

2.6 Incidental catch and mortality of Pacific halibut, 1990-2016

Claude L Dykstra

Abstract

Estimates of the bycatch mortality of Pacific halibut (*Hippoglossus stenolepis*) in 2016 totaled 7.1 million pounds (3,218 t) net weight, representing a decrease of 5% from 2015. Bycatch increased in some areas and decreased in others from 2015 values. In Area 2A, bycatch mortality rose 4%, although it continued to be low, mainly as a result of an individual quota program in the groundfish trawl fishery. Estimated bycatch in the Area 2B bottom trawl fishery in 2016 decreased by 21%. Bycatch trends were varied among Alaskan areas, with the largest changes being increases in Areas 3A (11%) and 3B (49%) resulting in several groundfish closures, a 12% decline in Area 4CDE (the area with the largest bycatch levels), and more modest increases or decreases in the other areas.

Introduction

Fisheries targeting on other fish and shellfish inadvertently catch Pacific halibut (*Hippoglossus stenolepis*). Information collected by at-sea observers has indicated the incidental catch, or bycatch, is substantial. United States (U.S.) and Canadian domestic regulations require that Pacific halibut be returned to the sea with no additional injury. Regardless, some fish die from being caught and handled. This document provides an overview of the estimated Pacific halibut bycatch mortality in 2016 by International Pacific Halibut Commission (IPHC) regulatory area.

Bycatch Limits

Groundfish fisheries off Washington, Oregon, and California are managed by the National Marine Fisheries Service (NMFS), following advice and recommendations developed by the Pacific Fishery Management Council (PFMC). Pacific halibut bycatch in trawl fisheries in this area are capped at 100,000 pounds (45 t) (net weight) of O32 Pacific halibut (PFMC 2016).

In Canada, Pacific halibut bycatch in trawl fisheries are capped at 453.59 t round weight (0.75 million pounds¹ net weight) by the Fisheries and Oceans Canada (DFO). Non-trawl bycatch is handled under an IFQ system within the directed Pacific halibut fishery cap.

Groundfish fisheries in Alaska are managed by the NMFS, following advice and recommendations developed by the North Pacific Fishery Management Council (NPFMC). The NPFMC sets limits on the amount of Pacific halibut bycatch mortality which is allowed to occur annually in the groundfish fisheries, known as the Prohibited Species Catch (PSC) limits. These PSC limits are published in metric tonnes (t) (round weight) and are shown in [Table 1a](#), with their equivalent net weight (mlb) in [Table 1b](#). If a fishery's PSC limit is reached, the fishery is closed. Certain gear types, e.g., pots or jigs, are exempted from closures due to their low bycatch properties and to encourage their use.

¹Throughout this report, weights in net pounds (head off, eviscerated) will be provided in brackets which are equivalent to the metric tonnes round weight (head on, not eviscerated) as issued by DFO or NMFS.

2016 Pacific halibut bycatch limits and fishery closures

The NPFMC adopts Pacific halibut bycatch mortality limits for the Alaskan groundfish fisheries during its annual specification process in the fall of the preceding year. Currently, the limits are set by management area: the Gulf of Alaska (GOA) ([Fig. 1](#)) and Bering Sea and Aleutian Islands (BSAI) ([Fig. 2](#)). The limits are fixed in regulation and can only be changed through a formal amendment, which can take up to a year. For both regions, regulations allow the NPFMC to apportion the trawl and fixed-gear limits into seasonal amounts and by fishery, to enable the groundfish fisheries to maximize their groundfish catch within the specified limits. A history of the Pacific halibut bycatch limits for both regions is in [Table 1](#).

Gulf of Alaska

The final year of a phased three-year reduction in GOA bycatch limits occurred in 2016. The reduction for the trawl sector was implemented through a 7% reduction in 2014, an additional 5% in 2015 (to 12%), and finally 3% for 2016, thereby totaling 15% across three years. The reductions resulted in new trawl fishery limits of 1,848 t in 2014, 1,759 t in 2015, and 1,706 t in 2016 and beyond for all trawl vessels. For the hook-and-line fleet, the reduction varied by vessel type. The bycatch limit for the hook-and-line catcher/processor (CP) fleet was reduced 7%, which was implemented as one step in 2014. The hook-and-line catcher vessel (CV) bycatch limit was reduced by 15%, on the same 3-year reduction schedule as the trawl sector. The trawl limit was divided by season for shallow water and deep water fisheries, as has been the practice since 1991.

Bycatch management in the GOA fixed-gear fisheries in 2016 was similar to previous years in that limits were assigned to specific fisheries. The bycatch limit was set at 266 t (0.44 million pounds; [Table 2](#)) for all fixed-gear fisheries, a slight reduction from 2015. The fixed-gear fisheries target primarily Pacific cod (*Gadus macrocephalus*) in the central and western GOA during the winter and rockfish in the eastern GOA in the spring. The fixed-gear limit is divided between the CV and CP sectors; the sector limits are further divided seasonally. All pot and jig gear fisheries, as well as the sablefish (*Anoplopoma fimbria*) Individual Fishing Quota (IFQ) fishery, are exempted from the bycatch limits.

Several programs exist in the GOA for which the NPFMC has allocated specific Pacific halibut bycatch limits from the overall limit. The Central GOA Rockfish Program (CGOARP) isolates fishing for certain rockfish species from other fisheries within the fishery management system. Fishery cooperatives (“co-ops”) are formed under the program, and a portion of the overall rockfish quotas and Pacific halibut bycatch limit are specified for the program.

Another program for Pacific halibut bycatch management in the GOA applies to vessels that participate in the fishery co-ops in the BSAI. Briefly, the BSAI Plan Amendment 80 (A80) permits vessels to form fishery co-ops, which allows for a more efficient prosecution of their fisheries. Although A80 does not require vessels to join a co-op, in 2016 all eligible A80 vessels belonged to one of two co-ops.

The final apportionment of Pacific halibut bycatch in the GOA is a result of the 1998 American Fisheries Act (AFA). The AFA specified that certain trawl CP vessels fishing for pollock in the BSAI were prohibited from fishing for certain other groundfish species in the GOA. The AFA also specified limits on the amounts of other non-pollock groundfish species those vessels were allowed to catch; these limits are also termed sideboards. For full details of sector PSC caps see NMFS (2016a).

Bering Sea/Aleutian Islands

The Pacific halibut bycatch mortality limits for the 2016 BSAI trawl and fixed-gear fisheries totaled 3,515 t (5.8 million pounds net; [Table 1](#)), a drop of 23.2% from the previous caps which had been in place since 1999.

The BSAI fixed-gear fisheries were allocated a total bycatch limit of 710 t (1.17 million pounds; [Table 1](#)), with 7.5% (53 t; 0.09 million pounds) reassigned to Community Development Quota (CDQ) fisheries, leaving 657 t (1.09 million pounds). This was divided between the hook-and-line fishery for Pacific cod and all other fixed-gear fisheries. The Pacific cod fishery bycatch limit was further divided between CPs and CVs. All pot and jig fisheries were exempted from Pacific halibut mortality closures. The sablefish IFQ hook-and-line fishery was also exempted from the bycatch limit.

The 2016 trawl fishery bycatch mortality limit was 2,805 t (4.64 million pounds; [Table 1](#)). By regulation, a fixed amount of 315 t (0.52 million pounds) is reallocated to CDQ fisheries (gear-nonspecific), leaving 2,490 t (4.12 million pounds) for all remaining trawl fisheries. A80 separated the trawl fleet into an A80 sector and a Limited Access sector. The latter group includes the pollock co-ops created by the AFA. Within the A80 fleet, the bycatch limit was assigned to the Alaska Seafood Cooperative and the Alaska Groundfish Cooperative.

In addition, the NPFMC created bycatch limit sideboards for the AFA vessels which apply to these vessels when they fish in non-AFA fisheries, i.e., any target species other than pollock.

The CDQ program operated throughout the year and a fixed amount of the trawl bycatch limit (315 t; 0.52 million pounds) and 7.5% of the hook-and-line bycatch limit (53 t; 0.09 million pounds) were allocated to the CDQ program, which was then subdivided among six participating CDQ groups in proportion to their groundfish allocations.

Discard mortality rates and assumptions

Discard mortality rates (DMRs), used to determine the fraction of the estimated bycatch that dies, vary by fishery and area. Where observers are used for fishery monitoring, DMRs are calculated from data collected on the release viability or injury of Pacific halibut. For areas without observers, assumed DMRs are used, which are based on the similarity of fisheries to those in other areas where data are available. The mortality models used to calculate these rates have been presented by Clark et al. (1993) and Williams (1997).

Observer data are used to calculate DMRs in fisheries in three major areas. In Areas 2A and 2B, observers deployed on the bottom trawl vessels examine each Pacific halibut to determine release viability. The bycatch mortality reported to IPHC incorporates these release viability observations. For the U.S. west coast, NMFS uses a DMR of 16% for the sablefish hook-and-line fishery, based on an analysis of observer data from the sablefish fishery off Alaska prior to the implementation of individual fishing quotas (IFQ) in 1995. The DMR for pot fisheries is assumed to be 18%. Bycatch mortality in the CP midwater fishery for Pacific hake is based on a 100% DMR.

NMFS manages the groundfish fisheries off Alaska according to a schedule of DMRs developed during the NPFMC annual specification process (based on recent years' realized fishery specific DMRs obtained from observer data). The Pacific halibut DMR schedule being used for in-season management of 2016-2017 Alaskan fisheries is shown in [Table 2](#).

Sources of information

IPHC relies upon information supplied by observer programs run by domestic agencies for bycatch estimates in most fisheries. Non-IPHC research survey information is used to generate estimates of bycatch in the few cases where fishery observations are unavailable. The NMFS operates observer programs off the U.S. West Coast and Alaska, which monitor the major groundfish fisheries. Data collected by those programs are used to estimate bycatch. Trawl fisheries off British Columbia (BC) are comprehensively monitored and bycatch information is provided to IPHC by DFO.

Off the U.S. West Coast, an individual quota (IQ) program was implemented in 2011 for the domestic groundfish trawl fisheries. The program is quite similar to the program for the BC trawl fishery, in that it contains an individual bycatch quota component for managing and reducing Pacific halibut bycatch mortality. Fishery monitoring is required at 100% coverage levels, so all vessels carry an observer to record the vessel's catch. Bycatch is reported to IPHC by NMFS (Jannot et al. 2016). Bycatch estimates for the shrimp trawl fishery have been provided by Oregon Department of Fish and Wildlife (ODFW) staff from examinations of Pacific halibut bycatch during gear experiments. Updated estimates were provided by ODFW in 2011.

The amount of information varies for fisheries conducted off BC. For the trawl fishery, bycatch is managed with an individual bycatch quota program implemented by DFO in 1996. Fishery observers sample the catch on each bottom trawler, collecting data to estimate bycatch and discard mortality. Bycatch in other fisheries, such as the shrimp trawl, sablefish pot, and rockfish hook-and-line fisheries, was largely unknown until the inception of the Integrated Fisheries Management Program in 2006. The program has requirements for full accounting and accountability of all bycatch, and includes 100% at-sea monitoring, either by human observers or electronic monitoring. Estimates of trawl bycatch were provided by DFO staff at the Pacific Biological Station, based on data collected by observers (M. Surry, DFO/PBS, 3190 Hammond Bay Road, Nanaimo, B.C. V9T 6N7, personal communication). Reporting of bycatch from the non-trawl programs is being developed with DFO staff and will be provided in future reports.

Estimates of bycatch off Alaska for 2016 in federally managed fisheries were provided by the NMFS Alaska Region. Several fishery programs have a mandatory 100% monitoring requirement, including the CGOARP, the BSAI CDQ fisheries, the AFA pollock cooperatives, and the BSAI A80 fishery cooperatives. An annual deployment plan (ADP) provides the scientific guidelines which determine how vessels not involved in these full coverage programs are chosen for monitoring, including vessels in the directed Pacific halibut IFQ fishery. Additional details about the ADP can be found in NMFS (2015). Provided estimates were based on data gathered by fishery observers and represented bycatch through 1 November 2016, with a projection for the remainder of 2016 (J. Keaton and J. Gasper, NMFS Alaska Fishery Science Center, 17109 Lena Point Loop Road, Juneau, AK 99801, personal communication, 11/1/2016). The NMFS projections were provided in metric tonnes, round weight, and were converted to pounds net weight using $\text{net weight} = \text{round weight} \times 0.75 \times 2,204.62$ (Table 3). We were notified on 21 November 2016 that the estimated bycatch failed to include Pacific halibut taken by exempted fishery permits (EFP) in 2016.

Estimates of Pacific halibut bycatch in scallop dredge and crab fisheries are obtained from the Alaska Department of Fish and Game (ADF&G), but not on an annual basis. The catch estimates are based on fishery data collected by on-board observers. The most recent estimates were summarized by Williams (2016) and current year estimates were simply rolled forward for 2016. Work is underway to develop an annual approach to updating these data.

Bycatch mortality by regulatory area

Pacific halibut bycatch mortality was relatively low until the 1960s, when it increased rapidly due to the rapid development of the foreign trawl fisheries off the North American coast. Total estimated bycatch mortality (excluding the Japanese directed fishery in the eastern and western Bering Sea) peaked in 1965 at about 21 mlb (9,526 t) ([Fig. 3](#)). Bycatch mortality declined during the late 1960s, but increased to about 20 mlb (9,072 t) in the early 1970s. During the late 1970s and early 1980s, it dropped to roughly 13 mlb (5,897 t), as foreign fishing off Alaska came under increasing control and restrictions. By 1985, bycatch mortality had declined to 7.2 mlb (3,266 t), the lowest level since the IPHC began its monitoring nearly 25 years earlier. Bycatch mortality increased in the late 1980s due to the growth and development of the U.S. groundfish fishery off Alaska, which had few bycatch restrictions, peaking at 20.3 mlb (9,208 t) in 1992. Estimated bycatch mortality has since declined. Preliminary estimates for 2016 total 7.1 mlb (3,221 t), representing a 5.2% decrease from 2015, estimated to be the lowest amount since 1960.

Detailed estimates of bycatch mortality by fishery and major IPHC regulatory area for 2007 through 2016 are shown in [Table 3](#) and discussed in the following sections. [Table 4](#) provides bycatch mortality estimates by IPHC regulatory area, beginning in 1990.

Area 2A – U.S. West Coast

Estimates for 2016 were not available (but are under development), so the 2015 estimates were used as the area's preliminary estimate for 2016, and will be updated when final estimates become available. As the fishery continues to adapt to IQ management and reporting becomes timelier, it is expected that year-end projections will be available, as in other areas. The final estimate of bycatch mortality in Area 2A for 2015 was 0.098 mlb (44.5 t) ([Fig. 4](#); [Table 3](#)), almost identical to the 2011-14 average for this fishery. As in prior years, the bottom trawl fishery and hook-and-line fishery for sablefish were responsible for the bulk of the bycatch. Bycatch in the area remains substantially below (<80%) levels seen in the pre-IFQ fishery period.

Additionally, as noted in previous reports, bycatch in shrimp trawls has been revised to zero (Williams 2012). Fish excluders have been required in shrimp trawls since 2003 (R. Hannah, ODFW, 2040 S.E. Marine Science Drive, Newport OR, 97365, personal communication). An excluder directs fish out of the net, so fish bycatch is believed to be essentially nonexistent.

Area 2B – British Columbia

Bycatch mortality in the 2016 BC bottom trawl fishery was estimated at 0.26 mlb (118 t), which is a 21% decrease from 2015 ([Table 3](#)). Similar to 2015, the amount of Pacific halibut bycatch was relatively constant throughout the first nine months of 2016 ([Fig. 5](#)). In prior years (2008-2013), bycatch was lowest in the winter (October-March) periods.

Monthly estimates of mortality were supplied for 2015 (final estimates) and 2016, with the 2016 data complete through September. Projections for the full calendar year 2016 were made by extrapolating to the full 12 months based on the mean proportion of bycatch (0.915) taken through the same time period, e.g., January-September, during 2011-2015.

Areas 2C, 3, and 4– Alaska

Note on 2016 bycatch estimates for Alaskan areas: projections were made for the full year based on fishery data collected through 1 November 2016. The following sections are based on these projections and include anticipated additional fishing in specific fisheries in each area.

Area 2C – Southeast Alaska

For the federal waters of Area 2C in 2016, only bycatch by hook-and-line vessels fishing in the outside waters has been reported by NMFS. These vessels are primarily targeting Pacific cod and rockfish (*Sebastes* spp.) in open access fisheries, and sablefish in the IFQ fishery. In the aggregate, these fisheries resulted in approximately 0.03 million pounds (13.6 t) of bycatch mortality in 2016 ([Fig 6](#)).

Fisheries occurring within state waters that take Pacific halibut as bycatch in this area include pot fisheries for red (*Paralithodes camtschatica*) and golden (*Lithodes aequispinus*) king crab, and tanner crab (*Chionoecetes bairdi*). Information is provided periodically by ADF&G (last examined in Williams (2016)), and the 2015 estimate was rolled forward to 2016.

Area 3 – Eastern, Central and Western Gulf of Alaska

Area 3 is comprised of Areas 3A and 3B. IPHC tracks bycatch for each regulatory area due to assessment and stock management needs, while groundfish fisheries operate throughout both areas. Trawl fisheries are responsible for the majority of the bycatch in these areas, with hook-and-line fisheries a distant second. State-managed crab and scallop fisheries are also known to take Pacific halibut as bycatch, but at low levels (Williams, 2016). Bycatch trends for 3A and 3B were on a decline from 2003-2013, with an uptick in recent years ([Fig. 7](#)).

Bycatch mortality estimates in Area 3A decreased slightly in 2016, to 2.04 mlb (925 t) from 2.10 mlb (953 t) in 2015 ([Table 3](#)). In contrast, bycatch mortality estimates in Area 3B increased 48% from 2015, to 0.98 mlb (445 t) in 2016. This was primarily due to large increases in trawl fishery bycatch (0.8 mlb (363 t), up 47%), the non-IFQ hook and line fishery bycatch (0.15 mlb (68 t), up 57%), and the groundfish pot fishery bycatch (0.28 mlb (127 t), up 183%). Four deep water PSC limit closures were triggered during 2016.

For the Areas 3A and 3B combined, trawl fishery bycatch accounted for 84% of the total bycatch ([Fig. 8](#)), similar to 2015. Roughly 69% of this mortality was taken in Area 3A.

Area 3 remains the area where bycatch mortality is estimated most poorly. Observer coverage for most fisheries is relatively low, with 2016 observer target deployment rates of 28% for trawl fisheries, 15% for hook and line, and 15% for pot fisheries (NMFS, 2015), and with financial constraints pointing to lower target rates expected in 2017 (NMFS, 2016b). Tendering, loopholes in trip cancelling, and safety considerations likely result in observed trips not being representative of all trips (observed and unobserved) in many regards (e.g. duration, species composition, etc. (NMFS, 2016c). This, plus low coverage, lead to increased uncertainty in these bycatch estimates and to potential for bias.

Area 4 – Bering Sea and Aleutian Islands

Bycatch mortality for all regulatory areas within Area 4 was estimated at 3.7 mlb (1,678 t), a decrease of 0.6 mlb (272 t) (14.0%) from 2015 ([Table 3](#); [Fig. 9](#)). Since 2000, bycatch mortality estimates in this area have been as high as 7.7 mlb (3,493 t) (2005), and the estimate for 2016 is the lowest during this time period. The estimate was below the 2007-2015 average of 5.7 mlb (2,586 t). Decreases occurred in trawl (0.5 mlb (227 t), 13.6%), hook-and-line (0.09 mlb (41 t), 16.8%), and pot fisheries (<0.03 mlb (14 t), 40%).

Trawl fishery bycatch was estimated at 3.2 mlb (1,452 t), a second consecutive annual decline, now 35% less than in 2015. We were notified in late November that the 2016 value does not include the amount landed under EFPs, so the decline may not be as large as indicated.

Hook-and-line fishery bycatch in 2016 was estimated at 0.46 mlb (209 t), a 17% decrease from the 0.55 mlb (249 t) estimated for 2015. Pacific cod is the major fishery in this area with Pacific halibut bycatch, and is conducted in the late winter/early spring and late summer. Almost all of the vessels are required to have 100% observer coverage because of the vessel's size and requirements of their fishery cooperative; very few small vessels (<60') fish Pacific cod in this area. Because of this high level of observer coverage, bycatch estimates for this and other Area 4 fisheries are believed to be reliable.

Pots are used to fish for Pacific cod and sablefish and fish very selectively. Bycatch rates are quite low and survival is relatively high. Annual bycatch mortality estimates are typically low, usually less than 10,000 pounds (4.5 t), and was estimated at 5,000 pounds (2.3 t) in the pot Pacific cod and 3,000 pounds (1.4 t) in the pot sablefish fisheries for 2016.

Within the Bering Sea, bycatch mortality estimates have typically been the highest in Area 4CDE ([Fig. 10](#)). This is due to the groundfish fisheries which operate in the area, i.e., those for flatfish. In 2016, the bycatch mortality estimate in Area 4CDE accounted for 81% of the total Bering Sea bycatch, but was at its' lowest level in the past decade at 3.01mlb (1,365 t).

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Table 1. Pacific halibut bycatch limits in the Alaska groundfish fishery since 1990.

a. Metric tonnes (t), round weight					
Gulf of Alaska			Bering Sea/Aleutians Islands		
Time Period	Trawl	Fixed Gears	Time Period	Trawl	Fixed Gears
1990-1994	2,000	750	1991	5,333 ¹	None
1995-2012	2,000	300	1992	5,033 ¹	750
2013	1,973	300	1993	3,775	750
2014	1,848	279	1994-1998	3,775	900
2015	1,759	270	1999-2008	3,675	900
2016	1,706	266	2009	3,625 ²	900
			2010	3,625 ²	900
			2011	3,575 ²	900
			2012-15	3,525 ²	900
			2016	2,805	710

¹ Limit is in terms of catch for 1991 and 1992, and mortality in subsequent years.

² Values shown indicate the actual amount allocated by NMFS; overall limit specified in regulations was 3,675 t.

b. Millions of pounds, net weight					
Gulf of Alaska			Bering Sea/Aleutians Islands		
Time Period	Trawl	Fixed Gears	Time Period	Trawl	Fixed Gears
1990-1994	3.30	1.20	1991	8.80 ^a	none
1995-2012	3.30	0.50	1992	6.60 ^a	1.20
2013	3.26	0.50	1993	6.26	1.20
2014	3.06	0.46	1994-1998	6.26	1.50
2015	2.91	0.45	1999-2008	6.10	1.50
2016	2.82	0.44	2009	6.00	1.50
			2010	6.00	1.50
			2011	5.90	1.50
			2012-15	5.80	1.50
			2016	4.64	1.17

^a Limit is in terms of catch for 1991 and 1992, and mortality in subsequent years.

Table 2. Preseason assumed discard mortality rates (percent) used by NMFS for monitoring Pacific halibut bycatch mortality for 2016-2017 in the Alaskan groundfish fisheries.**a. Non-CDQ Fisheries**

Bering Sea/Aleutians		Gulf of Alaska	
Gear/Target	In use 2016-2017	Gear/Target	In use 2016-2017
<i>Trawl</i>		<i>Trawl</i>	
Atka mack	82	Bottom poll	58
Bottom poll	81	Pacific cod	62
Pacific cod	66	Dpwtr flats	62
Other Flats	63	Shallwtr flats	66
Rockfish	83	Rockfish	65
Flathead sole	72	Flathead sole	67
Midwtr poll	88	Midwtr poll	65
Rock sole	86	Sablefish	59
Sablefish	66	Arr. flndr	76
Turbot	82	Rex sole	72
Arr. flndr	84		
YF sole	84		
<i>Pot</i>		<i>Pot</i>	
Pacific cod	9	Pacific cod	15
<i>Longline</i>		<i>Longline</i>	
Pacific cod	9	Pacific cod	10
Rockfish	9	Rockfish	10
Turbot	11		

b. Bering Sea/Aleutian Islands Community Development Quota Fisheries

Gear/Target	In Use 2016-2017
<i>Trawl</i>	
Atka mackerel	82
Bottom pollock	86
Pacific cod	87
Rockfish	70
Flathead sole	79
Midwtr pollock	90
Rock sole	86
Turbot	89
Yellowfin sole	85
<i>Pot</i>	
Pacific cod	1
Sablefish	41
<i>Longline</i>	
Pacific cod	10
Turbot	10

Table 3. Estimates (thousands of pounds, net weight) of bycatch mortality of Pacific halibut by year, regulatory area, and fishery, for 2007 through 2016. Estimates for 2016 are preliminary and subject to change as new information becomes available.¹

IPHC Reg Area and Gear	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA 2A										
Groundfish Trawl	347	351	416	302						
IFQ Bottom Trawl					52	60	53	43	55	55
Other Groundfish Trawl					1	1	2	1	1	1
Groundfish Pot					1	1	0	0	1	1
Hook & Line	40	81	98	46	52	59	9	49	41	41
Shrimp Trawl	0	0	0	0	0	0	0	0	0	0
Total	388	432	513	347	107	120	65	94	98	98
AREA 2B										
Groundfish Bottom Trawl	320	143	213	181	232	189	225	245	326	258
Total	320	143	213	181	232	189	225	245	326	258
AREA 2C										
Crab Pot	23	19	7	18	10	21	13	1	1	1
Groundfish Trawl	0	0	0	0	0	0	0	0	0	0
Hook & Line (non-IFQ)	3	7	5	4	3	8	8	8	12	17
Hook & Line (IFQ)	3	3	3	3	3	12	13	9	7	13
Chatham Str. Sablefish	8	8	8	8	8	n/a	n/a	n/a	n/a	n/a
Clarence Str. Sablefish	25	25	25	25	25	n/a	n/a	n/a	n/a	n/a
Total	62	62	48	58	49	41	34	17	19	30
AREA 3A										
Scallop Dredge	6	3	9	14	12	10	12	24	24	24
Groundfish Trawl	2,347	2,381	2,141	2,030	2,232	1,422	1,336	1,680	1,792	1,741
Hook & Line (non-IFQ)	102	293	197	111	92	238	216	155	223	210
Hook & Line (IFQ)	119	119	119	119	119	25	31	16	33	25
Groundfish Pot	15	13	5	12	23	29	34	12	25	40
Pr Wm Sd Sablefish	10	10	10	10	10	n/a	n/a	n/a	n/a	n/a
Total	2,599	2,819	2,481	2,296	2,488	1,724	1,630	1,888	2,098	2,040
AREA 3B										
Crab Pot	0	0	0	0	0	0	0	0	0	0
Scallop Dredge	0	0	4	0	5	4	8	14	0	0
Groundfish Trawl	795	979	865	676	806	989	733	809	537	790
Hook & Line (non-IFQ)	136	190	256	269	172	105	88	115	96	150
Hook & Line (IFQ)	116	116	116	116	116	24	14	18	15	10
Groundfish Pot	18	18	7	36	21	20	44	18	10	28
Total	1,065	1,303	1,247	1,097	1,120	1,142	887	974	658	979

...cont'd

Table 3 (cont'd). Estimates (thousands of pounds, net weight) of bycatch mortality of Pacific halibut by year, regulatory area, and fishery, for 2007 through 2016. Estimates for 2016 are preliminary and subject to change as new information becomes available.

IPHC Reg Area and Gear	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA 4A										
Scallop Dredge	0	0	0	0	0	0	0	0	0	0
Crab Pot	2	7	5	22	14	12	27	0	0	0
Groundfish Trawl	1,418	1,021	1,315	800	789	1,314	606	615	483	423
Hook & Line (non-IFQ)	153	178	220	213	145	130	204	160	149	103
Hook & Line (IFQ)	15	15	15	15	15	5	4	3	3	2
Groundfish Pot	3	8	2	7	8	10	32	27	7	3
Total	1,591	1,229	1,557	1,058	971	1,472	873	805	642	531
AREA 4B										
Crab Pot	2	2	0	0	1	0	3	0	0	0
Groundfish Trawl	293	206	299	371	402	215	116	101	202	144
Hook & Line (non-IFQ)	139	114	119	65	32	27	6	24	20	5
Hook & Line (IFQ)	40	40	40	40	40	12	10	5	2	2
Groundfish Pot	3	2	1	1	1	1	5	2	0	0
Total	477	364	459	477	476	255	140	132	223	150
AREA 4CDE+CA										
Scallop Dredge	0	0	0	0	0	0	0	0	0	0
Crab Pot	43	54	33	63	49	29	29	0	37	37
Groundfish Trawl	4,145	3,469	3,160	3,429	2,496	3,458	4,110	4,205	3,003	2,619
Hook & Line (non-IFQ)	609	978	821	684	472	768	668	538	384	352
Hook & Line (IFQ)	5	5	5	5	5	1	151	11	0	0
Groundfish Pot	1	2	1	1	2	4	18	13	2	2
Total	4,804	4,508	4,021	4,182	3,024	4,260	4,977	4,767	3,425	3,010
AREA 4 Subtotal										
Scallop Dredge	0	0	1	0	0	0	0	0	0	0
Crab Pot	48	63	39	85	65	41	59	0	37	37
Groundfish Trawl	5,856	4,696	4,774	4,600	3,687	4,987	4,832	4,921	3,687	3,186
Hook & Line (non-IFQ)	901	1,270	1,160	962	649	925	878	722	552	460
Hook & Line (IFQ)	60	60	60	60	60	18	165	19	5	3
Groundfish Pot	7	12	4	9	11	15	55	42	8	5
Total	6,872	6,101	6,037	5,717	4,472	5,987	5,989	5,704	4,290	3,691
GRAND TOTAL	11,305	10,860	10,540	9,696	8,468	9,203	8,830	8,921	7,488	7,095

¹Note that some totals may not sum precisely due to rounding.

Table 4. Bycatch mortality estimates of Pacific halibut (thousands of pounds, net weight and metric tonnes, round weight) by IPHC regulatory area, since 1990. Estimates for 2016 are preliminary and subject to change as new information becomes available.

Year	Thousands of Pounds, net weight					Metric Tonnes, round weight									
	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area					
	2A	2B	2C	3A	3B	3C	4	TOTAL	2A	2B	2C	3A	3B	4	TOTAL
1990	408	1,679	856	4,114	2,045		8,580	17,682	247	1,015	518	2,488	1,237	5,189	10,694
1991	408	1,992	733	4,843	1,671		10,022	19,669	247	1,205	443	2,929	1,011	6,061	11,896
1992	444	1,745	736	4,668	1,982		10,718	20,293	269	1,055	445	2,823	1,199	6,482	12,273
1993	444	1,661	742	4,291	1,062		7,764	15,964	269	1,005	449	2,595	642	4,696	9,655
1994	444	1,219	528	3,907	1,387		9,466	16,951	269	737	319	2,363	839	5,725	10,252
1995	614	1,522	348	2,963	1,760		8,726	15,933	371	920	210	1,792	1,064	5,277	9,636
1996	614	299	345	2,743	1,957		8,507	14,465	371	181	209	1,659	1,184	5,145	8,748
1997	614	215	397	2,965	1,443		7,880	13,514	371	130	240	1,793	873	4,766	8,173
1998	1,082	213	361	2,662	1,389		7,725	13,432	654	129	218	1,610	840	4,672	8,124
1999	987	193	358	2,885	1,737		7,684	13,844	597	117	217	1,745	1,051	4,647	8,373
2000	822	230	395	2,892	1,510		7,441	13,290	497	139	239	1,749	913	4,500	8,038
2001	837	177	341	3,009	1,675		7,120	13,159	506	107	206	1,820	1,013	4,306	7,958
2002	635	244	340	2,194	1,924		7,273	12,610	384	148	206	1,327	1,164	4,399	7,626
2003	256	244	341	3,180	1,734		6,822	12,577	155	148	206	1,923	1,049	4,126	7,606
2004	286	251	70	3,431	1,224		6,485	11,747	173	152	42	2,075	740	3,922	7,104
2005	537	346	50	2,978	1,076		7,432	12,417	325	209	30	1,801	651	4,495	7,511
2006	575	294	53	2,733	1,350		6,446	11,452	348	178	32	1,653	817	3,899	6,926
2007	388	320	62	2,599	1,065		6,872	11,304	235	194	38	1,572	644	4,156	6,837
2008	432	143	62	2,819	1,303		6,101	10,854	261	86	37	1,705	788	3,690	6,568
2009	513	213	48	2,481	1,247		6,037	10,540	310	129	29	1,500	754	3,651	6,374
2010	347	181	58	2,296	1,097		5,717	9,696	210	109	35	1,389	663	3,457	5,864
2011	107	232	49	2,488	1,120		4,472	8,468	65	140	30	1,505	677	2,705	5,121
2012	120	189	41	1,724	1,142		5,987	9,203	73	114	25	1,043	691	3,621	5,566
2013	65	225	34	1,630	887		5,989	8,830	39	136	21	986	537	3,622	5,341
2014	94	245	17	1,888	974		5,704	8,921	57	148	10	1,142	589	3,450	5,395
2015	98	326	19	2,098	658		4,290	7,488	59	197	11	1,269	398	2,594	4,529
2016	98	258	30	2,040	979		3,691	7,096	59	156	18	1,234	592	2,232	4,291

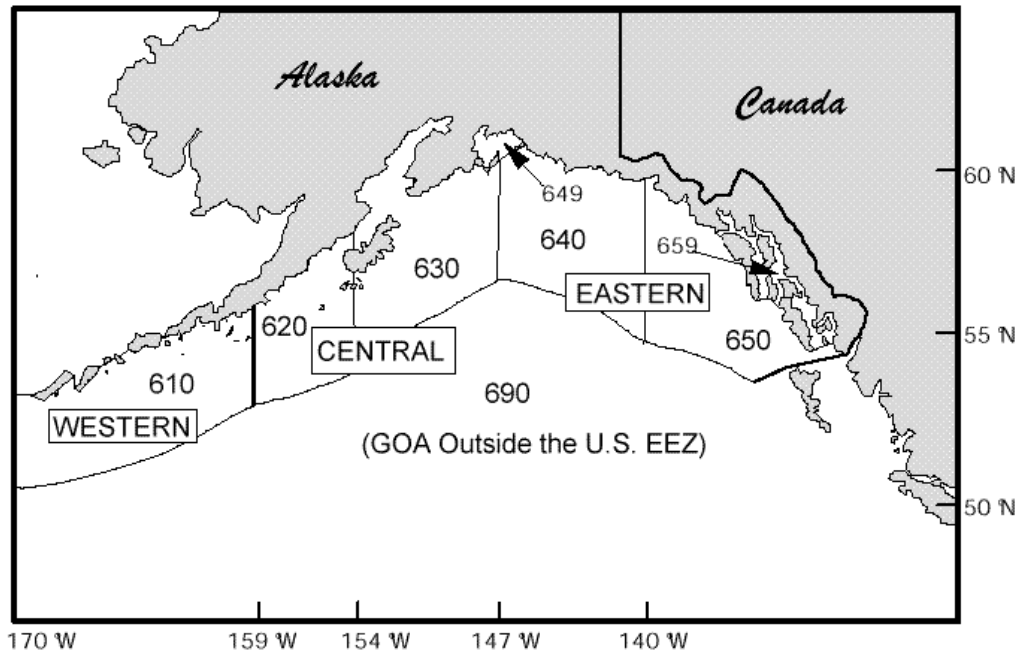


Figure 1. NMFS statistical and management areas for the Gulf of Alaska.

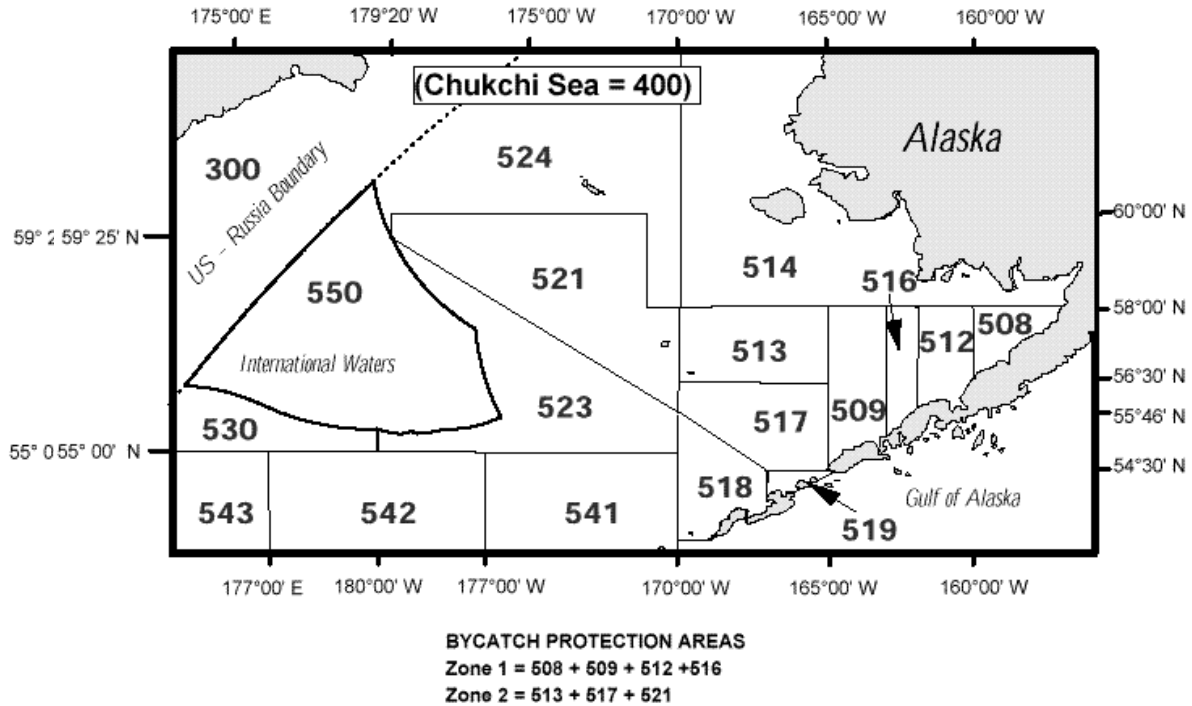


Figure 2. NMFS statistical and management areas for the Bering Sea/Aleutian Islands.

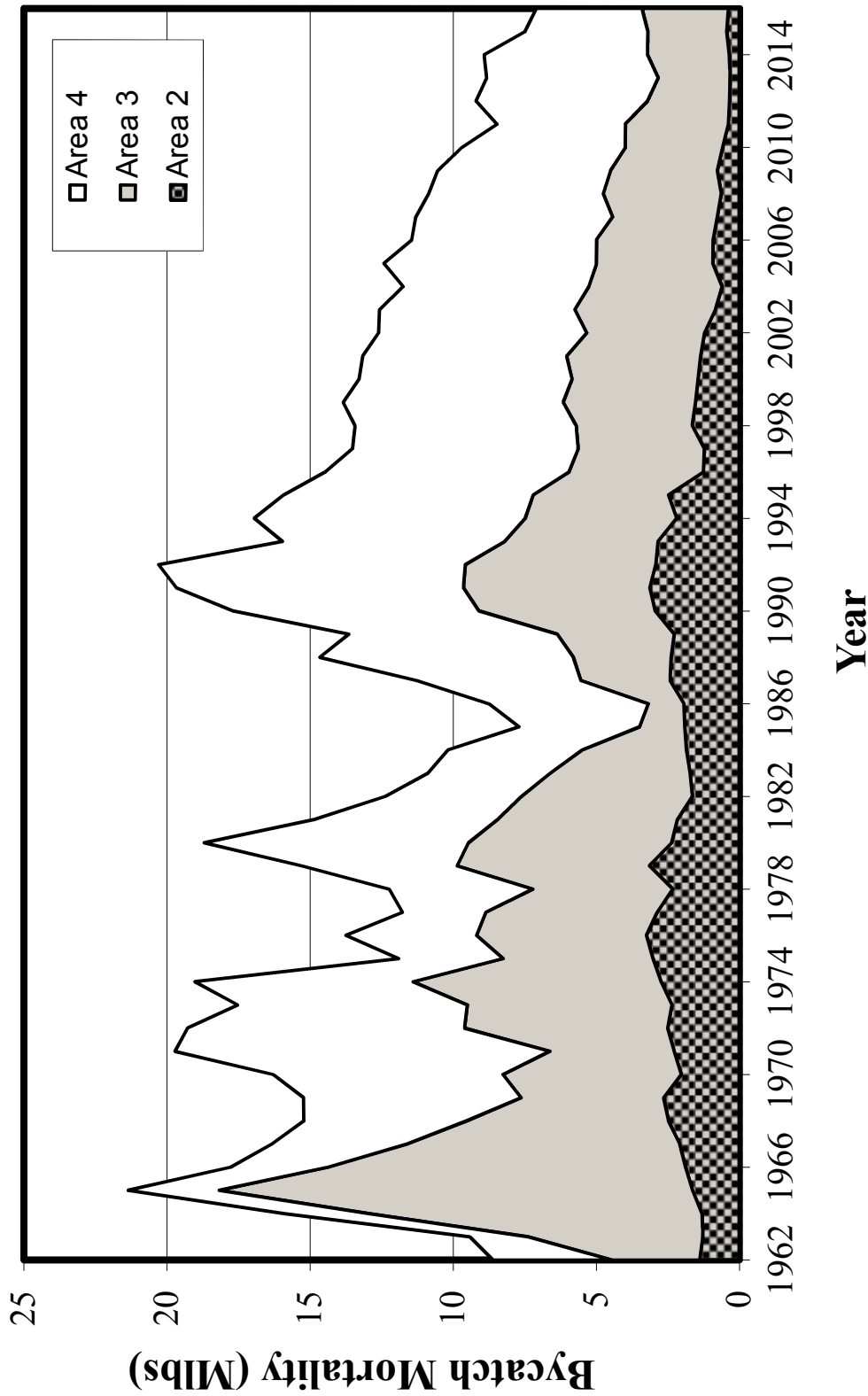


Figure 3. Bycatch mortality estimates of Pacific halibut by IPHC regulatory area (millions of pounds, net weight), 1990-2016.

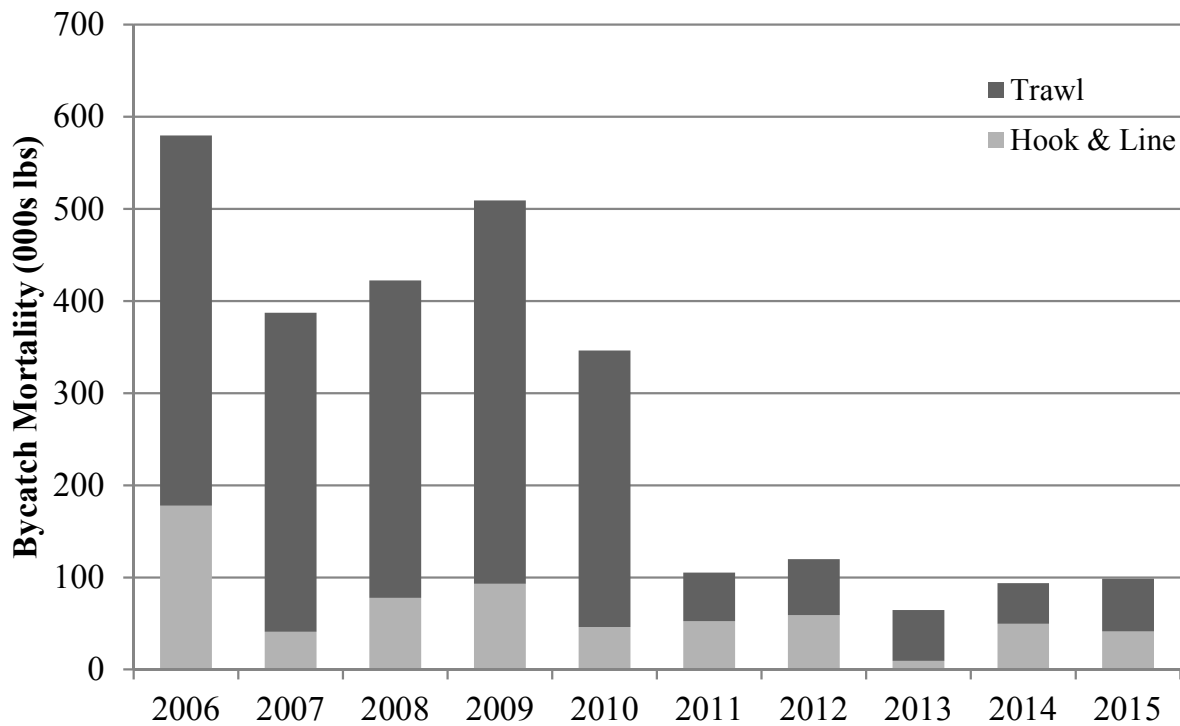


Figure 4. Pacific halibut bycatch mortality (thousands of pounds, net weight) in the trawl and hook-&-line groundfish fisheries in IPHC Area 2A during 2006-2015. Data from Jannot et al. (2016).

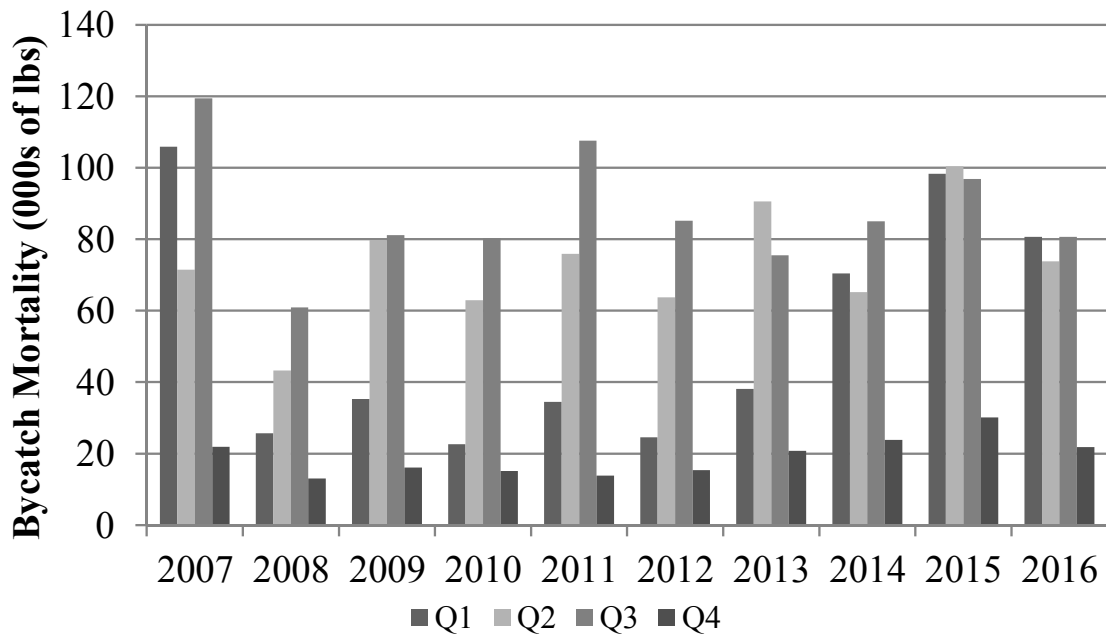


Figure 5. Pacific halibut bycatch mortality (thousands of pounds, net weight) by calendar quarter in the 2007-2016 Area 2B (BC) bottom trawl groundfish fishery.

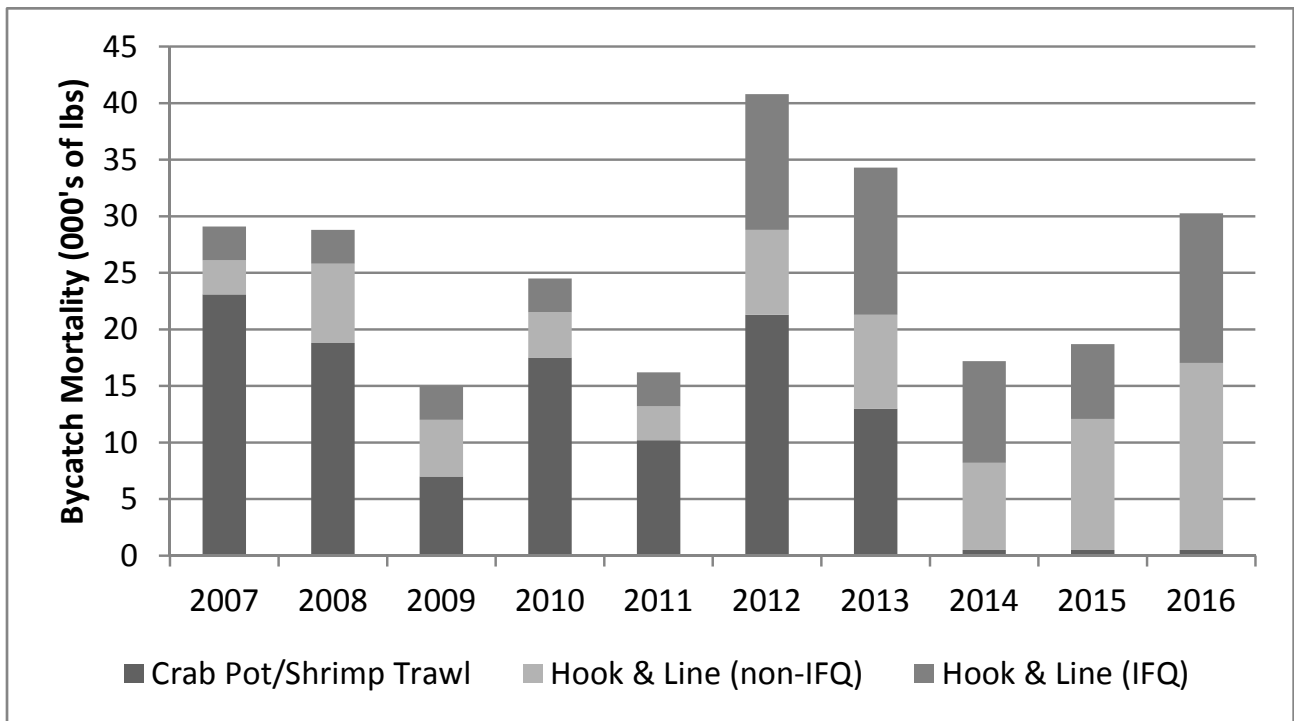


Figure 6. Pacific halibut bycatch mortality (thousands of pounds, net weight) in IPHC Area 2B during 2007-2016 by gear.

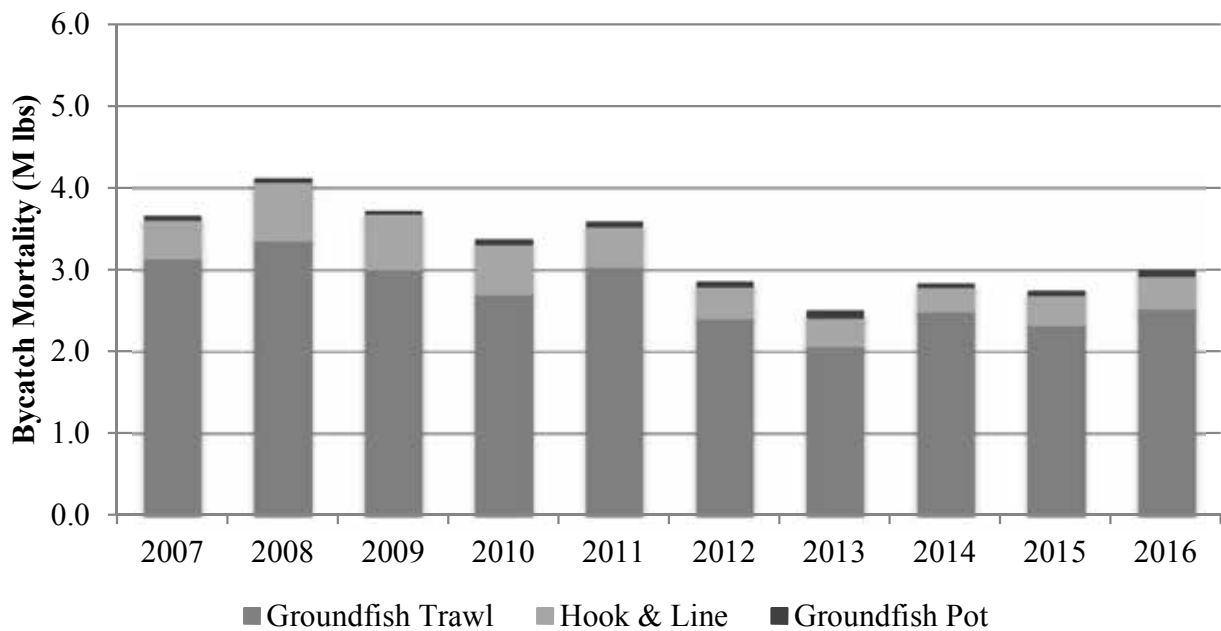


Figure 7. Bycatch mortality (millions of pounds, net weight) in Area 3 during 2007-2016 by gear.

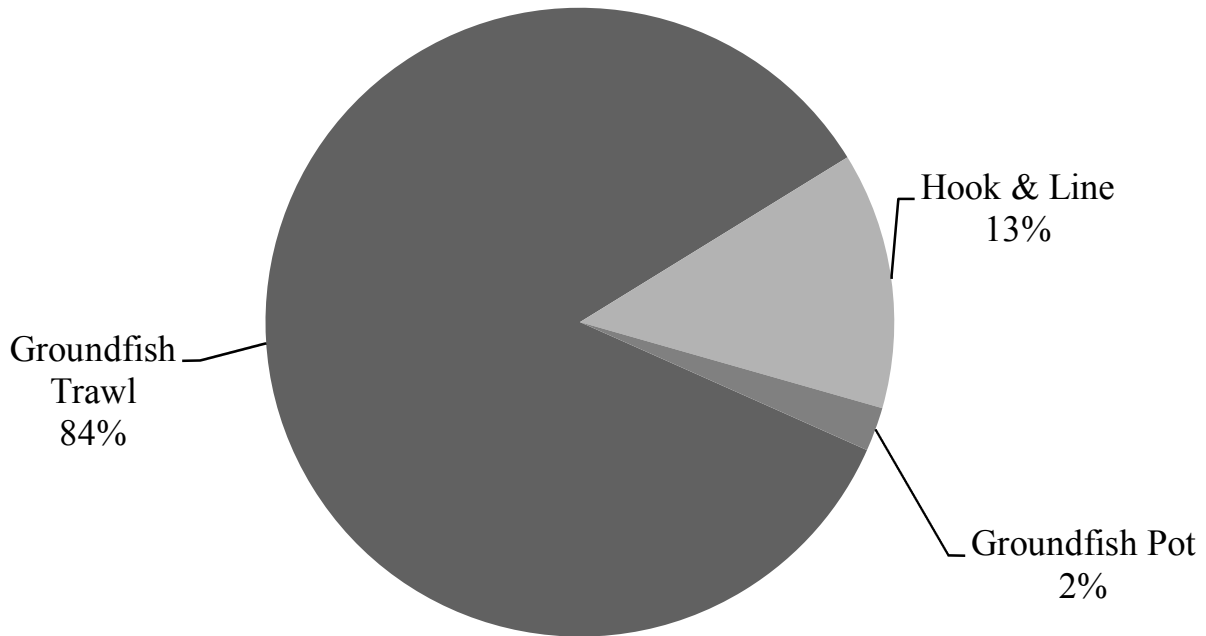


Figure 8. Proportion of 2016 bycatch mortality in Areas 3A/3B by gear type.

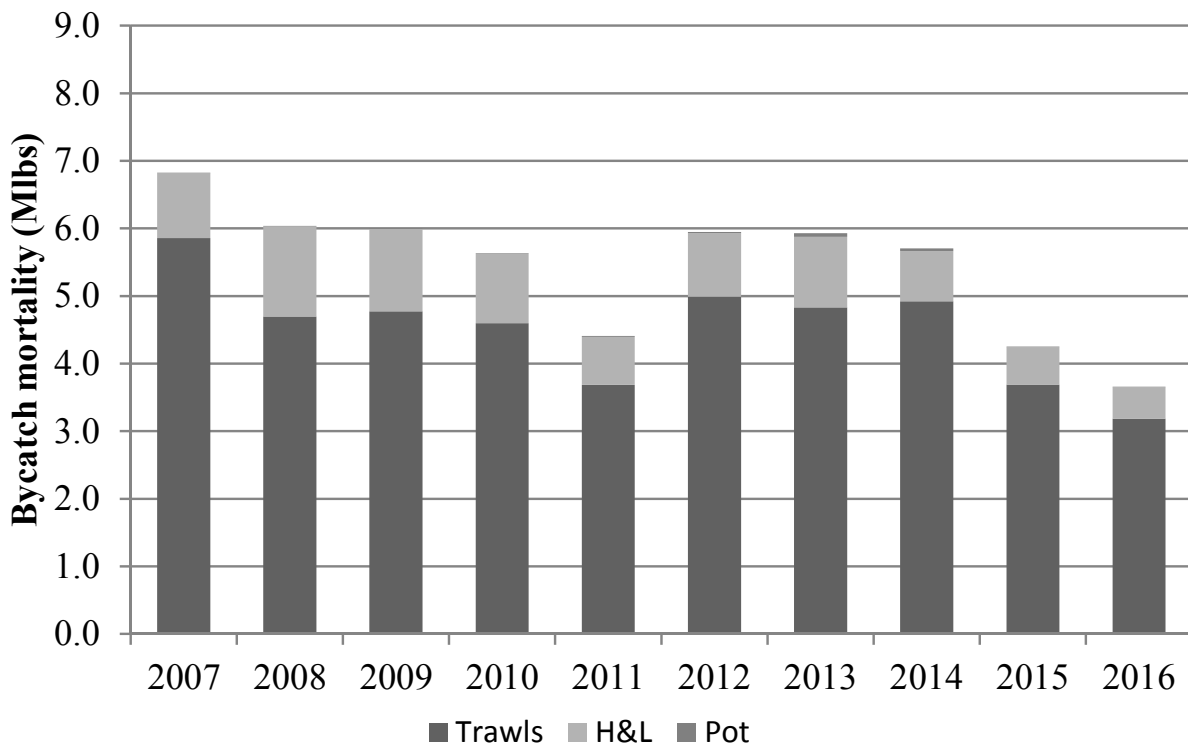


Figure 9. Bycatch mortality (millions of pounds, net weight) in Area 4 by gear type during 2007-2016.

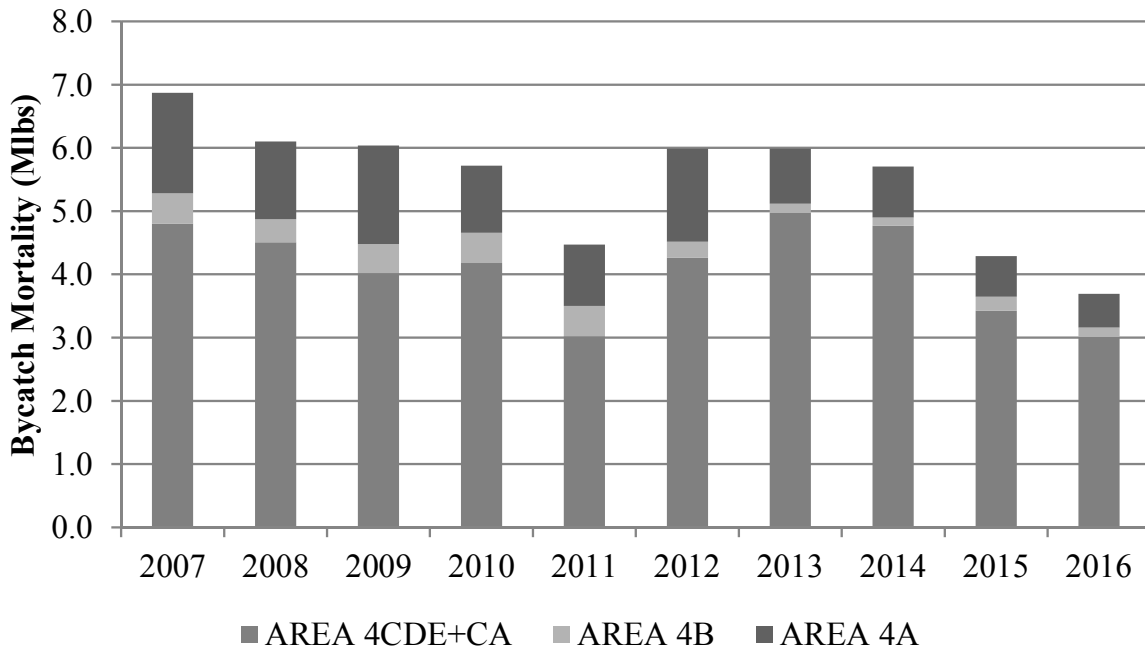


Figure 10. Bycatch mortality among the Bering Sea IPHC regulatory areas since 2007. (“CA” = Closed Area)