



Additional Harvest Decision Tables, Treatment and effects of Pacific halibut discard mortality (bycatch) projected for 2020 and 2021, and time series of bycatch and discard mortality

PREPARED BY: IPHC SECRETARIAT (28 JANUARY 2019)

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TOPIC 1: Additional Harvest Decision Tables

Purpose

On request, this section includes Harvest Decision Tables reflecting alternative harvest strategy ('reference levels') of [F_{43%}](#), [F_{48%}](#) and [F_{50%}](#). These projections represent a constant catch over the three-year period (identical to the standard [F_{46%}](#) table), such that the stock trend and status sections remain unchanged. However, the fishery trend and status sections reflect the probabilities of having to reduce catch to achieve the alternative reference level and exceeding that reference SPR.



Alternative 1:

TABLE 1. Alternative Harvest decision table for 2019 based on a reference level of fishing intensity of $F_{43\%}$. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probability, in “times out of 100” (or percent chance) of a particular risk.

2019 Alternative		No fishing mortality		Status quo										Reference $SPR=43\%$				
Total mortality (M lb)		0.0	11.7	21.8	31.8	37.6	39.0	40.4	41.8	43.1	44.3	45.5	46.8	48.3	49.9	61.8		
TCEY (M lb)		0.0	10.0	20.0	30.0	35.8	37.2	38.6	40.0	41.3	42.5	43.7	45.0	46.5	48.1	60.0		
2019 Fishing intensity		$F_{100\%}$	$F_{78\%}$	$F_{64\%}$	$F_{54\%}$	$F_{49\%}$	$F_{48\%}$	$F_{47\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{34\%}$		
Fishing intensity interval		--	56-87%	41-76%	31-67%	27-63%	26-62%	25-61%	25-60%	24-59%	23-59%	23-58%	22-57%	22-56%	21-55%	17-49%		
Stock Trend (spawning biomass)	in 2020	is less than 2019	1	3	26	60	77	81	84	87	90	92	93	95	96	97	>99	a
		is 5% less than 2019	<1	<1	1	10	26	30	34	37	39	41	43	45	48	50	78	b
	in 2021	is less than 2019	1	7	41	75	90	93	94	96	97	98	98	99	99	99	>99	c
		is 5% less than 2019	<1	1	11	42	57	61	65	69	73	77	80	83	87	90	99	d
	in 2022	is less than 2019	1	12	51	82	93	94	96	97	98	98	99	99	99	>99	>99	e
		is 5% less than 2019	<1	3	28	58	76	79	83	86	88	90	92	93	95	96	>99	f
Stock Status (Spawning biomass)	in 2020	is less than 30%	5	7	11	14	17	17	18	18	19	19	20	20	21	21	25	g
		is less than 20%	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	h
	in 2021	is less than 30%	3	7	13	20	24	25	25	26	27	27	27	28	29	29	33	i
		is less than 20%	<1	<1	<1	<1	1	1	1	1	2	2	2	3	3	4	10	j
	in 2022	is less than 30%	2	8	17	25	28	29	29	30	30	31	31	32	33	33	41	k
		is less than 20%	<1	<1	<1	2	4	5	6	7	8	9	10	12	13	15	24	l
Fishery Trend (TCEY)	in 2020	is less than 2019	0	<1	10	25	29	33	37	42	46	51	54	58	62	66	88	m
		is 10% less than 2019	0	<1	5	25	26	27	29	32	35	39	43	47	52	56	80	n
	in 2021	is less than 2019	0	<1	14	26	35	39	44	49	53	56	60	63	67	70	92	o
		is 10% less than 2019	0	<1	9	25	29	31	35	39	43	47	50	54	58	62	86	p
	in 2022	is less than 2019	0	<1	18	27	40	45	49	53	56	59	62	66	69	73	94	q
		is 10% less than 2019	0	<1	14	26	33	37	41	45	48	52	55	58	61	65	88	r
Fishery Status (Fishing intensity)	in 2019	is above $F_{43\%}$	0	<1	7	25	27	28	31	36	40	45	50	53	57	61	83	s



Alternative 2:

TABLE 2. Alternative Harvest decision table for 2019 based on a reference level of fishing intensity of $F_{48\%}$. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probability, in “times out of 100” (or percent chance) of a particular risk.

2019 Alternative		No fishing mortality		Reference SPR=48%														
		0.0	11.7	21.8	31.8	37.6	39.0	40.4	41.8	43.1	44.3	45.5	46.8	48.3	49.9	61.8		
Total mortality (M Ib)		0.0	10.0	20.0	30.0	35.8	37.2	38.6	40.0	41.3	42.5	43.7	45.0	46.5	48.1	60.0		
TCEY (M Ib)		0.0	10.0	20.0	30.0	35.8	37.2	38.6	40.0	41.3	42.5	43.7	45.0	46.5	48.1	60.0		
2019 Fishing intensity		F _{100%}	F _{78%}	F _{64%}	F _{54%}	F _{49%}	F _{48%}	F _{47%}	F _{46%}	F _{45%}	F _{44%}	F _{43%}	F _{42%}	F _{41%}	F _{40%}	F _{34%}		
Fishing intensity interval		--	56-87%	41-76%	31-67%	27-63%	26-62%	25-61%	25-60%	24-59%	23-59%	23-58%	22-57%	22-56%	21-55%	17-49%		
Stock Trend (spawning biomass)	in 2020	is less than 2019	1	3	26	60	77	81	84	87	90	92	93	95	96	97	>99	a
		is 5% less than 2019	<1	<1	1	10	26	30	34	37	39	41	43	45	48	50	78	b
	in 2021	is less than 2019	1	7	41	75	90	93	94	96	97	98	98	99	99	99	>99	c
		is 5% less than 2019	<1	1	11	42	57	61	65	69	73	77	80	83	87	90	99	d
	in 2022	is less than 2019	1	12	51	82	93	94	96	97	98	98	99	99	99	>99	>99	e
		is 5% less than 2019	<1	3	28	58	76	79	83	86	88	90	92	93	95	96	>99	f
Stock Status (Spawning biomass)	in 2020	is less than 30%	5	7	11	14	17	17	18	18	19	19	20	20	21	21	25	g
		is less than 20%	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	h
	in 2021	is less than 30%	3	7	13	20	24	25	25	26	27	27	27	28	29	29	33	i
		is less than 20%	<1	<1	<1	<1	1	1	1	1	2	2	2	3	3	4	10	j
	in 2022	is less than 30%	2	8	17	25	28	29	29	30	30	31	31	32	33	33	41	k
		is less than 20%	<1	<1	<1	2	4	5	6	7	8	9	10	12	13	15	24	l
Fishery Trend (TCEY)	in 2020	is less than 2019	0	<1	21	29	49	55	59	64	67	70	74	77	80	84	97	m
		is 10% less than 2019	0	<1	16	26	36	42	47	52	56	60	63	66	70	74	93	n
	in 2021	is less than 2019	0	<1	23	33	54	59	63	67	71	74	77	80	84	87	98	o
		is 10% less than 2019	0	<1	19	27	43	48	53	57	61	64	67	71	74	78	96	p
	in 2022	is less than 2019	0	<1	24	38	57	61	65	69	73	76	79	82	86	89	99	q
		is 10% less than 2019	0	<1	21	30	48	52	56	60	63	66	70	73	77	80	97	r
Fishery Status (Fishing intensity)	in 2019	is above $F_{48\%}$	0	<1	20	27	45	50	56	60	64	67	70	73	76	80	96	s



Alternative 3:

TABLE 3. Alternative Harvest decision table for 2019 based on a reference level of fishing intensity of $F_{50\%}$. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probability, in “times out of 100” (or percent chance) of a particular risk.

2019 Alternative		No fishing mortality		Reference SPR=50%				Status quo											
		0.0	11.7	21.8	31.8	36.1	37.6	39.0	40.4	41.8	43.1	44.3	45.5	46.8	48.3	49.9	61.8		
Total mortality (M lb)		0.0	10.0	20.0	30.0	34.3	35.8	37.2	38.6	40.0	41.3	42.5	43.7	45.0	46.5	48.1	60.0		
TCEY (M lb)		0.0	10.0	20.0	30.0	34.3	35.8	37.2	38.6	40.0	41.3	42.5	43.7	45.0	46.5	48.1	60.0		
2019 Fishing intensity		$F_{100\%}$	$F_{78\%}$	$F_{64\%}$	$F_{54\%}$	$F_{50\%}$	$F_{49\%}$	$F_{48\%}$	$F_{47\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{34\%}$		
Fishing intensity interval		-	56-87%	41-76%	31-67%	28-64%	27-63%	26-62%	25-61%	25-60%	24-59%	23-59%	23-58%	22-57%	22-56%	21-55%	17-49%		
Stock Trend (spawning biomass)	in 2020	is less than 2019	1	3	26	60	73	77	81	84	87	90	92	93	95	96	97	>99	a
		is 5% less than 2019	<1	<1	1	10	22	26	30	34	37	39	41	43	45	48	50	78	b
	in 2021	is less than 2019	1	7	41	75	87	90	93	94	96	97	98	98	99	99	99	>99	c
		is 5% less than 2019	<1	1	11	42	53	57	61	65	69	73	77	80	83	87	90	99	d
	in 2022	is less than 2019	1	12	51	82	91	93	94	96	97	98	98	99	99	99	>99	>99	e
		is 5% less than 2019	<1	3	28	58	71	76	79	83	86	88	90	92	93	95	96	>99	f
Stock Status (Spawning biomass)	in 2020	is less than 30%	5	7	11	14	16	17	17	18	18	19	19	20	20	21	21	25	g
		is less than 20%	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	h
	in 2021	is less than 30%	3	7	13	20	23	24	25	25	26	27	27	27	28	29	29	33	i
		is less than 20%	<1	<1	<1	<1	1	1	1	1	1	2	2	2	3	3	4	10	j
	in 2022	is less than 30%	2	8	17	25	28	28	29	29	30	30	31	31	32	33	33	41	k
		is less than 20%	<1	<1	<1	2	4	4	5	6	7	8	9	10	12	13	15	24	l
Fishery Trend (TCEY)	in 2020	is less than 2019	0	<1	24	34	53	58	63	67	71	75	78	81	84	87	90	99	m
		is 10% less than 2019	0	<1	20	27	39	45	50	55	60	64	67	70	73	77	80	96	n
	in 2021	is less than 2019	0	<1	24	40	56	62	66	70	74	78	81	84	87	90	92	99	o
		is 10% less than 2019	0	<1	22	30	45	50	55	60	64	68	71	74	77	81	84	98	p
	in 2022	is less than 2019	0	<1	25	44	58	63	68	72	76	79	83	85	88	91	93	99	q
		is 10% less than 2019	0	<1	23	35	49	54	58	62	66	70	73	76	79	83	86	98	r
Fishery Status (Fishing intensity)	in 2019	is above $F_{46\%}$	0	<1	23	31	50	55	60	64	68	72	75	78	81	84	87	98	s



TOPIC 2: Inclusion of 2020 and 2021 potential effects of bycatch

Purpose

This analysis supplements the 14 December 2018 Briefing note with two additional years of evaluation of the effects of bycatch (U26 and all sizes) on the FCEY and TCEYs by IPHC Regulatory Area, Biological Region, and coastwide.

Bycatch definition: Pacific halibut mortality during fisheries that cannot legally retain Pacific halibut

Discard mortality definition: Pacific halibut not retained and subsequently estimated to have died during the directed commercial fishery

Caveats: The effects of bycatch beyond the one-year projection (2019) will be increasingly influenced by recruitment estimates not yet informed by data, instead relying on the central tendency of model stock-recruitment relationships or historical averages. Therefore, these additional years should not be considered formal projections, but may be used in a comparative manner to gauge potential future effects.

The methods for comparing results remain identical to those used for the 14 December 2018 briefing note. The extensions to the time-series were made by:

- 1) Extending the Interim Management Procedure (IMP) through 2019 and then comparing the mortality levels for the IMP for 2020 with and without any bycatch and with and without U26 bycatch ([Table 4](#)).
- 2) Extending the Interim Management Procedure (IMP) through 2019 and 2020 and then comparing the mortality levels for the IMP for 2021 with and without any bycatch and with and without U26 bycatch ([Table 5](#)).

Discussion

The results of the additional two years of evaluation of the potential effects of bycatch are qualitatively very similar to those for 2019. As the IMP TCEY levels decrease slowly over the three-year period, the effects of bycatch are also decreased as the stock is at lower abundance and the age structure is somewhat more truncated; this leads to less pronounced differences between the effects of different sources of mortality. For example, the rate of TCEY increase per pound of U26 bycatch reduced goes from 1.87 (Table 2 in the 14 December 2018 Briefing note) to 1.77 in 2020 ([Table 4](#)) and then 1.70 in 2021 ([Table 5](#)).



TABLE 4. Comparison among 2020 FCEYs and TCEYs from the IPHC's Interim Management Procedure (IMP), a potential case of no bycatch, and a potential case of no U26 bycatch.

Interim Management Procedure (IMP)	2A	2B	2C	3A	3B	4A	4B	4CDE	Region 2	Region 3	Region 4	Region 4B	Total
FCEY	0.61	3.93	4.21	12.56	2.30	1.84	1.64	2.47	8.75	14.87	4.30	1.64	29.56
TCEY	0.75	4.75	6.05	15.81	2.87	2.14	1.88	4.44	11.55	18.67	6.57	1.88	38.68
No Bycatch (-6.06 Mlb)	2A	2B	2C	3A	3B	4A	4B	4CDE	Region 2	Region 3	Region 4	Region 4B	Total
FCEY	0.81	4.61	4.79	15.28	2.87	2.19	2.02	4.69	10.21	18.15	6.89	2.02	37.26
Difference from IMP	0.19	0.68	0.58	2.72	0.57	0.35	0.38	2.23	1.45	3.29	2.58	0.38	7.70
Percent difference	31.5%	17.2%	13.8%	21.6%	24.7%	19.3%	23.4%	90.3%	16.6%	22.1%	60.0%	23.4%	26.1%
									2020 FCEY increase rate (lbs FCEY/lbs bycatch)				1.27
TCEY	0.82	5.18	6.61	17.24	3.13	2.33	2.05	4.84	12.60	20.37	7.17	2.05	42.20
Difference from IMP	0.07	0.43	0.55	1.44	0.26	0.19	0.17	0.40	1.05	1.70	0.60	0.17	3.52
Percent difference	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%	9.1%
									2020 TCEY increase rate (lbs TCEY/lbs bycatch)				0.58
No U26 Bycatch (-1.73 Mlb)	2A	2B	2C	3A	3B	4A	4B	4CDE	Region 2	Region 3	Region 4	Region 4B	Total
FCEY	0.67	4.30	4.69	13.81	2.51	2.00	1.78	2.81	9.65	16.33	4.81	1.78	32.57
Difference from IMP	0.06	0.36	0.48	1.25	0.21	0.16	0.15	0.34	0.90	1.46	0.50	0.15	3.01
Percent difference	9.5%	9.2%	11.4%	9.9%	9.1%	8.7%	8.9%	14.0%	10.3%	9.8%	11.7%	8.9%	10.2%
									2020 FCEY increase rate (lbs FCEY/lbs U26 bycatch)				1.74
TCEY	0.81	5.12	6.53	17.05	3.09	2.30	2.03	4.79	12.46	20.15	7.09	2.03	41.736
Difference from IMP	0.06	0.38	0.48	1.25	0.23	0.17	0.15	0.35	0.91	1.48	0.52	0.15	3.06
Percent difference	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%
									2020 TCEY increase rate (lbs TCEY/lbs U26 bycatch)				1.77



TABLE 5. Comparison among 2021 FCEYs and TCEYs from the IPHC's Interim Management Procedure (IMP), a potential case of no bycatch, and a potential case of no U26 bycatch.

Interim Management Procedure (IMP)	2A	2B	2C	3A	3B	4A	4B	4CDE	Region 2	Region 3	Region 4	Region 4B	Total
FCEY	0.58	3.72	3.93	11.84	2.18	1.75	1.55	2.27	8.24	14.02	4.01	1.55	27.82
TCEY	0.72	4.53	5.78	15.08	2.74	2.04	1.80	4.23	11.02	17.82	6.27	1.80	36.91
No Bycatch (-6.06 Mlb)	2A	2B	2C	3A	3B	4A	4B	4CDE	Region 2	Region 3	Region 4	Region 4B	Total
FCEY	0.77	4.39	4.49	14.51	2.74	2.09	1.93	4.48	9.65	17.25	6.57	1.93	35.40
Difference from IMP	0.19	0.66	0.56	2.67	0.56	0.35	0.38	2.21	1.41	3.23	2.56	0.38	7.58
Percent difference	32.9%	17.8%	14.3%	22.5%	25.6%	19.9%	24.3%	97.6%	17.2%	23.0%	63.8%	24.3%	27.2%
									2021 FCEY increase rate (lbs FCEY/lbs bycatch)				1.25
TCEY	0.78	4.94	6.31	16.47	2.99	2.23	1.96	4.62	12.04	19.46	6.85	1.96	40.30
Difference from IMP	0.07	0.42	0.53	1.38	0.25	0.19	0.16	0.39	1.01	1.64	0.58	0.16	3.39
Percent difference	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%
									2021 TCEY increase rate (lbs TCEY/lbs bycatch)				0.56
No U26 Bycatch (-1.73 Mlb)	2A	2B	2C	3A	3B	4A	4B	4CDE	Region 2	Region 3	Region 4	Region 4B	Total
FCEY	0.64	4.07	4.39	13.04	2.38	1.90	1.69	2.60	9.10	15.43	4.50	1.69	30.72
Difference from IMP	0.06	0.35	0.46	1.20	0.20	0.15	0.14	0.33	0.87	1.40	0.48	0.14	2.89
Percent difference	9.7%	9.4%	11.7%	10.1%	9.2%	8.8%	9.1%	14.6%	10.5%	10.0%	12.1%	9.1%	10.4%
									2021 FCEY increase rate (lbs FCEY/lbs U26 bycatch)				1.67
TCEY	0.77	4.89	6.24	16.29	2.95	2.20	1.94	4.57	11.90	19.24	6.77	1.94	39.853
Difference from IMP	0.06	0.36	0.46	1.20	0.22	0.16	0.14	0.34	0.88	1.42	0.50	0.14	2.94
Percent difference	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
									2021 TCEY increase rate (lbs TCEY/lbs U26 bycatch)				1.70



TOPIC 3: Time series of bycatch and commercial discard mortality estimates

These bycatch estimates are based on the data available for the 2018 stock assessment, and will be updated for the 2019 AM with end-of-year estimates pending resolution of the U.S.A. government shutdown. Bycatch mortality of Pacific halibut:

Table 6: [Bycatch \(mortality during fisheries that cannot legally retain Pacific halibut\) <26 inches in length \(U26; million net pounds\)](#)

Table 7: [Bycatch \(mortality during fisheries that cannot legally retain Pacific halibut\) >26 inches in length \(O26; million net pounds\)](#)

Table 8: [Discard mortality \(Pacific halibut not retained and subsequently estimated to have died during the directed commercial fishery\) all sizes \(all sizes; million net pounds\)](#)



TABLE 6. Bycatch mortality (mortality during fisheries that cannot legally retain Pacific halibut) of Pacific halibut <26 inches in length (U26; million net pounds).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1990	0.02	0.35	0.05	0.53	0.33	0.97	0.07	1.97	4.29
1991	0.02	0.41	0.04	0.62	0.24	1.48	0.05	3.63	6.48
1992	0.03	0.25	0.04	0.90	0.38	1.52	0.10	3.97	7.18
1993	0.03	0.50	0.21	1.34	0.34	1.47	0.15	2.73	6.76
1994	0.03	0.16	0.03	0.65	0.22	0.83	0.09	2.54	4.55
1995	0.04	0.21	0.04	0.70	0.44	0.99	0.12	1.62	4.16
1996	0.01	0.02	0.03	0.59	0.44	0.68	0.05	1.14	2.96
1997	0.01	0.02	0.04	0.62	0.34	0.67	0.07	0.89	2.66
1998	0.01	0.02	0.01	0.43	0.24	0.43	0.08	1.10	2.32
1999	0.01	0.01	0.01	0.53	0.30	0.75	0.06	1.54	3.21
2000	0.01	0.02	0.01	0.53	0.26	0.66	0.05	1.60	3.13
2001	0.01	0.00	0.01	0.71	0.53	0.45	0.06	1.06	2.83
2002	0.10	0.02	0.02	0.56	0.66	0.89	0.05	1.26	3.54
2003	0.04	0.02	0.02	0.86	0.59	0.76	0.03	1.57	3.89
2004	0.04	0.03	0.02	1.00	0.43	0.75	0.03	1.55	3.86
2005	0.12	0.04	0.02	0.87	0.38	0.86	0.04	1.77	4.09
2006	0.13	0.02	0.01	0.96	0.40	0.75	0.24	1.92	4.42
2007	0.07	0.02	0.01	0.91	0.32	0.68	0.14	1.87	4.03
2008	0.03	0.01	0.01	0.99	0.39	0.53	0.11	1.75	3.81
2009	0.04	0.02	0.01	0.87	0.37	0.67	0.14	1.56	3.67
2010	0.00	0.01	0.01	0.81	0.33	0.45	0.14	1.63	3.38
2011	0.00	0.02	0.01	0.87	0.33	0.42	0.14	1.18	2.96
2012	0.01	0.03	0.01	0.61	0.34	0.63	0.08	1.66	3.35
2013	0.00	0.02	0.00	0.48	0.33	0.38	0.02	1.81	3.03
2014	0.00	0.02	0.00	0.58	0.27	0.23	0.02	1.60	2.73
2015	0.00	0.03	0.00	0.73	0.22	0.26	0.01	1.34	2.58
2016	0.00	0.02	0.00	0.53	0.43	0.16	0.01	0.93	2.07
2017	0.00	0.02	0.00	0.32	0.21	0.14	0.01	1.03	1.73
2018	0.00	0.02	0.00	0.37	0.11	0.10	0.01	1.12	1.73



TABLE 7. Bycatch mortality (mortality during fisheries that cannot legally retain Pacific halibut) of Pacific halibut ≥ 26 inches in length (O26; million net pounds).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1990	0.38	1.33	0.80	3.58	1.72	1.03	0.87	3.68	13.39
1991	0.38	1.58	0.70	4.23	1.43	0.85	1.05	2.98	13.19
1992	0.42	1.49	0.70	3.77	1.60	0.97	1.07	3.09	13.11
1993	0.42	1.16	0.53	2.96	0.73	0.33	0.70	2.39	9.20
1994	0.42	1.06	0.49	3.26	1.17	1.36	0.95	3.70	12.40
1995	0.58	1.31	0.31	2.26	1.32	1.03	0.83	4.13	11.78
1996	0.61	0.28	0.32	2.16	1.51	1.29	0.88	4.47	11.50
1997	0.61	0.20	0.36	2.34	1.10	1.16	0.80	4.30	10.85
1998	1.07	0.19	0.08	2.24	1.15	1.37	0.77	3.98	10.84
1999	0.98	0.18	0.05	2.36	1.44	1.03	0.78	3.52	10.33
2000	0.81	0.21	0.11	2.36	1.25	1.07	0.77	3.30	9.90
2001	0.83	0.17	0.04	2.30	1.14	1.20	0.72	3.63	10.04
2002	0.54	0.22	0.04	1.39	1.27	0.80	0.75	3.53	8.55
2003	0.23	0.22	0.05	2.08	1.14	0.82	0.72	2.92	8.18
2004	0.25	0.23	0.05	2.43	0.84	0.81	0.71	2.88	8.20
2005	0.42	0.31	0.04	2.11	0.74	0.92	0.81	3.29	8.65
2006	0.45	0.27	0.05	1.77	0.95	0.99	0.58	3.02	8.08
2007	0.32	0.30	0.06	1.69	0.75	0.91	0.34	2.94	7.28
2008	0.40	0.13	0.06	1.83	0.92	0.70	0.26	2.76	7.05
2009	0.47	0.20	0.04	1.61	0.88	0.89	0.32	2.46	6.87
2010	0.34	0.17	0.05	1.49	0.77	0.60	0.34	2.56	6.32
2011	0.09	0.21	0.04	1.61	0.79	0.55	0.34	1.85	5.49
2012	0.11	0.16	0.04	1.12	0.80	0.84	0.18	2.61	5.85
2013	0.07	0.20	0.03	1.15	0.56	0.50	0.12	3.17	5.80
2014	0.10	0.22	0.02	1.30	0.71	0.57	0.11	3.17	6.19
2015	0.08	0.30	0.02	1.37	0.44	0.38	0.21	2.09	4.89
2016	0.10	0.25	0.03	1.27	0.44	0.41	0.14	2.32	4.95
2017	0.13	0.23	0.02	1.11	0.68	0.26	0.20	1.72	4.34
2018	0.13	0.27	0.03	1.28	0.36	0.18	0.22	1.87	4.33



TABLE 8. Discard mortality (Pacific halibut not retained and subsequently estimated to have died during the directed commercial fishery) all sizes (all sizes; million net pounds)

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1990	0.04	0.44	0.51	1.69	0.41	0.15	0.07	0.09	3.40
1991	0.01	0.24	0.52	1.67	0.71	0.13	0.08	0.12	3.47
1992	0.02	0.22	0.44	1.23	0.39	0.09	0.07	0.05	2.50
1993	0.03	0.32	0.41	0.85	0.25	0.08	0.06	0.05	2.06
1994	0.01	0.27	0.44	1.48	0.13	0.06	0.07	0.05	2.51
1995	0.01	0.23	0.16	0.42	0.06	0.02	0.02	0.02	0.93
1996	0.01	0.21	0.18	0.54	0.08	0.04	0.04	0.05	1.15
1997	0.01	0.29	0.19	0.53	0.25	0.06	0.05	0.07	1.45
1998	0.02	0.33	0.23	0.68	0.29	0.07	0.05	0.06	1.72
1999	0.02	0.32	0.23	0.55	0.32	0.07	0.07	0.06	1.64
2000	0.02	0.19	0.20	0.48	0.38	0.09	0.06	0.03	1.45
2001	0.02	0.25	0.23	0.46	0.48	0.13	0.08	0.04	1.69
2002	0.02	0.20	0.17	0.65	0.52	0.10	0.04	0.02	1.72
2003	0.04	0.34	0.20	0.68	0.65	0.11	0.04	0.03	2.09
2004	0.02	0.31	0.37	0.76	0.72	0.08	0.03	0.03	2.31
2005	0.04	0.34	0.34	0.72	0.57	0.14	0.02	0.05	2.22
2006	0.05	0.61	0.44	0.74	0.48	0.10	0.01	0.06	2.49
2007	0.04	0.53	0.38	0.97	0.45	0.14	0.02	0.08	2.60
2008	0.04	0.45	0.30	1.00	0.68	0.15	0.03	0.11	2.76
2009	0.05	0.35	0.30	1.18	0.80	0.16	0.02	0.09	2.95
2010	0.03	0.30	0.26	1.45	0.90	0.14	0.04	0.10	3.21
2011	0.03	0.28	0.08	0.93	0.77	0.14	0.04	0.19	2.47
2012	0.03	0.22	0.10	0.59	0.53	0.10	0.04	0.08	1.67
2013	0.03	0.21	0.11	0.52	0.40	0.07	0.04	0.06	1.43
2014	0.02	0.25	0.12	0.44	0.33	0.04	0.06	0.05	1.30
2015	0.03	0.24	0.12	0.52	0.22	0.08	0.04	0.05	1.29
2016	0.04	0.23	0.12	0.38	0.23	0.05	0.06	0.07	1.18
2017	0.02	0.18	0.09	0.35	0.24	0.06	0.03	0.03	0.99
2018	0.02	0.14	0.06	0.29	0.21	0.07	0.02	0.03	0.83