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Marine Mammal Mortality in U.S. West Coast Groundfish Fisheries 2002-2016

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SUMMARY

Marine mammal bycatch estimates are provided for the years 2002 through 2016 from all fishery sectors observed by the Northwest Fishery Science Center Groundfish Observer Program (Table 1). In addition, we provide historical estimates of marine mammal bycatch in the Limited Entry (LE) bottom trawl fishery for the 2002-2010 period.

The five year average bycatch of pinnipeds and 95% confidence interval is given in Figure 1. California sea lions are the most frequently caught pinniped in the fisheries reported here, followed by Steller sea lions and northern elephant seals. Pinniped bycatch is mainly in fisheries using bottom and midwater trawls. During the LE bottom trawl years (2002-2010), pinniped mortality was relatively high driven by the bycatch of California sea lions in the LE trawl fishery (Table 7). In 2010, pinniped mortality begins to drop over the 2010-2015 period (Figure 1), coinciding with the implementation of the Catch Shares management program of the LE bottom trawl fishery in 2011. Pinniped bycatch made a sharp upswing in 2016 (Figure 1) due to unusually high bycatch of both California and Steller sea lions in the At-sea hake catcher-processor fleet that year (Figure 1).

The five year average bycatch and 95% confidence interval of cetaceans excluding humpback whales is given in the top portion of Figure 2 and hovered around a five year average of 10 for 2002-2016. Dolphins and porpoises are the most frequently caught cetaceans in the fisheries reported here, mainly in fisheries using bottom and midwater trawls.

The five year average bycatch and 95% confidence interval of humpback whales is given in the bottom portion of Figure 2. Two humpback whales have been observed entangled in pot gear over the 2002-2016 period. The single humpback whale entnaged in the LE Sablefish pot fishery in 2014 (Table 14) resulted in an estimtated five year average of one (1) entangled whale in 2012-2016 (95% confidence interval: 1 – 3). The single humpback whale entnaged in the Open Access (OA) fixed gear fishery in 2016 (Table 16) resulted in an estimated five year average of three (3) entangled whales in 2012-2016 (95% confidence interval: 1 – 6).

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INTRODUCTION

The California Current marine ecosystem on the United States (U.S.) West Coast (Washington, Oregon, California) supports a diversity of marine mammals. Managing and conserving marine biodiversity requires accounting for human-induced mortality to marine mammals. The distributions of marine mammals overlap with commercial fisheries operating within the U.S. Exclusive Economic Zone (E.E.Z.), which can cause incidental human-induced serious injury or mortality of these species, a.k.a., bycatch. Under the Marine Mammal Protection Act, a 'take' is defined as any act that harasses, hunts, captures, or kills, or attempts to harass, hunt, capture, or kill a marine mammal. While commercial fisheries are granted an exemption on the prohibition of 'takes' under the MMPA, the Act tasks NMFS with managing serious injuries and mortalities of marine mammals from bycatch in commercial fishing operations. This report summarizes interactions between the U.S. west coast groundfish fishery and marine mammals and presents estimates of fleet-wide bycatch for these species based on data from the fishery and federal observer programs for 2002-2016.

Marine Mammal Protection Act

The MMPA was passed in 1972 and amended in 1994. The Act states that marine mammal species and population stocks should not be permitted to diminish below their optimum sustainable population level and that measures must be taken to replenish depleted species or population stocks. Measures include reduction in the taking of marine mammals in U.S. waters, by U.S. citizens on the high seas, and through the importation of marine mammals and marine mammal products in the United States. The MMPA contains specific provisions for reducing marine mammal bycatch in U.S. commercial fisheries.

Effects of U.S. commercial fisheries on marine mammal populations are determined annually and reported in the List of Fisheries (LOF), which is published by the National Marine Fisheries Service (NMFS) as required by section 118 of the MMPA (16 USC 1387 (c) (1)). Each fishery is placed into one of three categories based on the level of marine mammal serious injury and mortality in the fishery; Category 1 has the highest injury/mortality level and Category III has the lowest injury/mortality level. The categorization process often relies on Marine Mammal Stock Assessment Reports (SAR) to provide the allowable biological removal of the stock that ensures a sustainable population is maintained. The categorization level of a fishery determines if compliance is required with particular provisions of the MMPA, including registration, observer coverage, and take reduction plans. Category I and Category II commercial fisheries are required to comply with MMPA provisions, while Category III commercial fisheries are not.

FISHERY DESCRIPTIONS

Table 1 provides a description of permits, gears used, target groups, vessel length range, fishing depth range, and management of fishery sectors and sub-sectors in U.S. west coast groundfish fisheries. For brevity, management descriptors are generalized for the given time period and are not meant to be complete or comprehensive.

Table 1: A description of permits, gears used, target groups, vessel length range, fishing depth range, and management of fishery sectors and sub-sectors in U.S. west coast groundfish fisheries. For brevity, management descriptors are generalized for the given time period and are not meant to be complete or comprehensive.

							Management	
Sector	**Sub-Sector**	**Permits**	**Gear(s)**	**Target(s)**	**Length (m)**	**Depths (m)**	**2002-2010**	**2011-present**
Limited Entry (LE) Trawl		Federal LE permit[1] with trawl endorsement	Bottom Trawl, after Jan 1, 2011 also Hook & Line and Pot gear	Species assemblages	11-29	Wide range	Cumulative two-month trip limits; depth-based closures; 14-23% observer coverage	Individual Fishing Quotas (IFQ); 100% observer coverage
LE California Halibut		CA Halibut permit[2] and LE permit with trawl endorsement	Bottom Trawl	California halibut[5]	9-22	< 55	Cumulative two-month trip-limits; depth-based closures; 3-23% observer coverage	IFQ; 100% observer coverage
At-Sea Hake	Mothership-Catcher Vessel (MSCV)	LE permit with MSCV endorsement	Midwater Trawl	Pacific hake[6]	26-45[4]	53-460[4]	Seasonal quotas for target and bycatch species of concern; 100% observer coverage	IFQ; Seasonal; 100% observer coverage
	Catcher-processors (CP)	LE permit with CP endorsement	Midwater Trawl	Pacific hake	82-115	60-570	Same as At-Sea Hake MSCV	IFQ; Seasonal; 100% observer coverage
	Tribal	(none)	Midwater Trawl	Pacific hake		53-460	Tribal; 100% observer coverage	
Shoreside Hake		LE permit with trawl endorsement	Midwater Trawl	Pacific hake	17-29	Wide range	Same as At-Sea Hake MSCV; electronic monitoring	IFQ; Seasonal; 100% observer coverage

							Management
Sector	**Sub-Sector**	**Permits**	**Gear(s)**	**Target(s)**	**Length (m)**	**Depths (m)**	**2002-present**
Non-Nearshore Fixed Gear	Sablefish endorsed	LE permit with fixed gear endorsement and sablefish quota	Longlines, Pots	Sablefish[7]	11-32	> 145	Sablefish tier quotas; seven month season; 9-27% observer coverage
	Sablefish non-endorsed (a.k.a. Zero Tier)	LE permit with fixed gear endorsement w/o sablefish quota	Longlines, Pots	Sablefish, rockfish[8] and flatfish[9]	5-18	> 145	Trip limits; 1-12% observer coverage
	Open Access	(none)	Longlines, Pots	Sablefish and other groundfish	3-30	> 64	Trip limits; 1-6% observer coverage
Open Access (OA) California Halibut		CA Halibut permit[2]	Bottom Trawl	California halibut	9-22	< 55	All fishing occurs within CA waters, most in the California Halibut Trawl Grounds where minimum mesh sizes, seven month season, and minimum size requirements hold; 1-16% observer coverage
Nearshore Fixed Gear[3]		CA or OR state nearshore permits and endorsements	Variety of hand lines, pot gear, stick gear, rod and reel	Rockfish, Cabezon[10], Greenlings[11]	3-15	< 110 (usu. < 55 in OR waters)	Federal and CA or OR state nearshore regulations; area closures; two-month trip limits; minimum size limits; 2-8% observer coverage
Pink Shrimp		WA, OR, or CA state pink shrimp permit	Shrimp trawl	Pink shrimp[12]	11.5-33	91-256	WA, OR, or CA state pink shrimp regulations; Bycatch Reduction Devices required; trip limits on groundfish landed; 4-14% observer coverage

[1] a.k.a., LE permit; all LE permits are issued by Federal agency (NOAA).
[2] Issued by the state of California.
[3] The state of WA does not conduct a nearshore fishery.
[4] Average values for catcher vessels delivering catch to motherships.
[5] *Paralichthys californicus*
[6] *Merluccius productus*
[7] *Anoplopoma fimbria*
[8] *Sebastes* spp.
[9] Pleuronectiformes
[10] *Scorpaenichthys marmoratus*
[11] Hexagrammidae
[12] *Pandalus jordani*

MARINE MAMMAL DATA COLLECTION

Serious Injury and Mortality Determinations

Mammal bycatch can occur by a variety of means and species vary in susceptibility to fishing mortality. Fishing behavior and methods, gear type, time, and weather all contribute to the probability of mammal mortality. In addition, species-specific characteristics such as feeding locations and times, diet preferences, size, and individual physical condition also play a role in susceptibility.

Serious injury and mortality designations were determined by marine mammal injury experts at both NOAA's Southwest Fisheries Science Center (La Jolla, CA, USA) and Marine Mammal Laboratory (Seattle, WA, USA) (Carretta et al., 2016; Carretta et al., 2017). The combination of the interaction category, interaction outcome, and specific details in observer notes recorded at the time of the interaction informed injury and mortality designations. For most interactions, the interaction category in combination with the interaction outcome was sufficient to make the determination. In other instances, the observer notes recorded at the time of the interaction indicated that the interaction resulted in, or was likely to result in, the mortality of the animal. Observers typically detail the nature of the injury and changes in the animal's behavior following its release. Noted factors indicating a potential mortality could include evidence of bleeding, broken bones, wounds, trailing gear, vomiting, and abnormal behavior. In the cases of live but potentially injured animals, NMFS and NOAA guidelines and policies were applied to determine whether the injury had the potential to cause mortality, was serious, or was non-serious (NMFS, 2012b; NMFS, 2012a; NOAA, 2012; Carretta et al., 2017). Serious injuries and mortalities were used in bycatch estimates, whereas non-serious injuries or other non-lethal interactions were excluded from bycatch estimates.

For the purposes of bycatch estimation, we assume that any observed marine mammals represent a complete census of the mammals in the catch. This assumption is justified because the large size of marine mammals makes them easy to observe and sample, even in among large quantities of fish catch. In addition, marine mammal interactions are priority over other observer duties.

Marine Mammal Bycatch Estimation

Observer coverage, defined as the percentage of observed landings to total landings, varies among the U.S. west coast groundfish fleets based on fisheries management priorities and observer program logistics and priorities. A substantial portion of the fleet is 100% monitored – that is, either an observer or electronic monitoring equipment is used on every fishing trip. In these fisheries, we assume that that the observed number of marine mammal interactions is a complete census of the population.

In other fishery sectors, observer coverage is less than 100%. In sectors with less than 100% coverage, we must expand the observed marine mammal interactions to the unobserved portion of the fleet.

Ratio estimators have been widely used in expanding discards for the purposes of estimating fleet-wide discards (Stratoudakis et al., 1999; Borges et al., 2005; Walmsley et al., 2007), including to estimate marine mammal bycatch in fisheries reported here (Jannot et al., 2011). Ratio estimators rely heavily on the assumption that bycatch is proportional to some metric or proxy of fishing effort, such as fishery landings, an assumption not often supported by data (Rochet and Trenkel, 2005). In some cases, bycatch might vary nonlinearly or even be unrelated to the ratio estimator denominator. Most mammal species reported here are rarely or sporadically caught. The rarity of mammal bycatch combined with less than 100% observer monitoring in many of these fisheries makes it difficult to assess the link between mammal bycatch and fishing effort. Low levels of observer coverage can produce biased estimates when ratio estimators are used to calculate fleet-wide bycatch of protected species (Carretta and Moore 2014, Martin et al. 2015).

To overcome the limitations of ratio estimators, we applied a Bayesian modeling approach to estimate total bycatch and associated error for fisheries sectors with less than 100% observer monitoring. These methods have been used with other rare bycatch species, including cetaceans, delphinids, pinnipeds, sea turtles, and sharks (Martin et al. 2015). We modeled bycatch rate as constant and inferred annual expected mortality, given a specified level of effort. Fleet-wide bycatch

for fisheries with less than 100% observer coverage was estimated using observer coverage rate (observed landings/total landings).

The general modeling approach was to use a simple Poisson process model, where the total number of bycatch events were assumed to follow a Poisson distribution,

$$n_{take,y} \sim Poisson\left(\lambda_y = \theta \cdot E_y\right) \tag{1}$$

where, for each stratum:

E_y = represents the effort in year y
θ = is an estimated bycatch rate
λ_y = represents the mean expected bycatch
$n_{take,y}$ = represents the number of observed bycatch events (or take events) in year y

The estimated bycatch rate θ is assumed constant through time, but the quantity $\theta \cdot E_y$ includes uncertainty (as θ is estimated). Thus, a time series of the mean bycatch can be generated for a given species, with a given metric of effort. All uncertainty in the time series originates from fluctuating levels of effort through time (percent observer coverage only affects the expansion). We used a Bayesian model (Martin et al. 2015) to generate mean and 95% CIs of the parameter θ, as well as for $\theta \cdot E_y$. Because observer coverage is less than 100% in some fleets, and variable through time, we need to expand the estimated bycatch,$\theta \cdot E_y$, to the fleet-wide level. One approach for expansion would be to divide $\theta \cdot E_y$ by the percent observer coverage; however, this ignores uncertainty in the expansion. We accounted for uncertainty in the expansion by treating the observer coverage and estimated bycatch ($\theta \cdot E_y$) as known and sampling from the distribution of total bycatch in proportion to the Binomial density function. This process was repeated for each Markov Chain Monte Carlo (MCMC) draw, to propagate uncertainty in the estimates through the uncertainty in the expansion.

As noted above, the relationship between bycatch and fishery landings as a metric of effort is not always supported in fisheries data (Rochet and Trenkel, 2005). To examine the effects of different metrics on our bycatch estimates, we estimated bycatch using the Bayesian approach described above with three different metrics of effort: total sector landings, gear units, and hours gear spent in the water. We compare the results of these different effort metrics to each other and to the estimated bycatch using a ratio estimator, by sector, gear type and bird species in Appendix C. Our results indicate that in the majority of cases, the annual bycatch estimate does not vary substantially among effort metrics using the Bayesian approach. However, there are significant differences in annual bycatch estimates between the Bayesian approach and the ratio estimator method, as was expected (Carretta and Moore 2014, Martin et al. 2015).

In the tables and figures, we present the results from the Bayesian approach using landings as the effort metric because this is consistent with both NWFSC observer coverage calculations and NWFSC bycatch estimation for non-bird species.

We did not post-stratify the data, as has been done in previous reports (Jannot et al. 2011). In the past, we used separate stratification schemes for each marine mammal, based on biology as described in Jannot et al. 2011. Post-stratification of the data was inconsistent with the sampling design employed by the WCGOP. Dropping the post-stratification could account for the differences between the Bayesian estimates and the ratio estimator estimates. We tested for this effect by comparing Bayesian estimates generated with the strata described above to those generated without strata (data not shown). The largest difference between annual estimates calculated by the two methods was less than 1%. Thus, we do not feel that removal of the stratification accounts for the large differences between Bayesian and ratio estimates. Here we report the Bayesian estimates generated without post-stratification. We also present the five year mean of the Bayesian estimate for comparison.

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REFERENCES

Borges, L., et al. 2005. Choosing the best sampling unit and auxiliary variable for discards estimations. Fish Res 75(1-3):29-39.

Carretta, J., J. E. Moore, K. A. Forney. 2017. Regression tree and ratio estimates of marine mammal, sea turtle and seabird bycatch in the California Drift Gillnet Fishery: 1990-2015. Pages 1-83 NOAA Technical Memorandum. US Dept Commer.

Carretta, J., et al. 2017. Sources of Human-Related Injury and Mortality for U.S. Pacific West Coast Marine Mammal Stock Assessments, 2011-2015. U.S. Dept. Commer. Southwest Fisheries Science Center, NMFS, NOAA, DOC.

Carretta, J., et al. 2016. Sources of human-related injury and mortality for U.S. Pacific west coast marine mammal stock assessments, 2010-2014. Pages 104 U.S. Dept. Commer. Southwest Fisheries Science Center, NMFS, NOAA, DOC.

Hanson, B., T.P. Good, J. Jannot, and J. McVeigh. 2017. Humpback whale bycatch in the 2014-2015 U.S. West Coast Groundfish Fisheries. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112.

Jannot, J., Heery, E., Bellman, M.A., and J. Majewski. 2011.Estimated bycatch of marine mammals, seabirds, and sea turtles in the US west coast commercial groundfish fishery, 2002-2009. West Coast Groundfish Observer Program. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112.

Martin, S. L., et al. 2015. Bayesian inference and assessment for rare-event bycatch in marine fisheries: a drift gillnet fishery case study. Ecol. Appl. 25(2):416-429.

NMFS. 2012a. National Marine Fisheries Service Instruction 02-238-01. Process for injury determination.

NMFS. 2012b. National Marine Fisheries Service Policy Directive 02-238. Processing for distinguishing serious from non-serious injury of marine mammals.

NOAA. 2012. Federal Register 77:3233. National Policy for Distinguishing Serious From Non-Serious Injuries of Marine Mammals. Available: http://www.gpo.gov/fdsys/pkg/FR-2012-01-23/pdf/2012-1261.pdf

Rochet, M. J. and V. M. Trenkel. 2005. Factors for the variability of discards: assumptions and field evidence. Can J Fish Aquat Sci 62(1):224-235.

Stratoudakis, Y., et al. 1999. Fish discarded from Scottish demersal vessels: estimators of total discards and annual estimates for targeted gadoids. ICES Journal of Marine Science 56(5):592-605.

Walmsley, S., et al. 2007. Bycatch and discarding in the South African demersal trawl fishery. Fish Res 86(1):15-30.

TABLES

Trawl Fisheries

Catch Shares

Table 2: Catch Shares (a.k.a. Individual Fishing Quota, IFQ) trawl fisheries marine mammal bycatch and observer coverage statistics by year, sector, and gear type. These vessels carried a scientific observed for 100% of the trips, electronic monitoring (EM) was not used. All IFQ fisheries are 100% observed by a scientific observer or electronically monitored. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed			Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Trips	Tow Hrs	Sets	Catch (mt)	Sets	Catch (mt)	Sets	Catch (mt)	Species	Observed Number
2011	Catch Shares	Bottom & Midwater Trawl	72	1134	40198.1	9195	17253.2	58	96.64	0.99	0.99	California Sea Lion	10
2012	Catch Shares	Bottom Trawl	67	1089	38029.4	8968	17178.8	52	106.43	0.99	0.99	California Sea Lion	6
2013	Catch Shares	Bottom Trawl	68	1193	42066.2	10017	18615.4	24	50.89	1.00	1.00	California Sea Lion	0
2014	Catch Shares	Bottom Trawl	64	1033	34171.2	8333	16094.1	32	75.70	1.00	1.00	California Sea Lion	8
2015	Catch Shares	Bottom Trawl	60	904	28855.2	7480	15666.1	13	52.41	1.00	1.00	California Sea Lion	4
2016	Catch Shares	Bottom Trawl	53	802	25050.6	6623	14968.3	16	42.70	1.00	1.00	California Sea Lion	3
2011	Catch Shares	Bottom & Midwater Trawl	72	1134	40198.1	9195	17253.2	58	96.64	0.99	0.99	Northern Elephant Seal	1
2012	Catch Shares	Bottom Trawl	67	1089	38029.4	8968	17178.8	52	106.43	0.99	0.99	Northern Elephant Seal	0
2013	Catch Shares	Bottom Trawl	68	1193	42066.2	10017	18615.4	24	50.89	1.00	1.00	Northern Elephant Seal	1
2014	Catch Shares	Bottom Trawl	64	1033	34171.2	8333	16094.1	32	75.70	1.00	1.00	Northern Elephant Seal	0
2015	Catch Shares	Bottom Trawl	60	904	28855.2	7480	15666.1	13	52.41	1.00	1.00	Northern Elephant Seal	2
2016	Catch Shares	Bottom Trawl	53	802	25050.6	6623	14968.3	16	42.70	1.00	1.00	Northern Elephant Seal	1
2011	Catch Shares	Bottom & Midwater Trawl	72	1134	40198.1	9195	17253.2	58	96.64	0.99	0.99	Pacific White-Sided Dolphin	0
2012	Catch Shares	Bottom Trawl	67	1089	38029.4	8968	17178.8	52	106.43	0.99	0.99	Pacific White-Sided Dolphin	0
2013	Catch Shares	Bottom Trawl	68	1193	42066.2	10017	18615.4	24	50.89	1.00	1.00	Pacific White-Sided Dolphin	0
2014	Catch Shares	Bottom Trawl	64	1033	34171.2	8333	16094.1	32	75.70	1.00	1.00	Pacific White-Sided Dolphin	1
2015	Catch Shares	Bottom Trawl	60	904	28855.2	7480	15666.1	13	52.41	1.00	1.00	Pacific White-Sided Dolphin	2
2016	Catch Shares	Bottom Trawl	53	802	25050.6	6623	14968.3	16	42.70	1.00	1.00	Pacific White-Sided Dolphin	0
2011	Catch Shares	Bottom & Midwater Trawl	72	1134	40198.1	9195	17253.2	58	96.64	0.99	0.99	Seal Unidentified	1
2012	Catch Shares	Bottom Trawl	67	1089	38029.4	8968	17178.8	52	106.43	0.99	0.99	Seal Unidentified	0
2013	Catch Shares	Bottom Trawl	68	1193	42066.2	10017	18615.4	24	50.89	1.00	1.00	Seal Unidentified	0
2014	Catch Shares	Bottom Trawl	64	1033	34171.2	8333	16094.1	32	75.70	1.00	1.00	Seal Unidentified	0
2015	Catch Shares	Bottom Trawl	60	904	28855.2	7480	15666.1	13	52.41	1.00	1.00	Seal Unidentified	0
2016	Catch Shares	Bottom Trawl	53	802	25050.6	6623	14968.3	16	42.70	1.00	1.00	Seal Unidentified	0
2011	Catch Shares	Bottom & Midwater Trawl	72	1134	40198.1	9195	17253.2	58	96.64	0.99	0.99	Steller Sea Lion	20
2012	Catch Shares	Bottom Trawl	67	1089	38029.4	8968	17178.8	52	106.43	0.99	0.99	Steller Sea Lion	8
2013	Catch Shares	Bottom Trawl	68	1193	42066.2	10017	18615.4	24	50.89	1.00	1.00	Steller Sea Lion	6
2014	Catch Shares	Bottom Trawl	64	1033	34171.2	8333	16094.1	32	75.70	1.00	1.00	Steller Sea Lion	5
2015	Catch Shares	Bottom Trawl	60	904	28855.2	7480	15666.1	13	52.41	1.00	1.00	Steller Sea Lion	13
2016	Catch Shares	Bottom Trawl	53	802	25050.6	6623	14968.3	16	42.70	1.00	1.00	Steller Sea Lion	0
2012	Midwater Rockfish	Midwater Trawl	5	10	73.0	36	197.6	0	0.00	1.00	1.00	–	0
2013	Midwater Rockfish	Midwater Trawl	8	26	138.0	79	404.7	0	0.00	1.00	1.00	–	0
2014	Midwater Rockfish	Midwater Trawl	9	34	268.5	133	873.7	0	0.00	1.00	1.00	–	0
2015	Midwater Rockfish	Midwater Trawl	7	43	246.5	147	968.5	0	0.00	1.00	1.00	–	0
2016	Midwater Rockfish	Midwater Trawl	4	16	100.6	49	375.3	0	0.00	1.00	1.00	–	0

Table 3: Catch Shares (a.k.a. Individual Fishing Quota, IFQ) trawl fisheries marine mammal bycatch and observer coverage statistics by year, sector, and gear type. These vessels carried electronic monitoring (EM) equipment on 100% of the trips and a scientific observer for the proportion of trips given under 'Proportion Sampled Catch'. All IFQ fisheries are 100% observed by a scientific observer or electronically monitored. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed			Sampled					
Year	Sector	Gear	Vessels	Trips	Tow Hrs	Sets	Catch (mt)	Landed Catch (mt)	Proportion Sampled Catch	Species	Observed Number
2015	Catch Shares EM	Bottom and Midwater Trawl	4	9	317.4	57	134.8	404.5	0.33	Northern Elephant Seal	1
2016	Catch Shares EM	Bottom and Midwater Trawl	8	30	922.6	186	503.5	1732.0	0.29	Northern Elephant Seal	0

Table 4: Catch Shares (a.k.a. Individual Fishing Quota, IFQ) midwater trawl fisheries marine mammal bycatch and observer coverage statistics by year, sector, and gear type. Shoreside Hake vessels carried observers on 100% of trips. Since 2015, Midwater Hake vessels carried either an observer or electronic monitoring (EM) equipment on 100% of the trips and a scientific observer for the proportion of sampled catch given under 'Proportion Sampled Catch'. All IFQ fisheries are 100% observed by a scientific observer or electronically monitored. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed			**Sampled**		**Unsampled**		**Proportion**			
Year	Sector	Gear	Vessels	Trips	Tow Hrs	Sets	Catch (mt)	Sets	Catch (mt)	Sets	Catch (mt)	Species	Observed Number
2011	Shoreside Hake	Midwater Trawl	27	929	3974.6	1717	90777.3	0	0.00	1.00	1.00	California Sea Lion	0
2012	Shoreside Hake	Midwater Trawl	24	744	5960.8	1601	65396.4	0	0.00	1.00	1.00	California Sea Lion	0
2013	Shoreside Hake	Midwater Trawl	24	960	4628.1	1734	96867.8	0	0.00	1.00	1.00	California Sea Lion	0
2014	Shoreside Hake	Midwater Trawl	25	996	4732.7	1725	97925.2	1	57.48	1.00	1.00	California Sea Lion	1
2015	Midwater Hake	Midwater Trawl	5	129	1194.0	289	11461.4	0	0.00	1.00	1.00	California Sea Lion	0
2016	Midwater Hake	Midwater Trawl	4	100	652.6	207	8970.0	0	0.00	1.00	1.00	California Sea Lion	0
2011	Shoreside Hake	Midwater Trawl	27	929	3974.6	1717	90777.3	0	0.00	1.00	1.00	Northern Elephant Seal	1
2012	Shoreside Hake	Midwater Trawl	24	744	5960.8	1601	65396.4	0	0.00	1.00	1.00	Northern Elephant Seal	0
2013	Shoreside Hake	Midwater Trawl	24	960	4628.1	1734	96867.8	0	0.00	1.00	1.00	Northern Elephant Seal	0
2014	Shoreside Hake	Midwater Trawl	25	996	4732.7	1725	97925.2	1	57.48	1.00	1.00	Northern Elephant Seal	0
2015	Midwater Hake	Midwater Trawl	5	129	1194.0	289	11461.4	0	0.00	1.00	1.00	Northern Elephant Seal	0
2016	Midwater Hake	Midwater Trawl	4	100	652.6	207	8970.0	0	0.00	1.00	1.00	Northern Elephant Seal	0
2011	Shoreside Hake	Midwater Trawl	27	929	3974.6	1717	90777.3	0	0.00	1.00	1.00	Steller Sea Lion	1
2012	Shoreside Hake	Midwater Trawl	24	744	5960.8	1601	65396.4	0	0.00	1.00	1.00	Steller Sea Lion	0
2013	Shoreside Hake	Midwater Trawl	24	960	4628.1	1734	96867.8	0	0.00	1.00	1.00	Steller Sea Lion	0
2014	Shoreside Hake	Midwater Trawl	25	996	4732.7	1725	97925.2	1	57.48	1.00	1.00	Steller Sea Lion	1
2015	Midwater Hake	Midwater Trawl	5	129	1194.0	289	11461.4	0	0.00	1.00	1.00	Steller Sea Lion	0
2016	Midwater Hake	Midwater Trawl	4	100	652.6	207	8970.0	0	0.00	1.00	1.00	Steller Sea Lion	0

Table 5: At-sea hake midwater trawl catcher processor marine mammal bycatch and observer coverage statistics by year. These vessels carried two scientific observers for the 100% of trips. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed		Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Tow Hrs	Tows	Catch (mt)	Tows	Catch (mt)	Tows	Catch (mt)	Species	Observed Number
2002	Catcher Processor	Midwater Trawl	5	1061.3	556	36529.7	1	89.52	1.00	1.00	California Sea Lion	0
2003	Catcher Processor	Midwater Trawl	6	911.0	766	41408.1	1	25.05	1.00	1.00	California Sea Lion	2
2004	Catcher Processor	Midwater Trawl	6	1973.4	1492	74589.0	4	186.53	1.00	1.00	California Sea Lion	2
2005	Catcher Processor	Midwater Trawl	6	2238.8	1332	79310.6	2	22.18	1.00	1.00	California Sea Lion	0
2006	Catcher Processor	Midwater Trawl	9	2980.7	1488	79917.4	2	28.41	1.00	1.00	California Sea Lion	1
2007	Catcher Processor	Midwater Trawl	9	4403.7	1566	74214.5	4	89.06	1.00	1.00	California Sea Lion	0
2008	Catcher Processor	Midwater Trawl	8	5557.9	1864	109939.8	18	1086.35	0.99	0.99	California Sea Lion	1
2009	Catcher Processor	Midwater Trawl	5	1932.4	863	38495.2	0	0.00	1.00	1.00	California Sea Lion	0
2010	Catcher Processor	Midwater Trawl	6	2653.1	1063	54750.8	1	29.24	1.00	1.00	California Sea Lion	0
2011	Catcher Processor	Midwater Trawl	9	4761.9	1530	72600.8	4	157.61	1.00	1.00	California Sea Lion	1
2012	Catcher Processor	Midwater Trawl	9	3545.6	1100	55534.5	2	133.70	1.00	1.00	California Sea Lion	0
2013	Catcher Processor	Midwater Trawl	9	3293.9	1439	78216.5	4	226.66	1.00	1.00	California Sea Lion	1
2014	Catcher Processor	Midwater Trawl	9	4731.4	1683	103546.8	1	89.47	1.00	1.00	California Sea Lion	2
2015	Catcher Processor	Midwater Trawl	9	5690.9	1503	69076.9	4	129.21	1.00	1.00	California Sea Lion	0
2016	Catcher Processor	Midwater Trawl	9	7291.4	2188	109679.5	1	60.42	1.00	1.00	California Sea Lion	49
2002	Catcher Processor	Midwater Trawl	5	1061.3	556	36529.7	1	89.52	1.00	1.00	Harbor Seal	0
2003	Catcher Processor	Midwater Trawl	6	911.0	766	41408.1	1	25.05	1.00	1.00	Harbor Seal	0
2004	Catcher Processor	Midwater Trawl	6	1973.4	1492	74589.0	4	186.53	1.00	1.00	Harbor Seal	0
2005	Catcher Processor	Midwater Trawl	6	2238.8	1332	79310.6	2	22.18	1.00	1.00	Harbor Seal	1
2006	Catcher Processor	Midwater Trawl	9	2980.7	1488	79917.4	2	28.41	1.00	1.00	Harbor Seal	1
2007	Catcher Processor	Midwater Trawl	9	4403.7	1566	74214.5	4	89.06	1.00	1.00	Harbor Seal	0
2008	Catcher Processor	Midwater Trawl	8	5557.9	1864	109939.8	18	1086.35	0.99	0.99	Harbor Seal	1
2009	Catcher Processor	Midwater Trawl	5	1932.4	863	38495.2	0	0.00	1.00	1.00	Harbor Seal	0
2010	Catcher Processor	Midwater Trawl	6	2653.1	1063	54750.8	1	29.24	1.00	1.00	Harbor Seal	0
2011	Catcher Processor	Midwater Trawl	9	4761.9	1530	72600.8	4	157.61	1.00	1.00	Harbor Seal	0
2012	Catcher Processor	Midwater Trawl	9	3545.6	1100	55534.5	2	133.70	1.00	1.00	Harbor Seal	0
2013	Catcher Processor	Midwater Trawl	9	3293.9	1439	78216.5	4	226.66	1.00	1.00	Harbor Seal	0
2014	Catcher Processor	Midwater Trawl	9	4731.4	1683	103546.8	1	89.47	1.00	1.00	Harbor Seal	0
2015	Catcher Processor	Midwater Trawl	9	5690.9	1503	69076.9	4	129.21	1.00	1.00	Harbor Seal	0
2016	Catcher Processor	Midwater Trawl	9	7291.4	2188	109679.5	1	60.42	1.00	1.00	Harbor Seal	0
2002	Catcher Processor	Midwater Trawl	5	1061.3	556	36529.7	1	89.52	1.00	1.00	Northern Elephant Seal	0
2003	Catcher Processor	Midwater Trawl	6	911.0	766	41408.1	1	25.05	1.00	1.00	Northern Elephant Seal	0
2004	Catcher Processor	Midwater Trawl	6	1973.4	1492	74589.0	4	186.53	1.00	1.00	Northern Elephant Seal	3
2005	Catcher Processor	Midwater Trawl	6	2238.8	1332	79310.6	2	22.18	1.00	1.00	Northern Elephant Seal	0
2006	Catcher Processor	Midwater Trawl	9	2980.7	1488	79917.4	2	28.41	1.00	1.00	Northern Elephant Seal	0
2007	Catcher Processor	Midwater Trawl	9	4403.7	1566	74214.5	4	89.06	1.00	1.00	Northern Elephant Seal	1
2008	Catcher Processor	Midwater Trawl	8	5557.9	1864	109939.8	18	1086.35	0.99	0.99	Northern Elephant Seal	5
2009	Catcher Processor	Midwater Trawl	5	1932.4	863	38495.2	0	0.00	1.00	1.00	Northern Elephant Seal	1
2010	Catcher Processor	Midwater Trawl	6	2653.1	1063	54750.8	1	29.24	1.00	1.00	Northern Elephant Seal	2
2011	Catcher Processor	Midwater Trawl	9	4761.9	1530	72600.8	4	157.61	1.00	1.00	Northern Elephant Seal	0
2012	Catcher Processor	Midwater Trawl	9	3545.6	1100	55534.5	2	133.70	1.00	1.00	Northern Elephant Seal	0
2013	Catcher Processor	Midwater Trawl	9	3293.9	1439	78216.5	4	226.66	1.00	1.00	Northern Elephant Seal	0
2014	Catcher Processor	Midwater Trawl	9	4731.4	1683	103546.8	1	89.47	1.00	1.00	Northern Elephant Seal	0
2015	Catcher Processor	Midwater Trawl	9	5690.9	1503	69076.9	4	129.21	1.00	1.00	Northern Elephant Seal	1
2016	Catcher Processor	Midwater Trawl	9	7291.4	2188	109679.5	1	60.42	1.00	1.00	Northern Elephant Seal	1
2002	Catcher Processor	Midwater Trawl	5	1061.3	556	36529.7	1	89.52	1.00	1.00	Steller Sea Lion	1
2003	Catcher Processor	Midwater Trawl	6	911.0	766	41408.1	1	25.05	1.00	1.00	Steller Sea Lion	1
2004	Catcher Processor	Midwater Trawl	6	1973.4	1492	74589.0	4	186.53	1.00	1.00	Steller Sea Lion	0
2005	Catcher Processor	Midwater Trawl	6	2238.8	1332	79310.6	2	22.18	1.00	1.00	Steller Sea Lion	2
2006	Catcher Processor	Midwater Trawl	9	2980.7	1488	79917.4	2	28.41	1.00	1.00	Steller Sea Lion	2
2007	Catcher Processor	Midwater Trawl	9	4403.7	1566	74214.5	4	89.06	1.00	1.00	Steller Sea Lion	3
2008	Catcher Processor	Midwater Trawl	8	5557.9	1864	109939.8	18	1086.35	0.99	0.99	Steller Sea Lion	1
2009	Catcher Processor	Midwater Trawl	5	1932.4	863	38495.2	0	0.00	1.00	1.00	Steller Sea Lion	0
2010	Catcher Processor	Midwater Trawl	6	2653.1	1063	54750.8	1	29.24	1.00	1.00	Steller Sea Lion	8
2011	Catcher Processor	Midwater Trawl	9	4761.9	1530	72600.8	4	157.61	1.00	1.00	Steller Sea Lion	1
2012	Catcher Processor	Midwater Trawl	9	3545.6	1100	55534.5	2	133.70	1.00	1.00	Steller Sea Lion	1
2013	Catcher Processor	Midwater Trawl	9	3293.9	1439	78216.5	4	226.66	1.00	1.00	Steller Sea Lion	2
2014	Catcher Processor	Midwater Trawl	9	4731.4	1683	103546.8	1	89.47	1.00	1.00	Steller Sea Lion	3
2015	Catcher Processor	Midwater Trawl	9	5690.9	1503	69076.9	4	129.21	1.00	1.00	Steller Sea Lion	0
2016	Catcher Processor	Midwater Trawl	9	7291.4	2188	109679.5	1	60.42	1.00	1.00	Steller Sea Lion	21

Table 6: At-sea hake midwater trawl catcher vessels delivering at-sea to motherships (MS) marine mammal bycatch and observer coverage statistics by year. Mothership vessels carried two scientific observers for the 100% of trips. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed		Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Tow Hrs	Tows	Catch (mt)	Tows	Catch (mt)	Tows	Catch (mt)	Species	Observed Number
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	California Sea Lion	1
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	California Sea Lion	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	California Sea Lion	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	California Sea Lion	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	California Sea Lion	1
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	California Sea Lion	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	California Sea Lion	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	California Sea Lion	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	California Sea Lion	1
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	California Sea Lion	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	California Sea Lion	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	California Sea Lion	1
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	California Sea Lion	2
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	California Sea Lion	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	California Sea Lion	3
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Dall's Porpoise	1
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Dall's Porpoise	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Dall's Porpoise	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Dall's Porpoise	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Dall's Porpoise	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Dall's Porpoise	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Dall's Porpoise	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Dall's Porpoise	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Dall's Porpoise	0
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Dall's Porpoise	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Dall's Porpoise	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Dall's Porpoise	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Dall's Porpoise	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Dall's Porpoise	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Dall's Porpoise	0
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Dolphin Unidentified	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Dolphin Unidentified	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Dolphin Unidentified	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Dolphin Unidentified	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Dolphin Unidentified	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Dolphin Unidentified	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Dolphin Unidentified	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Dolphin Unidentified	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Dolphin Unidentified	0

Table 6: At-sea hake midwater trawl catcher vessels delivering at-sea to motherships (MS) marine mammal bycatch and observer coverage statistics by year. Mothership vessels carried two scientific observers for the 100% of trips. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet. *(continued)*

			Observed		Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Tow Hrs	Tows	Catch (mt)	Tows	Catch (mt)	Tows	Catch (mt)	Species	Observed Number
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Dolphin Unidentified	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Dolphin Unidentified	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Dolphin Unidentified	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Dolphin Unidentified	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Dolphin Unidentified	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Dolphin Unidentified	1
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Harbor Seal	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Harbor Seal	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Harbor Seal	1
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Harbor Seal	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Harbor Seal	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Harbor Seal	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Harbor Seal	1
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Harbor Seal	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Harbor Seal	0
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Harbor Seal	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Harbor Seal	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Harbor Seal	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Harbor Seal	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Harbor Seal	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Harbor Seal	0
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Northern Elephant Seal	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Northern Elephant Seal	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Northern Elephant Seal	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Northern Elephant Seal	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Northern Elephant Seal	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Northern Elephant Seal	1
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Northern Elephant Seal	2
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Northern Elephant Seal	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Northern Elephant Seal	0
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Northern Elephant Seal	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Northern Elephant Seal	1
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Northern Elephant Seal	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Northern Elephant Seal	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Northern Elephant Seal	1
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Northern Elephant Seal	0
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Northern Fur Seal	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Northern Fur Seal	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Northern Fur Seal	0

Table 6: At-sea hake midwater trawl catcher vessels delivering at-sea to motherships (MS) marine mammal bycatch and observer coverage statistics by year. Mothership vessels carried two scientific observers for the 100% of trips. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet. *(continued)*

			Observed		Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Tow Hrs	Tows	Catch (mt)	Tows	Catch (mt)	Tows	Catch (mt)	Species	Observed Number
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Northern Fur Seal	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Northern Fur Seal	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Northern Fur Seal	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Northern Fur Seal	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Northern Fur Seal	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Northern Fur Seal	0
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Northern Fur Seal	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Northern Fur Seal	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Northern Fur Seal	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Northern Fur Seal	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Northern Fur Seal	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Northern Fur Seal	1
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Northern Right Whale Dolphin	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Northern Right Whale Dolphin	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Northern Right Whale Dolphin	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Northern Right Whale Dolphin	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Northern Right Whale Dolphin	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Northern Right Whale Dolphin	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Northern Right Whale Dolphin	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Northern Right Whale Dolphin	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Northern Right Whale Dolphin	0
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Northern Right Whale Dolphin	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Northern Right Whale Dolphin	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Northern Right Whale Dolphin	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Northern Right Whale Dolphin	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Northern Right Whale Dolphin	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Northern Right Whale Dolphin	1
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Otariid Unidentified	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Otariid Unidentified	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Otariid Unidentified	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Otariid Unidentified	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Otariid Unidentified	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Otariid Unidentified	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Otariid Unidentified	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Otariid Unidentified	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Otariid Unidentified	2
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Otariid Unidentified	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Otariid Unidentified	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Otariid Unidentified	0

Table 6: At-sea hake midwater trawl catcher vessels delivering at-sea to motherships (MS) marine mammal bycatch and observer coverage statistics by year. Mothership vessels carried two scientific observers for the 100% of trips. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet. *(continued)*

			Observed		Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Tow Hrs	Tows	Catch (mt)	Tows	Catch (mt)	Tows	Catch (mt)	Species	Observed Number
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Otariid Unidentified	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Otariid Unidentified	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Otariid Unidentified	0
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Pacific White-Sided Dolphin	1
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Pacific White-Sided Dolphin	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Pacific White-Sided Dolphin	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Pacific White-Sided Dolphin	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Pacific White-Sided Dolphin	0
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Pacific White-Sided Dolphin	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Pacific White-Sided Dolphin	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Pacific White-Sided Dolphin	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Pacific White-Sided Dolphin	0
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Pacific White-Sided Dolphin	0
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Pacific White-Sided Dolphin	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Pacific White-Sided Dolphin	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Pacific White-Sided Dolphin	0
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Pacific White-Sided Dolphin	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Pacific White-Sided Dolphin	0
2002	MS Catcher Vessels	Midwater Trawl	11	1624.6	573	26607.6	1	32.52	1.00	1.00	Steller Sea Lion	0
2003	MS Catcher Vessels	Midwater Trawl	12	500.9	522	25368.3	14	671.74	0.97	0.97	Steller Sea Lion	0
2004	MS Catcher Vessels	Midwater Trawl	10	796.8	569	24109.6	2	52.99	1.00	1.00	Steller Sea Lion	0
2005	MS Catcher Vessels	Midwater Trawl	18	1882.7	1038	49314.8	1	20.00	1.00	1.00	Steller Sea Lion	0
2006	MS Catcher Vessels	Midwater Trawl	20	2325.7	1243	53873.8	40	1729.10	0.97	0.97	Steller Sea Lion	1
2007	MS Catcher Vessels	Midwater Trawl	20	3133.6	1135	47582.7	11	402.45	0.99	0.99	Steller Sea Lion	0
2008	MS Catcher Vessels	Midwater Trawl	19	3866.2	1346	58083.6	3	175.07	1.00	1.00	Steller Sea Lion	0
2009	MS Catcher Vessels	Midwater Trawl	19	1686.3	597	24249.0	3	47.54	1.00	1.00	Steller Sea Lion	0
2010	MS Catcher Vessels	Midwater Trawl	22	2804.5	908	35935.4	0	0.00	1.00	1.00	Steller Sea Lion	1
2011	MS Catcher Vessels	Midwater Trawl	18	2975.7	1246	50329.7	2	1.02	1.00	1.00	Steller Sea Lion	1
2012	MS Catcher Vessels	Midwater Trawl	16	3161.8	931	37988.7	18	654.52	0.98	0.98	Steller Sea Lion	0
2013	MS Catcher Vessels	Midwater Trawl	18	3075.7	1249	52746.2	7	141.04	0.99	1.00	Steller Sea Lion	0
2014	MS Catcher Vessels	Midwater Trawl	19	3547.1	1288	62178.8	18	155.11	0.99	1.00	Steller Sea Lion	1
2015	MS Catcher Vessels	Midwater Trawl	14	2134.7	625	27805.0	6	47.15	0.99	1.00	Steller Sea Lion	0
2016	MS Catcher Vessels	Midwater Trawl	17	5502.1	1550	65426.7	7	64.31	1.00	1.00	Steller Sea Lion	2

Limited Entry Trawl 2002-10

Table 7: Limited Entry (LE) trawl fishery marine mammal bycatch and observer coverage statistics by year. This fishery was converted to the Catch Shares fishery in 2011. From 2002-10, LE trawl vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed									Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Hauls	Tow Hrs	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2002	Limited Entry Trawl	Bottom Trawl	133	578	3206	13573.9	2681.4	19708.4	0.14	California Sea Lion	3	18.20	18.16	13.34	23.72	19	11	26
2003	Limited Entry Trawl	Bottom Trawl	125	465	2315	11578.8	2590.4	20109.3	0.13	California Sea Lion	8	23.67	23.66	18.05	29.29	21	13	29
2004	Limited Entry Trawl	Bottom Trawl	103	616	3483	13900.9	4311.0	18652.2	0.23	California Sea Lion	1	13.81	13.76	9.40	18.56	19	11	26
2005	Limited Entry Trawl	Bottom Trawl	105	524	3504	12715.4	4249.3	19286.2	0.22	California Sea Lion	4	17.39	17.33	13.12	22.42	19	11	26
2006	Limited Entry Trawl	Bottom Trawl	87	477	3027	11577.6	3443.4	17794.9	0.19	California Sea Lion	4	16.83	16.81	12.56	21.39	18	10	25
2007	Limited Entry Trawl	Bottom Trawl	88	374	2550	11457.9	3448.6	20516.3	0.17	California Sea Lion	2	17.23	17.32	12.15	22.66	18	10	25
2008	Limited Entry Trawl	Bottom Trawl	100	438	3224	15129.5	4918.5	24203.2	0.20	California Sea Lion	2	19.19	19.17	13.52	25.31	17	9	24
2009	Limited Entry Trawl	Bottom Trawl	101	590	4455	19786.5	6074.6	26063.9	0.23	California Sea Lion	7	24.84	24.85	18.98	31.09	20	12	28
2010	Limited Entry Trawl	Bottom Trawl	83	348	2640	13152.0	4076.4	22320.4	0.18	California Sea Lion	1	17.32	17.29	11.85	23.51	20	12	28
2002	Limited Entry Trawl	Bottom Trawl	133	578	3206	13573.9	2681.4	19708.4	0.14	Northern Elephant Seal	0	1.12	0.99	0.12	2.82	16	9	23
2003	Limited Entry Trawl	Bottom Trawl	125	465	2315	11578.8	2590.4	20109.3	0.13	Northern Elephant Seal	0	1.16	1.01	0.17	3.13	13	6	19
2004	Limited Entry Trawl	Bottom Trawl	103	616	3483	13900.9	4311.0	18652.2	0.23	Northern Elephant Seal	0	0.92	0.80	0.12	2.39	10	4	15
2005	Limited Entry Trawl	Bottom Trawl	105	524	3504	12715.4	4249.3	19286.2	0.22	Northern Elephant Seal	0	0.96	0.83	0.12	2.52	5	1	9
2006	Limited Entry Trawl	Bottom Trawl	87	477	3027	11577.6	3443.4	17794.9	0.19	Northern Elephant Seal	0	0.92	0.80	0.12	2.40	2	0	5
2007	Limited Entry Trawl	Bottom Trawl	88	374	2550	11457.9	3448.6	20516.3	0.17	Northern Elephant Seal	1	2.10	1.97	1.15	3.95	2	0	5
2008	Limited Entry Trawl	Bottom Trawl	100	438	3224	15129.5	4918.5	24203.2	0.20	Northern Elephant Seal	0	1.22	1.07	0.17	3.21	2	0	5
2009	Limited Entry Trawl	Bottom Trawl	101	590	4455	19786.5	6074.6	26063.9	0.23	Northern Elephant Seal	1	2.27	2.11	1.17	4.34	2	0	5
2010	Limited Entry Trawl	Bottom Trawl	83	348	2640	13152.0	4076.4	22320.4	0.18	Northern Elephant Seal	0	1.18	1.00	0.16	3.09	2	0	5
2002	Limited Entry Trawl	Bottom Trawl	133	578	3206	13573.9	2681.4	19708.4	0.14	Pacific White-sided Dolphin	0	0.69	0.52	0.03	2.16	2	0	5
2003	Limited Entry Trawl	Bottom Trawl	125	465	2315	11578.8	2590.4	20109.3	0.13	Pacific White-sided Dolphin	1	1.71	1.53	1.03	3.25	2	0	5
2004	Limited Entry Trawl	Bottom Trawl	103	616	3483	13900.9	4311.0	18652.2	0.23	Pacific White-sided Dolphin	0	0.55	0.42	0.03	1.70	2	0	5
2005	Limited Entry Trawl	Bottom Trawl	105	524	3504	12715.4	4249.3	19286.2	0.22	Pacific White-sided Dolphin	0	0.58	0.44	0.03	1.76	1	0	3
2006	Limited Entry Trawl	Bottom Trawl	87	477	3027	11577.6	3443.4	17794.9	0.19	Pacific White-sided Dolphin	0	0.56	0.45	0.04	1.81	1	0	3
2007	Limited Entry Trawl	Bottom Trawl	88	374	2550	11457.9	3448.6	20516.3	0.17	Pacific White-sided Dolphin	0	0.66	0.53	0.03	2.10	1	0	3
2008	Limited Entry Trawl	Bottom Trawl	100	438	3224	15129.5	4918.5	24203.2	0.20	Pacific White-sided Dolphin	0	0.74	0.56	0.04	2.27	1	0	3
2009	Limited Entry Trawl	Bottom Trawl	101	590	4455	19786.5	6074.6	26063.9	0.23	Pacific White-sided Dolphin	0	0.76	0.59	0.05	2.39	1	0	3
2010	Limited Entry Trawl	Bottom Trawl	83	348	2640	13152.0	4076.4	22320.4	0.18	Pacific White-sided Dolphin	0	0.70	0.54	0.05	2.14	1	0	3
2002	Limited Entry Trawl	Bottom Trawl	133	578	3206	13573.9	2681.4	19708.4	0.14	Rissos Dolphin	0	1.67	1.52	0.37	3.87	1	0	3
2003	Limited Entry Trawl	Bottom Trawl	125	465	2315	11578.8	2590.4	20109.3	0.13	Rissos Dolphin	0	1.72	1.55	0.35	3.99	2	0	5
2004	Limited Entry Trawl	Bottom Trawl	103	616	3483	13900.9	4311.0	18652.2	0.23	Rissos Dolphin	0	1.38	1.26	0.29	3.04	2	0	5
2005	Limited Entry Trawl	Bottom Trawl	105	524	3504	12715.4	4249.3	19286.2	0.22	Rissos Dolphin	0	1.45	1.31	0.34	3.26	2	0	5
2006	Limited Entry Trawl	Bottom Trawl	87	477	3027	11577.6	3443.4	17794.9	0.19	Rissos Dolphin	0	1.38	1.27	0.29	3.14	2	0	5
2007	Limited Entry Trawl	Bottom Trawl	88	374	2550	11457.9	3448.6	20516.3	0.17	Rissos Dolphin	0	1.64	1.48	0.35	3.84	2	0	5
2008	Limited Entry Trawl	Bottom Trawl	100	438	3224	15129.5	4918.5	24203.2	0.20	Rissos Dolphin	3	4.84	4.68	3.40	7.12	3	0	6
2009	Limited Entry Trawl	Bottom Trawl	101	590	4455	19786.5	6074.6	26063.9	0.23	Rissos Dolphin	0	1.90	1.73	0.41	4.29	3	0	6
2010	Limited Entry Trawl	Bottom Trawl	83	348	2640	13152.0	4076.4	22320.4	0.18	Rissos Dolphin	0	1.76	1.61	0.44	4.06	3	0	6
2002	Limited Entry Trawl	Bottom Trawl	133	578	3206	13573.9	2681.4	19708.4	0.14	Sea Lion Unid	1	1.67	1.54	1.03	3.13	3	0	6
2003	Limited Entry Trawl	Bottom Trawl	125	465	2315	11578.8	2590.4	20109.3	0.13	Sea Lion Unid	0	0.70	0.58	0.04	2.12	3	0	6
2004	Limited Entry Trawl	Bottom Trawl	103	616	3483	13900.9	4311.0	18652.2	0.23	Sea Lion Unid	0	0.56	0.46	0.03	1.73	2	0	5
2005	Limited Entry Trawl	Bottom Trawl	105	524	3504	12715.4	4249.3	19286.2	0.22	Sea Lion Unid	0	0.58	0.45	0.03	1.90	2	0	5
2006	Limited Entry Trawl	Bottom Trawl	87	477	3027	11577.6	3443.4	17794.9	0.19	Sea Lion Unid	0	0.57	0.46	0.02	1.79	1	0	3
2007	Limited Entry Trawl	Bottom Trawl	88	374	2550	11457.9	3448.6	20516.3	0.17	Sea Lion Unid	0	0.67	0.53	0.02	2.15	1	0	3
2008	Limited Entry Trawl	Bottom Trawl	100	438	3224	15129.5	4918.5	24203.2	0.20	Sea Lion Unid	0	0.74	0.58	0.03	2.28	1	0	3
2009	Limited Entry Trawl	Bottom Trawl	101	590	4455	19786.5	6074.6	26063.9	0.23	Sea Lion Unid	0	0.75	0.60	0.04	2.39	1	0	3
2010	Limited Entry Trawl	Bottom Trawl	83	348	2640	13152.0	4076.4	22320.4	0.18	Sea Lion Unid	0	0.72	0.56	0.02	2.27	1	0	3
2002	Limited Entry Trawl	Bottom Trawl	133	578	3206	13573.9	2681.4	19708.4	0.14	Steller Sea Lion	2	9.91	9.72	6.36	14.08	3	0	6
2003	Limited Entry Trawl	Bottom Trawl	125	465	2315	11578.8	2590.4	20109.3	0.13	Steller Sea Lion	0	8.09	7.88	4.56	12.45	5	1	9
2004	Limited Entry Trawl	Bottom Trawl	103	616	3483	13900.9	4311.0	18652.2	0.23	Steller Sea Lion	0	6.61	6.41	3.81	10.32	6	2	10
2005	Limited Entry Trawl	Bottom Trawl	105	524	3504	12715.4	4249.3	19286.2	0.22	Steller Sea Lion	0	6.95	6.84	3.91	10.64	7	2	12
2006	Limited Entry Trawl	Bottom Trawl	87	477	3027	11577.6	3443.4	17794.9	0.19	Steller Sea Lion	0	6.60	6.47	3.79	10.28	8	3	13
2007	Limited Entry Trawl	Bottom Trawl	88	374	2550	11457.9	3448.6	20516.3	0.17	Steller Sea Lion	2	9.90	9.65	6.55	14.11	8	3	13
2008	Limited Entry Trawl	Bottom Trawl	100	438	3224	15129.5	4918.5	24203.2	0.20	Steller Sea Lion	0	8.90	8.68	5.18	13.72	8	3	13
2009	Limited Entry Trawl	Bottom Trawl	101	590	4455	19786.5	6074.6	26063.9	0.23	Steller Sea Lion	5	14.20	14.00	10.31	18.87	10	4	15
2010	Limited Entry Trawl	Bottom Trawl	83	348	2640	13152.0	4076.4	22320.4	0.18	Steller Sea Lion	7	15.43	15.31	11.85	20.14	12	6	18

California Halibut

Table 8: Limited Entry (LE) California (CA) halibut trawl fishery marine mammal bycatch and observer coverage statistics by year. Since 2011, this fishery estimates are included in the Catch Shares trawl fisheries (above). From 2002-09, LE trawl vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Values from the 2010 LE CA Halibut fishery are combined with the Open Access (OA) CA Halibut fishery (below) to meet confidentiality requirements. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed								Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Hauls	Tow Hrs	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2002	LE CA Halibut	Bottom Trawl	7	19	52	4824.3	3.6	108.3	0.03	California Sea Lion	2	37.21	36.65	25.69	50.65	28	18	37
2003	LE CA Halibut	Bottom Trawl	12	73	207	17190.8	19.1	105.5	0.18	California Sea Lion	12	40.89	40.55	32.38	50.91	9	4	14
2004	LE CA Halibut	Bottom Trawl	8	46	171	16009.5	31.5	136.4	0.23	California Sea Lion	2	37.08	36.69	26.94	49.09	17	9	24
2005	LE CA Halibut	Bottom Trawl	10	74	235	17830.1	30.5	188.9	0.16	California Sea Lion	1	53.95	53.38	38.70	71.32	24	15	32
2006	LE CA Halibut	Bottom Trawl	9	78	224	11458.4	14.3	119.5	0.12	California Sea Lion	14	49.17	48.70	38.99	60.96	35	24	45
2007	LE CA Halibut	Bottom Trawl	5	40	81	6640.3	5.4	18.6	0.29	California Sea Lion	4	8.41	8.36	7.15	9.99	44	31	55
2008	LE CA Halibut	Bottom Trawl	6	40	118	9132.5	9.6	36.4	0.26	California Sea Lion	4	12.97	12.83	10.38	16.26	38	26	48
2009	LE CA Halibut	Bottom Trawl	3	12	29	1106.7	2.9	47.2	0.06	California Sea Lion	0	14.91	14.85	9.88	20.38	33	22	43
2002	LE CA Halibut	Bottom Trawl	7	19	52	4824.3	3.6	108.3	0.03	Harbor Porpoise	0	1.56	1.20	0.09	5.21	1	0	3
2003	LE CA Halibut	Bottom Trawl	12	73	207	17190.8	19.1	105.5	0.18	Harbor Porpoise	0	1.09	0.86	0.07	3.42	18	10	25
2004	LE CA Halibut	Bottom Trawl	8	46	171	16009.5	31.5	136.4	0.23	Harbor Porpoise	1	2.30	2.02	1.08	4.96	8	3	13
2005	LE CA Halibut	Bottom Trawl	10	74	235	17830.1	30.5	188.9	0.16	Harbor Porpoise	0	1.99	1.48	0.13	6.30	7	2	12
2006	LE CA Halibut	Bottom Trawl	9	78	224	11458.4	14.3	119.5	0.12	Harbor Porpoise	0	1.37	1.03	0.11	4.30	5	1	9
2007	LE CA Halibut	Bottom Trawl	5	40	81	6640.3	5.4	18.6	0.29	Harbor Porpoise	0	0.17	0.13	0.01	0.57	2	0	5
2008	LE CA Halibut	Bottom Trawl	6	40	118	9132.5	9.6	36.4	0.26	Harbor Porpoise	0	0.35	0.27	0.02	1.12	2	0	5
2009	LE CA Halibut	Bottom Trawl	3	12	29	1106.7	2.9	47.2	0.06	Harbor Porpoise	0	0.70	0.54	0.03	2.35	2	0	5
2002	LE CA Halibut	Bottom Trawl	7	19	52	4824.3	3.6	108.3	0.03	Harbor Seal	0	1.43	1.12	0.08	4.62	2	0	5
2003	LE CA Halibut	Bottom Trawl	12	73	207	17190.8	19.1	105.5	0.18	Harbor Seal	0	0.99	0.77	0.07	3.14	1	0	3
2004	LE CA Halibut	Bottom Trawl	8	46	171	16009.5	31.5	136.4	0.23	Harbor Seal	0	1.18	0.93	0.07	3.65	1	0	3
2005	LE CA Halibut	Bottom Trawl	10	74	235	17830.1	30.5	188.9	0.16	Harbor Seal	0	1.77	1.41	0.13	5.44	1	0	3
2006	LE CA Halibut	Bottom Trawl	9	78	224	11458.4	14.3	119.5	0.12	Harbor Seal	1	2.22	1.96	1.08	4.89	2	0	5
2007	LE CA Halibut	Bottom Trawl	5	40	81	6640.3	5.4	18.6	0.29	Harbor Seal	0	0.16	0.13	0.01	0.52	2	0	5
2008	LE CA Halibut	Bottom Trawl	6	40	118	9132.5	9.6	36.4	0.26	Harbor Seal	0	0.31	0.23	0.01	1.01	2	0	5
2009	LE CA Halibut	Bottom Trawl	3	12	29	1106.7	2.9	47.2	0.06	Harbor Seal	0	0.62	0.51	0.04	1.82	2	0	5
2002	LE CA Halibut	Bottom Trawl	7	19	52	4824.3	3.6	108.3	0.03	Steller Sea Lion	0	3.34	2.98	0.69	7.72	3	0	6
2003	LE CA Halibut	Bottom Trawl	12	73	207	17190.8	19.1	105.5	0.18	Steller Sea Lion	1	3.55	3.31	1.58	6.92	2	0	5
2004	LE CA Halibut	Bottom Trawl	8	46	171	16009.5	31.5	136.4	0.23	Steller Sea Lion	0	3.06	2.83	0.75	6.75	2	0	5
2005	LE CA Halibut	Bottom Trawl	10	74	235	17830.1	30.5	188.9	0.16	Steller Sea Lion	0	4.63	4.34	1.10	10.57	3	0	6
2006	LE CA Halibut	Bottom Trawl	9	78	224	11458.4	14.3	119.5	0.12	Steller Sea Lion	0	3.09	2.84	0.72	7.26	4	1	8
2007	LE CA Halibut	Bottom Trawl	5	40	81	6640.3	5.4	18.6	0.29	Steller Sea Lion	1	1.40	1.37	1.08	1.95	4	1	8
2008	LE CA Halibut	Bottom Trawl	6	40	118	9132.5	9.6	36.4	0.26	Steller Sea Lion	1	1.79	1.74	1.17	2.74	4	1	8
2009	LE CA Halibut	Bottom Trawl	3	12	29	1106.7	2.9	47.2	0.06	Steller Sea Lion	0	1.43	1.30	0.26	3.33	3	0	6

Table 9: Open Access (OA) California (CA) halibut trawl fishery marine mammal bycatch and observer coverage statistics by year. OA trawl vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Values from the 2010 LE CA Halibut fishery (above) are combined with the OA fishery in this table to meet confidentiality requirements. The OA CA halibut fishery was not observed in 2006. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed									Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Hauls	Tow Hrs	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2003	OA CA Halibut	Bottom Trawl	5	18	110	2018.3	2.0	25.8	0.08	California Sea Lion	0	3.20	3.10	1.67	5.17	4	1	8
2004	OA CA Halibut	Bottom Trawl	4	53	244	5404.5	5.1	70.9	0.07	California Sea Lion	1	9.70	9.55	5.89	14.52	6	2	10
2005	OA CA Halibut	Bottom Trawl	6	59	362	7752.1	7.4	64.5	0.12	California Sea Lion	2	9.50	9.30	6.48	13.57	7	2	12
2006	OA CA Halibut	Bottom Trawl	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2007	OA CA Halibut	Bottom Trawl	8	48	227	2694.9	2.7	39.2	0.07	California Sea Lion	0	4.80	4.65	2.54	7.89	8	3	13
2008	OA CA Halibut	Bottom Trawl	7	49	199	2701.2	2.7	51.9	0.05	California Sea Lion	1	7.54	7.37	4.43	11.53	9	4	14
2009	OA CA Halibut	Bottom Trawl	3	9	30	586.4	0.6	82.4	0.01	California Sea Lion	0	11.84	11.03	4.64	22.23	10	4	15
2010	LE & OA CA Halibut	Bottom Trawl	8	43	153	5587.9	8.8	123.6	0.07	California Sea Lion	1	16.00	15.66	9.79	23.96	11	5	17
2011	OA CA Halibut	Bottom Trawl	13	48	204	7187.0	12.4	79.9	0.16	California Sea Lion	3	11.78	11.63	8.28	16.41	11	5	17
2012	OA CA Halibut	Bottom Trawl	7	27	78	1835.1	3.5	55.8	0.06	California Sea Lion	0	6.95	6.86	3.92	10.90	12	6	18
2013	OA CA Halibut	Bottom Trawl	5	29	81	3350.6	4.3	68.9	0.06	California Sea Lion	1	9.46	9.25	5.59	14.27	11	5	17
2014	OA CA Halibut	Bottom Trawl	6	51	145	5484.3	18.1	81.4	0.22	California Sea Lion	0	8.22	8.01	5.03	12.41	10	4	15
2015	OA CA Halibut	Bottom Trawl	8	100	339	11546.4	30.6	92.1	0.33	California Sea Lion	4	11.99	11.80	8.78	16.04	10	4	15
2016	OA CA Halibut	Bottom Trawl	11	114	500	14131.2	27.3	89.6	0.30	California Sea Lion	4	12.11	11.94	9.03	16.19	3	0	6
2003	OA CA Halibut	Bottom Trawl	5	18	110	2018.3	2.0	25.8	0.08	Northern Elephant Seal	0	0.34	0.27	0.01	1.02	7	2	12
2004	OA CA Halibut	Bottom Trawl	4	53	244	5404.5	5.1	70.9	0.07	Northern Elephant Seal	0	0.77	0.62	0.05	2.44	6	2	10
2005	OA CA Halibut	Bottom Trawl	6	59	362	7752.1	7.4	64.5	0.12	Northern Elephant Seal	0	0.62	0.50	0.04	1.87	3	0	6
2006	OA CA Halibut	Bottom Trawl	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2007	OA CA Halibut	Bottom Trawl	8	48	227	2694.9	2.7	39.2	0.07	Northern Elephant Seal	0	0.48	0.38	0.02	1.54	1	0	3
2008	OA CA Halibut	Bottom Trawl	7	49	199	2701.2	2.7	51.9	0.05	Northern Elephant Seal	0	0.66	0.51	0.02	1.95	1	0	3
2009	OA CA Halibut	Bottom Trawl	3	9	30	586.4	0.6	82.4	0.01	Northern Elephant Seal	0	1.93	1.40	0.07	6.78	1	0	3
2010	LE & OA CA Halibut	Bottom Trawl	8	43	153	5587.9	8.8	123.6	0.07	Northern Elephant Seal	0	1.23	0.97	0.10	3.97	1	0	3
2011	OA CA Halibut	Bottom Trawl	13	48	204	7187.0	12.4	79.9	0.16	Northern Elephant Seal	0	0.69	0.54	0.04	2.16	2	0	5
2012	OA CA Halibut	Bottom Trawl	7	27	78	1835.1	3.5	55.8	0.06	Northern Elephant Seal	0	0.63	0.51	0.02	1.93	2	0	5
2013	OA CA Halibut	Bottom Trawl	5	29	81	3350.6	4.3	68.9	0.06	Northern Elephant Seal	0	0.76	0.60	0.05	2.38	1	0	3
2014	OA CA Halibut	Bottom Trawl	6	51	145	5484.3	18.1	81.4	0.22	Northern Elephant Seal	0	0.63	0.49	0.04	1.99	1	0	3
2015	OA CA Halibut	Bottom Trawl	8	100	339	11546.4	30.6	92.1	0.33	Northern Elephant Seal	0	0.60	0.46	0.04	1.98	1	0	3
2016	OA CA Halibut	Bottom Trawl	11	114	500	14131.2	27.3	89.6	0.30	Northern Elephant Seal	1	1.61	1.48	1.03	2.95	9	4	14
2003	OA CA Halibut	Bottom Trawl	5	18	110	2018.3	2.0	25.8	0.08	Steller Sea Lion	0	1.30	1.18	0.37	2.71	2	0	5
2004	OA CA Halibut	Bottom Trawl	4	53	244	5404.5	5.1	70.9	0.07	Steller Sea Lion	0	3.41	3.21	1.12	6.63	2	0	5
2005	OA CA Halibut	Bottom Trawl	6	59	362	7752.1	7.4	64.5	0.12	Steller Sea Lion	0	2.94	2.80	1.15	5.68	3	0	6
2006	OA CA Halibut	Bottom Trawl	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2007	OA CA Halibut	Bottom Trawl	8	48	227	2694.9	2.7	39.2	0.07	Steller Sea Lion	0	1.90	1.73	0.64	3.93	3	0	6
2008	OA CA Halibut	Bottom Trawl	7	49	199	2701.2	2.7	51.9	0.05	Steller Sea Lion	0	2.64	2.44	0.83	5.46	4	1	8
2009	OA CA Halibut	Bottom Trawl	3	9	30	586.4	0.6	82.4	0.01	Steller Sea Lion	0	5.33	4.88	0.82	12.23	4	1	8
2010	LE & OA CA Halibut	Bottom Trawl	8	43	153	5587.9	8.8	123.6	0.07	Steller Sea Lion	0	5.80	5.50	2.08	11.30	4	1	8
2011	OA CA Halibut	Bottom Trawl	13	48	204	7187.0	12.4	79.9	0.16	Steller Sea Lion	0	3.40	3.19	1.27	6.59	4	1	8
2012	OA CA Halibut	Bottom Trawl	7	27	78	1835.1	3.5	55.8	0.06	Steller Sea Lion	0	2.69	2.49	0.95	5.59	5	1	9
2013	OA CA Halibut	Bottom Trawl	5	29	81	3350.6	4.3	68.9	0.06	Steller Sea Lion	0	3.39	3.16	1.12	6.87	4	1	8
2014	OA CA Halibut	Bottom Trawl	6	51	145	5484.3	18.1	81.4	0.22	Steller Sea Lion	0	3.17	2.98	1.20	5.94	4	1	8
2015	OA CA Halibut	Bottom Trawl	8	100	339	11546.4	30.6	92.1	0.33	Steller Sea Lion	3	6.07	5.91	4.19	8.89	5	1	9
2016	OA CA Halibut	Bottom Trawl	11	114	500	14131.2	27.3	89.6	0.30	Steller Sea Lion	3	6.11	5.91	4.14	8.93	1	0	3

Pink Shrimp

Table 10: State managed pink shrimp trawl fisheries marine mammal bycatch and observer coverage statistics by state and year. Pink shrimp vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Observations in the Washington pink shrimp fishery did not start until 2010. (*) = confidential, (–) = not observed.

				Observed							
State	Year	Sector	Gear	Vessels	Trips	Hauls	Tow Hrs	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species
WA	2010	Pink Shrimp	Shrimp Trawl	7	18	341	6551.3	399.5	4295.6	0.09	–
WA	2011	Pink Shrimp	Shrimp Trawl	11	35	578	12142.4	697.2	4312.1	0.16	–
WA	2012	Pink Shrimp	Shrimp Trawl	10	31	522	9752.0	626.0	4239.4	0.15	–
WA	2013	Pink Shrimp	Shrimp Trawl	13	29	386	5731.4	626.8	6157.9	0.10	–
WA	2014	Pink Shrimp	Shrimp Trawl	17	44	401	6536.7	980.9	13876.2	0.07	–
WA	2015	Pink Shrimp	Shrimp Trawl	24	100	1458	31290.6	2151.1	18814.3	0.11	–
WA	2016	Pink Shrimp	Shrimp Trawl	17	59	974	21828.6	1107.9	6395.9	0.17	–
OR	2004	Pink Shrimp	Shrimp Trawl	18	43	765	24688.1	427.2	5537.0	0.08	–
OR	2005	Pink Shrimp	Shrimp Trawl	22	36	533	12441.0	402.9	7159.4	0.06	–
OR	2006	Pink Shrimp	Shrimp Trawl	–	–	–	–	–	–	–	–
OR	2007	Pink Shrimp	Shrimp Trawl	28	61	929	19047.5	650.0	9128.6	0.07	–
OR	2008	Pink Shrimp	Shrimp Trawl	30	49	785	17144.6	672.5	11575.9	0.06	–
OR	2009	Pink Shrimp	Shrimp Trawl	34	52	672	10586.3	751.2	10048.7	0.07	–
OR	2010	Pink Shrimp	Shrimp Trawl	39	94	1233	19055.0	1706.8	14290.4	0.12	–
OR	2011	Pink Shrimp	Shrimp Trawl	41	132	1892	36261.3	2986.0	21915.1	0.14	–
OR	2012	Pink Shrimp	Shrimp Trawl	52	154	2122	28754.8	3014.2	22291.6	0.14	–
OR	2013	Pink Shrimp	Shrimp Trawl	46	107	1403	20143.0	2313.2	21604.3	0.11	–
OR	2014	Pink Shrimp	Shrimp Trawl	38	106	1463	25802.9	2291.3	23573.3	0.10	–
OR	2015	Pink Shrimp	Shrimp Trawl	42	131	1990	31465.9	2282.1	24273.6	0.09	–
OR	2016	Pink Shrimp	Shrimp Trawl	54	157	2467	46138.7	2309.4	16115.6	0.14	–
CA	2004	Pink Shrimp	Shrimp Trawl	*	*	*	*	*	*	*	*
CA	2005	Pink Shrimp	Shrimp Trawl	*	*	*	*	*	*	*	*
CA	2006	Pink Shrimp	Shrimp Trawl	–	–	–	–	–	–	–	–
CA	2007	Pink Shrimp	Shrimp Trawl	*	*	*	*	*	*	*	*
CA	2008	Pink Shrimp	Shrimp Trawl	*	*	*	*	*	*	*	*
CA	2009	Pink Shrimp	Shrimp Trawl	*	*	*	*	*	*	*	*
CA	2010	Pink Shrimp	Shrimp Trawl	8	14	134	1193.9	265.5	1770.9	0.15	–
CA	2011	Pink Shrimp	Shrimp Trawl	8	19	203	1720.4	420.6	3332.9	0.13	–
CA	2012	Pink Shrimp	Shrimp Trawl	7	15	175	1178.0	347.6	2790.6	0.12	–
CA	2013	Pink Shrimp	Shrimp Trawl	10	17	188	1358.0	359.8	3915.3	0.09	–
CA	2014	Pink Shrimp	Shrimp Trawl	11	26	337	3666.4	597.5	3845.0	0.16	–
CA	2015	Pink Shrimp	Shrimp Trawl	9	23	335	4977.0	334.7	3452.9	0.10	–
CA	2016	Pink Shrimp	Shrimp Trawl	11	28	406	8103.9	313.4	1337.2	0.23	–

Fixed Gear Fisheries

Catch Shares

Table 11: Catch Shares (a.k.a. Individual Fishing Quota, IFQ) fixed gear fisheries marine mammal bycatch and observer coverage statistics by year, sector, and gear type. These vessels carried a scientific observer for 100% of the trips, electronic monitoring (EM) was not used. All IFQ fisheries are 100% observed by a scientific observer or electronically monitored. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed			Sampled		Unsampled		Proportion			
Year	Sector	Gear	Vessels	Trips	FG Units	Sets	Catch (mt)	Sets	Catch (mt)	Sets	Catch (mt)	Species	Observed Number
2011	Catch Shares	Hook & Line	11	94	2265264	630	335.6	1	0.00	1.00	1.00	Northern Elephant Seal	2
2012	Catch Shares	Hook & Line	8	32	1472865	506	241.3	0	0.00	1.00	1.00	Northern Elephant Seal	0
2013	Catch Shares	Hook & Line	8	29	587238	215	79.5	0	0.00	1.00	1.00	Northern Elephant Seal	0
2014	Catch Shares	Hook & Line	8	31	601654	227	88.7	32	9.84	0.88	0.90	Northern Elephant Seal	0
2015	Catch Shares	Hook & Line	5	16	592919	185	137.8	0	0.00	1.00	1.00	Northern Elephant Seal	0
2016	Catch Shares	Hook & Line	5	30	1110926	351	192.8	0	0.00	1.00	1.00	Northern Elephant Seal	0
2011	Catch Shares	Pot	17	233	41307	1536	813.8	18	3.41	0.99	1.00	–	0
2012	Catch Shares	Pot	19	278	52248	1709	740.7	0	0.00	1.00	1.00	–	0
2013	Catch Shares	Pot	10	100	30097	1086	470.8	0	0.00	1.00	1.00	–	0
2014	Catch Shares	Pot	14	118	31876	1288	681.2	0	0.00	1.00	1.00	–	0
2015	Catch Shares	Pot	8	62	18808	584	405.3	0	0.00	1.00	1.00	–	0
2016	Catch Shares	Pot	8	61	15785	584	387.0	0	0.00	1.00	1.00	–	0

Table 12: Catch Shares (a.k.a. Individual Fishing Quota, IFQ) fixed gear fisheries marine mammal bycatch and observer coverage statistics by year, sector, and gear type. These vessels carried electronic monitoring (EM) equipment on 100% of the trips and a scientific observer for the proportion of trips given under 'Proportion Sampled Catch'. All IFQ fisheries are 100% observed by a scientific observer or electronically monitored. There is no uncertainty in these values because the observed value represents a complete census of the fishing fleet.

			Observed			Sampled					
Year	Sector	Gear	Vessels	Trips	FG Units	Sets	Catch (mt)	Landed Catch (mt)	Proportion Sampled Catch	Species	Observed Number
2015	Catch Shares EM	Pot	7	18	4272	184	102.4	339.4	0.30	–	0
2016	Catch Shares EM	Pot	6	19	6275	249	152.0	470.5	0.32	–	0

LE Sablefish

Table 13: Limited Entry (LE) sablefish marine mammal bycatch and observer coverage statistics by year for vessels fishing hook and line gear. These vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed									Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Sets	FG Units	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2002	Limited Entry Sablefish	Hook & Line	25	68	391	779624.0	190.8	788.5	0.24	California Sea Lion	0	1.43	1.39	0.63	2.46	4	1	8
2003	Limited Entry Sablefish	Hook & Line	15	48	351	733602.0	222.8	1034.9	0.22	California Sea Lion	1	2.94	2.88	1.89	4.37	4	1	8
2004	Limited Entry Sablefish	Hook & Line	17	45	326	492009.0	180.0	1309.4	0.14	California Sea Lion	1	3.70	3.63	2.18	5.71	3	0	6
2005	Limited Entry Sablefish	Hook & Line	26	101	678	1456102.0	481.5	1293.1	0.37	California Sea Lion	5	6.92	6.87	5.90	8.25	3	0	6
2006	Limited Entry Sablefish	Hook & Line	19	68	470	939951.0	295.9	1377.3	0.21	California Sea Lion	0	2.57	2.52	1.20	4.48	3	0	6
2007	Limited Entry Sablefish	Hook & Line	22	75	517	1034046.0	298.5	1080.7	0.28	California Sea Lion	0	1.88	1.83	0.88	3.21	3	0	6
2008	Limited Entry Sablefish	Hook & Line	18	77	540	1244141.0	338.1	1094.7	0.31	California Sea Lion	0	1.80	1.75	0.86	3.12	3	0	6
2009	Limited Entry Sablefish	Hook & Line	8	45	287	648980.0	97.8	1447.6	0.07	California Sea Lion	0	3.31	3.14	1.40	6.19	2	0	5
2010	Limited Entry Sablefish	Hook & Line	21	143	762	1761173.0	345.8	1304.2	0.27	California Sea Lion	1	3.28	3.20	2.08	4.91	2	0	5
2011	Limited Entry Sablefish	Hook & Line	23	98	673	1405444.0	240.7	1153.5	0.21	California Sea Lion	0	2.18	2.14	1.00	3.78	10	4	15
2012	Limited Entry Sablefish	Hook & Line	17	88	532	1580075.0	239.3	1075.0	0.22	California Sea Lion	0	2.00	1.95	0.92	3.50	9	4	14
2013	Limited Entry Sablefish	Hook & Line	18	58	353	1047526.0	166.4	751.1	0.22	California Sea Lion	0	1.40	1.36	0.61	2.49	8	3	13
2014	Limited Entry Sablefish	Hook & Line	17	85	495	1200615.0	203.2	745.2	0.27	California Sea Lion	1	2.30	2.25	1.57	3.24	7	2	12
2015	Limited Entry Sablefish	Hook & Line	26	97	632	1536820.0	392.0	938.5	0.42	California Sea Lion	0	1.29	1.26	0.61	2.21	4	1	8
2016	Limited Entry Sablefish	Hook & Line	21	94	671	1743233.0	338.1	1025.3	0.33	California Sea Lion	0	1.63	1.61	0.74	2.77	4	1	8
2002	Limited Entry Sablefish	Hook & Line	25	68	391	779624.0	190.8	788.5	0.24	Northern Elephant Seal	0	0.96	0.92	0.35	1.89	2	0	5
2003	Limited Entry Sablefish	Hook & Line	15	48	351	733602.0	222.8	1034.9	0.22	Northern Elephant Seal	0	1.30	1.23	0.45	2.55	2	0	5
2004	Limited Entry Sablefish	Hook & Line	17	45	326	492009.0	180.0	1309.4	0.14	Northern Elephant Seal	0	1.80	1.73	0.59	3.53	2	0	5
2005	Limited Entry Sablefish	Hook & Line	26	101	678	1456102.0	481.5	1293.1	0.37	Northern Elephant Seal	0	1.28	1.21	0.46	2.57	2	0	5
2006	Limited Entry Sablefish	Hook & Line	19	68	470	939951.0	295.9	1377.3	0.21	Northern Elephant Seal	1	2.72	2.59	1.64	4.31	2	0	5
2007	Limited Entry Sablefish	Hook & Line	22	75	517	1034046.0	298.5	1080.7	0.28	Northern Elephant Seal	0	1.24	1.15	0.45	2.43	2	0	5
2008	Limited Entry Sablefish	Hook & Line	18	77	540	1244141.0	338.1	1094.7	0.31	Northern Elephant Seal	0	1.19	1.13	0.42	2.34	2	0	5
2009	Limited Entry Sablefish	Hook & Line	8	45	287	648980.0	97.8	1447.6	0.07	Northern Elephant Seal	0	2.22	2.05	0.70	4.51	2	0	5
2010	Limited Entry Sablefish	Hook & Line	21	143	762	1761173.0	345.8	1304.2	0.27	Northern Elephant Seal	1	2.52	2.43	1.54	4.01	2	0	5
2011	Limited Entry Sablefish	Hook & Line	23	98	673	1405444.0	240.7	1153.5	0.21	Northern Elephant Seal	0	1.47	1.39	0.50	2.86	1	0	3
2012	Limited Entry Sablefish	Hook & Line	17	88	532	1580075.0	239.3	1075.0	0.22	Northern Elephant Seal	1	2.33	2.25	1.46	3.61	1	0	3
2013	Limited Entry Sablefish	Hook & Line	18	58	353	1047526.0	166.4	751.1	0.22	Northern Elephant Seal	0	0.95	0.89	0.30	1.93	1	0	3
2014	Limited Entry Sablefish	Hook & Line	17	85	495	1200615.0	203.2	745.2	0.27	Northern Elephant Seal	0	0.87	0.81	0.29	1.74	2	0	5
2015	Limited Entry Sablefish	Hook & Line	26	97	632	1536820.0	392.0	938.5	0.42	Northern Elephant Seal	3	3.86	3.81	3.33	4.71	2	0	5
2016	Limited Entry Sablefish	Hook & Line	21	94	671	1743233.0	338.1	1025.3	0.33	Northern Elephant Seal	0	1.08	1.02	0.40	2.05	2	0	5
2002	Limited Entry Sablefish	Hook & Line	25	68	391	779624.0	190.8	788.5	0.24	Pinniped Unid	0	0.22	0.17	0.01	0.72	1	0	3
2003	Limited Entry Sablefish	Hook & Line	15	48	351	733602.0	222.8	1034.9	0.22	Pinniped Unid	0	0.30	0.21	0.01	1.00	1	0	3
2004	Limited Entry Sablefish	Hook & Line	17	45	326	492009.0	180.0	1309.4	0.14	Pinniped Unid	0	0.44	0.32	0.01	1.41	1	0	3
2005	Limited Entry Sablefish	Hook & Line	26	101	678	1456102.0	481.5	1293.1	0.37	Pinniped Unid	0	0.29	0.21	0.01	1.01	1	0	3
2006	Limited Entry Sablefish	Hook & Line	19	68	470	939951.0	295.9	1377.3	0.21	Pinniped Unid	0	0.39	0.29	0.02	1.29	1	0	3
2007	Limited Entry Sablefish	Hook & Line	22	75	517	1034046.0	298.5	1080.7	0.28	Pinniped Unid	0	0.28	0.21	0.01	1.01	1	0	3
2008	Limited Entry Sablefish	Hook & Line	18	77	540	1244141.0	338.1	1094.7	0.31	Pinniped Unid	0	0.28	0.20	0.01	0.92	1	0	3
2009	Limited Entry Sablefish	Hook & Line	8	45	287	648980.0	97.8	1447.6	0.07	Pinniped Unid	0	0.59	0.44	0.02	1.99	1	0	3
2010	Limited Entry Sablefish	Hook & Line	21	143	762	1761173.0	345.8	1304.2	0.27	Pinniped Unid	0	0.35	0.26	0.01	1.15	1	0	3
2011	Limited Entry Sablefish	Hook & Line	23	98	673	1405444.0	240.7	1153.5	0.21	Pinniped Unid	0	0.34	0.25	0.02	1.20	2	0	5
2012	Limited Entry Sablefish	Hook & Line	17	88	532	1580075.0	239.3	1075.0	0.22	Pinniped Unid	0	0.31	0.23	0.02	1.06	2	0	5
2013	Limited Entry Sablefish	Hook & Line	18	58	353	1047526.0	166.4	751.1	0.22	Pinniped Unid	0	0.22	0.16	0.01	0.76	2	0	5
2014	Limited Entry Sablefish	Hook & Line	17	85	495	1200615.0	203.2	745.2	0.27	Pinniped Unid	0	0.21	0.16	0.01	0.71	1	0	3
2015	Limited Entry Sablefish	Hook & Line	26	97	632	1536820.0	392.0	938.5	0.42	Pinniped Unid	1	1.19	1.15	1.01	1.66	1	0	3
2016	Limited Entry Sablefish	Hook & Line	21	94	671	1743233.0	338.1	1025.3	0.33	Pinniped Unid	0	0.24	0.19	0.01	0.84	1	0	3
2002	Limited Entry Sablefish	Hook & Line	25	68	391	779624.0	190.8	788.5	0.24	Sea Lion Unid	0	0.52	0.45	0.10	1.27	1	0	3
2003	Limited Entry Sablefish	Hook & Line	15	48	351	733602.0	222.8	1034.9	0.22	Sea Lion Unid	0	0.71	0.64	0.14	1.70	1	0	3
2004	Limited Entry Sablefish	Hook & Line	17	45	326	492009.0	180.0	1309.4	0.14	Sea Lion Unid	0	1.00	0.89	0.21	2.52	2	0	5
2005	Limited Entry Sablefish	Hook & Line	26	101	678	1456102.0	481.5	1293.1	0.37	Sea Lion Unid	0	0.69	0.62	0.16	1.70	2	0	5
2006	Limited Entry Sablefish	Hook & Line	19	68	470	939951.0	295.9	1377.3	0.21	Sea Lion Unid	0	0.93	0.82	0.20	2.28	2	0	5
2007	Limited Entry Sablefish	Hook & Line	22	75	517	1034046.0	298.5	1080.7	0.28	Sea Lion Unid	0	0.67	0.60	0.16	1.61	2	0	5
2008	Limited Entry Sablefish	Hook & Line	18	77	540	1244141.0	338.1	1094.7	0.31	Sea Lion Unid	0	0.65	0.57	0.15	1.58	2	0	5
2009	Limited Entry Sablefish	Hook & Line	8	45	287	648980.0	97.8	1447.6	0.07	Sea Lion Unid	0	1.25	1.08	0.24	3.25	1	0	3
2010	Limited Entry Sablefish	Hook & Line	21	143	762	1761173.0	345.8	1304.2	0.27	Sea Lion Unid	1	1.82	1.70	1.18	2.93	1	0	3
2011	Limited Entry Sablefish	Hook & Line	23	98	673	1405444.0	240.7	1153.5	0.21	Sea Lion Unid	2	2.79	2.70	2.17	3.94	1	0	3
2012	Limited Entry Sablefish	Hook & Line	17	88	532	1580075.0	239.3	1075.0	0.22	Sea Lion Unid	0	0.73	0.65	0.14	1.81	1	0	3
2013	Limited Entry Sablefish	Hook & Line	18	58	353	1047526.0	166.4	751.1	0.22	Sea Lion Unid	0	0.52	0.45	0.09	1.25	1	0	3
2014	Limited Entry Sablefish	Hook & Line	17	85	495	1200615.0	203.2	745.2	0.27	Sea Lion Unid	0	0.47	0.42	0.09	1.17	1	0	3
2015	Limited Entry Sablefish	Hook & Line	26	97	632	1536820.0	392.0	938.5	0.42	Sea Lion Unid	0	0.46	0.40	0.10	1.12	1	0	3
2016	Limited Entry Sablefish	Hook & Line	21	94	671	1743233.0	338.1	1025.3	0.33	Sea Lion Unid	0	0.59	0.52	0.12	1.43	1	0	3
2002	Limited Entry Sablefish	Hook & Line	25	68	391	779624.0	190.8	788.5	0.24	Sperm Whale	0	0.23	0.18	0.01	0.75	1	0	3
2003	Limited Entry Sablefish	Hook & Line	15	48	351	733602.0	222.8	1034.9	0.22	Sperm Whale	0	0.32	0.24	0.02	0.97	1	0	3
2004	Limited Entry Sablefish	Hook & Line	17	45	326	492009.0	180.0	1309.4	0.14	Sperm Whale	0	0.45	0.35	0.02	1.40	1	0	3
2005	Limited Entry Sablefish	Hook & Line	26	101	678	1456102.0	481.5	1293.1	0.37	Sperm Whale	0	0.29	0.23	0.01	0.92	1	0	3
2006	Limited Entry Sablefish	Hook & Line	19	68	470	939951.0	295.9	1377.3	0.21	Sperm Whale	0	0.40	0.31	0.02	1.26	1	0	3
2007	Limited Entry Sablefish	Hook & Line	22	75	517	1034046.0	298.5	1080.7	0.28	Sperm Whale	1	1.29	1.22	1.01	1.91	1	0	3
2008	Limited Entry Sablefish	Hook & Line	18	77	540	1244141.0	338.1	1094.7	0.31	Sperm Whale	0	0.29	0.21	0.02	0.92	1	0	3
2009	Limited Entry Sablefish	Hook & Line	8	45	287	648980.0	97.8	1447.6	0.07	Sperm Whale	0	0.60	0.48	0.03	1.81	1	0	3
2010	Limited Entry Sablefish	Hook & Line	21	143	762	1761173.0	345.8	1304.2	0.27	Sperm Whale	0	0.35	0.28	0.02	1.09	1	0	3
2011	Limited Entry Sablefish	Hook & Line	23	98	673	1405444.0	240.7	1153.5	0.21	Sperm Whale	0	0.35	0.27	0.02	1.03	1	0	3
2012	Limited Entry Sablefish	Hook & Line	17	88	532	1580075.0	239.3	1075.0	0.22	Sperm Whale	0	0.32	0.25	0.02	1.06	1	0	3
2013	Limited Entry Sablefish	Hook & Line	18	58	353	1047526.0	166.4	751.1	0.22	Sperm Whale	0	0.23	0.19	0.01	0.71	1	0	3
2014	Limited Entry Sablefish	Hook & Line	17	85	495	1200615.0	203.2	745.2	0.27	Sperm Whale	0	0.20	0.17	0.01	0.63	1	0	3
2015	Limited Entry Sablefish	Hook & Line	26	97	632	1536820.0	392.0	938.5	0.42	Sperm Whale	0	0.20	0.16	0.01	0.63	1	0	3
2016	Limited Entry Sablefish	Hook & Line	21	94	671	1743233.0	338.1	1025.3	0.33	Sperm Whale	0	0.25	0.20	0.01	0.80	1	0	3
2002	Limited Entry Sablefish	Hook & Line	25	68	391	779624.0	190.8	788.5	0.24	Steller Sea Lion	0	0.39	0.32	0.04	1.08	1	0	3
2003	Limited Entry Sablefish	Hook & Line	15	48	351	733602.0	222.8	1034.9	0.22	Steller Sea Lion	0	0.52	0.45	0.05	1.50	1	0	3
2004	Limited Entry Sablefish	Hook & Line	17	45	326	492009.0	180.0	1309.4	0.14	Steller Sea Lion	0	0.74	0.63	0.09	2.04	1	0	3
2005	Limited Entry Sablefish	Hook & Line	26	101	678	1456102.0	481.5	1293.1	0.37	Steller Sea Lion	0	0.51	0.43	0.07	1.41	1	0	3
2006	Limited Entry Sablefish	Hook & Line	19	68	470	939951.0	295.9	1377.3	0.21	Steller Sea Lion	0	0.69	0.58	0.09	1.82	1	0	3
2007	Limited Entry Sablefish	Hook & Line	22	75	517	1034046.0	298.5	1080.7	0.28	Steller Sea Lion	0	0.49	0.41	0.07	1.38	1	0	3
2008	Limited Entry Sablefish	Hook & Line	18	77	540	1244141.0	338.1	1094.7	0.31	Steller Sea Lion	0	0.47	0.41	0.06	1.33	1	0	3
2009	Limited Entry Sablefish	Hook & Line	8	45	287	648980.0	97.8	1447.6	0.07	Steller Sea Lion	0	0.98	0.83	0.08	2.84	1	0	3
2010	Limited Entry Sablefish	Hook & Line	21	143	762	1761173.0	345.8	1304.2	0.27	Steller Sea Lion	0	0.61	0.52	0.07	1.73	1	0	3
2011	Limited Entry Sablefish	Hook & Line	23	98	673	1405444.0	240.7	1153.5	0.21	Steller Sea Lion	0	0.60	0.51	0.06	1.65	1	0	3
2012	Limited Entry Sablefish	Hook & Line	17	88	532	1580075.0	239.3	1075.0	0.22	Steller Sea Lion	0	0.53	0.46	0.08	1.52	1	0	3
2013	Limited Entry Sablefish	Hook & Line	18	58	353	1047526.0	166.4	751.1	0.22	Steller Sea Lion	0	0.38	0.33	0.04	1.09	1	0	3
2014	Limited Entry Sablefish	Hook & Line	17	85	495	1200615.0	203.2	745.2	0.27	Steller Sea Lion	0	0.35	0.30	0.04	0.92	1	0	3
2015	Limited Entry Sablefish	Hook & Line	26	97	632	1536820.0	392.0	938.5	0.42	Steller Sea Lion	0	0.34	0.29	0.05	0.98	1	0	3
2016	Limited Entry Sablefish	Hook & Line	21	94	671	1743233.0	338.1	1025.3	0.33	Steller Sea Lion	2	2.43	2.38	2.05	3.25	1	0	3

Table 14: Limited Entry (LE) sablefish marine mammal bycatch and observer coverage statistics by year for vessels fishing pot gear. These vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed								Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Sets	FG Units	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2002	Limited Entry Sablefish	Pot	6	23	247	5438.0	82.5	352.2	0.23	Humpback Whale	0	0.18	0.13	0.01	0.59	1	0	3
2003	Limited Entry Sablefish	Pot	6	35	362	9017.0	148.3	604.2	0.25	Humpback Whale	0	0.29	0.21	0.01	0.93	1	0	3
2004	Limited Entry Sablefish	Pot	3	13	139	5378.0	82.7	619.6	0.13	Humpback Whale	0	0.36	0.27	0.02	1.15	1	0	3
2005	Limited Entry Sablefish	Pot	7	39	492	13822.0	281.2	615.0	0.46	Humpback Whale	0	0.20	0.15	0.01	0.65	1	0	3
2006	Limited Entry Sablefish	Pot	7	39	289	10708.0	200.5	581.8	0.34	Humpback Whale	0	0.24	0.18	0.01	0.81	1	0	3
2007	Limited Entry Sablefish	Pot	4	30	154	5816.0	90.0	428.4	0.21	Humpback Whale	0	0.22	0.18	0.02	0.74	1	0	3
2008	Limited Entry Sablefish	Pot	6	24	329	13638.0	244.9	433.0	0.57	Humpback Whale	0	0.11	0.09	0.00	0.37	1	0	3
2009	Limited Entry Sablefish	Pot	3	27	67	3883.0	66.5	489.1	0.14	Humpback Whale	0	0.30	0.22	0.00	0.92	1	0	3
2010	Limited Entry Sablefish	Pot	7	43	314	11294.0	140.4	503.5	0.28	Humpback Whale	0	0.23	0.17	0.01	0.76	1	0	3
2011	Limited Entry Sablefish	Pot	3	22	227	9029.0	137.4	371.9	0.37	Humpback Whale	0	0.15	0.11	0.01	0.50	2	0	5
2012	Limited Entry Sablefish	Pot	5	19	351	14218.0	101.1	286.0	0.35	Humpback Whale	0	0.12	0.09	0.00	0.39	2	0	5
2013	Limited Entry Sablefish	Pot	3	14	47	1934.0	40.5	283.1	0.14	Humpback Whale	0	0.19	0.15	0.00	0.60	1	0	3
2014	Limited Entry Sablefish	Pot	4	16	195	7574.0	104.0	338.1	0.31	Humpback Whale	1	1.15	1.11	1.01	1.48	1	0	3
2015	Limited Entry Sablefish	Pot	9	35	299	11329.0	218.8	358.2	0.61	Humpback Whale	0	0.08	0.06	0.00	0.27	1	0	3
2016	Limited Entry Sablefish	Pot	7	55	596	21219.0	254.3	359.0	0.71	Humpback Whale	0	0.06	0.05	0.00	0.20	1	0	3

LE Fixed Gear DTL

Table 15: Limited Entry (LE) fixed gear daily trip limit (DTL) fishery marine mammal bycatch and observer coverage statistics by year and gear. These vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed									Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Sets	FG Units	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2002	LE Fixed Gear DTL	Hook & Line	4	11	22	46000.0	1.7	231.9	0.01	Bottlenose Dolphin	0	2.64	2.10	0.07	8.49	2	0	5
2003	LE Fixed Gear DTL	Hook & Line	17	130	219	537817.0	14.3	213.5	0.07	Bottlenose Dolphin	0	1.26	0.92	0.07	4.00	3	0	6
2004	LE Fixed Gear DTL	Hook & Line	14	62	130	318048.0	3.7	161.1	0.02	Bottlenose Dolphin	0	1.30	1.05	0.06	4.00	3	0	6
2005	LE Fixed Gear DTL	Hook & Line	11	35	60	198150.0	2.4	245.3	0.01	Bottlenose Dolphin	0	2.25	1.79	0.10	7.30	4	1	8
2006	LE Fixed Gear DTL	Hook & Line	21	121	201	533830.0	7.0	200.5	0.03	Bottlenose Dolphin	0	1.40	1.09	0.06	4.46	4	1	8
2007	LE Fixed Gear DTL	Hook & Line	36	158	304	724389.0	16.5	241.6	0.07	Bottlenose Dolphin	0	1.42	1.09	0.09	4.97	4	1	8
2008	LE Fixed Gear DTL	Hook & Line	32	122	221	631689.0	9.3	323.5	0.03	Bottlenose Dolphin	0	2.08	1.55	0.10	6.86	4	1	8
2009	LE Fixed Gear DTL	Hook & Line	34	138	273	669091.0	12.0	484.0	0.02	Bottlenose Dolphin	1	4.11	3.37	1.15	11.06	4	1	8
2010	LE Fixed Gear DTL	Hook & Line	38	226	472	1103073.0	33.8	699.9	0.05	Bottlenose Dolphin	0	3.94	2.95	0.22	13.46	4	1	8
2011	LE Fixed Gear DTL	Hook & Line	38	201	426	1154241.0	52.5	889.4	0.06	Bottlenose Dolphin	0	4.92	3.67	0.31	16.07	2	0	5
2012	LE Fixed Gear DTL	Hook & Line	26	128	252	706437.0	15.1	552.9	0.03	Bottlenose Dolphin	0	3.44	2.60	0.19	10.65	2	0	5
2013	LE Fixed Gear DTL	Hook & Line	22	124	248	705827.0	17.7	584.9	0.03	Bottlenose Dolphin	0	3.53	2.67	0.20	11.40	2	0	5
2014	LE Fixed Gear DTL	Hook & Line	18	77	154	493845.0	15.7	537.5	0.03	Bottlenose Dolphin	0	3.25	2.44	0.20	10.56	2	0	5
2015	LE Fixed Gear DTL	Hook & Line	21	65	144	453472.0	29.2	534.3	0.05	Bottlenose Dolphin	0	3.03	2.27	0.18	9.86	2	0	5
2016	LE Fixed Gear DTL	Hook & Line	16	41	70	247067.0	19.4	522.3	0.04	Bottlenose Dolphin	0	3.14	2.32	0.14	10.10	2	0	5
2002	LE Fixed Gear DTL	Hook & Line	4	11	22	46000.0	1.7	231.9	0.01	California Sea Lion	0	3.77	3.23	0.33	9.96	4	1	8
2003	LE Fixed Gear DTL	Hook & Line	17	130	219	537817.0	14.3	213.5	0.07	California Sea Lion	0	2.06	1.80	0.24	5.26	4	1	8
2004	LE Fixed Gear DTL	Hook & Line	14	62	130	318048.0	3.7	161.1	0.02	California Sea Lion	1	2.96	2.67	1.22	6.15	5	1	9
2005	LE Fixed Gear DTL	Hook & Line	11	35	60	198150.0	2.4	245.3	0.01	California Sea Lion	0	3.36	2.83	0.32	9.35	6	2	10
2006	LE Fixed Gear DTL	Hook & Line	21	121	201	533830.0	7.0	200.5	0.03	California Sea Lion	0	2.17	1.83	0.28	5.73	6	2	10
2007	LE Fixed Gear DTL	Hook & Line	36	158	304	724389.0	16.5	241.6	0.07	California Sea Lion	1	3.31	2.99	1.32	6.95	7	2	12
2008	LE Fixed Gear DTL	Hook & Line	32	122	221	631689.0	9.3	323.5	0.03	California Sea Lion	0	3.43	2.86	0.53	9.06	7	2	12
2009	LE Fixed Gear DTL	Hook & Line	34	138	273	669091.0	12.0	484.0	0.02	California Sea Lion	0	5.01	4.27	0.59	13.08	7	2	12
2010	LE Fixed Gear DTL	Hook & Line	38	226	472	1103073.0	33.8	699.9	0.05	California Sea Lion	0	6.65	5.79	1.04	17.16	6	2	10
2011	LE Fixed Gear DTL	Hook & Line	38	201	426	1154241.0	52.5	889.4	0.06	California Sea Lion	0	8.27	7.26	1.24	21.07	4	1	8
2012	LE Fixed Gear DTL	Hook & Line	26	128	252	706437.0	15.1	552.9	0.03	California Sea Lion	0	5.59	4.71	0.81	14.30	4	1	8
2013	LE Fixed Gear DTL	Hook & Line	22	124	248	705827.0	17.7	584.9	0.03	California Sea Lion	0	5.81	5.09	0.79	14.21	3	0	6
2014	LE Fixed Gear DTL	Hook & Line	18	77	154	493845.0	15.7	537.5	0.03	California Sea Lion	0	5.37	4.74	0.74	13.63	4	1	8
2015	LE Fixed Gear DTL	Hook & Line	21	65	144	453472.0	29.2	534.3	0.05	California Sea Lion	0	5.12	4.31	0.78	13.02	3	0	6
2016	LE Fixed Gear DTL	Hook & Line	16	41	70	247067.0	19.4	522.3	0.04	California Sea Lion	0	5.17	4.48	0.73	13.36	3	0	6
2002	LE Fixed Gear DTL	Hook & Line	4	11	22	46000.0	1.7	231.9	0.01	Harbor Seal	0	2.55	2.03	0.09	8.74	2	0	5
2003	LE Fixed Gear DTL	Hook & Line	17	130	219	537817.0	14.3	213.5	0.07	Harbor Seal	0	1.18	0.91	0.07	3.78	3	0	6
2004	LE Fixed Gear DTL	Hook & Line	14	62	130	318048.0	3.7	161.1	0.02	Harbor Seal	0	1.22	0.95	0.08	4.05	3	0	6
2005	LE Fixed Gear DTL	Hook & Line	11	35	60	198150.0	2.4	245.3	0.01	Harbor Seal	0	2.25	1.78	0.08	7.19	4	1	8
2006	LE Fixed Gear DTL	Hook & Line	21	121	201	533830.0	7.0	200.5	0.03	Harbor Seal	0	1.29	0.97	0.08	4.00	4	1	8
2007	LE Fixed Gear DTL	Hook & Line	36	158	304	724389.0	16.5	241.6	0.07	Harbor Seal	0	1.30	0.98	0.09	4.17	4	1	8
2008	LE Fixed Gear DTL	Hook & Line	32	122	221	631689.0	9.3	323.5	0.03	Harbor Seal	0	2.00	1.54	0.09	5.91	4	1	8
2009	LE Fixed Gear DTL	Hook & Line	34	138	273	669091.0	12.0	484.0	0.02	Harbor Seal	1	3.89	3.28	1.18	10.03	4	1	8
2010	LE Fixed Gear DTL	Hook & Line	38	226	472	1103073.0	33.8	699.9	0.05	Harbor Seal	0	3.70	2.87	0.30	11.63	4	1	8
2011	LE Fixed Gear DTL	Hook & Line	38	201	426	1154241.0	52.5	889.4	0.06	Harbor Seal	0	4.59	3.52	0.32	14.39	5	1	9
2012	LE Fixed Gear DTL	Hook & Line	26	128	252	706437.0	15.1	552.9	0.03	Harbor Seal	0	3.19	2.48	0.23	10.29	4	1	8
2013	LE Fixed Gear DTL	Hook & Line	22	124	248	705827.0	17.7	584.9	0.03	Harbor Seal	0	3.36	2.48	0.16	11.03	4	1	8
2014	LE Fixed Gear DTL	Hook & Line	18	77	154	493845.0	15.7	537.5	0.03	Harbor Seal	0	3.01	2.29	0.19	9.46	3	0	6
2015	LE Fixed Gear DTL	Hook & Line	21	65	144	453472.0	29.2	534.3	0.05	Harbor Seal	0	2.86	2.17	0.21	8.93	2	0	5
2016	LE Fixed Gear DTL	Hook & Line	16	41	70	247067.0	19.4	522.3	0.04	Harbor Seal	0	2.93	2.21	0.21	9.14	2	0	5
2002	LE Fixed Gear DTL	Hook & Line	4	11	22	46000.0	1.7	231.9	0.01	Pinniped Unid	0	2.58	1.94	0.07	8.59	2	0	5
2003	LE Fixed Gear DTL	Hook & Line	17	130	219	537817.0	14.3	213.5	0.07	Pinniped Unid	0	1.21	0.97	0.08	3.57	3	0	6
2004	LE Fixed Gear DTL	Hook & Line	14	62	130	318048.0	3.7	161.1	0.02	Pinniped Unid	0	1.22	0.97	0.02	3.80	3	0	6
2005	LE Fixed Gear DTL	Hook & Line	11	35	60	198150.0	2.4	245.3	0.01	Pinniped Unid	0	2.26	1.76	0.09	6.97	4	1	8
2006	LE Fixed Gear DTL	Hook & Line	21	121	201	533830.0	7.0	200.5	0.03	Pinniped Unid	0	1.32	1.09	0.06	3.85	4	1	8
2007	LE Fixed Gear DTL	Hook & Line	36	158	304	724389.0	16.5	241.6	0.07	Pinniped Unid	1	2.34	2.07	1.07	5.15	4	1	8
2008	LE Fixed Gear DTL	Hook & Line	32	122	221	631689.0	9.3	323.5	0.03	Pinniped Unid	0	2.00	1.59	0.15	6.10	4	1	8
2009	LE Fixed Gear DTL	Hook & Line	34	138	273	669091.0	12.0	484.0	0.02	Pinniped Unid	0	2.93	2.29	0.18	9.19	4	1	8
2010	LE Fixed Gear DTL	Hook & Line	38	226	472	1103073.0	33.8	699.9	0.05	Pinniped Unid	0	3.73	2.91	0.27	11.58	4	1	8
2011	LE Fixed Gear DTL	Hook & Line	38	201	426	1154241.0	52.5	889.4	0.06	Pinniped Unid	0	4.62	3.49	0.23	13.88	3	0	6
2012	LE Fixed Gear DTL	Hook & Line	26	128	252	706437.0	15.1	552.9	0.03	Pinniped Unid	0	3.23	2.46	0.22	9.41	3	0	6
2013	LE Fixed Gear DTL	Hook & Line	22	124	248	705827.0	17.7	584.9	0.03	Pinniped Unid	0	3.32	2.49	0.20	10.23	3	0	6
2014	LE Fixed Gear DTL	Hook & Line	18	77	154	493845.0	15.7	537.5	0.03	Pinniped Unid	0	3.16	2.45	0.19	9.20	3	0	6
2015	LE Fixed Gear DTL	Hook & Line	21	65	144	453472.0	29.2	534.3	0.05	Pinniped Unid	0	2.93	2.17	0.20	9.02	2	0	5
2016	LE Fixed Gear DTL	Hook & Line	16	41	70	247067.0	19.4	522.3	0.04	Pinniped Unid	0	2.97	2.21	0.20	9.12	2	0	5

Open Access Fixed Gear

Table 16: Open Access (OA) fixed gear fishery marine mammal bycatch and observer coverage statistics by year and gear. These vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

			Observed									Bayes				Bayes 5 yr.		
Year	Sector	Gear	Vessels	Trips	Sets	FG Units	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean	Median	LCL	UCL	Mean	LCL	UCL
2003	OA Fixed Gear	Hook & Line	13	41	49	86518	16.6	548.4	0.03	–	0	–	–	–	–	–	–	–
2004	OA Fixed Gear	Hook & Line	14	42	52	85895	16.2	477.9	0.03	–	0	–	–	–	–	–	–	–
2005	OA Fixed Gear	Hook & Line	10	34	37	58384	9.8	632.6	0.02	–	0	–	–	–	–	–	–	–
2006	OA Fixed Gear	Hook & Line	7	10	11	29296	4.5	491.4	0.01	–	0	–	–	–	–	–	–	–
2007	OA Fixed Gear	Hook & Line	25	51	67	55215	10.5	267.3	0.04	–	0	–	–	–	–	–	–	–
2008	OA Fixed Gear	Hook & Line	33	58	68	73885	16.3	409.9	0.04	–	0	–	–	–	–	–	–	–
2009	OA Fixed Gear	Hook & Line	34	69	104	119849	22.3	650.1	0.03	–	0	–	–	–	–	–	–	–
2010	OA Fixed Gear	Hook & Line	37	70	105	160570	23.1	758.1	0.03	–	0	–	–	–	–	–	–	–
2011	OA Fixed Gear	Hook & Line	40	69	101	162419	20.2	436.2	0.05	–	0	–	–	–	–	–	–	–
2012	OA Fixed Gear	Hook & Line	24	34	53	82597	11.5	324.0	0.04	–	0	–	–	–	–	–	–	–
2013	OA Fixed Gear	Hook & Line	14	23	30	51870	4.7	194.0	0.02	–	0	–	–	–	–	–	–	–
2014	OA Fixed Gear	Hook & Line	21	28	39	71459	11.8	219.8	0.05	–	0	–	–	–	–	–	–	–
2015	OA Fixed Gear	Hook & Line	20	38	54	124895	17.5	364.3	0.05	–	0	–	–	–	–	–	–	–
2016	OA Fixed Gear	Hook & Line	31	57	78	111092	15.7	309.3	0.05	–	0	–	–	–	–	–	–	–
2003	OA Fixed Gear	Pot	7	16	50	345	2.9	186.6	0.02	Humpback Whale	0	2.22	1.73	0.10	7.40	3.00	0.00	6.00
2004	OA Fixed Gear	Pot	17	96	185	1950	17.0	186.0	0.09	Humpback Whale	0	1.53	1.16	0.08	5.18	4.00	1.00	8.00
2005	OA Fixed Gear	Pot	14	43	50	835	10.7	379.4	0.03	Humpback Whale	0	3.44	2.57	0.25	11.45	4.00	1.00	8.00
2006	OA Fixed Gear	Pot	15	38	39	666	7.9	443.3	0.02	Humpback Whale	0	4.33	3.32	0.34	14.30	3.00	0.00	6.00
2007	OA Fixed Gear	Pot	21	46	75	624	8.8	257.9	0.03	Humpback Whale	0	2.44	1.87	0.13	7.95	3.00	0.00	6.00
2008	OA Fixed Gear	Pot	20	55	75	833	10.4	240.9	0.04	Humpback Whale	0	2.21	1.66	0.14	7.27	3.00	0.00	6.00
2009	OA Fixed Gear	Pot	18	30	45	540	8.5	372.6	0.02	Humpback Whale	0	3.62	2.74	0.19	11.90	2.00	0.00	5.00
2010	OA Fixed Gear	Pot	26	40	71	646	10.7	318.3	0.03	Humpback Whale	0	2.95	2.27	0.21	9.58	2.00	0.00	5.00
2011	OA Fixed Gear	Pot	29	61	85	831	18.9	255.8	0.07	Humpback Whale	0	2.20	1.71	0.11	7.36	2.00	0.00	5.00
2012	OA Fixed Gear	Pot	19	35	70	610	9.1	127.2	0.07	Humpback Whale	0	1.12	0.85	0.07	3.79	3.00	0.00	6.00
2013	OA Fixed Gear	Pot	17	25	48	590	6.3	72.2	0.09	Humpback Whale	0	0.67	0.49	0.04	2.16	3.00	0.00	6.00
2014	OA Fixed Gear	Pot	21	41	63	686	11.7	147.8	0.08	Humpback Whale	0	1.30	0.98	0.07	4.24	3.00	0.00	6.00
2015	OA Fixed Gear	Pot	17	49	64	604	14.6	234.3	0.06	Humpback Whale	0	2.03	1.57	0.13	6.93	3.00	0.00	6.00
2016	OA Fixed Gear	Pot	28	56	74	717	15.4	206.5	0.07	Humpback Whale	1	2.76	2.35	1.09	6.69	3.00	0.00	6.00

Nearshore

Table 17: Oregon and California Nearshore hook and line fisheries marine mammal bycatch and observer coverage statistics by year. These vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Mean/Median = the mean/median estimate from the Bayesian analysis; LCL/UCL = the lower/upper 95% confidence interval; Bayes 5 yr. = the 5 year rolling mean from the Bayesian analysis

				Observed									Bayes				Bayes 5 yr.		
State	Year	Sector	Gear	Vessels	Trips	Sets	FG Units	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species	Observed Takes	Mean estimated	Median estimated	CI LOW	CI UP	Meayr estimated	Cyr LOW	Cyr UP
OR	2004	Nearshore	Hook & Line	31	109	184	25112	9.7	204.5	0.05	Harbor Seal	0	2.39	2.01	0.30	6.34	3	0	6
OR	2005	Nearshore	Hook & Line	48	138	170	44235	11.8	176.2	0.07	Harbor Seal	0	1.95	1.62	0.30	5.34	3	0	6
OR	2006	Nearshore	Hook & Line	55	238	365	69772	18.7	160.5	0.12	Harbor Seal	0	1.68	1.39	0.23	4.53	3	0	6
OR	2007	Nearshore	Hook & Line	36	164	230	54286	15.3	176.5	0.09	Harbor Seal	0	1.93	1.64	0.27	5.35	2	0	5
OR	2008	Nearshore	Hook & Line	43	149	183	47677	14.5	184.6	0.08	Harbor Seal	2	4.02	3.71	2.24	7.45	3	0	6
OR	2009	Nearshore	Hook & Line	45	151	197	59983	13.4	220.5	0.06	Harbor Seal	0	2.49	2.10	0.38	6.87	3	0	6
OR	2010	Nearshore	Hook & Line	56	162	209	60178	13.4	169.1	0.08	Harbor Seal	0	1.86	1.57	0.28	5.02	3	0	6
OR	2011	Nearshore	Hook & Line	57	205	244	80497	15.9	191.5	0.08	Harbor Seal	0	2.06	1.76	0.31	5.78	3	0	6
OR	2012	Nearshore	Hook & Line	60	235	290	109675	20.7	193.8	0.11	Harbor Seal	0	2.04	1.72	0.29	5.66	3	0	6
OR	2013	Nearshore	Hook & Line	65	209	259	74698	15.6	203.8	0.08	Harbor Seal	0	2.25	1.94	0.30	6.06	3	0	6
OR	2014	Nearshore	Hook & Line	57	174	194	60396	16.5	200.2	0.08	Harbor Seal	0	2.17	1.88	0.28	6.30	3	0	6
OR	2015	Nearshore	Hook & Line	57	189	235	65441	18.3	210.9	0.09	Harbor Seal	0	2.29	1.92	0.34	6.30	3	0	6
OR	2016	Nearshore	Hook & Line	53	214	263	79133	21.7	176.3	0.12	Harbor Seal	0	1.79	1.56	0.26	4.91	3	0	6
CA	2003	Nearshore	Hook & Line	30	98	177	52829	5.7	190.7	0.03	California Sea Lion	0	2.19	1.64	0.15	6.70	3	0	6
CA	2004	Nearshore	Hook & Line	57	220	334	115083	17.7	235.1	0.08	California Sea Lion	0	2.31	1.74	0.17	7.43	3	0	6
CA	2005	Nearshore	Hook & Line	43	151	192	79707	11.4	232.9	0.05	California Sea Lion	0	2.47	1.90	0.22	8.19	3	0	6
CA	2006	Nearshore	Hook & Line	39	100	148	51072	8.0	217.3	0.04	California Sea Lion	1	3.44	2.93	1.25	8.95	3	0	6
CA	2007	Nearshore	Hook & Line	40	133	214	76767	10.8	238.5	0.05	California Sea Lion	0	2.54	1.94	0.21	8.19	3	0	6
CA	2008	Nearshore	Hook & Line	24	70	79	62042	6.3	247.4	0.03	California Sea Lion	0	2.85	2.11	0.23	8.58	3	0	6
CA	2009	Nearshore	Hook & Line	28	89	121	72765	6.7	222.6	0.03	California Sea Lion	0	2.58	2.08	0.18	8.42	3	0	6
CA	2010	Nearshore	Hook & Line	22	87	108	131934	6.6	184.2	0.04	California Sea Lion	0	2.07	1.64	0.16	6.52	3	0	6
CA	2011	Nearshore	Hook & Line	32	145	214	146393	8.5	178.5	0.05	California Sea Lion	0	1.94	1.51	0.16	6.33	3	0	6
CA	2012	Nearshore	Hook & Line	31	138	211	155080	9.9	158.7	0.06	California Sea Lion	0	1.67	1.28	0.13	5.35	3	0	6
CA	2013	Nearshore	Hook & Line	34	131	173	119332	9.6	178.4	0.05	California Sea Lion	0	1.87	1.44	0.16	6.30	2	0	5
CA	2014	Nearshore	Hook & Line	32	119	151	111841	8.9	196.7	0.05	California Sea Lion	0	2.15	1.68	0.14	6.88	3	0	6
CA	2015	Nearshore	Hook & Line	33	176	230	165065	18.9	282.2	0.07	California Sea Lion	0	2.83	2.16	0.18	9.24	3	0	6
CA	2016	Nearshore	Hook & Line	23	87	99	75487	9.7	205.7	0.05	California Sea Lion	0	2.22	1.67	0.16	7.34	3	0	6

Table 18: Oregon and California Nearshore pot fisheries marine mammal bycatch and observer coverage statistics by year. These vessels carried a scientific observer for the proportion of landings given under 'Proportion Landed Observed'. Values for Oregon and California are combined to maintain confidentiality. (*) = confidential

				Observed							
State	Year	Sector	Gear	Vessels	Trips	Sets	FG Units	Catch (mt)	Landed Catch (mt)	Proportion Landed Observed	Species
OR & CA	2003	Nearshore	Pot	5	14	31	2121	2.4	68.6	0.04	–
OR & CA	2004	Nearshore	Pot	24	64	126	4500	6.1	58.9	0.10	–
OR & CA	2005	Nearshore	Pot	7	21	27	801	1.6	47.2	0.03	–
OR & CA	2006	Nearshore	Pot	5	16	33	667	1.3	43.1	0.03	–
OR & CA	2007	Nearshore	Pot	4	26	31	878	1.9	38.7	0.05	–
OR & CA	2008	Nearshore	Pot	4	8	12	306	0.5	49.7	0.01	–
OR & CA	2009	Nearshore	Pot	*	*	*	*	*	*	*	*
OR & CA	2010	Nearshore	Pot	6	9	13	403	0.6	36.5	0.02	–
OR & CA	2011	Nearshore	Pot	6	14	24	807	1.5	43.0	0.03	–
OR & CA	2012	Nearshore	Pot	8	16	28	1058	2.0	43.2	0.05	–
OR & CA	2013	Nearshore	Pot	7	16	25	1125	2.5	43.1	0.06	–
OR & CA	2014	Nearshore	Pot	11	22	33	1586	2.7	49.0	0.06	–
OR & CA	2015	Nearshore	Pot	12	39	49	5296	4.1	51.4	0.08	–
OR & CA	2016	Nearshore	Pot	17	37	61	3890	4.1	44.2	0.09	–

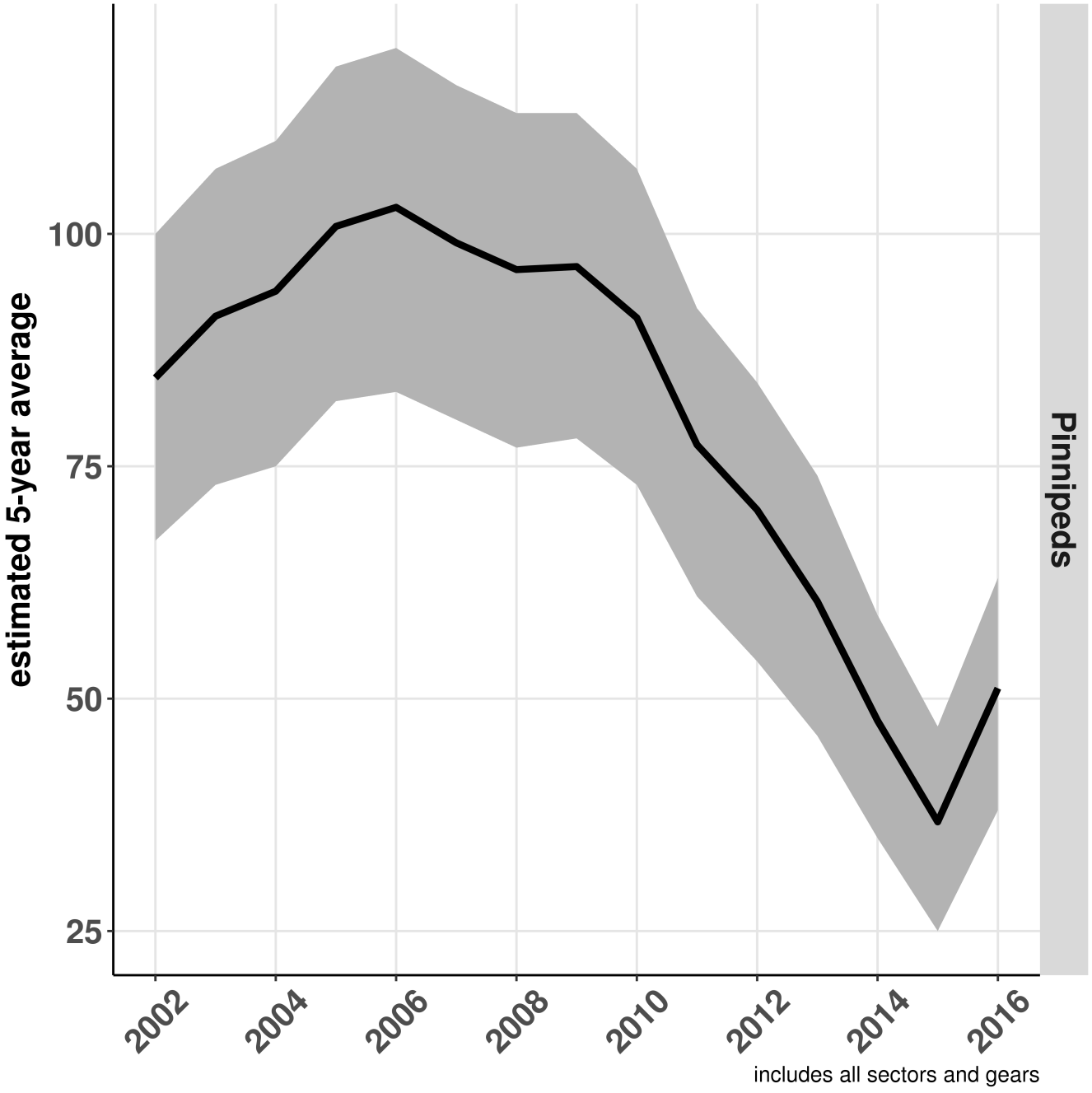

Figure 1: Estimated 5-year mean (line) and 95% confidence interval(ribbon) for pinniped mortality from all sectors and gears (Table 1), 2002-2016 observed by the NWFSC Groundfish Observer Program.

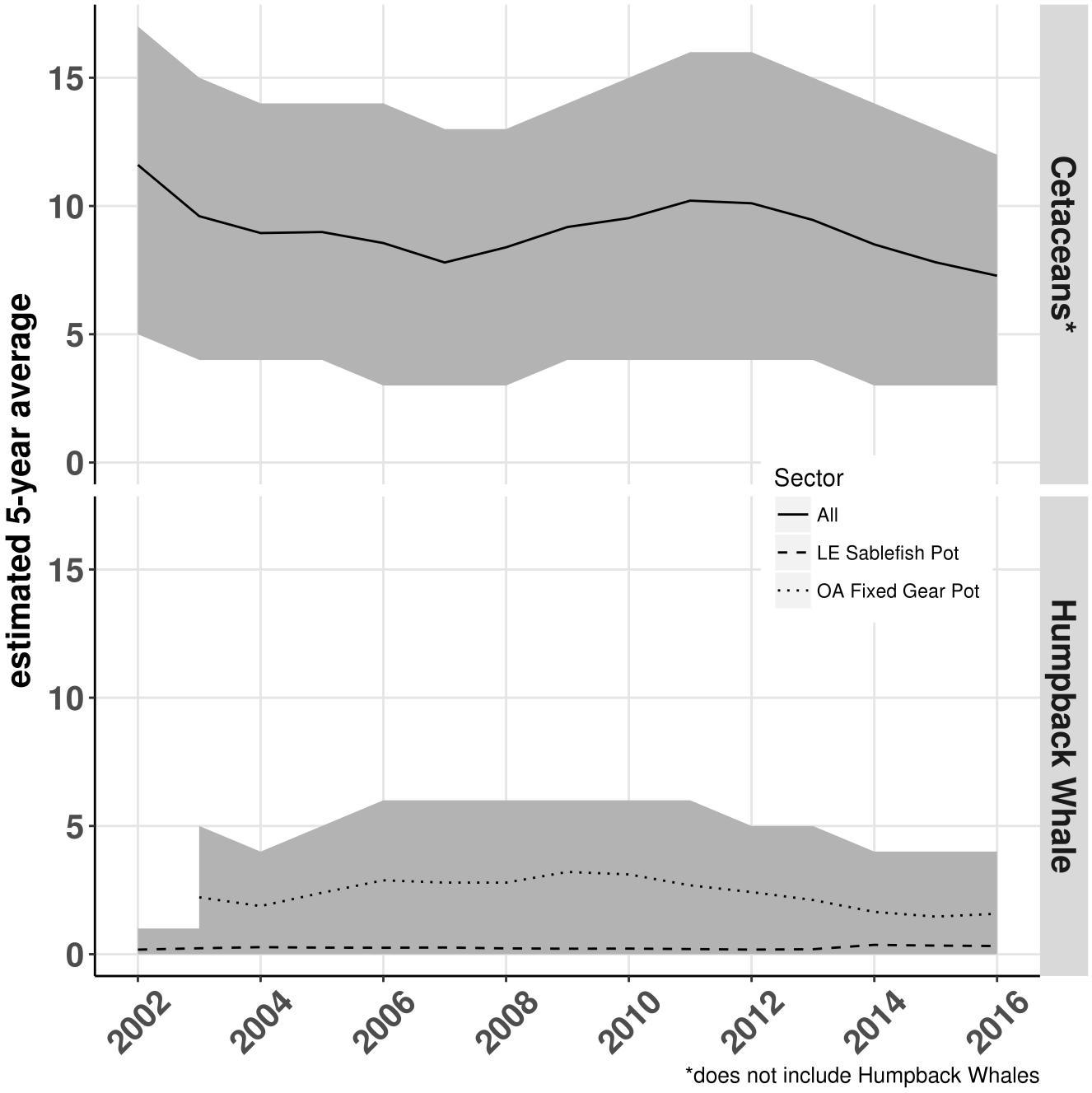

Figure 2: Estimated 5-year mean (line) and 95% confidence interval(ribbon) for cetacean and humpback whale mortality, 2002-2016 observed by the NWFSC Groundfish Observer Program. Cetaceans exclude humpback whales bycatch, but include all fishery sectors and gears

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