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Pacific Halibut Bycatch in the US West Coast Groundfish Fisheries (2002-2012)

NOAA

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EXECUTIVE SUMMARY

Pacific halibut mortality estimates are provided for 2002 through 2012 from all fishery sectors observed by the Northwest Fishery Science Center Groundfish Observer Program. These included:

- IFQ fisheries (2011-present)
- Limited entry (LE) bottom trawl (2002-2010)
- Non-nearshore fixed gear targeting groundfish (2002-present)
- Nearshore fixed gear (2003-present)
- Pink shrimp trawl (2004-present)
- California halibut trawl (2002-present)
- At-sea Pacific hake (2002-present)

Final estimates are shown in Table ES-1, which is synonymous with Table 22 in the report. In 2012, the IFQ non-hake bottom trawl sector constituted the largest source of discard mortality of Pacific halibut (P. halibut) among the sectors analyzed, followed by the non-nearshore fixed gear sector. Within the non-nearshore fixed gear sector, the majority of 2012 estimated discard mortality occurred in the limited entry (LE) sablefish endorsed component, which consists of federally permitted vessels fishing sablefish tier quota during the primary season from April through October. Specifically, discard rates for the non-nearshore fixed gear sector were highest on LE sablefish endorsed vessels fishing with longline gear in the area north of Point Chehalis, Washington. A smaller amount of Pacific halibut mortality also occurred on LE non-sablefish endorsed vessels fishing longline gear and open access (OA) vessels targeting non-nearshore groundfish species with hook-&-line gear.

The 2012 estimate of IFQ Pacific halibut discard mortality (both north and south of 40º 10' N. lat.) was about 10 mt greater (43.29 mt = sum of 2012 IFQ, summing values from Table ES1 might result in small difference due to rounding) than the 2011 estimate (33.32 mt, Figure ES1). Results from prior years indicate that discard mortality of Pacific halibut increased from 2003 through 2006 and then dropped in 2007. Discard mortality increased gradually during the 2007-09 time period, but dropped again in 2010 (Figure ES-1). Pacific halibut discard in the nearshore fixed gear sector, pink shrimp trawl fishery, California halibut trawl fishery, and at-sea Pacific hake fishery represents a very small component of overall total Pacific halibut mortality.

The base data used in this 2013 report has been updated to include the most recent revisions (if any) for all years to both the observer and Pacific Fisheries Information Network (PacFIN) databases. The estimates for all sectors and years (except LE Trawl 2002-2010) have been recalculated based on this up-to-date base data. To provide more accurate P. halibut estimates, we made a new assumption regarding unsampled catch on IFQ fishing trips: if some portion of the catch was unsampled but Pacific halibut was sampled, we assume that all Pacific halibut were sampled and therefore we do not expand these hauls for unsampled Pacific halibut. This occurred on a small portion of the hauls (1.3% in 2011, 0.7% in 2012) and is consistent with observer training and discard reporting to the the Vessel Account System. In all other respects, this 2013 report uses the same methods as reported in 2012.

Table ES1. Pacific halibut discard mortality estimates (metric tons, 2002-2012) for all sectors observed by the NWFSC Groundfish Observer Program. Discard mortality rates were applied in the bottom trawl fisheries (LE and IFQ), IFQ hook-&-line, IFQ pot, and non-IFQ, non-nearshore fixed gear sectors, for which some information regarding survivorship was available. All weights are round weight units (i.e, whole fish). Rounding of weight might mask very small weights in some categories. Tables with unrounded values are provided on the NOAA/NWFSC/FOS website. (*) Confidential data.

| | | IFQ fishery (2011 - 2012) | | | | | | Non-nearshore fixed gear | | | | | | | | Totals | |
| | | | | | | | | | | | Nearshore fixed gear[1] | Pink shrimp[1] | CA halibut‡[1] | At-sea hake[1] | Total discard mortality | Mortality rate applied | No mortality rate |
Year	LE bottom trawl	Shoreside hake[1]	LE CA halibut[1]	Bottom trawl	Midwater trawl[1]	Hook-and-Line	Pot	LE endorsed	LE non-endorsed	OA						LE bottom trawl/IFQ + Non-nearshore fixed gear	Nearshore + Pink shrimp + CA halibut + At-sea hake
2002	344.8							22.8	0.0	-	-	-	-	1.1	368.8	367.6	1.1
2003	124.4							30.2	0.0	-	0.0	-	0.0	2.7	157.3	154.7	2.7
2004	133.1							38.4	0.0	-	1.0	0.0	0.7	1.1	174.4	171.5	2.8
2005	286.5							33.8	0.0	-	2.2	0.1	0.0	2.0	324.5	320.3	4.2
2006	242.5							104.1	0.0	-	0.5	-	-	0.8	347.9	346.6	1.4
2007	208.8							20.3	0.3	3.6	0.1	0.2	0.1	1.2	234.5	232.9	1.6
2008	207.8							41.5	0.5	6.8	0.4	0.0	0.3	4.0	261.3	256.6	4.7
2009	251.1							51.6	0.0	5.9	1.3	0.0	0.0	0.3	310.3	308.7	1.6
2010	181.0							22.4	0.1	5.3	0.1	0.0	0.0	1.6	210.5	208.8	1.7
2011		0.03	0.0	31.4	*	1.0	0.9	21.9	3.4	2.2	3.1	0.2	0.0	0.6	64.8	60.9	3.9
2012		0.00	*	40.4	0.05	2.3	0.5	24.3	2.5	4.0	2.2	0.0	0.0	0.6	77.0	74.1	2.9
Total	1980.1	0.03	0.0	71.8	0.05	3.3	1.4	411.4	6.8	27.7	10.9	0.5	1.1	16.0	2531.2	2502.7	28.5

‡ Since 2011, CA Halibut only includes Open Access sector because the Limited Entry sector is covered under the IFQ Fishery.

" - " Indicates years of incomplete or no observer coverage for which estimates are not available

[1] Mortality rate of 100% applied

Table ES2. A comparison of Pacific halibut IBQ total discard mortality (mortality rates applied; mt, north of 40°10´ N latitude) between the Vessel Account System (VAS) and the NWFSC Observer Program final estimation. The two systems use different approaches (see Methods) to estimate P. halibut mortality.

Year	Total IBQ mortality of P. halibut (mt)	
Source	VAS	Observer Program
2011	32.14	33.08
2012	45.65	42.65

Figure ES1. Total estimated P. halibut discard mortality (metric tons) for 2002-2012 from all sectors observed by the NWFSC Groundfish Observer Program. Estimates are not included for sectors and years where there were insufficient observer data.
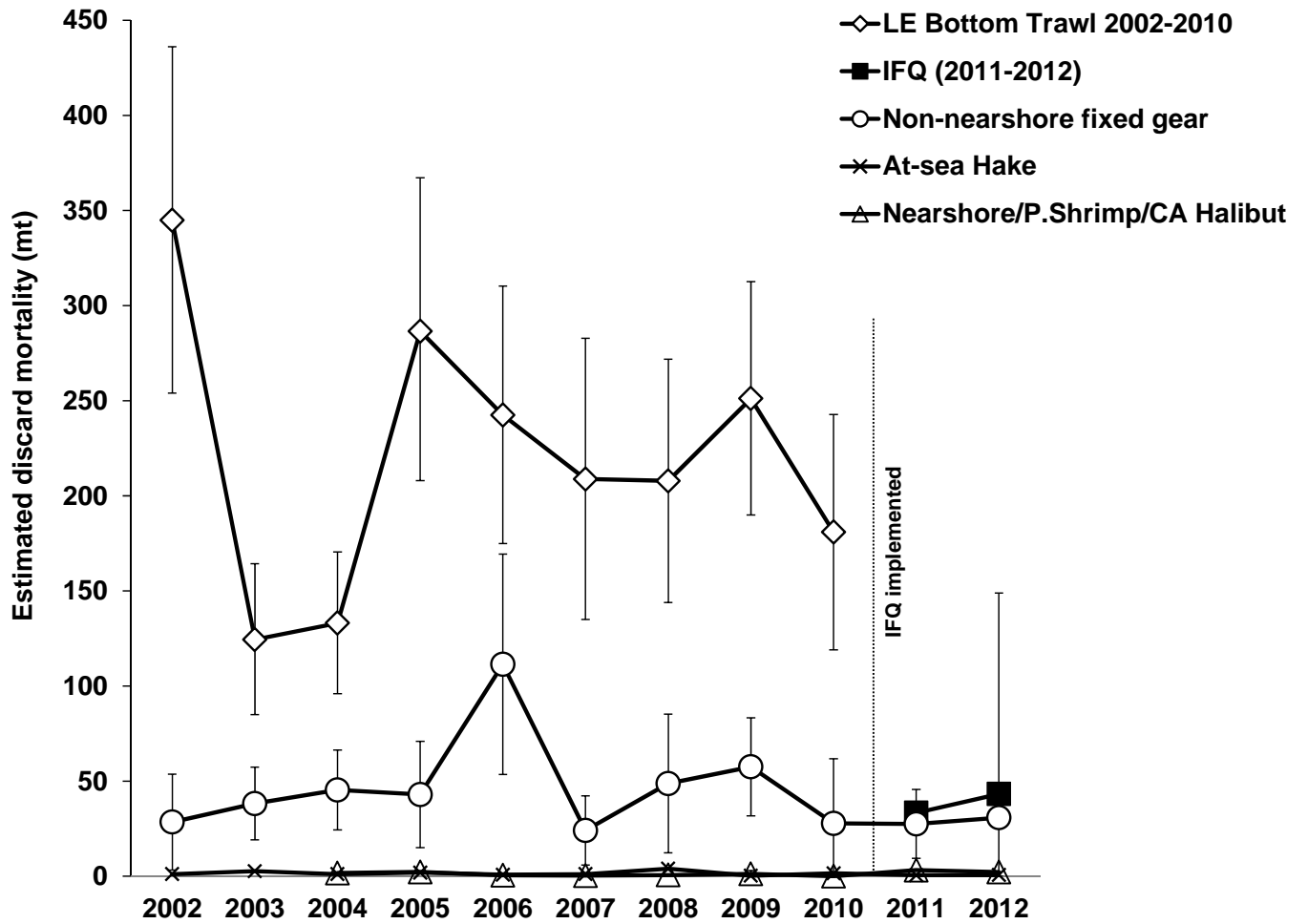
INTRODUCTION

Pacific halibut (*Hippoglossus stenolepis*) is found in coastal waters throughout the North Pacific. Off the west coast of the United States, it inhabits continental shelf areas (< 150 fm) from Washington to central California (Clark and Hare 1998). Pacific halibut has long supported a directed commercial fishery in the US and Canada, but it is also caught as bycatch in other fisheries that target demersal species inhabiting similar depths and seafloor habitat types (Chastain 2012). The objective of this report is to provide estimates of Pacific halibut bycatch in the U.S. west coast groundfish fishery from 2002-2012.

West Coast Groundfish Fishery

The west coast groundfish fishery is a multi-species fishery that utilizes a variety of gear types. The fishery harvests species designated in the Pacific Coast Groundfish Fishery Management Plan (FMP; PFMC PFMC 2011) and is managed by the Pacific Fishery Management Council (PFMC). Over 90 species are listed in the groundfish FMP, including a variety of rockfish, flatfish, roundfish, skates, and sharks. These species are found in both federal (> 5.6 km) and state waters (0-5.6 km). Groundfish are both targeted and caught incidentally by trawl nets, hook-&-line gears, and fish pots.

Under the FMP, the groundfish fishery consists of four management components:

The Limited Entry (LE) component encompasses all commercial fishers who hold a federal limited entry permit. The total number of limited entry permits available is restricted. Vessels with an LE permit are allocated a larger portion of the total allowable catch for commercially desirable species than vessels without an LE permit.

The Open Access (OA) component encompasses commercial fishers who do not hold a federal LE permit. Some states require fishers to carry a state issued OA permit for certain OA sectors.

The Recreational component includes recreational anglers who target or incidentally catch groundfish species. Estimates of P. halibut catch in recreational fisheries are compiled by the IPHC and are not covered by this report.

The Tribal component includes native tribal commercial fishers in Washington State that have treaty rights to fish groundfish. Estimates of Pacific halibut bycatch from tribal fisheries are compiled by the IPHC and are not included in this report, with the exception of the observed tribal at-sea Pacific hake sector which are included as part of the "At-sea hake" values included in ES Table1 and Table 22.

These four components can be further subdivided into sectors based on gear type, target species, permits and other regulatory factors. This report includes data from the following sectors:
- IFQ fishery (formerly LE bottom trawl and At-sea hake, 2002-2010): This sector is subdivided into the following components due to differences in gear type and target strategy:

- o Bottom trawl: Bottom trawl nets are used to catch a variety of groundfish species. Catch is delivered to shore-based processors.
  - o Midwater non-hake trawl: Midwater trawl nets are used to target mid-water non-hake species. Catch is delivered to shore-based processors.
  - o Pot: Pot gear is used to target groundfish species, primarily sablefish. Catch is delivered to shore-based processors.
  - o Hook-and-line: Longlines are primarily used to target groundfish species, mainly sablefish. Catch is delivered to shore-based processors.
  - o LE California halibut trawl: Bottom trawl nets are used to target California halibut by fishers holding a state California halibut permit and a LE federal trawl groundfish permit. Catch is delivered to shore-based processors.
  - o Shoreside hake trawl: Midwater trawl nets are used to catch Pacific hake. Catch is delivered to shore-based processors.
  - o At-sea motherships and catcher-processors: Midwater trawl nets are used to catch Pacific hake. Catcher vessels deliver unsorted catch to a mothership. The catch is sorted and processed aboard the mothership. Catcher-processors catch and process at-sea. This component also includes the at-sea processing component of the tribal sector. The tribal sector must operate within defined boundaries in waters off Northwest Washington. The catch can be delivered to a contracted mothership by catcher vessels for processing or be caught and processed by a contracted catcher-processor.
- OA pink shrimp trawl: Trawl nets are used to target pink shrimp. Catch is delivered to shore-based processors.
- OA California halibut trawl: Trawl nets are used to target California halibut by fishers holding a state California halibut permit. Catch is delivered to shore-based processors.
- LE fixed gear (non-nearshore): This sector is subdivided into two components due to differences in permitting and management:
  - o LE sablefish endorsed season: Longlines and pots are used to target sablefish. Catch is generally delivered to shore-based processors.
  - o LE non-sablefish endorsed: Longlines and pots are used to target groundfish, primarily sablefish and thornyheads. Catch is delivered to shore-based processors or sold live.
- OA fixed gear (non-nearshore): Fixed gear, including longlines, pots, fishing poles, stick gear, etc. is used to target non-nearshore groundfish. Catch is delivered to shore-based processors.
- Nearshore fixed gear: A variety of fixed gear, including longlines, pots, fishing poles, stick gear, etc. are used to target nearshore rockfish and other nearshore species managed by state permits in Oregon and California. Catch is delivered to shore-based processors or sold live.

Northwest Fisheries Science Center (NWFSC) Groundfish Observer Program

The NWFSC Groundfish Observer Program observes commercial sectors that target or take groundfish as bycatch. The observer program has two units: the West Coast Groundfish Observer Program (WCGOP) and the At-Sea Hake Observer Program (A-SHOP).

The NWFSC Groundfish Observer Program was established in May 2001 by NOAA Fisheries

(NMFS) in accordance with the Pacific Coast Groundfish Fishery Management Plan (50 CFR Part 660) (50 FR 20609). This regulation requires all vessels that catch groundfish in the US EEZ from 3-200 miles offshore carry an observer when notified to do so by NMFS or its designated agent. Subsequent state rule-making has extended NMFS's ability to require vessels fishing in the 0-3 mile state territorial zone to carry observers.

The NWFSC Groundfish Observer Program's goal is to improve estimates of total catch and discard by observing groundfish fisheries along the U.S. west coast. The WCGOP and A-SHOP observe distinct sectors of the groundfish fishery. The WCGOP observes multiple sectors of the groundfish fishery, including: IFQ shore-side delivery of groundfish and Pacific hake, at-sea mothership catcher-vessels fishing for Pacific hake, LE and OA fixed gear, and state-permitted nearshore fixed gear sectors. The WCGOP also observes several fisheries that incidentally catch groundfish, including the California halibut trawl and pink shrimp trawl fisheries. The A-SHOP observes the IFQ fishery that delivers Pacific hake at-sea including: catcher-processor, mothership, and tribal vessels.

Pacific Halibut Management and Fishery Interaction

The International Pacific Halibut Commission (IPHC), a body founded through treaty agreement between the US and Canada, sets the Pacific halibut annual total allowable catch (TAC) for area 2A. The IPHC refers to U.S. waters off the states of Washington, Oregon and California collectively as Area 2A. The TAC is based on bycatch mortality, which takes into account potential survival after being discarded. Regulations for Area 2A are set by NOAA Fisheries Northwest Regional Office. Pacific halibut catch in Area 2A is divided between tribal and non-tribal fisheries, between commercial and recreational fisheries, and between recreational fisheries in different states (Washington, Oregon and California). The Pacific Fishery Management Council describes this P. halibut catch division each year in a catch-sharing plan. In 2012, the LE fixed gear sablefish endorsed sector was allowed to retain and land P. halibut north of Point Chehalis, WA. The IFQ shore-delivery Pacific hake fishery is a maximized-retention fishery. Under this fishery, small amounts of incidental take are allowed to be landed and subsequently donated to food banks. In all other West Coast commercial groundfish fishery sectors, P. halibut must be discarded at-sea. Here we only report estimates of P. halibut discarded at-sea. Any retained P. halibut, including from fisheries covered by this report, are estimated by the IPHC in their annual report (Chastain 2012).

In 2011, the limited entry (LE) bottom trawl sector of the U.S. west coast groundfish fishery began fishing under an Individual Fishing Quota (IFQ) management program. An IFQ is defined as a federal permit under a limited access system to harvest a quantity of fish, representing a portion of the total allowable catch of a fishery that can be received or held for exclusive use by a person (MSA 16 USC 1802(23)). The implementation of the IFQ management program in 2011 resulted in changes to the methods used for estimating fishing mortality, including the mandate that vessels must carry NMFS observers on all IFQ fishing trips. A list of changes can be found in Jannot, et al. 2012.

Under the IFQ program, Pacific halibut is managed at the permit level, through Individual Bycatch Quota (IBQ) pounds. An IBQ accounts for bycatch mortality, which can assume some

level of survivorship. This is the only species managed under IBQ for the west coast groundfish IFQ fishery. Each federal groundfish permit with a trawl endorsement is allocated IBQ pounds for P. halibut caught north of 40° 10´ N. latitude. Pacific halibut caught south of 40° 10´ N. latitude are not managed as an IFQ quota but are reported here under the IFQ fishery.

Data collection and reporting for this fishery is described in the "Pacific Halibut Data Collection in the shore-based IFQ Fishery" sections by gear type. The shore-based IFQ fishery includes all IFQ fishery components with the exception of at-sea motherships and catcher-processors. Motherships and catcher-processors have a bycatch quota for Pacific halibut, but it is not accounted for at the permit level.

With the exception of the IFQ fishery, P. halibut bycatch mortality is accounted for at the fishery sector level only. P. halibut is regularly caught as bycatch in the LE sablefish endorsed fixed gear, LE non-sablefish endorsed fixed gear, and OA fixed gear sectors.

METHODS

Data Sources

Data sources for this analysis include onboard observer data (from the WCGOP and A-SHOP), and landing receipt data (referred to as fish tickets, obtained from PacFIN). To date, observer data is used as the sole source for discard estimation in the IFQ sectors. A list of fisheries, coverage priorities and data collection methods employed by WCGOP in each observed fishery can be found in the IFQ and Non-IFQ WCGOP manuals (NWFSC 2013). A-SHOP program information and documentation on data collection methods can be found in the A-SHOP observer manual (NWFSC 2013).

The sampling protocol employed by the WCGOP is primarily focused on the discarded portion of catch. To ensure that the recorded weights for the retained portion of the observed catch are accurate, haul-level retained catch weights recorded by observers are adjusted based on trip-level fish ticket records. This process is described in further detail on the WCGOP Data Processing webpage and was conducted prior to the analyses presented in this report. All weights of P. halibut presented in this report are round weights, that is, whole, in-tact fish. IPHC converts these weights to dressed weights (i.e., head and organs removed).

For data processing purposes, species and species groups were defined based on management (NWFSC 2013). A complete listing of groundfish species is defined in the Pacific Coast Groundfish Fishery Management Plan (PFMC PFMC 2011).

Fish ticket landing receipts are completed by fish-buyers in each port for each delivery of fish by a vessel. Fish tickets are trip-aggregated sales receipts for market categories that may represent single or multiple species. Fish tickets are issued to fish-buyers by a state agency and must be returned to the agency for processing. Fish ticket and species-composition data are submitted by state agencies to the Pacific Fisheries Information Network (PacFIN) regional database. Annual fish ticket landings data were retrieved from the PacFIN database (July 2013) and subsequently

divided into various sectors of the groundfish fishery as indicated in Figure 1 and in further detail online (NWFSC 2013c).

Shore-based IFQ Fishery

The methods used to report in-season IBQ estimates are separate from those methods used to estimate final fleet-wide P. halibut mortality. In prior years, estimates from the two methods resulted in very similar fleet-wide estimates of P. halibut mortality (Table ES2).

Pacific Halibut Data Collection in the Shore-delivery IFQ Fishery

The WCGOP designed sampling methodologies that help ensure P. halibut mortality can be estimated, regardless of the limitations imposed by the vessel, catch composition, or catch quantity. Three pieces of information are necessary to estimate Pacific halibut mortality (also see Table 1):

1. A count of individual P. halibut in the haul or sample
2. Actual or visual length measurements (cm)
3. A viability obtained by physical assessment of individual P. halibut using IPHC designed dichotomous keys that relate the physical condition of the fish to a viability code (NWFSC 2013). A unique key is used for each gear type (trawl, longline, pot).

Observers could sample all or a subset of P. halibut caught in a haul/set. The proportion of P. halibut sampled is based on the number of P. halibut caught in the haul/set, the level of assistance provided by the crew, as well as other variables (e.g., physical space, time of day, weather). Sampling and assessment of P. halibut is dependent on crew assistance and cooperation. Regulations prohibit vessel crew from discarding any P. halibut without first notifying the observer. The vessel crew must comply with any and all requests by the observer to ensure proper P. halibut sampling, including but not limited to: modifying P. halibut sorting procedures, assisting the observer by delivering the P. halibut to the observer, and modifying operations to ensure P. halibut sampling is completed. Table 1 describes the P. halibut data obtained on IFQ-permitted vessels fishing different gear types.

On vessels fishing fixed gear (pot or hook-&-line), observers must sample at least 50% of the gear per set. Actual length measurements are obtained on bottom trawl, midwater trawl, and pot vessels, but only visual length estimates are made on vessels fishing hook-&-line gear. Visual estimates are done in 10 cm increments (55-64 cm, 65-74 cm, etc.).

The crew's cooperation is vital to the observer's sampling success when hook-&-line fishing. When an observer samples for P. halibut, the crew are not permitted to shake loose or discard any P. halibut before the observer can estimate the fish length, nor can they restrict the observer's view of the line as it comes out of the water. If requested by the observer, the crew is required to physically hand an individual fish to the observer or slow the gear retrieval.

Table 1. Data collected from Pacific halibut caught on IFQ vessels using different types of gear.

Gear	Count	Length Measurement	Viability
Bottom trawl	all in the haul	actual, all or subset	yes
Midwater trawl	all in the haul	actual, all or subset	yes
Pot	all in sampled portion	actual, all or subset	yes
Hook -and- line	all in sampled portion	visual, all or subset	no

Viability is assessed at the point of fish release when returned to sea. On vessels using "resuscitation boxes" or other techniques to increase the likelihood of survival, condition sampling is performed prior to the fish being returned to sea. Observations of several condition characteristics are used to assign each fish to one of three viability categories for trawl and pot gear: Excellent, Poor, or Dead (NWFSC 2013; Williams and Chen 2004). Observer field estimates of viability for Pacific halibut discarded in the IFQ fishery by vessels fishing bottom trawl or pot gear are used to compute the total estimated mortality of discarded Pacific halibut. IBQ weight (or simply IBQ) refers to the estimated mortality of discarded P. halibut, with the appropriate mortality rate applied based on viability (Tables 2 & 3 or 100%).

Viability categories are used to assign mortality rates to P. halibut. Mortality rates for vessels fishing bottom trawl gear are based on mortality data collected by Hoag (1975), who found some survivorship among fish in the dead condition category. Mortality rates for vessels fishing pot gear are based on conservative assumptions of likely survival from pot-induced injuries (Williams and Wilderbuer 1995). Because of the difficulties of collecting P. halibut viability on hook-and-line vessels, we used a discard mortality rate (DMR) of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008). Discard mortality was assumed to be 100% for midwater trawl bycatch estimates.

Table 2. Mortality rates used for each of the condition categories (m_c) for IFQ bottom trawl vessels (Clark et al. 1992).

m_c	Rate
m_{exc}	0.20
m_{poor}	0.55
m_{dead}	0.90

Table 3. Mortality rates used for each of the condition categories (m_c) for IFQ pot gear vessels (IPHC).

m_c	Rate
m_{exc}	0.00
m_{poor}	1.00
m_{dead}	1.00

Final Shore-based IFQ Fishery Bycatch Estimation

We stratified IFQ Pacific halibut bycatch data based on sector (shoreside non-hake groundfish, shoreside Pacific hake, at-sea Pacific hake, and LE California halibut) and gear (bottom trawl, midwater trawl, pot, hook-&-line). Within the shoreside non-hake groundfish sector, we further stratified using area and depth based on gear type. We maintained area and depth strata that were applied to bottom trawl, hook-&-line, and pot gear in previous reports (see Table 4 of this report for specific strata; Heery et al. 2010, Jannot et al. 2011, Jannot et al. 2012) because prior work had demonstrated that these variables were correlated with Pacific halibut bycatch (Heery et al. 2010). Observations from IFQ vessels fishing midwater trawl gear targeting Pacific hake or other midwater target species were not post-stratified. Similarly, observations of IFQ vessels targeting California halibut with bottom trawl gear were not post-stratified. In addition to the strata described above, we also provide bycatch estimates north and south of the North/South groundfish management line (40°10′ N. lat.) for each sector and gear type.

Despite the 100% observer coverage mandate in 2012, there were some rare occasions (e.g., observer illness) when tows or sets were either only partially sampled, or not sampled. In this report, we made the following assumption about IFQ data: if an observer sampled P. halibut on unsampled or partially sampled hauls, we assumed that all P. halibut were sampled on those hauls and therefore did not expand estimates on these hauls. This change from the 2012 report was made after staff reviewed these data. The intent of this assumption is to more accurately estimate P. halibut mortality without double counting. We used ratio estimators to apportion unsampled weight to specific species, including Pacific halibut, within each stratum. To obtain the estimated weight of Pacific halibut (W) when the entire haul or set was unsampled, the unsampled discard weight, summed across unsampled hauls within the stratum, was multiplied by the ratio of the weight of Pacific halibut discard (summed across fully sampled hauls within a stratum) divided by the total discard weight of all species in all fully sampled hauls within a stratum:

$$\widehat{W}_{p,s} = \sum_{p} x_{p,s} \times \frac{\sum_f w_{f,s}}{\sum_f x_{f,s}}$$

where, for each stratum:
s = stratum, which includes sector and year and could include, area, depth, gear
p = unsampled haul
f = fully sampled haul
x = weight of discarded catch
$\widehat{W}$ = estimated weight of unsampled P. halibut in the stratum

w = sampled weight of P. halibut

The unsampled weight of partially sampled hauls or sets was categorized into weight of non-IFQ species (NIFQ) or IFQ species. Unsampled IFQ species weight was further categorized into IFQ flatfish (IFQFF), IFQ rockfish (IFQRF), IFQ roundfish (IFQRD) and IFQ mixed species (IFQM). For the purposes of this report, we assume that unsampled P. halibut would only occur in NIFQ (south of 40°10′ north latitude only), IFQM, or IFQFF unsampled categories. Thus, those are the only categories for which P. halibut is estimated. IFQM included all 2012 IFQ managed species (see 76 FR 27508 for a listing of IFQ species). NIFQ included all species encountered that were not designated as an IFQ species in management. IFQFF included all IFQ flatfish species managed as a complex under the groundfish FMP. North of the 40°10′ north latitude groundfish management line, Pacific halibut would be included in unsampled IFQFF or IFQM categories. South of the groundfish management line, Pacific halibut would only be included in the unsampled NIFQ category.

To obtain the estimated weight of Pacific halibut ($\widehat{W}$) in partially sampled hauls or sets, the unsampled discard weight, summed across partially sampled hauls within the stratum, was multiplied by the ratio of the weight of Pacific halibut (summed across fully sampled hauls within a stratum) divided by the total discard weight of all species occurring within a category (NIFQ, IFQFF, IFQM) in all fully sampled hauls within a stratum. Estimated Pacific halibut weight was summed across unsampled categories

$$\widehat{W}_{p,s} = \sum_{y} \left(\sum_{p} x_{p,y,s} \times \frac{\sum_f w_{f,s}}{\sum_f x_{f,y,s}} \right)$$

where, for each stratum:
s = stratum, which includes year and sector, and could include, area, depth, gear
y = unsampled category (either NIFQ, IFQFF, or IFQM)
p = partially sampled haul
f = fully sampled haul
x = weight of discarded catch
$\widehat{W}$ = estimated weight of unsampled P. halibut in the stratum
w = sampled weight of P. halibut

Expanded weights of Pacific halibut obtained using the equations above for unsampled or partially sampled hauls were then added to the sampled weight of Pacific halibut within each stratum to obtain the total Pacific halibut weight per stratum.

Viability Analysis

We used observer field estimates of viability for Pacific halibut discarded in the IFQ fishery by vessels fishing bottom or pot gear to compute the total estimated mortality of discarded Pacific halibut by IFQ gear/sector and stratum.

To account for the impact of fish size on survivorship, we computed a weighted mortality rate for each condition category. Length measurements associated with each viability record were converted to weight based on the IPHC length-weight relationship:

$$W = 6.921 \times 10^{-6} \cdot L^{3.24}$$

where:
L = fork length (cm)
W = weight (lbs., whole fish)

A discard mortality rate for each condition category was then computed as the proportion of P. halibut sampled weight in a viability category multiplied by the viability category-specific mortality rate (see Tables 2 & 3 above):

$$DMR_{csj} = m_c \times P_{csj}$$

where:
s = stratum, which could include, area, depth, gear, and sector
c = viability condition (Excellent, Poor, Dead)
j = year
m_c = mortality rate
P = proportion of sampled P. halibut weight (w)
DMR = discard mortality rate

Discard mortality rates for each condition category c and stratum s were then multiplied by gross discard estimates to compute total estimated discard mortality for each of the two gear types:

$$\hat{F}_{sj} = \sum_c \left(B_{sj} \cdot DMR_{sj} \right)$$

where:
s = stratum, which could include, area, depth, gear, and sector
c = viability condition (Excellent, Poor, Dead)
j = year
F = total estimated discard mortality
B = gross estimated discard weight

Viability data are collected from only a subsample of the Pacific halibut that observers encounter. Based on previous evaluations by Wallace and Hastie (2009), we expect that survivorship of Pacific halibut in bottom trawl tows are most directly affected by the length of the tow and the amount of catch that fills the net. These variables are not part of the bycatch ratio stratification process (above), and their use in stratifying viability data would make it difficult to then apply discard mortality rates to initial gross estimates of bycatch. We found that tow duration was directly related to depth, one of the variables used to stratify discard ratios and initial gross discard estimates for bottom trawl gear. Because depth and tow duration appeared

to co-vary, we used depth and area to stratify IFQ viability data collected from bottom trawl gear. For IFQ viability data collected from pot gear, only area is used to stratify the data. For longline gear, we used a discard mortality rate of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008).

Final estimates of Pacific halibut bycatch and discard mortality are also presented in the context of the estimated mortality of legal-sized halibut. This was computed by applying the proportion of sampled P. halibut weight in each depth stratum that was from legal-sized fish (82 cm or larger) to initial estimates. Viabilities were then applied to gross legal-sized discard estimates in the same manner as described above.

Length Frequencies

The length frequency distribution for Pacific halibut in the 2012 IFQ fishery is provided in Table 10. Pacific halibut pose unique challenges for observer sampling. Observers typically measure the length of Pacific halibut and then convert the measurement to weight using the IPHC length-weight conversion table. Occasionally, observers actually weigh individual fish. Sometimes crew members presort the catch by removing Pacific halibut and immediately return them to sea. Vessel crews presort Pacific halibut to increase the likelihood of survival of the discarded fish. Presorting is most prevalent on vessels fishing with hook-&-line gear. Fishers have raised concerns regarding crew safety when landing large P. halibut. In addition, hook-&-line fishers are concerned that P. halibut individuals would be injured during landing because of their interaction with the vessel 'crucifier' (gear used to strip the bait and any catch off of the hook and gangion line). Therefore, shake-offs prior to the crucifier (a form of pre-sorting) is almost universal on IFQ hook-&-line vessels. Another case of pre-sorting can occur when halibut are too heavy and/or awkward to weigh in observer baskets. In all cases of pre-sorting, random samples are not available. Therefore, observers visually estimate the length of the halibut in ten-centimeter units (40cm, 50cm , 60cm, etc.), which are later converted to weight using the IPHC length-weight conversion table.

Table A1 (Appendix A) provides the actual observed length frequency distributions of discarded Pacific halibut for vessels fishing IFQ using bottom trawl or pot gear. These length frequencies have been weighted based on the ratio of total estimated P. halibut discard weight to the weight of P. halibut that was measured in each stratum (see Appendix A for further details). Because size-specific mortality rates have not been determined, we were not able to compute the length frequency distribution of discarded fish that died. However, we have summarized the proportion of length measurements in each condition category (Excellent, Poor, and Dead) in Table 2A (Appendix A) to inform size-specific modeling of mortality. The frequency of sampled fish within each condition category was weighted in the same manner as length frequency distributions and then summarized for each 2 cm length bin.

Non-nearshore Fixed Gear Fishery

The WCGOP samples each non-nearshore fixed gear sector through separate random selection processes, with the limited entry (LE) sablefish endorsed season permits receiving the highest level of coverage, then LE non-sablefish endorsed permits, and open access (OA) fixed gear the lowest. LE sablefish endorsed vessels that fish outside of the primary season or that have reached their tier quota in the primary season are not observed. Given this sampling structure

and anticipated differences in variance from one sector to the next, we chose to maintain sector as a stratification variable in our analysis. Testing of alternative stratification schemes (Heery et al. 2010) indicated that latitude and gear type were the most important variables with respect to Pacific halibut bycatch in the non-nearshore fixed gear groundfish fishery. Bycatch estimates were produced separately for each sector and gear combination. Two latitudinal strata were applied to the LE sablefish endorsed longline sector (north and south of Point Chehalis, Washington = 46° 53.30′ N. lat.) because previous modeling demonstrated that these strata significantly improved the fit of predicted bycatch amounts to the amounts observed (Heery et al. 2010). Point Chehalis, WA was used in previous estimates of Pacific halibut bycatch in the LE sablefish endorsed season longline sector because of its relevance to groundfish management and its apparent ability to split out higher bycatch rates off the northern coast of Washington (Heery and Bellman 2009). Evaluations of latitudinal strata for the other fixed gear sectors did not improve the fit of models to an extent that justified their use. Thus, we maintained the same stratification for the other groundfish fixed gear sectors that was used previously (Heery and Bellman 2009, Heery et al. 2010, Jannot et al. 2011, Jannot et al. 2012).

Discard Estimation

A deterministic approach was used to estimate Pacific halibut discard for all sectors of the non-nearshore groundfish fixed gear fishery. Discard ratios were computed from observer data as the discarded weight of Pacific halibut divided by the retained weight of either sablefish or all FMP groundfish (except Pacific hake), depending on the sector (Table 11; FMP groundfish species: NWFSC 2013). Ratio denominators were identified for each sector of the non-nearshore fixed gear fishery based on the targeting behavior of that sector (Table 12). Discard ratios were then multiplied by the total sector landed weight of either sablefish or FMP groundfish (except Pacific hake), corresponding to the denominator used to compute the observed discard ratio for each sector. This provided an expanded gross estimate of Pacific halibut discard for each sector. A discard mortality rate (discussed below) was then applied to compute estimated discard mortality.

Total landed weights for each sector are obtained from fish ticket landing receipts. Fish tickets for fixed gear that included recorded weights for sablefish were included in the non-nearshore fixed gear sector. Commercial fixed gear fish tickets with recorded nearshore species weight were not used in this portion of the fixed gear analysis, regardless of whether they included recorded weights for sablefish (Figure 1). In addition, fixed gear fish tickets without recorded sablefish or nearshore species were included in the non-nearshore fixed gear sectors only if groundfish landings were greater than non-groundfish landings based on a unique vessel and landing date.

Fish tickets from the non-nearshore fixed gear sector were partitioned into the three commercial fixed-gear sectors (LE sablefish endorsed season, LE non-sablefish endorsed, and OA fixed gear) through the following process. Commercial fixed-gear fish tickets were first divided out by whether the vessel had a federal groundfish permit (limited entry) or no federal groundfish permit (open access). OA fish tickets were placed in the OA fixed gear groundfish sector. Next, LE fish tickets were separated based on whether the vessel's federal groundfish permit(s) had a sablefish endorsement with tier quota for the primary season or if it was not endorsed (also referred to as 'zero' tier). Fish tickets for all LE sablefish vessels with tier endorsements that

were operating within this period and within their allotted tier quota were placed in the LE sablefish endorsed sector. If LE sablefish endorsed vessels fished outside of the primary season (November through March) or made trips within the season after they had reached their tier quota, the fish tickets were placed in the LE non-sablefish endorsed sector. In addition, fish tickets from non-endorsed LE vessels were also placed in the LE non-sablefish endorsed sector.

Further processing of fish tickets identified and removed the directed commercial Pacific halibut fishery landings from the non-nearshore fixed gear analysis. The directed Pacific halibut fishery occurs for only a few days each year, during 10-hour openings that are designated by the IPHC. LE and OA fixed gear vessels that typically target groundfish can participate in the directed fishery. For most fixed gear vessels, (other than LE sablefish endorsed vessels north of Point Chehalis) this is the only time during which they are allowed to land Pacific halibut. Fish tickets that included Pacific halibut landings on or within the 2 days after a directed fishery opening were considered to be part of the directed fishery and not part of the non-nearshore fixed gear fishery targeting federal FMP groundfish. These fish tickets were removed prior to our analysis. This approach may have resulted in the removal of some non-directed fishery landings north of Point Chehalis, but any bias introduced by this step is considered to be extremely small given the short time period across which fish tickets were removed.   This filtering step was applied to the area north of Point Chehalis only.

WCGOP observer data were stratified according to sector and gear type (longline and pot/trap). As discussed earlier, one additional latitudinal stratum at Point Chehalis, Washington (46° 53.30' N lat.) was used for the LE sablefish endorsed longline sector. Some retention of Pacific halibut was allowed in the LE sablefish endorsed season in the area north of Point Chehalis. The Point Chehalis line was the only latitudinal stratification incorporated into our analysis and was only applied to the LE sablefish endorsed sector. Discard amounts provided for the other two fixed gear sectors represent coast-wide estimates.

The number of observed trips, sets, and vessels are summarized for each sector, gear type, and area (where applicable) (Table 11). The landed weight of sablefish and FMP groundfish (excluding Pacific hake) is used as a measure for expanding discard from observed trips to the entire fleet (Table 12 and13). Observed discard ratios were calculated by sector, gear type and area based on the following equation:

$$\hat{D}_s = \frac{\sum_t d_{st}}{\sum_t r_t} \times F_s$$

where:
s: stratum, including year, sector, gear type, and area
t: observed sets
d: observed discard (mt) of Pacific halibut
r: observed retained weight (mt) of sablefish or all FMP groundfish except Pacific hake
F: weight (mt) of retained sablefish or all FMP groundfish excluding Pacific hake recorded on fish tickets in strata *s*

$\hat{D}_s$: Discard estimate for stratum *s*

For all strata, except the LE non-sablefish endorsed longline and the OA sectors, discard ratios were calculated by dividing the stratum discard weight of Pacific halibut by the retained catch weight of sablefish. Retained groundfish was used as the ratio denominator for the LE non-sablefish endorsed longline and the OA sectors because these sectors target a wider range of groundfish species. A broader denominator was therefore necessary to effectively capture the level of fishing effort in these sectors. Please refer to earlier reports for further details of data pooling and discard ratios in prior years of observer coverage.

Where FMP groundfish (excluding Pacific hake) was used to compute discard ratios, any retained weights recorded by the observer not appearing on fish tickets were excluded from the denominator. This prevents double-counting associated with differences in the species codes used by observers and processors. For instance, while observers may record rockfish catch at the species level; various species of rockfish are often grouped, weighed, and recorded together on the fish ticket by the processor under a grouped species code such as NUSP - northern unspecified slope rockfish. In some cases, this difference in species coding prevents observer and fish ticket weights from being matched and adjusted properly. Species coding on fish tickets varies considerably between processors and over time, and it is not possible to make assumptions regarding which individual observer-recorded species likely coincide with species grouping codes on fish tickets. By using only the retained groundfish weight from fish tickets in discard ratio denominators, we prevent double-counting of retained weights. This is not a factor when using a single species in the denominator, such as sablefish, as any retained weights in observer and fish ticket data that share the same species code will match and adjust properly.

Table 13 demonstrates the expansion factors for each fishery sector and gear type. The discard rate multiplied by the expansion factor yielded an expanded gross P. halibut discard estimate for each stratum (Table 15). If landings were made by a fixed gear sector for which there were no or very few WCGOP observations, the most appropriate observed discard ratio was selected and applied to those landings based on similarities in the fishery management structure, fishing and discard behavior, and the gear fished. The LE sablefish endorsed vessels fishing outside of the primary season with pot gear often land a small amount of groundfish; however, this portion of the fleet is not observed by the WCGOP program. Given similarities in gear type and catch composition, OA fixed gear pot observations were selected as the most appropriate source of information for an observed discard rate (Table 12).

Discard Mortality Rates

Once an initial gross estimate of P. halibut discard had been produced, this value was multiplied by a discard mortality rate (Table 15) to generate a final discard mortality estimate (Table 16 and Figure 3). Ideally, discard mortality would have been approximated based on viabilities in a manner similar to the approach used for IFQ bottom trawl and pot gear. WCGOP observers do record viability conditions as Pacific halibut are discarded from non-IFQ longline vessels. However, much of the time, Pacific halibut are removed from the line before being brought on-board. This is to ensure safety, as longline vessels are often small, and to have the least possible impact on Pacific halibut survivorship. Because these fish are not typically brought on-board,

the observer is not able to effectively assess viability or gain a random sample from Pacific halibut catch. Although viabilities from pot gear would be appropriate to use in estimating discard mortality, bycatch of Pacific halibut in pot gear is infrequent and the sample size was too small to utilize in this analysis.

Thus, Pacific halibut viabilities recorded from the non-nearshore fixed gear fishery were not used in our analysis. Discard mortality rates therefore had to be identified through other means. Review of the literature on Pacific halibut bycatch revealed little that could be applied to the entire discard estimate. Several studies have examined the survivorship of Pacific halibut in various conditions (Kaimmer and Trumble 1998, Trumble et al. 2000). However, without any information on the state of Pacific halibut that were being discarded, the findings from these examinations could not be put to use.

Instead, we relied on discard mortality rates computed for groundfish fisheries off Alaska (Williams 2008). An 18% discard mortality rate was applied to estimates for pot gear, coinciding with the DMR used for the sablefish pot CDQ fishery in Alaska. For longline gear, we used a discard mortality rate of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008).

For additional context, we present the length frequency distribution of Pacific halibut from visual length estimates and physically measured lengths in non-nearshore fixed gear sectors (Table 17) and the proportion of sampled Pacific halibut discard of legal (>82 cm) and sublegal ($\leq$ 82 cm) sizes in non-nearshore fixed gear sectors (Table 18). The majority of Pacific halibut lengths recorded in these fisheries have been collected through visual length estimation, rounded to the nearest 10 cm. In other words, specimens that are 76 cm and 82 cm are both visually estimated to be 80 cm. With this level of resolution, it was not possible to compute the exact proportion of sublegal versus legal Pacific halibut from visually estimated lengths. Visual estimates were instead summarized in the manner in which they are recorded; with sublegal and legal sized halibut falling within the 75-84 cm length bin. Observers have been instructed to make physical measurements of P. halibut lengths from randomly sampled fish on LE sablefish endorsed vessels, with the help of vessel crew.

Other Fisheries

Pacific halibut bycatch was also observed in the nearshore groundfish fixed gear sector (Table 19), the state pink shrimp trawl fisheries (Table 20), and the OA California halibut trawl fishery (Table 21) (LE California halibut is covered under the IFQ fishery). Bycatch estimates for these three fishery sectors were computed based on the following equation:

$$\hat{B} = \frac{\sum_t b_t}{\sum_t r_t} \times F$$

where:
b: observed discard (mt) of Pacific halibut on set/haul t

r: observed retained weight (mt) of target species on set/haul *t*

F: weight (mt) of retained target species

$\hat{B}$: Discard estimate of Pacific halibut (mt)

The nearshore fixed gear fishery targets a variety of groundfish species that inhabit areas shallower than 50 fathoms. All species included in the nearshore target group as listed in the WCGOP data processing appendix were included in the denominator when calculating bycatch ratios for the nearshore fixed gear sector . Pink shrimp and California halibut were considered the target species in their respective fisheries. Discard mortality rates were not applied to discard estimates for these other fishery sectors due to a lack of information regarding survivorship.

RESULTS

IFQ Fishery

All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). For most strata, 98% or more of the observed IFQ tows or sets were sampled (Table 4).   Non-IFQ species represented the largest portion of unsampled catch (Table 4), as only every third haul or set was required to be sampled for non-IFQ species under WCGOP sampling protocol (NWFSC 2013).

The total estimated weight of Pacific halibut from unsampled tows or sets in 2012 represents a small fraction (1.4 mt ~ 1.5%) of the total 2012 IFQ gross discard weight of P. halibut (Table 5). Unsampled P. halibut catch from both unsampled and partially sampled hauls represented 2.5% of the total gross discard weight (2.3 of 91.8 mt). Sixty percent of the total gross discard weight (1.4 mt) came from unsampled hauls, whereas another 38% (0.9 mt) came from IFQM catch (Table 5). The remainder was estimated from unsampled IFQFF or NIFQ catch (~0.06 mt).

Gross bycatch estimates and total discard mortality estimates were largest for vessels fishing bottom trawl gear, north of the 40°10´ N. latitude management line in depths greater than 60 fathoms (Tables 7, 8). This gear-area-depth stratum accounts for ~77% of 2012 Pacific halibut discard mortality in the fishery. The next largest fraction (~16%) of total discard mortality is found in the same gear-area combination in shallow waters (<60 fm). Together, bottom trawl gear fishing north of the 40°10´ N. latitude management line accounts for 93% of the 2012 Pacific halibut discard mortality in the IFQ fishery (Tables 7, 8).

In terms of viability, the majority of individuals were classified as either Excellent or Dead (Table 6). Individuals caught with bottom trawls were approximately evenly split between Excellent and Dead categories, north of Point Chehalis in all depths and south of Point Chehalis at depths greater than 60 fathoms (Table 6). South of Point Chehalis in the shallow depths, most individuals were either Excellent (north of 40°10´ N) or Dead (south of 40°10´ N).

Of the few individuals sampled from midwater trawl gear, individuals were Excellent when caught in the non-hake shoreside sector or Dead when caught in the shoreside hake sector (Table 6). Catch on midwater trawl vessels for non-hake groundfish is treated in a similar manner as

catch on bottom trawl vessels -- catch is normally dumped and sorted on deck. In contrast, midwater trawl vessels fishing for hake to be delivered shoreside dump the catch directly in the hold, with only rare presorting events, thus most P. halibut are Dead in this fishery. In addition, tow duration differs between the two types of midwater fishing: non-hake midwater tows observed in 2011-12 catch shares have generally been of shorter duration than those observed as shoreside hake. The majority of P. halibut caught with pot gear are categorized as Excellent viability (Table 6).

Estimated P. halibut discard mortality from all sectors and gears of the 2012 IFQ fishery was 29% greater than the 2011 IFQ estimated discard mortality. The most likely reason for the increase was probably less conservatism among fishers – fishers had more experience and knowledge about their IBQ usage relative to their fishing behavior or preferred fishing grounds and therefore could more closely match target catch and IBQ. Differences in effort among the IFQ bottom trawl fleet between 2011 and 2012 were relatively minor as the number of vessels, number of tows and number of hours spent towing was very similar in the two years (Figure 5).

Despite the increase from 2011, the 2012 IFQ estimated P. halibut discard mortality (all gears) remains 76% less than the estimated discard mortality from the 2010 LE bottom trawl fishery (Figure ES1) and 80% less than the 2002-2010 LE bottom trawl average. There are at least two possible explanations for this drop. First, IBQs for P. halibut might have increased fisher incentives to avoid P. halibut bycatch and thereby changed fisher behavior (i.e., fish different grounds or gear than in past). Second, testing of gear to exclude P.halibut from the catch became general practice in much of the 2012 trawl fleet, which enabled fishermen to increase fishing activity without additional risk to quota.

Estimated bycatch weight of P. halibut (0.6 mt) from the at-sea hake component of the 2012 IFQ fishery was similar to the 2011 value and low relative to the majority of prior years' reported (Table 22). At-sea hake sectors reported a range of P. halibut bycatch weight from 0.3 to 4 mt during the period from 2002 to 2012.

Non-Nearshore Fixed Gear Fishery

From 2011 to 2012, estimated discard mortality of Pacific halibut in the LE sablefish endorsed season longline sector decreased in the area north of Point Chehalis, WA but increased south of Point Chehalis (Table 15). During 2012, fleet-wide landings of sablefish and the observed discard ratio decreased relative to 2011 north of Point Chehalis (Table 13). South of Point Chehalis, 2012 also saw a drop in fleet-wide landings but an increase in the discard ratio relative to 2011 values (Table 13), indicating that fishing effort by the LE sablefish endorsed longline sector might have been lower in 2012 but encounter rates higher, relative to 2011 in this area. Decreased P. halibut discard mortality north of Point Chehalis and increased mortality south of Point Chehalis led to a 2012 coast-wide estimate very close to the 2011 coast-wide estimate for this sector (Table 15 & Figure 3). Gross estimated discard of P. halibut from LE sablefish endorsed season pot gear was on par with recent years (Table 15).

Discard of Pacific halibut among the non-sablefish endorsed fixed gear sectors (LE and OA) during 2012 deviated from previous years, a pattern first noticed in 2011. In 2012, estimated

discard mortality in the LE non-sablefish endorsed longline sector continued to be elevated relative to the annual estimates during the 2002-2010 time period (Table 15). The estimated discard mortality for OA fixed gear vessels fishing with hook-&-line gears in 2012 was within the historic range for this sector (3.9 mt; Table 15).

A large source of uncertainty in our estimates of Pacific halibut discard mortality on non-nearshore fixed gear vessels is the actual discard mortality rate applied to initial gross estimates. A small sample size of observed viability data are available from sablefish vessels fishing with pots, but not enough to be used in discard mortality estimation. Instead, we relied on findings from observed pot vessels in Alaska that assign specimens to the same condition codes used for trawl gear and then apply the discard mortality rates assumed by Williams (2008). This informed our decision to increase the discard mortality rate applied to pot estimates to 18% from 16%. As more viability information is collected by WCGOP observers from pot vessels, we intend to apply this directly to compute discard mortality in a manner consistent with the methods of Williams (2008).

Just as for trawl gear, discard mortality rates have been determined experimentally for Pacific halibut caught with longline gear (Kaimmer and Trumble 1998, Trumble et al. 2000). To apply these rates, Pacific halibut caught on longlines are assigned to one of four condition categories (minor, moderate, severe, and dead) based on the extent of their injuries at the time of release. Kaimmer and Trumble (1998) derived discard mortality rates for each of these categories using mark-recapture data. Their rates were later updated by Trumble et al. (2000) to account for hook sizes that are more consistent with gear used on the U.S. west coast for commercial purposes.

For reasons described earlier, Pacific halibut were infrequently brought on-board observed fixed gear vessels from 2002 to 2010, resulting in a small and potentially biased sample of viability data. Mortality rates specified by Trumble et al. (2000) cannot therefore be used in conjunction with these data to assess overall discard mortality. However, changes were implemented in the 2011 WCGOP data collection protocol that allowed observers on fixed gear vessels to collect a random sample of Pacific halibut from which to gather viability data. Sample sizes remain low but data collection continues. In the interim, discard mortality rates of 16% for longline gear and 18% for pot gear (Williams 2008) are thought to be the best option currently available.

Other Fisheries

Very small amounts of Pacific halibut bycatch were observed in other observed fisheries. Even without the application of discard mortality rates, bycatch estimates for the nearshore groundfish fixed gear sector, pink shrimp trawl fishery, and the OA sector of the California halibut trawl fishery made up a minor portion of the total mortality estimate for Pacific halibut. Discard estimates of P. halibut for these sectors provided in Tables 19, 20, and 21 are not intended to represent mortality values, as discard mortality rates for these sectors are not available.

SUMMARY & CONCLUSIONS

IFQ Fishery

- Estimated P. halibut discard mortality from the entire 2012 IFQ fishery represents a 30% increase from 2011, but is still 76% lower than the 2010 LE bottom trawl fishery estimate.
- The increase from 2011 to 2012 does not appear to be related to effort as measured by number of vessels, tows, or hours towed. Rather, the increase in effort appears to be primarily related to the increased discard in the bottom trawl vessels fishing north of 40°10´ N. latitude.
- P. halibut discard from the at-sea Pacific hake fishery in 2012 was nearly the same as in 2011.

Non-IFQ Fisheries

- The 2012 estimate of P. halibut mortality in the LE non-sablefish endorsed longline sector remains higher than historic (2002-2010) averages. The 2012 OA fixed gear longline sector exhibited an increase in estimated P. halibut mortality relative to the 2011estimate, but remains on the low end of the historic range.
- Estimated P. halibut mortality in all other non-IFQ observed sectors/fisheries are within the range observed in previous years.

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Table 4. Number of vessels, trips, and tows/sets observed and metric tons of discarded Pacific halibut sampled in the IFQ fishery by gear type fished. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). (*) Confidential data, (--) not applicable.

								Unsampled categories from partially sampled hauls			Coverage rate	
Area												
Depth (fm)			No. sampled tows	No. unsampled tows	Sampled tow hours	Unsampled tow hours	P. halibut discard (mt)				% tows sampled	% tow hours sampled
Year	No. of vessels	No. of trips						IFQFF	IFQM	Non-IFQ		
North of Pt. Chehalis												
0-60												
2011	13	46	303	0	836	0	7.36	1	4	8	100%	100%
2012	13	65	316	5	704	7	4.77	0	0	1	98.4%	99.0%
> 60												
2011	22	146	1108	2	4269	12	21.65	1	5	48	100%	100%
2012	19	168	1338	3	5142	14	30.22	0	13	30	100%	100%
40° 10' to Pt. Chehalis												
0-60												
2011	20	137	1115	12	2129	24	10.48	9	2	33	98.9%	98.9%
2012	21	154	975	8	1943	19	7.72	1	3	14	99.2%	99.1%
> 60												
2011	56	754	5097	25	26486	133	22.02	5	13	133	100%	99.5%
2012	54	710	4540	24	23695	91	19.83	2	17	111	99.5%	100%
South of 40° 10' N Lat												
0-60												
2011	3	23	66	0	164	0	0.17	3	0	1	100%	100%
2012	*	*	*	*	*	*	*	*	*	*	*	*
> 60												
2011	15	241	1373	3	5983	12	0.16	3	0	34	100%	100%
2012	13	255	1645	3	6215	4	0.81	1	1	66	100%	100%
LE California Halibut												
South of 40° 10' N Lat												
2011	3	63	157	0	513	0	0.00	0	0	2	100%	100%
2012	*	*	*	*	*	*	*	*	*	*	*	*

Table 4. continued

Midwater Trawl												

Area	No. of vessels	No. of trips	No. sampled tows	No. unsampled tows	Sampled tow hours	Unsampled tow hours	P. halibut discard (mt)	Unsampled categories from partially sampled hauls			Coverage rate	
Year								IFQFF	IFQM	Non-IFQ	% tows sampled	% tow hours sampled
Non-hake Shoreside												
North of 40° 10' N Lat												
2011	*	*	*	*	*	*	*	*	*	*	*	*
2012	6	11	37	0	112	0	0.05	0	0	0	100%	100%
Shoreside Hake												
North of 40° 10' N Lat												
2011	26	913	1701	0	3940	0	0.03	0	0	2	100%	100%
2012	24	713	1562	0	5900	0	0.00	0	0	3	100%	100%

Hook-and-Line											

Area	No. of vessels	No. of trips	No. sampled sets	No. unsampled sets	Sampled tow hours	Unsampled tow hours	P. halibut discard (mt)	Unsampled categories from partially sampled sets			Coverage rate
Year								IFQFF	IFQM	Non-IFQ	% sets sampled
North of 40° 10' N Lat											
2011	6	21	410	1	--	--	6.06	0	0	0	100%
2012	6	22	486	0	--	--	14.66	0	0	0	100%
South of 40° 10' N Lat											
2011	6	71	212	0	--	--	0.00	0	0	1	100%
2012	*	*	*	*	--	--	*	*	*	*	*

Pot											

Area	No. of vessels	No. of trips	No. sampled sets	No. unsampled sets	Sampled tow hours	Unsampled tow hours	P. halibut discard (mt)	Unsampled categories from partially sampled sets			Coverage rate
Year								IFQFF	IFQM	Non-IFQ	% sets sampled
North of Pt. Chehalis											
2011	3	12	63	0	--	--	1.03	0	0	0	100%
2012	5	45	419	0	--	--	1.27	0	0	7	100%
40° 10' to Pt. Chehalis											
2011	8	75	714	2	--	--	2.30	0	0	1	100%
2012	9	60	468	0	--	--	0.62	0	0	0	100%
South of 40° 10' N Lat				--	--						
2011	11	148	738	0	--	--	0.00	0	0	2	100%
2012	13	167	814	0	--	--	0.00	0	0	1	100%

Table 5. Values used to calculate the expanded weight (mt) of Pacific halibut (PHLB) from each unsampled category in the U.S. west coast groundfish IFQ fishery by year. 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, as a function of gear or sector, depth (bottom trawl only), management area, and area north or south of Point Chehalis, WA. The sum of expanded discard weight (mt) is the sum of the estimated gross P. halibut discard across categories. 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.

Bottom Trawl																			
Area Depth (fm) Year	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																			
0-60																			
2011	57.91	0.13	0.14	0.02	77.70	0.10	3.86	0.37	59.76	0.00	2.27	0.00	137.46	0.05	0.00	0.00	0.39	7.44	7.82
2012	50.47	0.09	0.00	0.00	55.83	0.09	0.00	0.00	46.28	0.00	0.09	0.00	102.11	0.05	0.56	0.03	0.03	4.77	4.80
> 60																			
2011	114.66	0.20	0.45	0.09	142.74	0.16	0.84	0.13	222.18	0.00	3.19	0.00	364.92	0.06	0.10	0.01	0.23	22.47	22.70
2012	91.37	0.43	0.00	0.00	129.32	0.31	1.48	0.45	281.81	0.00	4.70	0.00	411.36	0.10	12.10	1.16	1.61	39.48	41.10
40° 10' to Pt. Chehalis																			
0-60																			
2011	95.13	0.11	0.61	0.07	116.15	0.09	2.40	0.22	179.69	0.00	5.03	0.00	295.85	0.04	3.77	0.14	0.42	10.66	11.09
2012	70.72	0.11	0.28	0.03	84.05	0.09	0.85	0.08	144.43	0.00	1.07	0.00	228.48	0.03	1.95	0.07	0.17	7.72	7.89
> 60																			
2011	179.40	0.12	0.78	0.10	338.71	0.07	3.77	0.25	733.54	0.00	12.08	0.00	1072.25	0.02	6.38	0.13	0.47	22.06	22.53
2012	175.83	0.11	0.06	0.01	360.01	0.06	6.42	0.35	626.75	0.00	8.29	0.00	986.76	0.02	6.63	0.13	0.49	19.85	20.34
South of 40° 10' N Lat																			
0-60																			
2011	4.60	0.00	0.04	0.00	5.04	0.00	0.00	0.00	11.59	0.01	0.01	0.00	16.63	0.01	0.00	0.00	0.00	0.17	0.17
2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
> 60																			
2011	154.90	0.00	0.10	0.00	270.17	0.00	0.00	0.00	216.59	0.00	2.86	0.00	486.76	0.00	1.36	0.00	0.00	0.16	0.16
2012	75.94	0.00	0.01	0.00	255.67	0.00	0.03	0.00	214.71	0.00	7.08	0.03	470.38	0.00	1.93	0.00	0.03	0.81	0.84
LE California Halibut																			
South of 40° 10' N Lat																			
2011	0.73	0.00	0.00	0.00	0.74	0.00	0.00	0.00	74.19	0.00	0.01	0.00	74.93	0.00	0.00	0.00	0.00	0.00	0.00
2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 5. continued

Midwater Trawl

Area / Year	IFQ Flatfish Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Mixed IFQ Species Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Non-IFQ Species Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	All Species (IFQ & Non-IFQ) Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Sum of Exp. Discard Weight	Sampled Discarded PHLB	Total Discard
Non-hake Shoreside																			
North of 40° 10' N Lat																			
2011	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2012	0.05	0.97	0.00	0.00	0.29	0.18	0.00	0.00	0.53	0.00	0.00	0.00	0.82	0.06	0.00	0.00	0.00	0.05	0.05
Shoreside Hake																			
North of 40° 10' N Lat																			
2011	0.03	0.99	0.00	0.00	521.49	0.00	0.00	0.00	3.39	0.00	1.37	0.00	524.88	0.00	0.00	0.00	0.00	0.03	0.03
2012	0.00	0.00	0.00	0.00	128.31	0.00	0.00	0.00	8.19	0.00	0.36	0.00	136.50	0.00	0.00	0.00	0.00	0.00	0.00

Hook-and-Line

Area / Year	IFQ Flatfish Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Mixed IFQ Species Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Non-IFQ Species Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	All Species (IFQ & Non-IFQ) Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Sum of Exp. Discard Weight	Sampled Discarded PHLB	Total Discard
North of 40° 10' N Lat																			
2011	7.18	0.84	0.00	0.00	22.02	0.28	0.00	0.00	56.65	0.00	0.00	0.00	78.67	0.08	0.00	0.00	0.00	6.06	6.06
2012	19.30	0.76	0.00	0.00	36.79	0.40	0.00	0.00	96.49	0.00	0.00	0.00	133.28	0.11	0.00	0.00	0.00	14.66	14.66
South of 40° 10' N Lat																			
2011	0.18	0.00	0.00	0.00	3.70	0.00	0.00	0.00	20.82	0.00	0.00	0.00	24.52	0.00	0.00	0.00	0.00	0.00	0.00
2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Pot

Area / Year	IFQ Flatfish Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Mixed IFQ Species Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Non-IFQ Species Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	All Species (IFQ & Non-IFQ) Sampled Weight	Discard Ratio	Unsampled Weight	Est. Discard	Sum of Exp. Discard Weight	Sampled Discarded PHLB	Total Discard
North of Pt. Chehalis																			
2011	1.05	0.98	0.00	0.00	1.53	0.68	0.00	0.00	0.25	0.00	0.00	0.00	1.78	0.58	0.00	0.00	0.00	1.03	1.03
2012	2.46	0.52	0.00	0.00	9.11	0.14	0.00	0.00	2.26	0.00	0.01	0.00	11.37	0.11	0.00	0.00	0.00	1.27	1.27
40° 10' to Pt. Chehalis																			
2011	2.45	0.94	0.00	0.00	7.95	0.29	0.00	0.00	3.38	0.00	0.00	0.00	11.32	0.20	0.01	0.00	0.00	2.30	2.31
2012	1.22	0.51	0.00	0.00	3.86	0.16	0.00	0.00	6.03	0.00	0.00	0.00	9.88	0.06	0.00	0.00	0.00	0.62	0.62
South of 40° 10' N Lat																			
2011	0.30	0.00	0.00	0.00	6.48	0.00	0.00	0.00	6.88	0.00	0.00	0.00	13.36	0.00	0.00	0.00	0.00	0.00	0.00
2012	0.52	0.00	0.00	0.00	4.22	0.00	0.00	0.00	4.67	0.00	0.00	0.00	8.89	0.00	0.00	0.00	0.00	0.00	0.00

Table 6. Pacific halibut viabilities in the IFQ fishery by gear, depth, area, and year. The condition of sampled Pacific halibut was identified as Excellent (Exc), Poor, or Dead, consistent with IPHC protocol (NWFSC Observer Manual, 2013). The number of fish in each category was weighted based on the length-weight relationship (see Methods). Hook-and-line caught P. halibut viabilities are not currently used for estimating mortality. (*) Confidential data, (--) not applicable.

Bottom Trawl							
Area					**Weighted percentages in each category**		
Depth (fm)		**Number of fish**					
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
North of Pt. Chehalis							
0-60							
2011	517	137	308	962	57%	14%	28%
2012	314	156	299	769	46%	20%	34%
> 60							
2011	1063	439	927	2429	47%	18%	35%
2012	1299	709	1368	3376	40%	21%	39%
40° 10' to Pt. Chehalis							
0-60							
2011	1076	169	199	1444	80%	10%	10%
2012	789	175	228	1192	68%	14%	18%
> 60							
2011	967	554	1188	2709	38%	20%	42%
2012	855	447	1200	2502	36%	17%	47%
South of 40° 10' N Lat							
0-60							
2011	0	0	10	10	0%	0%	100%
2012	*	*	*	*	*	*	*
> 60							
2011	7	1	6	14	48%	6%	46%
2012	35	7	36	78	49%	9%	42%
LE California Halibut							
South of 40° 10' N Lat							
2011	0	0	0	0	--	--	--
2012	*	*	*	*	*	*	*

Midwater Trawl							
Area		**Number of fish**			**Weighted percentages in each category**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
Non-hake Shoreside							
North of 40° 10' N Lat							
2011	*	*	*	*	*	*	*
2012	6	0	2	8	79%	0%	21%
Shoreside Hake							
North of 40° 10' N Lat							
2011	0	1	2	3	0%	46%	54%
2012	0	0	0	0	0%	0%	0%

Table 6. continued

Hook-and-Line							
Area		**Number of fish**			**Weighted percentages in each category**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
North of 40° 10' N Lat							
2011	--	--	--	902	--	--	--
2012	--	--	--	1271	--	--	--
South of 40° 10' N Lat							
2011	--	--	--	0	--	--	--
2012	*	*	*	*	*	*	*

Pot							
Area		**Number of fish**			**Weighted percentages in each category**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
North of Pt. Chehalis							
2011	53	3	19	75	84%	2%	14%
2012	103	21	24	148	66%	17%	17%
40° 10' to Pt. Chehalis							
2011	149	10	65	224	69%	5%	26%
2012	58	4	3	65	87%	8%	5%
South of 40° 10' N Lat							
2011	0	0	0	0	--	--	--
2012	0	0	0	0	--	--	--

Table 7. Estimated gross discard (mt) and discard mortality (mt) of Pacific halibut in IFQ fishery by gear type, depth, area, and year. Estimates were allocated to the three condition categories based on information presented in Table 6. DMR = Discard Mortality Rate. (*) Confidential data, (--) not applicable.

Bottom Trawl									
Area	**Estimate Gross Discard (mt)**				**Estimated Discard Mortality (mt)**				**DMR**
Depth (fm)									
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	m(Total)	
North of Pt. Chehalis									
0-60									
2011	4.48	1.11	2.23	7.82	0.90	0.61	2.00	3.51	45%
2012	2.20	0.97	1.62	4.80	0.44	0.54	1.46	2.44	51%
> 60									
2011	10.61	4.14	7.95	22.70	2.12	2.28	7.15	11.55	51%
2012	16.58	8.56	15.96	41.10	3.32	4.71	14.36	22.39	54%
40° 10' to Pt. Chehalis									
0-60									
2011	8.90	1.06	1.13	11.09	1.78	0.58	1.02	3.38	30%
2012	5.34	1.10	1.45	7.89	1.07	0.60	1.31	2.98	38%
> 60									
2011	8.46	4.56	9.52	22.53	1.69	2.51	8.56	12.76	57%
2012	7.33	3.54	9.47	20.34	1.47	1.95	8.52	11.94	59%
South of 40° 10' N Lat									
0-60									
2011	0.00	0.00	0.17	0.17	0.00	0.00	0.15	0.15	90%
2012	*	*	*	*	*	*	*	*	*
> 60									
2011	0.08	0.01	0.08	0.16	0.02	0.01	0.07	0.09	54%
2012	0.41	0.08	0.35	0.84	0.08	0.04	0.32	0.44	52%
LE California Halibut									
South of 40° 10' N Lat									
2011	--	--	--	0.00	--	--	--	0.00	0%
2012	*	*	*	*	*	*	*	*	*

Midwater Trawl									
Area	**Estimate Gross Discard (mt)**				**Estimated Discard Mortality (mt)**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	m(Total)	
Non-Hake Shoreside									
North of 40° 10' N Lat									
2011	*	*	*	*	*	*	*	*	*
2012	0.04	0.00	0.01	0.05	--	--	--	0.05	100%
Shoreside Hake									
North of 40° 10' N Lat									
2011	0.00	0.01	0.01	0.03	--	--	--	0.03	100%
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%

Table 7. continued

Hook-and-Line									
Area	**Estimate Gross Discard (mt)**				**Estimated Discard Mortality (mt)**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	m(Total)	
North of Pt. Chehalis									
2011	--	--	--	6.06	--	--	--	0.97	16%
2012	--	--	--	14.66	--	--	--	2.34	16%
40° 10' to Pt. Chehalis									
2011	--	--	--	0.00	--	--	--	0.00	0%
2012	*	*	*	*	*	*	*	*	*

Pot									
Area	**Estimate Gross Discard (mt)**				**Estimated Discard Mortality (mt)**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	m(Total)	
North of Pt. Chehalis									
2011	0.86	0.02	0.15	1.03	0.00	0.02	0.15	0.17	16%
2012	0.84	0.21	0.21	1.27	0.00	0.21	0.21	0.43	34%
40° 10' to Pt. Chehalis									
2011	1.59	0.11	0.61	2.31	0.00	0.11	0.61	0.71	31%
2012	0.54	0.05	0.03	0.62	0.00	0.05	0.03	0.08	13%
South of 40° 10' N Lat									
2011	--	--	--	0.00	--	--	--	0.00	0%
2012	--	--	--	0.00	--	--	--	0.00	0%

Table 8. Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (≥ 82 cm) mortality (mt), and percent of legal-sized discard by weight in the IFQ fishery by gear or sector, depth, area and year. (*) Confidential data.

Area Depth (fm) Year	Total discard (mt)	Total discard mortality (mt)	Estimated legal-sized mortality (mt)	Estimated % legal-sized discarded by weight
Bottom Trawl				
North of Pt. Chehalis				
0-60				
2011	7.82	3.51	1.92	55%
2012	4.80	2.44	1.14	47%
> 60				
2011	22.70	11.55	8.15	71%
2012	41.10	22.39	15.49	69%
40° 10' to Pt. Chehalis				
0-60				
2011	11.09	3.38	2.10	62%
2012	7.89	2.98	1.58	53%
> 60				
2011	22.53	12.76	8.79	69%
2012	20.34	11.94	8.43	71%
South of 40° 10' N Lat				
0-60				
2011	0.17	0.15	0.15	100%
2012	*	*	*	*
> 60				
2011	0.16	0.09	0.09	97%
2012	0.84	0.44	0.38	86%
LE California Halibut				
South of 40° 10' N Lat				
2011	0.00	0.00	0.00	0%
2012	*	*	*	*

Area Year	Total bycatch (mt)	Total discard mortality (mt)	Estimated legal-sized mortality (mt)	Estimated % legal-sized discarded by weight
Midwater Trawl				
Non-Hake Shoreside				
North of 40° 10' N Lat				
2011	*	*	*	*
2012	0.05	0.05	0.04	71%
Shoreside Hake				
North of 40° 10' N Lat				
2011	0.03	0.03	0.00	100%
2012	0.00	0.00	0.00	0%

Table 8. continued

Hook-and-Line				
Area Year	Total bycatch (mt)	Total discard mortality (mt)	Estimated legal-sized mortality (mt)	Estimated % legal-sized discarded by weight
North of 40° 10' N Lat				
2011	6.06	0.97	0.43	45%
2012	14.66	2.34	1.81	77%
South of 40° 10' N Lat				
2011	0.00	0.00	0.00	0%
2012	*	*	*	*

Pot				
Area Year	Total bycatch (mt)	Total discard mortality (mt)	Estimated legal-sized mortality (mt)	Estimated % legal-sized discarded by weight
North of Pt. Chehalis				
2011	1.03	0.17	0.13	77%
2012	1.27	0.43	0.34	81%
40° 10' to Pt. Chehalis				
2011	2.31	0.71	0.53	74%
2012	0.62	0.08	0.06	74%
South of 40° 10' N Lat				
2011	0.00	0.00	0.00	0%
2012	0.00	0.00	0.00	0%

Table 9. Pacific halibut bycatch (gross discard, mt) by month for vessels fishing bottom trawl gear in the 2012 IFQ fishery. The number of vessels per area-depth-month stratum do not meet confidentiality requirements; therefore we present monthly estimates.

		IFQ Fishery 2012 - Bottom Trawl	
Month	**Expanded Discard (mt)**	**Sampled Discard (mt)**	**Total Bycatch (mt)**
Jan	0.01	3.77	3.77
Feb	0.02	4.27	4.29
Mar	0.10	6.70	6.80
Apr	0.03	7.99	8.02
May	1.55	8.11	9.65
Jun	0.06	6.10	6.16
Jul	0.14	7.11	7.25
Aug	0.40	6.96	7.36
Sep	0.03	4.03	4.06
Oct	0.00	1.83	1.83
Nov	0.00	2.39	2.39
Dec	0.00	13.62	13.62

Table 10. Pacific halibut length frequencies collected by WCGOP observers during the U.S. west coast groundfish IFQ fishery by gear type, summed across all years. (a) Physical measurement of P. halibut lengths (cm). (b) Visual estimates of P. halibut lengths (cm). Note that there were no physical measurements from vessels fishing with hook-&-line gear. The lower limits on the length intervals are inclusive, while the upper limits are exclusive. Numbers are numbers of individual P. halibut per bin by gear type.

IFQ Fishery 2011-2012

a. Physical measurements

Length bin (cm)	No. of fish caught with		
	Bottom Trawl	Midwater Trawl	Pot
17-22	1	0	0
22-27	1	0	0
27-32	2	0	0
32-37	8	0	0
37-42	13	0	0
42-47	22	0	1
47-52	40	0	0
52-57	85	0	2
57-62	393	0	9
62-67	1208	0	16
67-72	1948	1	31
72-77	2602	1	60
77-82	2217	1	87
82-87	2020	4	111
87-92	1551	1	78
92-97	1198	0	45
97-102	758	0	29
102-107	535	0	11
107-112	372	0	10
112-117	240	0	8
117-122	128	0	4
122-127	73	0	3
127-132	35	0	2
132-137	16	0	2
137-142	8	0	1
142-147	11	0	0
147-152	3	0	0
152-157	1	0	0
157-162	0	0	0
162-167	0	0	0
167-172	0	0	1
172-177	0	0	0
177-182	0	0	0
182-187	0	0	0
187-192	0	0	0
192-197	0	0	0
197-202	0	0	1

b. Visual estimates

Length bin (cm)	No. of fish caught with		
	Bottom Trawl	Pot	Hook and Line
30	0	1	20
40	2	2	101
50	3	1	212
60	4	2	375
70	15	4	427
80	10	11	324
90	8	7	256
100	7	7	179
110	3	1	132
120	7	2	77
130	2	1	29
140	3	0	12
150	2	0	1
160	0	0	1
170	0	0	2
180	0	0	1

Table 11. Number of observed trips, sets, and vessels by year in the non-IFQ fixed gear fisheries, by sector, gear, area, and year.

| | LE Sablefish Endorsed | | | LE Non-Sablefish Endorsed | OA Fixed Gear | |
| | Longline | | | | Hook-and-line gears | |
Year	North of Pt Chehalis	South of Pt Chehalis	Pot	Longline		Pot
	Number of observed trips					
2002	23	47	23	11	0	0
2003	25	25	35	130	41	16
2004	13	35	13	62	42	96
2005	31	73	39	35	34	43
2006	31	34	39	121	10	38
2007	36	40	30	158	50	45
2008	17	60	24	122	58	55
2009	13	34	27	138	68	30
2010	18	127	43	226	69	40
2011	18	84	22	201	68	60
2012	7	86	19	128	34	35
	Number of observed sets					
2002	207	181	247	22	0	0
2003	191	158	362	219	49	50
2004	115	205	139	130	50	185
2005	388	275	491	60	37	50
2006	291	159	288	196	11	39
2007	381	136	154	303	66	72
2008	194	345	329	220	68	74
2009	178	109	67	271	101	45
2010	251	505	314	470	104	69
2011	284	389	227	426	100	84
2012	47	485	351	252	53	70
	Number of observed vessels					
2002	9	18	6	4	0	0
2003	8	8	6	17	13	7
2004	6	13	3	14	14	17
2005	10	18	7	11	10	14
2006	9	10	7	21	7	15
2007	9	14	4	36	25	20
2008	6	13	6	32	33	20
2009	4	6	3	34	33	18
2010	5	20	7	38	37	26
2011	7	20	3	38	40	28
2012	5	16	5	26	24	19

Table 12. Expansion factors and WCGOP observed discard rate by gear type for limited entry (LE) and open access (OA) non-nearshore fixed gear sectors used to expand discard estimates of Pacific halibut to the fleet-wide level.

Fishery		Expansion Factor	Observed Discard Rate Applied	
LE Sablefish Endorsed	Longline Pot	Retained Sablefish	LE Sablefish Endorsed	Longline Pot
LE Non-Sablefish Endorsed	Longline Pot	Retained Groundfish Retained Sablefish	LE Non-Sablefish Endorsed OA Fixed Gear --	Longline Pot
OA Fixed Gear	Hook-and-line Pot	Retained Groundfish	OA Fixed Gear --	Hook-and-line Pot

-- No discard ratio or discard estimate was computed in the OA fixed gear sector for 2002-2006 because the WCGOP only covered OA vessels in California during this time.

Table 13. Total sablefish and groundfish landings (mt) and observed discard ratios for each sector and gear type in the non-nearshore fixed gear fishery. Sablefish landings were used as the discard ratio denominator and expansion factor in all cases except for the limited entry (LE) non-sablefish endorsed and the OA fixed gear sectors, where target species include a variety of groundfish species.

	LE Sablefish Endorsed			LE Non-Sablefish Endorsed		OA Fixed Gear	
	Longline					Hook-and-Line gears	
	North of Pt Chehalis	South of Pt Chehalis	Pot	Longline	Pot		Pot
Expansion factor *(Based on fish tickets)*	*Sablefish landings (mt)*			*Groundfish landings (mt)*	*Sablefish landings (mt)*	*Groundfish landings (mt)*	
2002	384	407	352	625	7	388	109
2003	458	571	604	546	7	548	186
2004	653	653	620	400	11	474	186
2005	586	674	615	553	3	625	379
2006	660	709	582	468	30	495	443
2007	467	605	428	515	2	272	258
2008	394	695	433	642	3	428	241
2009	435	1008	489	808	7	668	373
2010	259	1031	509	1016	17	774	326
2011	223	924	372	1242	24	446	256
2012	200	866	297	795	9	333	126
Observed Pacific halibut discard ratios							
2002	0.33	0.03	0.01	--	--	--	--
2003	0.35	0.05	0.00	0.00	--	--	--
2004	0.24	0.07	0.05	--	--	--	--
2005	0.33	0.02	0.00	--	--	--	--
2006	0.78	0.16	0.03	--	--	--	--
2007	0.22	0.03	0.01	0.00	0.00	0.08	0.00
2008	0.37	0.15	0.02	0.00	0.00	0.10	0.00
2009	0.64	0.04	0.00	0.00	0.00	0.05	0.00
2010	0.26	0.06	0.01	0.00	0.00	0.04	0.00
2011	0.48	0.03	0.01	0.02	0.00	0.03	0.00
2012	0.45	0.06	0.02	0.02	0.00	0.07	0.00

-- No discard ratio is provided for the OA fixed gear sector for 2002-2006 because the WCGOP only covered OA vessels in California during this time.

Because 2007-2008 OA pot discard rates were used to estimate LE non-endorsed discard, discard ratios for this sector-gear were excluded.

Table 14. Summary of the percent of observed trips that caught Pacific halibut by sector, gear, and area (where applicable). Observed average, minimum and maximum annual catch and annual discard weights are also provided, along with the percent of Pacific halibut catch weight that was discarded by year.

	LE Sablefish Endorsed			LE Non-Sablefish Endorsed		OA Fixed Gear	
	Longline					Hook-and-Line Gears	
	North of Pt Chehalis	South of Pt Chehalis	Pot	Longline	Pot		Pot
% of observed trips that caught Pacific halibut							
2002	95.7%	46.8%	17.4%	0%	--	0%	0%
2003	100%	52.0%	8.6%	0.8%	--	0%	0%
2004	100%	71.4%	38.5%	0%	--	0%	0%
2005	96.8%	58.9%	33.3%	0%	--	0%	0%
2006	100%	76.5%	56.4%	0%	--	10.0%	0%
2007	94.4%	47.5%	33.3%	1.9%	--	26.0%	6.7%
2008	100%	78.3%	83.3%	3.3%	--	34.5%	5.5%
2009	84.6%	35.3%	33.3%	0.7%	--	38.2%	10.0%
2010	83.3%	47.2%	51.2%	1.3%	--	21.7%	2.5%
2011	88.9%	42.9%	45.5%	6.0%	--	30.9%	6.7%
2012	71.4%	58.1%	31.6%	7.0%	--	32.4%	8.6%
Observed annual catch (mt) of Pacific halibut							
Mean	42.8	11.8	2.0	0.3	--	0.9	0.0
Min	8.3	2.3	0.1	0.0	--	0.1	0.0
Max	118.4	36.6	5.4	1.4	--	1.6	0.0
Observed annual discard (mt) of Pacific halibut							
Mean	37.2	11.7	2.0	0.3	--	0.9	0.0
Min	8.0	2.3	0.1	0.0	--	0.1	0.0
Max	109.6	36.6	5.4	1.4	--	1.6	0.0
% of Pacific halibut catch that was discarded							
2002	77.6%	95.5%	100%	n.o.c.	--	n.o.c.	n.o.c.
2003	80.1%	99.4%	100%	100%	--	n.o.c.	n.o.c.
2004	76.3%	97.3%	100%	n.o.c.	--	n.o.c.	n.o.c.
2005	82.7%	100.0%	100%	n.o.c.	--	n.o.c.	n.o.c.
2006	92.6%	97.5%	100%	n.o.c.	--	100%	n.o.c.
2007	78.0%	100%	100%	100%	--	100%	100%
2008	87.4%	100%	100%	100%	--	100%	100%
2009	100%	100%	100%	100%	--	100%	100%
2010	100%	100%	100%	100%	--	100%	100%
2011	100%	100%	100%	100%	--	100%	100%
2012	96.6%	100%	100%	100%	--	100%	100%

n.o.c. No observed catch of Pacific halibut and thus a % discarded calculation is not possible.

-- No WCGOP observers were deployed for the sector/year/gear type combination.

Table 15. Estimated gross discard (mt) and discard mortality (mt) in the limited entry (LE) sablefish endorsed, LE non-sablefish endorsed, and open access (OA) fixed gear sectors. Estimated discard mortality (mt) was computed by applying a 16% (longline) or 18% (pot) discard mortality rate (DMR) to gross discard estimates. Discard estimates were not initially computed for the 2002 - 2006 OA fixed gear sector because the WCGOP only observed OA fixed gear vessels off of California. To estimate 2002-2006 values, a combined discard rate from the first 2 years of coastwide observation (2007-08) was applied to the 2002-06 period. The results of assuming the 2007-2008 discard rate are shown in brackets.

	LE Sablefish Endorsed				LE Non-Sablefish Endorsed		OA Fixed Gear	
	Longline			Pot	Longline	Pot	Hook-and-Line	Pot
	North of Pt Chehalis	South of Pt Chehalis	Coastwide	Coastwide	Coastwide	Coastwide	Coastwide	Coastwide
Year				**Gross Discard Estimate (mt)**				
2002	126.6	11.5	138.1	4.0	0.0	‡ [0.0]	‡ [35.2]	‡ [0.2]
2003	161.7	26.7	188.4	0.3	0.2	‡ [0.0]	‡ [49.8]	‡ [0.4]
2004	154.7	48.7	203.4	32.6	0.0	‡ [0.0]	‡ [43.1]	‡ [0.4]
2005	194.4	13.8	208.1	2.6	0.0	‡ [0.0]	‡ [56.7]	‡ [0.8]
2006	516.8	116.0	632.8	15.8	0.0	‡ [0.1]	‡ [44.9]	‡ [0.9]
2007	102.0	20.1	122.2	3.9	1.7	0.00	21.4	0.89
2008	146.3	105.8	252.1	6.6	2.9	0.00	42.2	0.23
2009	280.2	41.6	321.8	0.9	0.3	0.00	36.4	0.27
2010	68.5	65.7	134.3	5.3	0.4	0.00	32.8	0.51
2011	106.6	26.0	132.6	4.1	21.4	0.00	13.6	0.06
2012	90.6	54.4	145.0	6.2	15.8	0.00	24.4	0.41
				Estimated Discard Mortality (mt)				
Year	DMR 16%	DMR 16%	DMR 16%	DMR 18%	DMR 16%	DMR 18%	DMR 16%	DMR 18%
2002	20.3	1.8	22.1	0.7	0.0	-- ‡	-- ‡	-- ‡
2003	25.9	4.3	30.1	0.1	0.0	-- ‡	-- ‡	-- ‡
2004	24.8	7.8	32.5	5.9	0.0	-- ‡	-- ‡	-- ‡
2005	31.1	2.2	33.3	0.5	0.0	-- ‡	-- ‡	-- ‡
2006	82.7	18.6	101.2	2.8	0.0	-- ‡	-- ‡	-- ‡
2007	16.3	3.2	19.5	0.7	0.3	0.00	3.4	0.11
2008	23.4	16.9	40.3	1.2	0.5	0.00	6.8	0.04
2009	44.8	6.7	51.5	0.2	0.0	0.00	5.8	0.05
2010	11.0	10.5	21.5	1.0	0.1	0.00	5.3	0.09
2011	17.1	4.2	21.2	0.7	3.4	0.00	2.2	0.02
2012	14.5	8.7	23.2	1.1	2.5	0.00	3.9	0.07

‡ The LE non-sablefish endorsed pot sector has not been observed by the WCGOP and therefore estimates are based on discard rates from observed OA fixed gear pot vessels. Because the OA fixed gear pot sector was only observed on a coastwide basis in 2007 and 2008, estimates for LE non-sablefish endorsed pot are only available in these years as well.

Table 16. Estimated discard mortality (mt) from each sector of the non-nearshore fixed gear fishery, by year.

	Estimated discard mortality (mt)			
	LE Sablefish Endorsed	LE Non-Sablefish Endorsed	OA Fixed Gear	All Sectors
2002	22.83	0.00	0.00	22.83
2003	30.19	0.03	0.00	30.22
2004	38.42	0.00	0.00	38.42
2005	33.77	0.00	0.00	33.77
2006	104.08	0.00	0.00	104.08
2007	20.25	0.28	3.58	24.11
2008	41.53	0.47	6.79	48.80
2009	51.65	0.04	5.87	57.56
2010	22.44	0.06	5.34	27.85
2011	21.95	3.42	2.19	27.55
2012	24.32	2.53	3.98	30.83

Table 17. Pacific halibut length frequencies collected by WCGOP observers in the LE sablefish endorsed, LE sablefish non-endorsed, and OA fixed gear fisheries, including both pot and longline gears (2002-to present). (a) Physical measures of P. halibut lengths (cm). (b) Visual estimates of P. halibut lengths (cm). Note that observers were only required to collect physical measurements from LE sablefish endorsed vessels starting in 2011. The lower limits on the length intervals are inclusive, while the upper limits are exclusive. Numbers are numbers of individual P. halibut per bin.

Fixed Gear Sectors 2002-2012

a. Physical measurements

Length bin (cm)	No. of fish caught with	
	Hook-and-Line	Pot
LE Endorsed		
42-47	2	0
47-52	7	0
52-57	9	0
57-62	22	5
62-67	59	10
67-72	135	33
72-77	234	87
77-82	263	86
82-87	210	82
87-92	191	51
92-97	173	36
97-102	118	15
102-107	70	7
107-112	41	3
112-117	32	2
117-122	17	1
122-127	8	5
127-132	1	1
132-137	3	0
137-142	1	0
142-147	0	1
LE Non-endorsed		
67-72	4	0
72-77	10	0
77-82	11	0
82-87	7	0
87-92	14	0
92-97	8	0
97-102	3	0
102-107	4	0
107-112	3	0
112-117	3	0
117-122	2	0
122-127	1	0
132-137	1	0
OA Fixed Gear		
42-47	2	0
47-52	1	0
52-57	1	0
57-62	2	0
62-67	8	1
67-72	6	2
72-77	16	2
77-82	15	1
82-87	20	1
87-92	14	2
92-97	9	0
97-102	7	0
102-107	4	0
107-112	6	1
112-117	1	0
117-122	1	0
122-127	1	0

b. Visual estimates

Length bin (cm)	No. of fish caught with	
	Hook-and-Line	Pot
LE Endorsed		
20	0	0
30	21	0
40	56	1
50	303	5
60	2950	43
70	4946	104
80	5312	76
90	4228	71
100	2290	35
110	808	16
120	338	9
130	104	2
140	21	3
150	5	0
160	1	0
170	0	0
LE Non-endorsed		
50	2	0
60	11	0
70	29	0
80	36	0
90	22	0
100	14	0
110	8	0
120	9	0
130	4	0
OA Fixed Gear		
40	2	0
50	2	0
60	13	0
70	25	0
80	48	0
90	28	0
100	13	0
110	5	0
120	1	0
130	1	0

Table 18. Pacific halibut physically measured lengths and visual estimates of lengths approximating legal (> 82 cm) versus sublegal definitions (IPHC), collected by the WCGOP in the LE sablefish endorsed, LE non-endorsed, and OA fixed gear sectors (2002-present).

	Pacific halibut lengths	
	Number	Percentage
Physical length		
< 82 cm	952	47%
≥ 82 cm	1069	53%
Visual estimate		
0 - 74 cm	8482	39%
75 - 84 cm	5435	25%
85 - 150 cm	8021	37%

Table 19. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the nearshore fixed gear groundfish fisheries by state and year. The WCGOP began observing the California nearshore fishery in 2003 and the Oregon nearshore fishery in 2004. Bycatch estimates in this table are not intended to represent mortality values, as discard mortality rates are not available for the nearshore fixed gear fishery.

		Observed						Total fleet catch of nearshore species (mt)	Estimated		
	Fleet observer coverage rate‡	Number of observed sets	% of sets with Pacific halibut	Pacific halibut bycatch (mt)	Nearshore species retained (mt)	Pacific halibut bycatch rate	SE		Pacific halibut bycatch (mt)	Lower bound (mt)	Upper bound (mt)
Nearshore fixed gear groundfish fisheries											
Oregon											
2002 *not observed*	--	--	--	--	--	--	--	279	--	--	--
2003 *not observed*	--	--	--	--	--	--	--	208	--	--	--
2004	4.9%	207	1.9%	0.05	10	0.0048	0.0027	210	1.005	0.002	2.121
2005	6.3%	167	0.6%	0.03	11	0.0028	0.0028	181	0.514	0.002	1.521
2006	11.6%	379	1.3%	0.06	19	0.0032	0.0016	168	0.543	0.005	1.081
2007	8.9%	242	0.4%	0.01	16	0.0005	0.0005	182	0.087	0.002	0.259
2008	7.6%	183	0.5%	0.03	14	0.0019	0.0019	189	0.360	0.002	1.067
2009	6.2%	219	2.3%	0.08	14	0.0058	0.0028	224	1.298	0.060	2.536
2010	7.7%	210	0.5%	0.01	13	0.0005	0.0005	173	0.080	0.002	0.236
2011	8.1%	244	2.0%	0.09	16	0.0056	0.0031	195	1.102	0.002	2.278
2012	10.4%	287	1.4%	0.11	21	0.0055	0.0033	197	1.080	0.002	2.367
California											
2002 *not observed*	--	--	--	--	--	--	--	380	--	--	--
2003	3.2%	205	0.0%	0.00	8	0.0000	0.0000	255	0.000	0.000	0.000
2004	8.0%	422	0.0%	0.00	23	0.0000	0.0000	288	0.000	0.000	0.000
2005	4.8%	219	0.9%	0.08	13	0.0060	0.0054	280	1.672	0.003	4.604
2006	3.2%	158	0.0%	0.00	8	0.0000	0.0000	258	0.000	0.000	0.000
2007	4.4%	224	0.0%	0.00	12	0.0000	0.0000	273	0.000	0.000	0.000
2008	2.2%	87	0.0%	0.00	7	0.0000	0.0000	294	0.000	0.000	0.000
2009	2.6%	122	0.0%	0.00	7	0.0000	0.0000	260	0.000	0.000	0.000
2010	3.2%	117	0.0%	0.00	7	0.0000	0.0000	219	0.000	0.000	0.000
2011	3.9%	210	0.5%	0.08	8	0.0092	0.0092	216	1.981	0.002	5.862
2012	6.1%	241	1.2%	0.07	12	0.0058	0.0042	200	1.160	0.002	2.790

‡ Coverage rate in the nearshore sector is defined as the proportion of nearshore target species landings that were observed. Nearshore target species are listed in Appendix D.

Table 20. Coverage information, bycatch rates, and bycatch estimates (mt) for Pacific halibut in the pink shrimp trawl fishery. The WCGOP began observing the pink shrimp fishery in 2004, but was not able to observe the fishery in 2006. Bycatch estimates in this table are not intended to represent morality values, as discard mortality rates are not available for the pink shrimp fishery.

	Observed								Estimated		
	Fleet observer coverage rate‡	Number of observed tows	% of tows with Pacific halibut	Pacific halibut bycatch (mt)	Pink shrimp retained (mt)	Pacific halibut bycatch rate	SE	Total fleet catch of pink shrimp (mt)	Pacific halibut bycatch (mt)	Lower bound (mt)	Upper bound (mt)
Pink shrimp trawl fishery											
2002	*not observed*	-	-	-	-	-	-	25,338	-	-	-
2003	*not observed*	-	-	-	-	-	-	13,887	-	-	-
2004	6.5%	1027	0.0%	0.00	583,911	0.00000		8,974	0.00	0.00	0.00
2005	3.9%	509	0.2%	2.27	424,683	0.00001	0.00001	10,862	0.06	0.11	0.17
2006	*not observed*	-	-	-	-	-	-	8,400	-	-	-
2007	6.2%	951	0.2%	15.26	672,663	0.00002	0.00002	10,935	0.25	0.11	0.65
2008	5.2%	840	0.0%	0.00	805,763	0.00000	0.00000	15,375	0.00	0.00	0.00
2009	6.1%	708	0.0%	0.00	881,553	0.00000	0.00000	14,412	0.00	0.00	0.00
2010	11.7%	1654	0.0%	0.00	2,383,305	0.00000	0.00000	20,357	0.00	0.00	0.00
2011	13.9%	2579	0.1%	26.99	4,103,755	0.00001	0.00000	29,460	0.19	0.29	0.43
2012	13.6%	2731	0.0%	0.00	3,987,160	0.00000	0.00000	29,325	0.00	0.00	0.00

‡ Coverage rate in the pink shrimp trawl fishery is defined as the proportion of pink shrimp landings that were observed.

Table 21. Coverage information, bycatch rates, and bycatch estimates (mt) for Pacific halibut in the California halibut trawl fishery. The fishery is comprised of a limited entry component and an open access component. Beginning in 2011, the limited entry component of the California halibut fishery is observed under the IFQ groundfish fishery (see above). Bycatch estimates in this table are not intended to represent morality values, as discard mortality rates are not available for the California halibut fishery.

	Observed						Estimated			
	Fleet observer coverage rate‡	Number of observed tows	% of tows with Pacific halibut	Pacific halibut bycatch (mt)	California halibut retained (mt)	Pacific halibut bycatch rate	SE	Total fleet catch of California halibut (mt)	Pacific halibut bycatch (mt)	Lower bound (mt)	Upper bound (mt)
California halibut trawl fishery											
Limited Entry Sector											
2002	3.4%	52	0.0%	0.000	3.59	0.0000	0.0000	105	0.000	0.000	0.000
2003	18.1%	206	0.0%	0.000	19.10	0.0000	0.0000	106	0.000	0.000	0.000
2004	23.1%	170	0.6%	0.003	31.49	0.0001	0.0001	136	0.015	0.001	0.045
2005	16.2%	233	0.4%	0.005	30.51	0.0002	0.0002	189	0.029	0.002	0.086
2006	12.0%	224	0.9%	0.003	14.29	0.0002	0.0002	120	0.024	0.001	0.062
2007	13.9%	80	1.3%	0.008	5.45	0.0015	0.0015	39	0.058	0.000	0.173
2008	24.7%	118	8.5%	0.083	9.64	0.0086	0.0030	39	0.334	0.107	0.560
2009	6.0%	29	0.0%	0.000	2.90	0.0000	0.0000	48	0.000	0.000	0.000
2010	11.7%	41	0.0%	0.000	6.40	0.0000	0.0000	55	0.000	0.000	0.000
2011 2012					Observed under IFQ Fishery, see Tables 1 & 2						
Open Access Sector											
2002 *not observed*				-	-	-	-	36	-	-	-
2003	7.7%	110	0.0%	0.0	1.98	0.0000	0.0000	26	0.000	0.000	0.000
2004	7.2%	244	1.6%	0.0	5.10	0.0097	0.0058	71	0.686	0.001	1.494
2005	11.6%	360	0.0%	0.0	7.49	0.0000	0.0000	65	0.000	0.000	0.000
2006 *not observed*				-	-	-	-	55	-	-	-
2007	6.9%	226	0.0%	0.0	2.69	0.0000	0.0000	39	0.000	0.000	0.000
2008	5.1%	197	0.0%	0.0	2.61	0.0000	0.0000	51	0.000	0.000	0.000
2009	0.8%	30	0.0%	0.0	0.63	0.0000	0.0000	82	0.000	0.000	0.000
2010	3.4%	111	0.0%	0.0	2.35	0.0000	0.0000	69	0.000	0.000	0.000
2011	15.6%	204	0.0%	0.0	12.45	0.0000	0.0000	80	0.000	0.000	0.000
2012	6.3%	77	0.0%	0.0	3.54	0.0000	0.0000	56	0.000	0.000	0.000

‡Coverage rate in the California halibut trawl fishery is defined as the proportion of California halibut landings that were observed.

Table 22. Discard estimates for all fishery sectors observed by the NWFSC Groundfish Observer Program (WCGOP), 2002-2012. Total discard mortality estimates are also provided where discard mortality rates were applied. (*) Confidential data.

	Year	LE bottom trawl (2002-2010)	IFQ fishery (2011 - Present)						Non-nearshore fixed gear			Nearshore fixed gear[1]	Pink shrimp[1]	CA halibut‡[1]	At-sea hake[1]	Total
			Shoreside hake[1]	LE CA halibut[1]	Bottom trawl	Midwater trawl[1]	Hook-and-Line	Pot	LE endorsed	LE non-endorsed	OA					
Gross discard estimates (mt)	2002	524							142.16	0.00	-	-	-	-	1.1	668
	2003	187							188.67	0.17	-	0.000	-	0.000	2.7	378
	2004	212							236.02	0.00	-	1.005	0.000	0.701	1.1	451
	2005	460							210.73	0.00	-	2.186	0.058	0.029	2.0	675
	2006	391							648.55	0.00	-	0.543	-	-	0.8	1041
	2007	294							126.10	1.72	22.25	0.087	0.248	0.058	1.2	446
	2008	305							258.75	2.94	42.42	0.360	0.000	0.334	4.0	614
	2009	385							322.70	0.26	36.64	1.298	0.000	0.000	0.3	746
	2010	265							139.59	0.37	33.33	0.080	0.000	0.000	1.6	440
	2011		0.0	0.0	64.5	*	6.1	3.3	136.68	21.35	13.65	3.082	0.194	0.000	0.6	249
	2012		0.0	*	75.2	0.1	14.7	1.9	151.25	15.78	24.80	2.240	0.000	0.000	0.6	287
Total discard mortality (mt)	2002	345							22.83	0.00	-	-	-	-	1.1	369
	2003	124							30.19	0.03	-	0.000	-	0.000	2.7	157
	2004	133							38.42	0.00	-	1.005	0.000	0.701	1.1	174
	2005	287							33.77	0.00	-	2.186	0.058	0.029	2.0	325
	2006	242							104.08	0.00	-	0.543	-	-	0.8	348
	2007	209							20.25	0.28	3.58	0.087	0.248	0.058	1.2	234
	2008	208							41.53	0.47	6.79	0.360	0.000	0.334	4.0	261
	2009	251							51.65	0.04	5.87	1.298	0.000	0.000	0.3	310
	2010	181							22.44	0.06	5.34	0.080	0.000	0.000	1.6	210
	2011		0.03	0.0	31.4	*	1.0	0.9	21.95	3.42	2.19	3.082	0.194	0.000	0.6	65
	2012		0.00	*	40.4	0.1	2.3	0.5	24.32	2.53	3.98	2.240	0.000	0.000	0.6	77

‡ Since 2011, CA Halibut only includes Open Access sector because the Limited Entry sector is covered under the IFQ Fishery.

"- " Indicates years of incomplete or no observer coverage for which estimates are not available

[1] Mortality rate of 100% applied.

FIGURES

Figure 1. Fish ticket data processing for division into 2012 groundfish fishery sectors after retrieval from the Pacific Fisheries Information Network (PacFIN) database. Grey boxes indicate sectors for which federal observer data is available. Fish ticket processing methods are updated regularly, thus this figure might differ from similar figures in previous reports.

Fish Ticket Processing
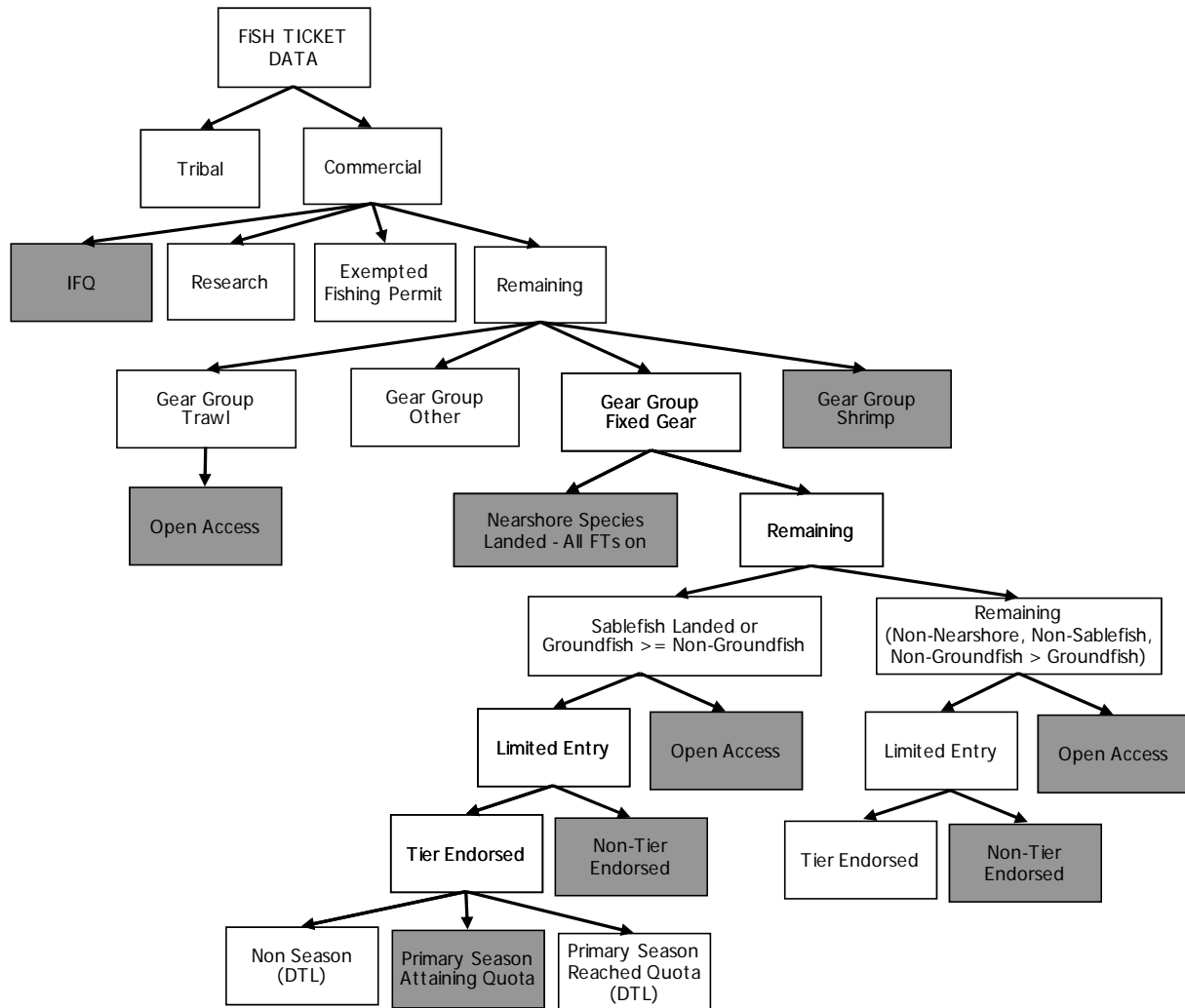
Figure 2a. Spatial distribution of Pacific halibut catch (mt/km^2) observed by the West Coast Groundfish Observer Program, off the U.S. west coast (WA, OR). Gear types observed by the WCGOP include bottom trawl, midwater trawl, shrimp trawl, fixed gear hook-&-line and pot gear. The four catch classifications were defined by dividing the maximum value (2.0697) in half to obtain the 1.0349-2.0697 catch bin. The next lower bin was obtained by dividing the lower bound of the upper bin (1.0348) in half again to obtain the 0.51745-1.0348 catch bin. The remaining observations were allocated into equal proportions into the two lowest classifications. Cells calculated from less than 3 vessels were omitted from the map due to confidentiality.
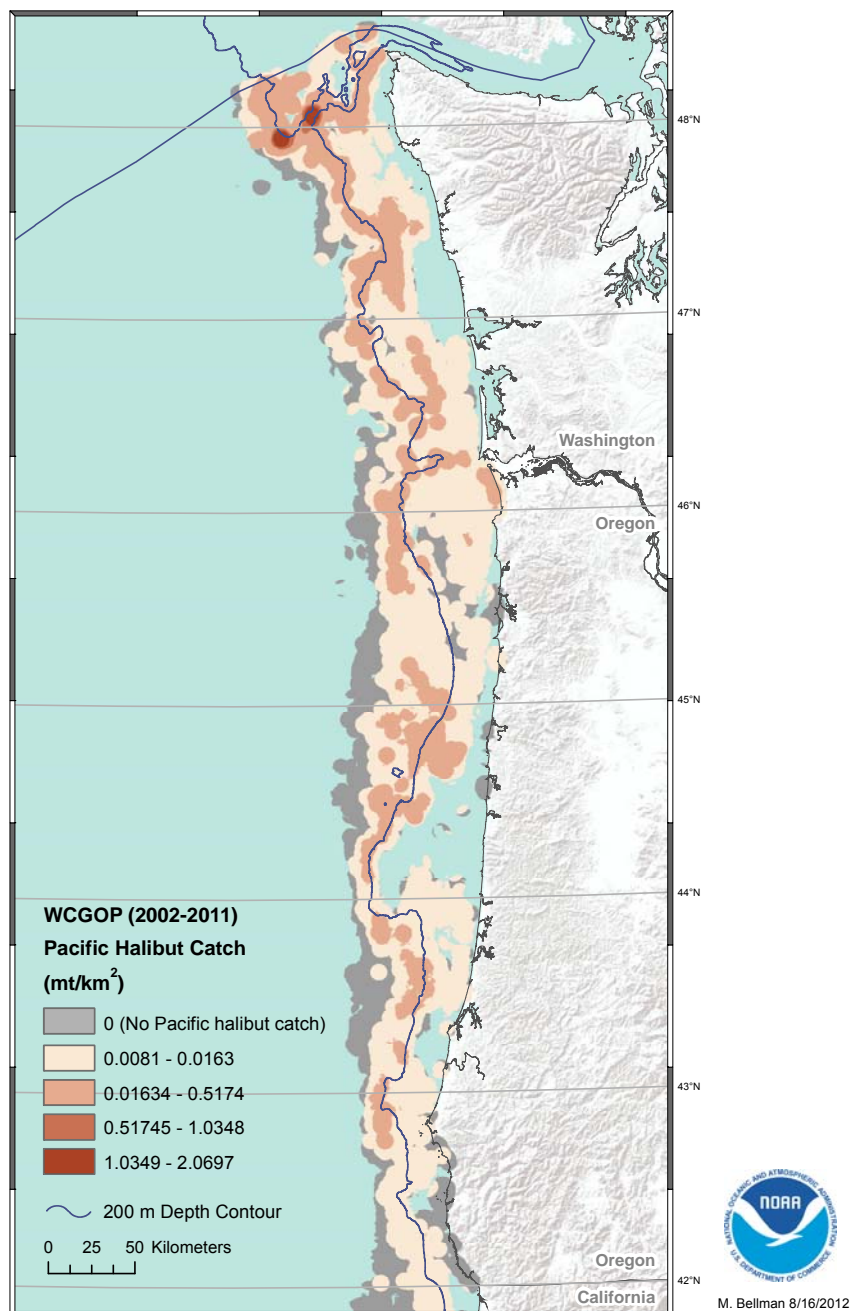
Figure 2b. Spatial distribution of Pacific halibut catch (mt/km^2) and fishing grounds observed by the West Coast Groundfish Observer Program, off the U.S. west coast (CA). See Figure 2a caption for full description.
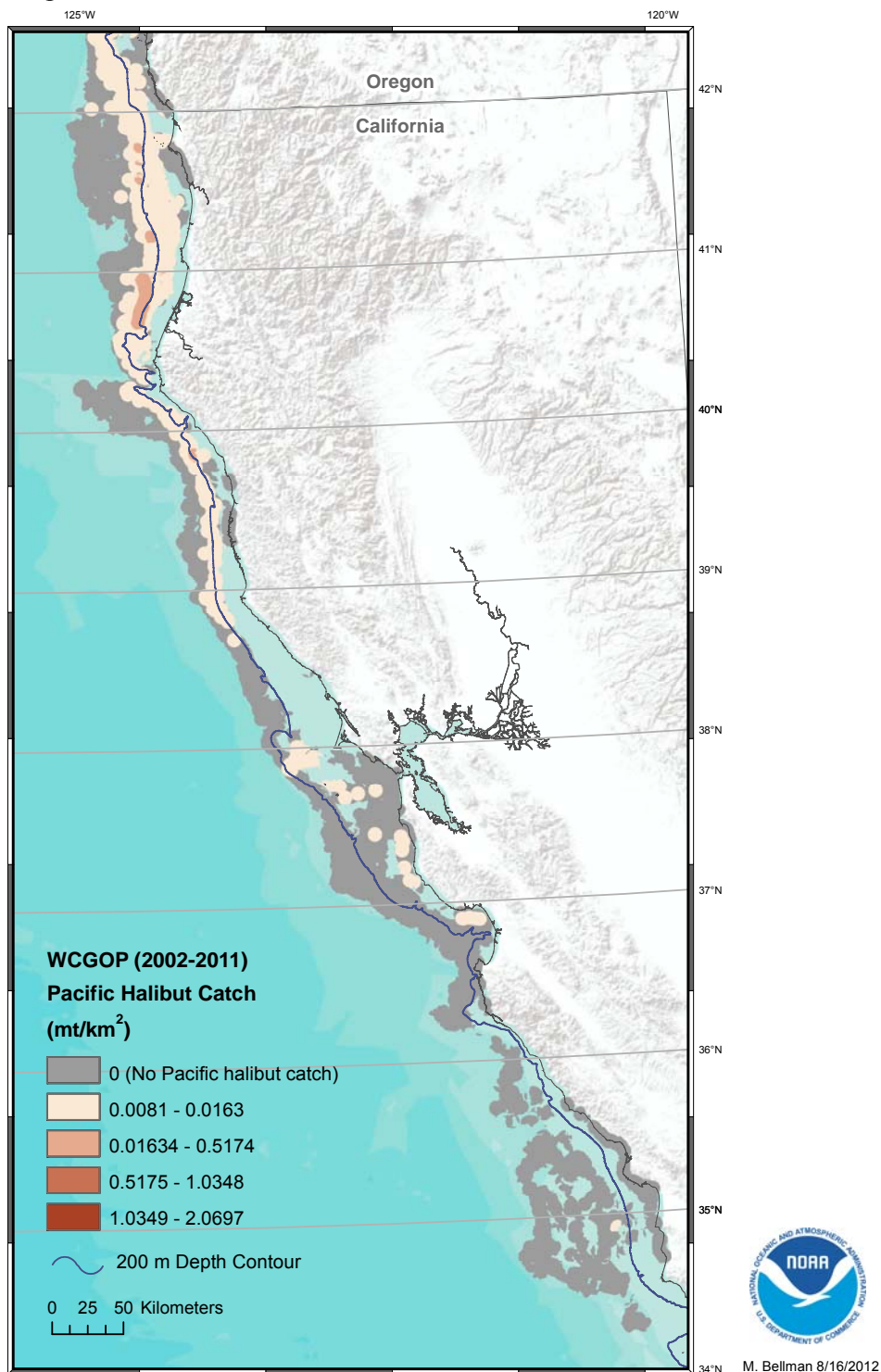
Figure 3. Estimated discard mortality of Pacific halibut in the non-nearshore groundfish fixed gear fishery. Estimates are presented for fixed gear sectors with annual discard estimates exceeding 1 mt, which included all components of the limited entry (LE) sablefish endorsed sector (longline gear (LL) by area and pot gear (POT) coastwide) and the open access (OA) sector using hook-&-line gears. The OA fixed gear sector was only observed in California from 2003-2006 and was not covered in 2002. A fixed average discard rate from 2007 and 2008 data was applied to generate 2002-2006 discard estimates for the OA sector. Although OA 2002-2006 discard estimates are not included in final total mortality summaries, they are shown here for comparison purposes. Other fixed gear sectors include LE non-sablefish endorsed and OA fixed gear vessels fishing with pot gear.
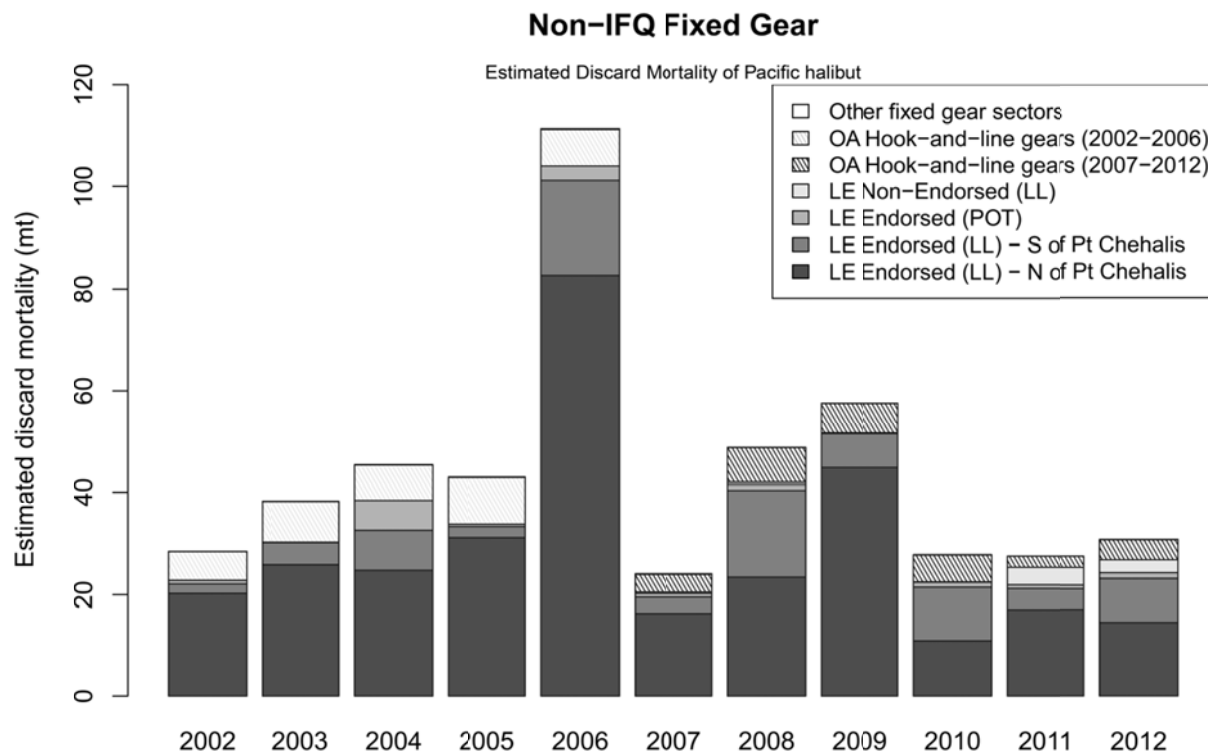
Figure 4. Length frequency distribution of discarded Pacific halibut on WCGOP observed non-IFQ, limited entry (LE) and open access (OA) groundfish fixed gear vessels from September 2003 through December 2012. The majority of Pacific halibut lengths collected in this fishery were visual estimates (grey bars), which are only estimated in 10 cm bins.
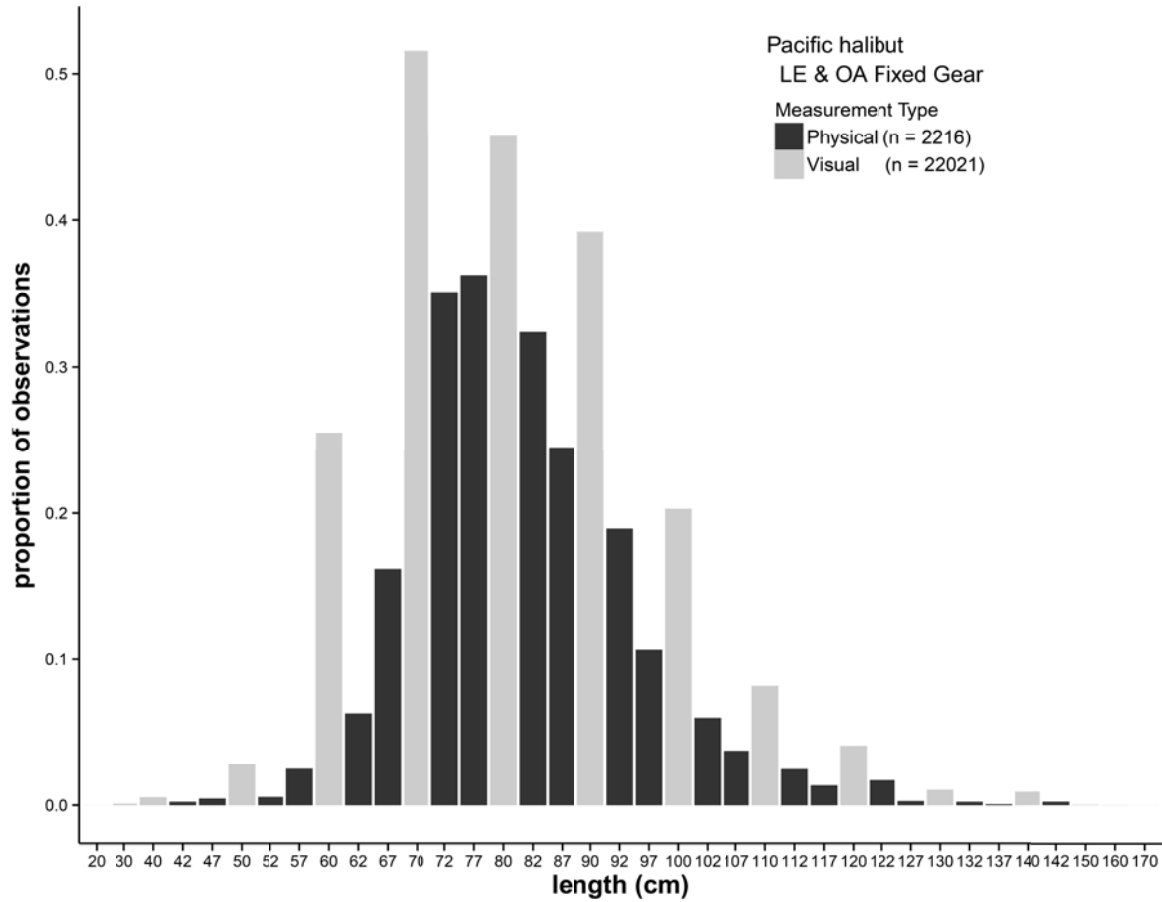
Figure 5. Number of vessels, tows, and tow hours for bottom trawl vessels in the IFQ fishery (excluding LE Califonia Halibut) by month and year.
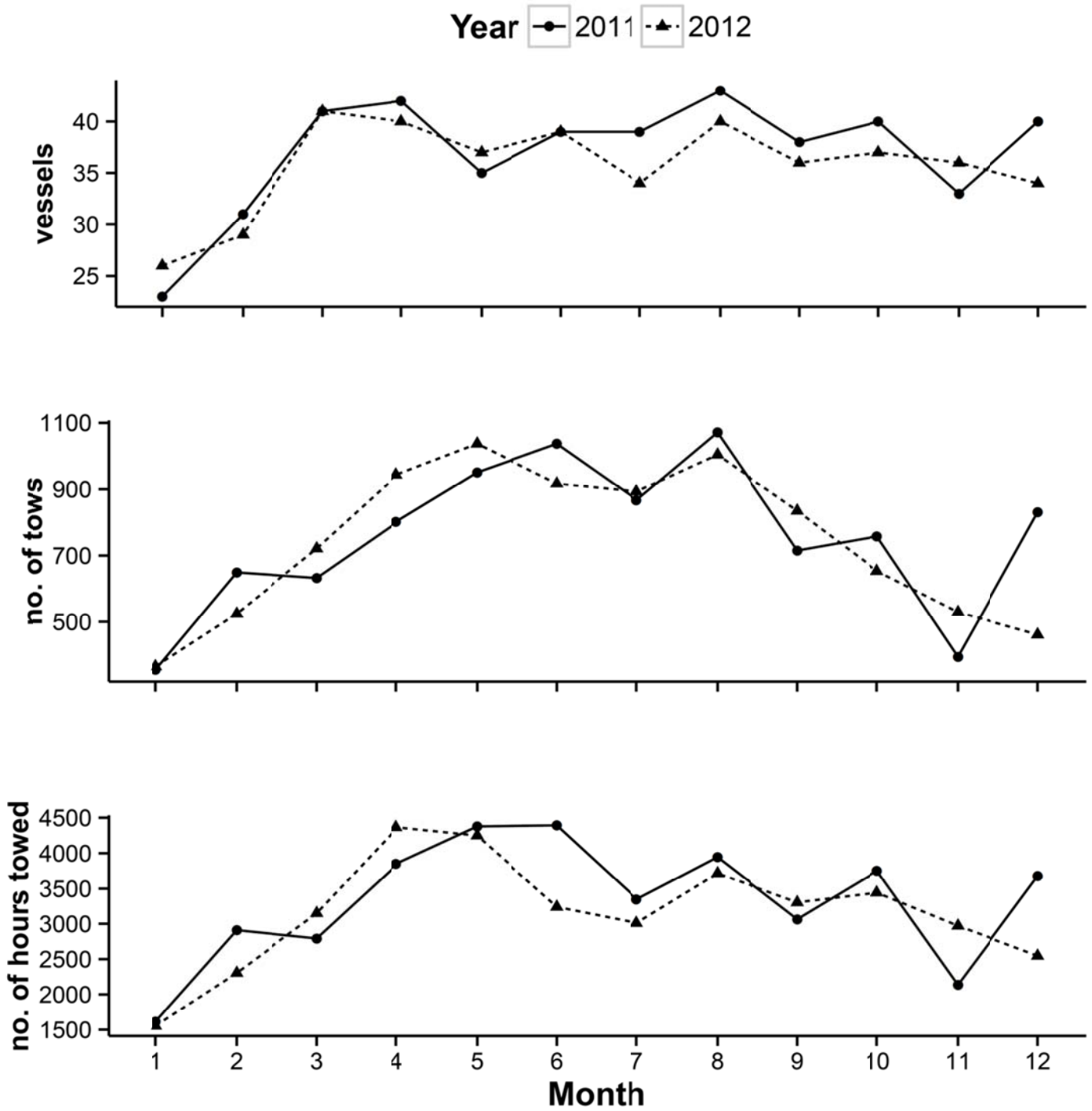
APPENDIX A

Weighted catch composition data from the IFQ fishery for bottom trawl and pot gears. The frequency within each length bin was weighted based on the following equation:

$$n_{wghtd_l} = n_l \times \frac{W_{st}}{\sum_l w_{stl}} \times \frac{\sum_t W_{st}}{W_{st}} \times \frac{\hat{W}_s}{\sum_t W_{st}} = n_l \times \frac{\hat{W}_s}{\sum_l w_{stl}}$$

where:

n_l: number of measured fish in length bin l

w_{stl}: total weight of length l fish measured, as determined through the IPHC length-weight relationship

W_{st}: total observed discard weight of Pacific halibut on tow t, in stratum s

$\hat{W}_s$: estimated total discard weight of Pacific halibut in stratum s

Table A1. Weighted length frequency distributions for Pacific halibut in the IFQ fishery for bottom trawl and pot gears, by year.

| Length bin (cm)	Bottom Trawl 2011	Bottom Trawl 2012	Pot 2011	Pot 2012	Length bin (cm)	Bottom Trawl 2011	Bottom Trawl 2012	Pot 2011	Pot 2012
0	0.0000	0.0000	0.0000	0.0000	102	0.0058	0.0071	0.0025	0.0085
2	0.0000	0.0000	0.0000	0.0000	104	0.0052	0.0042	0.0024	0.0054
4	0.0000	0.0000	0.0000	0.0000	106	0.0036	0.0035	0.0000	0.0137
6	0.0000	0.0000	0.0000	0.0000	108	0.0027	0.0034	0.0035	0.0012
8	0.0000	0.0000	0.0000	0.0000	110	0.0024	0.0033	0.0014	0.0011
10	0.0000	0.0000	0.0000	0.0000	112	0.0020	0.0022	0.0013	0.0010
12	0.0000	0.0000	0.0000	0.0000	114	0.0016	0.0013	0.0028	0.0020
14	0.0000	0.0000	0.0000	0.0000	116	0.0008	0.0012	0.0005	0.0000
16	0.0000	0.0000	0.0000	0.0000	118	0.0008	0.0007	0.0011	0.0009
18	0.0081	0.0000	0.0000	0.0000	120	0.0005	0.0009	0.0015	0.0000
20	0.0000	0.0000	0.0000	0.0000	122	0.0005	0.0005	0.0029	0.0000
22	0.0000	0.0124	0.0000	0.0000	124	0.0005	0.0003	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	126	0.0003	0.0004	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	128	0.0003	0.0000	0.0008	0.0000
28	0.0000	0.0000	0.0000	0.0000	130	0.0001	0.0000	0.0004	0.0000
30	0.0000	0.0091	0.0000	0.0000	132	0.0001	0.0001	0.0000	0.0000
32	0.0000	0.0073	0.0000	0.0000	134	0.0001	0.0001	0.0007	0.0000
34	0.0000	0.0118	0.0000	0.0000	136	0.0001	0.0000	0.0007	0.0000
36	0.0000	0.0050	0.0000	0.0000	138	0.0000	0.0000	0.0003	0.0000
38	0.0000	0.0120	0.0000	0.0000	140	0.0000	0.0000	0.0000	0.0000
40	0.0015	0.0060	0.0000	0.0000	142	0.0001	0.0000	0.0000	0.0000
42	0.0026	0.0123	0.0000	0.0000	144	0.0001	0.0000	0.0000	0.0000
44	0.0000	0.0027	0.0247	0.0000	146	0.0000	0.0000	0.0000	0.0000
46	0.0004	0.0076	0.0000	0.0000	148	0.0000	0.0000	0.0000	0.0000
48	0.0032	0.0062	0.0000	0.0000	150	0.0000	0.0000	0.0000	0.0000
50	0.0030	0.0078	0.0000	0.0000	152	0.0000	0.0000	0.0000	0.0000
52	0.0045	0.0076	0.0000	0.0000	154	0.0000	0.0000	0.0000	0.0000
54	0.0076	0.0060	0.0129	0.0000	156	0.0000	0.0000	0.0000	0.0000
56	0.0081	0.0066	0.0054	0.0000	158	0.0000	0.0000	0.0000	0.0000
58	0.0201	0.0158	0.0151	0.0000	160	0.0000	0.0000	0.0000	0.0000
60	0.0330	0.0293	0.0670	0.0000	162	0.0000	0.0000	0.0000	0.0000
62	0.0459	0.0445	0.0539	0.0000	164	0.0000	0.0000	0.0000	0.0000
64	0.0573	0.0540	0.0217	0.0377	166	0.0000	0.0000	0.0004	0.0000
66	0.0610	0.0539	0.0136	0.0113	168	0.0000	0.0000	0.0000	0.0000
68	0.0584	0.0628	0.0215	0.0308	170	0.0000	0.0000	0.0000	0.0000
70	0.0780	0.0715	0.0745	0.0239	172	0.0000	0.0000	0.0000	0.0000
72	0.0751	0.0703	0.0908	0.0608	174	0.0000	0.0000	0.0000	0.0000
74	0.0866	0.0666	0.0541	0.0595	176	0.0000	0.0000	0.0000	0.0000
76	0.0648	0.0620	0.0183	0.0295	178	0.0000	0.0000	0.0000	0.0000
78	0.0554	0.0524	0.0744	0.0907	180	0.0000	0.0000	0.0000	0.0000
80	0.0560	0.0487	0.1015	0.0891	182	0.0000	0.0000	0.0000	0.0000
82	0.0468	0.0454	0.0631	0.1473	184	0.0000	0.0000	0.0000	0.0000
84	0.0453	0.0351	0.0543	0.1230	186	0.0000	0.0000	0.0000	0.0000
86	0.0298	0.0283	0.0411	0.0636	188	0.0000	0.0000	0.0000	0.0000
88	0.0271	0.0244	0.0372	0.0659	190	0.0000	0.0000	0.0000	0.0000
90	0.0255	0.0231	0.0473	0.0399	192	0.0000	0.0000	0.0000	0.0000
92	0.0203	0.0196	0.0216	0.0337	194	0.0000	0.0000	0.0000	0.0000
94	0.0169	0.0152	0.0187	0.0260	196	0.0000	0.0000	0.0000	0.0000
96	0.0125	0.0102	0.0153	0.0259	198	0.0000	0.0000	0.0000	0.0000
98	0.0097	0.0093	0.0123	0.0016	200	0.0000	0.0000	0.0001	0.0000
100	0.0079	0.0078	0.0163	0.0062					

Table A2. Percentage of weighted length measurements in each viability condition category, by gear type and year in the IFQ groundfish fishery.

Length bin (cm)	Bottom Trawl Excellent 2011	2012	Poor 2011	2012	Dead 2011	2012	Pot Excellent 2011	2012	Poor 2011	2012	Dead 2011	2012
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
22	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	0.0%	50.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
34	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
38	0.0%	82.3%	0.0%	16.1%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40	0.0%	86.6%	100.0%	0.0%	0.0%	13.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
42	48.6%	68.8%	51.4%	24.8%	0.0%	6.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
44	0.0%	47.7%	0.0%	0.0%	0.0%	52.3%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
46	0.0%	86.4%	0.0%	13.6%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
48	25.1%	96.9%	25.1%	0.0%	49.8%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50	30.0%	68.9%	0.0%	11.1%	70.0%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
52	24.7%	51.6%	35.9%	14.8%	39.4%	33.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
54	15.9%	58.3%	42.2%	34.2%	42.0%	7.6%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
56	21.0%	43.6%	46.4%	13.5%	32.6%	43.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
58	17.2%	41.1%	31.7%	9.2%	51.1%	49.7%	67.9%	0.0%	0.0%	0.0%	32.1%	0.0%
60	32.4%	34.9%	23.9%	21.9%	43.7%	43.3%	57.3%	0.0%	0.0%	0.0%	42.7%	0.0%
62	36.4%	39.4%	23.2%	21.6%	40.3%	39.0%	38.0%	0.0%	0.0%	0.0%	62.0%	0.0%
64	36.1%	31.6%	19.9%	20.7%	44.0%	47.7%	34.5%	100.0%	0.0%	0.0%	65.5%	0.0%
66	35.5%	34.3%	21.1%	22.6%	43.4%	43.1%	50.0%	100.0%	0.0%	0.0%	50.0%	0.0%
68	42.9%	34.9%	11.8%	21.2%	45.3%	43.9%	69.9%	100.0%	0.0%	0.0%	30.1%	0.0%
70	40.4%	39.4%	20.9%	20.0%	38.8%	40.6%	62.2%	100.0%	3.4%	0.0%	34.4%	0.0%
72	37.0%	31.0%	21.3%	19.7%	41.7%	49.3%	77.3%	85.9%	0.0%	14.1%	22.7%	0.0%
74	38.5%	32.4%	18.0%	21.8%	43.5%	45.8%	69.2%	93.6%	9.1%	6.4%	21.7%	0.0%
76	44.9%	37.0%	17.2%	17.1%	37.9%	45.9%	43.2%	49.7%	0.0%	37.8%	56.8%	12.4%
78	40.3%	33.4%	19.8%	24.5%	39.9%	42.1%	59.1%	63.3%	7.9%	14.6%	33.0%	22.2%
80	45.3%	38.9%	15.9%	19.1%	38.8%	42.0%	57.6%	100.0%	1.7%	0.0%	40.7%	0.0%
82	43.9%	36.3%	21.4%	21.6%	34.7%	42.2%	86.4%	54.9%	5.6%	9.6%	8.0%	35.5%
84	50.5%	40.0%	14.7%	18.7%	34.8%	41.2%	59.3%	73.6%	6.0%	13.2%	34.7%	13.2%
86	45.0%	36.2%	13.7%	22.4%	41.3%	41.4%	85.3%	76.6%	7.4%	7.6%	7.4%	15.8%
88	39.7%	40.2%	16.7%	22.8%	43.6%	37.0%	92.4%	79.3%	0.0%	6.8%	7.6%	13.9%
90	47.0%	42.3%	17.8%	19.8%	35.3%	37.9%	70.5%	68.2%	0.0%	21.4%	29.5%	10.5%
92	48.7%	42.4%	17.7%	19.4%	33.6%	38.2%	55.8%	59.0%	22.1%	23.5%	22.1%	17.4%
94	51.3%	45.7%	20.9%	15.0%	27.7%	39.4%	52.2%	100.0%	23.9%	0.0%	23.9%	0.0%
96	51.2%	42.9%	13.8%	13.7%	35.0%	43.5%	45.6%	80.2%	13.4%	13.1%	41.0%	6.7%
98	50.6%	40.8%	18.1%	16.8%	31.3%	42.4%	53.2%	100.0%	0.0%	0.0%	46.8%	0.0%
100	54.0%	44.7%	18.9%	21.3%	27.2%	34.1%	77.6%	100.0%	0.0%	0.0%	22.4%	0.0%
102	46.2%	52.8%	17.2%	16.8%	36.5%	30.4%	100.0%	34.0%	0.0%	33.0%	0.0%	33.0%
104	54.1%	44.5%	17.4%	11.2%	28.5%	44.4%	100.0%	0.0%	0.0%	50.0%	0.0%	50.0%

Table A2. Continued

Length bin (cm)	Bottom Trawl						Pot					
	Excellent		Poor		Dead		Excellent		Poor		Dead	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
106	47.8%	42.0%	20.6%	24.6%	31.6%	33.4%	0.0%	45.4%	0.0%	54.6%	0.0%	0.0%
108	54.8%	45.6%	21.8%	16.1%	23.4%	38.3%	18.5%	100.0%	0.0%	0.0%	81.5%	0.0%
110	53.0%	51.5%	13.1%	13.7%	33.8%	34.8%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
112	54.1%	54.7%	22.3%	22.6%	23.6%	22.7%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
114	47.7%	44.8%	27.0%	25.3%	25.3%	29.9%	57.6%	0.0%	0.0%	0.0%	42.4%	100.0%
116	66.7%	41.1%	15.7%	20.8%	17.5%	38.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
118	51.1%	55.2%	11.8%	5.6%	37.1%	39.2%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%
120	45.9%	17.8%	28.8%	17.4%	25.4%	64.8%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
122	54.7%	50.3%	9.3%	38.2%	35.9%	11.5%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
124	35.9%	30.6%	21.4%	55.3%	42.7%	14.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
126	40.5%	35.8%	13.4%	29.4%	46.0%	34.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
128	51.5%	91.8%	36.7%	0.0%	11.8%	8.2%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
130	72.6%	50.6%	27.4%	0.0%	0.0%	49.4%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
132	45.2%	100.0%	25.5%	0.0%	29.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
134	77.8%	100.0%	22.2%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
136	31.9%	100.0%	36.1%	0.0%	31.9%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
138	0.0%	1.5%	100.0%	67.3%	0.0%	31.2%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
140	13.3%	0.0%	86.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
142	24.9%	0.0%	25.4%	100.0%	49.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
144	54.0%	0.0%	46.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
146	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
148	49.5%	0.0%	0.0%	0.0%	50.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
150	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
152	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
154	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
156	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
158	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
160	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
162	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
164	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
166	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
168	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
170	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
172	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
174	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
176	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
178	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
180	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
182	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
184	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
186	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
188	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
190	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
192	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
194	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
196	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
198	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
200	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
202	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
204	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
206	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
208	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
210	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table A3. Weighted length frequency distributions for Pacific halibut in the limited entry bottom trawl fishery, 2004-2010.

Length bin (cm)	Weighted length frequency distribution						
	2004	2005	2006	2007	2008	2009	2010
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
36	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.0048	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	0.0000	0.0044	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.0025	0.0012	0.0057	0.0000	0.0000	0.0010	0.0000
46	0.0037	0.0000	0.0094	0.0000	0.0000	0.0009	0.0000
48	0.0000	0.0034	0.0046	0.0000	0.0000	0.0000	0.0000
50	0.0027	0.0068	0.0092	0.0000	0.0007	0.0010	0.0000
52	0.0021	0.0069	0.0080	0.0041	0.0001	0.0053	0.0000
54	0.0156	0.0076	0.0164	0.0042	0.0025	0.0004	0.0000
56	0.0138	0.0211	0.0242	0.0071	0.0022	0.0019	0.0000
58	0.0187	0.0331	0.0322	0.0293	0.0027	0.0091	0.0022
60	0.0400	0.0431	0.0670	0.0593	0.0169	0.0175	0.0056
62	0.0329	0.0719	0.0751	0.0638	0.0285	0.0275	0.0121
64	0.0428	0.0783	0.1001	0.0932	0.0614	0.0545	0.0155
66	0.0532	0.0807	0.0979	0.1150	0.0705	0.0606	0.0185
68	0.0757	0.0845	0.0870	0.0000	0.0599	0.0835	0.0256
70	0.0672	0.0851	0.0986	0.1022	0.0871	0.0971	0.0154
72	0.0774	0.0882	0.0478	0.1029	0.0973	0.0972	0.0314
74	0.0998	0.0746	0.0588	0.0840	0.1023	0.0941	0.0383
76	0.0890	0.0538	0.0461	0.0710	0.0743	0.0697	0.0284
78	0.0658	0.0506	0.0423	0.0539	0.0688	0.0744	0.0349
80	0.0586	0.0427	0.0372	0.0460	0.0599	0.0527	0.0298
82	0.0486	0.0320	0.0258	0.0325	0.0443	0.0434	0.0239
84	0.0337	0.0255	0.0186	0.0316	0.0428	0.0335	0.0227
86	0.0221	0.0166	0.0130	0.0000	0.0300	0.0290	0.0141
88	0.0235	0.0115	0.0120	0.0154	0.0263	0.0290	0.0122
90	0.0193	0.0127	0.0115	0.0168	0.0225	0.0263	0.0100
92	0.0157	0.0092	0.0101	0.0122	0.0179	0.0204	0.0094

Length bin (cm)	Weighted length frequency distribution						
	2004	2005	2006	2007	2008	2009	2010
94	0.0169	0.0108	0.0099	0.0148	0.0164	0.0151	0.0053
96	0.0062	0.0052	0.0066	0.0089	0.0143	0.0087	0.0066
98	0.0034	0.0058	0.0066	0.0091	0.0110	0.0103	0.0067
100	0.0089	0.0045	0.0025	0.0053	0.0080	0.0088	0.0023
102	0.0060	0.0034	0.0029	0.0036	0.0061	0.0069	0.0018
104	0.0065	0.0023	0.0027	0.0041	0.0083	0.0062	0.0021
106	0.0043	0.0029	0.0032	0.0031	0.0059	0.0028	0.0013
108	0.0016	0.0014	0.0019	0.0018	0.0027	0.0025	0.0014
110	0.0048	0.0015	0.0004	0.0017	0.0018	0.0021	0.0009
112	0.0015	0.0007	0.0020	0.0010	0.0016	0.0024	0.0013
114	0.0020	0.0010	0.0007	0.0007	0.0020	0.0017	0.0001
116	0.0026	0.0006	0.0002	0.0000	0.0010	0.0005	0.0005
118	0.0007	0.0004	0.0003	0.0002	0.0004	0.0002	0.0002
120	0.0013	0.0005	0.0002	0.0002	0.0005	0.0003	0.0002
122	0.0008	0.0003	0.0000	0.0004	0.0003	0.0003	0.0002
124	0.0010	0.0002	0.0001	0.0000	0.0003	0.0002	0.0003
126	0.0000	0.0001	0.0002	0.0001	0.0001	0.0002	0.0002
128	0.0002	0.0000	0.0002	0.0000	0.0000	0.0002	0.0000
130	0.0003	0.0002	0.0001	0.0002	0.0000	0.0002	0.0000
132	0.0005	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
134	0.0006	0.0000	0.0001	0.0000	0.0001	0.0001	0.0000
136	0.0001	0.0001	0.0002	0.0000	0.0000	0.0001	0.0000
138	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
140	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
142	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
146	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
150	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
152	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
154	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
158	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
160	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
164	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table A4. Percentage of weighted length measurements in each condition category for the limited entry bottom trawl fishery, 2004-2010.

Length bin (cm)	2004 Exc	Poor	Dead	2005 Exc	Poor	Dead	2006 Exc	Poor	Dead	Length bin (cm)	2007 Exc	Poor	Dead	2008 Exc	Poor	Dead	2009 Exc	Poor	Dead
22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
26	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	34	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
36	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	36	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
38	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	38	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
42	0.0%	0.0%	0.0%	0.0%	88.4%	11.6%	0.0%	0.0%	0.0%	42	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
44	0.0%	0.0%	100.0%	0.0%	70.8%	29.2%	0.0%	0.0%	100.0%	44	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
46	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	46	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
48	0.0%	0.0%	0.0%	22.4%	0.0%	77.6%	0.0%	0.0%	100.0%	48	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50	0.0%	0.0%	100.0%	61.1%	9.9%	29.0%	0.0%	0.0%	100.0%	50	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
52	100.0%	0.0%	0.0%	23.6%	31.3%	45.2%	0.0%	0.0%	100.0%	52	33.4%	0.0%	66.6%	100.0%	0.0%	0.0%	99.5%	0.5%	0.0%
54	75.5%	11.9%	12.6%	10.0%	20.8%	69.2%	16.9%	0.0%	83.1%	54	35.6%	0.0%	64.4%	0.0%	4.4%	95.6%	42.3%	57.7%	0.0%
56	12.6%	37.9%	49.5%	25.1%	12.7%	62.2%	22.0%	15.2%	62.8%	56	33.9%	0.0%	66.1%	0.0%	0.0%	100.0%	15.7%	65.3%	19.0%
58	21.4%	25.6%	53.0%	15.1%	29.5%	55.4%	4.1%	20.2%	75.7%	58	9.4%	6.8%	83.8%	3.3%	3.3%	93.3%	51.0%	4.4%	44.6%
60	58.6%	14.4%	27.0%	18.2%	21.0%	60.8%	12.9%	25.5%	61.6%	60	5.3%	7.4%	87.2%	9.0%	14.3%	76.8%	28.7%	21.9%	49.4%
62	40.0%	21.6%	38.4%	18.5%	23.7%	57.8%	27.3%	22.3%	50.4%	62	20.8%	9.5%	69.7%	6.1%	15.7%	78.2%	19.3%	19.5%	61.2%
64	33.4%	18.4%	48.2%	25.2%	28.4%	46.4%	31.5%	21.0%	47.5%	64	18.9%	5.3%	75.8%	17.3%	7.5%	75.2%	38.0%	9.4%	52.6%
66	23.9%	24.7%	51.4%	20.9%	26.7%	52.3%	29.6%	17.3%	53.0%	66	9.1%	12.5%	78.4%	25.8%	8.9%	65.4%	26.7%	19.7%	53.6%
68	38.2%	21.9%	39.9%	17.0%	27.5%	55.5%	35.5%	18.8%	45.7%	68	54.5%	45.5%	0.0%	17.4%	13.2%	69.4%	30.1%	17.5%	52.4%
70	29.5%	18.9%	51.6%	20.1%	30.3%	49.5%	30.2%	16.6%	53.2%	70	16.0%	7.6%	76.4%	13.1%	14.0%	73.0%	27.4%	17.5%	55.1%
72	22.9%	17.9%	59.2%	20.3%	27.1%	52.6%	37.2%	21.1%	41.8%	72	14.8%	9.1%	76.0%	19.1%	13.7%	67.2%	22.9%	18.3%	58.8%
74	23.8%	25.5%	50.7%	24.5%	23.4%	52.1%	39.6%	13.9%	46.5%	74	17.6%	16.9%	65.5%	24.8%	13.8%	61.3%	27.7%	14.8%	57.5%
76	24.0%	23.2%	52.8%	26.8%	29.1%	44.1%	31.2%	19.2%	49.6%	76	14.0%	9.9%	76.1%	21.9%	11.5%	66.6%	26.2%	16.6%	57.2%
78	18.8%	18.4%	62.9%	18.1%	23.5%	58.4%	35.0%	21.2%	43.8%	78	15.5%	13.4%	71.2%	24.7%	10.4%	64.9%	18.5%	12.1%	69.4%
80	19.1%	19.6%	61.3%	23.1%	27.9%	49.0%	34.3%	15.4%	50.2%	80	14.7%	11.6%	73.6%	21.2%	11.4%	67.4%	20.5%	14.1%	65.3%
82	14.4%	26.1%	59.5%	30.4%	25.1%	44.6%	31.7%	27.8%	40.5%	82	14.6%	3.0%	82.4%	21.5%	16.1%	62.4%	16.3%	18.5%	65.2%
84	21.7%	9.5%	68.9%	27.0%	18.9%	54.0%	30.1%	13.2%	56.7%	84	17.9%	7.0%	75.1%	15.9%	22.8%	61.3%	17.0%	12.0%	71.0%
86	32.4%	24.0%	43.6%	35.5%	24.7%	39.8%	31.3%	15.0%	53.7%	86	56.6%	43.4%	0.0%	17.6%	22.5%	59.8%	18.6%	15.5%	65.9%
88	27.8%	14.8%	57.5%	31.2%	27.8%	41.0%	22.9%	12.4%	64.7%	88	12.3%	10.5%	77.1%	18.1%	18.8%	63.1%	20.1%	17.2%	62.8%
90	30.2%	34.6%	35.2%	28.0%	16.6%	55.4%	23.8%	18.7%	57.5%	90	6.3%	3.7%	90.0%	23.9%	17.1%	59.0%	18.6%	13.6%	67.8%
92	40.2%	28.1%	31.7%	42.5%	21.7%	35.9%	43.7%	10.7%	45.6%	92	20.7%	8.4%	70.9%	20.9%	25.1%	54.0%	25.3%	11.8%	62.9%
94	26.1%	33.3%	40.6%	33.4%	16.3%	50.3%	35.3%	7.1%	57.6%	94	17.0%	18.4%	64.6%	18.8%	13.3%	67.9%	15.2%	18.4%	66.4%
96	19.9%	30.0%	50.1%	34.6%	19.2%	46.2%	16.5%	13.9%	69.6%	96	16.7%	3.6%	79.7%	15.4%	21.3%	63.4%	27.6%	19.6%	52.8%
98	33.8%	28.4%	37.8%	32.3%	22.8%	44.9%	16.8%	13.0%	70.2%	98	10.4%	8.2%	81.4%	28.4%	29.4%	42.3%	20.2%	16.9%	62.9%
100	14.6%	26.9%	58.5%	28.1%	17.4%	54.5%	48.5%	9.6%	41.9%	100	15.4%	23.2%	61.4%	15.0%	19.4%	65.6%	13.4%	25.5%	61.1%
102	16.0%	49.3%	34.7%	43.1%	6.9%	50.0%	13.7%	0.0%	86.3%	102	40.3%	9.2%	50.6%	27.6%	28.4%	44.1%	24.8%	23.8%	51.4%
104	19.0%	47.5%	33.5%	36.4%	16.2%	47.4%	49.6%	6.4%	44.0%	104	16.7%	15.8%	67.5%	36.6%	11.7%	51.7%	28.0%	8.4%	63.7%
106	23.6%	22.6%	53.9%	58.4%	11.9%	29.7%	10.4%	22.8%	66.8%	106	30.7%	20.1%	49.2%	34.8%	7.7%	57.6%	24.0%	13.5%	62.5%
108	27.6%	3.0%	69.4%	28.6%	22.6%	48.8%	42.2%	15.1%	42.6%	108	29.0%	2.3%	68.7%	19.4%	14.2%	66.4%	18.2%	27.7%	54.1%
110	25.4%	12.6%	62.0%	22.7%	28.1%	49.2%	32.0%	3.1%	64.9%	110	11.7%	45.1%	43.2%	40.2%	8.0%	51.9%	29.6%	10.4%	60.0%
112	95.8%	1.2%	3.0%	16.2%	0.0%	83.8%	7.2%	14.1%	78.7%	112	26.9%	23.3%	49.8%	25.1%	9.2%	65.7%	14.7%	17.4%	67.9%
114	0.0%	26.2%	73.8%	24.4%	4.9%	70.7%	38.9%	0.0%	61.1%	114	20.1%	0.0%	79.9%	22.4%	22.7%	54.9%	31.2%	7.4%	61.5%
116	58.7%	6.9%	34.4%	69.4%	0.0%	30.6%	77.8%	0.0%	22.2%	116	0.0%	0.0%	100.0%	41.6%	4.8%	53.6%	79.5%	0.5%	20.0%
118	2.7%	7.5%	89.9%	44.9%	35.0%	20.1%	33.8%	31.5%	34.7%	118	0.0%	0.0%	100.0%	25.5%	38.6%	35.9%	40.9%	4.4%	54.6%
120	5.7%	26.2%	68.0%	9.5%	28.7%	61.8%	0.0%	0.0%	100.0%	120	85.1%	0.0%	14.9%	65.5%	34.5%	0.0%	48.0%	0.7%	51.2%
122	40.8%	40.3%	18.9%	1.5%	15.2%	83.4%	50.0%	50.0%	0.0%	122	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	34.7%	0.0%	65.3%
124	70.3%	14.8%	14.8%	79.9%	0.0%	20.1%	15.6%	0.0%	84.4%	124	0.0%	0.0%	0.0%	0.0%	70.9%	29.1%	26.1%	37.0%	37.0%
126	0.0%	100.0%	0.0%	89.0%	11.0%	0.0%	47.1%	0.0%	52.9%	126	49.4%	0.0%	50.6%	0.0%	0.0%	100.0%	59.2%	40.8%	0.0%
128	82.0%	9.0%	9.0%	18.7%	0.0%	81.3%	89.8%	0.0%	10.2%	128	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	55.7%	1.0%	43.3%
130	13.5%	0.0%	86.5%	4.9%	47.6%	47.6%	0.0%	0.0%	100.0%	130	13.8%	0.0%	86.2%	0.0%	0.0%	0.0%	35.0%	65.0%	0.0%
132	100.0%	0.0%	0.0%	20.2%	63.3%	16.5%	0.0%	100.0%	0.0%	132	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
134	80.0%	0.0%	20.0%	100.0%	0.0%	0.0%	22.2%	0.0%	77.8%	134	0.0%	0.0%	0.0%	94.7%	0.0%	5.3%	100.0%	0.0%	0.0%
136	0.0%	0.0%	100.0%	10.5%	16.1%	73.4%	0.0%	0.0%	100.0%	136	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%
138	0.0%	0.0%	0.0%	15.2%	0.0%	84.8%	0.0%	0.0%	0.0%	138	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
140	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%	140	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%
142	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	142	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%
144	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	144	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
146	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	146	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
148	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	148	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
150	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	150	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
152	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	152	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
154	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	154	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
156	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	156	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
158	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	158	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
160	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	160	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
162	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	162	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
164	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	164	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Length bin	2010 Exc	Poor	Dead	Length bin	2010 Exc	Poor	Dead	Length bin	2010 Exc	Poor	Dead
10	0.0%	100.0%	0.0%	58	100.0%	0.0%	0.0%	106	2.4%	0.0%	97.6%
12	0.0%	0.0%	0.0%	60	33.4%	0.0%	66.6%	108	0.0%	20.1%	79.9%
14	0.0%	0.0%	0.0%	62	15.7%	29.4%	54.9%	110	14.2%	58.8%	27.0%
16	0.0%	0.0%	0.0%	64	30.1%	21.2%	48.7%	112	39.9%	0.0%	60.1%
18	0.0%	0.0%	0.0%	66	17.8%	15.4%	66.8%	114	0.0%	0.0%	100.0%
20	0.0%	0.0%	0.0%	68	15.0%	10.3%	74.8%	116	50.0%	0.0%	50.0%
22	0.0%	0.0%	0.0%	70	22.2%	7.4%	70.4%	118	0.0%	100.0%	0.0%
24	0.0%	0.0%	0.0%	72	23.6%	17.4%	59.0%	120	0.0%	0.0%	100.0%
26	0.0%	0.0%	0.0%	74	13.5%	24.8%	61.7%	122	0.0%	0.0%	100.0%
28	0.0%	0.0%	0.0%	76	20.1%	16.9%	63.0%	124	100.0%	0.0%	0.0%
30	0.0%	0.0%	0.0%	78	17.0%	17.4%	65.7%	126	0.0%	100.0%	0.0%
32	0.0%	0.0%	0.0%	80	10.6%	22.8%	66.6%	128	0.0%	0.0%	0.0%
34	0.0%	0.0%	0.0%	82	18.9%	19.9%	61.2%	130	0.0%	0.0%	0.0%
36	0.0%	0.0%	0.0%	84	21.9%	25.3%	52.8%	132	0.0%	0.0%	0.0%
38	0.0%	0.0%	0.0%	86	14.9%	16.4%	68.7%	134	0.0%	0.0%	0.0%
40	0.0%	0.0%	0.0%	88	24.8%	17.8%	57.4%	136	100.0%	0.0%	0.0%
42	0.0%	0.0%	0.0%	90	25.8%	24.2%	50.1%	138	0.0%	0.0%	0.0%
44	0.0%	0.0%	0.0%	92	5.0%	9.9%	85.1%	140	0.0%	0.0%	0.0%
46	0.0%	0.0%	0.0%	94	26.1%	29.2%	44.7%	142	0.0%	0.0%	0.0%
48	0.0%	0.0%	0.0%	96	17.4%	39.9%	42.7%	144	0.0%	0.0%	0.0%
50	0.0%	0.0%	0.0%	98	14.3%	23.3%	62.4%	146	0.0%	0.0%	0.0%
52	0.0%	0.0%	0.0%	100	2.2%	31.0%	66.8%	148	0.0%	0.0%	0.0%
54	0.0%	0.0%	0.0%	102	21.7%	20.6%	57.8%	150	0.0%	0.0%	0.0%
56	0.0%	0.0%	0.0%	104	18.3%	37.2%	44.6%	152	0.0%	100.0%	0.0%
								154	0.0%	0.0%	0.0%

APPENDIX B

Manual Pacific Halibut IBQ Expansions for Inseason Management

Inseason reporting to the Vessel Account System
The Vessel Account System (VAS) is a NOAA, Northwest Regional Office (NWR) database that allows fishers to manage their IFQ quota pounds. On a weekly basis, the WCGOP provided trip-level estimates of discarded P. halibut IBQ to the Pacific States Marine Fisheries Commission (PSMFC). The PSMFC then uploaded the data to the VAS. Occasionally, non-automated (i.e., manual) calculations of P. halibut IBQ were necessary. Manual calculations of P. halibut IBQ occurred as observer program staff identified the need and were uploaded directly to the VAS. Scenarios triggering a manual calculation and the equations used for those calculations are given in Table B2 below.

The WCGOP database calculates IBQ weight at the haul-level when the observer collects all the required data elements. The calculation is dependent on which gear type is fished.

Inseason IBQ Weight Calculations for Bottom Trawl Gear
The sampled P. halibut lengths are converted to weight using the IPHC length-weight conversion table (Appendix C). The total weight of P. halibut in the haul is calculated as:

$$W = \frac{w}{n} \cdot N$$

where, for each haul:
W = total weight of P. halibut
w = sampled weight of P. halibut
n = sampled number of P. halibut
N = total number of P. halibut

IBQ weight for each haul is then calculated as:

$$W_{IBQ} = \sum_c \left(\frac{w_c}{\sum_c w_c} \cdot W \cdot m_c \right)$$

where, for each haul:

c = viability condition category
W_{IBQ} = IBQ weight (mortality rate applied) of P. halibut
W = total weight of P. halibut in haul
w = sampled weight of P. halibut
m = mortality rate (Table 2)

Inseason IBQ Weight Calculations for Pot Gear
The sampled P. halibut lengths are converted to weight using the IPHC length-weight conversion table. Observers are not always able to sample 100% of all gear units due to time constraints and logistics, therefore sample weights need to be expanded to the haul/set level. The total weight of P. halibut in the set is calculated as:

$$W = \left(\frac{w}{n} \cdot N\right) \cdot \left(\frac{P}{p}\right)$$

where, for each set:
W = total weight of P. halibut
w = sampled weight of P. halibut
n = sampled number of P. halibut
N = total number of P. halibut
P = total number of pots fished
p = sampled number of pots

IBQ weight for each set is then calculated as:

$$W_{IBQ} = \sum_{c} \left(\frac{w_c}{\sum_c w} \cdot W \cdot m_c\right)$$

where, for each set:
c = viability condition category
W_{IBQ} = IBQ weight (mortality rate applied) of P. halibut
W = total weight of P. halibut in set
w = sampled weight of P. halibut
m = mortality rate (Table 3)

Inseason IBQ Weight Calculations for Hook-&-Line Gear
The visual estimates of Pacific halibut length (10 cm increments) are converted to weight using the IPHC length-weight conversion table. Observers are not always able to sample 100% of all gear units due to time constraints and logistics, therefore sample weights need to be expanded to the haul/set level.   The total weight of P. halibut in the set is calculated as:

$$W_{IBQ} = \left(\frac{H}{h} \cdot w\right) \cdot 0.16$$

where, for each set:

W_{IBQ} = IBQ weight (mortality rate applied) of P. halibut
w = sampled weight of P. halibut
H = total number of hooks fished
h = sampled number of hooks
0.16 = IPHC mortality rate applied to hook-&-line gear

Inseason IBQ Weight Manual Calculation Scenarios
In 2012, there were a number of scenarios that resulted in the inability to calculate IBQ weight through the automated process (Appendix B). The most prevalent causes were the pre-sorting of P. halibut by the crew and improper sampling. In these scenarios, observer program staff reviewed the trip and calculated IBQ weight manually.

To determine the most appropriate method to manually calculate IBQ weight (Appendix B), the observer program data management team consulted with the IPHC. For bottom trawl and pot gear, the

IPHC preferred the use of actually measured fish from other properly sampled hauls within the same trip, rather than the use of visually estimated lengths from the haul. All calculations utilized data from the same trip or a different trip from the same vessel. In other words, there was never a circumstance where data from Vessel A was used to calculate IBQ weight for Vessel B.

In addition to scenarios where the observer did not collect all required data, there were also instances of hauls where P. halibut was not sampled by the observer or all the gear was lost. In these instances, properly sampled hauls were used to estimate IBQ weight for the unsampled haul. Methods for expanding P. halibut weight to unsampled or partially sampled hauls varied by gear type.

To calculate P. halibut IBQ weight for unsampled trawl hauls, the sum of all IBQ weight from other properly sampled hauls is divided by the sum of tow duration (hours) from sampled hauls and multiplied by the tow duration of the unsampled haul.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t d} \right) \times D$$

where, for each tow:
t = tow
W_{IBQ} = unsampled IBQ weight (mortality rate applied) of P. halibut
w_{IBQ} = sampled IBQ weight (mortality rate applied) of P. halibut
d = tow duration (hr) of sampled haul
D = tow duration (hr) of unsampled haul

To calculate P. halibut IBQ weight when trawl gear is lost (i.e., entire net or codend is lost), the sum of all P. halibut expanded species weight from other properly sampled hauls is divided by the sum of tow durations from sampled hauls, multiplied by the tow duration of the unsampled haul. For lost trawl gear, a mortality rate for the "dead" P. halibut viability condition (0.90) is applied.

$$W_{IBQ} = \left(\frac{\sum_t w}{\sum_t d} \right) \times D \times 0.90$$

where, for each tow with lost gear:
t = tow
W_{IBQ} = IBQ weight (mortality rate applied) of unsampled P. halibut
w = weight of sampled P. halibut
d = tow duration of sampled haul
D = tow duration of unsampled haul
0.90 = mortality rate for "dead" P. halibut viability condition for trawl gear

To calculate P. halibut IBQ weight in unsampled fixed gear sets, the sum of all P. halibut IBQ weight from sets with similar properties (i.e., date, depth, target, gear type, area; determined by WCGOP data managers) is divided by the sum of the number of gear units sampled, and the result is multiplied by the total number of gear units fished from the unsampled set.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t g} \right) \times G$$

where, for each set:

t = set

W_{IBQ} = unsampled IBQ weight (mortality rate applied) of P. halibut

w_{IBQ} = sampled IBQ weight (mortality rate applied) of P. halibut

g = number of sampled gear units (e.g., hooks, pots)

G = total number of gear units (e.g., hooks, pots) fished in the unsampled set

To calculate P. halibut IBQ weight when fixed gear is lost, the sum of P. halibut weight from the sampled portion of the set, or, if all gear is lost, from sets with similar properties is divided by the sum of units sampled, and the result is multiplied by the total hooks from the unsampled set. For any lost fixed gear, a mortality rate for the "dead" P. halibut viability condition (1.0) is applied.

$$W_{IBQ} = \left(\frac{\sum_t w}{\sum_t g} \right) \times G \times 1.0$$

where, for each set with lost gear:

t = set

W_{IBQ} = unsampled IBQ weight (mortality rate applied) of P. halibut

w = sampled IBQ weight of P. halibut

g = number of sampled gear units (e.g., hooks, pots)

G = total number of gear units (e.g., hooks, pots) fished in the unsampled set

1.0 = mortality rate for "dead" P. halibut viability condition for fixed gear

Table B1. The number of vessels and trips that required manual expansions of P. halibut IBQ weight in the 2012 U.S. west coast groundfish IFQ fishery. All values are counts unless otherwise stated.

		Reason for Manual Calculation						
		PHLB scenarios	**Unsampled hauls (Trawl)**	**Lost Gear**		**Total**	**IFQ Total**	**% of total**
	Year			**Trawl**	**Fixed**			
Vessels	2011	13	16	4	1	24	108**	22.22 *
	2012	9	0	0	0	9	105	8.5
Trips	2011	19	21	4	3	38	2443**	1.56
	2012	10	0	0	0	10	2181	0.46

*Percentage of vessels with manually calculated discard may be included in one or more categories.

***Manual calculations due to unsampled or lost gear were performed in 2012. All discard for these events were reported via the automated load process.

Scenario 1: *Total count of PHLB exists with no length or viability data.*

Resolution: Determine an average mortality weight per individual PHLB in the trip from all sampled hauls. Multiply that average by the total count of PHLB to determine an IBQ.

Scenario 2: *Total count of PHLB exists with actual lengths and no viability data.*

Resolution: Determine catch weight for PHLB using the lengths in the haul and then apply that to the total count for a total weight. Determine CATCH_WEIGHT_MORT for all viabilities (E, P, D) from all other properly sampled hauls in the trip and apply to the CATCH_WEIGHT for IBQ estimate.

Scenario 3: *Total count of PHLB exists with visual estimates of PHLB lengths and no viabilities.*

Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method is to determine an average IBQ per individual PHLB in the trip from all sampled hauls. Multiply that average by the total count of PHLB to determine an IBQ.

Scenario 4: *Total count of PHLB exists with visual estimates of PHLB lengths and proper in-hand viabilities.*

Resolution: The use of visual lengths was discouraged by the IPHC, so the most appropriate method here would be to determine an average IBQ per individual PHLB in the trip from all sampled hauls. Multiply that average by the total count of PHLB to determine an IBQ.

Scenario 5: *Total count of PHLB does not exist without any length or viability data*

Resolution: Confirm PHLB was present in the haul, and no data was collected on them. Determine an average IBQ per haul for all sampled hauls in the trip. This scenario is unlikely and, to date, has never occurred.

Scenario 6: *Total count of PHLB does not exist with length and no viability data.*

Resolution: Catch weight for the haul will be determined by taking the measured PHLB sample, convert to weight, divided by the number of fish sampled, multiplied by the average number of PHLB for all sampled hauls in the trip. Then the average mortality rates from the sampled hauls are applied to the calculated PHLB weight. and, to date, has never occurred.

Scenario 7: *Total count of PHLB does not exist with length and viability data.*

Resolution: Catch weight for the haul will be determined by taking the length of the PHLB sample, converted to weight, divided by the number of fish sampled, multiplied by the average number of PHLB for all sampled hauls in the trip. Since viabilities and lengths exist, IBQ can be determined using normal protocols and the calculated catch weight. and, to date, has never occurred.

Scenario 8: *Total count of PHLB does not exist with visual length and no viability data.*

Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method here would be to determine an average IBQ per haul for all sampled hauls in the trip and apply to this haul as well.

Scenario 9: *Total count of PHLB does not exist with visual length and viability data.*

Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method here would be to determine an average IBQ per haul for all sampled hauls in the trip and apply to this haul as well.

Scenario 10: *Observer encounters predated fish that are dead and badly damaged so that accurate biological data cannot be collected.*

Resolution: If properly sampled PHLB exist in the haul they can be used to determine the portion of the catch weight attributed to the predated and non-predated fish. The IBQ for the PHLB not predated would be calculated separately using the data collected in the haul. The IBQ for the predated fish would be the portion of the PHLB catch weight attributed to the predated fish multiplied by the mortality rate for "dead" from the IPHC viability tables for that gear.

If all PHLB in the haul are heavily predated then a catch weight for the haul will need to be determined. This can be done by taking the total count of PHLB in the haul times an average catch weight (not IBQ estimates) per PHLB from other hauls in the trip (or like "sets" if PHLB doesn't exist in any other hauls). The estimated catch weight will then be multiplied by the mortality rate for "dead" from the IPHC viability tables for that gear to determine IBQ. In 2011, there were two instances where a Pacific halibut IBQ was manually calculated due to sand flea predation. In 2012, no sand flea predation was observed.

> **Table B2.** Calculations used in manual Pacific halibut IBQ calculations in the U.S. west coast groundfish IFQ fishery.

SCENARIO	CALCULATION
1	$\sum$CATCH_WEIGHT_MORT for all sampled hauls x CATCH_COUNT for unsampled haul=PHLB IBQ $\sum$CATCH_COUNT for all sampled hauls

2	CATCH_WEIGHT = Σ SPECIMEN_LENGTH* x CATCH_COUNT
	                              #_PHLB_SAMPLED_IFQ
	CATCH_WEIGHT_MORT =
	 CATCH_WEIGHT_MORT Σ (E) + CATCH_WEIGHT_MORT Σ (P) + CATCH_WEIGHT_MORT Σ (D)
	
	CATCH_WEIGHT_MORT Σ (E) =
	Σ (SPECIMEN_LENGTH* where VIABILITY = E) for all sampled hauls x CATCH_WEIGHT x (.20**)
	 Σ SPECIMEN_LENGTH* for all sampled hauls
	
	CATCH_WEIGHT_MORT Σ (P) =
	Σ (SPECIMEN_LENGTH* where VIABILITY = P) for all for all sampled hauls x CATCH_WEIGHT x (.55**)
	 Σ SPECIMEN_LENGTH* for all sampled hauls
	
	CATCH_WEIGHT_MORT Σ (D) =
	Σ (SPECIMEN_LENGTH* where VIABILITY = D) for all sampled hauls x CATCH_WEIGHT x (.90**)
	  Σ SPECIMEN_LENGTH* for all sampled hauls

3, 4, 5	∑CATCH_WEIGHT_MORT for all sampled hauls x CATCH_COUNT for unsampled haul=PHLB IBQ ∑CATCH_COUNT for all sampled hauls

6, 7	Average CATCH_COUNT for all sampled hauls = ∑CATCH_COUNT for all sampled hauls
	                                         Total # sampled hauls
	CATCH_WEIGHT = Σ SPECIMEN_LENGTH* x Average CATCH_COUNT for all sampled hauls
	                    #_PHLB_SAMPLED_IFQ
	
	CATCH_WEIGHT_MORT =
	 CATCH_WEIGHT_MORT Σ (E) + CATCH_WEIGHT_MORT Σ (P) + CATCH_WEIGHT_MORT Σ (D)
	
	CATCH_WEIGHT_MORT Σ (E) =
	Σ (SPECIMEN_LENGTH* where VIABILITY = E) for all sampled hauls x CATCH_WEIGHT x (.20**)
	 Σ SPECIMEN_LENGTH* for all sampled hauls
	
	CATCH_WEIGHT_MORT Σ (P) =
	Σ (SPECIMEN_LENGTH* where VIABILITY = P) for all sampled hauls x CATCH_WEIGHT x (.55**)
	 Σ SPECIMEN_LENGTH* for all sampled hauls
	
	CATCH_WEIGHT_MORT Σ (D) =

	Σ (SPECIMEN_LENGTH* where VIABILITY = D) for all sampled hauls x CATCH_WEIGHT x (.90**) Σ SPECIMEN_LENGTH* for all sampled hauls
8, 9	PHLB IBQ = $\dfrac{\sum \text{CATCH\_WEIGHT\_MORT for all sampled hauls}}{\text{Total \# of sampled hauls}}$
10	CATCH_WEIGHT_MORT = ∑CATCH_WEIGHT _MORT for the properly sampled PHLB + (CATCH_WEIGHT estimate for the predated PHLB* Mortality rate for "dead" for that fishery)

* Converted to weight using P. halibut length-weight conversion table (Appendix C below)

** IPHC mortality rates

APPENDIX C IPHC length weight conversion table for Pacific halibut

Centimeter	Pounds	Kilograms	Centimeter	Pounds	Kilograms	Centimeter	Pounds	Kilograms	Centimeter	Pounds	Kilograms
10	0.02	0.01	71	9.19	4.17	131	66.82	30.31	191	226.70	102.83
11	0.02	0.01	72	9.61	4.36	132	68.48	31.06	192	230.56	104.58
12	0.02	0.01	73	10.05	4.56	133	70.17	31.83	193	234.48	106.36
13	0.04	0.02	74	10.49	4.76	134	71.89	32.61	194	238.45	108.16
14	0.04	0.02	75	10.98	4.98	135	73.66	33.41	195	242.44	109.97
15	0.07	0.03	76	11.44	5.19	136	75.44	34.22	196	246.50	111.81
16	0.07	0.03	77	11.95	5.42	137	77.25	35.04	197	250.60	113.67
17	0.09	0.04	78	12.46	5.65	138	79.08	35.87	198	255.74	116.00
18	0.11	0.05	79	12.99	5.89	139	80.95	36.72	199	258.93	117.45
19	0.13	0.06	80	13.51	6.13	140	82.87	37.59	200	263.17	119.37
20	0.15	0.07	81	14.07	6.38	141	84.79	38.46	201	267.46	121.32
21	0.18	0.08	82	14.64	6.64	142	86.75	39.35	202	271.79	123.28
22	0.20	0.09	83	15.23	6.91	143	88.76	40.26	203	276.17	125.27
23	0.24	0.11	84	15.83	7.18	144	90.79	41.18	204	280.60	127.28
24	0.26	0.12	85	16.45	7.46	145	92.84	42.11	205	285.10	129.32
25	0.31	0.14	86	17.09	7.75	146	94.93	43.06	206	289.62	131.37
26	0.35	0.16	87	17.75	8.05	147	97.05	44.02	207	294.21	133.45
27	0.40	0.18	88	18.41	8.35	148	99.21	45.00	208	298.84	135.55
28	0.46	0.21	89	19.09	8.66	149	101.39	45.99	209	303.51	137.67
29	0.51	0.23	90	19.80	8.98	150	103.62	47.00	210	308.25	139.82
30	0.57	0.26	91	20.53	9.31	151	105.87	48.02	211	313.03	141.99
31	0.62	0.28	92	21.25	9.64	152	108.16	49.06	212	317.86	144.18
32	0.71	0.32	93	22.02	9.99	153	110.50	50.12	213	322.73	146.39
33	0.77	0.35	94	22.80	10.34	154	112.83	51.18	214	327.67	148.63
34	0.84	0.38	95	23.59	10.70	155	115.24	52.27	215	332.65	150.89
35	0.93	0.42	96	24.41	11.07	156	117.66	53.37	216	337.70	153.18
36	1.01	0.46	97	25.24	11.45	157	120.13	54.49	217	342.79	155.49
37	1.10	0.50	98	26.08	11.83	158	122.62	55.62	218	347.93	157.82
38	1.21	0.55	99	26.96	12.23	159	125.16	56.77	219	353.13	160.18
39	1.32	0.60	100	27.87	12.64	160	127.71	57.93	220	358.38	162.56
40	1.43	0.65	101	28.77	13.05	161	130.32	59.11	221	363.69	164.97
41	1.59	0.72	102	29.70	13.47	162	132.96	60.31	222	369.05	167.40
42	1.68	0.76	103	30.67	13.91	163	135.65	61.53	223	374.45	169.85
43	1.81	0.82	104	31.64	14.35	164	138.36	62.76	224	379.92	172.33
44	1.94	0.88	105	32.63	14.80	165	141.12	64.01	225	385.45	174.84
45	2.09	0.95	106	33.64	15.26	166	143.90	65.27	226	391.03	177.37
46	2.25	1.02	107	34.68	15.73	167	146.72	66.55	227	396.67	179.93
47	2.43	1.10	108	35.74	16.21	168	149.54	67.83	228	402.36	182.51
48	2.58	1.17	109	36.84	16.71	169	152.49	69.17	229	408.09	185.11
49	2.76	1.25	110	37.94	17.21	170	155.45	70.51	230	413.91	187.75
50	2.95	1.34	111	39.07	17.72	171	158.42	71.86	231	419.76	190.40
51	3.15	1.43	112	40.21	18.24	172	161.44	73.23	232	425.69	193.09
52	3.35	1.52	113	41.38	18.77	173	164.51	74.62	233	431.66	195.80
53	3.57	1.62	114	42.59	19.32	174	167.60	76.02	234	437.68	198.53
54	3.79	1.72	115	43.81	19.87	175	170.75	77.45	235	443.76	201.29
55	4.01	1.82	116	45.06	20.44	176	173.92	78.89	236	449.91	204.08
56	4.25	1.93	117	46.32	21.01	177	177.14	80.35	237	456.13	206.90
57	4.52	2.05	118	47.62	21.60	178	180.40	81.83	238	462.39	209.74
58	4.76	2.16	119	48.94	22.20	179	183.71	83.33	239	468.72	212.61
59	5.05	2.29	120	50.29	22.81	180	187.06	84.85	240	475.09	215.50
60	5.31	2.41	121	51.65	23.43	181	190.46	86.39	241	481.55	218.43
61	5.62	2.55	122	53.07	24.07	182	193.87	87.94	242	488.05	221.38
62	5.93	2.69	123	54.48	24.71	183	197.36	89.52	243	494.60	224.35
63	6.24	2.83	124	55.93	25.37	184	200.86	91.11	244	501.24	227.36
64	6.57	2.98	125	57.41	26.04	185	204.43	92.73	245	507.92	230.39
65	6.90	3.13	126	58.91	26.72	186	208.03	94.36	246	514.66	233.45
66	7.25	3.29	127	60.43	27.41	187	211.67	96.01	247	521.48	236.54
67	7.61	3.45	128	61.99	28.12	188	214.71	97.39	248	528.36	239.66
68	7.98	3.62	129	63.56	28.83	189	218.50	99.11	249	535.28	242.80
69	8.38	3.80	130	65.17	29.56	190	222.89	101.10	250	542.29	245.98
70	8.77	3.98									

APPENDIX D

Figure D1. IFQ groundfish fishery data flow from the West Coast Groundfish Observer Program (WCGOP) to the Vessel Account System (VAS) of the NW Regional Office.

IFQ Fishery Data Flow:
Observer to Vessel Account Process