	0.933
48	1.463	1.399	1.348	1.289	1.246	1.207	1.151	1.097	1.066	1.041	1.016	0.999	0.975	0.962	0.960	0.950
49	1.486	1.423	1.373	1.315	1.272	1.234	1.179	1.125	1.094	1.070	1.045	1.028	1.005	0.992	0.990	0.980
50	1.500	1.439	1.390	1.333	1.291	1.253	1.198	1.145	1.115	1.091	1.066	1.049	1.026	1.013	1.011	1.001

Table 7. Estimated effects of annual limits of one to four halibut on Area 2C charter anglers and projected harvest for 2020. Effects were estimated using 2018 logbook data from licensed anglers. The percent of affected anglers is the portion of individual anglers that harvested more than the specified annual limit in 2018.

Annual Limit	Subarea						
	Ketch	PWI	Pburg	Sitka	Jun	GlacB	Area 2C
Estimated percent of anglers affected by the annual limit:							
1	22.7%	71.2%	55.8%	69.5%	37.9%	45.2%	54.0%
2	8.4%	42.0%	29.1%	37.9%	23.5%	25.5%	29.8%
3	1.5%	10.1%	10.5%	9.0%	15.0%	13.9%	9.0%
4	0.3%	1.8%	3.1%	1.7%	7.1%	5.3%	2.5%
Estimated percent change in harvest relative to no annual limit:							
1	-24.9%	-55.7%	-50.0%	-54.3%	-46.0%	-47.6%	-48.7%
2	-7.9%	-24.2%	-22.1%	-22.5%	-25.5%	-24.0%	-21.5%
3	-1.6%	-5.6%	-7.6%	-5.2%	-12.8%	-10.6%	-6.5%
4	-0.4%	-1.2%	-2.3%	-1.1%	-4.7%	-3.4%	-1.8%
Projected harvest (number of halibut):							
1	7,095	7,503	845	10,947	5,023	3,872	35,284
2	8,702	12,841	1,317	18,555	6,925	5,622	53,962
3	9,301	15,996	1,563	22,703	8,104	6,608	64,274
4	9,409	16,750	1,652	23,685	8,856	7,145	67,497
No Limit	9,451	16,952	1,691	23,955	9,295	7,393	68,737

Table 8. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits ranging from U35O50 to U50O80 with a 1-fish bag limit combined with annual limits ranging from four to one fish. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

a. 4-fish annual limit, harvest = 67,497

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
35	1.205	1.124	1.063	0.994	0.944	0.900	0.838	0.778	0.743	0.717	0.690	0.671	0.646	0.632	0.631	0.620
36	1.235	1.156	1.096	1.028	0.979	0.935	0.874	0.814	0.780	0.753	0.726	0.708	0.684	0.670	0.668	0.657
37	1.251	1.174	1.114	1.047	0.999	0.955	0.894	0.835	0.801	0.775	0.748	0.730	0.706	0.692	0.690	0.679
38	1.278	1.202	1.143	1.077	1.029	0.986	0.926	0.868	0.834	0.808	0.782	0.764	0.739	0.726	0.724	0.713
39	1.296	1.221	1.164	1.099	1.051	1.009	0.949	0.891	0.858	0.832	0.806	0.788	0.764	0.750	0.748	0.738
40	1.311	1.237	1.181	1.116	1.069	1.027	0.968	0.911	0.878	0.852	0.826	0.808	0.784	0.771	0.769	0.758
41	1.330	1.258	1.202	1.138	1.092	1.050	0.992	0.935	0.902	0.877	0.851	0.833	0.809	0.796	0.794	0.783
42	1.341	1.270	1.215	1.152	1.106	1.065	1.007	0.950	0.918	0.893	0.867	0.850	0.826	0.812	0.811	0.800
43	1.354	1.284	1.229	1.167	1.122	1.081	1.024	0.968	0.935	0.910	0.885	0.868	0.844	0.831	0.829	0.818
44	1.373	1.304	1.251	1.189	1.145	1.105	1.048	0.992	0.960	0.936	0.910	0.893	0.870	0.856	0.855	0.844
45	1.394	1.327	1.274	1.214	1.170	1.131	1.074	1.019	0.988	0.963	0.938	0.921	0.898	0.884	0.883	0.872
46	1.407	1.341	1.289	1.230	1.186	1.147	1.091	1.037	1.006	0.981	0.956	0.939	0.916	0.903	0.901	0.891
47	1.425	1.361	1.310	1.251	1.209	1.170	1.115	1.061	1.030	1.006	0.981	0.964	0.941	0.928	0.926	0.916
48	1.437	1.374	1.324	1.266	1.224	1.185	1.130	1.077	1.046	1.022	0.997	0.981	0.958	0.945	0.943	0.933
49	1.459	1.397	1.348	1.291	1.250	1.212	1.158	1.105	1.074	1.051	1.026	1.010	0.987	0.974	0.972	0.962
50	1.474	1.413	1.365	1.309	1.268	1.230	1.177	1.125	1.094	1.071	1.046	1.030	1.008	0.995	0.993	0.983

b. 3-fish annual limit, harvest = 64,274

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
35	1.147	1.070	1.011	0.946	0.899	0.857	0.797	0.740	0.707	0.682	0.656	0.639	0.615	0.602	0.600	0.590
36	1.175	1.100	1.043	0.978	0.931	0.890	0.831	0.774	0.742	0.717	0.692	0.674	0.651	0.638	0.636	0.626
37	1.191	1.117	1.060	0.996	0.950	0.909	0.851	0.795	0.762	0.737	0.712	0.695	0.672	0.659	0.657	0.647
38	1.216	1.143	1.088	1.025	0.979	0.939	0.881	0.825	0.793	0.769	0.744	0.727	0.704	0.691	0.689	0.679
39	1.234	1.162	1.107	1.045	1.000	0.960	0.903	0.848	0.816	0.792	0.767	0.750	0.727	0.714	0.712	0.702
40	1.248	1.178	1.123	1.062	1.018	0.978	0.921	0.866	0.835	0.811	0.786	0.770	0.747	0.734	0.732	0.722
41	1.266	1.197	1.143	1.083	1.039	1.000	0.944	0.889	0.858	0.834	0.810	0.793	0.770	0.758	0.756	0.746
42	1.276	1.208	1.156	1.096	1.052	1.013	0.958	0.904	0.873	0.849	0.825	0.809	0.786	0.773	0.772	0.762
43	1.288	1.222	1.170	1.110	1.067	1.029	0.974	0.921	0.890	0.866	0.842	0.826	0.803	0.790	0.789	0.779
44	1.307	1.241	1.190	1.132	1.089	1.051	0.997	0.944	0.914	0.890	0.866	0.850	0.828	0.815	0.814	0.804
45	1.327	1.263	1.213	1.155	1.114	1.076	1.022	0.970	0.940	0.916	0.893	0.877	0.854	0.842	0.840	0.831
46	1.339	1.276	1.227	1.170	1.129	1.092	1.038	0.987	0.957	0.934	0.910	0.894	0.872	0.859	0.858	0.848
47	1.357	1.295	1.247	1.191	1.150	1.114	1.061	1.010	0.980	0.957	0.934	0.918	0.896	0.883	0.882	0.872
48	1.369	1.308	1.260	1.205	1.165	1.128	1.076	1.025	0.996	0.973	0.950	0.934	0.912	0.900	0.898	0.889
49	1.389	1.330	1.283	1.229	1.189	1.154	1.102	1.052	1.022	1.000	0.977	0.961	0.939	0.927	0.926	0.916
50	1.403	1.345	1.299	1.245	1.206	1.171	1.120	1.070	1.041	1.019	0.996	0.981	0.959	0.947	0.945	0.936

(continued)

Table 8. (continued)

c. 2-fish annual limit, harvest = 53,962

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
35	0.961	0.896	0.847	0.792	0.753	0.718	0.668	0.620	0.593	0.571	0.550	0.536	0.516	0.505	0.504	0.495
36	0.985	0.921	0.873	0.819	0.781	0.746	0.697	0.649	0.622	0.601	0.580	0.566	0.546	0.535	0.534	0.525
37	0.998	0.936	0.888	0.835	0.797	0.763	0.714	0.666	0.639	0.618	0.597	0.583	0.564	0.553	0.552	0.543
38	1.020	0.958	0.912	0.859	0.822	0.788	0.739	0.692	0.666	0.645	0.624	0.610	0.591	0.580	0.579	0.570
39	1.035	0.974	0.928	0.876	0.839	0.806	0.758	0.711	0.685	0.664	0.644	0.630	0.610	0.600	0.598	0.590
40	1.047	0.987	0.942	0.891	0.854	0.821	0.773	0.727	0.701	0.680	0.660	0.646	0.627	0.616	0.615	0.607
41	1.062	1.004	0.959	0.908	0.872	0.839	0.792	0.747	0.721	0.700	0.680	0.666	0.647	0.637	0.635	0.627
42	1.071	1.013	0.969	0.919	0.883	0.851	0.804	0.759	0.733	0.713	0.693	0.679	0.660	0.650	0.648	0.640
43	1.081	1.024	0.981	0.931	0.896	0.864	0.818	0.773	0.747	0.727	0.707	0.694	0.675	0.664	0.663	0.655
44	1.096	1.041	0.998	0.950	0.915	0.883	0.837	0.793	0.767	0.747	0.728	0.714	0.695	0.685	0.684	0.676
45	1.113	1.059	1.017	0.969	0.935	0.904	0.858	0.814	0.789	0.770	0.750	0.737	0.718	0.707	0.706	0.698
46	1.124	1.071	1.029	0.982	0.948	0.917	0.872	0.829	0.804	0.784	0.765	0.751	0.733	0.722	0.721	0.713
47	1.139	1.087	1.046	1.000	0.966	0.936	0.891	0.848	0.823	0.804	0.785	0.772	0.753	0.743	0.742	0.734
48	1.149	1.098	1.058	1.011	0.978	0.948	0.904	0.861	0.837	0.817	0.798	0.785	0.767	0.757	0.755	0.747
49	1.166	1.116	1.077	1.031	0.999	0.969	0.925	0.883	0.859	0.840	0.821	0.808	0.790	0.780	0.778	0.771
50	1.178	1.129	1.090	1.045	1.013	0.984	0.941	0.899	0.875	0.856	0.837	0.824	0.806	0.796	0.795	0.787

d. 1-fish annual limit, harvest = 35,284

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
35	0.623	0.580	0.549	0.514	0.490	0.467	0.434	0.403	0.386	0.372	0.358	0.349	0.336	0.329	0.328	0.323
36	0.639	0.597	0.566	0.532	0.508	0.486	0.453	0.422	0.405	0.391	0.377	0.369	0.356	0.349	0.348	0.343
37	0.648	0.606	0.576	0.542	0.518	0.496	0.464	0.433	0.417	0.403	0.389	0.380	0.367	0.361	0.360	0.354
38	0.662	0.622	0.592	0.558	0.535	0.513	0.482	0.451	0.434	0.421	0.407	0.398	0.386	0.379	0.378	0.373
39	0.672	0.632	0.603	0.570	0.547	0.525	0.494	0.463	0.447	0.433	0.420	0.411	0.398	0.392	0.391	0.385
40	0.680	0.641	0.611	0.579	0.556	0.535	0.504	0.474	0.457	0.444	0.430	0.422	0.409	0.403	0.402	0.396
41	0.690	0.652	0.623	0.591	0.569	0.547	0.517	0.487	0.471	0.457	0.444	0.436	0.423	0.416	0.416	0.410
42	0.696	0.658	0.630	0.598	0.576	0.555	0.524	0.495	0.479	0.465	0.452	0.444	0.431	0.425	0.424	0.419
43	0.703	0.665	0.637	0.606	0.584	0.563	0.533	0.504	0.488	0.475	0.461	0.453	0.441	0.434	0.433	0.428
44	0.713	0.676	0.649	0.618	0.596	0.576	0.546	0.517	0.501	0.488	0.475	0.467	0.454	0.448	0.447	0.442
45	0.724	0.688	0.661	0.631	0.609	0.589	0.560	0.531	0.515	0.502	0.489	0.481	0.469	0.463	0.462	0.457
46	0.731	0.696	0.669	0.639	0.618	0.598	0.569	0.540	0.525	0.512	0.499	0.491	0.479	0.472	0.471	0.466
47	0.741	0.706	0.680	0.651	0.630	0.610	0.581	0.553	0.538	0.525	0.512	0.504	0.492	0.486	0.485	0.480
48	0.747	0.713	0.688	0.659	0.638	0.619	0.590	0.562	0.547	0.534	0.521	0.513	0.501	0.495	0.494	0.489
49	0.759	0.725	0.700	0.672	0.651	0.632	0.604	0.576	0.561	0.548	0.536	0.528	0.516	0.510	0.509	0.504
50	0.766	0.734	0.709	0.681	0.661	0.642	0.614	0.587	0.572	0.559	0.547	0.539	0.527	0.521	0.520	0.515

Table 9. Estimated potential change in harvest and projected harvest (number of fish) associated under a reverse slot limits ranging with a 1-fish bag limit combined with 0 – 17 Wednesday closures during May through September of 2020 or a Wednesday closure for entire year.

Wednesday closure

Number of Closed Wednesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)
0		0.0%	68,737
1	July 29	-1.3%	67,869
2	July 29 - August 05	-2.0%	67,329
3	July 22 - August 05	-3.4%	66,408
4	July 15 - August 05	-4.9%	65,396
5	July 15 - August 12	-6.0%	64,596
6	July 08 - August 12	-7.3%	63,748
7	July 01 - August 12	-8.4%	62,993
8	July 01 - August 19	-9.2%	62,416
9	June 24 - August 19	-10.5%	61,527
10	June 17 - August 19	-11.5%	60,804
11	June 17 - August 26	-12.2%	60,380
12	June 10 - August 26	-13.0%	59,776
13	June 03 - August 26	-13.4%	59,503
14	June 03 - September 02	-13.8%	59,263
15	May 27 - September 02	-14.2%	58,999
16	May 20 - September 02	-14.4%	58,866
17	May 20 - September 09	-14.5%	58,764
48 (all season)	February 01 - December 31	-14.7%	58,638

Table 10. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays closed throughout the season, or a Wednesday closure for the entire year. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Wednesday closures

Lower Limit (in)	Number of Wednesday Closures																		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
35	0.631	0.623	0.618	0.609	0.600	0.593	0.585	0.578	0.573	0.564	0.557	0.553	0.548	0.545	0.543	0.540	0.539	0.538	0.537
36	0.669	0.660	0.655	0.646	0.636	0.629	0.620	0.613	0.607	0.598	0.591	0.587	0.581	0.578	0.576	0.573	0.572	0.571	0.570
37	0.692	0.683	0.677	0.668	0.658	0.650	0.641	0.634	0.628	0.619	0.611	0.607	0.601	0.598	0.596	0.593	0.591	0.590	0.589
38	0.726	0.717	0.711	0.701	0.691	0.682	0.673	0.665	0.659	0.650	0.642	0.637	0.631	0.628	0.625	0.622	0.621	0.620	0.619
39	0.751	0.741	0.735	0.726	0.714	0.706	0.696	0.688	0.682	0.672	0.664	0.659	0.652	0.649	0.647	0.643	0.642	0.641	0.640
40	0.772	0.762	0.756	0.746	0.735	0.725	0.716	0.707	0.701	0.691	0.682	0.677	0.671	0.667	0.665	0.661	0.660	0.659	0.658
41	0.798	0.788	0.781	0.771	0.759	0.750	0.740	0.731	0.724	0.714	0.705	0.700	0.693	0.690	0.687	0.683	0.682	0.681	0.680
42	0.815	0.804	0.798	0.787	0.775	0.765	0.755	0.746	0.740	0.729	0.720	0.715	0.707	0.704	0.701	0.698	0.696	0.695	0.694
43	0.834	0.823	0.816	0.805	0.793	0.783	0.773	0.764	0.757	0.746	0.737	0.731	0.724	0.720	0.717	0.714	0.712	0.711	0.710
44	0.860	0.849	0.842	0.831	0.818	0.808	0.797	0.788	0.780	0.769	0.760	0.754	0.746	0.743	0.740	0.736	0.734	0.733	0.732
45	0.888	0.877	0.870	0.858	0.845	0.835	0.824	0.814	0.806	0.795	0.785	0.779	0.771	0.768	0.764	0.761	0.759	0.757	0.756
46	0.907	0.895	0.888	0.877	0.863	0.852	0.841	0.831	0.824	0.812	0.802	0.796	0.788	0.784	0.781	0.777	0.775	0.773	0.772
47	0.933	0.921	0.913	0.901	0.888	0.876	0.865	0.855	0.847	0.835	0.824	0.818	0.810	0.806	0.803	0.799	0.797	0.795	0.794
48	0.950	0.938	0.930	0.918	0.904	0.893	0.881	0.871	0.863	0.850	0.840	0.834	0.825	0.821	0.818	0.813	0.811	0.810	0.809
49	0.980	0.967	0.960	0.947	0.932	0.921	0.908	0.898	0.889	0.877	0.866	0.860	0.851	0.846	0.843	0.839	0.837	0.835	0.834
50	1.001	0.988	0.980	0.967	0.952	0.940	0.928	0.917	0.909	0.895	0.885	0.878	0.869	0.865	0.861	0.857	0.855	0.853	0.852

Table 11. Estimated potential change in harvest and projected harvest (number of fish) associated under a reverse slot limits ranging with a 1-fish bag limit combined with 0 – 17 Sunday closures during May through September of 2020, or a Sunday closures for the entire year.

Sunday closure

Number of Closed Sundays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)
0		0.0%	68,737
1	July 26	-1.1%	67,960
2	July 26 - August 02	-2.3%	67,139
3	July 19 - August 02	-3.6%	66,242
4	July 12 - August 02	-4.8%	65,460
5	July 12 - August 09	-5.9%	64,697
6	July 05 - August 09	-7.2%	63,803
7	June 28 - August 09	-8.1%	63,164
8	June 28 - August 16	-9.1%	62,485
9	June 21 - August 16	-10.1%	61,812
10	June 14 - August 16	-10.9%	61,248
11	June 14 - August 23	-11.6%	60,737
12	June 07 - August 23	-12.1%	60,407
13	May 31 - August 23	-12.6%	60,088
14	May 31 - August 30	-13.1%	59,753
15	May 24 - August 30	-13.2%	59,674
16	May 17 - August 30	-13.3%	59,585
17	May 17 - September 06	-13.5%	59,487
48 (all season)	February 01 - December 31	-13.5%	59,432

Table 12. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Sundays closed throughout the season, or a Sunday closure for the entire year. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Sunday closures

Lower Limit (in)	Number of Sunday Closures																	All	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		17
35	0.631	0.624	0.617	0.609	0.602	0.595	0.587	0.581	0.575	0.569	0.564	0.559	0.556	0.553	0.550	0.549	0.548	0.548	0.547
36	0.669	0.662	0.654	0.645	0.638	0.631	0.622	0.616	0.610	0.603	0.598	0.593	0.590	0.586	0.583	0.582	0.581	0.580	0.580
37	0.692	0.684	0.676	0.667	0.660	0.652	0.643	0.637	0.630	0.624	0.618	0.613	0.610	0.606	0.603	0.602	0.601	0.600	0.600
38	0.726	0.718	0.710	0.700	0.692	0.684	0.675	0.669	0.662	0.655	0.649	0.644	0.640	0.637	0.633	0.632	0.631	0.630	0.630
39	0.751	0.743	0.734	0.724	0.716	0.708	0.699	0.692	0.684	0.677	0.671	0.666	0.662	0.658	0.655	0.654	0.653	0.652	0.651
40	0.772	0.764	0.755	0.745	0.736	0.728	0.718	0.711	0.704	0.696	0.690	0.685	0.681	0.677	0.673	0.672	0.671	0.670	0.669
41	0.798	0.789	0.780	0.770	0.761	0.752	0.742	0.735	0.728	0.720	0.713	0.708	0.704	0.700	0.696	0.695	0.694	0.693	0.692
42	0.815	0.806	0.796	0.786	0.777	0.768	0.758	0.751	0.743	0.735	0.729	0.723	0.719	0.715	0.711	0.710	0.709	0.708	0.707
43	0.834	0.824	0.815	0.804	0.795	0.786	0.776	0.768	0.760	0.752	0.746	0.740	0.736	0.732	0.727	0.726	0.725	0.724	0.723
44	0.860	0.850	0.840	0.830	0.820	0.811	0.800	0.793	0.784	0.776	0.769	0.763	0.759	0.755	0.750	0.749	0.748	0.747	0.746
45	0.888	0.879	0.868	0.857	0.848	0.838	0.827	0.819	0.811	0.802	0.795	0.789	0.784	0.780	0.775	0.774	0.773	0.772	0.771
46	0.907	0.897	0.887	0.875	0.866	0.856	0.845	0.837	0.828	0.819	0.812	0.805	0.801	0.797	0.792	0.791	0.790	0.788	0.787
47	0.933	0.923	0.912	0.900	0.890	0.880	0.869	0.861	0.852	0.843	0.835	0.828	0.824	0.819	0.815	0.813	0.812	0.811	0.810
48	0.950	0.940	0.929	0.917	0.907	0.896	0.885	0.877	0.868	0.858	0.851	0.844	0.839	0.835	0.830	0.829	0.827	0.826	0.825
49	0.980	0.969	0.958	0.946	0.935	0.925	0.913	0.904	0.895	0.885	0.877	0.870	0.866	0.861	0.856	0.855	0.853	0.852	0.851
50	1.001	0.990	0.979	0.966	0.956	0.945	0.933	0.924	0.915	0.905	0.897	0.890	0.885	0.880	0.875	0.874	0.872	0.870	0.870

Table 13. Estimated potential change in harvest and projected harvest (number of fish) associated under a reverse slot limits ranging with a 1-fish bag limit combined with 0 – 17 Wednesday closures during May through September of 2020 or a Wednesday closure for entire year with an annual limit of 4 halibut.

Wednesday closure – 4-fish annual limit

Number of Closed Wednesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)
0		-1.8%	67,497
1	July 29	-3.0%	66,646
2	July 29 - August 05	-3.8%	66,115
3	July 22 - August 05	-5.1%	65,212
4	July 15 - August 05	-6.6%	64,221
5	July 15 - August 12	-7.7%	63,437
6	July 08 - August 12	-8.9%	62,602
7	July 01 - August 12	-10.0%	61,863
8	July 01 - August 19	-10.8%	61,300
9	June 24 - August 19	-12.1%	60,426
10	June 17 - August 19	-13.1%	59,715
11	June 17 - August 26	-13.7%	59,299
12	June 10 - August 26	-14.6%	58,708
13	June 03 - August 26	-15.0%	58,440
14	June 03 - September 02	-15.3%	58,205
15	May 27 - September 02	-15.7%	57,945
16	May 20 - September 02	-15.9%	57,813
17	May 20 - September 09	-16.0%	57,715
48 (all season)	February 01 - December 31	-16.2%	57,628

Table 14. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays closed throughout the season, or a Wednesday closure for the entire year with an annual limit of 4 halibut. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Wednesday closure – 4-fish annual limit

Lower Limit (in)	Number of Wednesday Closures																	All	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		17
35	0.620	0.612	0.607	0.599	0.589	0.582	0.575	0.568	0.562	0.554	0.548	0.544	0.538	0.536	0.533	0.531	0.530	0.529	0.528
36	0.657	0.649	0.644	0.635	0.625	0.617	0.609	0.602	0.597	0.588	0.581	0.577	0.571	0.568	0.566	0.563	0.562	0.561	0.560
37	0.679	0.671	0.665	0.656	0.646	0.638	0.630	0.623	0.617	0.608	0.601	0.596	0.590	0.587	0.585	0.582	0.581	0.580	0.579
38	0.713	0.704	0.698	0.689	0.678	0.670	0.661	0.653	0.647	0.638	0.630	0.626	0.619	0.616	0.614	0.611	0.610	0.609	0.608
39	0.738	0.728	0.722	0.713	0.702	0.693	0.684	0.676	0.670	0.660	0.652	0.647	0.641	0.638	0.635	0.632	0.631	0.629	0.628
40	0.758	0.749	0.743	0.733	0.721	0.712	0.703	0.695	0.688	0.678	0.670	0.665	0.659	0.656	0.653	0.650	0.648	0.647	0.646
41	0.783	0.773	0.767	0.757	0.745	0.736	0.726	0.718	0.711	0.701	0.693	0.688	0.681	0.677	0.675	0.671	0.670	0.668	0.667
42	0.800	0.790	0.784	0.773	0.761	0.752	0.742	0.733	0.726	0.716	0.707	0.702	0.695	0.691	0.689	0.685	0.684	0.682	0.681
43	0.818	0.808	0.801	0.791	0.779	0.769	0.759	0.750	0.743	0.732	0.723	0.718	0.711	0.707	0.704	0.701	0.699	0.698	0.697
44	0.844	0.833	0.827	0.816	0.803	0.793	0.783	0.774	0.766	0.755	0.746	0.741	0.733	0.730	0.727	0.723	0.721	0.720	0.719
45	0.872	0.861	0.854	0.843	0.830	0.820	0.809	0.799	0.792	0.781	0.771	0.765	0.758	0.754	0.751	0.747	0.745	0.744	0.743
46	0.891	0.879	0.872	0.861	0.848	0.837	0.826	0.817	0.809	0.797	0.788	0.782	0.774	0.770	0.767	0.763	0.761	0.760	0.759
47	0.916	0.904	0.897	0.885	0.872	0.861	0.849	0.840	0.832	0.820	0.810	0.804	0.796	0.792	0.788	0.785	0.783	0.781	0.780
48	0.933	0.921	0.914	0.902	0.888	0.877	0.865	0.855	0.847	0.835	0.825	0.819	0.811	0.806	0.803	0.799	0.797	0.796	0.794
49	0.962	0.950	0.942	0.930	0.916	0.904	0.892	0.882	0.874	0.861	0.851	0.844	0.836	0.831	0.828	0.824	0.822	0.820	0.819
50	0.983	0.970	0.963	0.950	0.935	0.924	0.911	0.901	0.893	0.880	0.869	0.862	0.854	0.849	0.846	0.842	0.839	0.838	0.837

Table 15. Estimated potential change in harvest and projected harvest (number of fish) associated under a reverse slot limits ranging with a 1-fish bag limit combined with 0 – 17 Wednesday closures during May through September of 2020 or a Wednesday closure for entire year with an annual limit of 3 halibut.

Wednesday closure – 3-fish annual limit

Number of Closed Wednesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)
0		-6.5%	64,274
1	July 29	-7.7%	63,467
2	July 29 - August 05	-8.4%	62,961
3	July 22 - August 05	-9.6%	62,105
4	July 15 - August 05	-11.0%	61,163
5	July 15 - August 12	-12.1%	60,418
6	July 08 - August 12	-13.3%	59,620
7	July 01 - August 12	-14.3%	58,920
8	July 01 - August 19	-15.1%	58,382
9	June 24 - August 19	-16.3%	57,556
10	June 17 - August 19	-17.3%	56,879
11	June 17 - August 26	-17.8%	56,485
12	June 10 - August 26	-18.6%	55,922
13	June 03 - August 26	-19.0%	55,667
14	June 03 - September 02	-19.3%	55,445
15	May 27 - September 02	-19.7%	55,197
16	May 20 - September 02	-19.9%	55,070
17	May 20 - September 09	-20.0%	54,974
48 (all season)	February 01 - December 31	-20.1%	54,892

Table 16. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays closed throughout the season, or a Wednesday closure for the entire year with an annual limit of 3 halibut. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Wednesday closure – 3-fish annual limit

Lower Limit (in)	Number of Wednesday Closures																		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
35	0.590	0.583	0.578	0.570	0.561	0.554	0.547	0.541	0.536	0.528	0.522	0.518	0.513	0.510	0.508	0.506	0.505	0.504	0.503
36	0.626	0.618	0.613	0.605	0.596	0.588	0.580	0.574	0.568	0.560	0.553	0.550	0.544	0.541	0.539	0.537	0.535	0.534	0.534
37	0.647	0.639	0.634	0.625	0.616	0.608	0.600	0.593	0.588	0.579	0.572	0.568	0.562	0.560	0.557	0.555	0.553	0.552	0.552
38	0.679	0.670	0.665	0.656	0.646	0.638	0.630	0.622	0.617	0.608	0.600	0.596	0.590	0.587	0.585	0.582	0.581	0.580	0.579
39	0.702	0.693	0.688	0.679	0.668	0.660	0.651	0.644	0.638	0.629	0.621	0.617	0.610	0.608	0.605	0.602	0.601	0.600	0.599
40	0.722	0.713	0.707	0.698	0.687	0.679	0.670	0.662	0.656	0.646	0.639	0.634	0.628	0.625	0.622	0.619	0.618	0.616	0.615
41	0.746	0.737	0.731	0.721	0.710	0.701	0.692	0.684	0.677	0.668	0.660	0.655	0.648	0.645	0.643	0.639	0.638	0.637	0.636
42	0.762	0.752	0.746	0.736	0.725	0.716	0.706	0.698	0.692	0.682	0.674	0.669	0.662	0.659	0.656	0.653	0.651	0.650	0.649
43	0.779	0.769	0.763	0.753	0.741	0.732	0.722	0.714	0.707	0.697	0.689	0.684	0.677	0.674	0.671	0.668	0.666	0.665	0.664
44	0.804	0.793	0.787	0.777	0.765	0.755	0.745	0.737	0.730	0.719	0.711	0.706	0.698	0.695	0.692	0.689	0.687	0.686	0.685
45	0.831	0.820	0.813	0.803	0.790	0.781	0.770	0.761	0.754	0.743	0.734	0.729	0.722	0.718	0.715	0.712	0.710	0.709	0.708
46	0.848	0.837	0.831	0.820	0.807	0.797	0.787	0.778	0.770	0.759	0.750	0.745	0.737	0.734	0.731	0.727	0.725	0.724	0.723
47	0.872	0.861	0.854	0.843	0.830	0.820	0.809	0.800	0.792	0.781	0.771	0.766	0.758	0.754	0.751	0.747	0.746	0.744	0.743
48	0.889	0.877	0.870	0.859	0.846	0.835	0.824	0.815	0.807	0.796	0.786	0.780	0.772	0.768	0.765	0.761	0.760	0.758	0.757
49	0.916	0.905	0.897	0.885	0.872	0.861	0.850	0.840	0.832	0.820	0.810	0.804	0.796	0.792	0.789	0.785	0.783	0.781	0.780
50	0.936	0.924	0.917	0.905	0.891	0.880	0.868	0.858	0.850	0.838	0.827	0.821	0.813	0.809	0.806	0.802	0.800	0.798	0.797

Table 17. Estimated potential change in harvest and projected harvest (number of fish) associated under a reverse slot limits ranging with a 1-fish bag limit combined with 0 – 17 Sunday closures during May through September of 2020 or a Sunday closure for entire year with an annual limit of 4 halibut.

Sunday closure – 4-fish annual limit

Number of Closed Sundays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)
0		-1.8%	67,497
1	July 26	-2.9%	66,734
2	July 26 - August 02	-4.1%	65,926
3	July 19 - August 02	-5.4%	65,046
4	July 12 - August 02	-6.5%	64,278
5	July 12 - August 09	-7.6%	63,529
6	July 05 - August 09	-8.9%	62,652
7	June 28 - August 09	-9.8%	62,024
8	June 28 - August 16	-10.7%	61,356
9	June 21 - August 16	-11.7%	60,696
10	June 14 - August 16	-12.5%	60,141
11	June 14 - August 23	-13.2%	59,642
12	June 07 - August 23	-13.7%	59,315
13	May 31 - August 23	-14.2%	59,001
14	May 31 - August 30	-14.6%	58,672
15	May 24 - August 30	-14.8%	58,594
16	May 17 - August 30	-14.9%	58,505
17	May 17 - September 06	-15.0%	58,409
48 (all season)	February 01 - December 31	-15.1%	58,356

Table 18. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Sundays closed throughout the season, or a Sunday closure for the entire year with an annual limit of 4 halibut. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Sunday closure – 4-fish annual limit

Lower Limit (in)	Number of Sunday Closures																	All	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		17
35	0.620	0.613	0.606	0.598	0.591	0.584	0.576	0.571	0.565	0.559	0.554	0.549	0.546	0.543	0.540	0.539	0.539	0.538	0.537
36	0.657	0.650	0.642	0.634	0.627	0.619	0.611	0.605	0.599	0.592	0.587	0.582	0.579	0.576	0.573	0.572	0.571	0.570	0.570
37	0.679	0.672	0.664	0.655	0.648	0.640	0.632	0.626	0.619	0.613	0.607	0.602	0.599	0.596	0.592	0.591	0.590	0.589	0.589
38	0.713	0.705	0.697	0.688	0.680	0.672	0.663	0.657	0.650	0.643	0.637	0.632	0.629	0.625	0.622	0.621	0.620	0.619	0.618
39	0.738	0.729	0.721	0.711	0.703	0.695	0.686	0.679	0.672	0.665	0.659	0.654	0.650	0.647	0.643	0.642	0.641	0.640	0.639
40	0.758	0.750	0.741	0.731	0.723	0.715	0.705	0.699	0.691	0.684	0.678	0.672	0.669	0.665	0.661	0.660	0.659	0.658	0.657
41	0.783	0.775	0.766	0.756	0.747	0.739	0.729	0.722	0.714	0.707	0.700	0.695	0.691	0.687	0.683	0.682	0.681	0.680	0.679
42	0.800	0.791	0.782	0.772	0.763	0.754	0.745	0.737	0.730	0.722	0.716	0.710	0.706	0.702	0.698	0.697	0.696	0.695	0.694
43	0.818	0.809	0.800	0.790	0.781	0.772	0.762	0.754	0.747	0.739	0.732	0.726	0.722	0.718	0.714	0.713	0.712	0.711	0.710
44	0.844	0.835	0.825	0.815	0.805	0.796	0.786	0.778	0.770	0.762	0.755	0.749	0.745	0.741	0.737	0.736	0.734	0.733	0.732
45	0.872	0.863	0.853	0.842	0.832	0.823	0.812	0.804	0.796	0.788	0.781	0.774	0.770	0.766	0.761	0.760	0.759	0.758	0.757
46	0.891	0.881	0.871	0.860	0.850	0.840	0.830	0.822	0.813	0.805	0.797	0.791	0.787	0.782	0.778	0.777	0.775	0.774	0.773
47	0.916	0.906	0.895	0.884	0.874	0.864	0.853	0.845	0.836	0.828	0.820	0.814	0.809	0.805	0.800	0.799	0.797	0.796	0.795
48	0.933	0.923	0.912	0.901	0.890	0.880	0.869	0.861	0.852	0.843	0.835	0.829	0.824	0.820	0.815	0.814	0.812	0.811	0.810
49	0.962	0.952	0.941	0.929	0.918	0.908	0.896	0.888	0.879	0.870	0.862	0.855	0.850	0.845	0.841	0.839	0.838	0.836	0.835
50	0.983	0.972	0.961	0.949	0.938	0.928	0.916	0.907	0.898	0.889	0.881	0.874	0.869	0.864	0.859	0.858	0.856	0.855	0.854

Table 19. Estimated potential change in harvest and projected harvest (number of fish) associated under a reverse slot limits ranging with a 1-fish bag limit combined with 0 – 17 Sunday closures during May through September of 2020 or a Sunday closure for entire year with an annual limit of 3 halibut.

Sunday closure – 3-fish annual limit

Number of Closed Sundays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)
0		-6.5%	64,274
1	July 26	-7.5%	63,549
2	July 26 - August 02	-8.7%	62,775
3	July 19 - August 02	-9.9%	61,938
4	July 12 - August 02	-11.0%	61,210
5	July 12 - August 09	-12.0%	60,494
6	July 05 - August 09	-13.2%	59,659
7	June 28 - August 09	-14.1%	59,060
8	June 28 - August 16	-15.0%	58,426
9	June 21 - August 16	-15.9%	57,798
10	June 14 - August 16	-16.7%	57,268
11	June 14 - August 23	-17.4%	56,790
12	June 07 - August 23	-17.8%	56,481
13	May 31 - August 23	-18.3%	56,178
14	May 31 - August 30	-18.7%	55,864
15	May 24 - August 30	-18.8%	55,789
16	May 17 - August 30	-19.0%	55,705
17	May 17 - September 06	-19.1%	55,611
48 (all season)	February 01 - December 31	-19.2%	55,561

Table 20. Projected charter removals (Mlb) for Area 2C in 2020 under reverse slot limits with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches with 1 – 17 Sundays closed throughout the season, or a Sunday closure for the entire year with an annual limit of 3 halibut. Light shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the allocation of 0.60 Mlb under the reference coastwide TCEY scenario. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 0.80 Mlb allocation associated with the status quo coastwide TCEY scenario. All values in the table include corrections for 2015-2019 errors in estimation of average weight and inflation factors for release mortality by weight.

Sunday closure – 3-fish annual limit

Lower Limit (in)	Number of Sunday Closures																		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
35	0.590	0.584	0.577	0.569	0.563	0.556	0.549	0.543	0.538	0.532	0.527	0.523	0.520	0.517	0.514	0.514	0.513	0.512	0.511
36	0.626	0.619	0.612	0.604	0.597	0.590	0.582	0.576	0.570	0.564	0.559	0.554	0.551	0.548	0.545	0.545	0.544	0.543	0.542
37	0.647	0.640	0.632	0.624	0.617	0.610	0.602	0.596	0.590	0.583	0.578	0.573	0.570	0.567	0.564	0.563	0.562	0.561	0.561
38	0.679	0.672	0.664	0.655	0.648	0.640	0.632	0.625	0.619	0.612	0.607	0.602	0.599	0.595	0.592	0.591	0.590	0.589	0.589
39	0.702	0.695	0.686	0.677	0.670	0.662	0.653	0.647	0.640	0.633	0.628	0.622	0.619	0.616	0.612	0.611	0.610	0.609	0.609
40	0.722	0.714	0.706	0.697	0.689	0.681	0.672	0.665	0.658	0.651	0.645	0.640	0.637	0.633	0.630	0.629	0.628	0.627	0.626
41	0.746	0.738	0.729	0.720	0.712	0.703	0.694	0.687	0.680	0.673	0.667	0.662	0.658	0.654	0.651	0.650	0.649	0.647	0.647
42	0.762	0.753	0.744	0.735	0.727	0.718	0.709	0.702	0.695	0.687	0.681	0.676	0.672	0.668	0.665	0.664	0.663	0.661	0.661
43	0.779	0.771	0.761	0.752	0.743	0.735	0.725	0.718	0.711	0.703	0.697	0.691	0.687	0.684	0.680	0.679	0.678	0.676	0.676
44	0.804	0.795	0.786	0.775	0.767	0.758	0.748	0.741	0.733	0.726	0.719	0.713	0.709	0.705	0.701	0.700	0.699	0.698	0.697
45	0.831	0.821	0.812	0.801	0.792	0.783	0.773	0.766	0.758	0.750	0.743	0.737	0.733	0.729	0.725	0.724	0.723	0.721	0.720
46	0.848	0.839	0.829	0.819	0.809	0.800	0.790	0.782	0.774	0.766	0.759	0.753	0.749	0.745	0.740	0.739	0.738	0.737	0.736
47	0.872	0.863	0.853	0.842	0.832	0.823	0.813	0.805	0.796	0.788	0.781	0.775	0.770	0.766	0.762	0.760	0.759	0.758	0.757
48	0.889	0.879	0.869	0.858	0.848	0.838	0.828	0.820	0.811	0.803	0.796	0.789	0.785	0.780	0.776	0.775	0.773	0.772	0.771
49	0.916	0.906	0.896	0.884	0.875	0.865	0.854	0.845	0.837	0.828	0.820	0.814	0.809	0.805	0.800	0.799	0.798	0.796	0.795
50	0.936	0.926	0.915	0.903	0.893	0.883	0.872	0.864	0.855	0.846	0.838	0.832	0.827	0.822	0.818	0.816	0.815	0.814	0.813

Table 21. Projected effort (angler-trips), halibut harvest per unit effort (HPUE), and harvest (numbers of halibut) for Area 3A in 2020 under status quo regulations, with associated standard errors. Status quo regulations include a two-fish bag limit with a maximum size limit of 28" on one of the fish, permit and vessel trip limits, an annual limit of four fish per year, no retention of halibut on Wednesdays, and no retention on five Tuesdays in July and August.

Subarea	Effort	Std Error	HPUE	Std Error	Harvest	Std Error
CCI	15,401	377	1.67	0.03	25,773	817
EPWS	4,626	302	1.04	0.11	4,811	580
GlacB	2,158	281	0.74	0.18	1,596	430
Yak	4,156	301	0.96	0.15	3,992	667
LCI	33,683	857	1.60	0.04	53,872	1,919
NGulf	31,901	1,099	0.94	0.09	30,095	3,092
Kod	9,856	400	0.72	0.09	7,058	931
WPWS	5,092	379	1.03	0.12	5,256	744
Area 3A	106,872	1,554	1.24	NA	132,453	4,037

Table 22. Estimated potential change in harvest and projected removals associated with status quo management measures combined with 0 – 13 Tuesday closures during June through August of 2020 and Tuesdays closed for the entire year. Status quo management measures include one fish any size, 28-inch maximum on the second fish, four fish annual limit, vessel and permit trip limits, Wednesday closure, and Tuesdays closed five days. Projections include corrections for errors in estimation of average weight and an additional 1.1% release mortality by weight. All values are above allocations based on the reference and status quo coastwide TCEY scenarios.

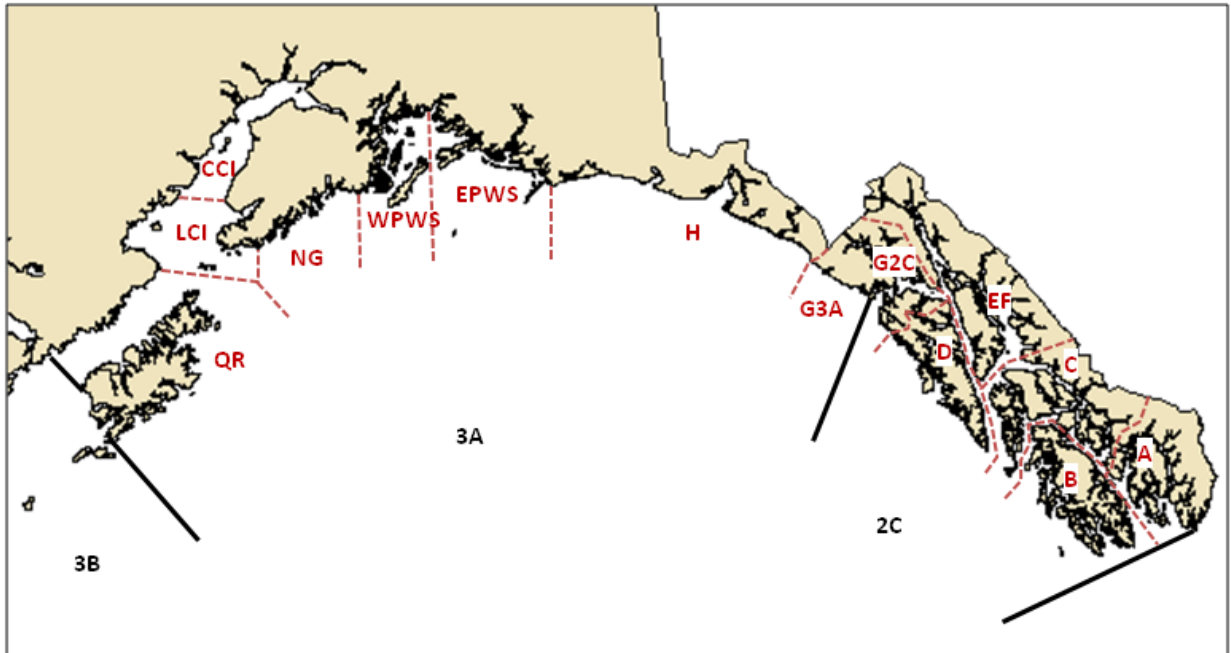
Number of Closed Tuesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)	Projected Removals (Mlb)
0		7.5%	142,407	2.083
1	July 28	6.1%	140,593	2.057
2	July 28 - August 04	4.5%	138,359	2.023
3	July 21 - August 04	3.1%	136,591	1.995
4	July 14 - August 04	1.6%	134,563	1.967
5 (status quo)	July 14 - August 11	0.0%	132,453	1.938
6	July 07 - August 11	-1.6%	130,399	1.909
7	June 30 - August 11	-2.9%	128,616	1.883
8	June 30 - August 18	-4.0%	127,179	1.861
9	June 23 - August 18	-4.9%	125,953	1.844
10	June 16 - August 18	-6.0%	124,505	1.821
11	June 16 - August 25	-6.2%	124,226	1.817
12	June 09 - August 25	-7.2%	122,981	1.798
13	June 02 - August 25	-7.6%	122,370	1.791
48 (all season)	February 01 - December 31	-9.5%	119,851	1.754

Table 23. Estimated potential change in harvest and projected removals associated with no Tuesday closures and with 0 – 13 Wednesday closures during June through August of 2020 and Wednesdays closed for the entire year. All other management measures are status quo. Status quo management measures include one fish any size, 28-inch maximum on the second fish, four fish annual limit, vessel and permit trip limits, Wednesday closure, and Tuesdays closed five days. Projections include corrections for errors in estimation of average weight and an additional 1.1% release mortality by weight. All values are above the allocations based on reference and status quo coastwide TCEY scenarios.

Number of Closed Wednesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)	Projected Removals (Mlb)
0		26.8%	167,980	2.461
1	July 29	25.0%	165,623	2.426
2	July 29 - August 05	24.3%	164,586	2.411
3	July 22 - August 05	23.5%	163,576	2.396
4	July 15 - August 05	22.7%	162,566	2.379
5	July 15 - August 12	21.7%	161,253	2.360
6	July 08 - August 12	20.4%	159,516	2.335
7	July 01 - August 12	19.2%	157,943	2.310
8	July 01 - August 19	17.8%	155,975	2.280
9	June 24 - August 19	16.0%	153,700	2.245
10	June 17 - August 19	15.1%	152,393	2.228
11	June 17 - August 26	13.2%	149,908	2.191
12	June 10 - August 26	11.3%	147,393	2.157
13	June 03 - August 26	9.5%	145,102	2.123
48 (all season)	February 01 - December 31	7.5%	142,407	2.083

Table 24. Violations of the Annual Limit in Area 3A. Annual limits were implemented in Area 3A in 2015 (5 fish) and 2016 – 2019 (4 fish; 2019 data unavailable at time of report writing).

Year	Licensed Anglers	Anglers that Exceeded Annual Limit	Percent of Anglers Exceeded Annual Limit	Total Halibut Kept by Licensed Anglers	"Excess" Halibut Harvested	Excess Halibut Portion of Harvest
2015	68,775	659	1.0%	154,468	875	0.6%
2016	71,192	352	0.5%	148,854	516	0.3%
2017	67,039	162	0.2%	134,325	214	0.2%
2018	65,587	201	0.3%	128,830	296	0.2%




 - Subareas for halibut harvest accounting

Figure 1. Subareas of IPHC Areas 2C and 3A used for analysis and reporting. A – Ketchikan; B - Prince of Wales (Craig, Klawock); C - Petersburg, Wrangell; D – Sitka; EF - Juneau, Haines, Skagway; G2C - Glacier Bay, Elfin Cove (2C areas); G3A - Glacier Bay, Elfin Cove (3A Areas); H – Yakutat; EPWS - Eastern Prince William Sound (Valdez, Cordova); WPWS - Western Prince William Sound (Whittier); NG - North Gulf (Seward); CCI - Central Cook Inlet (Deep Creek, Anchor Point); LCI - Lower Cook Inlet (Homer); QR – Kodiak.

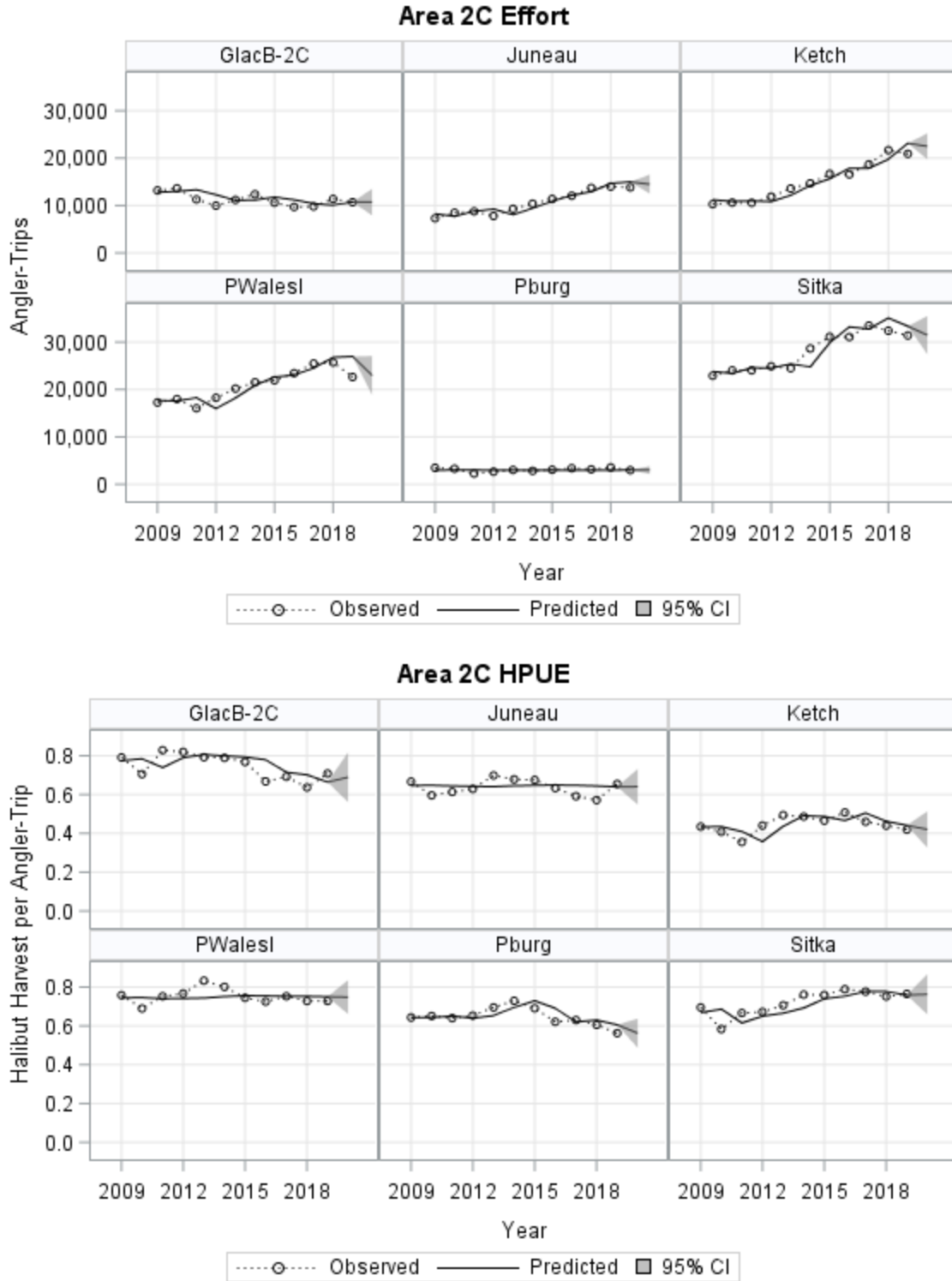


Figure 2. Time series of charter effort (upper) and HPUE (lower) for subareas of Area 2C with predicted values and forecasts for 2020. Shaded bands indicate 95% confidence intervals for the 2020 forecasts. (Source: ADF&G charter logbook)

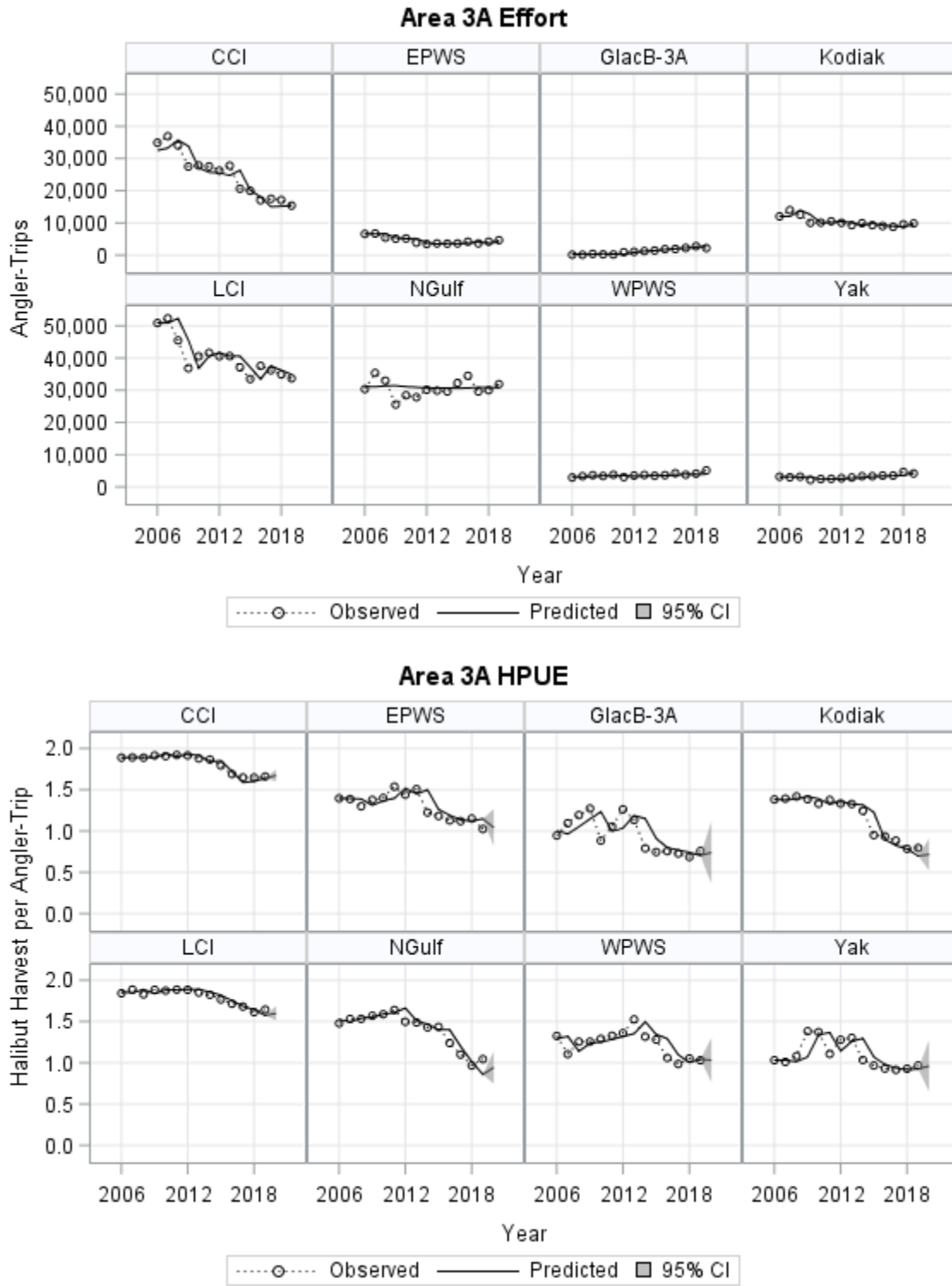


Figure 3. Time series of charter effort (upper) and HPUE (lower) by subarea of Area 3A, with predicted values and 2020 forecasts of HPUE only. No time series forecasts were made for effort (see Section 2.3). Shaded bands indicate 95% confidence intervals for the 2020 HPUE forecasts. (Source: ADF&G charter logbook)

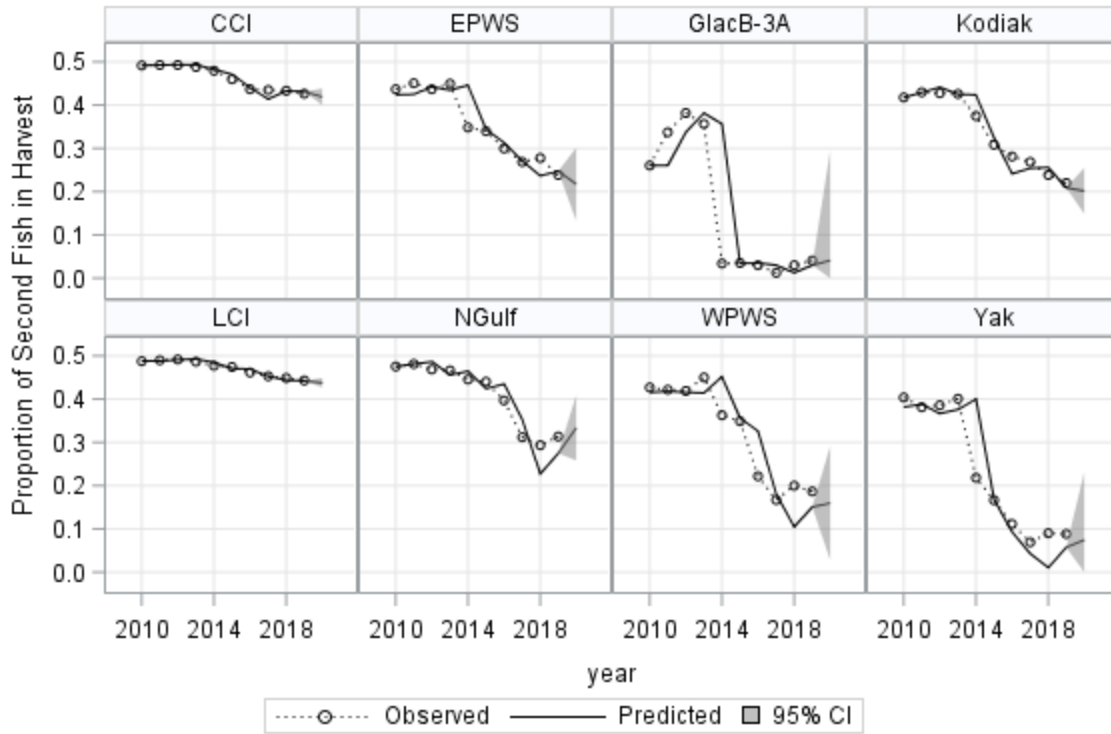


Figure 4. Time series of the proportion of second fish retained by anglers in each subarea of Area 3A, 2010-2019, with predicted values and forecasts for 2020. Shaded bands indicate 95% confidence intervals for the 2020 forecasts. (Source: ADF&G charter logbook)

Sunday closures dates for 2020:

No. Closed	May			June				July				August					Sept
	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	6
1											X						
2											X	X					
3										X	X	X					
4									X	X	X	X					
5									X	X	X	X	X				
6								X	X	X	X	X	X				
7							X	X	X	X	X	X	X				
8						X	X	X	X	X	X	X	X	X			
9					X	X	X	X	X	X	X	X	X	X			
10				X	X	X	X	X	X	X	X	X	X	X			
11				X	X	X	X	X	X	X	X	X	X	X	X		
12				X	X	X	X	X	X	X	X	X	X	X	X		
13			X	X	X	X	X	X	X	X	X	X	X	X	X		
14		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
15		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Wednesday closures dates for 2020:

No. Closed	May		June				July					August				September	
	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9
1											X						
2											X	X					
3										X	X	X					
4									X	X	X	X					
5									X	X	X	X	X				
6								X	X	X	X	X	X				
7							X	X	X	X	X	X	X				
8							X	X	X	X	X	X	X	X			
9						X	X	X	X	X	X	X	X	X			
10					X	X	X	X	X	X	X	X	X	X			
11					X	X	X	X	X	X	X	X	X	X	X		
12				X	X	X	X	X	X	X	X	X	X	X	X		
13			X	X	X	X	X	X	X	X	X	X	X	X	X		
14			X	X	X	X	X	X	X	X	X	X	X	X	X	X	
15		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Figure 5. Date ranges for day of the week closures for 2020 in Area 2C. These closures assume a one fish bag limit, a reverse slot limit with lower limits of the protected slot ranging from 35 to 50 inches and an upper limit of 80 inches, with 1 – 17 Sundays or Wednesdays closed throughout the season, or a Sunday or Wednesday closure for the entire year, with additional options for annual limits of 3 or 4 fish. Associated harvest and yield can be found in Tables 9 - 20.

Tuesday closure dates for 2020:

No. Closed	June					July				August			
	2	9	16	23	30	7	14	21	28	4	11	18	25
1									X				
2									X	X			
3								X	X	X			
4							X	X	X	X			
5							X	X	X	X	X		
5							X	X	X	X	X		
6						X	X	X	X	X	X		
7					X	X	X	X	X	X	X		
8				X	X	X	X	X	X	X	X	X	
9			X	X	X	X	X	X	X	X	X	X	
10		X	X	X	X	X	X	X	X	X	X	X	
11		X	X	X	X	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X	X

Wednesday closure dates for 2020:

No. Closed	June				July					August			
	3	10	17	24	1	8	15	22	29	5	12	19	26
1									X				
2									X	X			
3								X	X	X			
4							X	X	X	X			
5							X	X	X	X	X		
6					X	X	X	X	X	X	X		
7					X	X	X	X	X	X	X		
8					X	X	X	X	X	X	X	X	
9				X	X	X	X	X	X	X	X	X	
10		X	X	X	X	X	X	X	X	X	X	X	
11		X	X	X	X	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X	X	X	X	X	X

Figure 6. Date ranges for day of the week closures for 2020 in Area 3A. These closures assume a two fish daily bag limit, one fish of any size and one less than or equal to 28 inches, a four fish annual limit, one trip per vessel per day, and one trip per charter halibut permit per day. Tuesday closures assume that all Wednesdays are closed. Wednesday closures assume all Tuesdays are open. Associated harvests can be found in Tables 22 & 23.

APPENDIX I

Charter Halibut Management Process

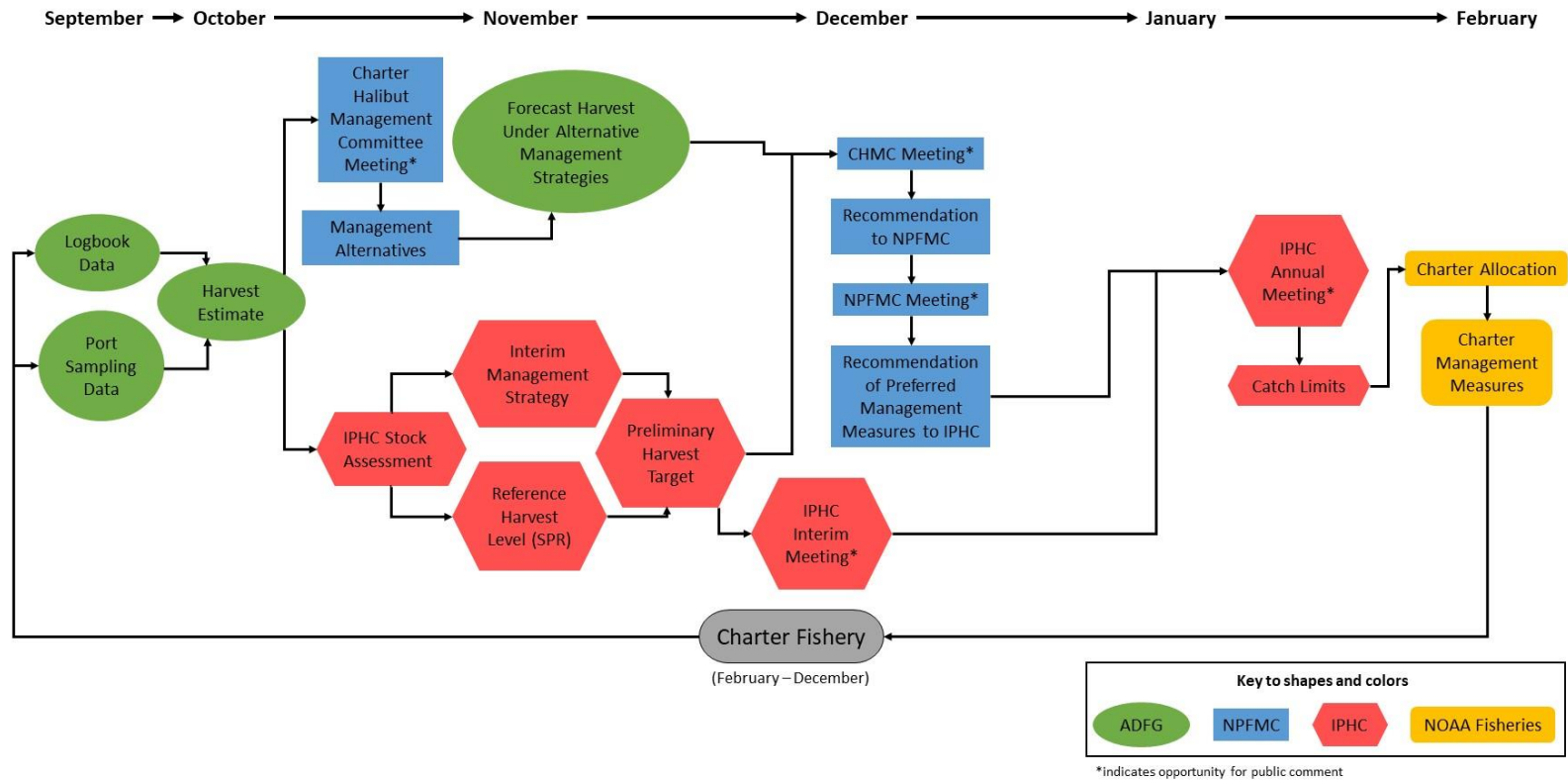


Figure A1. Outline of charter halibut management process and timeline.