Appendix 2. Pacific halibut discard mortality rates in the 2008 CDQ and non-CDQ groundfish fisheries, and recommendations for 2010-2012

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Introduction

Pacific halibut discard mortality rates (DMRs) in the Alaskan groundfish fisheries are estimated from viability (injury and condition) data collected by National Marine Fisheries Service (NMFS) observers. These data are analyzed each year by staff of the International Pacific Halibut Commission (IPHC). This paper reports on an analysis of viability data collected during the 2008 Community Development Quota (CDQ) and non-CDQ groundfish fisheries off Alaska. The analytical results also form the basis for recommended DMRs for inseason management of halibut bycatch in the 2010-2012 CDQ and non-CDQ groundfish fisheries.

Data description and methods

The analysis followed the same approach that has been employed since 1996, which was described by Williams (1996). Observer haul data from the NMFS groundfish observer database formed the basis of the analysis. The data records included the catch of groundfish by species or species group, estimates of the number and weight (kg) of halibut bycatch, and the number and length of halibut sampled for release condition or injury by category (excellent/poor/dead for trawl and pot gear, minor/moderate/severe/dead for longline gear). Records for all hauls sampled by observers in 2008 were obtained; hauls not sampled for species composition were excluded.

The records were assigned to target fishery categories, based on the catch of the particular species within the haul catch composition, relative to the overall total and retained catches (Table 1). For example, hauls were coded as midwater pollock if pollock comprised 95% or more of the summed total catch for the reporting week (Sunday-Saturday). Flatfish targets in the Bering Sea/Aleutians (BSA) were determined in a succession of comparisons of individual flatfish species compositions in the catch. The determination for the flatfish targets was based on the greatest percentage of the non-arrowtooth flounder catch. Table 1 shows the target codes and definitions used.

NMFS observers examined halibut for release condition or injury immediately before being returned to the sea. Each fish was judged according to a set of criteria (Williams and Chen 2003), which were used to determine internal and external injuries, and body damage from predators (e.g., amphipods and marine mammals). Beginning in 2000, a dichotomous key was introduced to reduce subjectivity in the determinations of condition and injury. Observers recorded the number of halibut in excellent, poor and dead condition (trawls and pots) or with minor, moderate, severe injuries, or deemed dead (longlines) on each haul or set sampled, respectively. Samples were only collected on hauls that were sampled for species composition. The species composition sampling provides an estimate of the total number of halibut caught in the haul, as well as the catch of groundfish, necessary for determining the target. Observers were instructed to limit the number of fish examined to a maximum of 20, although this was occasionally exceeded by enthusiastic observers.

Next, the viability distribution for a target fishery was calculated. First, for each haul, the proportion of halibut in each category was extrapolated to the total number of halibut caught. The extrapolated numbers of halibut for each vessel by viability category were then summed within each region/gear/target strata.

The general model for calculating the DMR for halibut caught by gear ***g*** was of the form:

$$DMR_g = \sum_{i=1}^{4} \left(m_{i,g} \times P_i \right)$$

where ***m*** is the mortality rate for gear ***g***, and ***P*** is the proportion of halibut in condition ***i***, where 1 is excellent/minor, 2 is poor/moderate, 3 is dead (trawl or pot)/severe, and 4 is dead (longline).

There are several factors which contribute to release condition, which vary by gear type. With trawl-caught halibut, condition is related to the size of the catch, tow duration, and halibut size. For longline bycatches, injuries are most frequently caused by improper release methods used by vessel crews. Another significant factor is the length of the soak time, which can exacerbate the mortality caused by hooking injuries and also increase the potential for amphipod predation. The condition of halibut caught in pots is affected by soak time and the presence of other animals in the pot, especially crabs.

The mortality rate ***m*** varies among gear types and represents the aggregate effects of external and internal injuries to the fish and the presence of predation by amphipods or marine mammals. The mortality rates have been determined through long term tagging studies conducted by IPHC. See Clark et al. (1992) for trawls, Williams (1996) for pots, and Kaimmer and Trumble (1998) for longlines. Estimated halibut mortality rates by gear and condition/injury were as follows:

Gear (*g*)	m_{exc}	m_{poor}	m_{dead}	
Trawl	0.20	0.55	0.90	
Pot	0.00	1.00	1.00	
	m_{minor}	$m_{moderate}$	m_{severe}	m_{dead}
Longline	0.035	0.363	0.662	1.00

Mean fishery DMRs and associated standard errors were estimated by assuming that each vessel acts as a separate sampling unit, so that a DMR was calculated for each individual vessel in a target fishery. The DMR for a target fishery was then estimated as the mean of vessel DMRs, where the vessel's proportion of the total number of bycaught halibut was used as a weighting factor, as follows:

Let DMR_v = observed DMR on vessel ***v***
p_v = proportion of total number of halibut caught on vessel ***v*** in a fishery

Then $$\overline{DMR} = \sum_{v=1}^{n} \left(p_v \times DMR_v \right)$$

Standard errors of the weighted mean DMR were estimated as:

$$V\left(\overline{DMR}\right) = \sum_{v=1}^{n} \left(p_v^2 \times V\left(DMR_v\right)\right)$$

and $$SE\left(\overline{DMR}\right) = \sqrt{V\left(\overline{DMR}\right)}$$

where $V\left(DMR_v\right)$ is the sample variance of all the $DMRs_v$, and $V\left(\overline{DMR}\right)$ and $SE\left(\overline{DMR}\right)$ are the variance and standard error of $\overline{DMR}$, respectively.

Results

Non-CDQ fisheries

A summary of observer coverage, sampling, and halibut size composition data is shown in Table 2. Coverage and sampling in the major targets produced a large number of sampled hauls, and a substantial number of halibut sampled. For example, observers sampled over 9,000 hauls and 8,500

halibut in the BSA midwater pollock fishery. Two flatfish targets, yellowfin and rock sole, had more halibut examined than any other target. Sample sizes were also very high (>1,000 hauls and/or >1,000 halibut measured) in most BSA trawl fisheries. The longline fishery for cod was the only BSA longline fishery to receive significant sampling in 2008. In past years, sampling has also occurred on rockfish and turbot vessels but only minimally, and 2008 was no exception, as only turbot fishing had any sampling. Pot fishing was focused on cod, as in past years.

Most of the sampling in GOA trawl fisheries occurred in the cod, rockfish, and flatfish targets, which continued patterns seen in past years. The rockfish fishery tallied the largest number of observed tows but it's not clear how the Rockfish Pilot Project might have factored into this, as hauls were not coded with any project designation. Sampling of the cod and the two pollock fisheries occurred at similar levels (29-38 vessels; ~160-400 hauls). Sampling of flatfish fishing was highest in the shallow water flatfish, arrowtooth and rex sole targets. For the third year in a row, no vessel effort was noted in the deepwater flatfish target, which in past years was primarily directed at Dover sole. In 2005, high catches of Dover sole were most frequently associated with even greater catches of arrowtooth flounder or rex sole, and to a lesser extent flathead sole. More directed fishing at arrowtooth and rex sole has likely made Dover sole a secondary target. Thus, vessel effort was assigned to those targets and not to deepwater flatfish. The number of sampled longline and pot vessels targeting cod was similar to past years.

Data on sampling levels and release viability (condition or injury) by region and fishery are summarized in Table 3. The raw data represent the observations recorded by observers. In most cases, these raw data total less than those shown in Table 2, as the latter include halibut which were not examined for condition/injury. The observations on each haul were extrapolated upwards to the total number of halibut caught on the haul, and then summed across vessel & target fishery strata. For most fisheries, the distribution of the extrapolated viability data is very similar to the raw data. The complete time series of fishery DMRs is provided in Tables 4 and 5 for the BSA and GOA, respectively.

CDQ fisheries

In 2008, CDQ fishing was conducted using pots, trawls, and longlines. The primary species targeted by trawl operations included pollock, rock sole and yellowfin sole. Pacific cod were targeted by longline, and sablefish by pots. Sampling levels and injury/viability data for CDQ operations are summarized in Table 6; the time series of mean annual DMRs is shown in Table 7.

Almost all halibut caught in the trawl operations were dead when examined. Usually this is caused by a larger haul size and/or longer haul duration. However, in most cases, the mean tow duration was about the same or slightly shorter in CDQ fishing than in non-CDQ fishing for the same target. Haul size was also not consistently greater or smaller between the two sectors, though in several targets, e.g., atka mackerel, cod, rockfish and midwater pollock, the differences were large:

	Mean Duration (hr)		Mean Haul Size (mt)	
Target	**CDQ**	**Non-CDQ**	**CDQ**	**Non-CDQ**
Atka	3.45	3.34	48.90	65.42
Btm Poll	3.96	5.24	55.80	51.31
Pac cod	3.05	4.33	25.30	16.71
Rockfish	2.97	3.67	29.87	39.88
Midwtr Poll	3.78	5.81	82.16	67.98
Rock sole	3.15	2.95	25.69	22.42
YF sole	3.77	3.33	28.14	27.58

DMRs for the CDQ trawl targets ranged from 0.86 to 0.90, which are generally higher than what is seen in non-CDQ fishing for the same species. This suggests there are other variables which negatively affect the condition of the released halibut.

Longline CDQ fishing consisted of 17 vessels targeting cod. Distribution of release injuries to halibut in the CDQ longline cod fishery was similar to that observed in the non-CDQ cod fishery, which is reflected by very similar DMRs (0.085 in CDQ vs. 0.083 in non-CDQ).

The pot fishery targeted sablefish, with three vessels observed, compared to five in 2007. Very few halibut were examined by observers, which is a concern. Conversely, not many halibut were caught (n = 15), so the infrequent capture probably contributed to the low number of sampled fish. The fishery DMR (0.219) was almost identical to the 2007 DMR, and more in line with the long term mean. Pot soak time is positively correlated with halibut mortality. The long soaks increase the potential for amphipod predation and injury from hard-shell crab in the pot.

Recommendations for 2010-12

The Council is using a plan in which the DMRs used to monitor halibut bycatch are an average of data from the most recent 10 year period. These 10-year mean DMRs for each fishery are used for a 3-year period, with the justification being two-fold: 1) interannual variability of fishery DMRs is relatively small, and 2) to provide stability for the industry to better plan their operations. The following table outlines the range of data used for the specific years of application:

10-Year Basis Period	Years of application
1990-1999	2001 - 2003
1993-2002	2004 – 2006
1996-2005	2007 - 2009
1999-2008	2010 - 2012

As shown, information from 1999-2008 is the basis for the DMRs for 2010-2012. The 10-year mean DMRs for 2010-2012 are shown in Table 8. For some targets, a full ten years of data is not available, so the recommended DMR is based on whatever data are available from the 1999-2008 time period.

For CDQ targets with no past observation or data, such as longline turbot, and pot cod, DMRs derived from non-CDQ fisheries data are recommended. The current non-CDQ fisheries are probably more alike the current CDQ fishing, than data from fishing conducted over five years ago or more. For the 'other species' and any other target not explicitly noted here in the non-CDQ fisheries, we recommend using the DMR for the cod fishery in that region/gear stratum.

Regarding interannual variability, we have seen that DMRs generally do not change greatly from one year to the next, absent of regulations that directly affect halibut discard and handling practices. The recent introduction of fishery cooperatives and attendant allocation of bycatch to the cooperatives potentially provides opportunity to improve handling and therefore survival of discarded halibut. DMRs are an expression of fishing practices and crew handling, so the potential for tracking DMRs by cooperative should be explored.

References

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Table 1. Groundfish target definitions and the method used to determine target species for observer sampled hauls, as used in the halibut discard mortality rate analysis.

BSA		GOA	
Target	**Definition**	**Target**	**Definition**
A	Atka mackerel	A	Atka mackerel
B	Bottom pollock	B	Bottom pollock
C	Pacific cod	C	Pacific cod
F	Other flatfish	D	Deep water flatfish
K	Rockfish	H	Shallow water flatfish
L	Flathead sole	K	Rockfish
O	Other spp.	L	Flathead sole
P	Midwater pollock	O	Other spp.
R	Rock sole	P	Midwater pollock
S	Sablefish	S	Sablefish
T	Greenland turbot	W	Arrowtooth flounder
W	Arrowtooth flounder	X	Rex sole
Y	Yellowfin sole		

CDQ and Non-CDQ TARGET FISHERY DETERMINATION

Bering Sea/Aleutians

P if pollock ≥ 95% of total catch, or
W if arrowtooth flounder ≥ 65% of total catch.

Y/R/L/F if (rock sole + other flatfish + yellowfin sole + flathead) is the largest component of the retained catch using this rule:
Y if yellowfin sole is ≥ 70% of (rock sole + other flatfish + yellowfin sole + flathead sole), or
R if rock sole > other flatfish and rock sole > flathead sole, or
L if flathead sole > other flatfish and flathead sole > rock sole, or
F if none of the three conditions above are met.

If target is not P, W, Y, R, L or F, then target is whichever species or species group (A, B, C, K, O, S, or T) forms the largest part of the total catch.

Gulf of Alaska

P if pollock ≥ 95% of total catch, or
W if arrowtooth flounder ≥ 65% of total catch.

If target is not P or W, then target is whichever species or species group (A, B, C, D, H, K, L, O, S, or X) forms the largest part of the total catch.

Table 2. Information on observer coverage, sampling, and size composition of the halibut bycatch in 2008.

Area/Gear /Target	No. of vsls Sampled	No. of sampled hauls	No. of fish Measured	Mean length (cm)	Percent <65 cm	Percent < 82 cm
BSA Longline						
Pacific cod	36	5,624	7,513	68.1	44.0	84.7
Turbot	3	78	20	72.6	30.0	75.0
BSA Pot						
Pacific cod	37	498	677	66.4	40.2	96.5
BSA Trawl						
Atka mackerel	8	926	208	91.5	18.3	54.8
Bottom pollock	81	2,472	4,389	49.2	84.9	95.6
Pacific cod	61	1,257	2,940	49.6	85.4	95.7
Other flatfish	2	89	212	67.1	33.5	97.2
Rockfish	9	334	394	75.8	29.7	74.4
Flathead sole	14	2,514	4,128	57.9	68.5	91.5
Midwtr pollock	96	9,100	8,529	59.2	63.9	86.3
Rock sole	23	3,246	15,865	38.7	94.8	97.9
Sablefish	1	18	4	90.8	0.0	50.0
Turbot	3	184	96	100.6	19.8	53.1
Arrowtooth flndr	5	188	288	65.4	44.4	92.4
Yellowfin sole	37	6,211	10,342	46.7	84.4	93.7
GOA Longline						
Pacific cod	15	369	1,171	69.3	38.6	82.8
GOA Pot						
Pacific cod	25	269	519	76.5	17.7	79.8
GOA Trawl						
Bottom pollock	37	380	581	60.4	67.6	91.6
Pacific cod	38	397	2,013	56.8	73.2	95.0
Dp wtr flatfish	0	0	0	--	--	--
Shall wtr flatfish	26	400	1,872	51.0	81.5	92.9
Rockfish	38	1,138	1,184	67.0	54.1	81.6
Flathead sole	9	82	420	57.6	78.8	93.1
Midwtr pollock	29	165	0	--	--	--
Sablefish	9	58	12	83.4	25.0	50.0
Arrowtooth flndr	17	245	692	65.5	49.1	91.6
Rex sole	4	187	414	63.3	59.2	94.4

Table 3. Distribution of 2008 halibut condition/injury data, by factor and target fishery.

	Raw data				Extrapolated data				
Target	**Exc**	**Poor**	**Dead**	**DMR**	**Exc**	**Poor**	**Dead**	**DMR**	**SE**
BSA Trawl									
Atka mackerel	0	1	119	0.897	0	33	2,299	**0.896**	0.1456
Bottom pollock	142	165	3,829	0.862	5,449	6,197	57,492	**0.792**	0.0414
Pacific cod	722	650	890	0.576	17,248	16,248	23,562	**0.606**	0.0585
Other flatfish	2	3	0	0.410	36	54	0	**0.410**	0.0460
Rockfish	24	48	270	0.802	840	780	3,098	**0.726**	0.2039
Flathead sole	222	436	976	0.712	5,303	11,495	29,746	**0.791**	0.0916
Midwtr pollock	145	350	7,938	0.873	914	3,823	44,299	**0.849**	0.0534
Rock sole	158	226	7,468	0.876	5,003	15,238	585,049	**0.863**	0.0648
Arrowtooth flounder	4	37	82	0.772	103	1,043	2,518	**0.779**	0.1357
Yellowfin sole	184	324	5,784	0.862	5,825	14,385	442,029	**0.873**	0.0786
BSA Pot									
Pacific cod	592	16	13	0.047	2,487	64	45	**0.039**	0.0296
GOA Trawl									
Bottom pollock	55	39	124	0.661	1,138	1,297	3,681	**0.702**	0.0459
Pacific cod	475	78	664	0.604	10,079	3,462	21,307	**0.629**	0.0796
Shallow water flatfish	265	378	615	0.647	6,083	10,562	20,907	**0.661**	0.0947
Rockfish	147	112	371	0.674	2,045	2,514	14,698	**0.745**	0.1100
Flathead sole	39	131	209	0.707	1,293	2,917	9,395	**0.777**	0.1634
Arrowtooth flounder	46	33	163	0.719	1,340	1,296	4,439	**0.731**	0.1251
Rex sole	15	23	233	0.832	536	780	11,124	**0.849**	0.1863
GOA Pot									
Pacific cod	440	44	19	0.125	2,222	163	86	**0.100**	0.1000

	Raw data					Extrapolated data					
Target	**Minor**	**Mod**	**Severe**	**Dead**	**DMR**	**Minor**	**Mod**	**Severe**	**Dead**	**DMR**	**SE**
BSA Longline											
Pacific cod	6,535	540	79	133	0.084	198,843	15,702	2,323	2,968	**0.083**	0.0140
Turbot	6	4	0	0	0.166	127	85	0	0	**0.167**	0.0296
GOA Longline											
Pacific cod	960	56	8	32	0.086	32,601	2,158	574	969	**0.099**	0.0318

Table 4. Summary of halibut discard mortality rates (DMRs) in the non-CDQ Bering Sea/Aleutian (BSA) groundfish fisheries during 1990-2008.

Gear/Target	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08
BSA Trawl																			
Atka mackerel	66	77	71	69	73	73	83	85	77	81	77	73	85	67	63	67	64	89	90
Bottom pollock	68	74	78	78	80	73	79	72	80	74	67	74	78	65	73	79	74	69	79
Pacific cod	68	64	69	67	64	71	70	67	66	69	69	69	69	67	70	81	77	78	61
Other Flatfish	80	75	76	69	61	68	67	71	78	63	76	81	77	79	80	65	82	--	41
Rockfish	65	67	69	69	75	68	72	71	56	81	89	85	73	84	68	79	90	87	73
Flathead sole	-	-	-	-	67	62	66	57	70	79	74	69	60	69	70	83	75	80	79
Midwtr pollock	85	82	85	85	80	79	83	87	86	87	88	89	90	89	88	90	90	90	85
Rock sole	64	79	78	76	76	73	74	77	79	81	75	77	83	82	85	84	83	83	86
Sablefish	46	66	-	26	20	-	-	-	-	90	60	-	-	-	-	-	-	-	-
Turbot	69	55	-	-	58	75	70	75	86	70	74	68	75	67	31	82	-	-	-
Arrowtooth fldr	-	-	-	-	-	-	-	-	-	-	-	-	-	67	67	90	-	-	78
Yellowfin sole	83	88	83	80	81	77	76	80	82	78	77	74	77	81	86	85	87	77	87
BSA Pot																			
Pacific cod	12	4	12	4	10	10	7	4	13	9	13	6	5	6	7	3	8	15	4
BSA Longline																			
Pacific cod	19	23	21	17	15	14	12	11	11	12	12	12	10	8	10	8	10	9	8
Rockfish	17	55	-	6	23	-	20	4	52	-	12	10	4	-	-	-	-	-	-
Sablefish	14	32	14	13	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbot	15	30	11	10	14	9	15	22	18	17	14	6	23	7	4	6	8	-	17

Table 5 Summary of halibut discard mortality rates (DMRs) in the Gulf of Alaska (GOA) groundfish fisheries during 1990-2008.

Gear/Target	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08
GOA Trawl																			
Atka mackerel	67	89	81	67	53	-	60	-	-	-	-	-	-	-	-	-	-	-	-
Bottom pollock	51	62	66	57	48	66	79	66	55	55	52	58	55	47	73	45	70	69	70
Pacific cod	60	62	66	59	53	64	70	62	64	54	57	67	59	69	63	66	56	61	63
Deep wtr flats	61	58	70	59	60	56	71	61	51	51	62	49	48	31	49	-	-	-	-
Shall wtr flats	66	71	69	65	62	70	71	71	67	81	67	62	66	80	71	77	70	71	66
Rockfish	65	75	79	75	58	71	65	63	68	74	71	61	64	65	73	66	48	77	75
Flathead sole	-	-	-	-	54	64	67	74	39	51	69	68	74	49	62	57	63	83	78
Midwtr pollock	71	82	72	63	61	51	81	70	80	86	80	89	90	34	88	62	66	87	-
Sablefish	70	60	68	59	67	58	80	61	-	68	38	66	62	-	79	-	89	52	-
Arrowtooth fldr	-	-	-	-	-	-	66	48	62	73	75	86	76	70	65	66	76	64	73
Rex sole	-	-	-	-	56	76	63	47	58	70	71	62	57	69	67	61	45	57	85
GOA Pot																			
Pacific cod	12	7	16	24	17	21	7	11	16	13	8	33	19	21	22	13	15	17	10
GOA Longline																			
Pacific cod	15	18	13	7	11	13	11	22	11	17	16	11	11	13	16	8	13	7	10
Rockfish	6	-	-	7	-	4	13	-	9	-	9	-	-	-	-	-	-	-	-
Sablefish	17	27	28	30	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6. Observer coverage and halibut viability/injury data collected from the 2008 Bering Sea/Aleutian Community Development Quota (CDQ) fisheries.

			Raw Data					Extrapolated data					
Target	**No. of Vsls**	**# of Hauls**	**Exc.**	**Poor**	**Dead**		**DMR**	**Exc.**	**Poor**	**Dead**		**DMR**	**SE**
CDQ Trawl													
Atka m.	2	146	0	2	37		0.882	0	1	235		**0.899**	0.1323
Btm pol	17	121	11	4	139		0.841	11	30	4,767		**0.895**	0.0065
Pac cod	2	17	0	0	6		0.900	0	0	48		**0.900**	---
Rockfis	4	64	0	1	13		0.875	0	20	398		**0.892**	0.0078
Pel pol	13	1,144	1	10	1,177		0.896	7	76	4,905		**0.890**	0.0171
Rocksol	4	113	19	19	782		0.876	2,102	1,457	52,195		**0.864**	0.0681
Turbot	3	21	0	1	13		0.875	0	16	251		**0.879**	0.0202
YF sole	4	293	3	26	357		0.871	61	595	14,017		**0.886**	0.0406
CDQ Pot													
Sable	3	103	4	0	2		0.333	12	0	3		**0.219**	0.6250
CDQ Longline			**Minor**	**Mod.**	**Sev.**	**Dead**	**DMR**	**Minor**	**Mod.**	**Sev.**	**Dead**	**DMR**	**SE**
P cod	17	2,437	2,484	161	47	64		53,741	4,599	865	1,753	**0.085**	0.0444

Table 7. Summary of halibut discard mortality rates (DMRs) in the Community Development Quota (CDQ) Bering Sea/Aleutian (BSA) groundfish fisheries during 1998-2008.

Gear/Target	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CDQ Trawl											
Atka mackerel	-	82	89	80	90	86	87	89	80	79	90
Bottom pollock	90	88	90	90	66	-	84	90	88	83	90
Pac cod	-	-	-	-	-	-	-	-	-	-	90
Rockfish	-	88	-	90	-	-	-	-	69	82	89
Flathead sole	-	-	83	90	-	-	-	-	-	79	-
Midwtr pollock	90	90	88	89	89	90	90	90	90	90	89
Rock sole	-	-	-	-	-	-	-	-	86	89	86
Turbot	-	-	-	-	-	-	-	-	-	-	88
Yellowfin sole	-	83	-	-	81	89	88	88	73	87	89
CDQ Pot											
Sablefish	-	-	38	46	25	22	18	56	40	24	22
CDQ Longline											
Pacific cod	10	10	13	11	9	9	9	10	10	8	9
Turbot	-	-	4	-	-	-	-	-	-	-	-

Table 8. Recommended Pacific halibut discard mortality rates (DMRs) for 2010-2012 CDQ and non-CDQ fisheries groundfish fisheries off Alaska.

I. Non-CDQ

Bering Sea/Aleutians			Gulf of Alaska		
Gear/Target	**Used in 2007-2009**	**2010-2012 Recommendation**	**Gear/Target**	**Used in 2007-2009**	**2010-2012 Recommendation**
Trawl			***Trawl***		
Atka mack	76	76	Bottom poll	59	59
Bottom poll	74	73	Pacific cod	63	62
Pacific cod	70	71	Dpwtr flats	53	48
Other Flats	74	72	Shallwtr flats	71	71
Rockfish	76	81	Rockfish	67	67
Flathead sole	70	74	Flathead sole	61	65
Midwtr poll	88	89	Midwtr poll	76	76
Rock sole	80	82	Sablefish	65	65
Sablefish	75	75	Arr. fldr	69	72
Turbot	70	67	Rex sole	63	64
Arr. fldr	75	76			
YF sole	80	81			
Pot			***Pot***		
Pacific cod	7	8	Pacific cod	16	17
Longline			***Longline***		
Pacific cod	11	10	Pacific cod	14	12
Rockfish	17	9	Rockfish	10	9
Turbot	13	11			

II. Bering Sea/Aleutian Isl. CDQ

Gear/Target	**Used in 2009**	**2010-2012 Recommendation**
Trawl		
Atka mackerel	85	85
Bottom pollock	85	85
Pacific cod	--	90
Rockfish	82	84
Flathead sole	84	84
Midwtr pollock	90	90
Rock sole	88	87
Turbot	--	88
Yellowfin sole	84	85
Pot		
Sablefish	34	32
Longline		
Pacific cod	10	10
Turbot	4	4

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