



Injury Determinations for Marine Mammals Observed Interacting with Hawaii and American Samoa Longline Fisheries During 2015–2016

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Abstract

Marine mammal interactions (i.e., hookings and entanglements) with the Hawaii and American Samoa longline fisheries observed during 2015–2016 were compiled, and the number of marine mammal deaths, serious injuries, and non-serious injuries by fishery, species, and management area were assessed. These values are used to compute the mortality and serious injury estimates included in the stock assessment reports of stocks impacted by these fisheries. Injury determinations were made using a nationally standardized process and established criteria for distinguishing serious from non-serious injuries (National Marine Fisheries Service, 2012). In the Hawaii deep-set fishery, 22 marine mammal interactions were observed from 2015 to 2016; most involved false killer whales (59.1%), resulted in death or serious injury (68.1%), and occurred outside the U.S. exclusive economic zone (EEZ) (81.8%). In the Hawaii shallow-set fishery, 18 marine mammal interactions were observed from 2015 to 2016; most involved Risso’s dolphins (27.8%), resulted in death or serious injury (77.8%), and occurred outside the U.S. EEZ (100.0%). In the American Samoa deep-set fishery, 6 marine mammal interactions were observed from 2015 to 2016; most involved false killer whales (66.7%), resulted in death or serious injury (83.3%), and occurred within the U.S. EEZ (100.0%).

Introduction

The Marine Mammal Protection Act (MMPA) mandates that incidental mortality and serious injury (M&SI) of marine mammals from commercial fishing operations be reduced to insignificant levels. Regulations define serious injury as an injury that will likely result in mortality.¹ In 2012, the National Marine Fisheries Service (NMFS) clarified its interpretation of this definition as any injury that is more likely than not to result in mortality.² The process for distinguishing serious from non-serious injuries pursuant to the MMPA was also revised (NMFS, 2012).³ These revisions were aimed at making the injury determination process more consistent and transparent, as well as providing additional guidance for cases that would have previously been classified as “cannot be determined.” Estimates of M&SI by source are compiled and averaged over 5-year periods and included in the marine mammal stock assessment reports (SARs) required by the MMPA. The combined process of observer data approval, injury determination, M&SI estimation, internal and external peer review, and MMPA-specified SAR public review causes a 2-year lag between the M&SI estimation period and the SAR year. The current SAR year (2018) requires estimates of M&SI from 2012 to 2016.

The pelagic longline fisheries based in Hawaii consist of a deep-set fishery targeting tunas and a shallow-set fishery targeting swordfish. Observer coverage for these fisheries began in 1994 and has been maintained at current levels since the shallow-set fishery reopened from a 4-year closure in 2004. A deep-set tuna fishery is also based in American Samoa and has been observed since 2006. Present observer coverage for the two deep-set fisheries is approximately 20% annually, while the shallow-set fishery operates under 100% observer coverage. Interactions (i.e., hookings or entanglements) with protected species, including marine mammals, are documented by the on-board observers. Observer data are used to determine the number of marine mammal deaths, serious injuries, and non-serious injuries by fishery, species, and management area. A False Killer Whale Take Reduction Plan was finalized in 2012, which includes eight regulatory measures designed to reduce the M&SI of false killer whales (*Pseudorca crassidens*) in Hawaii-based longline fisheries.⁴ Most of the measures, including closed areas and captain and crew training and notification, went into effect 31 December 2012, while gear requirements for the Hawaii deep-set fishery went into effect 27 February 2013.

The present report provides a summary of the mortality and injury severity of marine mammals observed interacting with Hawaii and American Samoa longline fisheries during 2015–2016. For the fully observed shallow-set fishery, the number of deaths and serious injuries represents total marine mammal bycatch during this period. For the partially observed deep-set fisheries, the number of deaths and serious injuries is a sample of total marine mammal bycatch, which must be quantitatively estimated. Previous reports summarizing outcomes of marine mammal interactions with these fisheries included injury determinations from all 5 years associated with a given SAR year (e.g., Bradford and Forney, 2017), even though only the most recent year(s) of determinations was unpublished (e.g., Bradford and Forney, 2016). To reduce redundancy and increase efficiency, the present and subsequent reports will only cover injury determinations that

¹ 50 *CFR* 229.2

² NMFS Policy Directive PD 02-238

³ 77 *Federal Register* 3233 (23 January 2012)

⁴ 77 *Federal Register* 71259 (29 November 2012)

have not previously been published. The last year of published injury determinations for marine mammals observed interacting with Hawaii and American Samoa longline fisheries was 2014 (Bradford and Forney, 2017).

Methods

Observer data on marine mammal interactions in the Hawaii and American Samoa longline fisheries during 2015–2016 were extracted from the web-based Pacific Islands Region Longline Observer Data System using the Datatrawler interface and compiled in a spreadsheet. These data include details about the trip (i.e., fishery type, duration, gear and bait used), the interaction (i.e., date, time, location, duration, description of events, behavior of animal, nature of injury, amount and type of gear left on animal), and the species involved (i.e., length, identifying characteristics). Copies of the original data forms and, if available, photos and videos taken during the interaction were also obtained and reviewed. The author of this report (ALB) maintained an ongoing practice of meeting (in-person or via phone) with the observers of marine mammal interactions and their NMFS Pacific Islands Regional Office (PIRO) Observer Program debriefers upon return of the observers to port. The purpose of these meetings was to seek clarification, when needed, on aspects of the collected data that may be relevant to injury determination. Notes from these meetings were assembled and reviewed along with the electronic data, data form copies, and available imagery.

The PIRO Observer Program assigned a species code to each marine mammal interaction based on the species involved (Table 1). The species code UC (unidentified cetacean) was used when the cetacean species taken could not be identified by the observer or verified by NMFS staff upon review of photos or video and a biopsy sample was not collected. Species identification for pygmy and dwarf sperm whales (*Kogia* sp.) and beaked whales is difficult, and thus a genus or family code is often assigned to interactions involving those species. For some UC interactions, the description, sketches, photos, and videos recorded by the observer indicated one or more candidate (or probable) species. These probable species were identified and reported as part of the present assessment. UC interactions that were determined to involve either false killer whales or short-finned pilot whales (*Globicephala macrorhynchus*) were assigned the species code BF (“blackfish”) for injury determination and bycatch estimation. To maintain consistency with the bycatch estimation, marine mammal interactions were considered to have occurred in the calendar year the fishing vessel returned to port. The geographic locations of the interactions were plotted and the exclusive economic zone (EEZ) and management area of the interaction determined.

The observer recorded the condition of the animal involved in each interaction as either dead or injured. Injury severity (i.e., serious or non-serious) of each injured animal was subsequently determined using the revised guidelines and criteria presented in NMFS (2012). Specific factors were considered in the application of some of the injury categories to the interactions (see Appendix for details of how these categories were applied). When there was insufficient information to establish injury severity, the case was classified as “cannot be determined” (CBD). Injury determinations were made independently by the author of this report (ALB) and, as instructed by NMFS (2012), sent for an additional independent review to another NMFS Science Center staffer (Karin Forney of the Southwest Fisheries Science Center, SWFSC) experienced in evaluating injury severity for cetaceans interacting with longline fisheries (e.g.,

Forney, 2010). Any differences between the initial and reviewed determinations were discussed and reconciled jointly.

Occasionally, U.S. West Coast pinniped species interact with the Hawaii shallow-set longline fishery when fishing operations take place outside the U.S. EEZ and closer to the U.S. mainland than to Hawaii. Given that these species are assessed by the SWFSC, the SWFSC has assumed responsibility for making and reporting injury determinations for any U.S. West Coast pinnipeds observed interacting with the Hawaii longline fisheries. However, to maintain completeness in the present injury determination report on marine mammals interacting with the Hawaii and American Samoa longline fisheries, injury determinations for cetaceans and pinnipeds were summarized together, although the associated SWFSC report was cited as the source for the pinniped injury determinations.

MMPA regulations direct commercial fishermen to submit a Marine Mammal Authorization Program (MMAP) Mortality/Injury Reporting Form (MMAP report) when their operations lead to mortality or injury of marine mammals. The level of detail requested by these forms is much less than that of the observer data forms, making it difficult to determine injury severity in most cases. MMAP reports cannot be used for bycatch estimation because they are not obtained using a quantifiable sampling scheme, but they could potentially provide minimum estimates of M&SI for species not observed interacting with the fishery. In the Pacific Islands Region, MMAP reports are infrequently submitted and generally overlap with observed takes. However, all MMAP reports from the Pacific Islands Region were reviewed and any unobserved interactions were noted and discussed in the context of injury determination.

Results and Discussion

Injury Determination Review

A total of 46 marine mammal interactions were observed in the three fisheries combined during the 2015–2016 period. While 8 (17.4%) of these interactions resulted in deaths, most (82.6%, $n = 38$) involved injured animals and required injury determination. Six of the shallow-set interactions (Table 2) resulted in injured U.S. West Coast pinnipeds that were evaluated by the SWFSC (Carretta et al., 2017, in review). For the remaining interactions, the author and the independent reviewer largely agreed on the initial injury determinations, although questions were raised about a few interactions. These interactions were subsequently revisited and discussed by both parties. In most cases, after discussing relevant details of the interactions, the initial determinations of the author were unanimously confirmed. However, in one case, the determination changed following input from the independent reviewer. Specifically, the determination changed from “serious” to “CBD” for the shallow-set interaction on 12/31/14 (Table 2).

Hawaii Longline Fisheries

From 2015 to 2016, 22 marine mammals were observed interacting with the Hawaii deep-set fishery, including 13 (59.1%) false killer whales, 2 (9.1%) Risso’s dolphins (*Grampus griseus*), 1 (4.5%) blackfish, 1 (4.5%) short-finned pilot whale, 1 (4.5%) rough-toothed dolphin (*Steno bredanensis*), 1 (4.5%) striped dolphin (*Stenella coeruleoalba*), 1 (4.5%) common bottlenose

dolphin (*Tursiops truncatus*), 1 (4.5%) unidentified cetacean, and 1 (4.5%) unidentified beaked whale (Tables 2 and 3). Three (13.6%) of the interactions were deaths, 12 (54.5%) were serious injuries, 4 (18.2%) were non-serious injuries, 1 (4.5%) involved prorating a large whale interaction as 0.75 serious (NMFS, 2012), and 2 (9.1%) were classified as CBD. A majority of the interactions (81.8%, n = 18) occurred outside the U.S. EEZ. All 4 (18.2%) interactions within the U.S. EEZ occurred around the Hawaiian Archipelago, including one false killer whale interaction from the pelagic stock (Table 2; Fig. 1). Most Hawaii EEZ takes were distributed south of the main Hawaiian Islands (MHI), while takes outside the U.S. EEZ were concentrated north of the MHI (Figure 1). Marine mammal interactions observed in the deep-set fishery during 2015–2016 were consistent with observed interactions from 2004 to 2014 (Forney, 2010; Bradford and Forney, 2014, 2017) in terms of the primary species involved (i.e., false killer whale) and the number and species composition of takes. However, compared to 2004–2008 (Forney 2010), takes outside the U.S. EEZ were more northerly distributed in 2015–2016, similar to more recent years (Bradford and Forney, 2014, 2017). Nine MMAP reports were submitted by Hawaii deep-set longliners during 2015–2016. All of the reports were associated with observed takes.

From 2015 to 2016, 18 marine mammals were observed interacting with the Hawaii shallow-set fishery, including 5 (27.8%) Risso’s dolphins, 3 (16.7%) unidentified pinnipeds, 3 (16.7%) common bottlenose dolphins, 2 (11.1%) unidentified otariids, 1 (5.6%) Guadalupe fur seal (*Arctocephalus townsendi*), 1 (5.6%) fin whale (*Balaenoptera physalus*), 1 (5.6%) ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*), 1 (5.6%) humpback whale (*Megaptera novaeangliae*), and 1 (5.6%) striped dolphin (Tables 2 and 4). Two (11.1%) of the interactions were deaths, 12 (66.7%) were serious injuries, 3 (16.7%) were non-serious injuries, and 1 (5.6%) was classified as CBD. All of the interactions occurred outside the U.S. EEZ. Most takes were observed in the northeastern portion of the shallow-set fishing area near the U.S. West Coast EEZ (Figure 2). Marine mammal interactions observed in the shallow-set fishery during 2015–2016 were consistent with observed interactions from 2004 to 2014 (Forney, 2010; Bradford and Forney, 2014, 2017) in terms of the primary species involved (i.e., Risso’s dolphin). However, the relatively higher number and more northerly distribution of takes in 2015–2016 is similar to more recent years (Bradford and Forney, 2014, 2017) than to the 2004–2008 period (Forney 2010). The species composition during the current period includes 3 species (Guadalupe fur seal, fin whale, and ginkgo-toothed beaked whale) not previously observed interacting with the shallow-set fishery, but these takes all occurred in the northeastern portion of the fishing area. Two MMAP reports were submitted by Hawaii shallow-set longliners during 2015–2016. Both of the reports were associated with observed takes.

American Samoa Longline Fishery

From 2015 to 2016, 6 marine mammals were observed interacting with the American Samoa deep-set fishery, including 4 (66.7%) false killer whales and 2 (33.3%) rough-toothed dolphins (Tables 5–6). Three (50.0%) of the interactions were deaths, 2 (33.3%) were serious injuries, and 1 (16.7%) was a non-serious injury. All of the interactions occurred within the U.S. EEZ around American Samoa and were distributed throughout the American Samoa EEZ (Fig. 3). Marine mammal interactions observed in the deep-set fishery during 2015–2016 were consistent with observed interactions from 2008 to 2014 (Bradford and Forney, 2014, 2017) in terms of the number, species composition, and distribution of takes, although the primary species involved in

previous years was the rough-toothed dolphin instead of the false killer whale. Two MMAP reports were submitted by American Samoa deep-set longliners during 2015–2016. Both of the reports were associated with observed takes.

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Table 1. Species code, common name, and scientific name of marine mammals relevant to the 2015–2016 observation period of the Hawaii and American Samoa longline fisheries.

Code	Common name	Scientific name
AT	Guadalupe fur seal	<i>Arctocephalus townsendi</i>
BA	Common minke whale	<i>Balaenoptera acutorostrata</i>
BB	Sei whale	<i>Balaenoptera borealis</i>
BE	Bryde's whale	<i>Balaenoptera edeni</i>
BF	"Blackfish" = PC or GM	-
BM	Blue whale	<i>Balaenoptera musculus</i>
BP	Fin whale	<i>Balaenoptera physalus</i>
GG	Risso's dolphin	<i>Grampus griseus</i>
GM	Short-finned pilot whale	<i>Globicephala macrorhynchus</i>
MG	Ginkgo-toothed beaked whale	<i>Mesoplodon ginkgodens</i>
MN	Humpback whale	<i>Megaptera novaeangliae</i>
PC	False killer whale	<i>Pseudorca crassidens</i>
PU	Unidentified pinniped	-
SB	Rough-toothed dolphin	<i>Steno bredanensis</i>
SC	Striped dolphin	<i>Stenella coeruleoalba</i>
TT	Common bottlenose dolphin	<i>Tursiops truncatus</i>
UC	Unidentified cetacean	-
UO	Unidentified eared seal	Otariid pinniped
ZU	Unidentified beaked whale	Ziphiid whale

Table 2. Injury determinations for marine mammals observed interacting with Hawaii longline fisheries during 2015–2016, using the most recent established criteria for distinguishing serious from non-serious injury of marine mammals (Tables 1–3 in NMFS, 2012). Interactions (n = 40) are in order of trip number (confidential data; not shown). For false killer whale or potential false killer whale takes within the U.S. EEZ around Hawaii, the stock(s) occurring in the take location is indicated, based on stock boundaries presented in Bradford et al. (2015). Species codes are defined in Table 1. Animal size estimates were generally made by the observers in ft, so are reported in this unit for consistency. Gear measurement units (ft or m) are reported as made by the observers. SS = shallow-set fishery; DS = deep-set fishery; P = pelagic stock; CBD = cannot be determined. Table continues on following three pages.

Fishery type	EEZ area	Vessel return year	Take date	Species code	Probable species code	Estimated size (ft)	Recorded condition	Injury determination	Injury categories	Interaction details and case-specific factors
SS	Outside	2015	12/31/14	MG	MG	16	Injured	CBD	S7b	Entangled around caudal peduncle by 1-2 wraps of mainline; cut free of gear; nature and extent of struggle and injuries, as well as behavior during handling and post-release, are suggestive of capture myopathy effects, but limited information to make further inference
SS	Outside	2015	01/28/15	GG	GG	9	Injured	Serious	S2 or S5a, S6	Hooked in head area (possibly mouth or ingested); cut free with hook and 10.5-m branchline attached
SS	Outside	2015	03/02/15	GG	GG	7.1	Dead	Dead	n/a	Hooked in mouth; line abrasions around body indicate prior entanglement or struggle against line
SS	Outside	2015	02/27/15	BP	BP	15	Injured	Non-serious	L3, L5b	Entangled in mainline, which formed a bridle through mouth; cut free of gear; superficial wound caused by line
SS	Outside	2015	03/21/15	MN	MN	18	Injured	Non-serious	L3	Entangled around caudal peduncle by 4-5 wraps of mainline and 2 wraps of floatline; cut free of gear
DS	Outside	2015	03/30/15	PC	PC	11	Injured	Serious	S2 or S5a, S6	Hooked in head area (possibly mouth or ingested); broke free with hook, 0.5-m wire leader, 45-g weight, and 0.72-m branchline attached
SS	Outside	2015	03/19/15	TT	TT	7	Injured	Serious	S5a	Hooked in mouth; broke free with hook and <6-in branchline attached
DS	Outside	2015	04/24/15	GG	GG	9	Dead	Dead	n/a	Hooked in fluke

Fishery type	EEZ area	Vessel return year	Take date	Species code	Probable species code	Estimated size (ft)	Recorded condition	Injury determination	Injury categories	Interaction details and case-specific factors
SS	Outside	2015	05/24/15	TT	TT	6.6	Injured	Serious	S2 or S5a, S6	Hooked in mouth (possibly ingested); broke free with hook, 5.4-m mono leader, 45-g weight, and light stick attached
DS	Outside	2015	04/30/15	UC	BF	Not Specified	Injured	CBD	S5d	Hooked in fluke; cut free with hook, 0.5-m wire leader, and 45-g weight attached; limited information to make inference about capture myopathy and extent of injury
DS	Outside	2015	07/26/15	SC	SC	6.6	Injured	Non-serious	S5c	Hooked in pectoral fin, but pulled free of hook; interaction was unlikely to have caused capture myopathy and no evidence of additional injuries
DS	Outside	2015	08/18/15	PC	PC	7	Injured	Serious	S5a, S6	Hooked in mouth; cut free with hook, 0.4-m wire leader, 45-g weight, and 9-in branchline attached; line abrasions around body indicate prior entanglement or struggle against line
DS	Outside	2015	08/29/15	PC	PC	11	Injured	Serious	S2 or S5a, S6	Hooked in mouth (possibly ingested); cut free with hook, 0.5-m wire leader, 45-g weight, and 10-ft branchline attached
DS	Outside	2015	10/12/15	PC	PC	13.1	Injured	Non-serious	S5c	Hooked in unknown body location (possibly head area), but partially straightened hook and was freed; interaction was unlikely to have caused capture myopathy and no evidence of additional injuries
SS	Outside	2015	10/27/15	GG	GG	5.8	Dead	Dead	n/a	Hooked in pectoral fin and entangled around pectoral fin and through mouth by branchline; line abrasions around caudal peduncle indicated prior entanglement
SS	Outside	2015	12/02/15	PU	PU	6.6	Injured	Serious	P5a	See Carretta et al. (2017) for details
SS	Outside	2015	12/04/15	UO	UO	4	Injured	Serious	P6	See Carretta et al. (2017) for details
SS	Outside	2015	12/05/15	PU	PU	5	Injured	Serious	P6	See Carretta et al. (2017) for details

Fishery type	EEZ area	Vessel return year	Take date	Species code	Probable species code	Estimated size (ft)	Recorded condition	Injury determination	Injury categories	Interaction details and case-specific factors
SS	Outside	2015	12/06/15	PU	PU	4	Injured	Serious	P6	See Carretta et al. (2017) for details
SS	Outside	2015	12/07/15	UO	UO	4	Injured	Serious	P6	See Carretta et al. (2017) for details
DS	Outside	2015	11/05/15	PC	PC	9	Dead	Dead	n/a	Hooked in unknown body location and entangled around body by 2 wraps of mainline and around caudal peduncle by 3 wraps of branchline
DS	Hawaii	2015	10/31/15	GM	GM	9	Injured	Serious	S2 or S5a, S6	Hooked in mouth (possibly ingested); broke free with hook and 0.35-m wire leader attached
DS	Outside	2015	11/23/15	GG	GG	7	Injured	Serious	S2 or S5a, S6	Hooked in head area (possibly mouth or ingested); cut free with hook, 0.6-m wire leader, 60-g weight, and 14.8-m branchline attached
SS	Outside	2016	12/28/15	AT	AT	3.3	Injured	Non-serious	P5c	See Carretta et al. (in review) for details
SS	Outside	2016	01/27/16	GG	GG	8	Injured	Serious	S2 or S5a, S6	Hooked in mouth (possibly ingested); cut free with hook, 4.6m-mono leader, light stick, and 2-m branchline attached
DS	Outside	2016	01/28/16	PC	PC	9.8	Injured	Serious	S2 or S5a, S6	Hooked in head area (possibly mouth or ingested); branchline pulled from hands of crew, leaving hook, 0.5-m wire leader, 45-g weight, 13.6-m branchline, 50-cm braided line, and metal clip attached
DS	Hawaii	2016	02/10/16	UC	BA, BB, BE, BM, BP	19.7	Injured	Prorate 0.75 Serious	L10	Hooked and/or entangled in unknown body location(s); broke free with one or more hooks, 0.5-m wire leaders, 45-g weights, and 13.5-m branchlines attached
SS	Outside	2016	03/28/16	TT	TT	8	Injured	Serious	S5a	Hooked in mouth; broke free with hook and 1-2-in mono leader attached
SS	Outside	2016	04/02/16	SC	SC	5	Injured	Serious	S5a, S6	Hooked in mouth; cut free with hook and 1-m mono leader attached

Fishery type	EEZ area	Vessel return year	Take date	Species code	Probable species code	Estimated size (ft)	Recorded condition	Injury determination	Injury categories	Interaction details and case-specific factors
DS	Outside	2016	04/21/16	PC	PC	9	Injured	CBD	One or more of S2, S5a, S5c, S5d, S6, S7b, S8a, or S8b	Unknown if hooked or entangled, but mainline came under tension when animal surfaced; broke free, but unknown how much or if any gear attached (possibly part or all of a branchline)
DS	Outside	2016	05/03/16	PC	PC	8	Injured	Serious	S6	Entangled around caudal peduncle by several tight wraps of branchline; broke free with hook, 0.4-m wire leader, 45-g weight, and 3.4-m branchline attached
DS	Outside	2016	05/17/16	PC	PC	9	Injured	Serious	S2 or S5a, S6	Hooked in mouth (possibly ingested) and possibly entangled in unknown body location; broke free with hook, 0.4-m wire leader, 45-g weight, and 4-ft branchline attached
DS	Hawaii (P)	2016	10/01/16	PC	PC	8	Injured	Serious	S5a, S6	Hooked in mouth (lip only); broke free with hook, 0.6-m wire leader, and 45-g weight left on animal
DS	Outside	2016	09/21/16	PC	PC	14	Injured	Non-serious	S5c	Hooked in mouth, but pulled free of hook; interaction was unlikely to have caused capture myopathy and no evidence of additional injuries
DS	Outside	2016	10/01/16	PC	PC	6	Injured	Serious	S5a, S6	Hooked in mouth; cut free with hook, 0.5-m wire leader, 45-g weight, and 1-m branchline attached
DS	Outside	2016	10/02/16	SB	SB	7.7	Dead	Dead	n/a	Hooked in mouth
DS	Outside	2016	10/25/16	TT	TT	7	Injured	Serious	S2, S6	Hooked in mouth (presumably ingested); broke free with hook, 0.5-m wire leader, 45-g weight, and 0.5-m branchline attached
DS	Outside	2016	11/14/16	PC	PC	8	Injured	Serious	S2 or S5a, S6	Hooked in head area (possibly mouth or ingested); cut free with hook, 0.7-m wire leader, 45-g weight, and 7-m branchline attached
SS	Outside	2016	12/10/16	GG	GG	4	Injured	Serious	S5a, S6	Hooked in mouth (blood observed); cut free with hook and 2-m mono leader attached

Fishery type	EEZ area	Vessel return year	Take date	Species code	Probable species code	Estimated size (ft)	Recorded condition	Injury determination	Injury categories	Interaction details and case-specific factors
DS	Hawaii	2016	12/12/16	ZU	ZU	10	Injured	Non-serious	S5d	Hooked in fluke (blood observed); cut free with hook, 0.5-m wire leader, 45-g weight, and <1-ft branchline attached; capture myopathy cannot be ruled out, but overall considered unlikely; no evidence of additional injuries

Table 3. Summary of deaths (D), serious injuries (SI), non-serious injuries (NSI), and injuries with a severity that cannot be determined (CBD) observed in the Hawaii deep-set longline fishery during 2015–2016. Species codes are defined in Table 1. Year is the vessel return year. Non-integer values for large whales indicate the use of injury categories with prorated severity (Table 1 in NMFS, 2012).

Species Code	Year	Hawaii EEZ				Outside U.S. EEZ			
		D	SI	NSI	CBD	D	SI	NSI	CBD
BF	2015	-	-	-	-	-	-	-	1
-	2016	-	-	-	-	-	-	-	-
GG	2015	-	-	-	-	1	1	-	-
-	2016	-	-	-	-	-	-	-	-
GM	2015	-	1	-	-	-	-	-	-
-	2016	-	-	-	-	-	-	-	-
PC	2015	-	-	-	-	1	3	1	-
-	2016	-	1	-	-	-	5	1	1
SB	2015	-	-	-	-	-	-	-	-
-	2016	-	-	-	-	1	-	-	-
SC	2015	-	-	-	-	-	-	1	-
-	2016	-	-	-	-	-	-	-	-
TT	2015	-	-	-	-	-	-	-	-
-	2016	-	-	-	-	-	1	-	-
UC	2015	-	-	-	-	-	-	-	-
-	2016	-	0.75	0.25	-	-	-	-	-
ZU	2015	-	-	-	-	-	-	-	-
-	2016	-	-	1	-	-	-	-	-

Table 4. Summary of deaths (D), serious injuries (SI), non-serious injuries (NSI), and injuries with a severity that cannot be determined (CBD) observed in the Hawaii shallow-set longline fishery during 2015–2016. Species codes are defined in Table 1. Year is the vessel return year.

Species Code	Year	Hawaii EEZ				Outside U.S. EEZ			
		D	SI	NSI	CBD	D	SI	NSI	CBD
AT	2015	-	-	-	-	-	-	-	-
-	2016	-	-	-	-	-	-	1	-
BP	2015	-	-	-	-	-	-	1	-
-	2016	-	-	-	-	-	-	-	-
GG	2015	-	-	-	-	2	1	-	-
-	2016	-	-	-	-	-	2	-	-
MG	2015	-	-	-	-	-	-	-	1
-	2016	-	-	-	-	-	-	-	-
MN	2015	-	-	-	-	-	-	1	-
-	2016	-	-	-	-	-	-	-	-
PU	2015	-	-	-	-	-	3	-	-
-	2016	-	-	-	-	-	-	-	-
SC	2015	-	-	-	-	-	-	-	-
-	2016	-	-	-	-	-	1	-	-
TT	2015	-	-	-	-	-	2	-	-
-	2016	-	-	-	-	-	1	-	-
UO	2015	-	-	-	-	-	2	-	-
-	2016	-	-	-	-	-	-	-	-

Table 5. Injury determinations for marine mammals observed interacting with American Samoa (AS) deep-set (DS) longline fishery during 2015–2016, using the most recent established criteria for distinguishing serious from non-serious injury of marine mammals (Tables 1–3 in NMFS, 2012). Interactions (n = 6) are in order of trip number (confidential data; not shown). Species codes are defined in Table 1. Animal size estimates were generally made by the observers in ft, so are reported in this unit for consistency. Gear measurement units (ft or m) are reported as made by the observers.

Fishery type	EEZ area	Vessel return year	Take date	Species code	Probable species code	Estimated size (ft)	Recorded condition	Injury determination	Injury categories	Interaction details and case-specific factors
DS	AS	2015	10/14/15	PC	PC	8	Dead	Dead	n/a	Hooked in mouth (possibly ingested)
DS	AS	2015	10/15/15	PC	PC	8	Injured	Serious	S2 or S5a, S6	Hooked in mouth (possibly ingested); cut free with hook and 7-8-m branchline attached
DS	AS	2016	01/04/16	SB	SB	6.5	Dead	Dead	n/a	Hooked in mouth
DS	AS	2016	01/06/16	SB	SB	4.4	Dead	Dead	n/a	Hooked in fluke
DS	AS	2016	03/14/16	PC	PC	19.7	Injured	Serious	S2, S6	Hooked in mouth (presumably ingested); cut free with hook and 2-m branchline attached
DS	AS	2016	09/06/16	PC	PC	12	Injured	Non-serious	S5b	Hooked in mouth (lip only); broke free with hook attached; capture myopathy cannot be ruled out, but overall considered unlikely; no evidence of additional injuries

Table 6. Summary of deaths (D), serious injuries (SI), non-serious injuries (NSI), and injuries with a severity that cannot be determined (CBD) observed in the American Samoa deep-set longline fishery during 2015–2016. Species codes are defined in Table 1. Year is the vessel return year. There were no interactions with this fishery outside the U.S. EEZ during 2015-2016.

Species Code	Year	American Samoa EEZ			
		D	SI	NSI	CBD
PC	2015	1	1	-	-
-	2016	-	1	1	-
SB	2015	-	-	-	-
-	2016	2	-	-	-

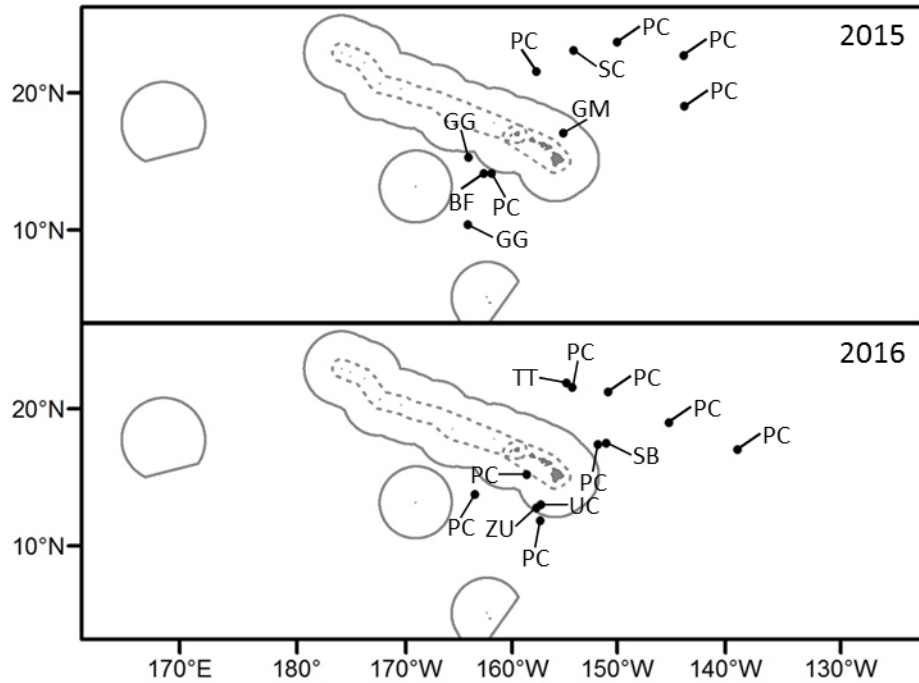


Figure 1. Locations of observed marine mammal interactions with the Hawaii deep-set longline fishery during 2015–2016. Solid gray outlines represent U.S. EEZs; dotted gray outlines are (from south to north): 1) the estimated range of the MHI insular stock of false killer whales, and 2) the estimated range of the Northwestern Hawaiian Islands stock of false killer whales. Takes are labeled by species code (defined in Table 1).

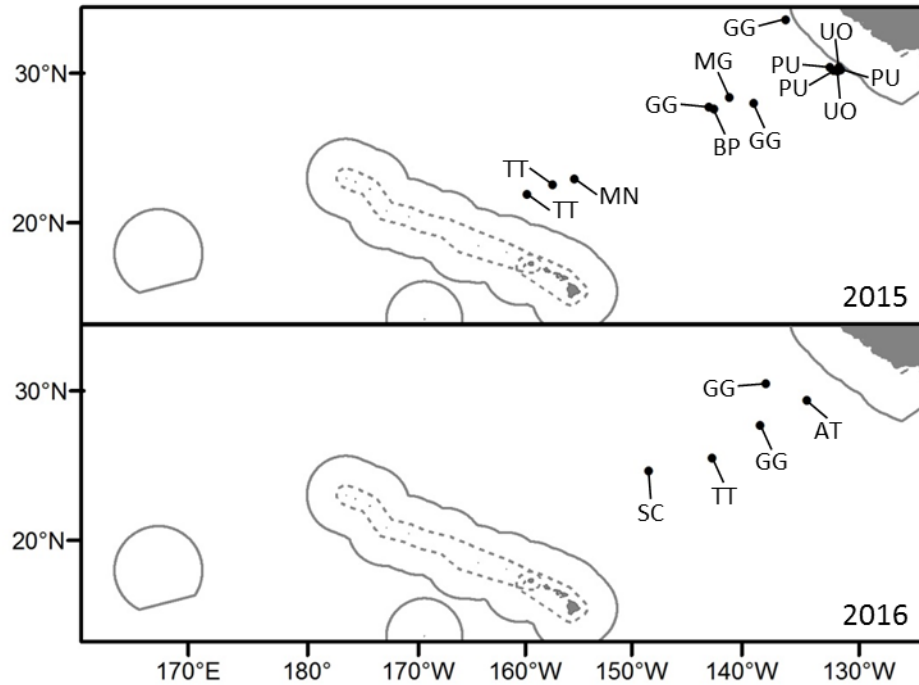


Figure 2. Locations of observed marine mammal interactions with the Hawaii shallow-set longline fishery during 2015–2016. Solid gray outlines represent U.S. EEZs; dotted gray outlines are (from south to north): 1) the estimated range of the MHI insular stock of false killer whales, and 2) the estimated range of the Northwestern Hawaiian Islands stock of false killer whales. Takes are labeled by species code (defined in Table 1).

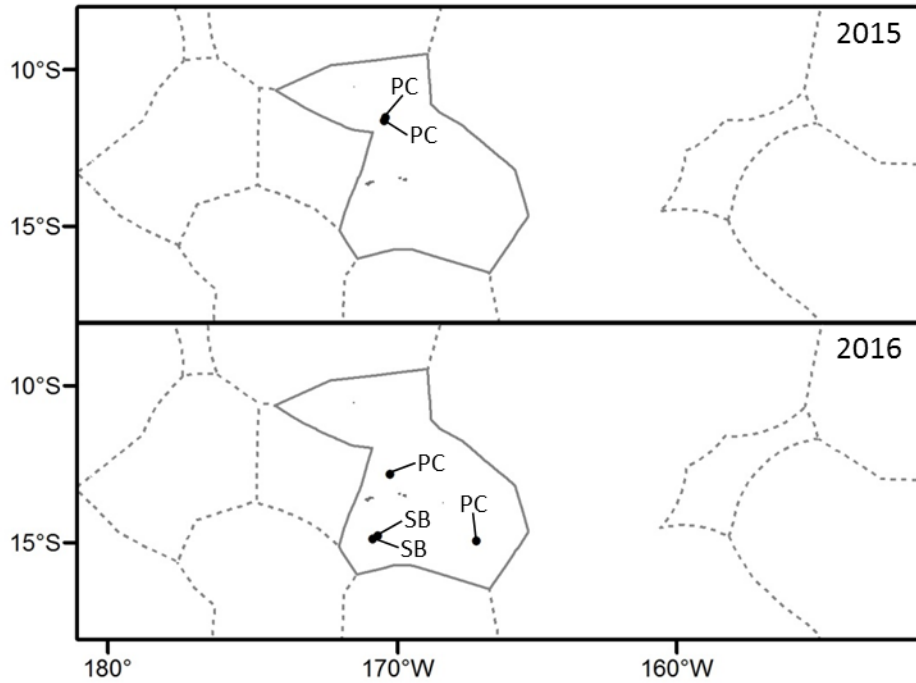


Figure 3. Locations of observed marine mammal interactions with the American Samoa deep-set longline fishery during 2015–2016. Solid outlines represent the U.S. EEZ; dotted gray outlines are non-U.S. EEZs. Takes are labeled by species code (defined in Table 1).

Appendix

Specific factors that are considered in the application of some of the injury categories (NMFS, 2012) to marine mammal interactions in the Hawaii and American Samoa longline fisheries. L = large whale category (Table 1 in NMFS, 2012); S = small cetacean category (Table 2 in NMFS, 2012); P = pinniped category (Table 3 in NMFS, 2012).

Injury category ¹	Factors considered
L3	This category was used to cover the case of an animal that had wrapped gear from which the animal was disentangled or freed itself, as there is currently not a category to cover this scenario.
L5a, L5b	Although not the practice of all members of the NMFS Determination Staff Working Group, these categories were applied when lacerations from fishing gear were reported. This use accounted for injuries remaining after the gear was removed.
S2, S5a, P2, P5a	The observers were generally able to determine when an animal was hooked in the mouth (or at least the head area), based on the presence of line coming from that region. However, it was more difficult to confirm whether the hook had been ingested. If the observer indicated that the hook was seen embedded in the mouth (or other part of the head), S5a or P5a was used. If the observer specified that the line came from the mouth, but that the hook or leader was not seen and that ingestion was presumed, S2 or P2 was applied. Otherwise, the interaction was classified as “S2 or S5a” or “P2 or P5a” to account for the possibility of ingestion. This classification did not affect the injury determination, as S2, P2, S5a, and P5a each represent a serious injury (NMFS, 2012).
S5b, S5c, S5d, S7b, P5b, P5c, P7b	For these categories that require “case-specific” injury determinations, a consideration of capture myopathy was included in the determination process (NMFS, 2012). Specific interaction characteristics that were considered were: 1) duration of the event, 2) behavior of the animal during the interaction and upon release, and 3) known species-specific sensitivity to capture myopathy. Interactions that were prolonged, resulted in the animal actively struggling and appearing lethargic upon release, and involved a species with known sensitivity (e.g., <i>Stenella</i> spp.) were considered more likely to have caused capture myopathy. For some interactions, the interaction duration and animal behavior were specified by the observer. For others, these attributes were implied from the event description or supporting information that suggested a lengthy period of struggle (e.g., the animal was pulled to the vessel from a long distance, the gear associated with the animal was tangled).
S6, P6	The length and body location of line remaining attached to the animal was considered relative to the length of the animal (as estimated by the observer). If the remaining line was longer than the animal, regardless of where the remaining line was attached, then S6 or P6 was used. S6 or P6 was also applied if the remaining line was shorter than the animal, but attached in a location where the line could be ingested, wrap around the goosbeak or other body parts, or become snagged on something in the environment. If the remaining line was shorter and not in a position to pose a risk, then S6 or P6 was not used.
S5d, S6	When wrapped line remained attached to an animal, these categories were consistently considered more appropriate to apply to the interaction than S8a or S8b. While the line might have been in a constricting (S8a) or loose (S8b) wrap prior to the animal breaking away or being cut free from the bulk of the gear, the observers were generally not able to assess the nature or persistence of the wrap post-release. Thus, accounting for the length and body location of the line and determining its potential (S6) or not (S5d) to wrap, be ingested, or become snagged on something in the environment was more applicable.
S15	This category was only considered in the context of a dependent animal being left with a seriously injured mother. Even though it was possible to infer dependent status for many of the injured animals (using observer size estimates, published estimates of size-at-weaning, and supporting visual information), the category description does not offer guidance as to how to determine whether a dependent animal was released alone post-interaction. Therefore, the category was not used in that way, but as described in the text, may apply to relevant interactions pending future guidance.

Description of injury categories (from Tables 1–3 in NMFS, 2012): L3 – loose wrap, bridled, or draped gear; L5a – deep laceration; L5b – superficial laceration; S2 – ingested gear or hook(s); S5a – hook(s) in head regardless of the presence of gear; S5b – hook(s) confirmed in lip only, external tissue outside of teeth, no trailing gear; S5c – hook(s) in any body part, but hook(s) is removed or pulls out; S5d – hook(s) in appendage or body, without trailing gear or with trailing gear that does not have potential to: 1) become a constricting wrap on animal, 2) be ingested, 3) accumulate drag, or 4) become snagged on something in the environment, anchoring the animal; S6 – gear attached to free-swimming animal with potential to: 1) become a constricting wrap on animal, 2) be ingested, 3) accumulate drag, or 4) become snagged on something in the environment, anchoring the animal; S7b – anchored, immobilized, entangled, or entrapped before being freed without gear attached; S15 – dependent animal (i.e., calf, juvenile) released alone post-interaction or dependent animal left with a seriously injured or dead mother; P2 – ingested gear or hook(s); P5a – hook(s) in mouth regardless of presence of gear; P5b – hook(s) confirmed in head (excluding criterion P5a), or in lip only (external tissue outside of teeth), no trailing gear; P5c – hook(s) in any body part, but hook(s) is removed or pulls out; P7b – anchored, immobilized, or entangled before being freed without gear attached; and P6 – gear attached in any manner to free-swimming animal with potential to: 1) become a constricting wrap on animal, 2) be ingested, 3) accumulate drag, or 4) become snagged on something in the environment, anchoring the animal.