

**Halibut DMR Working Group
 Recommendations for 2020
 September 2019 Groundfish Plan Team Meeting**

Jim Armstrong, Jen Cahalan, Jennifer Ferdinand, Mike Fey,
 Mary Furuness, Jason Gasper, Ian Stewart, Lisa Thompson

Background

Halibut discard mortality rates (DMRs) are reviewed each year as part of the Council’s groundfish harvest specifications process and are used for in-season management of halibut PSC relative to limits established for GOA and BSAI groundfish fisheries. DMRs are estimated and specified for eleven groundfish fishery operational groups as defined by unique combinations of area, gear, and handling characteristics that contribute differentially to halibut mortality (Figure 1). Specified DMRs for an upcoming year are averages taken from empirically estimated annual DMRs for the two most recent complete fishing years. This reference timeframe was chosen to keep PSC accounting consistent with recent DMR levels and fishery operational practices. Frequently updating applied DMRs may also, in the presence of other contributing factors, provide incentives for modifying handling practices to improve halibut survival.

DMR Estimation

Data contributing to estimates of fishery-specific DMRs are collected by onboard observers who sample halibut PSC according to established protocols including physical examination of individual halibut just prior to the discarding event. Based on injury type and overall vitality, halibut are assigned to condition categories (e.g., minor, moderate, serious, among others) that correspond to fixed mortality probabilities derived from the literature (e.g., Clark et al. 1992, Williams 1997, and Kaimmer and Trumble 1998).

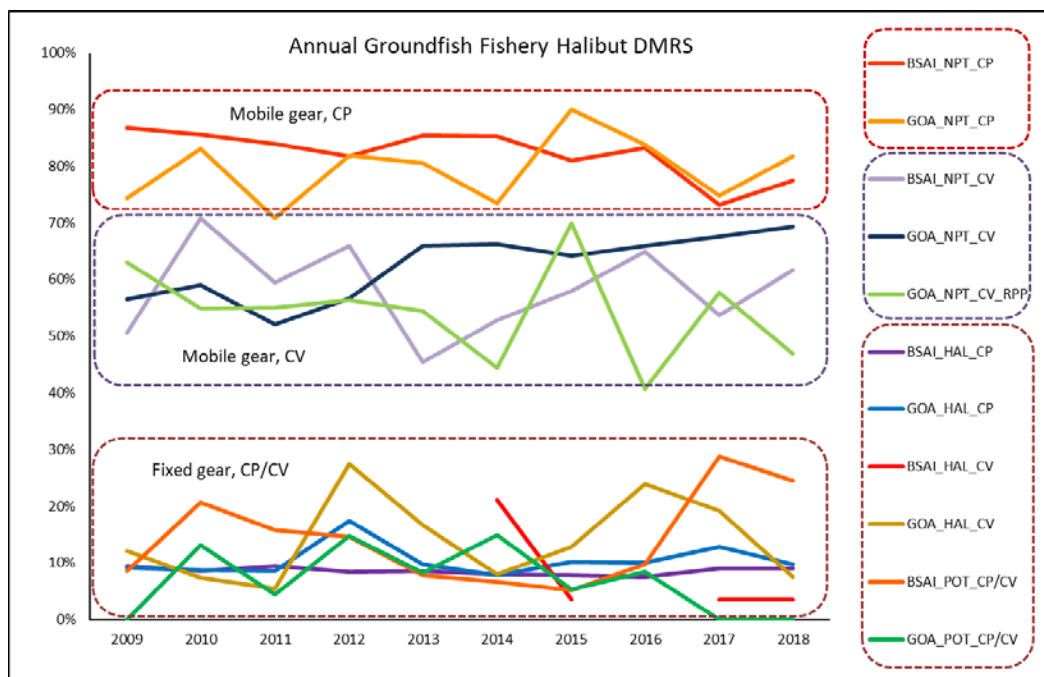


Figure 1. Annual halibut DMR estimates for fishery operational types defined for halibut PSC management in GOA and BSAI groundfish fisheries.

A detailed description of halibut DMR estimation methods was provided at the [October 2016 Groundfish Plan Team meeting](#) and has not changed. Briefly, the estimation process uses weighted averages of Halibut mortality (based on condition assessments) to expand estimated DMRs from the sample to the haul, trip, and fishery following the sampling hierarchy. At each level of the hierarchy, the total weight of halibut mortality is divided by the total weight of halibut discards to estimate the DMR for that sampling level (e.g. DMR for the trip). Note that the expansion of discard estimates is done within each sampling strata (e.g., full coverage or gear-specific partial coverage) before estimates are combined across strata to produce fishery-level DMRs.

While estimation methods have not changed, improvements have been made in better identifying fishery operation types within the observer database. For example, trips within the Rockfish Program had previously been identified based on catch characteristics but are now flagged within the data. Additionally, trips within the directed fishery are not included in these computations, since halibut PSC accounting only occurs in non-halibut fisheries. Previously all observed vessels with halibut condition assessment records were included in the estimation process.

Also not included are halibut sorted from the catch on-deck (e.g., vessels participating in the halibut deck-sorting EFP). Fishing operations and halibut handling on these vessels differ dramatically from vessels that are not deck-sorting halibut; halibut are discarded on deck before being transferred to the factory. These deck-sorted halibut have a lower post-capture mortality than halibut recovered in the factory and hence, data from these halibut are not applicable to non-deck-sorting situations. However, for halibut that are recovered in the factory, the specified DMR for the appropriate operational grouping (i.e. NPT CPs) is used in the estimation of mortality for that portion of the catch. Alternative DMR estimation methods are being use for deck-sorting operations and are not documented here. Note that deck-sorting operations that have been conducted under an EFP previously will be part of the regulated fishery in 2020.

Electronic Monitoring

With the continued expansion of the EM program, the number of vessels available for data collection by observers has decreased. Halibut condition category is determined for each assessed halibut using a dichotomous key developed by the IPHC that is based on having the halibut in-hand for inspection; an injury key for halibut caught on longline vessels and a viability key for halibut taken on trawl vessels. At this time, a visual key that could be used by EM reviewers has not been developed and hence condition data are not be available for vessels fishing in the EM program at this time. Note that research is currently being conducted by the IPHC and the Observer Program that may lead to development alternative data collections and/or DMR estimation methods (see below).

Many of the vessels participating in the EM program are also fishing under halibut IFQs, and therefore since IPHC estimates post-capture halibut mortality in the directed fishery using alternative methods, DMRs are not needed for the halibut IFQ fishery. However, for catches that are not taken under halibut IFQ fishing (halibut PSC catch), DMRs are needed in order to estimate halibut mortality and manage PSC. Halibut release method would still be recorded by EM reviewers and work will continue toward using release method to inform mortality. Table 3 is provided to indicate the number of vessels participating in the EM program relative to the total number of active vessels. The provided DMR estimates did not include any EM-based data and are, instead solely reliant on condition data collected by observers in the affected fisheries.

Research studies related to Halibut DMRs

The International Pacific Halibut Commission (IPHC) and FMA are conducting research studies related to the estimation of DMRs and halibut post-capture mortality.

1. Survivability assessment of discarded Pacific halibut in excellent condition (IPHC).

Survival of discarded Pacific halibut was inferred with the use of survivorship pop-up archival transmitting tags (sPAT) tags. In an experimental test fishing experiment conducted by IPHC on a longline chartered research vessel, 79 Pacific halibut that were captured in excellent condition were tagged with sPATs and released. Only 3 out of 79 sPATs did not generate data due to attachment or transmission failures. Of the 76 tags that successfully transmitted data, 71 tags were retained on tagged fish throughout their programmed 96-day deployment period. The remaining 6 tags that successfully transmitted data were released prematurely after 43-95 days. Data from sPAT tags was analyzed for movement patterns in order to determine survivability. 71 fish were classified as alive on the basis that their tags were retained until the programmed time of satellite transmission. On the 6 prematurely released tags, 3 tags showed continuous acceleration until the final recording and these tagged fish were therefore assumed to be alive. In contrast, the 3 other prematurely released tags showed discontinuous acceleration (absent from 4-50 hours prior to tag release) and these tagged fish were therefore assumed to be dead. In summary, our estimates of mortality of Pacific halibut released in excellent condition corresponded to a 4% mortality rate.

2. Capture of hook release method by electronic monitoring (IPHC).

A three-camera electronic monitoring (EM) system was installed on a longline chartered research vessel by Archipelago Marine Research. The EM system successfully captured imagery of the hauling station, fish stripper, and work area during gear retrieval from all sets. EM footage was reviewed by analysts at the Pacific States Marine Fish Commission for Pacific halibut release method, fish condition, and skate changes. Analysis of EM data revealed an almost perfect (95%-100%) agreement between the actual release method used and that captured by EM, with careful shake, gangion cut and hook stripper being captured with an accuracy of 100%, 97% and 95%, respectively. Therefore, we can conclude that different hook release methods are almost perfectly captured by EM systems.

3. Model-based discard mortality rates based on alternatives to halibut condition data (FMA).

Research is being conducted by FMA to assess whether DMRs may be estimated from models that incorporate covariates such as time out of water, haul size, fish length, and temperature. These covariates have previously been demonstrated to predict halibut mortality and could be collected by observers while deployed in lieu of conducting the current condition assessments. Using observer data collected on trawl catcher vessels targeting Pacific cod near Unimak Island, AK in 2016-2017, an ordinal logistic model was used to predict mortality rates of individual halibut and calculate DMRs that could be compared to the original estimates. Although the dataset in this study is limited, the model-based approach shows promise. With additional data, well-trained models may provide reliable DMR estimates that can replace the need for observers to assess the condition of discarded halibut and may be applied to larger commercial fisheries.

Future directions:

- DMR estimation methods for trawl CP vessels that sort halibut from the catch on-deck? The current methods could be documented and discussed.

Recommendations:

The Workgroup recommends that the DMRs provided in Table 1 be used for in-season management of halibut PSC in 2020 and 2021 noting that, for rulemaking purposes, groundfish specifications are done annually for two-year periods. Table 2 provides updated annual DMR estimates and additional supporting information (numbers of vessels, hauls, trips, condition assessments).

The Workgroup notes that very few vessels contributed to DMR estimates for some fisheries (highlighted in Table 2) and recommends proxy values based on analogous fisheries be used for DMR specifications (see footnotes in Table 1). Specifically, the BSAI Hook and Line CV fishery would use the rate estimated for BSAI hook and line CPs. Similarly, GOA non-pelagic trawl CP vessels would use the rate estimated for BSAI non-pelagic trawl CPs. As indicated in Table 1, pelagic trawl DMRs are not estimated, but are instead specified at 100%.

Also noted is the two-year annual average DMR for the GOA Pot fishery which is 0% in the update, and at the same time that the BSAI pot DMR increased to greater than 25%. For both BSAI and GOA, there are no halibut PSC limits established for pot fisheries, and hence, these would not potentially affect those fisheries, but the Workgroup recommends investigating the causes for these diverging trends.

Finally, reductions occurred in the numbers of vessels contributing to DMR estimates in the current update relative to last year for several reasons including the increase in the number of vessels participating in the EM program, data from within the directed (IFQ) halibut fishery were not included, and as a result of changes in overall observer deployment rates.

Table 1. 2019 halibut DMRs specified for fishery operational types defined for halibut PSC management in GOA and BSAI groundfish fisheries and halibut DMR Workgroup recommendations for 2020 and 2021.

Area	Gear	Operation	2019 DMR	2020/2021 DMR
BSAI	Pot	All	19%	27%
	Hook-and-line	CP	8%	9%
	Hook-and-line	CV	4%	9% ^a
	Non-pelagic trawl	Mothership / CP	78%	75%
	Non-pelagic trawl	CV	59%	58%
GOA	Pot	All	4%	0%
	Hook-and-line	CP	11%	11%
	Hook-and-line	CV	21%	13%
	Non-pelagic trawl	Mothership / CP	79%	75% ^b
	Non-pelagic trawl	CV	67%	68%
	Non-pelagic trawl	CV-Rockfish Prog	49%	52%
All	Pelagic trawl	All	100%*	100%*

^a Based on BSAI HAL CP

^b Based on BSAI NPT CP

*Fixed, not estimated

References

- Clark, W. G., Hoag, S. H., Trumble, R. J., and Williams, G. H. 1992. Re-estimation of survival for trawl caught halibut released in different condition factors. *Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1992*: 197-206.
- Kaimmer, S. M. and R. J. Trumble. 1998. Injury, condition, and mortality of Pacific halibut bycatch following careful release by Pacific cod and sablefish longline fisheries. *Fish. Res.* 38:131-144.
- Williams, Gregg H. 1997. Pacific halibut discard mortality rates in the 1990-1995 Alaskan groundfish fisheries, with recommendations for monitoring in 1997. *Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1996*: 173-183.

Table 2. DMRs (top) and numbers of vessels, hauls, trips, and condition assessments from 2009 – 2018 observer data used for generating annual DMR estimates for groundfish operations in GOA and BSAI. Source: AKFIN Data.

AREA_GEAR_SECT	Discard Mortality Rate										Mean values: used for specs in ...		
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018	2019	2020
BSAI_POT_CP/CV	8.56%	20.72%	15.76%	14.60%	7.89%	6.69%	5.20%	9.81%	28.76%	24.47%	7%	19%	27%
BSAI_HAL_CP	9.52%	8.60%	9.46%	8.45%	8.57%	7.95%	7.77%	7.58%	8.98%	9.07%	8%	8%	9%
BSAI_HAL_CV						21.12%	3.50%		3.50%	3.50%	12%	3%	4%
BSAI_NPT_CP	86.82%	85.61%	83.99%	81.75%	85.51%	85.26%	81.07%	83.23%	73.14%	77.50%	83%	78%	75%
BSAI_NPT_CV	50.60%	70.81%	59.49%	65.97%	45.49%	52.90%	57.94%	64.92%	53.67%	61.65%	59%	59%	58%
GOA_POT_CP/CV	0.00%	13.15%	4.48%	14.69%	8.31%	14.94%	5.38%	8.35%	0.00%	0.00%	10%	4%	0%
GOA_HAL_CP	9.22%	8.76%	8.55%	17.38%	9.76%	7.88%	10.22%	9.99%	12.88%	9.73%	9%	11%	11%
GOA_HAL_CV	12.14%	7.40%	5.47%	27.45%	16.65%	7.99%	12.85%	23.90%	19.25%	7.57%	15%	22%	13%
GOA_NPT_CP	74.41%	83.10%	70.82%	81.84%	80.55%	73.54%	90.00%	83.78%	74.81%	81.68%	82%	79%	78%
GOA_NPT_CV	56.46%	58.98%	52.03%	56.59%	65.96%	66.31%	64.26%	65.90%	67.52%	69.31%	65%	67%	68%
GOA_NPT_CV_RPP	62.98%	54.87%	55.11%	56.40%	54.40%	44.36%	69.89%	40.72%	57.67%	46.92%	52%	49%	52%

AREA_GEAR_SECT	Vessels										Means		
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2014-2016	2016-2017	2017-2018
BSAI_POT_CP/CV	16	25	32	26	21	20	24	24	14	22	23	19	18
BSAI_HAL_CP	35	33	27	30	30	28	29	29	27	23	29	28	25
BSAI_HAL_CV						1	1		1	2	1	1	2
BSAI_NPT_CP	21	21	22	16	19	20	10	14	11	4	15	13	8
BSAI_NPT_CV	27	28	25	35	24	22	34	43	46	33	33	45	40
GOA_POT_CP/CV	9	11	16	15	26	17	32	37	20	9	29	29	15
GOA_HAL_CP	17	13	8	5	8	9	8	9	10	4	9	10	7
GOA_HAL_CV	3	2	1	2	11	10	20	22	18	18	17	20	18
GOA_NPT_CP	9	4	8	5	6	2	1	7	5	1	3	6	3
GOA_NPT_CV	32	31	29	36	27	21	19	36	28	25	25	32	27
GOA_NPT_CV_RPP	11	14	14	15	16	12	10	16	17	14	13	17	16

Table 2 (cont'd). DMRs (top) and numbers of vessels, hauls, trips, and condition assessments from 2009 – 2018 observer data used for generating annual DMR estimates for groundfish operations in GOA and BSAI. Source: AKFIN Data.

AREA_GEAR_SECT	Hauls										Means		
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2014-2016	2016-2017	2017-2018
BSAI_POT_CP/CV	129	236	348	428	259	264	310	245	191	101	273	218	146
BSAI_HAL_CP	1702	1805	2178	2555	3352	2962	2870	2247	1940	1065	2693	2094	1503
BSAI_HAL_CV						5	1		1	17	3	1	9
BSAI_NPT_CP	1680	1717	801	600	892	535	186	881	517	47	534	699	282
BSAI_NPT_CV	200	411	514	430	459	581	446	652	567	364	560	610	466
GOA_POT_CP/CV	42	40	200	228	163	68	210	158	50	20	145	104	35
GOA_HAL_CP	216	232	328	75	121	321	431	203	258	32	318	231	145
GOA_HAL_CV	22	27	9	42	165	135	116	85	104	74	112	95	89
GOA_NPT_CP	216	170	201	78	167	73	1	76	424	98	50	250	261
GOA_NPT_CV	327	410	247	443	111	99	66	239	144	105	135	192	125
GOA_NPT_CV_RPP	47	54	33	63	50	23	30	108	99	57	54	104	78

AREA_GEAR_SECT	Trips										Means		
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2014-2016	2016-2017	2017-2018
BSAI_POT_CP/CV	47	62	87	78	45	52	78	66	33	34	65	50	34
BSAI_HAL_CP	132	131	160	184	249	212	261	241	222	138	238	232	180
BSAI_HAL_CV						2	1		1	4	2	1	3
BSAI_NPT_CP	133	134	108	67	93	66	22	96	61	8	61	79	35
BSAI_NPT_CV	63	89	117	127	129	169	146	162	152	110	159	157	131
GOA_POT_CP/CV	13	23	51	67	56	31	82	62	25	11	58	44	18
GOA_HAL_CP	21	22	22	18	14	21	29	19	25	6	23	22	16
GOA_HAL_CV	5	7	2	6	33	36	30	27	25	20	31	26	23
GOA_NPT_CP	22	14	18	8	18	12	1	13	38	17	9	26	28
GOA_NPT_CV	97	106	76	138	48	35	33	94	59	46	54	77	53
GOA_NPT_CV_RPP	23	33	19	33	28	16	17	46	47	23	26	47	35

Table 2 (cont'd). DMRs (top) and numbers of vessels, hauls, trips, and condition assessments from 2009 – 2018 observer data used for generating annual DMR estimates for groundfish operations in GOA and BSAI. Source: AKFIN Data.

AREA_GEAR_SECT	Condition Assessments										Means		
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2014-2016	2016-2017	2017-2018
BSAI_POT_CP/CV	231	616	1259	1502	491	498	723	424	335	197	548	380	266
BSAI_HAL_CP	8635	8503	11171	13757	16784	11048	10182	7146	6365	3615	9459	6756	4990
BSAI_HAL_CV						21	6		2	83	14	2	43
BSAI_NPT_CP	8967	7375	2363	1410	2868	1928	463	3685	2003	197	2025	2844	1100
BSAI_NPT_CV	765	2151	2972	2228	2090	2780	1977	2611	2860	1846	2456	2736	2353
GOA_POT_CP/CV	78	179	1067	1070	363	179	895	732	168	69	602	450	119
GOA_HAL_CP	1356	1606	2227	343	740	1546	1785	1493	1781	239	1608	1637	1010
GOA_HAL_CV	90	180	18	127	801	446	531	391	440	284	456	416	362
GOA_NPT_CP	1170	569	903	591	424	164	1	232	2367	680	132	1300	1524
GOA_NPT_CV	1628	2256	1558	2726	533	487	346	1433	778	641	755	1106	710
GOA_NPT_CV_RPP	155	113	106	156	124	58	94	375	400	246	176	388	323

Table 3. Total number of vessels associated with operational groupings (top) and number of vessels in the electronic monitoring (EM) pool. Source: AKFIN Data

All Vessels				
Fishery	2015	2016	2017	2018
BSAI_HAL_CP	31	32	29	26
BSAI_HAL_CV	17	14	14	13
BSAI_POT_CP/CV	51	59	69	82
GOA_HAL_CP	12	12	11	7
GOA_HAL_CV	336	327	293	283
GOA_POT_CP/CV	116	119	129	79

EM Catcher Vessels				
Fishery	2015	2016	2017	2018
HAL	16	33	61	91
POT			25	