Injury Determinations for Humpback Whales and Other Cetaceans Reported to NOAA Response Networks in the Hawaiian Islands During 2018

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Abstract

Reports of cetaceans with human-caused injuries in Hawaiian waters are made each year to the Pacific Islands Region Marine Mammal Response Network (PIR-MMRN, coordinated by the NOAA National Marine Fisheries Service (NMFS) Pacific Islands Regional Office) and the Hawaiian Islands Entanglement Response Network (HIERN, coordinated by the NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary). These injury reports largely involve humpback whales that were entangled in fishing gear or marine debris or were struck by or otherwise injured by contact with a vessel. Bradford and Lyman (2015, 2018, 2019) made determinations of injury severity (i.e., serious or non-serious) for cetaceans in Hawaii reported injured by human causes during 2007–2017. The present report provides a summary of injury determinations for cetaceans in Hawaii reported injured by human causes during 2018. Injury determinations were made using a nationally standardized process and criteria for distinguishing serious from non-serious injuries (NMFS 2012). During 2018, there were 19 reports of cetaceans with human-caused injuries, including 4 humpback whales involved in vessel collisions, 11 humpback whales entangled in presumed fishing gear or marine debris, and 4 other cetaceans with human-caused injuries. The 15 humpback whale vessel collisions and entanglements led to 11 serious injuries. For the other cetaceans, injury determinations of serious were made for two spinner dolphins of the Hawaii Island stock entangled in fishing gear. While accounting for injuries reported to PIR-MMRN and HIERN has improved the stock assessment process for some populations, significantly more effort is needed to report, document, and monitor injured cetaceans in Hawaiian waters, particularly species other than humpback whales.

Introduction

The Marine Mammal Protection Act (MMPA) requires the NOAA National Marine Fisheries Service (NMFS) to prepare Stock Assessment Reports (SARs) for marine mammal stocks occurring in U.S. waters. Along with information on stock abundance and status, the SARs include an estimate of the annual human-caused mortality and serious injury (M&SI) by source. Regulations define serious injury as one that will likely result in mortality.[1] In 2012, 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 human-caused M&SI are compiled and averaged over 5-year periods for inclusion in the SARs. However, the process of injury determination, including internal and external peer review, and the MMPA-specified SAR public review leads to a 2-year lag between the M&SI estimation period and the SAR year. The 2020 SARs require estimates of M&SI from 2014 to 2018.

Reports of injured and dead cetaceans in the U.S. Exclusive Economic Zone around the Hawaiian Islands (Hawaiian EEZ) are received each year by the Pacific Islands Region Marine Mammal Response Network (PIR-MMRN), which is coordinated by the NMFS Pacific Islands Regional Office (PIRO), and the Hawaiian Islands Entanglement Response Network (HIERN), which is coordinated by the NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary. These two agencies work closely together and are part of the greater NMFS Marine Mammal Health and Stranding Response Program. Most of the injury reports involve humpback whales (*Megaptera novaeangliae*) that are entangled in fishing gear or marine debris or have been struck by or otherwise injured by contact with a vessel. Occasionally, however, reports of other species are received. While reported cetaceans have traditionally been assessed for injury and impact by PIR-MMRN or HIERN, and response efforts mobilized as appropriate, determinations of injury severity (i.e., serious or non-serious) were only recently initiated (Bradford and Lyman 2015). Prior to that effort, injury determinations based on reports to PIR-MMRN or HIERN had not previously been accounted for in estimates of M&SI for the affected stocks.

Bradford and Lyman (2015, 2018, 2019) provided a summary of injury determinations for cetaceans in and around the Hawaiian EEZ reported injured by human causes to PIR-MMRN and HIERN during 2007–2017. The present paper extends this time series of injury determinations through 2018. These determinations are based on injury reports that are opportunistic and not a part of a quantifiable and directed sampling scheme. Thus, the resulting determinations of serious injury (or mortality) cannot be used to estimate undocumented M&SI from the same source. However, these serious injuries and mortalities can serve as minimum estimates of M&SI by source and should be included in the relevant SARs (NMFS 2016).

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[1] 50 *CFR* 229.2
[2] NMFS Policy Directive PD 02-238
[3] 77 Federal Register 3233 (23 January 2012)

Most cetacean species that occur in the Hawaiian EEZ are recognized as Hawaii stocks, with differentiation as pelagic and island-associated stocks for some species. Hawaiian stocks of cetaceans are assessed and managed by the NMFS Pacific Islands Fisheries Science Center (PIFSC) and PIRO, respectively. However, humpback whales that overwinter in the Hawaiian EEZ are part of the central North Pacific (CNP) stock, which falls under the purview of the NMFS Alaska Fisheries Science Center (AFSC) for assessment and the NMFS Alaska Regional Office and PIRO for management. Therefore, in terms of SAR preparation, the determinations contained herein are directed at AFSC for humpback whales and at PIFSC for all other cetaceans.

Methods

The PIR-MMRN maintains an electronic database of more than 1,500 records with summary information (e.g., date, species, location, condition) for each stranded or injured marine mammal reported from 1848 to the present. Generally, these records are associated with case-specific documentation, such as a Level A Form, a necropsy report or photographs. The PIR-MMRN database was accessed and cetacean records in and around the Hawaiian EEZ during 2018 (n = 34) were extracted. These records were reviewed to identify reports of cetaceans injured by human causes so that injury determinations could be made and applied to the assessment and management of the affected stocks.

The identified PIR-MMRN reports were supplemented with 17 confirmed injury reports (i.e., containing sufficient descriptive information from a reliable source) from 2018 maintained in the HIERN database, which dates back to 2002 and contains more than 1,000 records also associated with case-specific documentation. Database records from HIERN occasionally overlap with those from PIR-MMRN, but are usually considered more complete because HIERN was the primary data source. Further supplementing the reports compiled from the two databases was a report of an injured spinner dolphin (*Stenella longirostris*) from a research team led by R. Baird (Cascadia Research Collective), which should have been incorporated into the PIR-MMRN database. The merged set of 2018 injury reports was evaluated, and the injury severity of each cetacean injured by human causes was determined using the revised guidelines and criteria presented in NMFS (2012). When follow-up (observation or response) of injured individuals occurred, which was often the case for entangled humpback whales, an injury determination was made both before and after follow-up and any mitigation efforts. This differentiation ensures that the appropriate number of mortalities and serious injuries can be considered when classifying commercial fisheries on the MMPA-mandated List of Fisheries (LOF) and when comparing M&SI estimates with the Potential Biological Removal (PBR) value reported in the SARs. That is, initial injury determinations prior to follow-up and mitigation are used in LOF classifications, and determinations after these efforts are relevant to the PBR comparisons (NMFS 2012).

Injury determinations were made collaboratively by the authors, with EGL taking the lead on the reports of humpback whales and ALB on the reports of other cetaceans. Additional interpretation or consideration was required in the application of some of the injury categories for injured large whales (see Appendix for details of how these categories were applied). As directed by NMFS (2012), the preliminary injury determinations were then sent for independent review to members of the NMFS Determination Staff Working Group with applicable expertise (Forney 2010; Henry et al. 2019). The humpback injury determinations were reviewed by A. Henry (NMFS

Northeast Fisheries Science Center), and the other cetacean injury determinations were reviewed by K. Forney (NMFS Southwest Fisheries Science Center). Differences between the preliminary and reviewer determinations were discussed and reconciled by ALB and EGL, with input from the reviewers as needed.

Follow-up and mitigation efforts of entangled cetaceans, particularly disentanglement activities by the HIERN, often involved the photo-documentation and occasionally the collection of entangling gear. The HIERN made substantial efforts, in collaboration with PIRO and other partner agencies, to identify the gear type and associated fishery (if applicable) for the humpback entanglement cases. However, unlike other regions where there are dedicated gear specialists, staff resources in the Pacific Islands are challenged to systematically review the gear in all cases. A summary of the information available for a systematic gear review for all the cetacean entanglements is included along with the injury determinations. For the humpback entanglements, the details and available results of gear reviews conducted to date are included along with assessment of the possibility of further classification from additional review efforts.

Results and Discussion

In total, 19 reports of cetaceans with human-caused injuries from 2018 were identified. The reports consist of 4 humpback whales involved in vessel collisions (Table 1), 11 humpback whales entangled in presumed or confirmed fishing gear or marine debris (Table 2), and 4 other cetaceans with human-caused injuries (Table 3). The other cetaceans include a bottlenose dolphin (*Tursiops truncatus*) with a gunshot wound (Harnish et al. 2019) and three spinner dolphins entangled in presumed or confirmed fishing gear. As in Bradford and Lyman (2015, 2018, 2019), the review process highlighted the challenging nature of some of the humpback whale injury events and revealed regional differences in the ways some injury categories are applied to large whales (Appendix). For the 15 humpback whale vessel collisions and entanglements, the injury determinations by the reviewer differed from the preliminary determinations in 2 (13.3%) cases (both entanglements; Table 4). Follow-up discussions led to changing both of the preliminary entanglement injury determinations (Table 4). The reviewer was in agreement with the preliminary determinations for the other injured cetaceans.

The 4 humpback whale vessel collisions led to 4 serious injuries for comparison to PBR (Table 1). The 11 humpback whale entanglements led to 7.75 serious injuries (note that some large whale injury categories involve prorating injuries as proportionally serious; NMFS 2012) for consideration with the LOF and 7 serious injuries for comparison to PBR (Table 2). For the 4 other cetaceans reported injured, there were 3 serious injuries for consideration with the LOF and 2 serious injuries for comparison with PBR values (Table 3). The serious injuries of relevance to the SARs were from two spinner dolphins of the Hawaii Island stock. These M&SI estimates can be combined with those from 2014–2017 (Bradford and Lyman 2018, 2019) for use in the applicable 2020 SARs.

HIERN attempts to cross-match the injured humpback whales that were adequately photo-identified with other photo-identified whales in its database and with other CNP humpback

whale photo-identification catalogs, including use of the Happywhale[4] platform. However, there are not dedicated personnel to systematically pursue identification of injured individuals to the greatest extent possible, and the CNP stock of humpback whales numbers in the thousands of individuals (Muto et al. 2019). Additionally, many reports are made without images suitable for photo-identification. Based on identification efforts to date, there are no individuals of any cetacean species known to have been injured more than once between 2014 and 2018. Thus, for the purposes of establishing minimum estimates of M&SI, all injured cetaceans summarized here and in Bradford and Lyman (2018, 2019) are considered separate individuals. There may be cases where a given individual is associated with more than one injury report, which would lead to a positive bias in the resulting minimum M&SI estimates. However, any positive bias is unlikely to exceed the level of undocumented M&SI from vessel collisions and fishing gear entanglement.

The follow-up injury determination for the bottlenose dolphin calf with a gunshot wound to the head (Table 3) would have been serious without the follow-up sightings that revealed healing of the wound and survival of the calf (Harnish et al. 2019). This case demonstrates the value of follow-up information in determining the outcome of a human-caused injury. Known outcomes are particularly valuable in defining what constitutes a serious injury, but these data are substantially more limited for small cetaceans as compared to large whales (NMFS 2012). Cascadia Research Collective (CRC) previously provided a report of a rough-toothed dolphin (*Steno bredanensis*) off Kauai in 2015 with line tightly wrapped around its pectoral flipper, which was determined to be seriously injured (Bradford and Lyman 2018). After a recent update of their photo-identification catalogs, CRC provided follow-up information on this rough-toothed dolphin, as well as new reports and follow-up information for 2 additional cetacean individuals that were injured in previous years. Two sightings of the rough-toothed dolphin in August 2018 indicate that the individual survived the entanglement injury, which can now be considered non-serious for the purposes of the 2020 (and 2021) SAR. The other two reports are outside of the M&SI period for the 2020 SAR but offer valuable known outcome data for future reference. A bottlenose dolphin from the Hawaii Island stock was encountered on 12/09/09 with line tightly wrapped around its pectoral flipper, a serious injury according to category S8a (NMFS 2012). Although this individual was sighted 5 more times, the last sighting was on 8/17/10. The CRC bottlenose dolphin catalog is current through 2017, so the lack of follow-up sightings of this individual supports the serious injury determination. A short-finned pilot whale (*Globicephala macrorhynchus*) was encountered off Hawaii Island on 10/30/11 with line trailing from its mouth, a serious injury according to categories S2 or S5a and S6 (NMFS 2012). This individual was sighted 23 more times, with the last sighting on 11/29/15. The CRC short-finned pilot whale catalog is current through 2015, so the demonstrated survival of the individual indicates the injury was non-serious.

Of the 11 humpback whale entanglements, gear type was identified for 5 (45.5%), involving higher-latitude gill net (n = 1; the first known observation of a humpback whale carrying an active gill net set from higher latitudes to Hawaii) and British Columbia pot gear (n = 4) (Table 2). Of the entanglement cases with unknown gear types, one is considered to have involved marine debris (not from an active set) that was once possibly mooring gear. None of the 5

[4] https://happywhale.com/home

entanglements with known gear types were further linked to specific commercial fisheries. Although a substantial effort was made to review the photographed and collected gear, staff resources did not allow a complete review in all cases. The best assessment of available gear and photographs suggests additional effort in identifying the fishery associated with the 4 pot gear entanglements is warranted, but there is limited possibility of further classification from additional review effort for any of the other humpback whale entanglement cases. Of the 3 spinner dolphin entanglements, gear type was identified for 1 (33.3%), involving the entrance tunnel of an eel or hagfish trap (Table 3).

Part of the process of reviewing the PIR-MMRN database for reports of cetaceans injured by human causes involved following up on stranding records where there was noted or suggested evidence of human-caused injury. This follow-up can require obtaining information from necropsy reports prepared by the marine mammal stranding program led by K. West (University of Hawaii at Manoa). If the injury was determined to be the cause of death, the associated record would be added to the subset of injury reports of relevance to the human-caused M&SI estimates and summarized herein. If the injury could not be confirmed or was determined not to be the cause of death, the associated record would be excluded from the subset of injury reports compiled for the present paper. During 2018, there were no PIR-MMRN stranding records with evidence of human-caused injuries.

Cetaceans in Hawaiian waters, particularly humpback whales, are subject to human-caused injuries from a variety of sources, which should continue to be accounted for in the SARs. For cetacean species other than humpback whales, significantly more effort and resources are needed to report, document, and monitor individuals with anthropogenic injuries. PIR-MMRN and HIERN have been expanding their efforts in this regard, primarily by communicating to various partners and stakeholders and highlighting the value of reporting injured cetaceans. Continued progress in soliciting and documenting such injuries will inform and improve the assessment and management of the affected cetacean stocks.

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Table 1. Injury determinations for humpback whales reported to be involved in vessel collisions in Hawaiian waters during 2018, using the most recent established criteria for distinguishing serious from non-serious injury of large whales (Table 1 in NMFS 2012).

Report date	Age class	Vessel length (ft)	Vessel speed (kn)	Event summary	Observed injury	Injury categories	Injury determination	Value for PBR
01/06/18	Calf	?	?	Whale discovered with injuries consistent with vessel strike (date and location of strike unknown).	Propeller and skeg lacerations (superficial) on back and peduncle	L5b, L12	Serious	1
02/22/18	Calf	?	?	Whale discovered with injuries consistent with vessel strike (date and location of strike unknown).	Propeller lacerations (severity unknown) on right flank	L11, L12	Serious	1
03/09/18	Calf	?	?	Whale discovered with injuries consistent with vessel strike (date and location of strike unknown).	Propeller lacerations (superficial) across back	L5b, L12	Serious	1
12/26/18	Calf	?	?	Whale discovered with injuries consistent with vessel strike (date and location of strike unknown).	Propeller laceration (superficial) on dorsal fin	L5b, L12	Serious	1

Table 2. Injury determinations for humpback whales reported to be entangled in presumed fishing gear or marine debris in Hawaiian waters during 2018, using the most recent established criteria for distinguishing serious from non-serious injury of large whales (Table 1 in NMFS 2012). The "initial" injury determination is associated with the condition of the whale prior to any follow-up and mitigation efforts and may be used for List of Fisheries (LOF) fisheries classifications. The condition of the whale following a change in entanglement status, whether by mitigation or self-release, is reflected in the "follow-up" injury determination, which is used for Potential Biological Removal (PBR) comparison. Note that in cases where there were no follow-up or mitigation efforts, the initial and follow-up determinations are the same. An injury determination of serious followed by an asterisk indicates that the basis of the determination was the significant health decline caused by the injury (NMFS 2012). Table continues on following page.

Report date	Age class	Event summary	Initial injury categories	Initial injury determination	Value for LOF	Response outcome	Follow-up injury categories	Follow-up injury determination	Value for PBR	Gear type	Fishery	Fishery review details
01/04/18	Adult	Line wrapped five times tightly around caudal peduncle with deep wounds from line at fluke insertion.	L2, L5a	Serious	1	Response mounted, but whale not tagged or disentangled.	L2, L5a	Serious	1	Higher latitude gill net	Unknown	Photographed gear reviewed by a level 5 responder. First observation of humpback carrying active gill net set from higher latitude to Hawaii. Little identifying information on gear to identify fishery. Limited possibility of further classification from additional review effort.
01/11/18	Adult	Line went through the mouth forming a loose bridle with a twist below body. Line trailed from twist 75 ft on one side and at least 200ft on the other ending in three buoys.	L3	Non-serious	0	Fully disentangled.	n/a	Non-serious	0	BC pot gear	Unknown	Recovered gear reviewed by a level 5 responder. Identifying features on buoys may be enough to determine fishery with additional review effort.
01/19/18	Subadult	Two buoys attached, one on each side of body. Lack of constricting gear not confirmed.	L10	Prorate 0.75 Serious	0.75	Response mounted, but whale not re-located.	L10	Prorate 0.75 Serious	0.75	Unknown	Unknown	Video showing gear reviewed by a level 5 responder. Little identifying information on gear to identify gear type or fishery. Limited possibility of further classification from additional review effort.
01/21/18	Adult	Line wrapped or draped over back, likely originating from the mouth or right pectoral flipper, with superficial line scars on sides of dorsal fin suggesting entanglement was previously more involved. Lack of constricting gear not confirmed.	L10, L5b	Prorate 0.75 Serious	0.75	Response mounted, but whale not re-located.	L10, L5b	Prorate 0.75 Serious	0.75	Unknown	Unknown	No gear recovered and gear not documented enough for a review of gear type and fishery.
01/27/18	Adult	Line draped around pectoral flipper, forming a loose bridle that meets at a pair of buoys at the peduncle, with one line trailing 10–15 ft to another pair of buoys, and the other line trailing 80 ft. Whale was moderately emaciated with small cyamid patches and light skin and was considered to be in significant health decline.	L3	Serious*	0	Partially disentangled; loose wrap remains and whale still showed signs of significant health decline.	L3	Serious*	0	BC pot gear	Unknown	Photographed gear reviewed by a level 5 responder. Identifying features on buoys may be enough to determine fishery with additional review effort.

Report date	Age class	Event summary	Initial injury categories	Initial injury determination	Value for LOF	Response outcome	Follow-up injury categories	Follow-up injury determination	Value for PBR	Gear type	Fishery	Fishery review details
02/04/18	Subadult	Line wrapped multiple times around body and peduncle, with mouth involved and buoys at the peduncle, before trailing 80 ft behind. Deep wounds from line at fluke insertion, with less deep wound from line on pectoral flipper. Whale was moderately emaciated with cyamid carpets and light and rough skin and was considered to be in significant health decline.	L2, L5a	Serious*	1	Partially disentangled, with over 80-ft line removed. Constricting wrap and deep wounds remain and whale still showed signs of significant health decline.	L2, L5a	Serious*	1	BC pot gear	Unknown	Recovered gear reviewed by a level 5 responder. Identifying features on buoys may be enough to determine fishery with additional review effort.
02/05/18	Subadult	Netting and line entangling rostrum and back. Lack of constricting gear not confirmed.	L10	Prorate 0.75 Serious	0.75	Response mounted, but whale self-released from gear.	n/a	Non-serious	0	Unknown	Unknown	Recovered gear reviewed by a level 5 responder. Little identifying information on gear to identify gear type or fishery, although possibly mooring gear. Gear likely marine debris and not from an active set. Limited possibility of further classification from additional review effort.
02/13/18	Adult	Line wrapped through mouth, draped or wrapped around pectoral flipper, and twice around caudal peduncle, with superficial insertion and chafe wounds suggesting entanglement was previously more involved. Lack of constricting gear not confirmed.	L10, L5b	Prorate 0.75 Serious	0.75	Response mounted, but whale not tagged or disentangled.	L10, L5b	Prorate 0.75 Serious	0.75	Unknown	Unknown	Photographed gear reviewed by a level 5 responder. Little identifying information on gear to identify gear type or fishery. Limited possibility of further classification from additional review effort.
03/15/18	Subadult	Line wrapped tightly around pectoral flipper, possibly involving mouth, with buoys attached and line trailing along flank. Deep wounds from line close to flipper insertion, with less deep wound from line on caudal peduncle. Whale was significantly emaciated with cyamid carpets and light skin and was considered to be in significant health decline.	L2, L5a	Serious*	1	Response mounted and whale tagged, but whale not disentangled (except removal of tagging gear).	L2, L5a	Serious*	1	BC pot gear	Unknown	Photographed gear reviewed by a level 5 responder. Identifying features on buoys may be enough to determine fishery with additional review effort.
04/05/18	Adult	Line with buoy trailed behind whale from unknown location on body. Lack of constricting gear not confirmed.	L10	Prorate 0.75 Serious	0.75	No response	L10	Prorate 0.75 Serious	0.75	Unknown	Unknown	Video showing gear reviewed by a level 5 responder. Little identifying information on gear to identify gear type or fishery. Limited possibility of further classification from additional review effort.
05/20/18	Subadult	Line wrapped loosely around fluke blades and tightly around caudal peduncle, likely to become embedded as the whale grows. Line trails 3 ft to a pair of buoys, and superficial notch and chafe wounds on leading edge of fluke.	L2, L5b	Serious	1	Response mounted and whale tagged, but tag stopped transmitting and whale not disentangled.	L2, L5b	Serious	1	Unknown	Unknown	Photographed gear reviewed by a level 5 responder. Little identifying information on gear to identify gear type or fishery. Limited possibility of further classification from additional review effort.

Table 3. Injury determinations for cetaceans other than humpback whales reported to be injured in Hawaiian waters during 2018, using the most recent established criteria for distinguishing serious from non-serious injury of cetaceans (Tables 1–2 in NMFS 2012). The "initial" injury determination is associated with the condition of the whale or dolphin prior to any follow-up and mitigation efforts. For presumed fishery-related injuries, the initial determination is used for List of Fisheries (LOF) classification. The final known condition of the individual, regardless of injury type, follow-up, or mitigation, is reflected in the "follow-up" injury determination, which is used for Potential Biological Removal (PBR) comparison.

Report date	Species	Stock	Age class	Event summary	Initial injury categories	Initial injury determination	Value for LOF	Response outcome	Follow-up injury categories	Follow-up injury determination	Value for PBR	Gear type and fishery summary
07/14/18	Bottlenose dolphin	Oahu	Calf	Dolphin observed with a gunshot wound to the head.	S9	Serious	n/a	No response, but 10 follow-up sightings spanning a year since wound first photographed on 06/30/18 indicates wound healing and survival of dolphin (Harnish et al. 2019).	S9	Non-serious	0	n/a
10/25/18	Spinner dolphin	Hawaii Island	Unknown	Dolphin observed with eel or hagfish trap on rostrum.	S8a	Serious	1	No response, but dolphin self-released from gear during observation.	n/a	Non-serious	0	Gear photographed and identified as the entrance tunnel of an eel or hagfish trap.
11/08/18	Spinner dolphin	Hawaii Island	Unknown	Dolphin observed with multiple tight wraps of line around caudal peduncle, with embedded lines forming wounds and line training behind dolphin.	S8a	Serious	1	No response	S8a	Serious	1	Gear not recovered or photographed.
12/06/18	Spinner dolphin	Hawaii Island	Adult	Dolphin observed with multiple tight wraps of line around caudal peduncle, with lead weights attached to the gear.	S8a	Serious	1	No response	S8a	Serious	1	Gear not recovered or photographed.

Table 4. Summary of humpback whale vessel collisions and entanglements in Hawaiian waters during 2018 that resulted in different preliminary and reviewer injury determinations. The final injury determinations resulting from follow-up discussions are shown along with a rationale for the determination. The injury determination "categories" are based on the most recent established criteria for distinguishing serious from non-serious injury of large whales (Table 1 in NMFS 2012). The injury determination "values" refer to the number of serious injuries relevant to either List of Fisheries classification or Potential Biological Removal comparison. For entanglements, "|" is used to separate the initial and follow-up injury determination categories and values.

Report date	Injury type	Preliminary injury determination		Reviewer injury determination		Final injury determination		Final determination rationale
		Categories	Value	Categories	Value	Categories	Value	
02/05/18	Entanglement	L3 | n/a	0 | 0	L10 | n/a	0.75 | 0	L10 | n/a	0.75 | 0	Agreed with reviewer that there was not sufficient supporting evidence to use L3 for the initial determination.
05/20/18	Entanglement	L3, L5b | L3, L5b	0 | 0	L2 | L2	1 | 1	L2, L5b | L2, L5b	1 | 1	Agreed with reviewer that there was sufficient supporting evidence to use L2 for the initial and follow-up determinations.

Appendix

Additional interpretation or consideration required in the application of some of the injury categories (NMFS 2012) to large whales injured in Hawaiian waters during 2018. L = large whale category (Table 1 in NMFS 2012).

Injury categories[1]	Application of categories
L2, L3, L10	1) Although not the practice of all members of the NMFS Determination Staff Working Group, particularly members assessing injured whales on their feeding grounds, an entangled humpback whale that showed signs of a significant health decline was still considered to be seriously injured after partial or full disentanglement. The rationale for the serious determination in such cases is that the whales are on their breeding grounds and still have to migrate in order to improve their nutritive condition. 2) When follow-up observations indicated that a whale had self-released from entangling gear, the observed entanglement was still reflected in the initial injury determination that may be used for List of Fisheries classification. This approach is different than that used for marine mammals released from gear by fishermen in real-time (i.e., when the injury determination is made after the fisherman releases the animal from the gear; NMFS 2012). However, in the present context, an initial injury determination is needed to account for the unknown duration of the entanglement and the resulting impact to the whale.
L5a, L5b	Although not the practice of all members of the NMFS Determination Staff Working Group, these categories were applied whenever lacerations were reported, even for fishery-related injuries. This use accounted for one or more injuries resulting from an entanglement in the event that the whale was disentangled. That is, if an entanglement caused a deep laceration, that laceration would remain, even if all gear was removed from the whale.
L8	Along with other members of the NMFS Determination Staff Working group, a dependent calf of a mother with an injury of prorated severity was assigned the same prorated injury determination as the mother.
L12	Although not the practice of all members of the NMFS Determination Staff Working Group, this category was applied along with L5a, L5b, or L11 when a whale was observed with clear vessel collision injuries, even if the actual collision was not reported. The rationale for this use is that it prevents a bias in the injury determination process for calves. That is, if a calf was reported struck by a vessel of any size and unknown speed, even with no resulting visible injuries, it would be considered seriously injured because "a strike to a calf by a vessel of any size when speed is unknown will be considered a serious injury" (NMFS 2012). However, a calf with superficial injuries clearly indicating a vessel collision (L5a) would be considered non-seriously injured if the collision itself was not reported. To avoid this determination bias from unreported collisions, L12 was used when observed injuries were sufficient confirmation that a collision had occurred.

[1]Description of injury categories (from Table 1 in NMFS 2012): L2 – constricting wrap; L3 – loose wrap, bridled or draped gear; L5a – deep laceration; L5b – superficial laceration; L8 – dependent calf of a dead or seriously injured mother; L10 – evidence of entanglement; and L12 – vessel strike observed.