

**Supplemental Material for SSC Review of NWFSC Observer Program Annual Report on Pacific Halibut bycatch in U.S. west coast groundfish fisheries: Response to 2012 SSC comments and suggestions.**

In the 2012 report, we removed the ‘retained catch of other species’ strata from the IFQ bottom trawl vessels because qualitative information suggested that the incentives of the IFQ system had significantly changed fishing behavior. The strata represents a catch threshold (greater or less than 125 lbs.) for species which are correlated with catch of *P. halibut* (Heery et al. 2010). As requested by the SSC during the review of the 2012 report, we provide tables that compare the IFQ bottom trawl discard rates and gross discard (Table E1) with the same values for the LE Bottom Trawl fishery during the 2002-2010 period. We also provide coverage summaries (Table E2), expansion calculations (Table E3), viability summaries (Table E4) and discard mortality (Table E5) for the IFQ bottom trawl data using this additional catch threshold stratum. The strata used for the IFQ bottom trawl vessels in the 2013 report are the same as those used in the 2012 report and, thus, this threshold is not used. If the SSC deems the threshold strata relevant to IFQ bottom trawl vessels, we will add the tables below to the 2013 report.

**Table E1.** A comparison of discard ratios and gross discard estimates of the LE bottom trawl fishery from 2002-2010 versus the IFQ bottom trawl fishery from 2011-2012. Note that observer coverage of the LE bottom trawl fishery from 2002-2010 varied from 9-29% of the total fleet tow hours. IFQ coverage for the 2011-2012 years was greater than 98% of the tow hours.

Area lbs per tow hour	Year	0 to 60 fathoms					> 60 fathoms					
		Observed		Estimated			Observed		Estimated			
		Discard ratio (kg/hr)	SE	Gross discard estimate (kg)	95% CI lower	95% CI upper	Discard ratio (kg/hr)	SE	Gross discard estimate (kg)	95% CI lower	95% CI upper	
<b>North of Pt Chehalis</b>												
<b>≤ 125 lbs</b>												
LE Trawl	2002	6.85	0.99	6,261	4,483	8,040	LE Trawl	5.62	0.89	32,795	22,586	43,004
	2003	1.04	0.40	364	87	640		1.40	0.56	7,354	1,608	13,100
	2004	6.49	1.61	5,235	2,682	7,788		1.34	0.29	3,457	1,979	4,935
	2005	9.75	2.90	5,566	2,325	8,808		12.59	6.94	42,483	0	88,428
	2006	7.84	1.64	9,254	5,453	13,054		5.16	1.06	17,259	10,327	24,190
	2007	11.72	3.56	10,868	4,401	17,335		3.35	1.47	14,420	2,041	26,799
	2008	2.35	0.66	953	428	1,478		1.18	0.20	8,139	5,432	10,846
	2009	7.42	1.50	2,222	1,340	3,104		3.31	0.62	21,963	13,846	30,079
	2010	» 7.05	0.76	626	494	759		0.86	0.26	5,189	2,107	8,271
IFQ B.Trawl	2011	7.43	5.61	238	223	254	IFQ B.Trawl	1.91	2.05	3,571	3,551	3,592
IFQ B.Trawl	2012	9.61	11.51	829	779	878	IFQ B.Trawl	1.73	1.25	2,510	2,497	2,523
<b>&gt; 125 lbs</b>												
LE Trawl	2002	10.88	1.05	21,973	17,808	26,138	LE Trawl	46.28	5.97	367,146	274,388	459,904
	2003	2.55	0.70	3,003	1,388	4,617		20.65	3.40	109,201	73,947	144,455
	2004	12.54	1.55	34,254	25,944	42,564		32.46	4.75	106,598	76,023	137,173
	2005	12.48	1.64	24,818	18,433	31,204		38.88	3.39	236,715	196,312	277,117
	2006	12.34	1.49	23,006	17,566	28,447		45.08	6.66	172,672	122,674	222,669
	2007	14.33	5.30	14,865	4,090	25,641		28.03	6.33	88,142	49,137	127,147
	2008	7.92	1.52	7,428	4,628	10,229		35.53	5.33	145,011	102,366	187,656
	2009	22.15	3.94	14,796	9,634	19,958		38.71	4.42	171,175	132,907	209,443
	2010	» 11.95	0.68	3,208	2,847	3,569		22.16	4.87	57,367	32,681	82,053
IFQ B.Trawl	2011	8.86	1.35	7,126	7,119	7,134	IFQ B.Trawl	7.54	0.64	18,076	18,072	18,079
IFQ B.Trawl	2012	6.38	1.44	3,944	3,938	3,950	IFQ B.Trawl	7.50	0.77	27,707	27,702	27,712
<b>South of Pt Chehalis</b>												
<b>≤ 125 lbs</b>												
LE Trawl	2002	3.91	0.77	22,477	13,751	31,203	LE Trawl	0.44	0.08	26,125	17,061	35,190
	2003	0.32	0.16	1,378	14	2,741		0.20	0.04	9,287	6,016	12,558
	2004	1.10	0.20	4,205	2,743	5,668		0.28	0.04	8,411	5,942	10,881
	2005	2.78	0.39	8,645	6,240	11,049		0.35	0.06	9,438	6,333	12,543
	2006	1.34	0.22	5,333	3,641	7,024		0.27	0.04	7,483	5,384	9,583
	2007	3.70	0.72	14,082	8,728	19,436		0.47	0.06	15,392	11,234	19,550
	2008	1.21	0.27	2,318	1,303	3,334		0.92	0.20	39,272	22,436	56,108
	2009	2.63	0.32	7,680	5,828	9,532		0.84	0.11	46,433	34,095	58,770
	2010	2.66	0.57	4,159	2,425	5,893		0.52	0.08	25,225	17,631	32,819
IFQ B.Trawl	2011	7.50	1.80	3,820	3,814	3,827	IFQ B.Trawl	0.14	0.37	3,195	3,191	3,199
IFQ B.Trawl	2012	2.49	0.89	1,394	1,391	1,398	IFQ B.Trawl	0.13	0.19	2,695	2,693	2,698
<b>&gt; 125 lbs</b>												
LE Trawl	2002	2.95	0.39	7,799	5,770	9,828	LE Trawl	4.00	0.52	39,837	29,604	50,070
	2003	1.91	0.51	4,477	2,122	6,833		4.59	0.48	51,592	41,072	62,112
	2004	3.28	0.54	11,841	8,005	15,678		4.16	0.51	38,425	29,266	47,584
	2005	6.18	0.74	33,875	25,937	41,814		7.58	0.78	98,808	78,787	118,829
	2006	13.50	1.97	75,235	53,665	96,804		6.13	0.70	80,668	62,579	98,756
	2007	11.77	1.37	45,573	35,200	55,947		6.56	0.60	91,034	74,717	107,350
	2008	3.83	0.63	9,030	6,120	11,941		5.80	0.78	93,055	68,584	117,526
	2009	11.83	1.34	26,412	20,557	32,267		7.43	0.89	94,555	72,439	116,672
	2010	5.04	1.09	5,932	3,417	8,446		7.58	0.89	60,770	46,700	74,840
IFQ B.Trawl	2011	3.83	0.46	6,830	6,828	6,832	IFQ B.Trawl	1.97	0.25	18,991	18,989	18,992
IFQ B.Trawl	2012	4.26	0.71	6,549	6,546	6,551	IFQ B.Trawl	1.86	0.22	17,946	17,944	17,947

» These observed discard ratios were estimated by bootstrapping the means across all previous years (10,000x, with replacement). This was done because the number of observations in these strata were too small ( $\leq 3$  vessels) or not observed, and therefore, direct estimation of discard ratios were either not accurate or not possible.

**Table E2.** Number of vessels, trips, and tows/sets observed and metric tons of Pacific halibut sampled in the IFQ bottom trawl fishery. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). Some tows/sets are only partially sampled. Partially sampled tows/sets are included in the "No. of sampled tows", but for clarity, the number of unsampled catch categories in partially sampled tows/sets is provided. Some tows/sets are completely unsampled as noted below. (\*) Confidential data.

Area	Lbs per tow hour Depth (fm)	Year	No. of vessels	No. of trips	No. sampled tows	No. unsampled tows	Sampled tow hours	Unsampled tow hours	P. halibut discard (mt)	P. halibut retained (mt)	Unsampled categories from partially sampled hauls			Coverage rate		
											IFQFF	IFQM	Non-IFQ	% tows sampled	% tow hours sampled	
North of Pt. Chehalis	< 125lbs 0-60	2011	5	12	21	0	247	9	0.24	0.00	0	0	1	100%	96.5%	
		2012	9	21	38	1	564	63	0.83	0.00	0	1	2	97.4%	89.9%	
	> 60	2011	18	99	365	2	12770	1639	3.57	0.00	0	3	43	99.5%	88.6%	
		2012	17	102	276	1	9833	779	2.51	0.00	0	4	15	99.6%	92.7%	
	≥ 125lbs 0-60	2011	13	46	282	3	7859	534	7.13	0.00	2	5	9	98.9%	93.6%	
		2012	13	62	278	4	5515	551	3.94	0.00	0	0	8	98.6%	90.9%	
	> 60	2011	19	134	743	3	21962	2583	18.08	0.01	3	5	95	99.6%	89.5%	
		2012	19	161	1062	9	34440	2099	27.71	0.03	0	16	43	99.2%	94.3%	
	40° 10' to Pt. Chehalis	< 125lbs 0-60	2011	15	75	216	2	2999	181	3.71	0.00	3	0	7	99.1%	94.3%
			2012	16	75	221	2	3395	142	1.32	0.00	0	0	2	99.1%	96.0%
> 60		2011	55	634	2872	13	132293	6435	3.08	0.00	2	7	93	99.5%	95.4%	
		2012	52	578	2359	7	112898	5209	2.60	0.01	0	11	82	99.7%	95.6%	
≥ 125lbs 0-60		2011	18	131	899	17	15281	1702	6.77	0.00	9	2	58	98.1%	90.0%	
		2012	19	147	754	6	12263	1173	6.40	0.00	3	6	27	99.2%	91.3%	
> 60		2011	54	598	2225	16	83773	4695	18.94	0.01	3	7	85	99.3%	94.7%	
		2012	54	536	2181	19	80383	3327	17.23	0.03	2	16	55	99.1%	96.0%	
South of 40° 10' N Lat		< 125lbs 0-60	2011	3	20	39	0	644	83	0.11	0.00	3	0	1	100%	88.6%
			2012	*	*	*	*	*	*	*	*	*	*	*	*	*
	> 60	2011	15	230	1014	3	36452	1718	0.11	0.00	3	0	26	99.7%	95.5%	
		2012	13	232	1139	0	34518	3110	0.10	0.00	1	1	51	100%	91.7%	
	≥ 125lbs 0-60	2011	*	*	*	*	*	*	*	*	*	*	*	*	*	
		2012	*	*	*	*	*	*	*	*	*	*	*	*	*	
	> 60	2011	14	120	359	0	7542	478	0.05	0.00	0	0	8	100%	94.0%	
		2012	12	165	506	3	10035	992	0.72	0.00	0	0	18	99.4%	91.0%	

**Table E3.** Values used to calculate the expanded weight (mt) of Pacific halibut (PHLB) from each unsampled category in the U.S. west coast groundfish IFQ bottom trawl fishery. Unsampled catch weight could be assigned to one of four categories: IFQ flatfish species, IFQ mixed species, non-IFQ species, or all species (IFQ & non-IFQ). The sampled weight (mt), discard ratio, unsampled weight (mt) and estimated Pacific halibut gross discard (mt) are presented within each category, depth, catch threshold (125 pounds per tow hour) of correlated species, management area, area north or south of Point Chehalis, WA and year, from the bottom trawl fisheries. The sum of expanded discard weight (mt) is the sum of the estimated gross P. halibut discard across categories. The sampled PHLB in unsampled hauls is the sampled weight of P. halibut in partially sampled hauls. The sampled discarded PHLB weight (mt) is the sum of sampled PHLB from all observed hauls. The total discard (gross) is the sum of the PHLB in unsampled hauls plus the sampled PHLB. (\*) Confidential data.

Area	Lbs per tow hour Depth (fm)	IFQ Flatfish				Mixed IFQ Species				Non-IFQ Species				All Species (IFQ & Non-IFQ)				Sum of Exp. Discard Weight	Sampled Discarded PHLB	Total Discard	
		Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard				
North of Pt. Chehalis	< 125lbs																				
	0-60																				
	2011	1.05	0.226	0.00	0.00	1.66	0.143	0.00	0.00	1.60	0.000	0.02	0.00	3.27	0.073	0.00	0.00	0.00	0.24	0.24	
	2012	6.01	0.134	0.00	0.00	6.12	0.132	0.05	0.01	6.38	0.000	0.07	0.00	12.50	0.065	0.27	0.02	0.02	0.81	0.85	
	> 60																				
	2011	30.48	0.107	0.00	0.00	35.50	0.092	0.33	0.03	71.76	0.000	2.43	0.00	107.26	0.030	0.10	0.00	0.03	3.26	3.61	
	2012	14.55	0.167	0.00	0.00	19.28	0.126	0.10	0.01	74.28	0.000	0.31	0.00	93.56	0.026	11.02	0.29	0.30	2.43	2.81	
	>= 125lbs																				
	0-60																				
	2011	56.67	0.124	0.16	0.02	75.85	0.093	5.22	0.48	53.94	0.000	2.64	0.00	129.79	0.054	2.29	0.12	0.63	7.04	7.83	
	2012	42.32	0.084	0.00	0.00	46.64	0.076	0.00	0.00	36.71	0.000	0.95	0.00	83.35	0.043	0.29	0.01	0.01	3.55	3.96	
	> 60																				
2011	71.05	0.208	1.03	0.21	92.82	0.160	0.68	0.11	124.73	0.000	12.61	0.00	217.55	0.068	4.69	0.32	0.64	14.81	19.54		
2012	63.29	0.413	0.00	0.00	95.61	0.274	2.32	0.64	185.25	0.000	6.53	0.00	561.72	0.186	13.83	1.29	1.92	52.33	38.90		
40° 10' to Pt. Chehalis	< 125lbs																				
	0-60																				
	2011	14.12	0.263	0.29	0.08	14.63	0.254	0.00	0.00	30.43	0.000	3.07	0.00	45.06	0.082	1.66	0.14	0.21	3.71	3.93	
	2012	14.35	0.092	0.00	0.00	15.73	0.084	0.00	0.00	43.20	0.000	0.11	0.00	58.93	0.022	0.28	0.01	0.01	1.32	1.33	
	> 60																				
	2011	69.76	0.042	0.04	0.00	136.90	0.021	2.99	0.06	436.70	0.000	6.40	0.00	573.60	0.005	2.66	0.01	0.08	2.92	3.16	
	2012	62.62	0.041	0.00	0.00	132.51	0.019	4.47	0.09	354.68	0.000	5.77	0.00	487.19	0.005	2.72	0.01	0.10	2.58	2.70	
	>= 125lbs																				
	0-60																				
	2011	75.80	0.079	0.68	0.05	95.81	0.063	2.40	0.15	140.44	0.000	3.69	0.00	236.25	0.025	4.05	0.10	0.31	6.00	7.25	
	2012	54.72	0.110	0.45	0.05	66.25	0.090	2.35	0.21	97.54	0.000	2.45	0.00	163.78	0.037	1.67	0.06	0.32	5.99	6.72	
	> 60																				
2011	97.77	0.176	0.74	0.13	187.90	0.092	1.01	0.09	284.14	0.000	11.85	0.00	472.05	0.037	4.88	0.18	0.40	17.24	19.38		
2012	111.40	0.150	0.06	0.01	224.08	0.074	2.45	0.18	265.11	0.000	6.62	0.00	489.19	0.034	4.54	0.15	0.35	16.68	17.59		
South of 40° 10' N Lat	< 125lbs																				
	0-60																				
	2011	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	> 60																				
	2011	121.62	0.000	0.10	0.00	182.05	0.000	0.00	0.00	175.03	0.001	2.74	0.00	357.08	0.000	1.36	0.00	0.00	0.11	0.12	
	2012	48.74	0.000	0.01	0.00	97.73	0.000	0.03	0.00	147.02	0.001	6.67	0.00	244.75	0.000	0.00	0.00	0.00	0.08	0.10	
	>= 125lbs																				
	0-60																				
	2011	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	> 60																				
2011	33.28	0.000	0.00	0.00	88.12	0.000	0.00	0.00	41.56	0.001	0.12	0.00	129.68	0.000	0.00	0.00	0.00	0.05	0.05		
2012	27.09	0.000	0.00	0.00	157.21	0.000	0.00	0.00	67.50	0.010	0.47	0.00	224.71	0.003	1.93	0.01	0.01	0.67	0.73		

**Table E4.** Pacific halibut viabilities in the U.S. west coast groundfish IFQ bottom trawl fishery by depth, catch threshold (125 pounds per tow hour) of correlated species, management area, area north or south of Point Chehalis, WA, and year. The condition of sampled Pacific halibut was identified as Excellent (Exc), Poor, or Dead (WCGOP manual 2013), consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. (\*) Confidential data.

Area	Lbs per tow hour Depth (fm)	Year	Number of fish				Weighted percentages in each category		
			Exc	Poor	Dead	Total	Exc	Poor	Dead
<b>North of Pt. Chehalis</b>									
<b>&lt; 125lbs</b>									
<b>0-60</b>									
		2011	23	1	0	24	92%	8%	0%
		2012	36	22	45	103	40%	21%	40%
<b>&gt; 60</b>									
		2011	115	33	104	252	49%	15%	36%
		2012	80	50	90	220	38%	21%	41%
<b>&gt;= 125lbs</b>									
<b>0-60</b>									
		2011	494	136	308	938	56%	14%	29%
		2012	278	134	254	666	47%	20%	33%
<b>&gt; 60</b>									
		2011	948	406	823	2177	46%	19%	35%
		2012	1219	659	1278	3156	41%	21%	39%
<b>40° 10' to Pt. Chehalis</b>									
<b>&lt; 125lbs</b>									
<b>0-60</b>									
		2011	379	22	13	414	93%	4%	3%
		2012	*	*	*	*	*	*	*
<b>&gt; 60</b>									
		2011	115	69	159	343	33%	19%	48%
		2012	80	55	156	291	33%	19%	49%
<b>&gt;= 125lbs</b>									
<b>0-60</b>									
		2011	*	*	*	*	*	*	
		2012	*	*	*	*	*	*	
<b>&gt; 60</b>									
		2011	852	485	1029	2366	38%	20%	41%
		2012	775	392	1044	2211	37%	17%	46%
<b>South of 40° 10' N Lat</b>									
<b>&lt; 125lbs</b>									
<b>0-60</b>									
		2011	0	0	6	6	0%	0%	100%
		2012	0	0	4	4	0%	0%	100%
<b>&gt; 60</b>									
		2011	5	1	3	9	57%	9%	34%
		2012	5	1	5	11	49%	9%	42%
<b>&gt;= 125lbs</b>									
<b>0-60</b>									
		2011	0	0	4	4	0%	0%	100%
		2012	0	0	10	10	0%	0%	100%
<b>&gt; 60</b>									
		2011	2	0	3	5	26%	0%	74%
		2012	30	6	31	67	49%	9%	42%

**Table E4.** Estimated gross discard (mt) and discard mortality (mt) of Pacific halibut in the U.S. west coast groundfish IFQ bottom trawl fishery by depth, catch threshold (125 pounds per tow hour) of correlated species, management area, area north or south of Point Chehalis, WA and year. Estimates were allocated to the three condition categories based on information presented in Table E3 DMR = Discard Mortality Rate. (\*) Confidential data.

Area	Lbs per tow hour Depth (fm)	Year	Estimate Gross Discard (mt)				Estimated Discard Mortality (mt)				DMR
			Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	m(Total)	
North of Pt. Chehalis	< 125lbs 0-60	2011	0.24	0.02	0.00	0.26	0.05	0.01	0.00	0.06	23%
		2012	0.51	0.27	0.51	1.29	0.10	0.15	0.46	0.71	55%
	> 60	2011	1.84	0.56	1.36	3.76	0.37	0.31	1.22	1.90	51%
		2012	1.20	0.68	1.29	3.17	0.24	0.37	1.16	1.77	56%
	≥ 125lbs 0-60	2011	5.62	1.43	2.91	9.97	1.12	0.79	2.62	4.53	45%
		2012	2.86	1.23	1.98	6.07	0.57	0.67	1.78	3.03	50%
	> 60	2011	12.69	5.11	9.53	27.32	2.54	2.81	8.58	13.92	51%
		2012	15.69	8.04	14.96	38.69	3.14	4.42	13.47	21.03	54%
40° 10' to Pt. Chehalis	< 125lbs 0-60	2011	5.47	0.26	0.16	5.89	1.09	0.14	0.14	1.38	23%
		2012	1.63	0.27	0.24	2.14	0.33	0.15	0.21	0.69	32%
	> 60	2011	1.61	0.94	2.32	4.87	0.32	0.52	2.08	2.92	60%
		2012	1.38	0.79	2.06	4.23	0.28	0.44	1.86	2.57	61%
	≥ 125lbs 0-60	2011	7.94	1.34	1.54	10.82	1.59	0.73	1.39	3.71	34%
		2012	6.55	1.41	1.99	9.95	1.31	0.77	1.79	3.88	39%
	> 60	2011	11.06	5.88	11.94	28.89	2.21	3.24	10.74	16.19	56%
		2012	10.02	4.72	12.66	27.39	2.00	2.59	11.39	15.99	58%
South of 40° 10' N Lat	< 125lbs 0-60	2011	0.00	0.00	0.18	0.18	0.00	0.00	0.16	0.16	90%
		2012	*	*	*	*	*	*	*	*	*
	> 60	2011	0.11	0.02	0.07	0.19	0.02	0.01	0.06	0.09	47%
		2012	0.08	0.01	0.07	0.16	0.02	0.01	0.06	0.08	52%
	≥ 125lbs 0-60	2011	*	*	*	*	*	*	*	*	*
		2012	*	*	*	*	*	*	*	*	*
	> 60	2011	0.02	0.00	0.06	0.08	0.00	0.00	0.05	0.06	72%
		2012	0.57	0.11	0.48	1.15	0.11	0.06	0.43	0.60	52%