Analysis of Management Options for the Area 2C and 3A Charter Halibut Fisheries for 2021

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 3A[1]. 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 release (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 (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 27, 2020, to develop alternative management measures for analysis by the ADF&G for the 2021 season. ADF&G staff provided preliminary estimates of charter harvest and release mortality for the 2020 season to committee members prior to the meeting. The preliminary estimates were based on logbook data for trips through August 31, 2020 and will be finalized once all logbook data are entered and edited.

In Area 2C, the 2020 preliminary harvest estimate for the charter fishery was 37,415 halibut with an average weight of 12.75 lb (Webster et al. 2020). The Area 2C preliminary estimate of charter removals was 0.500 million pounds (Mlb), including an estimated 0.022 Mlb of release mortality. The preliminary estimate of charter removals was 36.0% less than the 0.780 Mlb allocation. Charter regulations in 2C through June 14 included a one-fish bag limit and a reverse slot limit allowing for harvest of fish less than or equal to 40 inches or greater than or equal to 80 inches (U40O80). An Emergency Action was granted to the charter sector (in 2C and 3A) in 2020 due to the anticipated effects of the COVID-19 pandemic and associated mandates; this action allowed for an in-season change in regulations effective June 15th. Regulations in 2C from June 15 through the end of the season included a one-fish bag limit and a reverse slot limit allowing for harvest of fish less than or equal to 45 inches or greater than or equal to 80 inches (U45O80).

In Area 3A, an estimated 108,379 halibut were harvested with an average weight of 14.60 lb (Webster et al. 2020). The preliminary estimate of charter removals for Area 3A was 1.597 Mlb, including 0.014 Mlb of release mortality. The preliminary estimate was 6.6% less than the allocation of 1.710 Mlb. Charter regulations in 3A through June 14 included a two-fish bag limit of which one fish could be any size and the second must be less than or equal to 26 inches, no harvest of halibut on Tuesdays or Wednesdays, a four-fish annual limit, a limit of one trip per vessel per day, and a limit of one trip per Charter Halibut Permit per day. Regulations in 3A from June 15 through the end of the season included a two-fish bag

[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

limit of which one fish could be any size and the second must be less than or equal to 32 inches, all days open to harvest of halibut no annual limit, a limit of one trip per vessel per day, and a limit of one trip per Charter Halibut Permit per day.

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 2021:

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

1) Status quo (reverse slot limit allowing harvest of a fish less than or equal to 45 inches or greater than or equal to 80 inches).
2) Additional reverse slot limits, with lower limits of the protected slot ranging from 40 to 50 inches and upper limits ranging from 50 to 80 inches.
3) One fish any size annually, and a reverse slot for all other harvest with lower limits of the protected slot ranging from 40 to 50 inches and an upper limit of 80 inches and annual limits ranging from 2 – 5 fish or no limit.
4) One fish any size through June 15, June 30, or July 15 and a reverse slot for the balance of the season with lower limits of the protected slot ranging from 40 to 45 inches and an upper limit of 80 inches.
5) Reverse slot limit with a lower limit of the protected slot of 45 inches and an upper limit of 80 inches prior to July 1, July 7, July 15, July 22, or August 1, and a reverse slot for the balance of the season with a lower limit of 40 inches and with an upper limit of 80 inches.

Area 3A (all options include a two-fish bag limit with a maximum size limit on one fish, one trip per vessel per day, and one trip per permit per day):

1) Status quo (two-fish bag limit with a maximum size limit of 32 inches on one fish).
2) Status quo with change to maximum size limits of one fish ranging from 26 inches to 33 inches.
3) Status quo with Annual limits (2 – 6 fish).
4) Status quo with addition of closed Wednesdays (1 – 13, all Wednesdays closed).
5) Status quo with all Wednesdays closed and addition of closed Tuesdays (1 – 13, all Tuesdays closed).
6) Status quo with a combination of closed days and annual limits.
7) Status quo with a combination of annual limits and changes to size limit of one fish.
8) Status quo with a combination of closed days and changes to size limit of one fish.
9) Status quo with a combination of closed days, annual limits, and changes to size limit of one fish.

This analysis provides information to stakeholders and the Council to assist them in selecting management measures 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 January 2021. The charter allocations will not be known when the Council is expected to make its recommendations in December 2020. 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. 2020) 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 IPHC's Interim Meeting on November 18, 2020, the IPHC secretariat presented results from the 2020 stock assessment, including the Regulatory Area Total Constant Exploitation Yield (TCEY)s and associated sector allocations for 2021 under the IPHC's interim management procedure. Results presented here are within the context of two possible scenarios. The first scenario is consistent with the interim management procedure and uses a TCEY at the reference level ($SPR_{43\%}$) of 39.00 Mlb; 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 2020 IPHC annual meeting; and the Space Time Model proportional distribution of O32 biomass for all areas in Alaska. The second scenario uses the 2020 (status quo) allocations.

	Charter Allocation (Mlb)	
Regulatory Area	Reference TCEY	2020 Allocation
2C	0.65	0.78
3A	1.93	1.71

This analysis projects total charter fishery removals (harvest plus release mortality) under the status quo charter fishery regulations at the end of the 2020 season in each Regulatory Area. The analysis does not attempt to integrate any future impacts of the COVID-19 pandemic on the charter fishery in 2021. As shown below, the projected charter removal for Area 2C in 2021 under status quo measures is 1.03 Mlb and the projection under the original 2020 regulations is 0.89 Mlb; both projections are above the allocation based on the IPHC's interim management strategy and above the status quo allocation. The projected removal for Area 3A under status quo measures is 2.92 Mlb; this is above both the reference and status quo allocations. The projected 3A removal under the original 2020 regulations is 1.75 Mlb; this is between the allocations based on the reference TCEY and the status quo limit.

Area	Projected Status Quo Regulation Removals (Mlb)	Projected early 2020 Regulation Removals
2C	1.03	0.89
3A	2.92	1.75

Appendix II in the report includes removal estimates under status quo management measures with a range of reductions in charter angler effort to address the uncertainty in 2021 around continued impacts from the COVID-19 pandemic. Two scenarios use a constant effort reduction across all subareas of 10% and 40%, respectively. These numbers were requested by the Charter Halibut Management Committee and do not represent any knowledge on behalf of ADF&G regarding effects of the COVID-19 pandemic in 2021. A third scenario estimates removals under the proportional difference between 2020 effort forecasts and estimated 2020 effort based on logbooks. This scenario includes subarea specific reductions in effort. For 3A, the calculated numbers assume that opening days to harvest opportunity would have increased effort and not shifted effort among days of the week (i.e. this effort was eliminated when days were closed in the past) as was assumed in the analysis; however, it is unknown whether an increase in effort would have occurred in the absence of the COVID-19 pandemic.

For consistency with analyses reported in recent years, the analyses included in this report generally follow previously reported methods (Meyer and Powers 2017; Webster and Powers 2018, 2019, 2020). 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 the charter allocation for each area. Where applicable, results reference candidate measures that result in projected charter removals within the two allocation scenarios. However, the IPHC is not limited to these options when setting TCEYs. The Council recommendation for each area should

include contingencies for higher or lower allocations 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" refers to halibut that die as a result of stress or injury from being caught and then released 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 2021 is calculated as:

$$r = 1.2 - 0.0033 * (Reverse\ Slot\ Limit)$$

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

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

and for 2021 is 1.014.

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

Time series methods are used to forecast effort in 2C and harvest per unit effort (HPUE) in both areas. 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, permitting that day was open to harvest of halibut. Forecasts are inherently uncertain because they rely only on past data, which are not necessarily indicative of future trends. Time series forecasts can't be used in all instances because they assume that the same underlying processes are in place as those that generated the historical data. 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™[2] software. Simple exponential models have a single parameter representing the level of the estimate 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. Generally, both simple and double exponential models 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 2021, attempts were made in both areas to forecast harvest under "normal" (non-pandemic) circumstances. Depending on the data type, this required making assumptions about aspects of the 2020 removals and whether they were likely related to or independent of the COVID-19 pandemic. If unrelated, those data were incorporated into forecasts, whereas data heavily impacted by the COVID-19 pandemic (e.g., effort) were omitted from analyses.

For Area 2C, the 2021 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 2021 effort 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 in 2C 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. Because charter angler effort was affected by the COVID-10 pandemic, 2020 effort data were omitted and the 2021 effort forecast used a 2-year time step, in contrast to the single year time step used in past projections. Conversely, HPUE may have been impacted by both the COVID-19 pandemic (e.g., changes in fishing pressure, trip duration, and vessel capacity) and non-pandemic (e.g., changes to size limits, non-halibut fishing regulations) related circumstances; therefore, simple exponential forecasts were generated for HPUE using logbook data for 2009-2020 (Table 3, Figure 2). 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.

In Area 3A 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 (Thursday) 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 Tuesdays were closed, respectively. 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 estimate of effort in 3A was assumed as the status quo effort level for 2021. This assumes effort in 2019 realized under 2019 regulations would be the same level of effort in 2021 under those same regulations, with effort in 2021 then adjusted to status quo regulations.

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

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 areawide 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). In 2020, the proportion of second fish in the harvest increased in all 3A ports. This may be related to the increased size limit or removal of the annual limit though causation cannot be ascertained with only a single data point. Considering these trends, exponential smoothing models were used to forecast HPUE for 2021 to capture the declining trend prior to 2020 while incorporating increases observed in 2020.

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. In 2018, the IPHC requested that all sizes of discards be included in the directed commercial fishery allocations (prior to 2018 only fish greater than or equal to 26 inches were included). While the CSP is vague with regards to sizes of discards, release mortalityof all sizes of halibut were included in projected removals for consistency with the commercial sector and the intent of the IPHC. For reference, the final estimates of release mortality of fish under 26 inches in 2019 was 0.002 Mlb in 2C and 0.006 Mlb in 3A. All sizes of release mortality have been estimated for 2013-2020 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 IPHC[3].

The numbers and average weight of released fish are expected to vary with the types of size limits or bag limits. 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 more of the released fish would be large. 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 likely increase as annual limits are made more restrictive.

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 is used for projections. Under status quo regulations, the predicted 2021 ratio of release mortality to harvested halibut is 0.052.

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 0.022 in 2014 to 0.009 in 2020. For 2020 projections, the 8-year average of 0.014 was applied to yield to account for release mortality under the status quo management measures and alternatives.

[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 2020 report is available under the "ADF&G Guided Sport Data" section at: https://www.npfmc.org/halibut-charter-management/

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 U45O80 reverse slot size limit. There were upward trends in angler effort in three of the six subareas of Area 2C in recent years (through 2019) and models predict continued increases in those subareas for 2021 (Table 3, Figure 2). Recent trends in HPUE were variable across subareas with little overall trend; however, HPUE increased in all areas in 2020. As such, model results predict increases in HPUE in all areas but to a lesser degree than was observed in 2020. The 2021 status quo effort forecast for Area 2C is 112,553 angler-trips, the weighted average HPUE forecast is 0.70 halibut per angler-trip, and the harvest forecast is 79,087 halibut, with a 95% margin of error (±2 standard errors) of ± 8,783 fish (Table 5). This is an increase from the final harvest estimate for 2019 of 70,600 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 methods used to analyze management measures for 2014-2020. 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 2012-2020 were compared to the 2010 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 predicted average weights for each subarea. The correction factors were based on the average ratio of the predicted and observed average weights from 2015 – 2020, all years with the same upper slot limit of 80 inches and also the most recent 6 years, and ranged from 0.73 to 1.04 among subareas. To test the correction factors, the bias correction was applied to the final harvest estimates for 2019 and preliminary harvest estimates for 2020.

Total charter removals were projected for 2021 under a range of reverse slot limits with lower limits ranging from 40 to 50 inches and upper limits ranging from 50 to 80 inches. 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.

3.2.2 Results

The projected charter removal under the status quo size limit of U45O80 is 1.026 Mlb (Table 6). Projections ranged from 0.893 to 1.709 Mlb. None of the combinations of size limits were below the reference allocation or the 2020 allocation.

3.3 One Fish of Any Size Annually, Reverse Slot Limits and Various Annual Limits for Subsequent Fish

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 2019 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 2011-2019. 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 harvested 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 1.5% for annual limits from 1 to 5 fish; therefore, the underestimation caused by anglers fishing multiple areas was considered negligible and may provide a slightly conservative estimate.

Harvests were projected under annual limits ranging from 1 to 5 halibut in Area 2C. The areawide estimated harvest reductions associated with annual limits range from about 48% under an annual limit of one fish to less than 1% under an annual limit of five fish (Table 7).

Total charter removals were projected for one fish of any size annually, plus a range of overall annual limits of 2 to 5 fish (all sizes combined) or no annual limit, and a reverse slot limit for all subsequent fish (after one any size) with lower limits ranging from 40 to 50 inches and an upper limit of 80 inches. Mean weight of fish with a reverse slot limit followed the methods outlined above (Section 3.2.1). Two scenarios were included for the fish of any size. The low removal scenario applied the mean weight of all sizes of fish from 2010 to the fish of any size under a one fish annual limit. The high removal scenario applied the mean weight of fish above the lower limit of each reverse slot from 2010 to the proportion of annual harvest above that size in 2010. In both scenarios the number of halibut harvested by subarea was the same. The difference between the scenarios was consideration of the size of fish harvested. The low removal scenario mimics a situation where the size of the fish-of-any-size is not impacted by the reverse slot limit (i.e., no angler selectivity). The high harvest scenario mimics a situation where the reverse slot limit does impact size of the fish-of-any-size; as the lower slot limit increases there is less angler selectivity to harvest a large fish as the fish-of-any-size. The projected number of fish harvested annually above the reverse slot limit in each subarea could not exceed the harvest projection for a one fish annual

limit. All remaining projected harvest for an annual limit of one fish was assigned the mean weight of fish below that reverse slot limit in 2010.

All projections 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. The inflation factor for a fish of any size used the same formulaic approach, treating the size limit as U50O50. A single level of harvest is associated with each annual limit because it was assumed that the size limits by themselves have no effect on the number of fish harvested.

3.3.2 Results

The projected charter removal under the low removal scenario ranged from 1.116 Mlb for an annual limit of two fish (one fish of any size and a reverse slot limit of U40O80 on one fish) to 1.432 Mlb for one fish of any size and a reverse slot limit of U50O80 on all subsequent fish (with no annual limit of reverse slot limit harvested halibut; Table 8). The projected charter removal under the high removal scenario ranged from 1.481 Mlb for an annual limit of two fish (one fish of any size and a reverse slot limit of U40O80 on one fish) to 1.738 Mlb for one fish of any size and a reverse slot limit of U50O80 on all subsequent fish (with no annual limit of reverse slot limit harvested halibut). None of the combinations of size limits and annual limits were below the reference TCEY allocation or the 2020 allocation.

3.4 Mid-season Change from no size limit to reverse slot limit

3.4.1 Approach

The Charter Halibut Management Committee requested analysis of one fish of any size through June 15, June 30, or July 15, and a reverse slot limit with a lower limit ranging from 40 – 45 inches and an upper limit of 80 inches for the balance of the season (beginning June 16, July 1, or July 16, respectively).

The analysis used harvest data from 2019 and evaluated the proportion of harvest prior to the requested date of regulation change in each area. 2019 was used as the base year because it is the most recent year with complete data and was unimpacted by the COVID-19 pandemic. Further, the proportion of harvest occurring in the early part of the season has declined, likely from a reduction in overall sport fishing effort due to changes in regulations in other fisheries that limit opportunities during the early part of the season. The proportion of harvest during the first part of the season was then applied to the 2021 harvest forecast to estimate the number of fish of any size that would be harvested. The mean weight of the fish of any size follow methods described in Section 3.3.1 and use length data from 2010 to estimate mean weight with a bias correction based on recent observations. The remaining proportion of the fish in the harvest forecast were assigned mean weights based on the respective reverse slot limit analyses and mean weight estimates described in previous sections.

All projections include an inflation factor for predicted release mortality based on the lower slot limit. The inflation factor for a fish of any size used the same formulaic approach, treating the size limit as U50O50.

Such a management measure would almost undoubtedly have an impact on the effort and proportion of harvest before and after the date of regulation change. It is likely there would be an increase in effort before the date of regulation change and thus in total effort, not a shift in the distribution of effort within the year; however, the scale of this impact cannot be predicted with available data. To reflect two possible outcomes, we provided estimates of removals should the effort increase by 10% or 20% during the early part of the season and assumed that effort in the later portion of the season would remain unaffected. These two numbers (10% and 20%) do not represent any knowledge from the department on how such regulations would affect effort and harvest and are provided for illustrative purposes.

3.4.2 Results

The projected charter removal under status quo effort projections ranged from 0.997 Mlb for a fish of any size through June 15 and a reverse slot limit of U40O80 for the balance of the season to 1.323 Mlb for a

fish of any size through July 15 and a reverse slot limit of U45O80 for the balance of the season (Table 9). The projected charter removal with a 20% increase in effort in the early part of the season ranged from 1.040 Mlb for a fish of any size through June 15 and a reverse slot limit of U40O80 for the balance of the season to 1.470 Mlb for a fish of any size through July 15 and a reverse slot limit of U45O80 for the balance of the season (Table 9). None of the combinations were below the reference TCEY allocation or the 2020 allocation.

3.5 Mid-season Change from a reverse slot limit of U45O80 to U40O80

3.5.1 Approach

The Charter Halibut Management Committee requested analysis of one fish with a reverse slot limit of U45O80 through June 30, July 7, July 15, July 22, or July 31 and a reverse slot limit of U40O80 for the remainder of the season.

The analysis used harvest data from 2019 and evaluated the proportion of harvest prior to the regulation change in each area. 2019 was used as the base year because it is the most recent year with complete data and was unimpacted by the COVID-19 pandemic. Further, the proportion of harvest occurring in the early part of the season has declined in recent years, likely from reduction in overall sport fishing effort due to changes in regulations in other fisheries that limit opportunities during the early part of the season. The proportion of harvest during the first part of the season was then applied to the 2021 harvest forecast to estimate the number of U45O80 fish that would be harvested. The remaining proportion of the fish in the harvest forecast were assigned a size limit of U40O80. Mean weight estimates under each size limit followed methods from previous sections.

All projections include an inflation factor for predicted release mortality based on the lower slot limit.

Such a management measure would almost undoubtedly have an impact on the effort and proportion of harvest before and after the date of regulation change. It is likely there would be an increase in effort before the date of regulation change and thus in total effort, not a shift in the distribution of effort within the year; however, the scale of this impact cannot be predicted with available data. To reflect two possible outcomes, we provided estimates of removals should the effort increase by 10% or 20% during the early part of the season and assumed that effort in the later portion of the season would remain unaffected. These two numbers (10% and 20%) do not represent any knowledge from the department on how such regulations would affect effort and harvest and are provided for illustrative purposes.

3.5.2 Results

The projected charter removal under status quo effort projections ranged from 0.929 Mlb for a U45O80 through June 30 and a reverse slot limit of U40O80 for the balance of the season to 0.976 Mlb for a U45O80 through July 31 and a reverse slot limit of U40O80 for the balance of the season (Table 10). The projected charter removal with a 20% increase in effort in the early part of the season ranged from 1.115 Mlb for a U45O80 through June 30 and a reverse slot limit of U40O80 for the balance of the season to 1.171 Mlb for a U45O80 through July 31 and a reverse slot limit of U40O80 for the balance of the season (Table 10). None of the combinations of size limits were below the reference TCEY allocation or the 2020 allocation.

3.6 2C Supplemental Analyses

After analyzing the requested alternatives for Area 2C and receiving information from the IPHC on the reference TCEY and associated allocations for 2021, it was noted that none of the requested alternatives provided projections at or below the reference TCEY allocation. In consultation with members of the Charter Halibut Management Committee, it was recommended that the following three additional management measures be evaluated:

1) Reverse slot limits with lower limits of the protected slot ranging from 40 to 50 inches and upper limits ranging from 50 to 80 inches with annual limits of 2 – 5 fish.

2) Reverse slot limits with lower limits of the protected slot ranging from 40 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays or Sundays closed during the season, or a Wednesday or Sunday closure for the entire year.

3) Reverse slot limits with lower limits of the protected slot ranging from 40 to 50 inches and an upper limit of 80 inches with 1 – 17 Wednesdays or Sundays closed during the season, or a Wednesday or Sunday closure for the entire year, combined with an annual limit.

3.7 Reverse Slot Limit with Various Annual Limits

3.7.1 Approach

The approach to estimate annual limits are described in Section 3.3.1 of this report.

Total charter removals were projected for a range of 2 – 5 fish annual limits under a range of reverse slot limits with lower limits ranging from 40 to 50 inches and upper limits ranging from 50 to 80 inches (Table 11a-d). A single level of annual limit harvest is associated with each sub-table of Table 11 because it was assumed that the various reverse slot limits do not affect 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.

3.7.2 Results

Removal estimates ranged from 0.703 Mlb for a reverse slot limit of U40O80 and an annual limit of two fish to 1.704 for no reverse slot limit and an annual limit of five fish (Table 11). Several combinations of size limits with an annual limit of two fish were at or below the 2020 allocation of 0.78 Mlb; projections from all combinations of size limits and annual limits greater than two were above the 2020 allocation. No combinations of size limits and annual limits were at or below the reference TCEY allocation of 0.65 Mlb. For reference, the most liberal combinations of size limits and annual limits for which the projected removals are within the 2020 allocation are highlighted in Table 11a-d.

3.8 Reverse Slot Limit with Day of the Week Closures

3.8.1 Approach

Harvest was projected with day of the week closures in Area 2C with reverse slot limits ranging from a lower limit of 40 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 2019. Generally speaking, the analysis proceeded by estimating the proportional effect of Wednesdays or Sundays in 2019 and applying those proportional effects to the harvest forecast for 2021.

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 dates identified for closures are found in Tables 12 and 14 for Wednesday and Sunday, respectively. Once the specific closed dates for each scenario were identified, the corresponding Wednesdays and Sundays to each of those dates was identified from the 2019 data set for analyses. There was a three-day difference in dates from 2019 to 2021. The analysis assumed that the proportion of harvest occurring on each day in 2019 would be eliminated if those days were closed. In other words, the harvest that occurred on those days represented the maximum 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) to estimate the proportional change in harvest for 2021.

The charter sector requested that closures begin at the end of the season and closure days be progressively added towards the beginning of the season. 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 averaged 65% since 2006. If daily closures were implemented in a manner that caused this proportion to vary significantly from its recent average, it could bias future preliminary harvest estimates and ability to analyze management measures in a subsequent year. Because this request closes days disproportionately to the past harvest occurring before August 2021 preliminary estimates and 2022 management measure analyses would need to assume all harvest that would have occurred on closed days was eliminated and that no harvest was displaced to other days of the week.

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; we 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 with all upper slot limits fixed at 80 inches.

3.8.2 Results

Implementation of a daily closure could be used to bring the projected removals within the 2020 allocation of 0.78 Mlb but all projections were above the reference TCEY allocation of 0.65 Mlb. In general, Wednesday closures are projected to result in slightly lower removals. A U40O80 reverse slot limit would need to be implemented and 13 Wednesdays or 15 Sundays closed (Tables 13 and 15 for Wednesday and Sunday, respectively). For reference, the most liberal combinations of size limits and day of the week closures for which the projected removals are within the 2020 allocation are highlighted in Tables 13 and 15.

3.9 Reverse Slot Limit with Annual Limits Combined with Day of the Week Closures

3.9.1 Approach

Harvest was projected in Area 2C under reverse slot limits with lower limits of 40 to 50 inches and an upper limit of 80 inches with a combination of annual limits of 2 to 5 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 stated before for day of the week closures, these estimates should be considered maximum reductions in harvest relative to annual limits because we do not know how many anglers might rebook on alternate days of the week and still harvest their annual limit. The actual reductions achieved from this management measures will be somewhere between reductions from a reverse slot limit with annual limits alone and the maximum reductions presented in Tables 16 and 17.

3.9.2 Results

Implementation of an annual limit combined with a daily closure could be used to bring the projected removals within the reference TCEY allocation or the 2020 allocation under numerous combinations of reverse slots, closed days, and annual limits. Overall, fewer days would need to be closed to stay within allocations if annual limits were implemented. Removal estimates range from 0.603 Mlb with a U40O80

reverse slot limit, a two fish annual limit, and all Wednesdays closed (Table 16d) to 1.148 Mlb with a U50O80 reverse slot limit, a five fish annual limit, and one Wednesday closed (Table 16a). Results were similar for Wednesdays and Sundays (Table 17). For reference, the most liberal combinations of size limits and annual limits for which the projected removals are within the reference TCEY allocation and 2020 allocation are highlighted in Tables 16 and 17.

4.0 Area 3A Management Measures

4.1 Status Quo 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 32 inches on one of the fish, and limits of one trip per vessel and one trip per charter halibut permit per day. As explained earlier, because 2019 effort was used for status quo projections, harvest (effort x HPUE) was estimated for the 2019 management measures, then harvest under 2020 status quo management measures followed by removing annual limits and removing closed days; methods can be found in sections 4.3 and 4.4 of this report. HPUE decreased in all subareas from 2013 – 2018 which was likely a result of the number of anglers retaining two fish due to size limits on the second fish and annual limits. HPUE was relatively stable areawide from 2018-2019 with variable changes by subarea, then increased in all subareas in 2020 (Table 4, Figure 3). The weighted average HPUE forecast for 2021 in Area 3A overall is 1.47 halibut per angler-day, slightly below the HPUE observed in 2020 and above the HPUE observed from 2016 – 2019. The status quo harvest forecast for 3A is 204,032 halibut with a 95% margin of error (± 2 standard errors) of 7,113 fish (Table 18). This harvest forecast has a considerable amount of additional uncertainty because we do not know the true effect of opening and closing days on angler effort. Here, we proceed by assuming all of the effort that occurred on closed days in past years was eliminated, when in fact the effort may have shifted to other days of the week.

4.2 Forecast of the Average Weight in each Subarea

4.2.1 Approach

Average weight was calculated as a weighted mean of the fish of any size and the fish subject to a maximum size limit. Charter removals were projected under maximum size limits ranging from 26 to 33 inches. Calculations were done for each subarea, then aggregated to Area 3A. 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 2021 projected proportions of harvest made up of "first" and "second" fish in an angler's bag limit. 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 2021 from 2010-2020 logbook data using the exponentially-weighted time series models described in Section 2.3. These forecasted proportions ranged from 46-48% in Cook Inlet down to 20-23% in the Glacier Bay and Yakutat subareas, with a weighted average of 42% 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. Bias corrections were based on the difference between predicted and estimated (observed) average weights for 2014-2020. 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 1.01 to 1.62 among subareas.

4.2.2 Results

The status quo forecast of average weight in 3A is 14.11 lbs. Status quo is based on a two fish bag limit with one fish of any size and a maximum size limit of 32 inches on one fish. This is below the 2020 preliminary average weight estimate of 14.60 lbs. Average weights and removals under varying size limits and all other status quo management measures for 3A ranged from 12.47 lbs and 2.58 Mlb for a 26-inch size limit to 14.29 lbs and 2.96 Mlb for a 33-inch size limit (Table 19).

4.3 Harvests under Various Annual Limits

4.3.1 Approach

The status quo regulations do not include an annual limit; however annual limits were in place from 2015 - 2019. Annual limits ranging from 2 to 6 fish per year were evaluated to provide the Council with additional flexibility. Once again, 2019 management measures were used as the starting point for these estimates. The effects of annual limits of two to four fish on harvest were estimated using charter logbook data that summarized the distribution of annual harvests by individual licensed anglers from 2019, the most recent year with complete logbook data. The effects of annual limits of five, six, or no annual limit were based on logbook data from 2014, the last year without an annual limit. For each subarea, harvests under each proposed annual limit were estimated by truncating the annual harvest of each angler during 2019 or 2014 at the given annual limit, then removing or adding that harvest back to the subarea as annual limits are adjusted from 4 fish. For example, if 500 anglers harvested four fish each in 2019 (2,000 fish total), then under an annual limit of three fish, that group of 500 anglers would only harvest 1,500 fish. Calculations of annual harvests could not be done for youth anglers because they are not required to be licensed, and therefore harvest cannot be assigned to individuals. Youth accounted for a relatively steady average of 5.4% of charter effort in Area 3A during the years 2017-2019, and ranged from 5.2% - 5.6% for the most recent 10 years with complete data. Because the proportion of youth effort was steady and relatively low, we assume that leaving youth anglers out of the calculations did not bias estimates of the effects of implementing annual limits.

For 2021, the projected harvest in the absence of an annual limit was estimated by starting with the harvest forecast using 2019 management measures, and then removing the estimated effect of a four-fish annual limit using 2014 data. Projected harvests under five and six fish annual limit options were then calculated by applying the estimated percent reductions to the harvest forecast without an annual limit. All initial harvest projections for 2021 include 2019 management measures, including the charter vessel trip limit, permit trip limit, maximum size limit on the second fish, Wednesday closure for the entire year, and five Tuesday closures in July and August. Harvest under status quo management measures was then estimated by using the 2021 forecast for no annual limit with 2019 day of the week closures, and methods to open all days to fishing, as outlined in section 4.4.

4.3.2 Results

The effects of annual limits on harvest varied by subarea, with the largest proportional effects in the Kodiak subarea (Table 20). Areawide, application of annual limits to the harvest without an annual limit (status quo) would result in harvest reductions from 15% under a two-fish annual limit to 1.7% under a six-fish limit. Lowering the annual limit under other status quo measures to four fish (2019 annual limit) is estimated to reduce the harvest from 204,032 to 193,555 halibut, a decrease of 5.1% relative to status quo (Table 20). No combination of annual limits with all other status quo management measures was below the reference TCEY allocation of 1.93 Mlb or the 2020 allocation of 1.71 Mlb for 3A (Table 21). The removal estimate with a two fish annual limit and all other status quo regulations was 2.497 Mlb.

4.4 Harvest with addition of Tuesday and Wednesday Closures

4.4.1 Approach

Status quo regulations in Area 3A do not have any closed days; however, 2019 regulations included a year-round closure of the charter fishery on Wednesdays as well as five Tuesdays closed (three in July and two in August). 2019 management measures and harvest were used as the baseline for analyses due to the perceived impacts of the COVID-19 pandemic on harvest and harvest distribution throughout the 2020 season. 2019 data were first corrected to account for the change in annual limits (4 to none) between 2019 and 2020.

The potential effect of closing Tuesdays and Wednesdays was estimated for the months June-August and for the entire year. It was assumed that any closures of days would progress by closing all Wednesdays before any Tuesdays were closed. The analysis for opening Wednesdays (relative to 2019) relied on complete logbook data for 2014, the last year in which the fishery did not have any daily closures. 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 2019, a year in which the fishery was closed on Wednesdays and five Tuesdays. Generally speaking, the analysis proceeded by estimating the proportional effect of allowing charter harvest of halibut on Tuesdays in 2016 or 2019 and on Wednesdays in 2014 and applying those proportional effects to the harvest forecast for 2021.

The first step was to identify the dates of specific Tuesdays and Wednesdays that would be closed in 2021 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 Tuesday and Wednesday closures are found in Tables 23 and 24. The proportion of harvest occurring before August is an important value used to make preliminary estimates of charter harvest each year using incomplete logbook data. The proportion of annual charter harvest occurring through July averaged 69% from 2014-2019. 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 and ability to analyze management measures in a subsequent year.

Closures of 1 – 13 Tuesdays and 1 – 13 Wednesdays during the period June-August, and Tuesdays and Wednesdays for the entire 2021 season were evaluated. Once the specific closed days for each scenario were identified, the corresponding day was identified from the historic data sets for analyses. There was a one-day difference in the date of each Tuesday from 2016 to 2021, a three-day difference in Tuesdays from 2019 to 2021, and a two-day difference in the date of each Wednesday from 2014 to 2021.

The analysis assumed that the proportion of harvest occurring on each day in previous years 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 relative to what was observed with all Wednesdays closed and five Tuesdays closed in 2019. The total annual harvest under each scenario of closed days was then compared to the harvest scenario of all days open to fishing (2020 status quo) to estimate the proportional reduction in harvest by closing each day to harvest of halibut in 2021. Because estimates originate from 2019 effort data, the baseline for changes in harvest resulting from opened and closed days is the estimate for all Wednesdays closed and five closed Tuesdays. Any increases in harvest from opening days or decreases in harvest from closing days represent the maximum expected changes in the number of fish harvested relative to the 2019 regulations of all Wednesdays closed and 5 Tuesdays closed. A day of the week closure would be unlikely to achieve the maximum change in halibut harvest because anglers could have booked alternate dates in recent years due to closures or book alternate days in future years if days were closed. There is a substantial amount of latent capacity on charter vessels in Area 3A (Marrinan and Fey 2017) that allow for such re-bookings to occur.

4.4.2 Results

Under status quo regulations, which do not include day of the week closures or an annual limit, the projected harvest was 204,032 fish and the removal estimate was 2.918 Mlb. The potential decrease in harvest ranged from 1.4% for one closed Wednesday to 28.7% should all Tuesdays and Wednesdays be closed for the entire year (Tables 22 and 23). The projected removals associated with these scenarios ranged from 2.875 Mlb to 2.078 Mlb. Thus no combinations of closed days and other status quo management measures are projected to keep the charter sector within the reference TCEY or 2020 allocation.

4.5 Harvest with Addition of Annual Limits and Closure Days

4.5.1 Approach

This regulatory measure was implemented from 2015 -2019. Combinations of annual limits and closure days were explored for flexibility in recommending management measures. First, annual limits from 2 – 6 fish were applied following methods outlined in section 4.3. Once annual limits were applied, closure days were applied and proceeded by first closing Wednesdays, then closing Tuesdays, following methods in section 4.4. Projected removals include a 1.4% inflation factor to account for release mortality. These projections incorporate all other status quo measures, including a two fish bag limit with one fish of any size and one fish of 32 inches or less, a charter vessel trip limit, and a charter halibut permit trip limit.

4.5.2 Results

Harvest under a combination of annual limits and day of the week closures ranged from 204,032 fish with no annual limit or closure days to 124,032 fish with an annual limit of two fish and all Tuesdays and Wednesdays closed (Tables 24a and 25a). Associated removals were 2.918 Mlb (Table 24b – max. size 32-inches) and 1.780 Mlb (Table 25g – max. size 32-inches), respectively. All Wednesdays and Tuesdays would need to be closed and an annual limit of two fish implemented to remain below the reference TCEY allocation. No combinations of closed days and annual limits with all other status quo management measures were below the 2020 allocation.

4.6 Changes to Maximum Size Limit on One Fish Combined with Annual Limit

4.6.1 Approach

This regulatory mechanism was implemented from 2015 -2019. The size limits ranging from 26 – 33 inches and annual limits ranging from 2 – 6 fish were explored to provide the Council flexibility in recommending management measures. Projected removals include a 1.4% inflation factor to account for release mortality. These projections incorporate all other status quo measures, including a two fish bag limit with one fish of any size, a charter vessel trip limit, and a charter halibut permit trip limit. Average weight under each size limit was calculated as detailed in section 4.2 and annual limits were calculated as detailed in section 4.3.

4.6.2 Results

Under status quo regulations, which include a 32-inch maximum size limit on the second fish and no annual limit, the projected average weight was 14.11 lbs and projected removal was 2.918 Mlb (Table 24b, no Wednesdays closed). Under a two fish annual limit and a 26-inch size limit, the projected removal is 2.209 Mlb (Table 24g). No combinations of annual limits and size limits analyzed were below the reference TCEY allocation or the 2020 allocation.

4.7 Changes to Maximum Size Limit on One Fish Combined with Closure Days

4.7.1 Approach

Status quo for this regulatory mechanism is a 32-inch maximum size limit on the second fish and no closure days. Combinations of other size limits and closure days were explored for flexibility in

recommending management measures. Charter removals were projected under maximum size limits ranging from 26 to 33 inches and Tuesday and Wednesday closures ranging from zero to thirteen days or for the entire season. As outlined in section 4.4, closure days proceeded by first closing Wednesdays, then closing Tuesdays. Projected removals include a 1.4% inflation factor to account for release mortality. These projections incorporate all other status quo measures.

Average weight under each size limit and change in harvest based on closure days followed procedures outlined in sections 4.2 and 4.4, respectively.

4.7.2 Results

Under status quo regulations, which include a 32-inch maximum size limit on the second fish and no closure days, the projected harvest is 204,032 fish and the projected removal is 2.918 Mlb (Table 24a and 24b). Closing all Wednesdays and a maximum size of 26 inches on the second fish resulted in a projected harvest of 172,845 fish (Table 24a) and removal of 2.183 Mlb (Table24b). Closing all Wednesdays and all Tuesdays and reducing the size limit to 26 inches resulted in a projected harvest of 145,422 fish (Table 25a) and removal of 1.837 Mlb (Table 25b). There were several combinations of closed Tuesdays and size limits that were below the reference TCEY allocation. No combinations of closed days and size limits were below the 2020 allocation.

4.8 Changes to Maximum Size Limit on One Fish Combined with Annual Limits and Closure Days

4.8.1 Approach

The status quo is a 32-inch maximum size limit on the second fish, with no annual limits or closure days. Combinations of alternative size limits, annual limits, and closure days were explored to provide the Council flexibility in recommending management measures. Charter removals were projected under maximum size limits ranging from 26 to 33 inches, annual limits from two to six fish, and closure days on Tuesdays and Wednesdays throughout the season. Projected removals include a 1.4% inflation factor to account for release mortality. These projections incorporate other status quo measures, including a two fish bag limit with one fish of any size, a charter vessel trip limit, and a charter halibut permit trip limit.

Average weight under each size limit was calculated as described in section 4.2. Effects of annual limits and closure days followed methods described in sections 4.3 and 4.4.

4.8.2 Results

Numerous combinations of size limits, annual limits, and day of the week closures are below both the reference TCEY allocation and the status quo allocation. Tables 24c-g and 25c-g provide results from these analyses. The most liberal combinations of size limits, closures, and annual limits below each of the allocations are highlighted in tables to facilitate interpretation of the results. Removal estimates range from 1.575 Mlb (Table 25g) to 2.867 Mlb (Table 24c).

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 releaseed thereby increasing removals associated with release mortality. Not only do these size limits generate additional regulatory (versus voluntary) release of halibut, 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. Tying size limits to annual limits, as proposed in 2C, may result in changes to average weights in unpredictable ways due to angler selectivity of the fish of any size.

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 State of Alaska fishing license. For anglers not required to have an annual license, a harvest card can be obtained from the ADF&G website[4] 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.

The license or harvest card is not submitted at the end of the year. Halibut harvest accounting by individual anglers would be implemented through ADF&G charter logbooks as was done in past years. 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 as they are 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 their annual limit is reported on their harvest record, 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 26 includes 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 2019, 66,846 licensed anglers harvested 131,035 halibut in 3A. Of those, 184 (0.3%) violated the annual limit and harvested 255 fish in excess of the annual limit which represented 0.2% of the total harvest by licensed anglers. Anglers in Cook Inlet subareas accounted for 65% the fish over the annual limit (165).

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 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 comprised only 4.1 – 4.7% of angler-trips in 2C and 5.2 – 5.6% of angler-trips in Area 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

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

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 change in halibut harvest but cannot predict possible changes in angler behavior, such as anglers booking alternate days. In 3A, closure of 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 other 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, such as closing days as the end of the season first and working backwards as was requested for analysis in 2C, estimation methods will need to be revised and could be biased if the maximum effect of daily closures is not achieved.

5.4 Mid-season Changes

As mentioned in section 5.3, good information on the effort throughout the season is integral to our ability to provide preliminary harvest estimates and to forecast harvest for the subsequent year, given the necessity to use partial year logbook data when these analyses are done. The effect of these management measures would be unknown when preliminary harvest estimates are 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 averaged 65% from 2006-2019. 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 increase or shift to the early part of the season as might be expected with more liberal size limits early in the season, this would result in an overestimation of harvest for the year. The overestimation of harvest would then carry through to the 2022 harvest forecasts when charter halibut management measures are evaluated next fall; this could result in more restrictive management measures in 2022 than necessary to stay within a given allocation. In summary, 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.

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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 relationships[5].

Length (Inches)	Net Weight (lb)	Round Weight (lb)
20	2.3	3.1
21	2.7	3.6
22	3.2	4.2
23	3.7	4.9
24	4.2	5.6
25	4.8	6.4
26	5.4	7.2
27	6.2	8.2
28	6.9	9.2
29	7.8	10.3
30	8.7	11.5
31	9.6	12.8
32	10.7	14.2
33	11.8	15.7
34	13.0	17.3
35	14.3	19.0
36	15.6	20.8
37	17.1	22.7
38	18.6	24.8
39	20.3	27.0
40	22.0	29.3
41	23.8	31.7
42	25.8	34.3
43	27.8	37.0
44	30.0	39.9
45	32.2	42.9
46	34.6	46.0
47	37.1	49.3
48	39.7	52.8
49	42.5	56.5
50	45.3	60.3

(continued at right)

Length (Inches)	Net Weight (lb)	Round Weight (lb)
51	48.3	64.3
52	51.5	68.5
53	54.8	72.8
54	58.2	77.4
55	61.7	82.1
56	65.5	87.1
57	69.3	92.2
58	73.3	97.5
59	77.5	103.1
60	81.9	108.9
61	86.4	114.9
62	91.0	121.1
63	95.9	127.5
64	100.9	134.2
65	106.1	141.1
66	111.5	148.3
67	117.0	155.7
68	122.8	163.3
69	128.7	171.2
70	134.9	179.4
71	141.2	187.8
72	147.8	196.5
73	154.5	205.5
74	161.5	214.8
75	168.7	224.3
76	176.1	234.2
77	183.7	244.3
78	191.5	254.7
79	199.6	265.5
80	207.9	276.5

[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 halibut sampling occurs, 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, 2006-2020. Preliminary estimates for 2020 (in italics) are based on logbook data for charter trips through August 31, 2020, entered as of October 09, 2020.

	Subarea						
Year	Ketch	PWI	Pburg	Sitka	Jun	GlacB-2C	Total 2C
Effort (angler-days)[a,b]							
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	21,002	24,412	3,194	33,057	14,674	10,414	106,753
2020	*5,646*	*13,101*	*2,003*	*17,113*	*4,522*	*5,439*	*47,826*
Halibut Harvest per Angler-Day (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	0.439	0.742	0.523	0.766	0.615	0.699	0.661
2020	*0.680*	*0.767*	*0.763*	*0.821*	*0.821*	*0.777*	*0.782*
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	9,217	18,105	1,672	25,306	9,020	7,280	70,600
2020	*3,841*	*10,052*	*1,529*	*14,057*	*3,712*	*4,224*	*37,415*

[a] – Effort is defined as angler-days with recorded bottomfish hours or harvest of at least one halibut.

[b] – Effort and harvest are client-only except 2014-2020 data which includes all reported crew data even though prohibited.

Table 4. Charter logbook effort, harvest per unit effort, and harvest of halibut in IPHC Area 3A, 2006-2020. Preliminary estimates for 2020 (in italics) are based on logbook data for charter trips through August 31, 2020, entered as of October 09, 2020.

	Subarea								
Year	GlacB-3A	Yak	EPWS	WPWS	NGulf	CCI	LCI	Kod	Tot 3A
Effort (angler-days)[a,b]									
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	3,267	3,527	3,484	30,864	19,882	33,011	8,756	104,643
2016	1,887	3,382	4,126	4,094	33,007	16,865	36,978	8,427	108,766
2017	2,211	3,405	3,579	3,679	27,934	17,330	35,426	7,899	101,463
2018	2,739	4,412	4,045	3,955	27,535	16,871	33,723	8,476	101,756
2019	2,094	4,365	4,653	4,764	29,889	15,184	33,681	8,961	103,591
2020	*1,009*	*2,174*	*3,558*	*3,809*	*21,130*	*10,914*	*24,791*	*5,703*	*73,088*
Halibut Harvest per Angler-Day (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	0.983	1.218	1.330	1.501	1.802	1.791	1.010	1.564
2016	0.757	0.964	1.149	1.096	1.294	1.705	1.741	1.001	1.455
2017	0.728	0.939	1.143	1.016	1.166	1.665	1.718	0.983	1.406
2018	0.688	0.980	1.187	1.088	1.056	1.670	1.668	0.883	1.340
2019	0.756	0.985	1.103	1.094	1.143	1.660	1.641	0.916	1.343
2020	*0.878*	*1.134*	*1.381*	*1.298*	*1.219*	*1.779*	*1.745*	*1.184*	*1.483*
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	1,582	4,301	5,132	5,214	34,171	25,200	55,274	8,208	139,092
2020	*886*	*2,465*	*4,913*	*4,943*	*25,756*	*19,413*	*43,249*	*6,754*	*108,379*

[a] – Effort is defined as angler-day on open days with recorded bottomfish hours or harvest of at least one halibut.

[b] – Effort and harvest are client-only except 2014-2020 data which includes all reported crew data even though prohibited.

Table 5. Forecasts of effort, halibut harvest per unit effort (HPUE), and harvest (numbers of halibut) for Area 2C in 2021 under status quo regulations, with associated standard errors. Status quo regulations include a one-fish bag limit and U45O80 reverse slot size limit.

Subarea	Effort (angler-trips)	Std Error	HPUE	Std Error	Harvest (no. halibut)	Std Error
Ketch	23,794	1,875	0.52	0.080	12,331	2,138
PWI	24,413	2,150	0.76	0.038	18,536	1,872
Pburg	3,125	389	0.66	0.067	2,046	328
Sitka	34,357	2,660	0.80	0.049	27,600	2,718
Jun	16,279	1,296	0.66	0.072	10,764	1,452
GlacB-2C	10,585	1,470	0.74	0.063	7,810	1,268
Area 2C	112,553	4,382	0.70	NA	79,087	4,392

Table 6. Projected charter removals (Mlb) for Area 2C in 2021 under reverse slot limits ranging from U40O50 to U50O80 with a 1-fish bag limit. All reverse slot limits exceeded the reference coastwide TCEY allocation scenario of 0.65 Mlb and the 2020 allocation of 0.78 Mlb. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

Harvest = 79,087

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
40	1.537	1.450	1.384	1.308	1.254	1.206	1.136	1.069	1.030	1.000	0.970	0.950	0.922	0.906	0.904	0.893
41	1.559	1.474	1.408	1.334	1.281	1.233	1.164	1.097	1.059	1.030	1.000	0.980	0.951	0.936	0.934	0.922
42	1.572	1.488	1.423	1.349	1.297	1.249	1.181	1.115	1.077	1.048	1.018	0.998	0.970	0.955	0.953	0.941
43	1.587	1.504	1.440	1.367	1.315	1.268	1.201	1.135	1.098	1.069	1.039	1.019	0.991	0.976	0.974	0.963
44	1.609	1.528	1.465	1.394	1.342	1.296	1.229	1.164	1.127	1.098	1.069	1.049	1.021	1.006	1.005	0.993
45	1.634	1.555	1.493	1.422	1.372	1.326	1.260	1.196	1.159	1.130	1.101	1.082	1.054	1.039	1.038	1.026
46	1.649	1.571	1.510	1.440	1.391	1.345	1.280	1.216	1.180	1.151	1.122	1.103	1.076	1.061	1.059	1.048
47	1.670	1.594	1.535	1.466	1.417	1.372	1.307	1.244	1.208	1.180	1.151	1.132	1.105	1.090	1.089	1.077
48	1.684	1.609	1.551	1.483	1.434	1.390	1.326	1.263	1.227	1.199	1.171	1.152	1.125	1.110	1.108	1.097
49	1.709	1.636	1.579	1.512	1.464	1.420	1.357	1.295	1.260	1.232	1.204	1.185	1.158	1.144	1.142	1.131
50	x	1.654	1.598	1.532	1.485	1.442	1.379	1.318	1.283	1.255	1.227	1.209	1.182	1.168	1.166	1.155

Table 7. Estimated effects of annual limits of one to five halibut on Area 2C charter anglers and projected harvest for 2021. Effects were estimated using 2019 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 2019.

Annual Limit	Subarea						Area 2C
	Ketch	PWI	Pburg	Sitka	Jun	GlacB	
			Estimated percent of anglers affected by the annual limit:				
1	17.7%	67.5%	41.6%	70.8%	38.7%	56.9%	53.1%
2	6.5%	40.8%	18.9%	41.8%	25.1%	35.3%	31.1%
3	0.8%	7.8%	6.4%	9.4%	12.3%	18.9%	8.5%
4	0.2%	1.4%	1.0%	1.6%	3.5%	6.8%	2.0%
5	0.1%	0.4%	0.1%	0.4%	1.1%	0.7%	0.5%
			Estimated percent change in harvest relative to no annual limit:				
1	-20.2%	-54.2%	-40.5%	-55.4%	-44.7%	-54.4%	-47.7%
2	-6.1%	-23.3%	-15.7%	-23.8%	-23.4%	-28.4%	-21.1%
3	-0.9%	-4.6%	-4.5%	-5.2%	-9.5%	-12.3%	-5.6%
4	-0.2%	-1.0%	-0.7%	-0.9%	-2.7%	-3.6%	-1.3%
5	-0.1%	-0.4%	-0.1%	-0.2%	-0.8%	-0.5%	-0.3%
			Projected harvest (number of halibut):				
1	9,840	8,489	1,217	12,313	5,949	3,563	41,371
2	11,578	14,222	1,724	21,027	8,249	5,592	62,393
3	12,219	17,688	1,955	26,176	9,740	6,851	74,629
4	12,301	18,349	2,032	27,339	10,474	7,526	78,020
5	12,321	18,471	2,045	27,533	10,683	7,769	78,821
No Limit	12,331	18,536	2,046	27,600	10,764	7,810	79,087

Table 8. Projected charter removals (Mlb) for Area 2C in 2021 with an annual limit of one fish of any size and reverse slot limits on subsequent fish with lower limits ranging from 40 to 50 inches with an upper limit of 80 inches and annual limits ranging from two to five fish or no annual limit. The low removal estimates assume that no additional angler selectivity occurs on the fish of any size. The high removal estimates assume that there will be additional angler selectivity on the fish of any size. All estimates exceeded the reference coastwide TCEY allocation scenario of 0.65 Mlb and the 2020 allocation of 0.78 Mlb. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

Lower	**Annual Limit Options**				
Slot Limit	2	3	4	5	None
			Harvest		
	62,393	74,629	78,020	78,821	79,087
			Low Removal Scenario		
40	1.116	1.254	1.293	1.303	1.305
41	1.123	1.266	1.306	1.316	1.319
42	1.129	1.274	1.316	1.326	1.329
43	1.134	1.283	1.326	1.336	1.339
44	1.143	1.296	1.340	1.350	1.354
45	1.151	1.310	1.355	1.366	1.369
46	1.157	1.319	1.365	1.377	1.380
47	1.165	1.331	1.379	1.390	1.394
48	1.170	1.339	1.388	1.399	1.403
49	1.179	1.354	1.404	1.416	1.420
50	1.186	1.364	1.415	1.428	1.432
			High Removal Scenario		
40	1.481	1.620	1.659	1.668	1.671
41	1.484	1.627	1.667	1.677	1.680
42	1.495	1.641	1.682	1.692	1.695
43	1.497	1.646	1.689	1.699	1.702
44	1.495	1.648	1.692	1.702	1.706
45	1.495	1.654	1.699	1.710	1.713
46	1.500	1.662	1.708	1.720	1.723
47	1.502	1.668	1.716	1.727	1.731
48	1.499	1.668	1.716	1.728	1.731
49	1.486	1.660	1.710	1.722	1.726
50	1.492	1.671	1.722	1.734	1.738

Table 9. Projected charter removals (Mlb) for Area 2C in 2021 with one fish of any size through June 15, June 30, or July 15, and reverse slot limits for the remainder of the year ranging from a lower limit of 40 to 45 inches and with an upper limit of 80 inches. Three effort estimates are incorporated in sub-tables indicating no change, a 10% increase in effort, and a 20% increase in effort during the early portion of the season. All estimates exceeded the reference coastwide TCEY allocation scenario of 0.65 Mlb and the 2020 allocation of 0.78 Mlb. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

Status Quo Effort		Regulation Change Date		
		Thru 15-Jun	Thru 30-Jun	Thru 15-Jul
Lower Length Limit (in)	40	0.997	1.114	1.247
	41	1.023	1.136	1.264
	42	1.040	1.150	1.275
	43	1.058	1.166	1.287
	44	1.084	1.187	1.304
	45	1.113	1.211	1.323

10% Increase Effort Before Change		Regulation Change Date		
		Thru 15-Jun	Thru 30-Jun	Thru 15-Jul
Lower Length Limit (in)	40	1.018	1.160	1.321
	41	1.045	1.182	1.338
	42	1.061	1.196	1.348
	43	1.079	1.211	1.361
	44	1.105	1.233	1.378
	45	1.134	1.257	1.396

20% Increase Effort Before Change		Regulation Change Date		
		Thru 15-Jun	Thru 30-Jun	Thru 15-Jul
Lower Length Limit (in)	40	1.040	1.205	1.394
	41	1.066	1.227	1.411
	42	1.082	1.241	1.422
	43	1.101	1.257	1.434
	44	1.127	1.279	1.451
	45	1.155	1.302	1.470

Table 10. Projected charter removals (Mlb) for Area 2C in 2021 with a reverse slot limit of U45O80 through June 30, July 7, July 15, July 22, or July 31 and reverse slot limit of U40O80 for the remainder of the season. Three effort estimates are incorporated indicating no change, a 10% increase, and a 20% increase in effort during the early portion of the season. All estimates exceeded the reference coastwide TCEY allocation scenario of 0.65 Mlb and the 2020 allocation of 0.78 Mlb. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

	Regulation Change Dates				
	Thru June 30	Thru July 7	Thru July 15	Thru July 22	Thru July 31
Status Quo	0.929	0.937	0.950	0.961	0.976
10% Increase Effort Before Change	1.022	1.031	1.045	1.057	1.073
20% Increase Effort Before Change	1.115	1.124	1.140	1.153	1.171

Table 11. Projected charter removals (Mlb) for Area 2C in 2021 under reverse slot limits with lower limits ranging from 40 to 50 inches and upper limits ranging from 50 to 80 inches with annual limits ranging from five to two fish. Dark shaded cells represent projections for the most liberal size limits that do not exceed the 0.78 Mlb 2020 allocation. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

a. 5-fish annual limit, harvest = 78,821

Lower	Upper Length Limit (in)															
Limit (in)	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
40	1.532	1.446	1.379	1.304	1.250	1.202	1.132	1.065	1.027	0.997	0.967	0.947	0.919	0.903	0.902	0.890
41	1.554	1.469	1.404	1.330	1.276	1.229	1.160	1.094	1.056	1.026	0.996	0.976	0.948	0.933	0.931	0.919
42	1.567	1.483	1.419	1.345	1.293	1.245	1.177	1.112	1.074	1.044	1.015	0.995	0.967	0.952	0.950	0.938
43	1.582	1.499	1.435	1.363	1.311	1.264	1.197	1.132	1.094	1.065	1.036	1.016	0.988	0.973	0.971	0.960
44	1.604	1.523	1.461	1.389	1.338	1.292	1.225	1.160	1.123	1.094	1.065	1.046	1.018	1.003	1.001	0.990
45	1.629	1.550	1.488	1.418	1.367	1.322	1.256	1.192	1.155	1.127	1.098	1.078	1.051	1.036	1.034	1.023
46	1.644	1.566	1.505	1.436	1.386	1.341	1.276	1.212	1.176	1.148	1.119	1.099	1.072	1.058	1.056	1.044
47	1.665	1.589	1.530	1.461	1.412	1.368	1.303	1.240	1.204	1.176	1.148	1.129	1.102	1.087	1.085	1.074
48	1.679	1.604	1.546	1.478	1.429	1.385	1.321	1.259	1.223	1.195	1.167	1.148	1.121	1.107	1.105	1.094
49	1.704	1.631	1.573	1.507	1.459	1.416	1.352	1.291	1.256	1.228	1.200	1.181	1.154	1.140	1.138	1.127
50	x	1.649	1.592	1.527	1.480	1.437	1.374	1.314	1.279	1.251	1.224	1.205	1.178	1.164	1.162	1.151

b. 4-fish annual limit, harvest = 78,020

Lower	Upper Length Limit (in)															
Limit (in)	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
40	1.515	1.430	1.364	1.289	1.236	1.188	1.120	1.054	1.016	0.986	0.957	0.937	0.909	0.894	0.892	0.880
41	1.537	1.453	1.388	1.314	1.262	1.215	1.147	1.082	1.044	1.015	0.986	0.966	0.938	0.923	0.921	0.910
42	1.549	1.467	1.403	1.330	1.278	1.231	1.164	1.099	1.062	1.033	1.004	0.984	0.957	0.942	0.940	0.928
43	1.564	1.482	1.419	1.347	1.296	1.250	1.183	1.119	1.082	1.053	1.024	1.005	0.977	0.963	0.961	0.949
44	1.586	1.506	1.444	1.373	1.323	1.277	1.211	1.147	1.111	1.082	1.054	1.034	1.007	0.992	0.991	0.979
45	1.610	1.532	1.471	1.402	1.352	1.307	1.242	1.179	1.142	1.114	1.086	1.066	1.039	1.025	1.023	1.012
46	1.625	1.548	1.488	1.420	1.371	1.326	1.261	1.199	1.163	1.135	1.107	1.088	1.061	1.046	1.044	1.033
47	1.646	1.571	1.512	1.445	1.396	1.352	1.288	1.227	1.191	1.163	1.135	1.116	1.090	1.075	1.073	1.062
48	1.660	1.586	1.528	1.461	1.413	1.370	1.307	1.245	1.210	1.182	1.155	1.136	1.109	1.095	1.093	1.082
49	1.685	1.613	1.556	1.490	1.443	1.400	1.337	1.277	1.242	1.214	1.187	1.168	1.142	1.128	1.126	1.115
50	x	1.630	1.575	1.510	1.463	1.421	1.359	1.299	1.264	1.237	1.210	1.191	1.165	1.151	1.149	1.139

(continued)

Table 11. (continued)

c. 3-fish annual limit, harvest = 74,629

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
40	1.445	1.364	1.301	1.229	1.179	1.134	1.069	1.005	0.969	0.941	0.914	0.895	0.868	0.854	0.852	0.841
41	1.466	1.386	1.324	1.254	1.204	1.159	1.095	1.032	0.996	0.969	0.941	0.922	0.896	0.882	0.880	0.869
42	1.478	1.399	1.338	1.268	1.219	1.175	1.111	1.049	1.013	0.986	0.959	0.940	0.913	0.899	0.898	0.887
43	1.492	1.414	1.354	1.285	1.236	1.193	1.129	1.067	1.032	1.005	0.978	0.959	0.933	0.919	0.917	0.907
44	1.513	1.437	1.377	1.310	1.262	1.219	1.156	1.095	1.060	1.033	1.006	0.988	0.961	0.948	0.946	0.935
45	1.536	1.462	1.404	1.337	1.290	1.247	1.185	1.125	1.090	1.063	1.037	1.018	0.992	0.979	0.977	0.966
46	1.551	1.477	1.420	1.354	1.308	1.265	1.204	1.144	1.110	1.083	1.057	1.039	1.013	0.999	0.997	0.987
47	1.571	1.499	1.443	1.378	1.332	1.291	1.229	1.171	1.136	1.110	1.084	1.066	1.040	1.027	1.025	1.015
48	1.584	1.514	1.458	1.394	1.349	1.308	1.247	1.189	1.155	1.129	1.103	1.085	1.059	1.046	1.044	1.034
49	1.608	1.539	1.484	1.421	1.377	1.336	1.276	1.218	1.185	1.159	1.133	1.115	1.090	1.077	1.075	1.065
50	x	1.555	1.502	1.440	1.396	1.356	1.297	1.239	1.206	1.181	1.155	1.137	1.112	1.099	1.098	1.087

d. 2-fish annual limit, harvest = 62,393

Lower Limit (in)	Upper Length Limit (in)															
	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
40	1.203	1.134	1.082	1.023	0.982	0.945	0.891	0.838	0.808	0.785	0.762	0.747	0.725	0.713	0.712	0.703
41	1.221	1.153	1.102	1.044	1.004	0.967	0.913	0.861	0.831	0.808	0.786	0.770	0.748	0.737	0.735	0.727
42	1.231	1.164	1.113	1.056	1.016	0.980	0.926	0.875	0.845	0.822	0.800	0.785	0.763	0.751	0.750	0.741
43	1.242	1.176	1.126	1.070	1.030	0.994	0.941	0.890	0.861	0.838	0.816	0.801	0.779	0.768	0.766	0.758
44	1.260	1.196	1.147	1.091	1.052	1.016	0.964	0.913	0.884	0.862	0.840	0.825	0.803	0.792	0.791	0.782
45	1.280	1.217	1.168	1.114	1.075	1.040	0.988	0.938	0.910	0.887	0.865	0.851	0.829	0.818	0.816	0.808
46	1.291	1.230	1.182	1.128	1.090	1.055	1.004	0.954	0.926	0.904	0.882	0.867	0.846	0.835	0.833	0.825
47	1.309	1.248	1.202	1.148	1.111	1.077	1.026	0.977	0.949	0.927	0.905	0.891	0.869	0.858	0.857	0.848
48	1.320	1.261	1.215	1.162	1.125	1.091	1.041	0.992	0.964	0.942	0.921	0.906	0.885	0.874	0.873	0.864
49	1.340	1.281	1.236	1.184	1.148	1.115	1.065	1.017	0.989	0.968	0.946	0.932	0.911	0.900	0.899	0.890
50	x	1.295	1.251	1.200	1.164	1.131	1.082	1.034	1.007	0.986	0.965	0.950	0.929	0.919	0.917	0.909

Table 12. Estimated potential change in Area 2C harvest and projected harvest (number of fish) under a reverse slot limits with a lower limit of 45 inches and an upper limit of 80 inches limit combined with 0 – 17 Wednesday closures during May through September of 2021 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%	79,087
1	September 08	-0.2%	78,904
2	September 01 - September 08	-0.7%	78,541
3	August 25 - September 08	-1.5%	77,922
4	August 18 - September 08	-2.3%	77,282
5	August 11 - September 08	-3.5%	76,306
6	August 04 - September 08	-4.7%	75,379
7	July 28 - September 08	-6.1%	74,286
8	July 21 - September 08	-7.0%	73,529
9	July 14 - September 08	-8.2%	72,580
10	July 07 - September 08	-9.5%	71,562
11	June 30 - September 08	-10.5%	70,793
12	June 23 - September 08	-11.6%	69,941
13	June 16 - September 08	-12.5%	69,205
14	June 09 - September 08	-13.0%	68,767
15	June 02 - September 08	-13.5%	68,407
16	May 26 - September 08	-13.8%	68,150
17	May 19 - September 08	-14.0%	67,984
48 (all season)	February 01 - December 31	-14.1%	67,908

Table 13. Projected charter removals (Mlb) for Area 2C in 2021 under reverse slot limits with lower limits of the protected slot ranging from 40 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. Dark shaded cells represent projections for the most liberal size limit and closure day combinations that do not exceed the 0.78 Mlb 2020 allocation. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

Wednesday closures

Lower	Number of Wednesday Closures																		
Limit (in)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
40	0.893	0.890	0.886	0.879	0.872	0.861	0.850	0.838	0.829	0.818	0.807	0.798	0.788	0.780	0.775	0.770	0.767	0.765	0.765
41	0.922	0.920	0.916	0.908	0.901	0.889	0.878	0.865	0.856	0.845	0.833	0.825	0.815	0.806	0.800	0.796	0.793	0.791	0.790
42	0.941	0.939	0.935	0.927	0.919	0.908	0.897	0.883	0.874	0.863	0.851	0.842	0.831	0.822	0.817	0.812	0.809	0.807	0.806
43	0.963	0.960	0.956	0.948	0.940	0.928	0.917	0.903	0.894	0.882	0.870	0.861	0.850	0.841	0.835	0.830	0.827	0.825	0.824
44	0.993	0.990	0.986	0.978	0.970	0.957	0.946	0.931	0.922	0.910	0.897	0.888	0.877	0.867	0.861	0.857	0.853	0.851	0.850
45	1.026	1.023	1.018	1.010	1.002	0.989	0.977	0.962	0.952	0.940	0.927	0.917	0.906	0.896	0.890	0.885	0.881	0.879	0.878
46	1.048	1.045	1.040	1.032	1.023	1.010	0.998	0.983	0.972	0.960	0.946	0.937	0.925	0.915	0.909	0.904	0.900	0.898	0.897
47	1.077	1.074	1.069	1.061	1.052	1.038	1.026	1.010	1.000	0.987	0.973	0.963	0.951	0.941	0.934	0.929	0.925	0.923	0.922
48	1.097	1.094	1.089	1.080	1.071	1.058	1.045	1.029	1.018	1.005	0.991	0.981	0.969	0.958	0.952	0.946	0.942	0.940	0.939
49	1.131	1.127	1.122	1.113	1.104	1.090	1.076	1.060	1.049	1.036	1.021	1.011	0.998	0.987	0.980	0.975	0.971	0.968	0.967
50	1.155	1.151	1.146	1.137	1.127	1.113	1.099	1.083	1.071	1.058	1.043	1.032	1.019	1.008	1.001	0.995	0.991	0.989	0.988

Table 14. Estimated potential change in Area 2C harvest and projected harvest (number of fish) under a reverse slot limits with a lower limit of 45 inches and an upper limit of 80 inches combined with 0 – 17 Sunday closures during May through September of 2021 or a Sunday closure for 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%	79,087
1	September 12	-0.3%	78,832
2	September 05 - September 12	-1.0%	78,330
3	August 29 - September 12	-1.9%	77,618
4	August 22 - September 12	-2.3%	77,244
5	August 15 - September 12	-3.6%	76,217
6	August 08 - September 12	-4.8%	75,283
7	August 01 - September 12	-5.9%	74,430
8	July 25 - September 12	-7.0%	73,554
9	July 18 - September 12	-8.3%	72,530
10	July 11 - September 12	-9.4%	71,688
11	July 04 - September 12	-10.3%	70,921
12	June 27 - September 12	-11.2%	70,218
13	June 30 - September 12	-11.9%	69,644
14	June 13 - September 12	-12.5%	69,219
15	June 06 - September 12	-12.8%	68,954
16	May 30 - September 12	-13.2%	68,679
17	May 23 - September 12	-13.3%	68,531
48 (all season)	February 01 - December 31	-13.5%	68,395

Table 15. Projected charter removals (Mlb) for Area 2C in 2021 under reverse slot limits with lower limits of the protected slot ranging from 40 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. Dark shaded cells represent projections for the most liberal size limits and closure day combinations that do not exceed the 0.78 Mlb 2020 allocation. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

Sunday closures

Lower	Number of Sunday Closures																		
Limit (in)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
40	0.893	0.890	0.884	0.876	0.872	0.861	0.850	0.841	0.831	0.820	0.811	0.802	0.795	0.788	0.783	0.780	0.777	0.775	0.774
41	0.922	0.919	0.914	0.906	0.901	0.890	0.879	0.869	0.859	0.847	0.838	0.829	0.821	0.815	0.810	0.807	0.803	0.801	0.800
42	0.941	0.938	0.933	0.924	0.920	0.908	0.897	0.887	0.877	0.865	0.856	0.847	0.839	0.832	0.827	0.824	0.820	0.818	0.817
43	0.963	0.960	0.954	0.945	0.941	0.929	0.917	0.907	0.897	0.885	0.875	0.866	0.858	0.851	0.846	0.842	0.839	0.837	0.835
44	0.993	0.990	0.984	0.975	0.970	0.958	0.946	0.936	0.925	0.913	0.903	0.893	0.885	0.878	0.872	0.869	0.865	0.863	0.862
45	1.026	1.023	1.016	1.007	1.003	0.990	0.978	0.967	0.956	0.943	0.933	0.923	0.914	0.907	0.901	0.898	0.894	0.892	0.890
46	1.048	1.044	1.038	1.029	1.024	1.011	0.998	0.988	0.976	0.963	0.953	0.943	0.934	0.927	0.921	0.917	0.913	0.911	0.909
47	1.077	1.074	1.067	1.058	1.053	1.039	1.027	1.015	1.004	0.990	0.980	0.970	0.960	0.953	0.947	0.943	0.939	0.937	0.935
48	1.097	1.094	1.087	1.077	1.072	1.058	1.046	1.034	1.023	1.009	0.998	0.988	0.978	0.971	0.964	0.960	0.956	0.954	0.952
49	1.131	1.127	1.120	1.110	1.105	1.091	1.078	1.066	1.054	1.040	1.029	1.018	1.008	1.000	0.994	0.990	0.986	0.983	0.982
50	1.155	1.151	1.144	1.134	1.129	1.114	1.101	1.089	1.076	1.062	1.051	1.040	1.030	1.022	1.015	1.011	1.007	1.005	1.003

Table 16. Projected charter removals (Mlb) and harvest for Area 2C in 2021 under reverse slot limits with lower limits of the protected slot ranging from 40 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, and annual limits ranging from two to five fish. Light shaded cells represent projections for the most liberal combinations that do not exceed the reference TCEY allocation of 0.65 Mlb. Dark shaded cells represent projections for the most liberal combinations that do not exceed the 2020 allocation of 0.78 Mlb. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

a. 5-fish annual limit

Lower	Number of Wednesday Closures																		
Limit (in)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
40	0.890	0.887	0.883	0.876	0.869	0.858	0.847	0.835	0.826	0.816	0.804	0.796	0.786	0.777	0.772	0.768	0.765	0.763	0.762
41	0.919	0.917	0.913	0.905	0.898	0.887	0.876	0.863	0.854	0.843	0.831	0.822	0.812	0.803	0.798	0.793	0.790	0.788	0.787
42	0.938	0.936	0.932	0.924	0.916	0.905	0.894	0.880	0.871	0.860	0.848	0.839	0.829	0.820	0.814	0.810	0.806	0.804	0.804
43	0.960	0.957	0.953	0.945	0.937	0.925	0.914	0.900	0.891	0.879	0.867	0.858	0.847	0.838	0.832	0.828	0.824	0.822	0.821
44	0.990	0.987	0.982	0.975	0.966	0.954	0.942	0.929	0.919	0.907	0.894	0.885	0.874	0.865	0.859	0.854	0.850	0.848	0.847
45	1.023	1.020	1.015	1.007	0.998	0.986	0.974	0.959	0.949	0.937	0.924	0.914	0.903	0.893	0.887	0.882	0.879	0.876	0.875
46	1.044	1.041	1.037	1.028	1.020	1.007	0.994	0.980	0.969	0.957	0.943	0.934	0.922	0.912	0.906	0.901	0.897	0.895	0.894
47	1.074	1.071	1.066	1.057	1.048	1.035	1.022	1.007	0.997	0.984	0.970	0.960	0.948	0.938	0.931	0.926	0.922	0.920	0.919
48	1.094	1.091	1.085	1.077	1.068	1.054	1.041	1.026	1.015	1.002	0.988	0.978	0.966	0.955	0.949	0.943	0.939	0.937	0.936
49	1.127	1.124	1.119	1.110	1.100	1.087	1.073	1.057	1.046	1.033	1.018	1.007	0.995	0.984	0.977	0.972	0.968	0.965	0.964
50	1.151	1.148	1.142	1.133	1.124	1.110	1.096	1.079	1.068	1.054	1.039	1.029	1.016	1.005	0.998	0.992	0.988	0.986	0.985
Harvest	78,821	78,639	78,275	77,660	77,023	76,050	75,128	74,039	73,283	72,338	71,324	70,559	69,708	68,976	68,538	68,179	67,922	67,757	67,682

b. 4-fish annual limit

Lower	Number of Wednesday Closures																		
Limit (in)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
40	0.880	0.878	0.874	0.867	0.860	0.849	0.838	0.826	0.818	0.807	0.796	0.787	0.778	0.769	0.764	0.760	0.757	0.755	0.754
41	0.910	0.907	0.903	0.896	0.888	0.877	0.866	0.854	0.845	0.834	0.822	0.813	0.804	0.795	0.790	0.785	0.782	0.780	0.779
42	0.928	0.926	0.922	0.914	0.907	0.895	0.884	0.871	0.862	0.851	0.839	0.830	0.820	0.811	0.806	0.801	0.798	0.796	0.795
43	0.949	0.947	0.942	0.935	0.927	0.915	0.904	0.891	0.881	0.870	0.858	0.849	0.838	0.829	0.824	0.819	0.816	0.814	0.813
44	0.979	0.977	0.972	0.964	0.956	0.944	0.932	0.919	0.909	0.897	0.885	0.876	0.865	0.856	0.850	0.845	0.841	0.839	0.838
45	1.012	1.009	1.004	0.996	0.988	0.975	0.963	0.949	0.939	0.927	0.914	0.905	0.894	0.884	0.878	0.873	0.869	0.867	0.866
46	1.033	1.030	1.025	1.017	1.009	0.996	0.984	0.969	0.959	0.947	0.934	0.924	0.913	0.903	0.896	0.891	0.888	0.885	0.884
47	1.062	1.059	1.054	1.046	1.037	1.024	1.011	0.996	0.986	0.973	0.960	0.950	0.938	0.928	0.922	0.916	0.913	0.910	0.909
48	1.082	1.079	1.074	1.065	1.056	1.043	1.030	1.015	1.004	0.992	0.978	0.968	0.956	0.945	0.939	0.933	0.930	0.927	0.926
49	1.115	1.112	1.107	1.098	1.089	1.075	1.062	1.046	1.035	1.022	1.007	0.997	0.985	0.974	0.967	0.962	0.958	0.955	0.954
50	1.139	1.135	1.130	1.121	1.111	1.098	1.084	1.068	1.057	1.043	1.028	1.018	1.005	0.994	0.987	0.982	0.978	0.975	0.974
Harvest	78,020	77,841	77,481	76,871	76,244	75,282	74,369	73,292	72,546	71,613	70,608	69,854	69,014	68,289	67,854	67,499	67,246	67,081	67,006

(continued)

Table 16. (continued)

c. 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
40	0.841	0.839	0.835	0.829	0.822	0.811	0.801	0.790	0.782	0.772	0.761	0.753	0.744	0.736	0.731	0.727	0.724	0.722	0.721
41	0.869	0.867	0.863	0.856	0.849	0.838	0.828	0.816	0.807	0.797	0.786	0.778	0.768	0.760	0.755	0.751	0.748	0.746	0.745
42	0.887	0.885	0.881	0.874	0.866	0.855	0.845	0.832	0.824	0.813	0.802	0.794	0.784	0.775	0.770	0.766	0.763	0.761	0.760
43	0.907	0.904	0.900	0.893	0.886	0.874	0.864	0.851	0.842	0.831	0.820	0.811	0.801	0.793	0.787	0.783	0.780	0.778	0.777
44	0.935	0.933	0.929	0.921	0.913	0.902	0.891	0.878	0.869	0.858	0.846	0.837	0.827	0.818	0.812	0.808	0.804	0.802	0.801
45	0.966	0.964	0.959	0.952	0.944	0.932	0.921	0.907	0.898	0.886	0.874	0.865	0.854	0.845	0.839	0.834	0.831	0.829	0.828
46	0.987	0.984	0.980	0.972	0.964	0.952	0.940	0.926	0.917	0.905	0.892	0.883	0.872	0.863	0.857	0.852	0.849	0.846	0.845
47	1.015	1.012	1.007	0.999	0.991	0.978	0.966	0.952	0.942	0.930	0.917	0.908	0.897	0.887	0.881	0.876	0.872	0.870	0.869
48	1.034	1.031	1.026	1.018	1.009	0.997	0.985	0.970	0.960	0.948	0.934	0.925	0.914	0.904	0.897	0.892	0.889	0.886	0.885
49	1.065	1.062	1.057	1.049	1.040	1.027	1.014	0.999	0.989	0.976	0.962	0.953	0.941	0.931	0.924	0.919	0.915	0.913	0.912
50	1.087	1.084	1.079	1.071	1.062	1.048	1.035	1.020	1.009	0.997	0.982	0.972	0.961	0.950	0.943	0.938	0.934	0.932	0.931
Harvest	74,629	74,457	74,114	73,534	72,937	72,019	71,149	70,121	69,412	68,521	67,561	66,842	66,044	65,352	64,938	64,597	64,354	64,194	64,122

d. 2-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
40	0.703	0.701	0.698	0.692	0.687	0.678	0.670	0.660	0.653	0.645	0.636	0.629	0.622	0.615	0.611	0.607	0.605	0.604	0.603
41	0.727	0.725	0.721	0.716	0.710	0.701	0.692	0.682	0.675	0.667	0.657	0.650	0.643	0.636	0.631	0.628	0.625	0.624	0.623
42	0.741	0.739	0.736	0.730	0.724	0.715	0.706	0.696	0.689	0.680	0.670	0.663	0.655	0.648	0.644	0.640	0.638	0.636	0.636
43	0.758	0.756	0.752	0.746	0.740	0.731	0.722	0.711	0.704	0.695	0.685	0.678	0.670	0.663	0.658	0.654	0.652	0.650	0.649
44	0.782	0.780	0.776	0.770	0.764	0.754	0.745	0.734	0.726	0.717	0.707	0.700	0.691	0.684	0.679	0.675	0.673	0.671	0.670
45	0.808	0.806	0.802	0.796	0.789	0.779	0.770	0.758	0.750	0.741	0.730	0.723	0.714	0.706	0.702	0.698	0.695	0.693	0.692
46	0.825	0.823	0.819	0.812	0.806	0.796	0.786	0.774	0.766	0.757	0.746	0.738	0.729	0.721	0.716	0.712	0.710	0.708	0.707
47	0.848	0.846	0.842	0.836	0.829	0.818	0.808	0.796	0.788	0.778	0.767	0.759	0.750	0.742	0.737	0.733	0.730	0.728	0.727
48	0.864	0.862	0.858	0.851	0.844	0.834	0.824	0.811	0.803	0.793	0.782	0.774	0.764	0.756	0.751	0.747	0.744	0.742	0.741
49	0.890	0.888	0.884	0.877	0.869	0.859	0.848	0.836	0.827	0.816	0.805	0.797	0.787	0.778	0.773	0.769	0.766	0.764	0.763
50	0.909	0.906	0.902	0.895	0.888	0.877	0.866	0.853	0.844	0.833	0.822	0.813	0.803	0.795	0.789	0.785	0.781	0.779	0.779
Harvest	62,393	62,250	61,966	61,482	60,986	60,222	59,497	58,633	58,043	57,298	56,494	55,894	55,233	54,651	54,310	54,025	53,821	53,691	53,628

Table 17. Projected charter removals (Mlb) and harvest for Area 2C in 2021 under reverse slot limits with lower limits of the protected slot ranging from 40 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, and annual limits ranging from two to five fish. Light shaded cells represent projections for the most liberal combinations that do not exceed the reference TCEY allocation of 0.65 Mlb. Dark shaded cells represent projections for the most liberal combinations limits that do not exceed the 2020 allocation of 0.78 Mlb. All values in the table include corrections for 2015-2020 errors in estimation of average weight and inflation factors for release mortality.

a. 5-fish annual limit

Lower	Number of Sunday Closures																		
Limit (in)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
40	0.890	0.887	0.881	0.874	0.869	0.858	0.848	0.838	0.829	0.817	0.808	0.800	0.792	0.786	0.781	0.778	0.775	0.773	0.771
41	0.919	0.916	0.911	0.903	0.898	0.887	0.876	0.866	0.856	0.845	0.835	0.827	0.819	0.812	0.807	0.804	0.801	0.799	0.797
42	0.938	0.935	0.930	0.921	0.917	0.905	0.894	0.884	0.874	0.862	0.853	0.844	0.836	0.829	0.824	0.821	0.817	0.816	0.814
43	0.960	0.957	0.951	0.942	0.938	0.926	0.914	0.904	0.894	0.882	0.872	0.863	0.855	0.848	0.843	0.839	0.836	0.834	0.833
44	0.990	0.987	0.981	0.972	0.967	0.955	0.943	0.933	0.922	0.910	0.900	0.891	0.882	0.875	0.869	0.866	0.862	0.860	0.859
45	1.023	1.019	1.013	1.004	0.999	0.986	0.974	0.964	0.953	0.940	0.930	0.920	0.911	0.904	0.898	0.895	0.891	0.889	0.887
46	1.044	1.041	1.035	1.025	1.021	1.007	0.995	0.984	0.973	0.960	0.950	0.940	0.931	0.924	0.918	0.914	0.910	0.908	0.906
47	1.074	1.070	1.064	1.054	1.049	1.036	1.023	1.012	1.001	0.987	0.977	0.967	0.957	0.950	0.944	0.940	0.936	0.934	0.932
48	1.094	1.090	1.083	1.074	1.069	1.055	1.042	1.031	1.019	1.005	0.995	0.985	0.975	0.967	0.961	0.957	0.953	0.951	0.949
49	1.127	1.123	1.117	1.107	1.102	1.087	1.074	1.063	1.051	1.036	1.025	1.015	1.005	0.997	0.991	0.987	0.983	0.980	0.978
50	1.151	1.147	1.140	1.130	1.125	1.111	1.097	1.085	1.073	1.058	1.047	1.037	1.027	1.019	1.012	1.008	1.004	1.001	1.000
Harvest	78,821	78,567	78,067	77,357	76,982	75,961	75,030	74,180	73,307	72,287	71,448	70,684	69,983	69,410	68,988	68,721	68,448	68,300	68,164

b. 4-fish annual limit

Lower	Number of Sunday Closures																		
Limit (in)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	All
40	0.880	0.877	0.872	0.864	0.860	0.849	0.839	0.829	0.820	0.809	0.800	0.791	0.784	0.777	0.772	0.769	0.766	0.765	0.763
41	0.910	0.907	0.901	0.893	0.889	0.877	0.867	0.857	0.847	0.836	0.826	0.818	0.810	0.803	0.798	0.795	0.792	0.790	0.789
42	0.928	0.925	0.920	0.912	0.907	0.895	0.885	0.875	0.865	0.853	0.844	0.835	0.827	0.820	0.815	0.812	0.809	0.807	0.805
43	0.949	0.946	0.940	0.932	0.928	0.916	0.904	0.895	0.884	0.872	0.863	0.854	0.846	0.839	0.834	0.830	0.827	0.825	0.823
44	0.979	0.976	0.970	0.961	0.957	0.944	0.933	0.923	0.912	0.900	0.890	0.881	0.872	0.866	0.860	0.857	0.853	0.851	0.849
45	1.012	1.008	1.002	0.993	0.989	0.976	0.964	0.954	0.943	0.930	0.920	0.910	0.902	0.894	0.889	0.885	0.881	0.879	0.878
46	1.033	1.030	1.024	1.014	1.010	0.997	0.984	0.974	0.963	0.950	0.939	0.930	0.921	0.914	0.908	0.904	0.900	0.898	0.896
47	1.062	1.059	1.052	1.043	1.038	1.025	1.012	1.001	0.990	0.976	0.966	0.956	0.947	0.939	0.933	0.930	0.926	0.924	0.922
48	1.082	1.078	1.072	1.062	1.057	1.044	1.031	1.020	1.008	0.995	0.984	0.974	0.965	0.957	0.951	0.947	0.943	0.941	0.939
49	1.115	1.111	1.105	1.095	1.090	1.076	1.063	1.051	1.039	1.025	1.014	1.004	0.994	0.986	0.980	0.976	0.972	0.970	0.968
50	1.139	1.135	1.128	1.118	1.113	1.098	1.085	1.073	1.061	1.047	1.036	1.025	1.015	1.007	1.001	0.997	0.993	0.990	0.988
Harvest	78,020	77,769	77,273	76,570	76,198	75,185	74,265	73,423	72,559	71,546	70,715	69,959	69,265	68,698	68,279	68,014	67,743	67,596	67,460

(continued)

Table 17. (continued)

c. 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
40	0.841	0.839	0.833	0.826	0.822	0.811	0.801	0.792	0.783	0.773	0.764	0.756	0.749	0.743	0.738	0.735	0.732	0.730	0.729
41	0.869	0.866	0.861	0.853	0.849	0.838	0.828	0.819	0.809	0.798	0.790	0.781	0.774	0.767	0.763	0.760	0.756	0.755	0.753
42	0.887	0.884	0.879	0.871	0.867	0.855	0.845	0.836	0.826	0.815	0.806	0.798	0.790	0.783	0.779	0.775	0.772	0.770	0.769
43	0.907	0.904	0.898	0.890	0.886	0.874	0.864	0.854	0.845	0.833	0.824	0.815	0.807	0.801	0.796	0.793	0.789	0.788	0.786
44	0.935	0.932	0.927	0.918	0.914	0.902	0.891	0.881	0.871	0.859	0.850	0.841	0.833	0.826	0.821	0.818	0.815	0.813	0.811
45	0.966	0.963	0.957	0.949	0.944	0.932	0.921	0.911	0.900	0.888	0.878	0.869	0.861	0.854	0.849	0.845	0.842	0.840	0.838
46	0.987	0.984	0.978	0.969	0.964	0.952	0.940	0.930	0.919	0.907	0.897	0.888	0.879	0.872	0.867	0.863	0.860	0.858	0.856
47	1.015	1.011	1.005	0.996	0.992	0.979	0.967	0.956	0.945	0.933	0.923	0.913	0.904	0.897	0.891	0.888	0.884	0.882	0.880
48	1.034	1.030	1.024	1.015	1.010	0.997	0.985	0.974	0.963	0.950	0.940	0.930	0.921	0.914	0.908	0.904	0.901	0.898	0.897
49	1.065	1.062	1.055	1.046	1.041	1.027	1.015	1.004	0.992	0.979	0.968	0.958	0.949	0.942	0.936	0.932	0.928	0.926	0.924
50	1.087	1.084	1.077	1.068	1.063	1.049	1.036	1.025	1.013	0.999	0.989	0.979	0.969	0.962	0.956	0.952	0.948	0.945	0.943
Harvest	74,629	74,388	73,913	73,236	72,880	71,910	71,026	70,222	69,395	68,427	67,630	66,905	66,239	65,693	65,294	65,039	64,778	64,636	64,501

d. 2-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
40	0.703	0.701	0.696	0.690	0.687	0.678	0.669	0.662	0.654	0.645	0.638	0.632	0.625	0.620	0.617	0.614	0.612	0.610	0.609
41	0.727	0.724	0.720	0.713	0.710	0.701	0.692	0.684	0.676	0.667	0.660	0.653	0.647	0.641	0.637	0.635	0.632	0.631	0.629
42	0.741	0.739	0.734	0.728	0.724	0.715	0.706	0.698	0.690	0.681	0.673	0.666	0.660	0.655	0.651	0.648	0.645	0.644	0.642
43	0.758	0.755	0.751	0.744	0.740	0.731	0.722	0.714	0.706	0.696	0.688	0.681	0.675	0.669	0.665	0.662	0.660	0.658	0.657
44	0.782	0.779	0.775	0.768	0.764	0.754	0.745	0.737	0.728	0.718	0.710	0.703	0.696	0.691	0.686	0.684	0.681	0.679	0.678
45	0.808	0.805	0.800	0.793	0.789	0.779	0.769	0.761	0.752	0.742	0.734	0.726	0.719	0.714	0.709	0.706	0.703	0.702	0.700
46	0.825	0.822	0.817	0.810	0.806	0.796	0.786	0.777	0.768	0.758	0.750	0.742	0.735	0.729	0.724	0.721	0.718	0.717	0.715
47	0.848	0.846	0.840	0.833	0.829	0.818	0.808	0.799	0.790	0.780	0.771	0.763	0.756	0.750	0.745	0.742	0.739	0.737	0.736
48	0.864	0.862	0.856	0.849	0.845	0.834	0.823	0.815	0.805	0.794	0.786	0.778	0.770	0.764	0.759	0.756	0.753	0.751	0.749
49	0.890	0.887	0.882	0.874	0.870	0.859	0.848	0.839	0.829	0.818	0.809	0.801	0.793	0.787	0.782	0.779	0.776	0.774	0.772
50	0.909	0.906	0.900	0.892	0.888	0.877	0.866	0.857	0.847	0.835	0.827	0.818	0.810	0.804	0.799	0.795	0.792	0.790	0.788
Harvest	62,393	62,187	61,786	61,219	60,919	60,111	59,370	58,697	58,007	57,194	56,532	55,921	55,367	54,915	54,583	54,368	54,149	54,030	53,907

Table 18. Forecasts of effort (angler-days), halibut harvest per unit effort (HPUE), and harvest (numbers of halibut) for Area 3A in 2021 under status quo regulations, with associated standard errors. Status quo regulations include a two-fish bag limit with a maximum size limit of 32” on one of the fish, permit trip limits, and vessel trip limits.

Subarea	Effort	Std Error	HPUE	Std Error	Harvest	Std Error
CCI	20,817	NA	1.87	0.05	38,910	701
EPWS	6,114	NA	1.31	0.12	7,990	557
GlacB	2,650	NA	0.84	0.17	2,221	363
Yak	5,580	NA	1.10	0.14	6,158	629
LCI	43,999	NA	1.74	0.05	76,339	1,526
NGulf	39,507	NA	1.22	0.09	48,152	2,777
Kod	14,224	NA	1.18	0.10	16,843	941
WPWS	5,931	NA	1.25	0.13	7,419	628
Area 3A	138,822	NA	1.47	NA	204,032	3,557

Table 19. Area 3A projected harvest for 2021 under a range of maximum size limits on one fish in the bag limit with all other status quo management measures. Projections include corrections for errors in estimation of average weight and an inflation factor of 1.4% for release mortality.

Size Limit	Removal (Mlb)
26	2.580
27	2.626
28	2.695
29	2.741
30	2.810
31	2.857
32	2.918
33	2.955

Table 20. Estimated effects of annual limits of two to six halibut on Area 3A anglers and projected harvest for 2021 under status quo management measures.

Annual Limit	Subarea								Area 3A
	CCI	EPWS	GlacBay	Yak	LCI	NGulf	Kod	WPWS	
	Estimated percent change in harvest relative to no annual limit:								
2	-16.8%	-7.4%	-12.6%	-18.3%	-14.1%	-9.1%	-37.2%	-3.1%	-14.8%
3	-10.4%	-3.1%	-2.3%	-7.2%	-8.5%	-4.9%	-24.0%	-0.9%	-8.7%
4	-5.9%	-1.3%	-0.3%	-3.6%	-4.5%	-3.1%	-17.4%	-0.3%	-5.1%
5	-3.8%	-0.5%	0.0%	-1.4%	-2.8%	-1.7%	-11.1%	0.0%	-3.2%
6	-2.0%	-0.2%	0.0%	-0.7%	-1.3%	-0.9%	-6.8%	0.0%	-1.7%
	Projected harvest (number of halibut):								
2	32,376	7,396	1,940	5,034	65,560	43,789	10,572	7,185	173,852
3	34,856	7,744	2,170	5,714	69,884	45,808	12,801	7,356	186,334
4	36,633	7,886	2,215	5,939	72,890	46,680	13,914	7,396	193,555
5	37,428	7,947	2,221	6,070	74,223	47,314	14,974	7,417	197,593
6	38,115	7,974	2,221	6,113	75,369	47,740	15,697	7,419	200,648
None	38,910	7,990	2,221	6,158	76,339	48,152	16,843	7,419	204,032

Table 21. Area 3A projected harvest (upper table) and removal (lower table) for 2021 under annual limits ranging from two to six fish. Projected removals assume all other status quo measures. Projections include corrections for errors in estimation of average weight and an inflation factor of 1.4% for release mortality.

Harvest (number of fish)

Annual Limit					
2	3	4	5	6	None
173,852	186,334	193,555	197,593	200,648	204,032

Removal (Mlb)

2	3	4	5	6	None
2.497	2.681	2.778	2.833	2.873	2.918

Table 22. Area 3A estimated potential change in harvest and projected removals associated with 0 – 13 Wednesday closures during June through August of 2021 or Wednesdays closed for the entire year. All other management measures are status quo. Projections include corrections for errors in estimation of average weight and an inflation factor of 1.4% for release mortality.

Number of Closed Wednesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)	Projected Removals (Mlb)
0		0.0%	204,032	2.918
1	July 28	-1.4%	201,094	2.875
2	July 28 - August 04	-2.0%	199,852	2.858
3	July 21 - August 04	-2.6%	198,637	2.839
4	July 14 - August 04	-3.3%	197,375	2.820
5	July 14 - August 11	-4.0%	195,798	2.798
6	July 07 - August 11	-5.1%	193,663	2.767
7	June 30 - August 11	-6.0%	191,726	2.739
8	June 30 - August 18	-7.2%	189,333	2.704
9	June 23 - August 18	-8.6%	186,580	2.663
10	June 16 - August 18	-9.3%	184,979	2.641
11	June 16 - August 25	-10.8%	181,962	2.598
12	June 09 - August 25	-12.3%	178,923	2.556
13	June 02 - August 25	-13.7%	176,127	2.517
48 (all season)	February 01 - December 31	-15.3%	172,845	2.470

Table 23. Area 3A 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 2021 or Tuesdays closed for the entire year, and Wednesdays closed for the entire year. Projections assume all other status quo management measures. Projections include corrections for errors in estimation of average weight and an inflation factor of 1.4% for release mortality.

Number of Closed Tuesdays	Beginning and Ending Dates	Percentage change in harvest relative to status quo	Projected Harvest (no. Fish)	Projected Removals (Mlb)
0		-15.3%	172,845	2.470
1	July 27	-16.4%	170,606	2.438
2	July 27 - August 03	-17.7%	167,886	2.398
3	July 20 - August 03	-18.8%	165,721	2.366
4	July 13 - August 03	-20.0%	163,240	2.332
5	July 13 - August 10	-21.3%	160,663	2.297
6	July 06 - August 10	-22.5%	158,189	2.262
7	June 29 - August 10	-23.5%	156,032	2.231
8	June 29 - August 17	-24.4%	154,276	2.205
9	June 22 - August 17	-25.1%	152,821	2.185
10	June 15 - August 17	-26.0%	151,060	2.159
11	June 15 - August 24	-26.1%	150,709	2.154
12	June 08 - August 24	-26.9%	149,217	2.132
13	June 01 - August 24	-27.2%	148,500	2.123
48 (all season)	February 01 - December 31	-28.7%	145,422	2.078

Table 24. Area 3A projected harvest and removals for 2021 under a range of maximum size limits on one fish in the bag limit and 0 – 13 Wednesdays closed or a Wednesday closure for the entire season, and annual limits ranging from two to six fish or no annual limit. Projections assume all other status quo management measures. Light shaded cells represent projections for the most liberal combinations that do not exceed the reference TCEY allocation of 1.93 Mlb. Projections include corrections for errors in estimation of average weight and an inflation factor of 1.4% for release mortality.

a. Projected Harvest (number of fish)

	Number of Wednesday Closures														
Annual Limit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
None	204,032	201,094	199,852	198,637	197,375	195,798	193,663	191,726	189,333	186,580	184,979	181,962	178,923	176,127	172,845
6	200,648	197,773	196,549	195,351	194,114	192,561	190,463	188,560	186,204	183,492	181,925	178,957	175,970	173,222	169,993
5	197,593	194,771	193,564	192,383	191,165	189,634	187,570	185,696	183,374	180,699	179,162	176,237	173,298	170,593	167,411
4	193,555	190,803	189,618	188,459	187,269	185,768	183,748	181,914	179,636	177,012	175,512	172,646	169,767	167,119	164,000
3	186,334	183,701	182,556	181,439	180,294	178,846	176,902	175,135	172,939	170,406	168,972	166,210	163,442	160,895	157,888
2	173,852	171,426	170,351	169,307	168,248	166,890	165,078	163,431	161,375	159,004	157,681	155,099	152,515	150,142	147,329

b. Projected Charter Removals (Mlb) - No Annual Limit

Size limit	Number of Wednesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.580	2.542	2.527	2.510	2.492	2.473	2.446	2.421	2.390	2.354	2.335	2.296	2.260	2.225	2.183
27	2.626	2.587	2.572	2.555	2.537	2.518	2.490	2.464	2.433	2.396	2.377	2.338	2.301	2.265	2.222
28	2.695	2.656	2.640	2.623	2.604	2.584	2.556	2.530	2.497	2.459	2.440	2.399	2.361	2.325	2.281
29	2.741	2.700	2.684	2.667	2.648	2.628	2.599	2.572	2.539	2.501	2.481	2.440	2.401	2.364	2.320
30	2.810	2.769	2.752	2.734	2.715	2.694	2.665	2.637	2.604	2.564	2.544	2.502	2.462	2.424	2.378
31	2.857	2.815	2.798	2.780	2.761	2.740	2.709	2.682	2.647	2.607	2.586	2.544	2.503	2.464	2.418
32	2.918	2.875	2.858	2.839	2.820	2.798	2.767	2.739	2.704	2.663	2.641	2.598	2.556	2.517	2.470
33	2.955	2.912	2.894	2.876	2.856	2.834	2.803	2.774	2.738	2.697	2.675	2.631	2.589	2.549	2.501

(continued)

Table 24. (continued)

c. Projected Charter Removals (Mlb) – 6-fish Annual Limit

Size	Number of Wednesday Closures														
limit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.541	2.504	2.489	2.472	2.455	2.436	2.409	2.385	2.354	2.318	2.300	2.262	2.226	2.192	2.151
27	2.586	2.548	2.533	2.516	2.499	2.480	2.452	2.427	2.396	2.360	2.341	2.302	2.266	2.231	2.189
28	2.654	2.616	2.600	2.583	2.565	2.545	2.517	2.491	2.459	2.422	2.403	2.363	2.326	2.290	2.247
29	2.699	2.659	2.643	2.626	2.608	2.588	2.559	2.533	2.501	2.463	2.443	2.403	2.365	2.328	2.284
30	2.767	2.727	2.710	2.693	2.674	2.653	2.624	2.597	2.564	2.525	2.505	2.464	2.425	2.387	2.342
31	2.814	2.773	2.756	2.738	2.719	2.698	2.668	2.641	2.607	2.568	2.547	2.505	2.465	2.427	2.381
32	2.873	2.831	2.814	2.796	2.777	2.755	2.725	2.697	2.662	2.622	2.601	2.558	2.517	2.478	2.432
33	2.910	2.867	2.850	2.832	2.812	2.790	2.760	2.731	2.696	2.656	2.634	2.591	2.549	2.510	2.463

d. Projected Charter Removals (Mlb) – 5-fish Annual Limit

Size	Number of Wednesday Closures														
limit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.506	2.470	2.455	2.439	2.422	2.403	2.377	2.352	2.322	2.287	2.268	2.231	2.196	2.162	2.121
27	2.551	2.514	2.498	2.482	2.464	2.446	2.419	2.394	2.363	2.327	2.309	2.271	2.235	2.200	2.159
28	2.618	2.580	2.564	2.547	2.530	2.510	2.483	2.457	2.426	2.389	2.370	2.331	2.294	2.258	2.216
29	2.662	2.623	2.607	2.590	2.572	2.552	2.524	2.498	2.466	2.429	2.409	2.370	2.332	2.296	2.253
30	2.729	2.689	2.673	2.656	2.637	2.617	2.588	2.562	2.529	2.490	2.470	2.430	2.391	2.354	2.310
31	2.775	2.734	2.718	2.700	2.681	2.661	2.631	2.604	2.571	2.532	2.512	2.470	2.431	2.393	2.349
32	2.833	2.792	2.775	2.757	2.738	2.717	2.687	2.660	2.626	2.586	2.565	2.523	2.483	2.444	2.398
33	2.870	2.828	2.811	2.792	2.773	2.752	2.721	2.693	2.659	2.619	2.598	2.555	2.514	2.475	2.429

e. Projected Charter Removals (Mlb) – 4-fish Annual Limit

Size	Number of Wednesday Closures														
limit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.458	2.422	2.407	2.392	2.375	2.357	2.331	2.307	2.277	2.242	2.225	2.188	2.154	2.120	2.080
27	2.501	2.465	2.450	2.434	2.417	2.398	2.372	2.348	2.317	2.282	2.264	2.227	2.192	2.158	2.117
28	2.567	2.530	2.514	2.498	2.481	2.461	2.434	2.410	2.379	2.342	2.324	2.285	2.249	2.214	2.173
29	2.610	2.572	2.557	2.540	2.522	2.503	2.475	2.450	2.418	2.382	2.363	2.324	2.287	2.252	2.209
30	2.676	2.637	2.621	2.604	2.586	2.566	2.538	2.512	2.480	2.442	2.423	2.383	2.345	2.308	2.265
31	2.721	2.681	2.665	2.648	2.629	2.609	2.580	2.554	2.521	2.483	2.463	2.422	2.384	2.347	2.303
32	2.778	2.738	2.721	2.704	2.685	2.664	2.635	2.608	2.574	2.535	2.515	2.474	2.434	2.397	2.352
33	2.813	2.773	2.756	2.738	2.719	2.698	2.668	2.641	2.607	2.568	2.547	2.505	2.465	2.427	2.381

(continued)

Table 24. (continued)

f. Projected Charter Removals (Mlb) – 3-fish Annual Limit

Size limit	Number of Wednesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.372	2.338	2.324	2.309	2.292	2.275	2.250	2.227	2.198	2.164	2.147	2.112	2.079	2.046	2.008
27	2.414	2.379	2.364	2.349	2.333	2.315	2.289	2.266	2.237	2.202	2.185	2.149	2.115	2.082	2.043
28	2.477	2.442	2.427	2.411	2.394	2.376	2.349	2.325	2.295	2.260	2.243	2.206	2.171	2.137	2.097
29	2.519	2.482	2.467	2.451	2.434	2.415	2.389	2.364	2.334	2.298	2.280	2.242	2.207	2.173	2.132
30	2.582	2.545	2.530	2.513	2.496	2.476	2.449	2.424	2.393	2.356	2.338	2.299	2.263	2.228	2.186
31	2.625	2.587	2.572	2.555	2.537	2.518	2.490	2.464	2.433	2.396	2.377	2.337	2.300	2.265	2.222
32	2.681	2.642	2.626	2.609	2.591	2.571	2.542	2.516	2.484	2.446	2.427	2.387	2.349	2.313	2.269
33	2.714	2.675	2.659	2.642	2.624	2.603	2.575	2.548	2.515	2.477	2.458	2.417	2.379	2.342	2.298

g. Projected Charter Removals (Mlb) – 2-fish Annual Limit

Size limit	Number of Wednesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.209	2.178	2.165	2.151	2.136	2.119	2.096	2.074	2.047	2.016	2.000	1.967	1.936	1.906	1.870
27	2.248	2.216	2.203	2.188	2.173	2.156	2.133	2.111	2.083	2.051	2.035	2.002	1.970	1.940	1.903
28	2.307	2.275	2.261	2.246	2.230	2.213	2.189	2.166	2.138	2.106	2.089	2.055	2.022	1.991	1.953
29	2.346	2.313	2.299	2.284	2.268	2.250	2.226	2.203	2.174	2.141	2.124	2.089	2.056	2.024	1.986
30	2.406	2.372	2.357	2.342	2.326	2.307	2.282	2.259	2.230	2.195	2.178	2.142	2.108	2.076	2.037
31	2.446	2.411	2.396	2.381	2.364	2.346	2.320	2.296	2.267	2.232	2.215	2.178	2.143	2.110	2.070
32	2.497	2.462	2.447	2.431	2.414	2.395	2.369	2.345	2.315	2.279	2.261	2.224	2.189	2.155	2.114
33	2.529	2.493	2.478	2.462	2.445	2.426	2.399	2.375	2.344	2.308	2.290	2.252	2.216	2.182	2.141

Table 25. Area 3A projected harvest and removals for 2021 under a range of maximum size limits on one fish in the bag limit, 0 – 13 Tuesdays closed or a Tuesday closure for the entire season, with Wednesdays closed for the entire season, and annual limits ranging from two to six fish or no annual limit. Projections assume all other status quo management measures. Light shaded cells represent projections for the most liberal combinations that do not exceed the reference TCEY allocation of 1.93 Mlb. Dark shaded cells represent projections for the most liberal upper and lower size limits that do not exceed the 1.71 Mlb 2020 allocation. Projections include corrections for errors in estimation of average weight and an inflation factor of 1.4% for release mortality.

a. Projected Harvest (number of fish)

	Number of Tuesday Closures														
Annual Limit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
None	172,845	170,606	167,886	165,721	163,240	160,663	158,189	156,032	154,276	152,821	151,060	150,709	149,217	148,500	145,422
6	169,993	167,794	165,118	162,990	160,554	158,025	155,590	153,469	151,741	150,309	148,574	148,232	146,761	146,056	143,034
5	167,411	165,247	162,612	160,515	158,120	155,632	153,234	151,146	149,443	148,033	146,322	145,987	144,536	143,843	140,870
4	164,000	161,883	159,301	157,247	154,904	152,471	150,120	148,075	146,407	145,024	143,346	143,020	141,596	140,918	138,012
3	157,888	155,847	153,361	151,382	149,130	146,794	144,531	142,564	140,956	139,628	138,009	137,698	136,324	135,675	132,886
2	147,329	145,426	143,107	141,260	139,164	136,991	134,875	133,042	131,540	130,302	128,790	128,507	127,220	126,615	124,032

b. Projected Charter Removals (Mlb) - No Annual Limit

Size	Number of Tuesday Closures														
limit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.183	2.155	2.120	2.092	2.062	2.031	2.001	1.973	1.950	1.933	1.909	1.904	1.885	1.877	1.837
27	2.222	2.194	2.158	2.129	2.099	2.067	2.036	2.009	1.985	1.967	1.943	1.938	1.919	1.911	1.870
28	2.281	2.252	2.215	2.185	2.154	2.122	2.090	2.061	2.037	2.019	1.994	1.989	1.969	1.961	1.919
29	2.320	2.290	2.252	2.222	2.191	2.157	2.125	2.096	2.072	2.053	2.028	2.023	2.002	1.994	1.951
30	2.378	2.348	2.309	2.278	2.246	2.212	2.179	2.149	2.124	2.105	2.079	2.074	2.053	2.044	2.001
31	2.418	2.387	2.348	2.317	2.284	2.249	2.215	2.185	2.160	2.140	2.114	2.109	2.087	2.079	2.034
32	2.470	2.438	2.398	2.366	2.332	2.297	2.262	2.231	2.205	2.185	2.159	2.154	2.132	2.123	2.078
33	2.501	2.469	2.429	2.396	2.362	2.326	2.291	2.260	2.233	2.213	2.186	2.181	2.159	2.150	2.104

(continued)

Table 25. (continued)

c. Projected Charter Removals (Mlb) – 6-fish Annual Limit

Size limit	Number of Tuesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.151	2.123	2.088	2.060	2.031	2.001	1.971	1.944	1.921	1.904	1.880	1.876	1.857	1.849	1.809
27	2.189	2.161	2.126	2.097	2.067	2.036	2.006	1.978	1.955	1.938	1.914	1.909	1.890	1.882	1.842
28	2.247	2.218	2.182	2.152	2.122	2.090	2.059	2.030	2.007	1.989	1.964	1.959	1.939	1.931	1.890
29	2.284	2.255	2.218	2.188	2.158	2.125	2.093	2.064	2.040	2.022	1.997	1.992	1.972	1.964	1.922
30	2.342	2.312	2.274	2.244	2.212	2.179	2.146	2.117	2.092	2.073	2.048	2.043	2.022	2.013	1.971
31	2.381	2.351	2.312	2.281	2.249	2.215	2.182	2.152	2.127	2.108	2.082	2.077	2.056	2.047	2.004
32	2.432	2.401	2.362	2.330	2.297	2.262	2.228	2.197	2.172	2.152	2.126	2.121	2.099	2.090	2.046
33	2.463	2.431	2.392	2.359	2.326	2.291	2.256	2.225	2.199	2.179	2.153	2.148	2.126	2.117	2.072

d. Projected Charter Removals (Mlb) – 5-fish Annual Limit

Size limit	Number of Tuesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.121	2.094	2.060	2.032	2.004	1.974	1.944	1.918	1.895	1.878	1.855	1.850	1.831	1.824	1.785
27	2.159	2.131	2.096	2.068	2.039	2.008	1.978	1.951	1.929	1.911	1.887	1.883	1.864	1.856	1.817
28	2.216	2.188	2.152	2.123	2.093	2.061	2.031	2.003	1.979	1.961	1.937	1.933	1.913	1.905	1.864
29	2.253	2.224	2.188	2.158	2.128	2.096	2.064	2.036	2.013	1.994	1.970	1.965	1.945	1.937	1.896
30	2.310	2.280	2.243	2.213	2.182	2.149	2.117	2.088	2.063	2.045	2.019	2.015	1.994	1.986	1.944
31	2.349	2.318	2.281	2.250	2.218	2.185	2.152	2.122	2.098	2.079	2.053	2.048	2.027	2.019	1.976
32	2.398	2.368	2.329	2.298	2.265	2.231	2.197	2.167	2.142	2.123	2.096	2.092	2.070	2.062	2.018
33	2.429	2.398	2.358	2.327	2.294	2.259	2.225	2.195	2.169	2.149	2.123	2.118	2.097	2.088	2.044

e. Projected Charter Removals (Mlb) – 4-fish Annual Limit

Size limit	Number of Tuesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.080	2.054	2.020	1.993	1.965	1.936	1.907	1.881	1.859	1.842	1.819	1.815	1.796	1.789	1.751
27	2.117	2.090	2.056	2.028	2.000	1.970	1.940	1.914	1.891	1.874	1.851	1.847	1.828	1.820	1.781
28	2.173	2.145	2.110	2.082	2.052	2.022	1.991	1.964	1.941	1.924	1.900	1.895	1.876	1.868	1.828
29	2.209	2.181	2.145	2.117	2.087	2.055	2.025	1.997	1.974	1.956	1.932	1.927	1.907	1.899	1.859
30	2.265	2.236	2.200	2.170	2.139	2.107	2.076	2.047	2.023	2.005	1.980	1.976	1.956	1.947	1.906
31	2.303	2.273	2.236	2.206	2.175	2.142	2.110	2.081	2.057	2.038	2.013	2.009	1.988	1.980	1.938
32	2.352	2.322	2.284	2.253	2.221	2.187	2.155	2.125	2.100	2.081	2.056	2.051	2.030	2.022	1.979
33	2.381	2.351	2.313	2.281	2.249	2.215	2.182	2.152	2.127	2.108	2.082	2.077	2.056	2.047	2.004

(continued)

Table 25. (continued)

f. Projected Charter Removals (Mlb) – 3-fish Annual Limit

Size limit	Number of Tuesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	2.008	1.982	1.950	1.924	1.897	1.868	1.840	1.815	1.794	1.778	1.756	1.752	1.734	1.727	1.690
27	2.043	2.017	1.984	1.957	1.930	1.901	1.873	1.847	1.825	1.809	1.786	1.782	1.764	1.757	1.720
28	2.097	2.070	2.036	2.009	1.981	1.951	1.922	1.896	1.873	1.856	1.833	1.829	1.810	1.803	1.765
29	2.132	2.105	2.070	2.043	2.014	1.984	1.954	1.927	1.905	1.887	1.864	1.860	1.841	1.833	1.794
30	2.186	2.158	2.123	2.094	2.065	2.034	2.003	1.976	1.953	1.935	1.911	1.907	1.887	1.879	1.840
31	2.222	2.194	2.158	2.129	2.099	2.067	2.036	2.008	1.985	1.967	1.943	1.938	1.918	1.911	1.870
32	2.269	2.240	2.203	2.174	2.143	2.111	2.079	2.051	2.027	2.008	1.984	1.979	1.959	1.951	1.910
33	2.298	2.268	2.231	2.201	2.170	2.137	2.105	2.076	2.052	2.034	2.009	2.004	1.984	1.975	1.934

g. Projected Charter Removals (Mlb) – 2-fish Annual Limit

Size limit	Number of Tuesday Closures														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	All
26	1.870	1.846	1.816	1.792	1.767	1.740	1.714	1.691	1.671	1.656	1.635	1.632	1.615	1.608	1.575
27	1.903	1.879	1.848	1.823	1.798	1.771	1.744	1.720	1.700	1.685	1.664	1.660	1.643	1.637	1.602
28	1.953	1.928	1.897	1.871	1.845	1.818	1.790	1.766	1.745	1.729	1.708	1.704	1.687	1.680	1.645
29	1.986	1.961	1.929	1.903	1.876	1.848	1.820	1.795	1.774	1.758	1.737	1.733	1.715	1.708	1.672
30	2.037	2.010	1.978	1.951	1.924	1.895	1.866	1.841	1.819	1.803	1.781	1.777	1.758	1.751	1.715
31	2.070	2.044	2.011	1.983	1.956	1.926	1.897	1.871	1.849	1.833	1.810	1.806	1.788	1.780	1.743
32	2.114	2.087	2.053	2.025	1.997	1.967	1.937	1.911	1.888	1.871	1.848	1.844	1.825	1.818	1.780
33	2.141	2.113	2.079	2.051	2.022	1.992	1.961	1.935	1.912	1.895	1.872	1.868	1.848	1.841	1.802

Table 26. Violations of the Annual Limit in Area 3A. Annual limits were implemented in Area 3A in 2015 (5 fish) and 2016 – 2019 (4 fish).

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	67,017	162	0.2%	134,325	214	0.2%
2018	65,595	201	0.3%	128,852	296	0.2%
2019	66,846	184	0.3%	131,035	255	0.2%

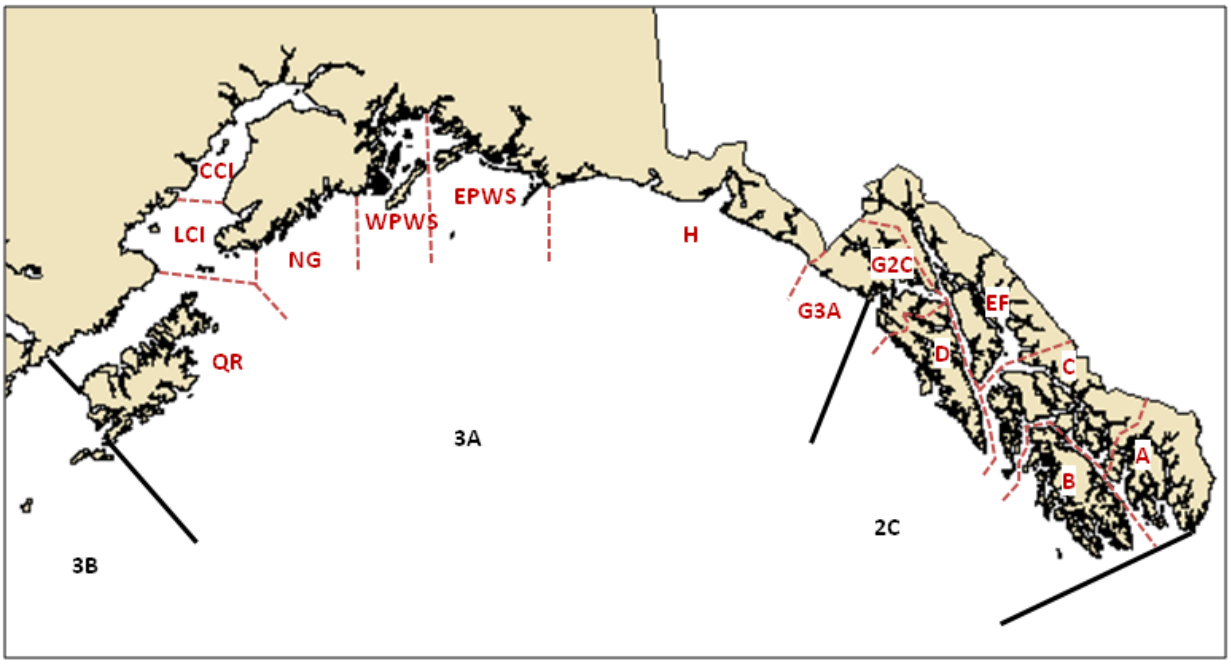

Figure 1. Subareas of IPHC Areas 2C and 3A used for analysis and reporting. A – Ketchikan; B - Prince of Wales (Craig, Klawock); C - Petersburg, Wrangell; D – Sitka; EF - Juneau, Haines, Skagway; G2C - Glacier Bay, Elfin Cove (2C areas); G3A - Glacier Bay, Elfin Cove (3A Areas); H – Yakutat; EPWS - Eastern 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.

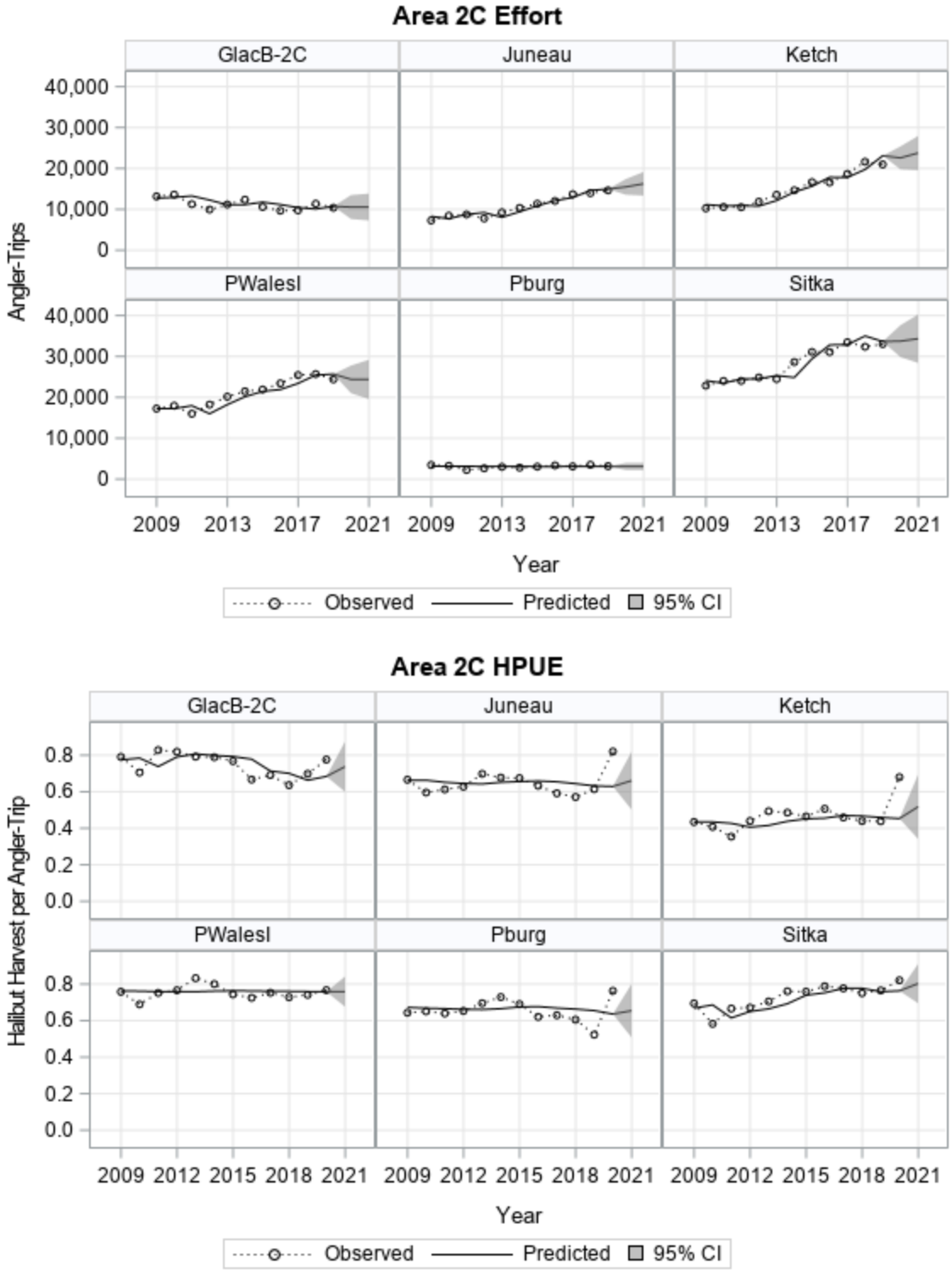

Figure 2. Time series of charter effort (upper) and HPUE (lower) for subareas of Area 2C with predicted values and forecasts for 2021. Shaded bands indicate 95% confidence intervals for the 2020 (effort) and 2021 (effort and HPUE) forecasts. (Source: ADF&G charter logbook)

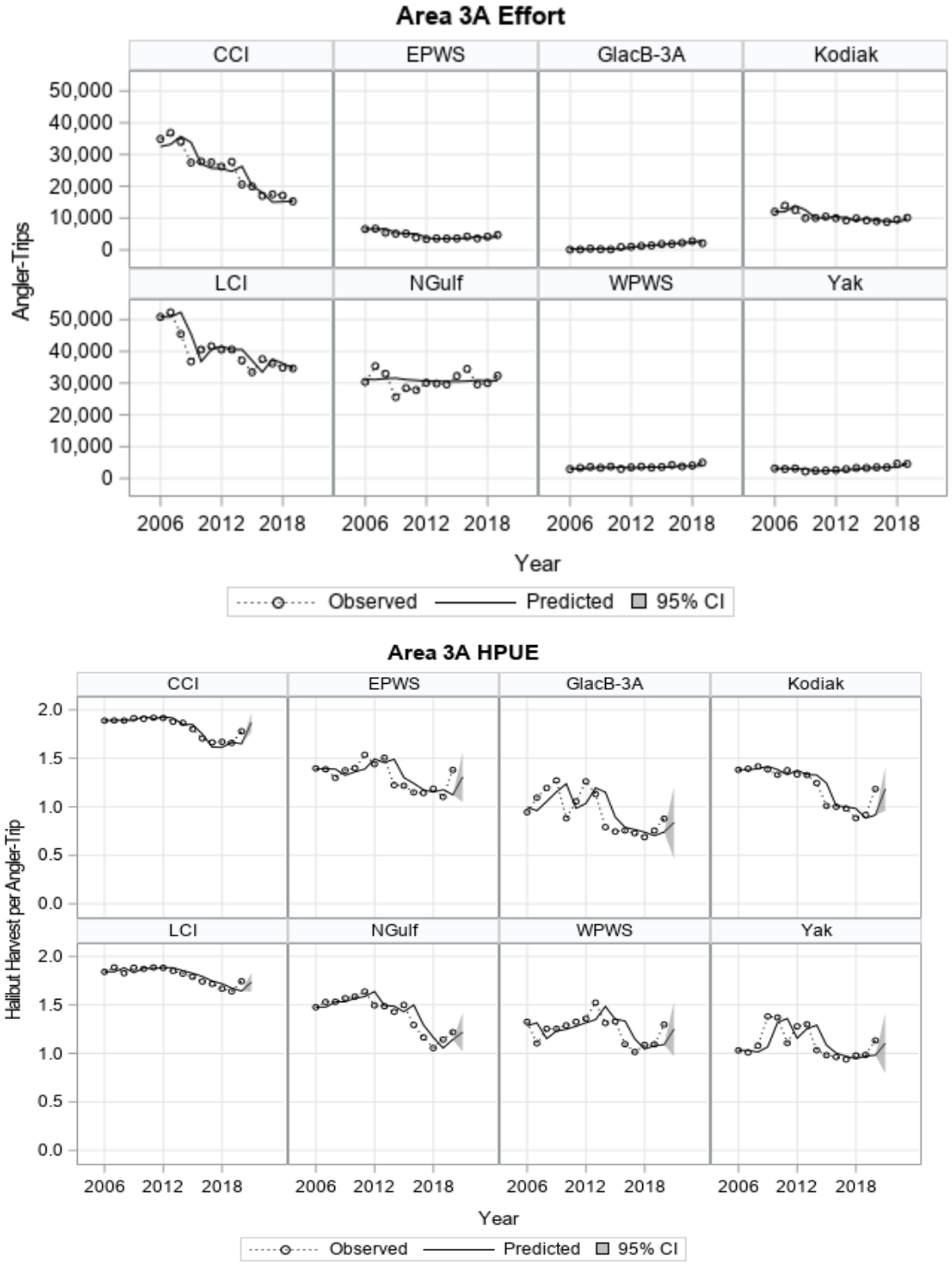

Figure 3. Time series of charter effort (upper) and HPUE (lower) by subarea of Area 3A, with predicted values and 2021 forecasts of HPUE only. No time series forecasts were made for effort (see Section 2.3). Shaded bands indicate 95% confidence intervals for the 2021 HPUE forecasts. (Source: ADF&G charter logbook)

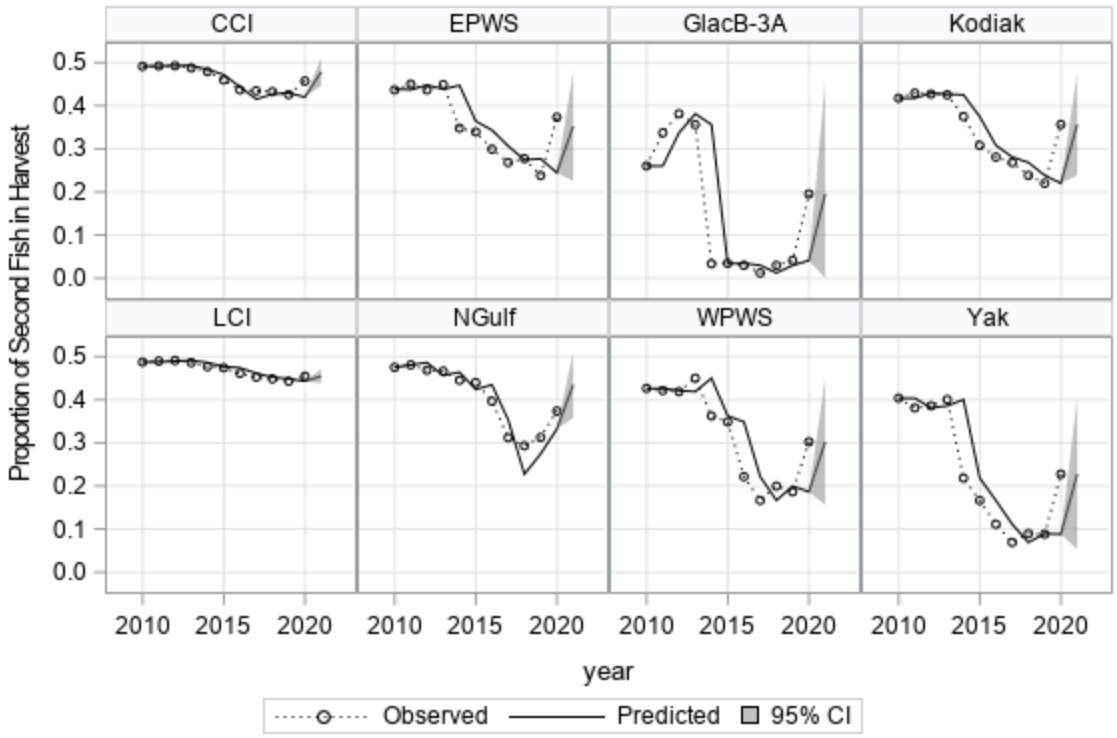

Figure 4. Time series of the proportion of second fish retained by anglers in each subarea of Area 3A, 2010-2020, with predicted values and forecasts for 2021. Shaded bands indicate 95% confidence intervals for the 2021 forecasts. (Source: ADF&G charter logbook)

APPENDIX I

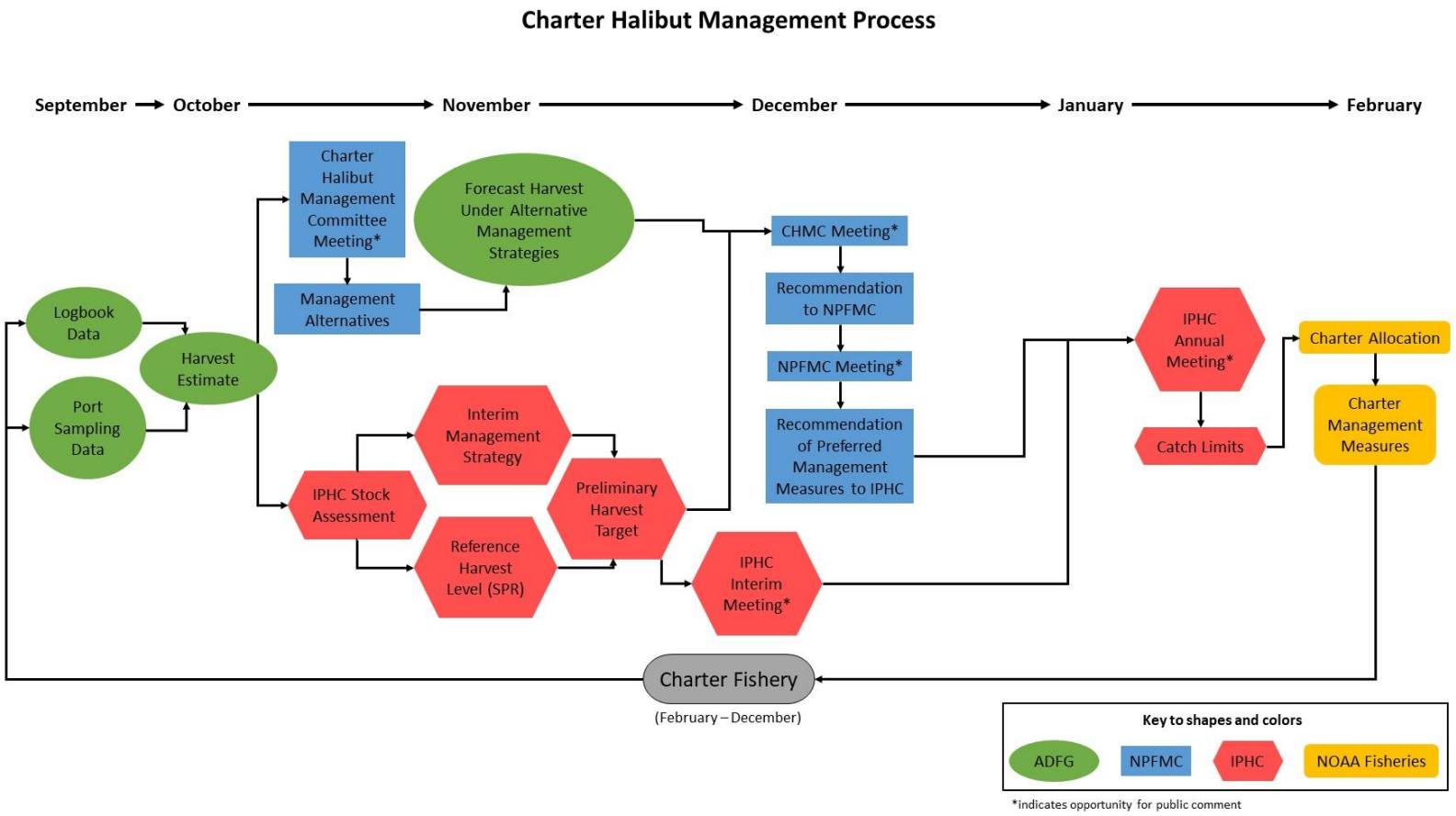

Figure A1. Outline of charter halibut management process and timeline.

APPENDIX II

Table A2-1. 2C removal estimates under status quo regulations with variable reductions in effort (no change, 10% reduction, 40% reduction, proportional reduction estimated between 2020 forecast and 2020 preliminary estimate) and estimated reduction in effort relative to 2020 forecast.

Subarea	Status Quo Effort	10% Effort Reduction	40% Effort Reduction	Reduction based on 2020 projected vs. observed	Estimated reduction from 2020 forecast
A	0.155	0.139	0.093	0.057	74.9%
B	0.186	0.167	0.112	0.093	42.2%
C	0.046	0.042	0.028	0.038	33.4%
D	0.394	0.354	0.236	0.177	45.5%
EF	0.107	0.096	0.064	0.037	68.8%
G2C	0.139	0.125	0.083	0.067	49.3%
Area 2C	**1.026**	**0.923**	**0.616**	**0.468**	**54.4%**

Table A2-2. 3A removal estimates under status quo regulations with variable reductions in effort (no change, 10% reduction, 40% reduction, proportional reduction estimated between 2020 forecast and 2020 preliminary estimate) and estimated reduction in effort relative to 2020 forecast. It is unknown to what degree the estimated reductions in effort in Area 3A were related to the COVID-19 pandemic versus uncertainty in 2020 effort projections that assumed the maximum effect of opening days of the week to fishing.

Subarea	Status Quo Effort	10% Effort Reduction	40% Effort Reduction	Reduction based on 2020 forecast vs. observed	Estimated reduction from 2020 forecast
CCI	0.525	0.472	0.315	0.289	44.9%
EPWS	0.213	0.192	0.128	0.130	39.3%
G3A	0.081	0.073	0.049	0.031	61.8%
H	0.204	0.184	0.123	0.087	57.2%
LCI	0.814	0.733	0.488	0.476	41.5%
NG	0.692	0.623	0.415	0.359	48.1%
QR	0.233	0.209	0.140	0.087	62.4%
WPWS	0.156	0.140	0.094	0.098	37.2%
Area 3A	**2.918**	**2.626**	**1.751**	**1.557**	**47.0%**