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Protected Resources Policy Directive
Process for Distinguishing Serious from Non-Serious Injury 02-238

Guidelines for Distinguishing Serious from Non-Serious Injury of Marine Mammals Pursuant to the Marine Mammal Protection Act

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SUMMARY OF REVISIONS:

The National Marine Fisheries Service's (NMFS) Office of Protected Resources (OPR) initiated a review of the NMFS Serious Injury Determination Policy: *Process for Distinguishing Serious from Non-Serious Injury of Marine Mammals* (NMFS-PD 02-238-01) in 2017. The review determined that, in general, the Procedural Directive is working well in meeting its objectives of providing a consistent, transparent, and systematic process for assessing serious from non-serious injuries of marine mammals. However, there was enough substantive feedback to warrant revising the Procedural Directive.

Overall, minor revisions and updated guidance were incorporated into NMFS-PD 02-238-01, including those that improve readability and clarity. Some edits were also made to clarify the determination process and reporting procedures as well as taxa-specific revisions. Revisions focused on the pinniped and small cetacean sections (Sections VIII and IX respectively), and included the creation of a new case specific harassment category (P16) for pinnipeds and two subcategories (S15a and S15b) for small cetaceans.

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I. Introduction

The Marine Mammal Protection Act (MMPA) directs NMFS to estimate the annual levels of human-caused mortality and serious injury (M/SI) to stocks (Section 117) and to classify commercial fisheries based on their level of incidental M/SI of marine mammals (Section 118). Based on the results of a 2007 workshop (Serious Injury Technical Workshop), NMFS issued a Policy Directive (02-238) and a Procedural Directive (02-238-01) in 2012 that established a consistent and transparent process for NMFS to distinguish serious from non-serious injuries of marine mammals, to apply serious injury criteria to injury cases, and to document injury determinations.

The Policy Directive directs NMFS to review both the Policy and Procedural Directives every five years, or when new information becomes available, to determine whether any revisions to the Directives are warranted.

II. Objective

NMFS issued a Policy Directive (02-238) and a Procedural Directive (02-238-01) in 2012 that established a consistent and transparent process for NMFS to distinguish serious from non-serious injuries of marine mammals, to apply serious injury criteria to injury cases, and to document injury determinations.

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Guidelines for Distinguishing Serious from Non-Serious Injury of Marine Mammals Pursuant to the Marine Mammal Protection Act

I. Introduction

The Marine Mammal Protection Act (MMPA) requires the National Marine Fisheries Service (NMFS) to estimate annual levels of human-caused mortality and serious injury to marine mammal stocks (section 117) and to categorize commercial fisheries based on their level of incidental mortality and serious injury of marine mammals (section 118). Based on results of a 1997 workshop discussing the impacts of injuries of marine mammals incidental to commercial fishing operations (Angliss and DeMaster, 1998) and specific regional experience with injury events, NMFS Science Center and Regional Office staff developed regional techniques for assessing and quantifying the serious injuries of marine mammals. Although these regional techniques helped to accomplish the MMPA's mandates, NMFS needed a nationally consistent and transparent process for effective conservation of marine mammal stocks and management of human activities impacting these stocks.

Accordingly, NMFS convened a workshop in 2007 to review performance under existing guidance, gather current scientific information, and update guidance based on the best scientific information available (Andersen *et al.*, 2008). Based on results of the 2007 Serious Injury Technical Workshop, NMFS Headquarters, Regional Office, and Science Center subject matter specialists developed recommendations for national guidance. These recommendations and results from new analysis of existing NMFS data are incorporated into this Procedural Directive. This document serves as the basis for analyzing injury incidents (e.g., opportunistic, commercial fishery-related mortality/injury self-reports, observer programs, and stranding and entanglement response programs) of marine mammals and incorporating the results into Stock Assessment Reports (SARs) and marine mammal conservation management regimes (e.g., MMPA List of Fisheries [LOF], Take Reduction Teams [TRTs], Take Reduction Plans [TRPs], and vessel speed regulations).

This Procedural Directive: (1) provides the process and criteria for distinguishing human-caused serious from non-serious injuries of marine mammals; (2) provides a uniform framework for the consistent application of these criteria as it relates to sections 117 and 118 of the MMPA across NMFS; and (3) ensures NMFS' approach for distinguishing serious from non-serious injuries of marine mammals is clear and transparent to the public. This Procedural Directive is organized by the following sections:

- Section II describes the basis for the criteria to distinguish between serious and non-serious injuries;
- Section III outlines NMFS' injury determination review process to ensure consistency across regions and the application of the best scientific information available;
- Section IV outlines the process for assessing and documenting the injury status of marine mammals after successful post-interaction mitigation efforts;
- Section V describes the process for accounting for cases where the severity of an injury cannot be determined (CBD);

- Section VI describes the process for assigning injury severity when estimating injuries from fishery observer data; and
- Sections VII-IX outline NMFS' criteria for distinguishing serious from non-serious injuries of marine mammals by taxonomic group: large cetaceans (all mysticetes and sperm whales, section VII), small cetaceans (all odontocetes except sperm whales, section VIII), and pinnipeds (all except walrus, section IX). Criteria for distinguishing serious from non-serious injuries of sirenians, polar bears, walrus, and sea otters, which are managed by the U.S. Fish and Wildlife Service, are not included in this Procedural Directive.

Every five years or when new information becomes available, NMFS will review this Procedural Directive based upon the best scientific information available, input from the MMPA Scientific Review Groups (SRG), as appropriate, and experience gained in implementing the process and criteria. If the review indicates significant revisions to the Directive are warranted, NMFS will consider making the revisions available for public review and comment prior to acceptance. Accordingly, in 2017, NMFS initiated a review of this Procedural Directive and invited subject matter experts from within NMFS to identify any necessary revisions based upon the best scientific information available, SRG input, and experience from implementing the Directive. NMFS determined revisions to the Procedural Directive were warranted.

During the revision process, pinniped and small cetacean injury categories and criteria were refined and clarified. For large whales, NMFS is currently developing a statistical approach for injury determination using a more recent and larger dataset that builds on NMFS' implementation of this Procedural Directive since its inception. Once the new methodology is finalized, this Directive will be reviewed to determine whether revisions are warranted. Therefore, during this revision process, only minor clarifying changes were made to section VII (Serious Injury Determination Process for Large Cetaceans) to maintain consistency across the time period until the new method is considered.

II. Basis for the Serious Injury Criteria

This section describes the basis for the criteria to distinguish between serious and non-serious injuries for each taxonomic group of marine mammals. The intent of the procedures described in this document is to correctly and consistently categorize a documented injury or injury event as a serious or a non-serious injury. These methods are not meant to estimate the actual level of impact to a population. NMFS' interpretation of the serious injury definition (an injury that is *more likely than not* to result in mortality, as described in NMFS PD 02-238: Process for Distinguishing Serious from Non-Serious Injury of Marine Mammals) coupled with the approach described in this Procedural Directive is expected to allow NMFS to evaluate the majority of documented injury events, providing a more accurate estimation of total annual human-caused serious injury and mortality to marine mammals. NMFS recognizes the results still underestimate serious injury and mortality due to the likelihood of undetected and unreported events (see Guidelines for Assessing Marine Mammal Stocks, GAMMS, NMFS 2023).

The procedures provide guidance for all injury events with the exception of noise-related injuries

because NMFS scientists making injury determinations are unlikely to detect noise-related injuries in live animals and the state of science on identifying noise-related injuries in live marine mammals is still developing. The procedures provide guidance for cases that are data poor, data rich, or require consideration of additional contributing factors. For "data poor" cases, in which information on the nature of the injury is available but follow-up on the condition of the injured animal to confirm its death or survival is not possible, the criteria in sections VII-IX provide the most complete guidance on determining injury status. Therefore, the criteria in sections VII-IX should be applied when assessing the information received in reports of injury events that lack detailed information regarding the injury and/or the final injury outcome, referencing section V as needed in cases where the outcome cannot be determined. For "data rich" cases in which additional detailed information regarding the injury is available and/or the condition of the injured animal is known or can be tracked over time, the available case-specific data can be used in lieu of, or in addition to, the criteria laid out in sections VII-IX to make the injury determination. In such cases, the final injury determinations may differ from those described in sections VII-IX.

The data that NMFS receives regarding marine mammal injury events vary greatly by region, source (e.g., opportunistic, commercial fishery-related mortality/injury self-reports, observer programs, and stranding and entanglement response programs), and quality. NMFS developed the process and criteria presented in this document to account for the range of data quantity and quality when assessing injury reports and to take into account the best scientific information available for each injury case. For many small cetaceans and pinnipeds, fisheries observer programs provide the majority of injury data used in the stock assessments. Observers are trained how to document marine mammal interactions with fishing operations, providing a standard injury dataset. Large cetaceans, however, are rarely entangled during observed fishing operations. Most reports of injuries to large whales are anecdotal, may be made by untrained persons, and may lack adequate documentation to assess the severity of an injury. However, individual identification in some large whale species has provided additional documentation of an individual whale's injuries through time and, in many cases, a final injury outcome (i.e., death or survival). These "longitudinal" injury data provide a dataset to make injury determinations for injuries with similar characteristics. Such longitudinal data are often not available for observed fisheries interactions because injured animals are released and rarely resighted. Necropsies and monitoring of haul out sites or coastal dolphin populations provided the basis for determinations for some pinniped and small cetacean injury categories, but many fishery interaction injury prognoses were based on expert opinion from the 2007 Serious Injury Technical Workshop (Andersen *et al*. 2008).

Because of these differences in source and nature of injury data, criteria for serious injury determinations were developed separately for large cetaceans, small cetaceans, and pinnipeds. In addition, the types and impacts of injuries differ among these broad taxonomic groups. For example, a fishing hook embedded in the head of a baleen whale is most likely not lethal; however, such an injury is likely to have a much more significant impact to a dolphin or sea lion.

The injury determinations for large whales in section VII are largely based on an analysis of data on injury events with known outcomes, with the exception of a few criteria that are based on expert opinion from the 2007 Serious Injury Technical Workshop (Andersen *et al.,* 2008).

Specifically, the results of an analysis of known outcomes of national large whale injury events from 2004-2008 were used in binomial tests to estimate the likelihood of the observed rate of mortality being higher or lower than 50%. The results of the binomial tests measured the reliability of categories' observed ratios of deaths to events (see section VII for additional details on the binomial test and prorating techniques).

In contrast to section VII, the injury criteria and determinations for small cetaceans and pinnipeds in sections VIII and IX are based almost entirely on expert opinion from the 2007 Serious Injury Technical Workshop (Andersen *et al.,* 2008) because data on documented injuries and outcomes (i.e., survival or death of the animal) in the wild are not available for most small cetaceans and pinnipeds. NMFS included additional considerations using the best scientific information available from NMFS internal discussions and analysis and, in some cases, consulted with external experts.

Sections VII-IX each include a table with injury determinations for different injury categories and relevant additional criteria. For many of the same reasons listed above, Table 1 (included in section VII) is presented in a slightly different format than Tables 2 and 3 (included in sections VIII and IX, respectively). The injury categories for Table 1 are broader in scope than those presented in Tables 2 and 3. This is largely because Table 1 was developed using the available existing data on documented injury events and outcomes; therefore, similar injury types were combined into more general categories based on the information provided in the data (see section VII for additional details). By contrast, the categories listed in Tables 2 and 3 are more specific and correspond to the types of information generally recorded in all reports of injuries to small cetaceans and pinnipeds. This approach was determined to be more useful to NMFS Science Center staff responsible for distinguishing serious from non-serious injuries of small cetaceans and pinnipeds because resightings of injured animals and data on the survival or death of injured animals are generally not available (see sections VIII and IX for additional details).

Tables 1-3 each include a column with additional details and factors to consider when assigning injuries to a specific category and, therefore, when making an injury determination. In Table 1, this column provides detailed criteria for each injury category, based on the available data on large whale injury outcomes. Additional factors potentially justifying a deviation from the injury outcome follow Table 1. Small cetacean and pinniped data on injury outcomes are largely lacking and thus, injury determinations are primarily based on expert opinion. This resulted in a number of categories that have 'case-specific' injury determinations, indicating that additional factors must be evaluated before the injury can be assigned as a serious or non-serious injury. In Tables 2 and 3, the last column provides the additional factors relevant to a case specific injury determination for each injury category. Additionally, following Tables 2 and 3 is an expansive list of factors that should be considered for all case specific events, regardless of the type of injury. Specific criteria for each injury category are also included in the description paragraphs immediately preceding each table.

III. Annual Injury Determination Process

Marine mammal injury event data vary greatly by region, source (e.g., opportunistic, commercial

fishery-related mortality/injury self-reports, observer programs, and stranding and entanglement response programs), and quality. Given the need for accurate and timely data to complete annual injury determinations, NMFS Science Center staff responsible for making injury determinations should communicate with the point of contact for each data source, if applicable, well in advance of the determination process regarding the timeliness, format, and quality of the data (e.g., level of confirmation/confidence in the reports) required for determinations. For further information regarding the data required for making such determinations, as well as sources of best scientific information available, refer to GAMMS sections 3.3, 3.6, and 3.7 (NMFS 2023).

The general annual process for making and documenting injury determinations is as follows:

Step 1- Initial injury determination: Annually, NMFS Science Center staff will compile all available information on injury events and make serious, non-serious, or - if needed - CBD determinations for each reported injury event (see also NMFS 2023: GAMMS section 3.3). For the majority of cases, the Science Center staff will first apply the criteria presented in sections VII-IX, which are meant to provide guidance in situations where data are available on the injury but follow-up on the condition of the injured animal to confirm its death or survival is not possible. However, for cases that are data rich (i.e., sufficient detail on the injury is available and/or the condition of the injured animal can be tracked over time), those data can be used in lieu of, or in addition to, the criteria laid out in sections VII-IX.

Step 2- Determination Staff Working Group information exchange: Science Center staff responsible for annually distinguishing serious from non-serious injuries circulate the injury determinations and a summary of the information on which the determinations were based to the NMFS Determination Staff Working Group[1] or an appropriate subset of this working group familiar with the species and/or cause of injury (e.g., fishing gear, vessel strikes) involved (i.e., cross-center review). Determination Staff Working Group members may consider the preliminary injury determinations and provide input for those species or fishing gear types with which they are most familiar, as appropriate. Science Center staff responsible for injury determinations may consider comments from other Determination Staff Working Group members and/or continue discussions on individual determinations, as needed. NMFS Science Center staff responsible for injury determinations may consult with external experts (including those with expertise in marine mammal anatomy, biology, physiology, health and stranding response), as appropriate, to help distinguish serious from non-serious injuries. Any disagreements that could not be resolved should be documented in the annual injury determination report. For unique cases or injuries, an *ad hoc* working group may be convened.

Step 3- Regional Office review: An overview of the preliminary injury determinations is provided to the Regional Office for review and input. This review may take place during cross-center review concurrent with Step 2 or as part of Steps 4 or 5 below.

Step 4- Report Preparation: The Science Center staff responsible for distinguishing serious from non-serious injuries complete a written report documenting the annual injury determinations for

[1] The "NMFS Determination Staff Working Group" is composed of NMFS staff in each Science Center responsible for distinguishing serious from non-serious injuries of marine mammals. The membership of this group is considered unofficial and/or fluid, depending on staffing and duty changes in each Science Center.

that region. While the format of these written reports may vary depending on the needs and clearance processes of each Science Center, each report will include: (1) a summary of the information on which each injury determination is based; (2) the criteria from sections VII-IX on which each injury determination is based (including CBD cases, section V); and (3) justification for any departure from the criteria in sections VII-IX (e.g., by citing a peer-reviewed document, such as NMFS Technical Memoranda or scientific publications, where additional information is available on a specific case to justify departure from the criteria in sections VII-IX).

Step 5- Scientific Review Group review: An overview of the preliminary injury determinations (similar to the information provided to the Regional Offices in Step 3) and/or a draft of the report prepared in Step 4 is provided to the regional Scientific Review Groups for peer review and input.

Step 6- Report Clearance: The injury determination reports should go through Science Center internal review, clearance procedures, and publication process to meet quality assurance and quality control requirements (NAO 202-735D.2: Procedural Handbook: Scientific Integrity).

Step 7- Inclusion of Injury Determinations in the annual SARs and marine mammal conservation management regimes: As is the current practice, a summary of all serious injury and mortality will also be presented in the SARs (citing the Science Centers' injury determination reports) and used for the purposes of marine mammal conservation management regimes (e.g., LOF, TRTs, TRPs, and vessel speed regulations).

IV. **Assessing and Documenting the Injury Status of Marine Mammals after Post-Interaction Mitigation Efforts and Self-Releases**

Marine mammals that become entangled in or hooked by fishing gear or marine debris are sometimes released or break free from the gear but remain hooked or entangled in a portion of the gear. In some instances, those entangled or hooked animals are sighted at a later date or time, and NOAA undertakes mitigation efforts to disentangle or dehook the animal (e.g., via the Marine Mammal Health and Stranding Response Program). This section establishes NMFS' process for assessing and documenting cases where an animal is disentangled or dehooked at some time after an interaction with fishing gear (i.e., post-interaction mitigation). This section also applies to cases of known or apparent self-release, in which an animal previously sighted with gear is later sighted gear-free or with a change in the configuration of the entanglement. This section does not apply to situations where commercial fishermen release animals from gear in real-time (i.e., at the time of the interaction). Rather, it specifically addresses cases where NOAA, NMFS, authorized stranding and entanglement response network partners, or unauthorized individuals work to disentangle or dehook an animal post-interaction (i.e., at some time after the initial interaction) or the animal is believed to have released itself from gear post-interaction. Cases where fishermen release the animal in real-time (i.e., at the time of the interaction) will be considered in the same manner they have been in the past (i.e., the injury determination is made after the fishermen releases the animal from the gear and that single determination is reflected in both the LOF and SARs).

Prior to the NMFS 2007 Serious Injury Technical Workshop, if NMFS determined an entangled or hooked marine mammal was seriously injured from the entanglement or hooking event but was later successfully released from the gear and determined to have no or non-serious injuries once the gear was removed, the interaction was not included as a serious injury in the SAR, fishery classifications on the LOF, or other management regimes because the animal was not removed from the population or likely to die. However, this approach did not accurately reflect the rate of entanglement and potential serious injury inflicted by a fishery. It may have also led to an underestimation of total serious injury and mortality of marine mammals because it relies on opportunistic detection and post-interaction intervention to mitigate injury effects. Following the 2007 Serious Injury Technical Workshop, NMFS revisited whether marine mammals successfully disentangled or dehooked at some date or time after the interaction occurred should be considered when classifying fisheries on the LOF and informing management (e.g., take reduction planning). The following paragraphs establish NMFS' current process for assessing and documenting these cases.

If an animal requires post-interaction mitigation to be released from fishing gear or marine debris, a determination of the severity of the injury will be made by applying the criteria in sections VII-IX, in the field or as part of a rehabilitation effort, before the animal is disentangled or dehooked.

- For cases where the animal is determined to be seriously injured and (a) is successfully disentangled or dehooked and the animal is determined to have no or non-serious injuries when released or (b) the animal is later seen with no or non-serious injuries and is presumed to have self-released, it will be recorded as a serious injury when classifying fisheries on the LOF and informing management (e.g., take reduction planning) but will be recorded as a non-serious injury when compared to PBR in the SARs. In this way, the fisheries classifications on the LOF will reflect a more accurate level of serious injury and mortality of marine mammals that is occurring incidental to commercial fishing operations. Further, recording the animal as a non-serious injury when assessing the status of stocks in the SARs will reflect the fact that the animal likely survived its injuries post-intervention and was not removed from the population.
- For cases where the animal is determined to be seriously injured and (a) is successfully disentangled or dehooked and the animal is determined to still have serious injuries when released or (b) the animal is later seen and presumed to have self-released but is determined to still have serious injuries, the animal will be recorded as a serious injury when classifying fisheries on the LOF, informing management (e.g., take reduction planning), and when comparing to PBR in the SARs.
- For an animal determined to be seriously injured and is disentangled or dehooked, but the animal's injuries require treatment in a rehabilitation center and despite successful treatment (i.e., it can survive in human care) is deemed not able to be released back into the wild, the animal will remain recorded as a serious injury when classifying fisheries on the LOF, informing management (e.g., take reduction planning), and when comparing to PBR in the SARs. The animal is accounted for in this manner because it is removed from the wild population as a result of its injuries and is no longer a functioning part of the wild population.
- For cases where the outcome of a disentanglement or dehooking attempt is unknown (i.e., disentanglement or dehooking is attempted but it is unknown whether the attempt

successfully removed all gear and/or whether the animal had serious injuries when released), the animal will be recorded as having the same injury determination post-mitigation (for comparing to PBR in the SARs) as it had pre-mitigation (for classifying fisheries on the LOF) unless there is historical information that provides a valid basis for prorating (see section VI for an example of the use of historical information to prorate cases where the injury determination cannot be determined).

- If a previously documented and assessed injured animal is re-sighted after an injury determination is published in the annual injury determination report and a SAR, and its condition has deviated from what was originally published (e.g., a large whale previously reported as having evidence of constricting wrap (L2) which is considered to be a serious injury, but has since been re-sighted gear-free and in good body condition with no serious injury), the animal's injury *category* (e.g., L2) will remain the same. However, a description of the animal's updated condition and the associated change in injury determination (e.g., Serious Injury (SI) to Non-Serious Injury (NSI)) will be published in subsequent reports and/or SARs. As above, in cases where an animal changes from a serious injury to a non-serious injury, the incident will be recorded as a serious injury when classifying fisheries on the LOF and informing management (e.g., take reduction planning) but will be recorded as a non-serious injury when compared to PBR in subsequent SARs.

Injury determination reports should denote the injury events with different pre- and post-mitigation (or pre- and post- self-release) injury determinations as NMFS will include all human-caused serious injuries in the SARs regardless of the outcome from subsequent mitigation efforts. Serious injuries from fishing gear are included in the SARs' fishery interaction tables. The injury determination reports should indicate which injuries were successfully mitigated (e.g., through disentanglement or rehabilitation efforts) or involved self-release and therefore, while considered serious injuries for the purposes of the LOF and management (e.g., take reduction planning), are not included in the comparison of estimated mortality and serious injury to the PBR when assessing the status of the affected stock.

V. Accounting for Cases where the Severity of an Injury Cannot Be Determined (CBD)

Injury datasets of both large and small marine mammals contain numerous events that lack sufficient detail to assess injury severity. Stranding or fishery observer reports may include insufficient information to make an injury determination. Fisheries observers often have only a brief opportunity to see a marine mammal hooked or entangled in fishing gear before it is released, and low light or high sea states may further compromise observer visibility. Entangled or vessel struck whale reports often contain only evidence that a line was on a whale or that a whale was hit. In some cases, the severity of an injury may depend on other, unknown additional factors such as the injured animal's age, reproductive status, or body condition. Furthermore, the current state of veterinary knowledge or clinical data about the impact of certain injuries might be insufficient to make a determination.

Prior to NMFS' 2007 Serious Injury Technical Workshop, the extent to which NMFS incorporated injury cases assigned as CBD into assessments of human impacts on the status of

marine mammal populations varied by Science Center. The exclusion of these CBD cases from existing tallies or estimates of human-caused serious injuries to marine mammals has resulted in only minimum values of serious injury and mortality. The distortion of the minimum values from the true rates has been compounded by the unknown number of dead and dying animals that were never detected and/or reported to NMFS and therefore, never included in analyses of human-caused serious injury and mortality of marine mammals (see NMFS 2023; GAMMS section 3.3.1 "Undetected Human-caused Mortality and Serious Injury"). Although CBD cases are likely to include some serious and non-serious injuries, the data are insufficient to resolve this on a case-by-case basis. If possible, NMFS staff should apply appropriate methods, based on the best scientific information available, to assign CBD cases as either serious or non-serious injuries for management and reporting purposes. Such methods can be based on fishery observer data, when available (see section VI for examples), or historical information from any data source that provides a valid basis for prorating (see below for examples). NMFS recognizes that CBD determinations will likely remain in some cases and there are different methods to analytically assign CBD based on the quantity and quality of available data, which currently differs among taxa.

A. Large Whale

Accounting for Large Cetacean Events where the Severity of an Injury Cannot Be Determined

For large whales, there are substantial longitudinal data with known outcomes (Appendix I), and the general injury categories (L10-L12) (see section VII) accommodate many events that lack the detail required for a clinical assessment of a given injury. This should reduce or eliminate the number of events for which the severity of an injury cannot be determined. Events that still cannot be assigned should be tallied by species (or to the highest taxonomic resolution possible), and these numbers should be included in the annual serious injury determination report.

B. Small Cetacean

Accounting for Small Cetacean Events where the Severity of an Injury Cannot Be Determined

For most small cetaceans, there have been limited opportunities to follow up on injury outcomes for specific individuals and injury types. Therefore, injury events that remain CBD following application of the criteria and evaluation of relevant additional factors should, when possible, be assigned the injury severity for the majority of comparable injuries for similar taxa and injury types. This approach is similar to the approach for large whales (section VII) except that the injury severity is assigned based on past serious injury determinations rather than known injury outcomes. This CBD assignment approach would apply only when appropriate fishery observer data are unavailable or insufficient to prorate CBD cases in a more quantitative manner, as described in section VI.

NMFS Science Center staff may estimate the proportions of serious versus non-serious determinations for a type of injury using any relevant and appropriate data (e.g., observer records for comparable fisheries, stranding and entanglement response programs, and Law Enforcement

and U.S. Coast Guard reports). Under this method, Science Center staff will assign all remaining CBD cases to be the same determination as for the majority of similar assignable cases. Evaluations should be done only for similar taxonomic groups (i.e., dolphins, beaked whales) and for the same injury type (e.g., laceration to head) or fishery characteristics (e.g., longline fisheries, small-mesh gillnet fisheries). For example, if 12 out of 20 (60%, the majority) of documented cases of dolphins with propeller lacerations to the head were determined to be serious, and 40% percent were non-serious, then all of the CBD cases for bottlenose dolphins observed with that type of injury would be designated as serious. In cases where data on assignable injury events are limited in one region or where sample sizes are small, data can be pooled across regions to provide a more robust sample set on which to base the severity assignment of a CBD injury event. Statistical evaluations, such as the binomial probability tests applied to large whale data (section VII-A), are encouraged when appropriate to aid in evaluating whether an injury is more likely to be serious or non-serious based on the available data. If sample sizes of similar assignable cases are insufficient to determine statistically whether an injury is more likely to be serious or non-serious, prorating can be used, as described in section VII-A for large whales (see also Appendix I). All CBD cases that are assigned or prorated based on previous assignable injury events should be indicated as such in the serious injury determination reports and SARs.

The overarching goal of the approach described above is to allow assignment of CBD cases when sufficient data are available to determine whether that type of injury is more likely to be serious or non-serious. Prorating should only be used in the following cases: 1) when sample sizes are insufficient to statistically establish whether a type of injury is more likely than not to be serious, 2) when an injury category includes a broad range of possible injury outcomes (such as the L10 ‘Evidence of entanglement’ criterion for large whales, section VII), or 3) for observer data (section VI) to estimate overall levels of mortality and serious injury.

C. Pinniped

Accounting for Pinniped Events where the Severity of an Injury Cannot Be Determined

Injury events that remain CBD following application of the criteria and evaluation of relevant additional factors should, when possible, be assigned the injury severity for the majority of comparable injuries for similar taxa and injury type. This approach is the same as that outlined for small cetaceans (section V-B.). It is similar to the approach for large whales (section V-A) except that the injury severity is assigned based on past serious injury determinations rather than known injury outcomes (which are largely lacking for pinnipeds). This CBD assignment approach would apply only when appropriate fishery observer data are unavailable or insufficient to prorate CBD cases as described in section VI.

NMFS Science Center staff may estimate the proportions of serious versus non-serious determinations for a type of injury using any relevant and appropriate data (e.g., observer records for comparable fisheries, stranding networks, entanglement response networks, and Law Enforcement and U.S. Coast Guard reports). Under this method, Science Center staff will assign all remaining CBD cases to be the same determination as for the majority of similar assignable

cases. Evaluations should be done only for similar taxonomic groups (i.e., seals, sea lions) and for the same injury type (e.g., laceration to head) or fishery characteristics (e.g., small-mesh gillnet fisheries). For example, if 12 out of 20 (60%, the majority) of documented cases of seals with propeller lacerations to the head were determined to be serious, and 40% percent were non-serious, then all of the CBD cases for harbor seals observed with that type of injury would be designated as serious. In cases where data on assignable injury events are limited in one region or where sample sizes are small, data can be pooled across regions to provide a more robust sample set on which to base the severity assignment of a CBD injury event. Statistical evaluations, such as the binomial probability tests applied to large whale data (section VII-A), are encouraged when appropriate to aid in evaluating whether an injury is more likely to be serious or non-serious based on the available data. If sample sizes of similar assignable cases are insufficient to determine whether an injury is more likely to be serious or non-serious, prorating can be used, as described in section VII-A for large whales (see also Appendix I). All CBD cases that are assigned or prorated based on previous assignable injury events should be indicated as such in the serious injury determination reports and SARs.

NMFS recognizes the results from these procedures will not provide estimates of the actual rates of human-caused serious injury and mortality to marine mammals given the likelihood of undetected and unreported events. However, NMFS' interpretation of the serious injury definition (an injury that is *more likely than not* to result in mortality, as described in NMFS PD 02-238: Process for Distinguishing Serious from Non-Serious Injury of Marine Mammals) coupled with the approaches described in this Procedural Directive is expected to allow NMFS to evaluate the majority of documented injury events using the best available scientific information. Furthermore, for the purposes of SARs, NMFS 2023 (GAMMS section 3.3.1) provides additional guidance on estimating and including undetected mortality and serious injury to provide a more accurate assessment of the total human-caused serious injury and mortality to marine mammals.

VI. Assigning Injury Severity when Estimating Injuries from Fishery Observer Data

In cases where data on injuries to marine mammals are available from a systematic fishery observer program (including NMFS fishery observer programs and state or other observer programs NMFS has deemed to be comparable to its own programs), the observer database can be used to assign injury severity as part of the statistical analysis for estimating overall mortality and serious injury of marine mammals. If sample sizes are sufficient, the proportions of animals determined to be seriously versus non-seriously injured within the observer database can be used to prorate undetermined cases (including any documented CBD cases and all estimated injuries). The following is a hypothetical example to illustrate an application of such a prorating method:

1) *Determination of injury events based on observer reports:* The observer program documents two injuries of species X in fishery/gear type Y during a given fishing year. Based on the information in the observer reports, the Science Center staff responsible for assessing injury severity determines that one of the injuries is serious and the other is CBD.

2) *Statistical extrapolation of annual serious injury and mortality levels in a fishery based on fishing effort and observer coverage levels:* Based on the two documented injuries, the level of observer coverage, and the total effort in fishery Y during the fishing year, Science Center staff conduct a statistically-based analysis that estimates a total of 13 injuries for the entire fishing year. One of the documented injuries was determined to be serious; the remaining 12 injuries (1 documented injury determined to be CBD and 11 estimated injuries) are prorated as described in the next two steps.

3) *Review of database to determine the proportion of assignable historic injuries:* The Science Center staff reviews the observer program database on injuries caused by interactions between species X and fishery Y to determine the proportion of all injuries that were "assignable" (i.e., for which a determination of serious or non-serious injury could be made). This may require pooling data over multiple years to achieve adequate sample sizes for estimating the proportions of serious versus non-serious injuries; however, pooling should only be done for years in which fishing practices (and hence, injury outcomes) are expected to be comparable. For example, if there are marked changes in gear used (e.g., because of new regulations) and these changes could influence injury severity, then the database should be limited to the period following the change. In this hypothetical example, the appropriate database indicated that half of assignable cases were determined to be serious and half were non-serious.

4) *Prorate the extrapolated injury level based on the proportions found in the review of the database:* The remaining 12 cases without known outcomes are prorated based on the known proportions in the database. In this example, 6 of the 12 cases are assigned as serious injuries and 6 as non-serious. Combining this with the one documented injury that was determined to be serious, the total 13 estimated injuries represent 7 serious injuries and 6 non-serious injuries.

The methodological details of this prorating approach are expected to vary slightly among fisheries because the nature of the available data is likely to differ. Prorating may, for example, also include a proportion of animals killed rather than injured, if a fishery both kills and injures marine mammals incidentally during fishing operations. Specific methods used for each fishery should be documented in the technical reports that present estimates of marine mammal mortality and serious injury.

VII. Serious Injury Determination Process for Large Cetaceans

A. *Introduction to the Large Cetacean Injury Determination Process*

The process described below is intended for evaluation of injury events involving mysticetes and sperm whales. The large cetacean injury categories and criteria are designed to allow categorization of most reports--both those with extensive documentation as well as reports containing few details--and to accurately assign a prognosis (i.e., death or survival) to these observed events. These categories and criteria were derived from multiple sources, including an analysis of known outcomes of large cetacean injury events, expert opinion from Serious Injury Workshop reports (Angliss and DeMaster, 1998; Andersen *et al.*, 2008), technical memoranda (e.g., Glass *et al*., 2008), contract reports (e.g., Robbins, 2010), scientific peer-reviewed papers (e.g., Vanderlaan and Taggart, 2007), discussions of the NMFS Determination Staff Working Group, and consultations with veterinarians and pathologists. Many of the large cetacean injury categories differ from those presented in Andersen *et al.* (2008) due to refinements made during continued discussions and consultations, and the introduction of a quantitative approach based on the analysis of known outcomes of national large cetacean injury events (see below and Appendix I). The resulting large cetacean injury categories and criteria are detailed in subsection D and summarized in Table 1.

Most injury categories below used the results of a quantitative analysis of known outcomes of national large whale injury events from 2004-2008 to assign types of injuries as serious or non-serious. These data were the most comprehensive and of relatively high quality at the time these criteria were developed and continue to be used to provide a consistent framework for making injury determinations. However, NMFS is currently developing a statistical approach using a more recent and larger dataset that builds on NMFS' implementation of this Procedural Directive since its inception. Once the new methodology is finalized, NMFS will review this Directive to determine whether revisions are warranted.

In the analysis of the 2004-2008 data, the categories used for large cetaceans were kept very general to provide reasonable sample sizes for analysis and, as much as possible, were made mutually exclusive to ensure consistent categorization of events. For each injury category, the number of events in which the injury type resulted in the whale's death (including whales last seen in deteriorating health; i.e., skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads) was divided by the total number of events with that type of injury for which the outcome (i.e., death or survival) was known. This provided the proportion of serious injury outcomes for each category. Despite collapsing the data into very general injury categories, many of the categories still contained small sample sizes. Therefore, before assigning categories with proportions higher than 50% as a serious injury, a binomial test was applied to each category to estimate the likelihood of the rate of mortality being higher or lower than 50%. The results of the binomial tests measured the reliability of categories' observed proportions of deaths to events and thereby indicated if future data collection might change the observed rate from higher than 50% to lower than 50% or vice versa. A relatively low significance threshold (alpha = 0.10) was chosen prior to testing to maximize category assignment of an injury event to a percentage interval. Although adjusting the alpha to

0.10 increases the risk of falsely rejecting the null hypothesis that the rate of serious injury for a category does not differ from 50%, this was a practical concession given the nature of the data. The results of the analysis are tabulated in Appendix I.

The binomial test for three categories (L2, L5a, and L10) resulted in deaths-to-events rates likely higher than 50% (given alpha = 0.10). The first two categories (L2 and L5a) were assigned serious injury determinations in accordance with the Policy Directive. The third (L10), however, is prorated due to a potential bias of observed records within this category—specifically, the increased likelihood of detection of more severe entanglements. This bias and associated prorating are discussed in more detail in subsection D. Three categories (L3, L5b, and L6c) are assigned non-serious injury determinations because no events of these types within the 2004-2008 dataset resulted in death or significant deterioration of a whale's health. The binomial tests for four injury categories resulted in equivocal odds (L6a, L6b, L7a and L11), and for two additional categories (L7b and L12), the proportion of deaths was less than 50%. To capture the probability of serious injury of these six categories, the proportions generated by the division of the number of lethal events by the total number of events from the original analysis is used as a multiplier to prorate the serious injury rate of each of these categories. For example, if 10 events are assigned to L11 ("vessel strike laceration"), which has an odds ratio of 0.52, the resulting value is 5.2. This value would then be added to the total number of serious injury events for the period. For L6a, however, peer reviewed publications indicate such events are likely to result in death, and therefore any event placed in this category is counted as a serious injury. Expert opinion was relied upon for four injury types for which outcome data were not available (categories L1, L4, L8, and L9).

It is important to note here that NMFS recognizes using a threshold vessel length of 65' for injury categories L6a, L6b, L7a, and L7b is not optimal, and vessels smaller than 65' are known to seriously injure or kill large cetaceans. NMFS also recognizes there are other potential factors (e.g., propeller diameter and speed, angle of strike, age and size of whale, and speed and direction of the whale) that likely play a role in the injury severity to large cetaceans struck by vessels, especially in whether the strike causes a laceration and/or blunt trauma injury, where the former injury is more readily detected rather than the latter if the condition of the whale is known. Scientific literature shows that both vessel speed and mass play a role in understanding the severity of a vessel strike on a marine mammal, for blunt force trauma related injuries (Wright *et al.,* 1995; Laist *et al.,* 2001; Pace and Silber, 2005; Calleson and Frohlick, 2007; Kite-Powell *et al.*, 2007; Vanderlaan and Taggart, 2007; Wang *et al.,* 2007; Silber et al. 2010; Conn and Silber 2013; NMFS 2020). Specifically, Vanderlaan and Taggart (2007) concluded that, assuming the mass of vessels represented in the data they analyzed were much greater than the mass of the whales struck, then vessel speed is sufficient to predict the probability of a lethal injury to a whale. However, there are other variables and factors, such as propeller characteristics (i.e., propeller diameter), that influence the severity of sharp force trauma to marine mammals resulting from vessel strikes, which are not correlated to vessel size, except in very large ships (Wright *et al.*, 1995; Calleson and Frohlick, 2007). The distinction between blunt force and sharp trauma for these injury categories is important because the condition of the whale is not likely known if these injury categories are applied.

The mass of a vessel, relative to a whale, plays a role in the severity of injury to a whale;

however, a mass or length threshold has not been defined in the scientific literature as it has for speed. Therefore, NMFS considered the best scientific information available to define injury categories for this policy. NMFS chose the vessel length (65') and speed (10 knots) threshold for injury categories L6a, L6b, L7a, and L7b because they are the vessel length and speed currently regulated under NMFS' Final Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic Right Whales (hereafter referred to as "North Atlantic right whale vessel speed rule") (73 FR 60173, October 10, 2008; 78 FR 73726, December 6, 2013). Length is being used as a proxy for mass in these injury categories because this information is more readily available when a vessel strike is confirmed. The specific length of 65' was identified in the North Atlantic right whale vessel speed rule not because data indicated that a 65' vessel has a more severe strike compared to a smaller vessel, but because 65' is a category that is commonly understood by the maritime community and is reflected in established United States Coast Guard regulations. However, NMFS noted in the North Atlantic right whale vessel speed rule that vessels less than 65' may also pose a threat to large cetaceans and the agency will consider measures in the future to address vessel classes below 65'. Therefore, if the 65' threshold is changed in the North Atlantic right whale vessel speed rule, or a new threshold is identified in the scientific literature, NMFS will review this Procedural Directive and determine whether revisions are warranted.

B. *Application of Large Cetacean Injury Determination Process*

Each large whale injury event is assigned to the appropriate category (or categories) listed in Table 1 using the best available information and scientific judgment. Well-documented events are likely to be placed in one of the more specific injury categories in the top rows (L1-L9) of the table, while poorly documented events will fall into one of the more general categories in the bottom rows (categories L10-L12). The criteria described in the category descriptions in subsection D below should be used to properly assign injuries to categories. Events that can be assigned to several specific injury categories are recorded as serious injuries if any one of the applicable specific categories has a serious injury determination. If an event includes injuries that fit into more than one category, the determination with the highest level of severity is assigned (e.g., an injury that fits into both a non-serious and a prorated category is placed in the prorated category with the highest prorating value). An event is recorded as a non-serious injury only if the injury does not fit in either a serious injury or prorated category. Events that have two or more injuries that separately fit into only non-serious injury categories will be assessed to determine if the combined effect of the multiple injuries compound to increase the severity of the injury event. Events should be placed in the general injury categories (L10-L12) only if they cannot be placed in a more specific injury category above.

More detailed information or extended observation may justify a determination differing from the guidance in Table 1. An animal that is fully disentangled would generally be considered not seriously injured unless there is additional evidence of a serious injury. Any injury leading to an indication of significant health decline (e.g., skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads) is considered a serious injury.

C. *Assessing and Documenting the Injury Status of Large Cetaceans after Successful Post-Interaction Mitigation Efforts*

Large cetacean injuries that are successfully mitigated--primarily disentanglement from commercial fishing gear--may change an event's assignment from a category with a serious injury determination to a non-serious determination. Events that would have been serious injuries prior to mitigation should be tallied separately as serious injuries. These events are not counted against PBR in the SAR, but are included in the recorded takes for the LOF and associated management measures. See section IV for more information on this process.

D. *Large Cetacean Injury Categories and Criteria*

L1: *"Ingested gear or hook(s)" – serious injury*

If there is no additional information indicating the impact is not lethal, a confirmed case of ingested gear or hook(s) is counted as a serious injury. Any indication of the ingestion of gear or hooks is placed in this category. An event is not placed in this category if it is not apparent that gear or hook(s) go down the throat. If gear or hook(s) is known to be in the mouth but it is unknown whether the gear is ingested or goes down the throat, the animal is placed in category L10 for evidence of entanglement. The ingestion of gear or hooks by a marine mammal is cited as a serious injury in multiple publications, including Andersen *et al.* (2008), Carretta *et al.* (2004), and Angliss and DeMaster (1998).

L2: *"Constricting wrap" – serious injury*

A constricting wrap includes any line that encircles any body part and has sufficient tension to either indent the skin or to not shift with the whale's movement. This category is also applied if a line is likely to become constricting as the whale grows. Any event with indication at the time of reporting that an attached line is heavily weighted, the whale is anchored, or the whale has a discolored appendage resulting from attached line is counted in this category as a serious injury. Analysis of known outcomes of whale entanglements from 2004 to 2008 found 84 of 85 events (99%) involving constricting wraps resulted in the whales' deteriorating health or death. Constricting wraps of gear can cause lacerations, partial or complete fin amputation, organ damage, or muscle damage and interfere with mobility, feeding, and breathing. Chronic tissue damage from line under pressure can compromise a whale's physiology. Unless additional information proves the injury is not lethal, a case with indication of a constricting wrap is counted as a serious injury.

L3: *"Loose wrap, bridled or draped gear" – non-serious injury*

Loose gear includes any configuration of line that moves or shifts freely with a whale's movement and does not indent the skin. Verification of complete absence of constricting wraps is required before an event is assigned to this category. If the absence of constricting wraps cannot be verified, the case is assigned to category L10. The analysis of events with known outcomes assessed the condition of 14 whale entanglement events involving non-constricting gear prior to any disentanglement efforts and found none (0%) resulted in the whales' deteriorating health or death. Loose wraps of gear damage tissue

and can result in disfigurement. However, any event involving only loose gear is still counted as a serious injury if there is indication that the whale's health has significantly declined as a result of the entanglement. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

L4: *"External hook" – non-serious injury*

A confirmed case of a fishing hook of any size on any external part of a large cetacean is counted as a non-serious injury. If any part of the hook is visible, it is considered external. Any trailing line is assessed using categories L2 or L3. Large cetacean experts participating in the 2007 Serious Injury Technical Workshop indicated that an external fishing hook of any size on any part of a large cetacean is likely a non-serious injury (Andersen *et al.,* 2008). However, any event involving an external fishing hook is still counted as a serious injury if there is indication that the whale's health has significantly declined as a result of the hook. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

L5a: *"Deep laceration" – serious injury*

Any incision or tearing that potentially penetrates the body cavity or cuts into the skeletal structure, or a deep laceration at the insertion of the flippers or flukes where major arteries are near the skin surface, is counted as a serious injury. Confirmation of body cavity penetration, skeletal damage, or artery severing is not required to assign a case to this category. Lacerations that do not penetrate the body cavity or damage the skeleton, or that only partially sever a fluke or flipper without severing a major artery (i.e., are away from the insertion point), are assigned to category L5b. Analysis of known outcomes of whale injuries from 2004 to 2008 found 12 out of 12 events (100%) involving deep, non-entanglement (non-wrapping) lacerations resulted in the whales' deteriorating health or death. Large cetacean experts participating in the 2007 Serious Injury Technical Workshop indicated that penetration of the body cavity, skeletal damage, or a deep wound that leads to significant blood loss is likely to result in the death of a marine mammal (Andersen *et al.,* 2008).

L5b: *"Superficial laceration" – non-serious injury*

An incision or tear that does not go deeper than the blubber layer or only partially severs a flipper or fluke lobe is counted as a non-serious injury. Criterion L5a is considered if a laceration is potentially deeper than the blubber layer or is near the insertion point of a fluke or flipper. If details surrounding the event are lacking and therefore, it is uncertain whether an event should be assigned to criteria L5a or L5b, assign the event to category L11. From 2004 to 2008, out of 9 events involving shallow lacerations or only partial fluke or flipper severing, none (0%) resulted in health decline or death. However, any event involving a superficial laceration is still counted as a serious injury if there is indication that the whale's health has significantly declined as a result of the laceration. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

L6a: *"Vessel much greater in size than whale or vessel ≥ 65' and > 10 knots" – serious injury*
Any collision involving a vessel that is much greater in size than a whale and traveling faster than 10 knots, or a vessel 65 feet or more in length traveling faster than 10 knots, is counted as a serious injury regardless of the apparent condition of the whale immediately following the strike. From 2004 to 2008, 5 out of 6 (83%) whales struck by a vessel 65 feet or more in length and traveling faster than 10 knots either showed signs of deteriorating health at the last sighting or died. Although a high proportion of events of this type resulted in death, this sample size was too small for the binomial test to establish the likelihood of the rate of mortality being higher or lower than 50%. However, results from separate studies (e.g., Pace and Silber, 2005; Vanderlaan and Taggart, 2007) support a designation of such events as serious injuries. Internal injuries from vessel collisions, which include fractures, organ damage, and internal hemorrhages, are not evident externally and typically are not detected unless the struck whale washes ashore and a necropsy is performed (Campbell-Malone *et al.*, 2008). See the discussion in subsection A above for information on why NMFS chose a 65' threshold for this injury category. If the 65' threshold is changed in the North Atlantic right whale vessel speed rule, NMFS will review this Procedural Directive and determine whether revisions are warranted.

L6b: *"Vessel smaller in size than whale or vessel < 65' and > 10 knots" – prorate*
Any collisions involving vessels smaller in size than the whale and traveling faster than 10 knots, or vessels less than 65 feet in length traveling faster than 10 knots, are prorated. To prorate, the number of events assigned to this category within the assessment period is multiplied by 0.20. An event is assigned to this category if there is no information on the injury to the whale, but there is information on the size and speed of the vessel that struck the whale. If there is information about the whale following a strike (e.g., injuries to the animal, presence of blood, behavior of the animal), the injury event will be assigned to another appropriate category based on that information. From 2004 to 2008, 1 out of 5 (20%) whale strikes by a vessel less than 65 feet in length and traveling faster than 10 knots resulted in the whale's deteriorating health and likely death. Although only a small proportion of events of this type resulted in death, this sample size was too small for the binomial test to establish the likelihood of the rate of mortality being higher or lower than 50%. However, the prorating reflects the probability that some of these events will cause serious injury. Further, a strike to a calf by a vessel of any size and traveling greater than 10 knots will be considered a serious injury. If there is indication that the whale's health has significantly declined following any collision, it is counted as a serious injury. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads. See the discussion in subsection A above for information on why NMFS chose a 65' threshold for this injury category. If the 65' threshold is changed in the North Atlantic right whale vessel speed rule, NMFS will review this Procedural Directive and determine whether revisions are warranted.

L6c: *"Vessel any size ≤ 10 knots" – non-serious injury*
A strike that involves a vessel of any size traveling 10 knots or less is counted as a non-serious injury. An event is assigned to this category only if there is no information on the

injury to the whale. If there is information about the whale following a strike (e.g., injuries to the animal, presence of blood, behavior of the animal), the injury event will be assigned to another appropriate category based on that information. From 2004 to 2008, zero out of 6 (0%) collisions involving whales struck by vessels of any size (known and unknown) traveling 10 knots or less resulted in the whales' deteriorating health or death. However, if there is indication that the whale's health has significantly declined following any collision, it is counted as a serious injury. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

L7a: *"Vessel much greater in size than whale or vessel ≥ 65' and speed unknown" – prorate*
Any collisions involving vessels traveling at an unknown speed and are 65 feet or more in length, or greater in size than a whale, are prorated. To prorate, the number of events assigned to this category within the assessment period is multiplied by 0.56. An event is assigned to this category only if there is no information on the injury to the whale. If there is information about the whale following a strike (e.g., injuries to the animal, presence of blood, behavior of the animal), the injury event will be assigned to another appropriate category based on that information. From 2004 to 2008, 5 out of 9 (56%) whales struck by a vessel 65 feet or more in length and traveling at an unknown speed either showed signs of deteriorating health or died. This sample size was too small for the binomial test to establish the likelihood of the rate of mortality being higher or lower than 50%. However, a strike to a calf by a vessel of any size when speed is unknown will be considered a serious injury. Further, if there is indication that the whale's health has significantly declined following any collision, it is counted as a serious injury. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads. See the discussion in subsection A above for information on why NMFS chose a 65' threshold for this injury category. If the 65' threshold is changed in the North Atlantic right whale vessel speed rule, NMFS will review this Procedural Directive and determine whether revisions are warranted.

L7b: *"Vessel smaller in size than whale or vessel < 65' and speed unknown" – prorate*
A strike that involves a vessel traveling at an unknown speed and is less than 65 feet in length, or smaller in size than a whale, is prorated. To prorate, the number of events assigned to this category within the assessment period is multiplied by 0.14. An event is assigned to this category only if there is no information on the injury to the whale. If there is information about the whale following a strike (e.g., injuries to the animal, presence of blood, or behavior of the animal), the injury event will be assigned to another appropriate category based on that information. From 2004 to 2008, 1 out of 7 (14%) whales struck by a vessel less than 65 feet in length and traveling at unknown speed resulted in the whales' deteriorating health or death. The binomial test results indicate it is likely that the rate of mortality from this type of event is lower than 50%. The prorating reflects the probability that some of these events will cause serious injury. However, a strike to a calf by a vessel of any size when speed is unknown will be considered a serious injury. Further, if there is indication that the whale's health has significantly declined following any collision, it is counted as a serious injury. Indications of

significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads. See the discussion in subsection A above for information on why NMFS chose a 65' threshold for this injury category. If the 65' threshold is changed in the North Atlantic right whale vessel speed rule, NMFS will review this Procedural Directive and determine whether revisions are warranted.

L8: *"Dependent" – serious injury*

Unless additional information proves a dependent calf (i.e., non-weaned calf) survives the loss or serious injury of its mother, a confirmed case involving a dependent calf of a dead or seriously injured mother is counted as a serious injury to the calf. Similarly, in cases where a mother's serious injury has been prorated, the proration shall also be applied to the dependent calf. The cause of the mother's death or serious injury is also assigned to the calf. Large cetacean experts participating in the 2007 Serious Injury Technical Workshop indicated that a dependent will die if the mother is seriously injured or killed (Andersen *et al.,* 2008).

L9: *"Brought on deck" – serious injury*

If no additional information proves the impact is not lethal, a confirmed case of a large cetacean being removed from the water and brought on deck for any length of time is a serious injury. Large cetacean experts participating in the 2007 Serious Injury Technical Workshop indicated that substantial stress and injuries will occur if a large cetacean is removed from the water and brought on the deck of a vessel (Andersen *et al.,* 2008).

<u>The following injury/information criteria encompass confirmed reports that are insufficiently documented to assign to one of the criteria above with a high degree of certainty.</u>

L10: *"Evidence of entanglement" – prorate*

This category encompasses confirmed events involving gear attached to a whale but that lack the necessary detail to assign to one of the L1-L4 categories. Events falling in this category are prorated. To prorate, the number of events assigned to this category within the assessment period is multiplied by 0.75. Of the 114 documented entanglement events with known outcomes from 2004-2008, 85 (75%) either resulted in the whales' deteriorating health or death, or would have resulted in the whales' death if not for intervention (40 were disentangled from constricting wraps). The binomial test indicated that it is likely the rate of mortality is higher than 50% given these data. However, there is a potential bias in the analysis for this category. The subset of events with known outcomes was extracted from a total of 228 confirmed entanglement events reported during 2004-2008. Events with known outcomes are likely biased by a higher probability of detection of more severe entanglements, including whales examined on the beach and identified as entanglement mortalities. This statement has some additional support from a systematic survey of humpback whale scars that found 2 of 6 (33%) entanglement cases involving greater injuries were witnessed in progress and reported, while only 1 of 20 (5%) cases involving apparently minor injuries was reported (Robbins, 2010). This scar study also suggests that, based on observed tissue damage, the majority of scars acquired in 2008 were from minor entanglements. Although more severe or prolonged

entanglements may be more likely to be reported, the 0.75 prorating reflects the probability that some confirmed entanglement reports lacking detail will be of minor events. However, if there is indication that the whale's health has significantly declined following any entanglement, it is counted as a serious injury. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

L11: *"Vessel strike laceration" – prorate*

Any confirmed reports of non-entanglement lacerations (non-wrapping incisions or tearing of the skin) that lack the detail to assign to the L5a or L5b categories are assigned here. This category is also used for observations of blood in the water without further details on the injury. The rate of serious injury for this category is prorated by multiplying the number of events assigned to this criterion by 0.52. Of all 25 documented non-entanglement laceration events from 2004-2008, 13 (52%) resulted in the whales' deteriorating health or death. The binomial test results indicate that the rate of mortality from this type of event does not differ from 50%. Though blunt-force injuries--such as contusions and skeletal fracturing--can result from vessel strike, these types of internal injuries are typically not observable in live whales. If there is indication that the whale's health has significantly declined following any collision, it is counted as a serious injury. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

L12: *"Vessel strike observed" – prorate*

A confirmed case of a vessel strike for which no other information on the whale or vessel is available is assigned to this category and prorated. To prorate, the number of events assigned to this category is multiplied by 0.36. Of all 33 vessel strike events used in the categories above (all sizes and speeds), 12 (36%) resulted in the whales' deteriorating health or death. The binomial test results indicate it is likely that the rate of mortality from this type of event is lower than 50%. The prorating reflects the probability that some of these events will cause serious injury. A strike to a calf by a vessel of unknown size traveling at an unknown speed will be considered a serious injury. Further, if there is indication that the whale's health has significantly declined following any collision, it is counted as a serious injury. Indications of significant health decline include skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads.

TABLE 1: Summary of Large Cetacean[2] Injury Categories and Criteria

Instructions: Each large cetacean injury event is recorded to the appropriate injury/information category using the best available information and scientific judgment, as described in the Procedural Directive. Criteria L10 - L12 accommodate events that lack details necessary for assignment to a more specific category. For a single injury event to which several categories apply, the injury determination with the highest level of severity is assigned. **More detailed information or extended observation on an individual case/animal may justify a determination different from this table.** An animal that is fully disentangled would generally be considered not seriously injured unless there is additional evidence of a serious injury. **Any injury leading to apparent significant health decline (e.g., skin discoloration, lesions near the nares, fat and muscle loss, musculo-skeletal deformity, or increased cyamid loads) is a serious injury.**

Category	Injury/ Information	Injury Determination	Criteria*
L1	Ingested gear[3] or hook(s)	SI[4]	Swallowed, not simply draped through mouth
L2	Constricting wrap	SI	Tightly wrapped line anywhere on the body that indents the skin or does not shift with the whale's movement, or line that is likely to become constricting as the whale grows. Indication that a whale that is heavily weighted, anchored or has a discolored appendage is sufficient evidence of constricting gear
L3	Loose wrap, bridled or draped gear	NSI[5]	Loosely wrapped gear that moves or shifts freely with the whale's movement. Absence of constricting gear must be confirmed
L4	External hook	NSI	Fishing hook of any size on any part of the body (i.e., not ingested)
L5a	Deep laceration[6]	SI	Laceration with the potential to affect major artery (e.g., laceration or severing at insertion of flipper/fluke), penetrating body cavity, or cutting bone
L5b	Superficial laceration	NSI	Laceration not deeper than blubber layer, does not affect major artery or cut bone
L6a	Vessel much greater in size than whale or vessel ≥65' and >10 knots	SI	Struck by vessel much greater in size than the whale and traveling greater than 10 knots, or struck by vessel equal or greater than 65' and traveling greater than 10 knots, and no information on injury to the whale
L6b	Vessel smaller in size than whale or vessel <65' and >10 knots	Prorate[7]: 0.20	Struck by vessel smaller in size than the whale and traveling greater than 10 knots, or struck by vessel less than 65' and traveling greater than 10 knots, and no information on injury to the whale. A strike to a calf by a vessel of any size and traveling greater than 10 knots will be considered a serious injury

[2] For the purposes of this table, "large cetaceans" include all mysticetes and sperm whales.
[3] For the purposes of this table, "gear" is defined as any portion of fishing gear excluding the hook, which is considered separately.
[4] SI = Serious Injury.
[5] NSI = Non-Serious Injury.
[6] For the purposes of this table, "laceration" is defined as a ragged incision or a tearing of the skin. Lacerations are caused by trauma that results in stretching, tearing, crushing, shearing, or avulsion of the tissue. Trauma, including blunt and sharp force trauma, includes a wound or bodily harm caused by an extrinsic agent.
[7] "Prorate" means the number of events assigned to a given category within the assessment period is multiplied by the prorate number provided for that category.

L6c	Vessel any size ≤10 knots	NSI	Struck by vessel of any size traveling at equal or less than 10 knots and no information on injury to the whale
L7a	Vessel much greater in size than whale or vessel ≥65' and speed unknown	Prorate: 0.56	Struck by vessel much greater in size than the whale traveling at an unknown speed, or struck by vessel equal or greater than 65' and traveling at unknown speed, and no information on injury to the whale. A strike to a calf by a vessel of any size when speed is unknown will be considered a serious injury
L7b	Vessel smaller in size than whale or vessel <65' and speed unknown	Prorate: 0.14	Struck by vessel smaller than the whale traveling at an unknown speed, or struck by vessel less than 65' and traveling at unknown speed, and no information on injury to the whale. A strike to a calf by a vessel of any size when speed is unknown will be considered a serious injury
L8	Dependent[8]	SI	Dependent (i.e., non-weaned) calf of a dead or seriously injured mother
L9	Brought on deck	SI	Whale removed from water and brought on deck
Criteria L10 - L12 consist of events that lack details necessary for assignment to a more specific category above			
L10	Evidence of entanglement	Prorate: 0.75	Confirmed entanglement but insufficient information available to place in any of the L1-L4 criteria with a high degree of certainty
L11	Vessel strike laceration	Prorate: 0.52	Whale confirmed with non-entanglement related laceration but lacking details to place in either criteria L5a or L5b with a high degree of certainty. Includes observation of blood in water
L12	Vessel strike observed	Prorate: 0.36	Confirmed vessel strike report where there is insufficient detail to assign event to criteria L6a – L7b with a high degree of certainty. A strike to a calf by a vessel of unknown size traveling at an unknown speed will be considered a serious injury

***** Criteria listed in the far right column of Table 1 are unique to the associated injury type. Factors that should be considered and potentially justify a deviation from the injury outcome include, but are not limited to:

- Seasonality (feeding vs. breeding ground)
- Reproductive state if known (e.g., pregnant, lactating, resting female)
- Age class
- Subsequent sighting history

[8] "Dependent" for a large cetacean means a non-weaned calf. Weaned calves and juvenile large cetaceans are no longer dependent on their mothers.

VIII. Serious Injury Determination Process for Small Cetaceans

A. *Introduction to the Small Cetacean Injury Determination Process*

The process described below is intended for evaluation of injury events involving all odontocetes except sperm whales. The injury categories and criteria and associated injury determinations for small cetaceans were derived predominantly from expert opinion and data presented at the 2007 Serious Injury Technical Workshop (Andersen *et al.*, 2008) because, unlike for large whales, there is limited information available on known outcomes of various injuries for small cetaceans. In some cases, additional considerations from the 1997 Serious Injury Workshop (Angliss and DeMaster, 1998), from subsequent discussions and analyses of the NMFS Determination Staff Working Group, or from multiple external experts were included (e.g., capture myopathy was identified as a common case-specific risk factor; for more detailed information on capture myopathy, see Appendix II). The resulting small cetacean injury categories and criteria are detailed in subsection D and summarized in Table 2.

B. *Application of the Small Cetacean Injury Determination Process*

Each small cetacean injury event is assigned to the appropriate category (or categories) listed in Table 2 using the best available information and scientific judgment. The criteria described in the category descriptions in subsection D below should be used to properly assign injuries to categories. However, as noted in section II, for "data rich" cases in which additional detailed information regarding the injury is available and/or the condition of the injured animal is known or can be tracked over time, the available case-specific data can be used in lieu of, or in addition to, the criteria to make the injury determination. Cases that involve deviations from the below criteria should be identified and explained in the annual injury determination report.

Single injury events that can be assigned to several specific injury categories will be recorded according to the injury category with the highest level of severity. For example, an animal that has both "gear wrapped and loose on any body part" (S8b, case specific) and "ingested gear or hook(s)" (S2, serious injury) will be recorded as seriously injured. Events that have two or more injuries that separately fit into only CBD injury categories will be assessed to determine if the combined effect of the multiple injuries compound to increase the severity of the injury event.

C. *Assessing and Documenting the Injury Status of Small Cetaceans after Successful Post-Interaction Mitigation Efforts*

Small cetacean injuries that are successfully mitigated may change an event's assignment from a category with a serious injury determination to a non-serious determination. Events that would have been serious injuries prior to mitigation should be tallied separately as serious injuries. These events are not counted against PBR in the SAR, but are included in the recorded takes for the LOF (see section IV for more information on this process).

D. *Small Cetacean Injury Categories and Criteria*

S1: *"A free-swimming animal observed at a date later than its human interaction, exhibiting signs of declining health believed to be resulting from initial injury (e.g., a marked skin discoloration, fat and muscle loss, or musculo-skeletal deformity)" – serious injury*

An animal that is resighted (which is rare for most small cetacean species) at some time after an injury event exhibiting marked signs of health decline as a result of the injury is counted as a serious injury. In such cases, the initial injury is a serious injury because it resulted in the animal's health decline.

S2: *"Ingested gear or hook(s)" – serious injury*

A confirmed case involving ingested gear or hook(s) is counted as a serious injury. Multiple publications cite the ingestion of gear or hooks by a marine mammal as a serious injury (Andersen *et al.* (2008), Wells *et al.* (2008), Carretta *et al.* (2004), and Angliss and DeMaster (1998)). In addition, small cetacean experts participating in the 2007 Serious Injury Technical Workshop indicated that the ingestion of gear by small cetaceans is a serious injury. Data from bottlenose dolphins in Florida show that fishing hooks (including partial hooks) embedded in the throat, goosebeak, or esophagus, or line wrapped around the goosebeak, generally lead to death, although there is some chance of survival if the hook(s) does not become embedded (Wells *et al.*, 2008). In addition, death from gear ingestion was not immediate, with most of the retrieved carcasses being emaciated (Wells *et al.*, 2008). Ingestion of gear or hook(s) is presumed if line is observed coming from the mouth, even if the hook/leader is not seen.

S3: *"Visible blood loss" – case specific*

Small cetacean experts participating in the 2007 Serious Injury Technical Workshop indicated that an injury with visible blood loss is case specific. Blood loss indicates that the animal is "injured" (50 CFR 229.2), and observation may provide additional information to determine whether the bleeding injury is serious or non-serious. Injuries with persistent bleeding may be considered a serious injury, whereas injuries where the bleeding stops relatively quickly may not be considered a serious injury. Additional factors about the injury need to be considered before making a determination of severity (see Table 2), such as the amount of blood and the location of the bleeding injury.

S4: *"Animal brought on vessel deck following entanglement/entrapment (excluding scientific research targeting marine mammals and authorized as such under a NMFS scientific research permit, where the animal is brought on and placed on the vessel deck in a controlled manner)" – serious injury*

A small cetacean brought on the vessel deck following an interaction is counted as seriously injured because such handling causes substantial stress to the individual and subjects the individual to a high risk of later death due to capture myopathy, aspiration, or hidden injuries. NMFS-permitted marine mammal scientific research is not included in this criterion because the permit for the research requires a certain level of care be taken during the research not to harm the animal. In these cases, the animal is brought on and placed on the vessel in a controlled manner, causing no harm or a significantly lower level of injury than an animal brought on board in an uncontrolled manner (e.g., pulled on

by fishing gear).

S5a: "Hook(s) in head (excluding criterion S5b), regardless of the presence of gear" – serious injury

A small cetacean hooked in the head (near the eyes) is considered seriously injured by Angliss and DeMaster (1998). Small cetacean experts participating in the 2007 Serious Injury Technical Workshop agreed with Angliss and DeMaster (1998) that a small cetacean with a hook in the head, including the eyes, blowhole, and mouth, is seriously injured because of the potential for ingesting attached gear, impairing feeding, breathing, or sight, or acting as a conduit for infection. Therefore, such cases are counted as serious injuries.

S5b: *"Hook(s) confirmed in lip only, external tissue outside of teeth" – case specific*

A small cetacean with a confirmed hook in the lip only (i.e., including only external tissue outside of the teeth) is case specific. A hook in the lip can pull out and could be considered non-serious unless there are other circumstances that would increase the severity, such as impairing the ability to feed, prolonged struggle while hooked that could lead to capture myopathy, or the presence of trailing gear, or other injuries. Additional factors about the injury and hooking event need to be considered before making a determination of severity (see Table 2). Given that most animals are only viewed externally during or after a fishery interaction for a brief period of time, and the external viewing may also only include a part of the body other than the mouth, it can be difficult to confirm that a hook is in the lip only. Therefore, part or most of the hook must be visible externally to consider whether an animal has been only lip-hooked. Other factors that should be considered in the confirmation process include the hook size and type, the size of the animal, the depth of the hook in the animal, and where the hook is along the mouthline (e.g., there is more external tissue toward the mouth crease than the tip of the rostrum). For cases where the hook location in the mouth cannot be determined, the injury should be assigned to criterion S5a.

S5c: *"Hook(s) in any body part, but hook(s) is removed or pulls out" – case specific*

This criterion accounts for cases where an animal is hooked and the hook is removed naturally over time or by human intervention. This injury is case specific because the location of the hook and the manner in which it is removed (i.e., pulls out cleanly vs. roughly) impacts the severity of the injury. Additional factors about the injury need to be considered before making a determination of severity (see Table 2).

S5d: *"Hook(s) in appendage or body (excluding criterion S5a), without trailing gear or with trailing gear that does not have the 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" – case specific*

A small cetacean hooked in an appendage or the body (excluding the head), without trailing gear or with trailing gear that does not have the potential to cause additional constricting wrapping, anchoring, or ingestion, is case specific. Additional factors about the injury need to be considered before making a determination of severity (see Table 2).

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" – serious injury*

A small cetacean entangled with trailing gear is considered seriously injured by Angliss and DeMaster (1998). Small cetacean experts participating in the 2007 Serious Injury Technical Workshop agreed with Angliss and DeMaster (1998) and further indicated that a small cetacean with attached gear that has the potential to entangle the animal is seriously injured because the gear may become constricting (S8a) and/or cause the animal to drown as a result of dragging gear for extended periods of time. "Potential" includes: 1) if the remaining line is longer than the animal, regardless of where the line is attached on the animal; and 2) if the remaining line is shorter than the animal, but attached in a location where the line could be ingested, wrap around a body part, or become snagged on something in the environment. Therefore, such cases are counted as serious injuries.

S7a: *"Anchored, immobilized, or entrapped and not freed" – serious injury*

An entanglement that immobilizes or significantly impairs the movement of a small cetacean is a serious injury because small cetaceans must generally eat every day and would be unable to do so if immobilized by an entanglement or entrapment. Also, a small cetacean may tire quickly as a result of its small body size, interfering with its ability to reach the surface to breath, and it may be susceptible to capture myopathy as it struggles to free itself.

S7b: *"Anchored, immobilized, entangled, or entrapped before being freed without gear attached" – case specific*

A small cetacean released without gear attached following an entanglement or immobilization is case specific. Capture myopathy considerations suggest some of these animals may subsequently die because the health of the animal may be compromised to a greater extent the longer it is immobilized by an entanglement or entrapment. Also, small cetaceans may be unable to feed while entangled or entrapped and/or have increased difficulty reaching the surface. The longer the animal is immobilized, anchored, or entrapped, the longer it may go without food or regular access to oxygen. Additional factors about the injury need to be considered before making a determination of severity (see Table 2).

S8a: *"Gear wrapped and constricting on any body part or is likely to become constricting as the animal moves or grows" – serious injury*

A small cetacean with constricting wraps of line around any body part, or line that is likely to become constricting as the animal grows or because of the animal's movement, is counted as a serious injury. This is a serious injury because the constricting wraps of gear can cause lacerations, fin amputation, organ damage, or muscle damage, and interfere with mobility, feeding, and breathing.

S8b: *"Gear wrapped and loose on any body part" – case specific*

This criterion distinguishes cases where gear was constricting or had the potential to become constricting (criteria S6 and S8a) from gear that, while wrapped on the animal, is loose and unlikely to become constricting. This injury is case specific because gear that is

loosely wrapped around a small cetacean could either work its way off the animal or remain and never become constricting nor accumulate drag (resulting in a non-serious injury), or it could become constricting (resulting in a serious injury, see criterion S8a). Therefore, additional factors about the injury need to be considered before making a determination of severity (see Table 2), such as the amount and size of the gear relative to the size of the animal.

S9: *"Body trauma not covered by any other criteria" – case specific*

This criterion incorporates general body trauma, including lacerations and other penetrating injuries (including those made from foreign objects) that do not extend to the body cavity, that is not specified in any other criteria. Body trauma is case specific because additional factors about the injury need to be considered before making a determination of severity (see Table 2), such as the location on the body (e.g., a laceration on the dorsal midline, including the peduncle, may be more serious than a laceration over the animal's ribcage; eye injuries and head trauma may be more serious than trauma to other body parts), the depth (e.g., a deep laceration or other trauma reaching the bone or penetrating muscle or organs is more serious than a superficial wound), and the cleanliness of the wound.

S10: *"Visible fractures, excluding pectoral fins (see criterion S13d for pectoral fin fractures)" – serious injury*

A visible fracture is a serious injury. Fractures that are visible can include open fractures (i.e., when a broken bone punctures the skin and exposes the wound to the open air) and closed fractures (i.e., when a broken bone does not puncture the skin), and are usually severe enough to interfere with everyday activities necessary to small cetaceans' survival such as mobility, feeding, and defense. Pectoral fins are covered separately in criterion S13d.

S11: *"Vertebral transection, including fully severed flukes" – serious injury*

An injury including vertebral transection is a serious injury because vertebral transection injuries are most commonly reported as mortalities, indicating the injury is often fatal.

S12: *"Body cavity penetration by foreign object or body cavity exposure" – serious injury*

Body cavity penetration or exposure (e.g., gunshot, puncture) is a serious injury as it can cause blood loss, seawater infiltration, damage to organs, and infections, any of which can lead to illness and death.

S13a: *"Loss or disfigurement of dorsal fin" – case specific*

The loss or disfigurement of the dorsal fin is case specific because there is evidence that small cetaceans can survive and reproduce without the dorsal fin (Wells *et al.*, 2008). Additional factors about the injury need to be considered before making a determination of severity (see Table 2), including duration of blood loss and the nature of the injury causing the loss of the dorsal fin, which will affect the likelihood of survival. Cases of bottlenose dolphins in Florida involving major disfigurement or loss of significant dorsal fin or fluke tissue show that, on average, individuals survived a minimum of 8.7 years with these wounds (Wells *et al.*, 2008). However, these observations include information

only on the survivors, and it is unknown what proportion of animals may die as a result of the loss of the dorsal fin (Wells *et al.*, 2008).

S13b: *"Partially severed flukes, transecting midline" – serious injury*
The partial severing of the flukes that transects the animal's midline is a serious injury. The reasons for this include, but are not limited to, a high risk of severing major vessels (e.g., arteries or veins) resulting in severe blood loss, and impairing an animal's ability to swim, surface, and forage. Also, this injury crosses the caudal vertebral column and exposes bone and major vessels to infection.

S13c: *"Partially severed flukes, not transecting midline" – case specific*
The partial severing of the flukes that does not transect the animal's midline is case specific. Additional factors about the injury need to be considered before making a determination of severity (see Table 2), such as the nature of the injury causing the partial severing, which will affect the likelihood of survival.

S13d: *"Partially or completely severed or fractured pectoral fin(s)" – case specific*
A partial or complete severing of the pectoral fin(s) is case specific. This criterion distinguishes fin fractures from other bone fractures (S10). Additional other factors about the injury need to be considered before making a determination of severity (see Table 2), such as the nature of the injury causing the severing of the fin(s) and the extent of fin(s) loss (i.e., full or partial) or the extent of the fracture (i.e., opened or closed), which will affect the likelihood of survival.

S14: *"Social animal released alone post-interaction and separated from its social unit" – case specific (excluding criteria S15a and S15b)*
A social animal released alone post-interaction that remains separated from its social unit may be subjected to additional stress and reduced survival (e.g., decreased foraging success, increased predation risk), and is case specific. For this criterion, an animal is considered to be released "alone" if, at the time of release, there is no indication of the presence of associated conspecifics such as a visual sighting, acoustic cue, or environmental indicator (e.g., fluke prints in water).

Several case-specific factors about the animal and the interaction need to be considered before establishing that the animal will remain separated from its social unit and making a determination as to whether such separation constitutes a serious injury (see Table 2). These include the social structure of the animal's species and whether survival may be dependent on the social unit (Sharp et al. 2016), as well as factors that may influence the animal's ability and time it may take to reunite with its social unit, as longer separations have the potential to lead to more severe effects. For the latter, factors to consider include: (1) whether the animal is from a stock that is resident, which would increase the likelihood of reuniting, (2) the size of the stock's geographic range and the animal's likely home range, with smaller ranges increasing the likelihood of reuniting, and (3) what is known about the species' acoustic communication as a means to reunite members of social units, with species that are known to use acoustic communication to locate such conspecifics (e.g., *Tursiops* spp.) more likely to reunite.

S15a: *"Dependent animal (i.e., non-weaned calf) released alone post-interaction and separated from its mother" – serious injury*

A nutritionally dependent (i.e., non-weaned calf) small cetacean released alone and separated from its mother is seriously injured because it would be subjected to significant additional stress and reduced survival. Dependency may be inferred from several factors, including the size of the animal and its behavior, among other factors, and should be informed by what is known about the life history of the species and stock. As with S14, a dependent is considered to be released "alone" if, at the time of release, there is no indication of the presence of its presumed mother such as a visual sighting, acoustic cue, or other environmental indicator (e.g., fluke prints in water). However, in contrast to S14, a dependent released alone post-interaction is assumed to remain separated from its mother (i.e., unlikely to reunite with its mother).

S15b: *"Dependent animal (i.e., non-weaned calf) left with a seriously injured or dead mother" – serious injury*

This criterion is distinct from S15a, but the same rationale applies: a nutritionally dependent animal with a seriously injured or dead mother is seriously injured because it would be subjected to significant additional stress and reduced survival. Similar to criterion S15a, dependency is determined by several factors, including, but not limited to, the size of the animal, and should be informed by what is known about the life history of the species and stock.

S16: *"Observed or reported collision with a vessel" – case specific*

Injuries to small cetaceans as a result of a collision with a vessel are not always observed after the vessel strike; therefore, the injury to that individual cannot be assessed. However, many vessel strikes are observed and reported to NMFS without information pertaining to the resulting injury. For example, NMFS receives a report that a bottlenose dolphin was struck by a vessel X feet in length and traveling Y knots, with no information on the animal after the strike. In these cases, the severity of an injury to a small cetacean from a collision with a vessel is case specific. Additional factors about the injury need to be considered before making a determination of severity (see Table 2), such as the size and speed of the vessel and the location of the injury. If injury information is available and provided to NMFS, the appropriate criteria from S1-S15 will be considered. For example, NMFS receives a report that a bottlenose dolphin was struck by a vessel X feet in length and traveling Y knots, and the animal swam away with head trauma. In this case, the determination staff would also apply criterion S9 to the injury event.

TABLE 2: Summary of Small Cetacean[9] Injury Categories and Criteria

Instructions: Each small cetacean injury event is recorded to the appropriate injury/information category using the best available information and scientific judgment, as described in the Procedural Directive. For a single injury event to which several categories apply, the injury determination with the highest level of severity is assigned. **More detailed information or extended observation on an individual case/animal may justify a determination different from this table. Any injury leading to apparent significant health decline (e.g., skin discoloration, fat and muscle loss, or musculo-skeletal deformity) is a serious injury.**

Category	Injury/Information	Injury Determination	Additional factors for evaluating whether "case specific" injuries are serious or non-serious (additional factors at end of table)*
S1	A free-swimming animal observed at a date later than its human interaction, exhibiting signs of declining health believed to be resulting from initial injury (e.g., a marked skin discoloration, fat and muscle loss, or musculo-skeletal deformity)	SI[10]	
S2	Ingested gear[11] or hook(s)	SI	
S3	Visible blood loss	Case specific[12]	Amount of blood, location of the bleeding injury, duration of bleeding
S4	Animal brought on vessel deck following entanglement/entrapment (excluding scientific research targeting marine mammals and authorized as such under a NMFS scientific research permit, where the animal is brought on and placed on the vessel deck in a controlled manner)	SI	
S5a	Hook(s) in head (excluding criterion S5b), regardless of the presence of gear	SI	
S5b	Hook(s) confirmed in lip only (i.e., external tissue outside of teeth)	Case specific	Prolonged restraint/struggle that could lead to capture myopathy, impairing ability to feed, presence of trailing gear or other injuries. Confirming a lip hooking requires that at least part of the hook is visible outside the mouth and consideration of hook size and type, animal size, depth of hooking, hook location along the mouthline
S5c	Hook(s) in any body part, but hook(s) is removed or pulls out	Case specific	Prolonged restraint/struggle that could lead to capture myopathy, depth of hooking, hook pulls out cleanly vs. causes further injury during dehooking, method used to remove hook, length of time hooked

[9] For the purposes of this table, small cetaceans include all odontocetes except sperm whales.
[10] SI = serious injury.
[11] For the purposes of this table, gear is defined as any portion of fishing gear excluding the hook, which is considered separately. Lures are considered gear. Gear also generally refers to any type of debris entangling or attached to the animal.
[12] Case specific = Could be a serious or non-serious injury, but either 1) there is insufficient information about the impact of a particular injury, or 2) additional factors must be considered on a case-by-case basis to determine the severity.

S5d	Hook(s) in appendage or body (excluding criterion S5a), without trailing gear or with trailing gear that does not have the potential[13] 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	Case specific	Prolonged restraint/struggle that could lead to capture myopathy, depth and location of hook, type and amount of gear attached
S6	Gear attached to free-swimming animal with potential[14] 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	SI	
S7a	Anchored, immobilized,[15] or entrapped[16] and not freed	SI	
S7b	Anchored, immobilized, entangled, or entrapped before being freed without gear attached	Case specific	Duration of entanglement/entrapment, prolonged restraint/struggle that could lead to capture myopathy, gear type, where/how gear is attached to animal, associated injury (i.e., where directly or indirectly caused by initial entanglement), response of individual animal, method used by human to remove gear from animal
S8a	Gear wrapped and constricting on any body part or is likely to become constricting as the animal moves or grows	SI	
S8b	Gear wrapped and loose on any body part	Case specific	Gear type, amount of gear, potential for snag, potential to lead to criterion S8a, animal body size relative to gear (e.g., because of species or age), effect on animal movement, species sensitivity (e.g., frightens easily)
S9	Body trauma[17] not covered by any other criteria	Case specific	Location of wound, depth (e.g., superficial or to the bone, penetrating muscle or organs), length, number of lacerations, cleanliness (i.e., compression vs. tearing)
S10	Visible fracture(s), excluding pectoral fins (see criterion S13d for pectoral fin fractures)	SI	

[13] For the purposes of this table, "potential" as it relates criterion S5d indicates that the trailing gear IS NOT capable of leading to any of the situations listed.

[14] For the purposes of this table, potential as it relates criterion S6 indicates that the trailing gear IS capable of leading to any of the situations listed, including: 1) if the remaining line is longer than the animal, regardless of where the line is attached and 2) if the remaining line is shorter than the animal, but attached in a location where the line could be ingested, wrap around a body part, or become snagged on something in the environment.

[15] For the purposes of this table, "immobilized" includes anchor lines, and how gear or other equipment is attached to the animal.

[16] For the purposes of this table, "entrapment" could also include human-made structures (e.g., levees, lock systems, inlets, or jetties).

[17] For the purposes of this table, "trauma" is defined as a wound or bodily harm caused by an extrinsic agent. Blunt trauma is an injury (abrasion, laceration, contusion or skeletal fracture) produced by a blunt object striking the body or impact of the body against a blunt object or surface. Sharp force trauma is an injury caused by a sharp or pointed object creating a penetrating (stab, chop or incision) wound. Laceration is defined as a ragged incision or a tearing of the skin. Lacerations are caused by blunt trauma that results in stretching, tearing, crushing, shearing, or avulsion of the tissue.

S11	Vertebral transection, including fully severed flukes	SI	
S12	Body cavity penetration[18] by foreign object or body cavity exposure	SI	
S13a	Loss or disfigurement of dorsal fin	Case specific	Cleanliness (i.e., compression vs. tearing), nature of injury causing the loss, extent of fin loss (i.e., full or partial), amount and duration of blood loss
S13b	Partially severed flukes, transecting midline	SI	
S13c	Partially severed flukes, not transecting midline	Case specific	Cleanliness (i.e., compression vs. tearing), nature of injury causing the loss, amount and duration of blood loss
S13d	Partially or completely severed or fractured pectoral fin(s)	Case specific	Cleanliness (i.e., compression vs. tearing), nature of injury causing the loss, extent of fin loss (i.e., full or partial), amount and duration of blood loss, opened or closed fracture
S14	Social animal released alone post-interaction and separated from its social unit (excluding criteria S15a and S15b)	Case specific	Species social structure and likelihood of reuniting with conspecifics (e.g., stock residency, geographic range/likely home range, acoustic communication capabilities)
S15a	Dependent animal (i.e., non-weaned calf) released alone post-interaction and separated from its mother	SI	
S15b	Dependent animal (i.e., non-weaned calf) left with a seriously injured or dead mother	SI	
S16	Observed or reported collision with vessel	Case specific	Speed of vessel, size of vessel, hull shape, part of vessel to strike the animal, size of animal compared to size of vessel, behavior of animal after collision, extent and location of wound(s) on animal

[18] For the purposes of this table, "penetration" is defined as a wound occurring when a foreign object punctures the body. Penetrating wounds can be characterized as one of three types: stab (small external wound that is greater in length into the body than is apparent on the skin surface), incised (clean cuts into the skin which are longer on the skin surface than they are deep), or chop wounds (incised wounds that penetrate deep to the bone, leaving a groove or cut in the bone).

* Factors listed in the far right column of Table 2 are unique to the associated injury type. In addition to those listed in this column, the factors that should be considered, if available, when reviewing all case specific injury events in Table 2 include, but are not limited to:

- Species
- Age or age class (e.g., calf, juvenile, adult)
- Sex
- Size of animal
- Overall health (e.g., nutritional status, body condition, pre-existing disease state, pre-existing injuries)
- Behavior during and/or after injury-causing interaction (e.g., dorsal arching, listlessness)
- Reproductive status (e.g., pregnant, lactating, has dependent calf)
- Natural history (e.g., indigenous, migratory)
- Location of injury (e.g., mouth, head, body, fin, tail, internal)
- Size of injury
- Duration of injury (e.g., single event, repeated, chronic)
- Depth of injury (e.g., superficial or to the bone, penetrating muscle or organs)
- Cleanliness of injury (e.g., compression, tearing)
- Environmental condition (e.g., individuals out of their normal habitat, climate stressors)
- Social stressors (e.g., social structure of species, separation of individuals from social unit, mother/calf separation)
- Cumulative effects of repeated exposures
- Compounding effects of multiple injuries obtained during a single event
- Availability of data on multiple sequential events involving the same individual over time
- Susceptibility of the species to capture myopathy; see Appendix II
- Ability of rehabilitated animal to be released
- Relative effect of blood loss on different species

In addition to those factors listed above, the factors that apply to all fishery or marine-debris interaction related case specific injuries include, but are not limited to:

- Entanglement type (e.g., hooked, anchored, entrapment)
- Amount and size of gear (e.g., size, length, and number of branches of line; number of buoys, traps, or anchors; volume of netting)
- Entanglement constriction (e.g., tight, loose, multiple wraps)
- Type of gear (e.g., wire, monofilament)
- Habitat where animal is located (e.g., an animal with trailing gear in areas of dense gear or an area with vegetation is more likely to risk snagging the gear and becoming anchored)
- Entanglement duration
- Existence, type, and amount of any trailing gear
- Method of handling the animal during disentanglement

IX. Serious Injury Determination Process for Pinnipeds

A. *Introduction to the Pinniped Injury Determination Process*

The process described below is intended for evaluation of injury events involving all pinniped species under NMFS jurisdiction. The injury categories and criteria and associated injury determinations for pinnipeds were derived predominantly from expert opinion and data presented at the 2007 Serious Injury Technical Workshop (Andersen *et al.*, 2008) because, unlike for large whales but similar to small cetaceans, there is limited information available on known outcomes of various injuries for pinnipeds. In some cases, additional considerations from the 1997 Serious Injury Workshop (Angliss and DeMaster, 1998), from subsequent discussions and analyses of the NMFS Determination Staff Working Group, or from multiple external experts were included (e.g., capture myopathy was identified as a common case-specific risk factor; for more detailed information on capture myopathy, see Appendix II). The resulting pinniped injury categories and criteria are detailed in subsection D and summarized in Table 3.

B. *Application of the Pinniped Injury Determination Process*

Each pinniped injury event is assigned to the appropriate category (or categories) listed in Table 3 using the best available information and scientific judgment. The criteria described in the category descriptions in subsection D below should be used to properly assign injuries to categories. However, as noted in section II, for "data rich" cases in which additional detailed information regarding the injury is available and/or the condition of the injured animal is known or can be tracked over time, the available case-specific data can be used in lieu of, or in addition to, the criteria to make the injury determination. Cases that involve deviations from the below criteria should be identified and explained in the annual injury determination report.

Single injury events that can be assigned to several specific injury categories will be recorded according to the injury category with the highest level of severity. For example, an animal that has both "gear wrapped and loose on any body part" (P8b, case specific) and "ingested gear or hook(s)" (P2, serious injury) will be recorded as seriously injured. Events that have two or more injuries that separately fit into only CBD injury categories will be assessed to determine if the combined effect of the multiple injuries compound to increase the severity of the injury event.

C. *Assessing and Documenting the Injury Status of Pinnipeds after Successful Post-Interaction Mitigation Efforts*

Pinniped injuries that are successfully mitigated may change an event's assignment from a category with a serious injury determination to a non-serious determination. Events that would have been serious injuries prior to mitigation should be tallied separately as serious injuries. These events are not counted against PBR, but are included in the recorded takes for the LOF (see section IV for more information on this process).

D. *Pinniped Injury Categories and Criteria*

P1: *"A free-swimming animal observed at a date later than its human interaction, exhibiting signs of declining health believed to be resulting from initial injury (e.g., a marked change in body condition, tissue necrosis, emaciation, or gangrene)" – serious injury*

This criterion accounts for animals that are resighted (while rare for many pinnipeds) at some time after an injury event exhibiting marked signs of health decline as a result of the injury. Therefore, the initial injury is a serious injury because it resulted in the animal's health decline.

P2: *"Ingested gear or hook(s)" – serious injury*

The ingestion of gear or hooks by a marine mammal is cited as a serious injury in multiple publications, including Andersen *et al.* (2008) and Angliss and DeMaster (1998). In addition, pinniped experts participating in the 2007 Serious Injury Technical Workshop indicated that the ingestion of gear, although not generally observed in pinnipeds, is a serious injury. Fishing gear and hooks embedded in the throat or esophagus can lead to death, especially if a hook perforates the wall of the digestive track. Pinnipeds are also known to swallow fishing lures, which has been shown to lead to mortality due to lead poisoning. Ingestion of gear or hook(s) is presumed if line is observed coming from the mouth, even if the hook/leader is not seen.

P3: *"Visible blood loss" – case specific*

An injury with visible blood loss is case specific. Blood loss indicates that the animal is "injured" (50 CFR 229.2), and observation may provide additional information to determine whether the bleeding injury is serious or non-serious. Injuries with persistent bleeding would be considered a serious injury, whereas injuries where the bleeding stops relatively quickly may not be considered a serious injury. Additional factors about the injury need to be considered before making a determination of severity (see Table 3), such as the amount of blood and the location of the bleeding injury.

P4: *"Animal brought on vessel deck following entanglement/entrapment (excluding scientific research targeting marine mammals and authorized as such under a NMFS scientific research permit, where the animal is brought on and placed on the vessel deck in a controlled manner)" – case specific*

A pinniped brought on the vessel deck following an interaction is case specific. Bringing a pinniped onboard a vessel is generally considered a non-serious injury, unless there are other factors to consider that increase the severity of the injury, such as the manner in which the animal is brought onboard (e.g., in net, over a roller, or through power block); clinical signs (e.g., increased or decreased respiration rate, foam or water being expelled from the nose or mouth, or minimally responsive) consistent with Peracute Underwater Entrapment (PUE), drowning, and capture myopathy; and the environmental conditions at the time (e.g., high temperatures). Additional factors about the injury need to be considered before making a determination of severity (see Table 3). NMFS-permitted marine mammal scientific research is not included in this criterion because the permit for the research requires a certain level of care be taken during the research not to harm the animal. In these cases, the animal is brought on and placed on the vessel in a controlled

manner, causing no harm or a significantly lower level of injury than an animal brought on board in an uncontrolled manner.

P5a: *"Hook(s) in mouth (excluding criterion P5b), regardless of the presence of gear" – serious injury*

A pinniped hooked in the mouth is considered seriously injured because of the potential for ingesting the gear and/or impairing feeding.

P5b: *"Hook(s) confirmed in head (excluding criterion P5a) or lip only (external tissue outside of teeth)" – case specific*

A hook in the head or lip only is case specific. Pinnipeds generally have less soft tissue on the head, so a hook in the head is less likely to lead to a severe injury. However, an animal hooked in the eye region would be seriously injured because hookings in this area could interfere with everyday activities necessary to pinnipeds' survival (e.g., sight). A hook in the lip is generally considered non-serious unless there are other circumstances to consider, such as whether the hook is impairing the ability to feed or the presence of trailing gear or other injuries. Additional factors about the injury need to be considered before making a determination of severity (see Table 3), such as the location on the head and the type of hook.

P5c: *"Hook(s) in any body part, but hook(s) is removed or pulls out"– case specific*

This criterion accounts for cases where an animal is hooked and the hook is removed naturally over time or by human intervention. This injury is case specific because the location of the hook and the manner in which it is removed (e.g., pulls out cleanly versus roughly) impacts the severity of the injury. Additional factors about the injury need to be considered before making a determination of severity (see Table 3).

P5d: *"Hook(s) in appendage or body (excluding criteria P5a-b and P12), without trailing gear or with trailing gear that does not have the 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" – non-serious injury*

A pinniped hooked in an appendage or the body (excluding the mouth), without trailing gear or with trailing gear that does not have the potential to cause additional constricting wrapping, anchoring, or ingestion is a non-serious injury because the resulting hookings would likely be superficial (e.g., reaching no deeper than the skin or blubber).

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" – serious injury*

A pinniped with attached gear that has the potential to entangle the animal is seriously injured because the gear may become constricting (P8a), be ingested (P2), and/or cause the animal to drown as a result of dragging gear for extended periods of time or snagging on other gear and anchoring the animal in place. "Potential" includes: 1) if the remaining line is longer than the animal, regardless of where the line is attached on the animal; and 2) if the remaining line is shorter than the animal, but attached in a location where the line could be ingested, wrap around a body part, or become snagged on something in the

environment. Therefore, such cases are counted as serious injuries.

P7a: *"Anchored or immobilized and not freed" – serious injury*

An entanglement that immobilizes or significantly impairs the movement of a pinniped is a serious injury because pinnipeds may tire quickly, interfering with their ability to reach the surface to breathe, and they may sustain injuries as a result of a struggle.

P7b: *"Anchored, immobilized, or entangled before being freed without gear attached" – case specific*

A pinniped released without gear attached following an entanglement or immobilization is case specific. Capture myopathy considerations suggest some of these animals may subsequently die because the animal's health may be compromised to a greater extent the longer it is immobilized by an entanglement. Also, pinnipeds may be unable to feed while entangled and/or have increased difficulty reaching the surface. The longer the animal is immobilized or anchored, the longer it may go without food or regular access to oxygen. Additional factors about the injury need to be considered before making a determination of severity (see Table 3).

P8a: *"Gear wrapped and constricting any body part or likely to become constricting as the animal moves or grows" – serious injury*

A pinniped with constricting wraps of line around any body part, or line that is likely to become constricting as the animal grows or because of the animal's movement, is seriously injured because the constricting wraps can cause lacerations, flipper amputation, organ damage (e.g., trachea), or muscle damage, and interfere with mobility, feeding, and breathing.

P8b: *"Gear wrapped loosely on any body part"– case specific*

This criterion distinguishes cases where gear was constricting or had the potential to become constricting (criteria P6b and P8a) from gear that, while wrapped on the animal, is loose and less likely to become constricting. This injury is case specific because gear that is loosely wrapped around a pinniped can either work its way off the animal, never becoming constricting or accumulating drag (resulting in a non-serious injury), or it can become constricting resulting in a serious injury (see criteria P6a and P8a). Therefore, additional factors about the injury need to be considered before making a determination of severity (see Table 3).

P9: *"Body trauma not covered by any other criteria" – case specific*

This criterion incorporates general body trauma, including lacerations and other penetrating injuries (including those made from foreign objects) that do not extend to the body cavity, that is not specified in any other criteria. Pinniped experts indicated that body trauma is case specific because additional factors about the injury need to be considered before making a determination of severity (see Table 3), such as the location on the body (e.g., a laceration on the dorsal midline may be more serious than a laceration over the animal's ribcage; eye injuries and head trauma may be more serious than trauma to other body parts), the depth (e.g., a deep laceration or other trauma reaching the bone or penetrating muscle or organs is more serious than a superficial

wound) and cleanliness of the wound. In addition, internal damage (e.g., fractured skull) can follow blunt trauma and be missed by external examination (Andersen *et. al,* 2008).

P10: *"Visible fracture, excluding broken appendages* (see criterion P13 for broken appendages)*" – serious injury*

A visible fracture is a serious injury because it can lead to blood loss, infection, loss of mobility, impairment of feeding, increased risk of predation, and strandings due to thrombosis. Visible fractures can include open fractures (i.e., when a broken bone punctures the skin and exposes the wound to the open air) and closed fractures (i.e., when a broken bone does not puncture the skin), and are usually severe enough to interfere with everyday activities necessary to pinnipeds' survival such as mobility, feeding, and defense. Fractures to appendages are covered separately under P13.

P11: *"Vertebral transection or fully severed flipper(s)" – serious injury*

An injury including vertebral transection is a serious injury because vertebral transection injuries are most commonly reported as mortalities, indicating the injury is often fatal. Also, the loss of a flipper can lead to high blood loss, infection, and impacts on the animal's mobility.

P12: *"Body cavity penetration by foreign object or body cavity exposure" – serious injury*

Body cavity penetration or exposure (e.g., gunshot, puncture) is a serious injury as it can cause blood loss, seawater infiltration, damage to organs, and infections, any of which can lead to illness and death.

P13: *"Partially severed or fractured flipper(s)" – case specific*

A partial severing of the flipper(s) is case specific. Pinniped experts on the NMFS Determination Staff Working Group included fractured flippers to be more comprehensive concerning injuries observed in the flippers of pinnipeds. Additional factors about the injury affecting the likelihood of survival that need to be considered before making a determination of severity (see Table 3), such as the nature of the injury causing the severing of the flipper(s) and the extent of flipper(s) loss, the extent of the fracture (i.e., opened or closed), and the impact on the animal's mobility.

P14: *"Dependent animal (i.e., non-weaned pup) immediately released alone post-interaction" or "dependent animal left with a seriously injured or dead mother" – serious injury*

A dependent (i.e., non-weaned pup) pinniped separated from its group or mother (i.e., animal is unlikely to locate its group or mother on its own) is seriously injured because a dependent animal released alone would be subjected to significant additional stress and reduced survival. Various types of harassment[19] such as displacement from land, unauthorized collection, or disturbance by pets may cause dependent animals to become prematurely separated from or abandoned by their mothers causing significant additional stress and reduced survival (i.e., serious injury).

[19] The MMPA defines harassment as, any act of pursuit, torment, or annoyance which— has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

P15: *"Observed or reported collision with a vessel or vehicle (e.g., car, train)" – case specific*

Injuries to pinnipeds as a result of a collision with a vessel are not always observed after the vessel strike; therefore, the injury to that individual cannot be assessed. However, many vessel strikes are observed and reported to NMFS without information pertaining to the resulting injury. For example, NMFS receives a report that a harbor seal was struck by a vessel X feet in length and traveling Y knots, with no information on the animal after the strike. In these cases, the severity of an injury to a pinniped from a collision with a vessel is case specific. Additional factors about the injury need to be considered before making a determination of severity (see Table 3), such as the size and speed of the vessel and location of injury. If injury information is available and provided to NMFS, the appropriate criteria from P1-P14 will be considered. For example, NMFS receives a report that a harbor seal was struck by a vessel X feet in length and traveling Y knots, and the animal swam away with head trauma. In this case, the determination staff would also apply criterion P9 to the injury event. This criterion was expanded in 2022 to also include observed or reported collisions with vehicles (e.g., cars, trains).

P16: *"Injuries resulting from observed or reported harassment, disturbance, feeding, or removal" – case specific*

During the 2022 revisions, NMFS created a new injury category encompassing injuries to non-dependent animals resulting from harassment (harassment of dependent animals that leads to maternal separation or abandonment is considered under injury category P14). Newcomb et al. (2021) outline types of harassment that may have possible impacts on marine mammal health, including human approach, physical contact, displacement from land, displacement from water, unauthorized collection, covering, feeding, canine interaction, and other unspecified harassment. They identify potential impacts as increased attentiveness, short- or long-term displacement, disruption of behaviors including resting and maternal care, disruption of mother-pup bond and abandonment of pups, injury, or mortality. Harassment itself is not an injury; only those instances of harassment that are likely to result in injury or mortality should be considered in the assessments. The severity of injury may depend on case-specific factors (see Table 3) including, but not limited to, type, duration, and severity of harassment, age of animal, seasonality (e.g., breeding, annual molt), behavioral state, and previous stressors and/or injuries.

TABLE 3: Summary of Pinniped[20] Injury Categories and Criteria

Instructions: Each pinniped injury event is recorded to the appropriate injury/information category using the best available information and scientific judgment, as described in the Procedural Directive. For a single injury event to which several categories apply, the injury determination with the highest level of severity is assigned. **More detailed information or extended observation on an individual case/animal may justify a determination different from this table. Any injury leading to apparent significant health decline (e.g., hair abnormality, fat and muscle loss, or musculo-skeletal deformity) is a serious injury.**			
Category	**Injury/Information**	**Injury Determination**	**Additional factors for evaluating whether "case specific" injuries are serious or non-serious (additional factors at end of table)***
P1	A free-swimming animal observed at a date later than its human interaction, exhibiting signs of declining health believed to be resulting from initial injury (e.g., a marked change in body condition, tissue necrosis, emaciation, gangrene)	SI[21]	
P2	Ingested gear[22] or hook(s)	SI	
P3	Visible blood loss	Case specific[23]	Amount of blood, location of the bleeding injury, duration of bleeding
P4	Animal brought on vessel deck following entanglement/entrapment (excluding scientific research targeting marine mammals and authorized as such under a NMFS scientific research permit, where the animal is brought on and placed on the vessel deck in a controlled manner)	Case specific	Manner in which animal is brought on deck, length of time animal is on deck, environmental conditions (e.g., temperature)
P5a	Hook(s) in mouth (excluding criterion P5b), regardless of the presence of gear	SI	
P5b	Hook(s) confirmed in head (excluding criterion P5a), or in lip only (external tissue outside of teeth)	Case specific	Location on head (e.g., eye), depth of penetration, hook size and type, prolonged restraint/struggle that may lead to capture myopathy, impairing ability to feed, presence of trailing gear or other injuries
P5c	Hook(s) in any body part, but hook(s) is removed or pulls out	Case specific	Prolonged restraint/struggle that could lead to capture myopathy, location of hooking on the body, depth of hook, hook pulls out cleanly vs. causes further injury during dehooking, method used to remove hook, length of time hooked

[20] For the purposes of this table, pinnipeds include all pinniped species except walrus.
[21] SI = serious injury.
[22] For the purposes of this table, gear is defined as any portion of fishing gear excluding the hook, which is considered separately. Lures are considered gear. Gear also generally refers to any type of debris entangling or attached to the animal. Ingestion of gear or hook(s) is presumed if line is observed coming from the mouth, even if the hook/leader is not seen.
[23] Case specific = Could be a serious or non-serious injury, but either 1) there is insufficient information about the impact of a particular injury, or 2) additional factors must be considered on a case-by-case basis to determine the severity.

P5d	Hook(s) in appendage or body (excluding criteria P5a-b and P12), without trailing gear or with trailing gear that does not have the potential[24] 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	NSI[25]	
P6	Gear attached in any manner to free-swimming animal with potential[26] 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	SI	
P7a	Anchored/immobilized and not freed	SI	
P7b	Anchored, immobilized, or entangled before being freed without gear attached	Case specific	Duration of entanglement, prolonged restraint/struggle that could lead to capture myopathy, type of fishing gear, where/how gear immobilized animal, associated injury (where directly or indirectly caused by initial entanglement), response of individual
P8a	Gear wrapped and constricting any body part or likely to become constricting as the animal moves or grows	SI	
P8b	Gear wrapped loosely on any body part	Case specific	Type and amount of fishing gear, animal body size relative to gear (species, age), effect on movement, species sensitivity
P9	Body trauma[27] not covered by any other criteria	Case specific	Location of trauma on body, depth (superficial or to the bone, penetrating muscle or organs), length of laceration(s), number of lacerations, cleanliness (compression vs. tearing), amount and duration of blood loss, risk of infection or disease transmission (e.g., dog bites)
P10	Visible fracture(s), excluding broken appendages (see criterion P13 for broken appendages)	SI	
P11	Vertebral transection or fully severed flipper(s)	SI	

[24] For the purposes of this table, potential as it relates to criterion P5d indicates that the trailing gear IS NOT capable of leading to any of the situations listed.

[25] NSI = non-serious injury.

[26] For the purposes of this table, potential as it relates to criterion P6 indicates that the trailing gear IS capable of leading to any of the situations listed, including: 1) if the remaining line is longer than the animal, regardless of where the line is attached and 2) if the remaining line is shorter than animal, but attached in a location where the line could be ingested, wrap around a body part, or become snagged on something in the environment.

[27] For the purposes of this table, "trauma" is defined as a wound or bodily harm caused by an extrinsic agent. Blunt trauma is an injury (abrasion, laceration, contusion or skeletal fracture) produced by a blunt object striking the body or impact of the body against a blunt object or surface. Sharp force trauma is an injury caused by a sharp or pointed object or a bullet from a gunshot creating a penetrating (stab, chop or incision) wound. Blast trauma is an injury (e.g., cerebral edema, contusion, laceration, skull fracture, blood loss) resulting from direct or indirect exposure to an explosion of any origin. Laceration is defined as a ragged incision or a tearing of the skin. Lacerations are caused by blunt trauma that results in stretching, tearing, crushing, shearing, or avulsion of the tissue.

P12	Body cavity penetration[28] by foreign object or body cavity exposure	SI	
P13	Partially severed or fractured flipper(s)	Case specific	Cleanliness (clean cut vs. tear), nature of injury causing the loss, extent of fin or flipper loss, opened or closed fracture, dislocation, amount/duration of blood loss
P14	Dependent animal (i.e., non-weaned pup) immediately released alone post-interaction or dependent animal left with a seriously injured or dead mother	SI	
P15	Observed or reported collision with vessel or vehicle (e.g., car, train)	Case specific	Speed of vessel/vehicle, size of vessel/vehicle, hull shape, part of vessel/vehicle to strike the animal (e.g., propeller, hull), size of animal compared to size of vessel/vehicle, location of strike on animal's body, extent and location of wound(s) to animal
P16	Observed or reported harassment, disturbance, feeding, or removal	Case specific	Type, duration, and severity of harassment, age of animal, seasonality (e.g., breeding, annual molt) behavioral state, previous stressors and/or injuries, etc.

* Factors listed in the far right column of Table 3 are unique to the associated injury type. In addition to those listed in this column, the factors that should be considered, if available, when reviewing all case specific injury events in Table 3 include, but are not limited to:

- Species
- Age or age class (e.g., calf, juvenile, adult)
- Sex
- Size of animal
- Overall health (e.g., nutritional status, body condition, pre-existing disease state, pre-existing injuries)
- Behavior during and/or after injury-causing interaction (e.g., listlessness)
- Reproductive status (e.g., pregnant, lactating, has dependent pup)
- Natural history (e.g., small home range, large home range)
- Location of injury (e.g., mouth, head, body, flipper, internal)
- Size of injury
- Duration of injury (e.g., single event, repeated, chronic)
- Depth of injury (e.g., superficial or to the bone, penetrating muscle or organs)
- Cleanliness of injury (e.g., compression, tearing)
- Environmental condition (e.g., individuals out of their normal habitat, environmental stressors)
- Social stressors (e.g., social structure of species, separation of individuals from social unit, mother/pup separation)
- Cumulative effects of repeated exposures
- Compounding effects of multiple injuries obtained during a single event
- Availability of data on multiple sequential events involving the same individual over time
- Susceptibility of the species to capture myopathy (some sensitive, others robust, some unknown); see Appendix II
- Ability of rehabilitated animal to be released
- Relative effect of blood loss on different species

[28] For the purposes of this table, "penetration" is defined as a wound occurring when a foreign object punctures the body, such as a bullet from a gunshot. Penetrating wounds can be characterized as one of three types: stab (small external wound that is greater in length into the body than is apparent on the skin surface), incised (clean cuts into the skin which are longer on the skin surface than they are deep), or chop wounds (incised wounds that penetrate deep to the bone, leaving a groove or cut in the bone).

In addition to those factors listed above, the factors that apply to all fishery or marine-debris interaction related case specific injuries include, but are not limited to:

- Entanglement type (e.g., hooked, anchored, entrapment)
- Amount and size of gear (e.g., size, length, and number of branch lines; number of buoys, traps, or anchors; volume of netting)
- Entanglement constriction (e.g., tight, loose, multiple wraps)
- Type of gear (e.g., wire, monofilament)
- Habitat where animal is located (e.g., an animal with trailing gear in areas of dense gear or an area with vegetation is more likely to risk snagging the gear and becoming anchored)
- Entanglement duration
- Existence, type, and amount of any trailing gear
- Method of handling the animal during disentanglement

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Appendix I: Results of Quantitative Analysis of Whale Injury Events from 2004-2008

Category	Injury/ Information	Injury Determination	Mortality/ Cases	P (x/r=0.5)	Interpretation (given alpha = 0.10)
L1	Ingested gear or hook(s)	SI	n/a	n/a	n/a
L2	Constricting wrap	SI	84/85 = 0.99	p << 0.0001	likely that rate > 0.5
L3	Loose wrap, bridled or draped gear	NSI	0/14	p << 0.0001	likely that rate < 0.5
L4	External hook	NSI	n/a	n/a	n/a
L5a	Deep laceration	SI	12/12	p = 0.0005	likely that rate > 0.5
L5b	Superficial laceration	NSI	0/9	p << 0.0001	likely that rate < 0.5
L6a	Vessel much greater in size than whale or vessel ≥65' and >10 knots	SI	5/6 = 0.83	p = 0.109	equivocal
L6b	Vessel smaller in size than whale or vessel <65' and >10 knots	Prorate: 0.20	1/5 = 0.20	p = 0.187	equivocal
L6c	Vessel any size ≤10 knots	NSI	0/6	p = 0.0156	likely that rate < 0.5
L7a	Vessel much greater in size than whale or vessel ≥65' and speed unknown	Prorate: 0.56	5/9 = 0.56	p = 0.5	equivocal
L7b	Vessel smaller in size than whale or vessel <65' and speed unknown	Prorate: 0.14	1/7 = 0.14	p = 0.063	likely that rate < 0.5
L8	Dependent	SI	n/a	n/a	n/a
L9	Brought on deck	SI	n/a	n/a	n/a
L10	Evidence of entanglement	Prorate: 0.75	85/114 = 0.75	p << 0.0001	likely that rate > 0.5
L11	Vessel strike laceration	Prorate: 0.52	13/25 = 0.52	p = 0.5	equivocal
L12	Vessel strike observed	Prorate: 0.36	12/33 = 0.36	p = 0.081	likely that rate < 0.5

Appendix II: Capture Myopathy

Capture Myopathy Background (Summarized from the Draft Report of the Workshop on the Pathogenesis of Capture Myopathy in Cetaceans, February 1-3, 2021)

Capture myopathy is a metabolic non-infectious condition that adversely affects many terrestrial animals and occasionally marine mammals during and after capture, restraint, confinement, and transportation (Breed et al. 2019). It is primarily used to describe capture-associated cardiac and skeletal muscle damage. The condition is used broadly for adverse capture events that range from peracute (shock-related) deaths, to generalized muscle-associated illness and death, to a chronic form where deaths occur days to weeks post-capture, and may even only occur months later at subsequent capture events (Spraker 1993, Paterson 2007).

The causes of the condition are multifactorial and complex (Breed et al. 2019). The mechanisms involved in causing the characteristic pathology have not been fully elucidated and are also likely multifactorial and complex. However, it appears that fear (and anxiety), an extreme stress response, and high levels of muscle activity play a central role in the cause or trigger of this condition. If the activation of the fight and flight stress response is severe, exaggerated, or protracted, it can adversely affect an animal, especially in situations where other physical stressors, like overexertion, place additional demands on the body's organs. In essence, extreme stress and over-activation of muscles overwhelms the body's ability to supply enough oxygen and nutrients to cells that are hypermetabolic (over-active and thus have a greater need for these substances). These effects cause an imbalance in "supply and demand" resulting in damage to cells and the production of excessive metabolic by-products like carbon dioxide, hydrogen ions (resulting in acidosis), oxygen free radicals, and heat. Usually, the body has the ability and systems to process/deactivate and rid itself of these by-products, but when overwhelmed, these accumulate and cause further damage to cells. Cellular damage also results in the release of substances from cells that can have further negative or toxic effects, often in other organs.

A number of factors can either predispose animals to capture myopathy or exacerbate it (Breed et al. 2019). Genetic abnormalities may play a role at both the individual and species level where they may negatively affect processes involved in metabolism of nutrients for energy and calcium-cycling in muscle cells, or the breakdown of metabolic by-products. Certain terrestrial species are more predisposed to developing this condition, as are certain "groups" within a species, i.e., very young and old animals, and sometimes males. Animals under nutritional stress (in poor condition) or those that are over-conditioned and/or unfit may also be predisposed. Deficiencies in nutrients like zinc, copper, magnesium, and selenium may also play a role. Environmental conditions, like bad terrain and extreme ambient conditions may amplify stress during capture. Capture drugs can either exacerbate or predispose animals, especially those that decrease blood oxygenation and tissue perfusion. Pre-existing diseases, like those causing anemia may also play a role. Other important factors include overexertion, excessive and poor handling, transportation, and poor

capture techniques that amplify the stress response. Severe capture (stress)-induced hyperthermia, which occurs when captures are done poorly, can amplify tissue damage through heat cytotoxicity and cause increased oxygen and nutrient requirements.

Capture Myopathy in Marine Mammals

In marine mammals, capture myopathy has mainly been documented in live-stranded cetaceans (Herráez et al. 2007, Cowan and Curry 2008, Herráez et al. 2013, Díaz-Delgado et al. 2018, Camara et al. 2019), although a recent case was described in a vaquita during capture health assessments (Rojas-Bracho et al. 2019). Stranded cetaceans with capture myopathy usually presented at necropsy with acute degenerative skeletal muscle, and heart and kidney lesions with myoglobinuria (Herráez et al. 2013, Sierra et al. 2017, Camara et al. 2019). Capture myopathy has rarely been reported in pinnipeds and when documented has been seen during capture release operations (Spraker and Lander 2010, Seguel et al. 2014).

Clinical signs of capture myopathy in cetaceans generally require a hands-on examination for diagnosis and taking of blood samples. However, a few external physical signs may be indicative of stress that could lead to capture myopathy, including but not limited to: agitation, arching, erratic swimming, uncoordinated movements (ataxia), increased or decreased respiration rate, and foam from the blowhole.

Similar to terrestrial species (Breed et al. 2019), certain cetacean species may be more predisposed to developing capture myopathy (e.g., porpoises, striped or spotted dolphins) but a definitive list is not currently available of which species are most susceptible. Potential risk factors in cetaceans that could lead to the development of capture myopathy in certain individuals are:

Intrinsic Risk Factors

- Species-specific behaviors (single vs gregarious; prey or predator; size and dive capabilities)
- Age (young and old)
- Body condition (fat and thin)
- Pre-existing health conditions or underlying disease or deficiencies
- Genetics (omics)
- Habituation (possibly protective)
- Sex
- Inshore vs Offshore species (shallow vs deep)
- Reproductive condition
- Seasonal physiologic changes (migration; thermal; feeding/fasting)

Extrinsic Risk Factors

- Duration of entanglement, including extent of submergence, or stranding prior to intervention
- Stranded on land vs in shallow water

- Duration and degree of immobilization
- Type of handling procedures/excessive handling
- Chase duration and characteristics (no breaks)
- Recent capture/chase attempts (attempts over subsequent days may increase risk)
- Extreme conditions (hot or cold weather)
- Cumulative threat exposure

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