Preliminary Pacific halibut catch tables for 2018

PREPARED BY: IPHC SECRETARIAT (I. STEWART; 27 NOVEMBER 2017)

PURPOSE

To provide the Commission with a summary of International Pacific Halibut Commission (IPHC) Regulatory Area-specific mortality projections for 2018 based on the interim management procedure and other alternatives.

SUMMARY

This document summarizes the results of the application of the IPHC's interim management procedure, as well as additional alternatives for 2018. The scale of coastwide mortality from all sources is based on the reference level of fishing intensity adopted for 2017 (IPHC 2017), a Spawning Potential Ratio (SPR) equal to 46%. The mortality consistent with the reference level, is estimated iteratively for 2018 based on the current stock assessment (Stewart and Hicks 2017). In order to distribute the target mortality among the IPHC's Regulatory Areas, there are two inputs: 2017 stock distribution, and relative target harvest rates among IPHC Regulatory Areas. The IPHC's fishery-independent setline survey legal-size (O32, or over 32 inches (81 cm) in total length) Weight-Per-Unit-Effort (WPUE) is used to estimate the distribution of the stock (Webster 2017). The relative target harvest rates for each IPHC Regulatory Area: 1.00 for Areas 2A-3A, and 0.75 for Areas 3B-4CDE, apply to the Total Constant Exploitation Yield (TCEY, approximately the mortality of Pacific halibut over 26 inches (66 cm) in length; O26). These relative rates are consistent with the historical approach of applying rates of 21.5% and 16.125% (Stewart 2017), the ratio being equal to 1.00:0.75. The combination of the stock distribution and relative target harvest rates results in a target distribution for the annual TCEY.

The application of the interim management procedure results in a substantial decrease in the 2018 TCEY (31.00 million lb, ~14,060 t) from both the 2017 reference level based on the 2016 stock assessment (-21%) and the catch limits adopted for 2017 (-24%). Because components within the TCEY have changed since 2016, the Fishery Constant Exploitation Yields (FCEYs), and allocations to specific fisheries based on domestic catch agreements have also changed; however, all projections for 2018 are lower than values from 2017. Detailed catch tables including all sizes and sources of removals are presented for the reference level, as well as several other requested management alternatives. This document remains ***preliminary***, as updated estimates for some sources of 2017 mortality (e.g., bycatch from the non-directed halibut fleets) will not be available until early January, and additional alternatives will be created between the IPHC's Interim and Annual Meetings, as well as during the Annual Meeting, on request.

INTRODUCTION

The IPHC's interim management procedure has changed appreciably since 2012. In that year, the IPHC began to transparently delineate between the results of scientific analyses, the application of harvest policy, and the management decisions resulting in annual catch limits[1]

[1] Note that the term "catch limit" is used variously to refer to portions of the total mortality, FCEYs, and specific limits on domestic fisheries; in some cases these limits may not contain all sources of mortality, and in no cases do they contain fish that are released and estimated to have survived the capture process.

(Stewart et al. 2013, Webster and Stewart 2013). From 2012 through 2017, the "Blue Line" represented results of both the scale and distributional targets of the IPHC's harvest policy, although it was never applied to annual catch limits (based on FCEYs) at the coastwide level or as a complete set of Regulatory Area-specific limits. In 2017, the Commission adopted a "Reference" level of coastwide fishing intensity based on the average of values estimated (from the 2016 stock assessment) for the period from 2014 through 2016. This reference was an SPR equal to 46%. In addition, the Commission directed the Secretariat to provide for future management decisions to be based on TCEYs, rather than FCEYs, such that catch limits would be more comparable across Regulatory Areas.

This document uses the most recent Pacific halibut mortality estimates from all sources, and the results from the 2017 stock assessment for Pacific halibut for projections of the mortality and level of fishing intensity for 2018.

SCALE

For any distribution of coastwide mortality across all fisheries and Regulatory Areas, the 2017 stock assessment can be used to determine the scale of this mortality that results in the reference SPR (46%). This is achieved iteratively, using all four models in the stock assessment ensemble via the following method:

1) Adding the projected mortality for 2018 to each model
2) Calculating the projected SPR for each model
3) Integrating the model results into a probability distribution for the projected SPR
4) Comparing the median projected SPR to the reference level
5) Iteratively repeating this approach until the median is equal to the reference.

This method includes all sizes and sources of mortality, as well as all currently available data, and is based on the parameter estimates from the current stock assessment. It includes uncertainty due to estimation as well as structural uncertainty among the four models that comprise the stock assessment ensemble.

DISTRIBUTION

There are two inputs to the current management procedure for distributing the TCEY among IPHC Regulatory Areas: the current stock distribution, and the relative target harvest rates. The stock distribution has historically been based on the catch of O32 Pacific halibut in the IPHC's fishery-independent setline survey. These values have been revised from 2016 estimates (Stewart and Hicks 2017), indicating a larger proportion of the coastwide stock in Regulatory Areas 2C, 3A, 4A, 4B, and 4CDE in 2017 and a smaller proportion in 2A, 2B, and 3B (Table 1). The relative target harvest rates for each IPHC Regulatory Area are 1.00 for Areas 2A-3A, and 0.75 for Areas 3B-4CDE, and are consistent with the historical rates of 21.5% and 16.125% (the ratio being equal to 1.00:0.75) used prior to the transition to an SPR-based fishing intensity target. The combination of the stock distribution and relative target harvest rates results in a target distribution for the annual TCEY (Table 1).

TABLE 1. IPHC Regulatory Area stock distribution from the 2017 O32 fishery-independent setline survey catch, IPHC Regulatory Area-specific relative target harvest rates, and resulting 2018 target TCEY distribution based on the IPHC's current management procedure.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O32 stock distribution	1.7%	11.3%	16.6%	35.6%	10.0%	6.6%	4.8%	13.3%	100.0%
Relative harvest rates	1.00	1.00	1.00	1.00	0.75	0.75	0.75	0.75	--
Target TCEY Distribution	1.9%	12.4%	18.2%	38.9%	8.2%	5.4%	3.9%	10.9%	100.0%

PROJECTION OF MORTALITY

Pacific halibut mortality by fishery within each Regulatory Area is projected for 2018 based on the allocations specified by the domestic catch agreements in place, as applicable. Further, projected discard mortality is based on the 2017 *rates*, such that the magnitude will scale with the retained removals for both commercial and recreational fisheries in each Regulatory Area. The remainder of the projected mortality is comprised of the following sources: unguided recreational mortality (retained and discarded) in Alaska, subsistence mortality, and mortality due to bycatch (halibut captured in fisheries where retention is prohibited). For default projections, these sources of mortality are assumed to remain unchanged from 2017, although alternative catch tables can (and have been) produced utilizing different values. A summary of estimated 2017 mortality, including those components used directly in projections is provided in Table 2.

TABLE 2. Estimated Pacific halibut mortality for 2017 based on data through 9 November 2017. All values reported in millions of net pounds. Values in bold are projected to remain constant through 2018 for default calculations.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Commercial discards[1]	0.02	0.17	NA	NA	0.21	0.06	0.03	0.03	0.52
Bycatch	**0.11**	**0.23**	**0.02**	**0.98**	**0.45**	**0.29**	**0.19**	**1.96**	**4.22**
Recreational (+ discards)	**NA**	**NA**	**1.43**	**1.86**	**0.01**	**0.02**	**0.00**	**0.00**	**3.31**
Subsistence	**NA**	**0.41**	**0.44**	**0.22**	**0.01**	**0.01**	**0.00**	**0.05**	**1.14**
Total Non-FCEY	0.13	0.81	1.89	3.06	0.69	0.37	0.22	2.04	9.19
O26 FCEY									
Commercial discard	NA	NA	0.08	0.34	NA	NA	NA	NA	0.42
Recreational (+ discards)[2]	0.52	1.23	0.96	2.11	NA	NA	NA	NA	4.82
Subsistence	**0.03**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.03**
Commercial Landings[1]	0.75	6.26	4.23	7.79	3.09	1.30	1.09	1.64	26.16
Total FCEY	1.30	7.49	5.28	10.23	3.09	1.30	1.09	1.64	31.42
TCEY	1.43	8.29	7.16	13.29	3.78	1.67	1.31	3.69	40.61
U26									
Commercial discards	0.00	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.05
Bycatch	**0.00**	**0.02**	**0.00**	**0.41**	**0.44**	**0.11**	**0.01**	**0.79**	**1.77**
Total U26	0.00	0.03	0.00	0.42	0.46	0.12	0.01	0.79	1.82
Total Mortality	1.43	8.32	7.17	13.71	4.24	1.79	1.32	4.47	42.44

[1] Includes research catches.
[2] Includes leases to the recreational sector: XRQ in Area 2B and Guided Angler Fish (GAF) in IPHC Regulatory Areas 2C and 3A.

REFERENCE PROJECTION

The reference projection results in a 2018 TCEY of 31.00 million lb, (~14,060 t; Table 3). This represents a reduction of 21% from the reference level calculated based on the 2016 stock assessment, and 24% from the catch limits adopted for 2017 (Table 4). Because components within the TCEY have changed since 2016, the Fishery Constant Exploitation Yields (FCEYs), and allocations to specific fisheries based on domestic catch agreements have also changed (Figure 1); however, projected FCEYs are all lower for 2018 than values adopted in 2017.

TABLE 3. Pacific halibut mortality projected for 2018 based on the reference SPR (46%) and interim management procedure for TCEY distribution. All values reported in millions of net pounds.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Commercial discards	0.01	0.07	NA	NA	0.13	0.06	0.03	0.02	0.32
Bycatch	0.11	0.23	0.02	0.98	0.45	0.29	0.19	1.96	4.22
Recreational (+ discards)	NA	NA	1.43	1.86	0.01	0.02	0.00	0.00	3.31
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.05	1.14
Total Non-FCEY	0.12	0.71	1.89	3.06	0.61	0.37	0.21	2.04	8.99
O26 FCEY									
Commercial discard	NA	NA	0.06	0.30	NA	NA	NA	NA	0.36
Recreational (+ discards)	0.21	0.48	0.69	1.70	NA	NA	NA	NA	3.09
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.23	2.65	3.02	7.01	1.95	1.32	1.00	1.36	18.53
Total FCEY	0.47	3.14	3.76	9.01	1.95	1.32	1.00	1.36	22.00
TCEY	0.59	3.84	5.65	12.07	2.56	1.69	1.21	3.39	31.00
U26									
Commercial discards	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.04
Bycatch	0.00	0.02	0.00	0.41	0.44	0.11	0.01	0.79	1.77
Total U26	0.00	0.02	0.00	0.42	0.45	0.12	0.01	0.79	1.81
Total Mortality	0.59	3.87	5.65	12.49	3.01	1.81	1.22	4.18	32.81

Table 4. Comparison of TCEY values (M lb).

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
2017 Reference SPR	**0.96**	**6.08**	**6.47**	**13.84**	**4.39**	**1.84**	**1.46**	**4.06**	**39.10**
2017 Adopted	**1.47**	**8.32**	**7.04**	**12.96**	**3.98**	**1.80**	**1.34**	**3.84**	**40.74**
2018 Reference SPR	**0.59**	**3.84**	**5.65**	**12.07**	**2.56**	**1.69**	**1.21**	**3.39**	**31.00**

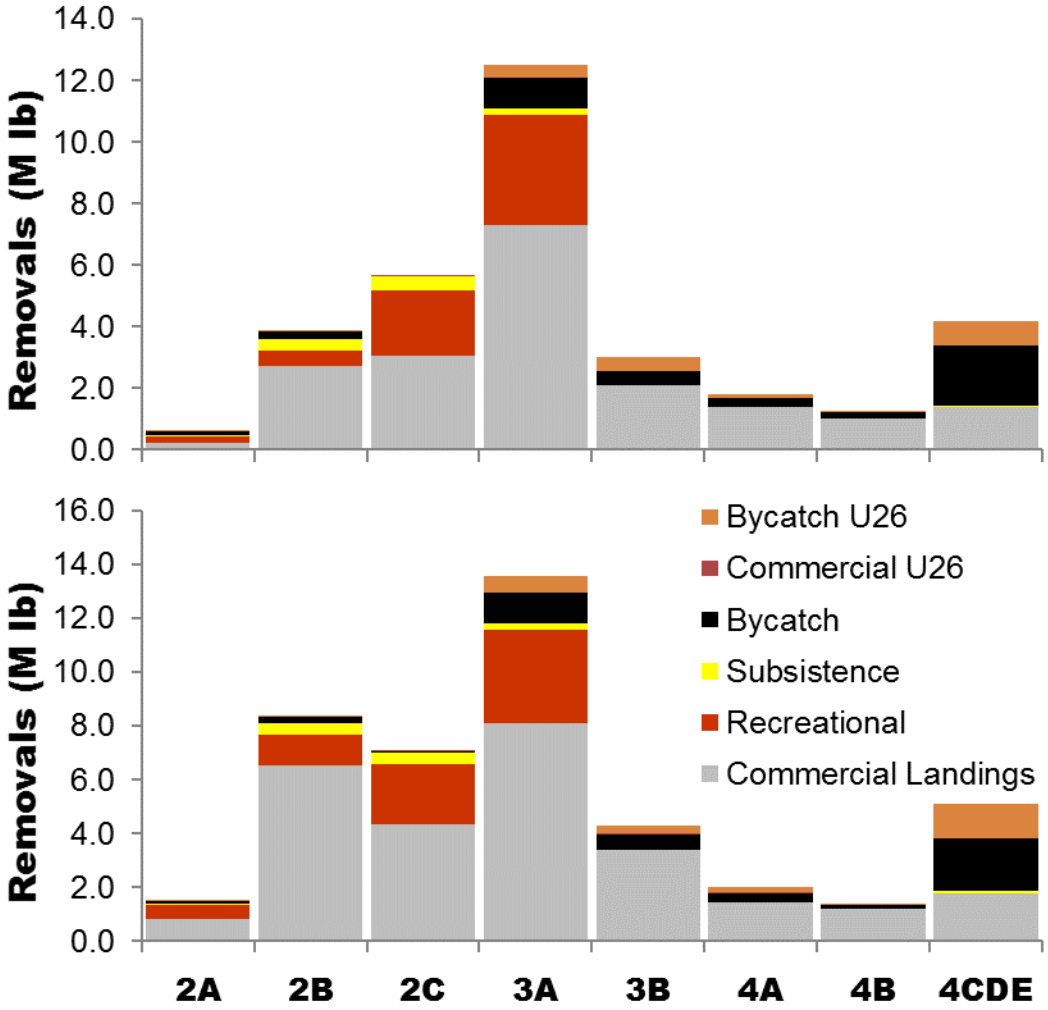

FIGURE 1. Comparison of the 2018 reference projection (top) and the 2017 adopted catch limits (bottom). Note that the scale differs between the two panels.

ALTERNATIVE PROJECTIONS

Applying the 2017 adopted TCEYs to the projection for 2018 results in a level of fishing intensity greater than the references level, an SPR of 38%. This fishing intensity is estimated to be higher than any recent value since 2013; however, these values have wide and overlapping plausibility intervals. A summary of all components for this projection is provided in Table 5; it is important to note that this projection does not result in the same FCEYs for 2018, as projections for specific components contributing to the TCEY have changed.

TABLE 5. Pacific halibut mortality projected for 2018 based on applying the same TCEYs adopted for 2017. All values reported in millions of net pounds.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Commercial discards	0.02	0.17	NA	NA	0.23	0.07	0.03	0.03	0.55
Bycatch	0.11	0.23	0.02	0.98	0.45	0.29	0.19	1.96	4.22
Recreational (+ discards)	NA	NA	1.43	1.86	0.01	0.02	0.00	0.00	3.31
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.05	1.14
Total Non-FCEY	0.13	0.81	1.89	3.06	0.70	0.38	0.22	2.04	9.22
O26 FCEY									
Commercial discard	NA	NA	0.08	0.33	NA	NA	NA	NA	0.41
Recreational (+ discards)	0.54	1.15	0.92	1.87	NA	NA	NA	NA	4.48
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.78	6.36	4.15	7.70	3.28	1.42	1.12	1.79	26.61
Total FCEY	1.34	7.52	5.15	9.90	3.28	1.42	1.12	1.79	31.52
TCEY	1.47	8.32	7.04	12.96	3.98	1.80	1.34	3.84	40.74
U26									
Commercial discards	0.00	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.05
Bycatch	0.00	0.02	0.00	0.41	0.44	0.11	0.01	0.79	1.77
Total U26	0.00	0.03	0.00	0.42	0.46	0.12	0.01	0.79	1.82
Total Mortality	1.47	8.35	7.04	13.38	4.43	1.92	1.35	4.62	42.57

As requested by the Commission, additional catch tables are provided to illustrate the results of differing assumptions regarding bycatch in non-Pacific halibut target fisheries in Alaska. These three tables project differing magnitudes of bycatch, assuming the same distribution among Regulatory Areas and sizes of fish:

1) Full attainment of regulatory limits (Prohibited Species Catch (PSC) limits) in Alaska
2) 110% of PSC limits in Alaska
3) 90% of 2017 bycatch estimates in Alaska

The TCEY in each of the three projections was iteratively scaled to achieve the reference SPR (46%) and an initial TCEY distribution was based on the current management procedure (methods described above). The detailed results of these projections are included in **APPENDIX A**. The projection including full PSC attainment resulted in insufficient TCEY to provide for the directed Pacific halibut fishery in Regulatory Area 4CDE, and the TCEYs in all other Regulatory Areas were reduced proportionally in order to achieve the reference SPR (Table A1). A similar result occurred for the projection including 110% of the PSC limits in Alaska (Table A2). The third projection (90% of 2017 bycatch estimates) resulted in a greater proportion of the TCEY allocated to the directed halibut fisheries, and also a slightly larger TCEY (31.5 million lb, ~14,290 t) than the reference projection (Table 3) due to the effect of the reduction in U26 bycatch on the estimated SPR.

This document remains preliminary, as updated estimates for some sources of 2017 mortality (e.g., bycatch) will be available in early January, and additional alternatives will be created between the IPHC's Interim and Annual Meetings, as well as during the Annual Meeting, on request.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2017-IM093-09 which provides a summary of preliminary projections for 2018.
b) **RECOMMEND** any additional analysis or alternatives for presentation at the Annual Meeting.

REFERENCES

IPHC. 2017. Report of the 93rd session of the IPHC Annual Meeting (AM093). Victoria, British Columbia, Canada, 23-27 January 2017. IPHC-2017-AM093-R Rev 1, 61 p.

Stewart, I., and Hicks, A. 2017. Summary of the 2017 stock assessment and draft harvest decision table. IPHC-2017-IM093-08.

Stewart, I.J. 2017. 4.4 Regulatory area harvest policy calculations and catch tables. IPHC Report of Assessment and Research Activities 2016: 403-420.

Stewart, I.J., Leaman, B.M., Martell, S., and Webster, R.A. 2013. Assessment of the Pacific halibut stock at the end of 2012. IPHC Report of Assessment and Research Activities 2012. p. 93-186.

Webster, R. 2017. Space-time modelling of fishery-independent setline survey data. IPHC-2017-IM093-07.

Webster, R.A., and Stewart, I.J. 2013. Apportionment and regulatory area harvest calculations. IPHC Report of Assessment and Research Activities 2012. p. 187-206.

APPENDICES

Appendix A: 2018 projected catch tables based on alternative bycatch levels in Alaska.

APPENDIX A
2018 catch tables based on alternative bycatch levels in Alaska and maintaining the reference SPR of 46%

TABLE A1. Pacific halibut mortality projected for 2018 based on full PSC attainment in Alaska and maintaining the reference SPR of 46%. All values reported in millions of net pounds.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Commercial discards	0.01	0.07	NA	NA	0.11	0.05	0.02	0.00	0.25
Bycatch	0.11	0.23	0.02	1.40	0.64	0.50	0.32	3.41	6.63
Recreational (+ discards)	NA	NA	1.43	1.86	0.01	0.02	0.00	0.00	3.31
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.05	1.14
Total Non-FCEY	0.12	0.70	1.89	3.48	0.77	0.57	0.35	3.46	11.34
O26 FCEY									
Commercial discard	NA	NA	0.05	0.26	NA	NA	NA	NA	0.32
Recreational (+ discards)	0.20	0.45	0.63	1.49	NA	NA	NA	NA	2.76
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.21	2.46	2.74	6.12	1.63	1.02	0.79	0.00	14.96
Total FCEY	0.44	2.91	3.42	7.87	1.63	1.02	0.79	0.00	18.06
TCEY	0.55	3.61	5.31	11.34	2.40	1.58	1.14	3.46	29.40
U26									
Commercial discards	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.03
Bycatch	0.00	0.02	0.00	0.58	0.62	0.20	0.02	1.37	2.80
Total U26	0.00	0.02	0.00	0.59	0.63	0.20	0.02	1.37	2.83
Total Mortality	0.55	3.63	5.31	11.93	3.03	1.79	1.16	4.83	32.23

TABLE A2. Pacific halibut mortality projected for 2018 based on 110% of PSC limits in Alaska and maintaining the reference SPR of 46%. All values reported in millions of net pounds.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Commercial discards	0.01	0.06	NA	NA	0.10	0.04	0.02	0.00	0.24
Bycatch	0.11	0.23	0.03	1.54	0.70	0.55	0.36	3.75	7.26
Recreational (+ discards)	NA	NA	1.43	1.86	0.01	0.02	0.00	0.00	3.31
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.05	1.14
Total Non-FCEY	0.12	0.70	1.89	3.62	0.83	0.61	0.38	3.81	11.95
O26 FCEY									
Commercial discard	NA	NA	0.05	0.25	NA	NA	NA	NA	0.30
Recreational (+ discards)	0.19	0.43	0.59	1.39	NA	NA	NA	NA	2.61
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.20	2.37	2.60	5.74	1.50	0.92	0.73	0.00	14.07
Total FCEY	0.42	2.80	3.25	7.38	1.50	0.92	0.73	0.00	17.00
TCEY	0.54	3.50	5.14	10.99	2.33	1.54	1.10	3.81	28.95
U26									
Commercial discards	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.03
Bycatch	0.00	0.02	0.00	0.64	0.68	0.22	0.02	1.50	3.08
Total U26	0.00	0.02	0.00	0.65	0.69	0.22	0.02	1.50	3.10
Total Mortality	0.54	3.52	5.15	11.64	3.02	1.76	1.12	5.31	32.05

TABLE A3. Pacific halibut mortality projected for 2018 based on 90% of 2017 bycatch estimates in Alaska and maintaining the reference SPR of 46%. All values reported in millions of net pounds.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Commercial discards	0.01	0.07	NA	NA	0.14	0.06	0.03	0.03	0.34
Bycatch	0.11	0.23	0.02	0.88	0.40	0.26	0.17	1.77	3.83
Recreational (+ discards)	NA	NA	1.43	1.86	0.01	0.02	0.00	0.00	3.31
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.05	1.14
Total Non-FCEY	0.12	0.71	1.88	2.96	0.57	0.34	0.20	1.84	8.62
O26 FCEY									
Commercial discard	NA	NA	0.06	0.31	NA	NA	NA	NA	0.37
Recreational (+ discards)	0.22	0.49	0.71	1.76	NA	NA	NA	NA	3.17
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.24	2.71	3.09	7.23	2.03	1.37	1.04	1.61	19.31
Total FCEY	0.48	3.20	3.86	9.30	2.03	1.37	1.04	1.61	22.88
TCEY	0.60	3.90	5.74	12.27	2.60	1.71	1.23	3.45	31.50
U26									
Commercial discards	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.04
Bycatch	0.00	0.02	0.00	0.37	0.39	0.10	0.01	0.71	1.60
Total U26	0.00	0.02	0.00	0.38	0.41	0.11	0.01	0.71	1.64
Total Mortality	0.60	3.93	5.74	12.64	3.00	1.82	1.24	4.16	33.14