Live and Dead Large Whale Emergency Response Best Practices

Statement of Inclusivity

The Best Practices principles and guidelines outlined in this document are primarily meant for use by authorized and trained responders and managers, as well as, members of federal and state agencies, NGOs, researchers, industries (fisheries, tour), and others from the on-water and coastal communities that might provide authorized large whale stranding response support under NOAA's MMHSRP. The MMHSRP is committed to building a safe and inclusive environment in which we leverage diversity (including, but not limited to, the representation of all ages, races, national, cultural, religious, and socio-economic backgrounds, genders, gender identities, sexual orientations, and physical and mental abilities) to achieve our mission goals and objectives, and maximize the potential of the U.S. Marine Mammal Stranding Response Network as a whole for the conservation of marine mammals. The MMHSRP values the unique capabilities, experiences, and perspectives of all our partners, and nothing should preclude people from becoming involved in the U.S Marine Mammal Stranding Response Network to the best of their abilities. Diversity, equity, and inclusion improves creativity, productivity, and the vitality of the marine mammal community in which the MMHSRP engages.

Table of Contents

1. Introduction

1.1. Background

The National Marine Fisheries Service's (NMFS) Large Whale Emergency Response Best Practices was developed to standardize procedures and roles to enhance large whale stranding response for both live and dead whales through improved coordination and communication.

For the purpose of this Best Practice, large whales include the following federally protected species:

Endangered Species

Mysticetes:
North Atlantic right whales (*Eubalaena glacialis*)
North Pacific right whales (*Eubalaena japonica*)
Fin whales (*Balaenoptera physalus*)
Sei whales (*Balaenoptera borealis*)
Blue whales (*Balaenoptera musculus*)
Bowhead whales (*Balaena mysticetus*)
Rice's whales (*Balaenoptera ricei*)
Western North Pacific Gray whales (*Eschrichtius robustus*)
Central American Humpback DPS (*Megaptera novaeangliae*)
Western North Pacific Humpback DPS (*Megaptera novaeangliae*)

Odontocetes:
Sperm whales (*Physeter macrocephalus*)
Southern Resident Killer whales (*Orcinus orca*)

Protected Species
Humpback whales (*Megaptera novaeangliae*)
Bryde's whale (*Balaenoptera brydei*)
Eastern North Pacific Gray whales (*Eschrichtius robustus*)
Minke whales (*Balaenoptera acutorostrata*)

This document also applies to any extra-limital mysticetes (*e.g.*, those that do not routinely occur in the U.S. waters, such as the Southern right whale (*Eubalaena australis*) or the Antarctic minke whale (*Balaenoptera bonaerensis*) if they are found in U.S. waters.

Additionally, much of the information found in this Best Practice is applicable or can be scaled when responding to larger odontocetes (*e.g.*, beaked whales). Additional guidance for these species may also be found in the Small Cetacean Intervention and the Cetacean Mass Stranding Response Best Practice documents.

This Best Practice was developed to guide the response to an emergency involving one or more of these whales in the waters and on the shores of the United States. Such emergencies for live whales include:

- Out of habitat events - where large whales are observed far from their typical habitat. This could include animals in freshwater rivers or bays, or an extra-limital "wanderer" such as a gray whale observed in the Atlantic
- Observed at sea significantly injured or moribund
- Entangled and free-swimming or anchored
- Stranded alive in the surf zone or on land or ice

Such emergencies for dead animals include:

- Floating carcasses
- Stranded dead in the surf zone, on land, or ice

1.2. Authorities

There are two key pieces of legislation that govern interactions with marine mammals in the United States. These are:

1.2.1. *The Marine Mammal Protection Act (MMPA)*

The MMPA, signed into law in 1972, prohibits the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, which includes harassing or disturbing these animals, as well as actual harming or killing, unless such take is specifically exempted in the statute or authorized. The MMPA divides responsibility for marine mammal species between the Secretary of Commerce (overseeing NOAA and the NMFS) for cetaceans and pinnipeds with the exception of walrus, and the Secretary of the Interior (overseeing the United States Fish and Wildlife Service (USFWS)) for walrus, polar bear, sea otter, and manatee. Title IV of the MMPA establishes the Marine Mammal Health and Stranding Response Program (MMHSRP) under the leadership of the Department of Commerce and NMFS in consultation with the Department of Interior and Marine Mammal Commission.

1.2.2. *The Endangered Species Act (ESA)*

> The ESA, enacted in 1973, provides for the conservation of species that are listed as endangered (in danger of extinction) or threatened (at risk of becoming endangered in the foreseeable future). The ESA also contains a prohibition on "take" including harassment and disturbance as well as injuring and killing.

Marine mammal stranding responders thus need to be authorized to respond under both of these statutes. The Marine Mammal Stranding Network (Stranding Network) consists of approximately 100 organizations that have applied for and received an authorization, called a Stranding Agreement (SA).

The SA is issued under Section 112(c) of the MMPA, and allows the take of marine mammals that are stranded. Organizations may receive authorization for the take of dead animals, live animal first response and triage, and/or rehabilitation; additionally, authorization may be different depending upon species or taxa (*e.g.*, cetaceans vs. pinnipeds). Additionally, State, local, Federal, and tribal government employees, when acting in the course of their duties, may take marine mammals for the protection and welfare of the animal or the protection of public health and welfare under Section 109(h) (with or without a SA in place).

For marine mammals listed under the ESA (which includes most of the species of large whales), authorization for take is provided under a scientific research and enhancement permit issued to the NOAA MMHSRP. Response to strandings involving a threatened or endangered marine mammal requires authorization and direction from the MMPA/ESA permit Principal Investigator (*i.e.,* the MMHSRP coordinator) or a Co-Investigator (*e.g.*, Regional Stranding Coordinators (RSC), MMHSRP Headquarters (HQ) staff, etc.). Existing relationships with authorized Stranding Network partners are used to delegate authority under the permit for endangered species response activities, provided activities are done in coordination with NMFS.

1.3. Purposes and Intended Uses

These best practices have been developed to serve as guidance and recommendations. This document is not intended for independent use as a training manual, and does not by itself qualify the reader for any actions or authorizations. These best practices balance the need for standardized procedures while allowing flexibility to address specific needs of different situations for diverse species and habitats, as well as unforeseen circumstances. In some situations, responders may choose a course of action not outlined in these documents, but consultation with NMFS is encouraged if the course of action will vary greatly from the best practices outlined in this document. These best practices are a "living document," and as such, we plan to periodically review and update them as new information becomes available. Responders should

never stop striving for innovative and new methods and training to increase safety and success, and nothing in these best practices should prevent or limit advances in technology, techniques, and training.

2. Roles and Responsibilities

2.1. Incident Command System Overview

The Incident Command System (ICS) is one of the most important best practices to be incorporated into marine mammal stranding response including strandings, entanglements, oil spills (refer to Cetacean and Pinniped Oil Spill Response Guidelines), and injured or ill free swimming individuals. An ICS, as adopted and defined by the National Response Team, is "a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries" (NRT 1996). The ICS will allow for flexibility on scene, a clear chain of command, and consistency when working with other response organizations and other federal, state, local or tribal agencies.

The ICS has proven to be an effective way to manage emergency response efforts, particularly those where there are capacity needs that require including individuals from multiple response organizations such as those required by most large whale emergency responses. The overall flexibility allows for the incorporation of certain roles and processes currently used during the response, while providing a common vocabulary and operating picture for all of the potential responders. A large whale response typically grows from a small, localized approach with a single organization and then is often expanded to fit the level necessary for a specific large whale incident. A tiered level approach for large whale events has been developed to help identify the type of ICS structure that may be needed to effectively respond to an event (Table 1). Developing a full ICS structure takes time and should ideally be developed prior to an event, used in training (drills), and used in a progressive manner during an event, as the situation evolves. The size and focus of the ICS is dependent on the magnitude of the incident, and can be expanded or contracted as necessary. Only the positions that are required for an adequate response need to be filled and one person can often fill more than one position. Organization levels (*e.g.*, section chiefs, coordinators) should be kept as small as possible to accomplish ICS objectives and maximize effectiveness.

Table 1. Tiered approach to ICS for large whale stranding events

	TIER I	TIER II	TIER III
Type of Event (Examples)	Single whale stranding, other than a right whale	Right whale calf; large whale associated with an UME; entangled or vessel struck dead large whale; live large whale out of habitat response; live or dead whale stranding in protected area	Adult or sub-adult right whale or other ESA species; multiple whales of any species on beach or out of habitat; strandings during natural or anthropogenic disaster
Number of Organizations Involved	2 or fewer, or organizations that typically work together (*e.g.*, local Network, harbormaster, and local Law Enforcement)	1-2+ Network organizations, with likely involvement of a Law Enforcement agency or other Federal partner (*e.g.*, National Marine Sanctuary, National Park, United States Coast Guard).	2+ Network organizations, Law Enforcement, United States Coast Guard, National Park, National Marine Sanctuary, etc.
ICS Organizational Level	Minimum	ICS structure expanded, not to full scale	Full scale ICS-Unified Command

ICS will be used to provide the on-scene management structure that guides response efforts, and typically consists of at minimum these four functions:

Planning section: responsible for developing a plan to accomplish response objectives, including collection and evaluation of information, tracking resources, and documenting response effort; accomplished through the completion of Incident Action Plans (IAPs) (see example in Appendix A), which project plans and resources needed for the next operational period.

Operations section: conducts tactical operations to carry out an action plan; directs resources.

Logistics section: provides the resources, support and services to meet plan needs.

Financial section: monitors costs related to the incident.

2.2. Large Whale Response Structure and Roles

2.2.1. *Unified Command*

The ICS structure may expand to become a Unified Command (UC) in cases in which the response impacts the jurisdictional or functional responsibility of more than one agency. To be a member of the UC, an agency (federal, state, local, tribal) must have the authority and jurisdiction to respond to the event. As a component of the ICS, the UC is a structure that brings together decision-makers from the major organizations that have responsibility for the incident to coordinate a more safe and effective response within their own jurisdictional missions. The UC is then responsible for the overall management of the incident and provides a forum for consensus decision making regarding the incident. It establishes incident

strategies and objectives so that all agencies can function as a team and melds resources and responders for an effective operation.

The makeup of the UC may change as an incident progresses. The composition of the UC will be determined on a case-by-case basis. It must be noted that participation in the UC occurs without any agency abdicating authority, responsibility, or accountability. Specifically for responses conducted under the MMHSRP MMPA/ESA Permit, MMHSRP HQ staff must be part of the UC. The UC may include:

- United States Coast Guard (USCG), if involved
- NMFS National Marine Mammal Stranding Response Coordinator or Veterinary Medical Officer
- NMFS Regional Stranding Coordinator (RSC)
- NMFS Regional Entanglement Coordinator, if applicable
- State Stranding Coordinator, if applicable
- Local Stranding Network responder
- Necropsy Team Leader (NTL)

The necessity for a UC increases when multiple agencies are involved or the incident becomes more complex. There are many advantages to implementing a UC, such as: single set of objectives, collective strategy approach, increased communication, performance optimization, and cost effectiveness.

2.2.2. *Command Staff*

The Safety Officer (SO), the Public Information Officer (PIO), and the Liaison Officer are part of what is known as the Command Staff; they support the UC and report to the Incident Commander (IC). The Safety Officer is a single person with responsibility for monitoring on-scene safety conditions (including weather conditions) and developing measures to ensure the safety of all assigned personnel. The Public Information Officer is a single person who has responsibility for all interaction between Command and the media and who coordinates the release of information on the incident situation and response efforts from Command to the media. The Liaison Officer acts as the on-scene contact point for representatives of assisting agencies assigned to the incident. In a large response, each of these positions would have a dedicated person, which could be someone from the Stranding Network, a NMFS employee, or another agency representative. In a smaller response, some or all of these positions may be filled by the IC or combined with other roles – the crucial aspect is that these positions are intended to reduce confusion by creating a single point of contact for each of these functions.

2.2.3. *Planning Staff*

The Planning Staff includes the Planning Section Chief who supports the organizational framework for the stranding event and ensures things are running smoothly. Other positions in this include the Documentation Officer and the Personnel Unit Leader. The Documentation Officer is responsible for compiling/tracking all the paper and digital documentation of the incident, including, but not limited to, photographs, sample checklists, necropsy notes, and data sheets. The Personnel Unit Leader oversees and is responsible for all personnel on-scene, making sure people are accounted for, fed, and housed (includes check-in and check-out of personnel on scene). In a smaller response, some or all of these positions may be filled by the IC or combined with other roles – the crucial aspect is that these positions are intended to reduce confusion by creating a single point of contact for each of these functions.

2.2.4. *Operations Staff*

The Operations Section Chief (OPS) oversees all the incident tactical operations and on-site activities, including air and vessel activities, equipment use, and resources in daily operations. Typically, during smaller large whale responses the OPS role can be combined with the IC role. However, for larger more complex events the OPS and IC roles will be different people. Actual operations and specific roles needed will vary depending upon if the response is for a live or dead whale. Specifically for large whale necropsies, Operations Staff can include the OPS, Necropsy Team Lead (NTL), and Technical Specialists (*e.g.,* Taggers, Vessel Operators, Cutters, Sample Coordinator, Photographer, and Data Recorder). The NTL is NMFS approved and responsible for all aspects of the necropsy including: conducting and assigning tasks during the necropsy; ensuring NMFS necropsy protocols are followed; sample collection; gear collection; photo-documentation; writing the draft and final gross necropsy report (and reviewing the case report for right whales); and sample dissemination and tracking, including following chain of custody procedures, if applicable. NTLs that regularly necropsy ESA large whales will also be Co-Investigators (CI) under the NMFS MMHSRP MMPA/ESA Permit. Technical Specialists report to the NTL and are people with specialized skills or knowledge (*i.e.,* trained biologists, veterinarians or pathologists). These Specialist roles can include the Cutter(s) who assists the NTL and is responsible for examining the carcass and organs, collecting samples, and dismembering the carcass; Sample Coordinator who is responsible for sample tracking and recording during the event; the Photographer who is responsible for taking photographs of the carcass, lesions, unusual markings, or injuries for the veterinary assessment team; and the Data Recorder is responsible for recording all information related to gross observations noted during the necropsy, morphometrics, and filling out any associated datasheets. Depending on the specifics of the response there may be other Operations Branches needed to oversee operational activities such as Air Support (aerial survey/animal relocation), Vessel Support (vessel survey/animal relocation), Telemetry, Hazing, Towing, Carcass Disposal, Veterinary Support, etc. More details on specific operational needs for specific response types are listed in subsequent sections (*i.e.,* Sections 4 and 5).

2.2.5. *Administration Staff (Logistics and Finance)*

The Logistics Staff consists of the Logistics Section Chief (LOG) who directs and coordinates the logistics on-site and identifies equipment needs, including air and vessel support and heavy equipment. The LOG works with county, state, and private entities to obtain the necessary logistical resources for towing, landing, necropsy, and disposal of a large whale. Ideally, many of these resources will have been identified prior to a response. The LOG may also end up taking on the role of the Planning Section Chief. The Logistics Section can also include the Equipment and Resource Coordinator (may be located off-site) who makes arrangements to ship or move equipment to the site and reports to the LOG and the Vessel Coordinator (may be located off-site) who is responsible for identifying and coordinating vessel support to tow whales into shore or for tagging carcasses.

The Finance Staff includes the Finance Section Chief who is responsible for tracking expenses needed for recovery, necropsy, and disposal operations, including vessel support, air support, and specialized equipment. Depending on the event there may also be a Procurement Officer, who is responsible for setting up contracts and processing invoices related to vessel support, air support, and other resources used during the event.

2.3. Equipment and Supplies

Each type of response (live-out of habitat, live-at sea: seriously injured, live-entangled, live-stranded: in surf or high and dry, dead-at sea: floating, dead-stranded: in surf or high and dry) requires specific equipment. Table 2 below summarizes general equipment used for the various types of responses. To view an example of a large whale supportive care equipment list, refer to Appendix B.

Table 2: General equipment used for different response scenarios. “X” indicates likely to be useful if feasible for the scenario.

General Equipment	Examples of Specific Equipment	Live - Out of Habitat	Live - At Sea (Seriously Injured or in need of apparent medical attention)	Live - Entangled	Live - Stranded (in Surf or High and Dry)	Dead - At Sea (Floating)	Dead - Stranded (in Surf or High and Dry)
Communications	Marine radio, cell phone, satellite phone	X	X	X	X	X	X
Data Collection Supplies	Datasheet forms, clipboards, pencils, electronic, notebooks, platforms, or data sheets	X	X	X	X	X	X

General Equipment	Examples of Specific Equipment	Live - Out of Habitat	Live - At Sea (Seriously Injured or in need of apparent medical attention)	Live - Entangled	Live - Stranded (in Surf or High and Dry)	Dead - At Sea (Floating)	Dead - Stranded (in Surf or High and Dry)
Safety equipment/Personal Protective Equipment and clothing	Coveralls, raingear, helmets/hard hats, life vests, non-permeable gloves, knee pads, eye wear, footwear, sunscreen, ID vests or clothing, throwbags, public health related requirements such as occurred during the SARS-CoV-2 pandemic or other zoonotic diseases	X	X	X	X	X	X
Medical equipment for humans	First aid kit, AED	X	X	X	X	X	X
Medical equipment for animals	Wound care kit, blood collection, ballistics, euthanasia solutions, sedation drugs, sharps container	X	X	X	X		
Sampling and tagging equipment	Measuring kit (tape measurer, calipers, rulers), photoscales/cards, tagging kit (suction cup tags, satellite tags, carcass tag, blood collection tag, tagging equipment), marking kit (paint stick), breath and fecal sampling supplies, remote biopsy supplies, subsampling containers, storage devices which may include coolers, liquid nitrogen	X	X	X	X	X	
Capture/Restraint/Towing/Anchoring/Securing equipment	Ropes, nylon straps, chains, buoys, anchors, marking supplies	X	X	X	X	X	
Vehicles	Response vehicles	X	X	X	X	X	
Vessels	Kayak, motor boat	X	X	X	X	X	
Local sedation or other chemical administration equipment	Needle and syringe, pole syringe (also sedation medications and reversals)	X	X	X	X		
Remote sedation or other chemical administration equipment	Dart projector, darts (also sedation medications and reversals)	X	X	X	X		

General Equipment	Examples of Specific Equipment	Live - Out of Habitat	Live - At Sea (Seriously Injured or in need of apparent medical attention)	Live - Entangled	Live - Stranded (in Surf or High and Dry)	Dead - At Sea (Floating)	Dead - Stranded (in Surf or High and Dry)
Documentation and Recording equipment	Cameras, GoPro, SD cards, hydrophones, playback equipment, drone with photogrammetry, still photography, or videography	X	X	X	X	X	X
Cleaning/sterilization/ disinfecting supplies	Dawn, hand sanitizer, disinfectant solution, scrub brushes, garbage bags, buckets	X	X	X	X	X	X
Entanglement response equipment	Knives, hooked pole knife, large buoys, telemetry buoy, ropes, helmets			X			
Heavy equipment	Cranes, front-end loaders, bulldozers, excavator, boat-lift, flat-bed tow truck, dump truck (also straps, chains, and line)				X	X	X
Necropsy equipment	Knife sharpeners, 6-12" knives, meat hooks, forceps, ball shears, bow saw, sharpies, Tyvek bags, plastic cutting boards, formalin, 95% alcohol, needles, plastic syringes, histology cassettes, buckets, sharps container					X	X

2.4. Personnel

2.4.1. *Categories of Personnel*

Similar to the different classifications of response organizations, there are different levels of personnel or resource teams that can be involved in a response – each of which has different requirements for skills, training, knowledge, abilities and responsibilities. These classifications roughly break down into the following Table 3:

Table 3: Classifications of levels of personnel or resource teams.

Personnel Classification	Role
Branch Director	Assigned to the upper manager for each of the key response functions during a response, and likely involves multiple agencies. This can include the Animal Response Branch (staffed by NOAA and Stranding or Entanglement Network Members), the Shore-side Security Branch (law enforcement agencies), the Waterside Safety Branch (USCG or local marine patrol), Air Operations (variable depending on the agencies involved) and/or any other broad category where multiple organized functions (each with a supervisor) fall under it. This position is responsible for developing the vision and direction of the Branch, collating information from Group Supervisors to move to the Section Chief and ultimately Incident Commander while projecting operational needs into the next period.
Group Supervisor	Assigned to the lead staff member with a specific function and multiple personnel under him/her. Established to divide the incident management structure into functional areas of operation. This can include manned and unmanned air operations, animal observation/documentation, sample collection, and other discrete functions, depending on the response scenario. This position is responsible for enacting all protocols and procedures for the group (and suggesting/implementing adjustments when necessary), and collating information from each area for reporting to the Group Supervisor.
Divisions	When the geographic scope of the response is large, Operations may be broken into geographically focused Divisions. For Example, if a response may cross state lines, there may be two divisions, one for each state. Each is led by a Division Supervisor and reports to the Branch Director.
Task Forces or Resource Teams	Units of personnel, each with a Leader, within the response to support an operational need. Can report to the Group Supervisor or directly to the Branch Director.
Technical Specialists	Key personnel with specialized training and experience that fills individual roles within the response. This can include deterrence, large whale euthanasia, or other key elements that may or may not be necessary within each response scenario. Veterinarians with marine mammal experience may also be considered technical specialists within any of the Groups, Task Forces, or Areas.

2.4.2. *Training*

Depending on the role that the individual will be filling, different levels of training (both required and recommended) will be necessary. Some training requirements will directly relate to the tasks that the person will fill, including those directed at mastering specific marine mammal rescue and rehabilitation tasks. Others are mandated to ensure the safe accomplishment of activities, such as recognizing and minimizing the risk of injuries and physical hazards associated with a live or dead whale response operation. Basic training on the fundamentals of ICS should be required of all personnel, as these courses are free and available online, and a baseline understanding of the principles and tenets will help everyone that is part of a response.

ICS 100 is available here: https://training.fema.gov/is/courseoverview.aspx?code=IS-100.c; ICS 200 is available here: https://training.fema.gov/is/courseoverview.aspx?code=IS-200.c

Minimum standards and qualifications may be established for particular roles (refer to Sections 4.1.2, 4.2.2, 4.3.2, 4.4.2, 5.1.2, and 5.2.2). Responders may be required to hold other required authorizations or licenses (*e.g.*, driver's license for transport, captain's license for vessel operation, FAA authorization for unmanned aerial system (UAS) use). However, respondents should be trained in first aid, cardiopulmonary resuscitation (CPR), boat safety, and/or live animal handling, if responding to live animals. It is important to emphasize during training and events, that **human safety comes first**.

3. Communication

3.1. Outreach and Social Media for Audiences

3.1.1. *Public*

The PIO is a single person who has responsibility for all interaction between Command and the media (including social media) and who coordinates the release of information on the incident situation and response efforts from Command to the media and public. The public has a range of perspectives during live or dead large whale responses. It is important to be prepared on how to communicate the situation and that information given is consistent. There should always be at least one primary designated spokesperson when dealing with the public and this person should be in contact with the PIO so messaging is consistent. In some larger events there may be spokespersons from multiple agencies or Stranding Network facilities; to maintain a consistent message they should all be in contact with the PIO or a Joint Information Center (JIC) should be established. Distributing informational brochures or Q&As (example Q&A in Appendix G) to the public on site or electronically can be helpful for consistent messaging and awareness. This literature should contain basic information on the regional stranding network, a fact sheet on the species that has stranded, a questionnaire for recruitment, guidelines on appropriate conduct and health and safety measures, and stranding network contact numbers. It should also outline the range of actions possible with stranded animals, from immediate release to euthanasia (Geraci *et al.* 2005).

3.1.2. *Media*

Press releases to social media (*e.g.,* Twitter, Facebook, etc.) can be a great way to inform and engage the public. The key is to provide accurate information and emphasize the message you are trying to get across. The PIO serves as the coordinator for all media - traditional and social. A Media Team with representatives from many or all of the participating partner agencies can help manage and be responsible for dealing with media inquiries during an event. This Coordinator/Team can take initiative to contact the press, post updates on social media accounts, and create and drive the media strategy for providing consistent information and coverage during an event.

The IC must coordinate with the MMHSRP, RSC, and the NMFS National and Regional Office of Communications concerning media contacts relating to all events conducted under the MMHSRP MMPA/ESA Permit and other high-profile large whale response events, as necessary. Media interview requests should be coordinated through the PIO or JIC, who will work with the NOAA Office of Communications Public Affairs Specialist. NOAA Office of Communications Public Affairs can assist with news media, such as news releases, news conferences, and media interviews. All media interviews should be considered "on the record."

3.1.3. *Elected Officials*

It is important to make sure elected officials at all levels (*e.g.*, mayors, council representatives, state representatives, etc.) are communicated with when there is a large whale event within their jurisdiction. If possible, the officials or their representatives should be made aware of any developments or changes prior to the public, and may have a voice in decision-making. Elected officials and their offices can be an asset to helping meet needs of the event on a management level by using connections to help identify or escalate resources for the response. Some examples might include identification of resources to provide crowd control at a beach site, or assist with expediting approvals needed to land a whale carcass on a particular beach for examination.

3.1.4. *Agencies*

For each response situation, there should always be a communication plan in place. This plan is helpful to have developed and in place ahead of the emergency need with an appropriate communication tree and updated contacts (both weekday and weekend/holiday contacts). Similarly, to elected officials, the inclusion of particular agencies will depend on the situation and the geographic location. It may include Federal agencies (*e.g.*, Army Corps of Engineers, other Department of Defense Agencies, the USCG, USFWS, National Parks Service, etc.), state agencies (*e.g.*, State wildlife or environmental departments, state park agencies, etc.), and other county, town, or local agencies. There are times when, for example, USCG is needed to help regulate or secure an area around a floating whale at sea, or a state wildlife agency is needed to help verify the location or condition of a carcass, and it is important to know and be able to call the appropriate manager of those resources to get assistance. It is recommended that both NMFS (RSC) and Stranding Network responders have good working relationships with these agencies.

An additional subset of Agencies is law enforcement agencies that can assist with crowd control of a scene. This can frequently be NMFS Office of Law Enforcement, but often through Joint Enforcement Agreements, or the needs of a particular situation, this role may be filled by others (*e.g.*, county sheriff, state or local police, state game wardens, etc.).

3.1.5. *Stranding Network*

It is important to communicate with all Stranding Network members in the geographic locality when an event is first reported. While primary responsibility will typically default to the appropriate response organization that is geographically situated where the event is happening, nearby response stranding network members may be able to supply more personnel, equipment, experience in particular situations, etc. In some cases, NMFS will request or require that a NTL CI be in charge of the response especially for ESA responses, and this individual may be from outside the immediate geographic area. It is also helpful to let all nearby response organizations know about the event as soon as possible in case they are also receiving calls about the same situation. Being able to collaborate quickly and effectively saves time and decreases duplicate work so that an event and its needs can be responded to in a timely manner.

3.1.6. *Research Community (e.g., Photo-ID, taggers, etc.)*

During large whale response events, there will likely be a need for experienced researchers for specific needs. If possible, prior to the event a standard list of research needs will be developed, which can be modified depending upon the species involved. Communicating with these individuals at the start of a response will help make sure the right plan is in place. For example, an early priority may be to see if there is any life history information available on the subject animal, including age, previous sighting history, etc. Early communication with researchers that maintain catalogs of individuals of the specific whale species will help ensure that the appropriate images (*e.g.*, body parts and angles) are collected and matching attempted as soon as possible. Additionally, certain researchers may have expertise in the collection of specific sample types or have a particular protocol that needs to be followed. This requires notice as early as possible to accommodate logistics and speed during a large whale response. Having a list of experts and/or talking with your RSC to help coordinate with experienced researchers for the species and location will result in a more efficient response. However, the response should not be delayed for specific research requests and NMFS can help with prioritizing requests.

3.2. Feedback mechanism to provide data and information to resource managers (*e.g.*, Stock Assessment Reports (SARs), Take Reduction Teams (TRTs), Recovery Teams, etc.)

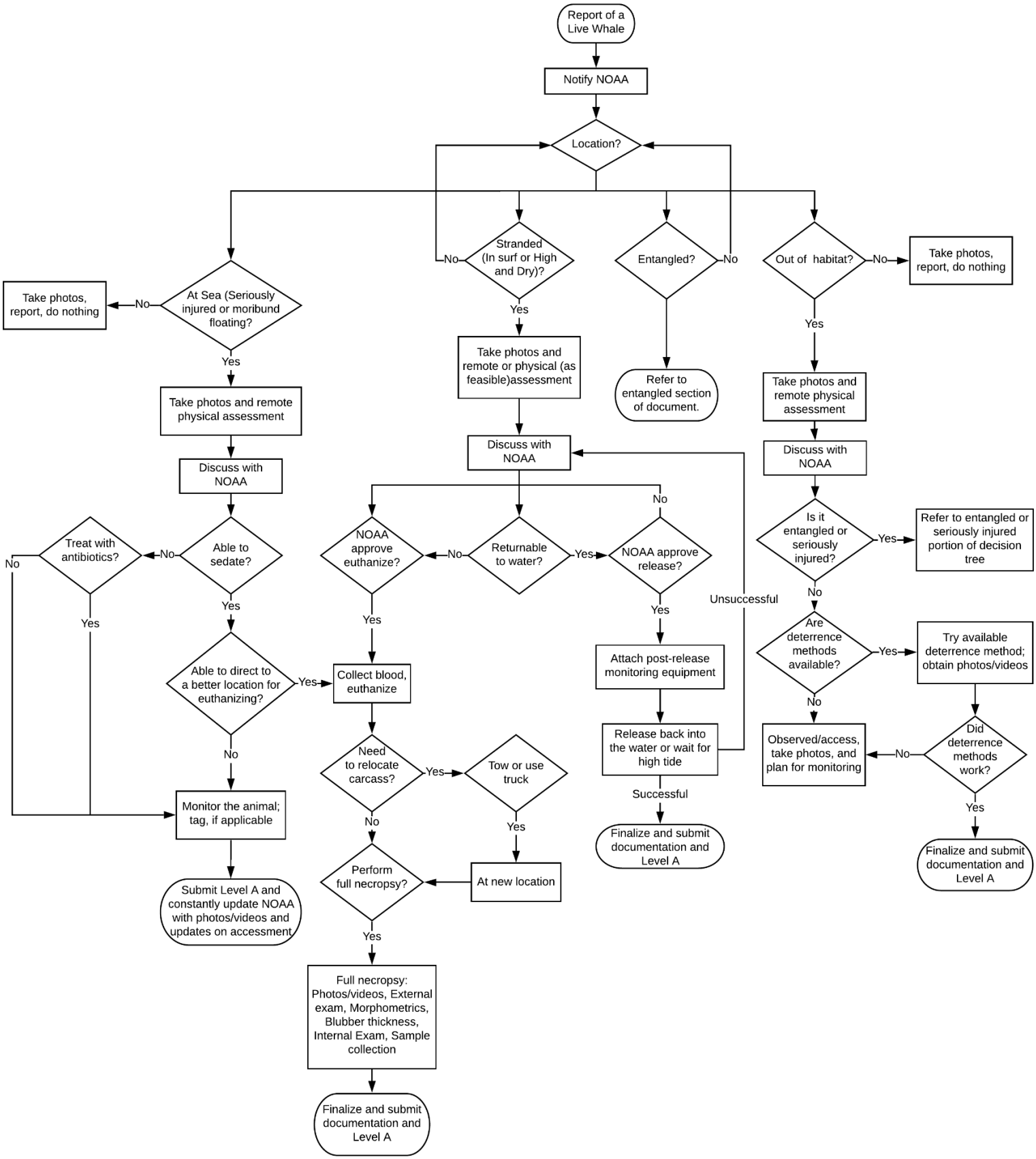
It is the responsibility of the RSC to collate and relay information about the event to the resource managers. The RSC, or another individual specifically assigned to this task, is responsible for coordinating reporting to applicable and relevant teams (*e.g.*, SARs, TRTs, Recovery Teams, Working Group on Marine Mammal Unusual Mortality Events, etc.) during responses as well as providing a designated area for event information/data (*e.g.*, Google Drive folder). To have a central location for data allows the resource managers to share and view the same information. This allows for consistent messaging and availability of

full data evaluation of the event.

4. Live Large Whale Emergency Response Medical and Physical Interventions

Logistical planning begins with the first report of live large whale stranding. Plans need to be made that take into account available resources, logistics of the stranding location (*e.g.*, accessibility, protected/sensitive habitats such as seagrass and corals that should be avoided, etc.), transport (if applicable), necropsy, palliative care, sampling, disposal, resources (*e.g.*, heavy equipment and experience of team members), and handling the media.

The decision tree below encompasses the overall process of different responses for live large whale events. It is impossible to articulate every scenario, thus the individual sections below will provide a basic understanding of principles and actions involved in a successful response for those live scenarios.


Report of a Live Whale
Notify NOAA
Location?
At Sea (Seriously injured or moribund floating?
No
Take photos, report, do nothing
Yes
Take photos and remote physical assessment
Discuss with NOAA
Able to sedate?
No
Treat with antibiotics?
No
Yes
Yes
Able to direct to a better location for euthanizing?
Yes
No
Monitor the animal; tag, if applicable
Submit Level A and constantly update NOAA with photos/videos and updates on accessment
Stranded (In surf or High and Dry)?
No
Yes
Take photos and remote or physical (as feasible)assessment
Discuss with NOAA
NOAA approve euthanize?
No
Returnable to water?
Yes
NOAA approve release?
No
Yes
Yes
Collect blood, euthanize
Need to relocate carcass?
Yes
Tow or use truck
Yes
No
At new location
Perform full necropsy?
Yes
Full necropsy: Photos/videos, External exam, Morphometrics, Blubber thickness, Internal Exam, Sample collection
Finalize and submit documentation and Level A
Attach post-release monitoring equipment
Release back into the water or wait for high tide
Unsuccessful
Successful
Finalize and submit documentation and Level A
Entangled?
No
Refer to entangled section of document.
Out of habitat?
No
Take photos, report, do nothing
Yes
Take photos and remote physical assessment
Discuss with NOAA
Is it entangled or seriously injured?
Yes
Refer to entangled or seriously injured portion of decision tree
No
Are deterrence methods available?
Yes
Try available deterrence method; obtain photos/videos
No
Observed/access, take photos, and plan for monitoring
No
Did deterrence methods work?
Yes
Finalize and submit documentation and Level A

4.1. Out of Habitat

An animal is considered out of habitat if it is not in the typical range for that species, including offshore waters, coastal waters, or bays, sounds, estuaries and rivers. Typically for large whales, an out of habitat animal is found in an inlet, creek, river, coastal, or other body of water that may be directly connected to the continental shelf or open ocean, connected through river mouths, but may only be connected with the ocean (or bay/sound/estuary) at certain tidal cycles, or under certain conditions.

An animal of concern has an initial assessment conducted in coordination with NMFS, the local response or research Stranding Network, or other experts. This initial assessment will consider the animal's size, age, body condition, skin condition including injuries, behavior, habitat (including environmental parameters such as salinity), social context (more than one animal or a single animal), prey availability, season of year, and the overall risk to the whale. In some cases, mom/calf pairs have been out of habitat together. In addition, the responders evaluate whether the animal is prevented from leaving the area, either by a physical barrier or a perceived barrier. If the animal or animals are not in imminent danger or showing signs of significant illness or injury, NMFS, in coordination with the local Stranding Network or research community, will continue to monitor the situation for any significant change to the situation and collect additional assessment information if requested by NMFS.

Once an animal has been deemed out of habitat, the next step is to determine if intervention is necessary and to gather information on how long the animal may have been in the area. When evaluating whether to intervene, NMFS generally considers the likelihood of the animal leaving on its own or leaving after hazing, its chances of survival if no intervention occurs, if the environment will allow for the intervention to be safe for both the response team and animal, and whether it is possible to relocate or rehabilitate the animal (rehabilitation would only be considered for certain age classes of ESA species). NMFS generally consults with marine mammal behavior experts, veterinarians, scientists, and other experts when determining the best course of action.

4.1.1. *Decision Trees and Triage Criteria for Response*

For live free-swimming, trapped, or out of habitat large whales, the Stranding Network should only intervene (*e.g.*, haze, catch, relocate, or euthanize) under the following conditions which are not mutually exclusive:

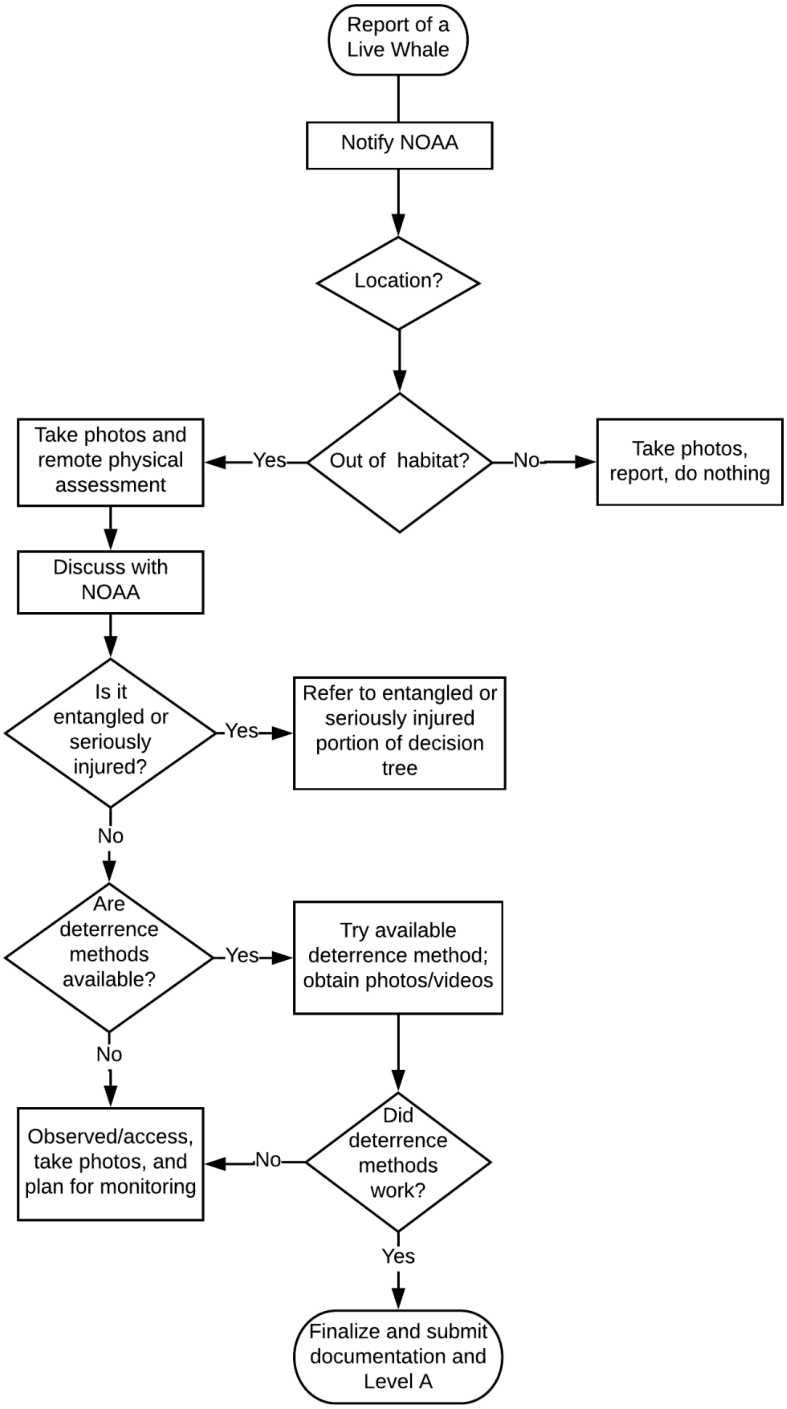
1) If the animal is suffering from a life-threatening condition; or

2) Evidence suggests the animal is unlikely to survive in its immediate surroundings and is prevented from returning to its natural habitat by a physical or perceived barrier (*e.g.*, unable to feed or forage appropriately, animals displaced to inland waters due to hurricanes, trapped, etc.)

The decision of whether (or not) to intervene is made by NMFS, after discussions between multiple parties – the local Stranding Network or response organizations that have "boots on the ground" that are responsible for response, the NMFS RSC, the MMHSRP at Office of Protected Resources (OPR) HQ, and other parties that may have jurisdiction (*e.g.*, tribes, NPS, state, etc.). Ideally, these consultations also include marine mammal veterinarian(s) and experts in the biology and life history of the affected species. The decision to intervene is made by NMFS after taking into consideration the following minimum questions (others questions may be developed) that help evaluate the benefits and risks based upon the specific situation:

- What field observations have been reported and how recently have they been reported?
- What is the health status of the individual?
- Is there a medical diagnosis?
- What are the potential causes of the animals' observed condition?
- What is the estimated or known life history (*e.g.*, sex, age, size)? Is it a known individual?
- What is the conservation status/reproductive potential?
- Are there safety and logistical concerns for intervention (for the responders and/or animals)?
- What resources are available and is an intervention logistically feasible?
- What potential risks are there for conspecifics or other species?
- Is there a contingency plan in place if intervention is not successful (*i.e.,* if the animal dies in the course of intervention, if the intervention is unsuccessful, or if the animal requires rehabilitation)?
- What are the environmental conditions (*i.e.,* tidal cycle, are there protected/sensitive habitats that should be avoided, etc.)?

Below is a decision tree that can help when deciding the appropriate action for an out of habitat response:



4.1.2. *Specific Training and Qualifications (including CI letters)*

Most free-swimming large cetacean responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. In very particular circumstances for non-ESA listed species, a response can be conducted under a SA (by the SA holder after consultation with the Regional Stranding Coordinator) or by a

government employee acting under MMPA Section 109(h). Therefore, only responders who have been authorized by NMFS and who have the training, experience, equipment, and support needed should attempt large cetacean interventions. Authorized response efforts may also rely on partners at tribal, local, state and federal agencies (including law enforcement agencies and the USCG), non-governmental organizations, fishermen, and other groups to assist with some responses.

Stranding Network members are trained or have experience in proper techniques for assessment, hazing, safe capture, restraint, and removal of gear from various marine mammal species. Occasional training workshops have been offered to members of the Stranding Network. Specific training requirements may be more appropriate to address at regional or state levels by working with your RSC. Table 4 and 5 below provides an example of the suggested number of personnel and roles required for a typical large whale out of habitat response effort.

The Stranding Network is made up of individuals who are qualified and experienced with large whales, and for certain activities are issued a CI letter under the MMPA/ESA permit for responding to large whale scenarios. A CI remains authorized to respond to large whales as long as their CI letter is valid (which is typically the life of the MMPA/ESA permit, with some exceptions). These CIs are expected to coordinate to the extent possible with the NMFS Large Whale Coordinators and the MMHSRP. All response actions are reviewed after the event with the participating responders and MMHSRP staff.

Table 4: Suggested number of personnel and roles required for a typical large whale out-of-habitat first response effort.

Team member roles	Number of personnel required
Incident Commander/Safety Officer	1-2
Vessel Captain (also may represent Safety Officer)	1-2
Crew (vessel dependent)	1-3 (roles can be shared with other roles)
Data Collector	1
Documentation personnel including photographer, videographer	1-3 (roles can be shared with other roles)
Biopsy Sampling	1 (roles can be shared with other roles)
Deterrence Coordinator	1

Team member roles	Number of personnel required
Communications Person (PIO or JIC)	1 (role can be shared with other roles)
Optional – UAS Pilot (see UAS; Section 6)	2-3 (roles can be shared with other roles)

Table 5: Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*e.g.*, IC and SO; 2º documentation and data collection).

Team Member Role	Role Description	Role Qualifications
Incident Commander (IC)	The IC, working closely with shoreside (or otherwise remote) authorizing parties (*e.g.*, Park director, USCG, NMFS Regional Stranding Coordinator [RSC]/ HQ), is responsible for the on-scene oversight and supervision of the first response operation. The IC may participate directly in the operation depending on circumstances, but typically does not directly participate (*i.e.,* hands-on) in the operation. This enables the IC to remain focused on the larger picture of the response and objectively ensure that safety is maintained for responders, the public, and animals.	Completion of the ICS free or paid courses, experience with close-approach assessment of large whales, including hazing, tagging and biopsying. Must be trained and/or experienced in protocols, procedures, risks, and risk mitigation in all aspects of the first responder mission being carried out. Must have the authority to carry out operations.
Safety Officer (SO)	The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate with the team and adjust the strategy of the response as needed. The SO works very closely with the IC. Under certain circumstances and depending on experience, the role of the SO can overlap with that of the vessel operator of the support or approach vessels, and if necessary and otherwise appropriate, the role of IC and SO can be performed by one person.	Experience with close-approach assessment of large whales, including: entanglement response efforts; ability to continually watch over all personnel involved; communicate to the team to adjust strategy or call off the effort as necessary; and watch for hazards (*i.e.,* not adhering to protocols, presence of other animals, incoming environmental or weather changes, and time of day considerations). Willingness and ability to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.
Vessel Operator(s)	This person(s) is/are responsible for the safe transit and operations of the vessel(s), including the safe maneuvering around and approach to whales. Vessel operator(s) should have experience operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the vessel operator role whether on the transit, support, or approach vessels is one of the most important roles beyond that of the IC.	Experience, training, and in some cases certifications (*e.g.*, USCG license, NOAA certified components course) in order to "captain" a vessel. Vessel operators should have experience operating the vessel around large whales and all aspects of the response operation.
Data Collector	The data collector is essential in recording all aspects of the response. This person is responsible for ensuring all data is complete on data sheets and data loggers, including the assessment of the animal, recording identity of associated documentation, behavior of animal (*e.g.*, respirations, changes due to response), the response efforts (*e.g.*, an outline of response steps taken, risk factors encountered, who was involved), and sampling if any.	Familiarity with procedures and data sheet/data loggers, attention to details. Ability to accurately and completely compile a great deal of information. Lacking a disposition to seasickness is valuable.

Team Member Role	Role Description	Role Qualifications
Documenter(s)	This person(s) is/are responsible for obtaining and maintaining (*e.g.*, identifying and safe storage) still and video imagery on all aspects of the response. They work closely with the Data Collector and the vessel operator. This person may also serve as the data collector. Under certain circumstances, responders with other roles may take on, in part, the role of documenter, through use of helmet or vessel-mounted POV cameras. However, such persons must maintain focus on their primary role and maintain safety. POV cameras should be turned on and forgotten by the user and instead either tended to or operated remotely by a dedicated documenter.	Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response.
Biopsy Sampling	This role is responsible for maintaining biopsy gear (*e.g.*, crossbow or air guns, darts, and collection vials), safely obtaining the sample, and its storage and processing (*e.g.*, labeling).	The person needs to be trained and otherwise familiar with the safe use of the crossbow or pneumatic gun. Additional training, like gun handling, is recommended. The person obtaining the biopsy sample must work closely with the helmsperson and the data person.
Deterrent Lead	This role is responsible for deterrent or hazing operations. This person has experience with various hazing techniques (*e.g.,* vessel approach, pingers, pipes, etc.). The hazing lead must work closely with the IC and SO to ensure all hazing activities are safe for personnel and the whale.	The person needs to be trained and otherwise familiar with the safe use of various hazing techniques with large whales (*e.g.,* vessel approach, pingers, pipes, etc.). The hazing lead must have experience assessing large whale behavior and responses to hazing techniques.
Communications Person	This person is responsible for maintaining all-important communications aboard vessels, between vessels (*e.g.*, a supporting partner vessel) and to shoreside contacts, including float plan contact and NMFS authorizing agents (*e.g.*, Regional and/or National LWERCs). Shoreside contacts typically take on the role of further disseminating information, including to agency partners/leads, any other authorizing agencies, and media coordinators. Communications at this stage do not involve the media as this is the role of media coordinator and others at later stages.	Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response.
Optional – UAS Pilot (see UAS; Section 6)	If permitted to operate a UAS during the response, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success or safety of the operation, or causing disturbance to any animals.	Pilots must have an FAA Part 107 license, follow all existing FAA and other regulations, and be trained and/or experienced operating a UAS over water from a vessel during response operations. More detail on UAS use is addressed in Section 6.

4.1.3. *Communication/Public Relations (specific for out of habitat free-swimming)*

For an out of habitat free-swimming whale, there can be a lot of groups involved and it is important the communication regarding this event is constant and consistent. Depending on the scenario and locality of the event, spearheading communication may be escalated to the NMFS Communication Team who will work with the local communication team on the event's publicity. This may include social media and posting frequent updates as well as broadcasts with local news agencies. Managing expectations is the key. If the response decision is to perform hands-off monitoring, then it needs to be communicated with all agencies, communities/the public, tourist sight-seeing retailers (*e.g.*, whale watch boats) so they know

something is currently being done about the situation even if it doesn't look like it. Having everyone be on the same page and know what is going on makes the response go more smoothly and allow for more information to be collected. Making sure updates are constantly provided via social media and to the groups will also ease the concerns of response in general as well as hands-off monitoring.

4.1.4. *Data Collection Protocols*

Data collection is typically performed by qualified individuals and the amount of data collected may depend on the level of response and capacities. It is important to document the event by recording the location and time of each sighting. Monitoring the animal(s) is essential and data can be collected on a form such as the Free Swimming Whale Assessment Form and Monitoring Datasheet (see example in Appendix C). Obtaining good photographs and/or video of the animal can help identify individual animals and also assess their condition for further determinations. Recording the animal(s) behavior when observed is helpful to aid in the assessment and in determining the best course of action. At minimum, field information necessary for completion of NOAA's Level A form must be collected. This will include the assignation of a unique identifier (Field ID#, per Regional Stranding Network protocols). Live animals must also be indicated in the appropriate section of the Search Effort Log on the Level A form. Level A forms may be completed electronically via direct entry in the National Stranding Database.

Anytime samples are collected and/or handed-over they should be recorded. Photo logs are a record of each photo taken, which helps to identify the photographer and date/time taken. During data collection, photos should be taken with a label with ID, date, species, log number, and have a size scale (see examples in Appendix D). With all the data collected, a report should be finalized with the photos documented, complete recording of all pertinent findings, and all samples collected.

4.1.5. *Available Tools and Techniques*

Deterrent, hazing and herding strategies, techniques and equipment should be considered as tools that can be useful in out of habitat situations to help guide, lead (attractant), or force (deterrent) the animals out of dangerous areas. Deterrents seek to exclude animals from areas by discouraging them from entering into an area or encourage them to leave an area through either acoustic or physical means. Attractants may include playing sounds from conspecifics (particularly those associated with feeding) in the downstream or "open" area in an attempt to encourage the animal to move in that direction to investigate the sounds. Acoustic deterrence means vary from the most basic, such as slapping the water with paddles to the use of targeted acoustical deterrents (generally not effective for baleen whales), such as oikomi pipes or commercially available pingers used in fisheries. Physical deterrents can also be useful in some situations. These methods include, but are not limited to, fire boats with hose spraying and bubble nets (Gulland *et al.* 2008). In any

situation where deterrents or herding techniques are utilized, the situation needs to be constantly monitored and regularly assessed to determine if the actions are producing the desired effects and to monitor the impact on the animal from a health and welfare perspective. If possible, a D-Tag can be used to document the animal's response to any deterrence or attractant methods. While determining which methods to implement requires experience, consulting outside experts is highly recommended. See section 4.1.5.4 for more specific information on deterrence methods.

4.1.5.1. Remote Physical Assessment (including respiration rate and behavior)

Each case/event should be assessed through physical and behavioral observations or sample collection from the animal(s) and environmental observations at the site and any obstacles between the current location and the target exit from the situation. These observations and data will improve decision-making and adaptive management of the situation to determine the appropriate course of action for that particular individual and situation. Careful planning and adaptive management will also provide important information that can be used to inform decision making for future cases. Lessons learned from each situation through thorough debriefing also is critical to inform tools and techniques and species reactions to either attractants or deterrents. A standardized health assessment form *may* be available, depending on the region and taxa. If so, it should capture all necessary information. If there is no form available then the questions below should be determined (Cape Cod Stranding Network 2008) in order to more generally assess the whale's status and condition. Below are examples of some questions that might inform decision making. In the future, regional health assessment forms, if not already available, may be developed.

- Determine the species involved and use identification characteristics and catalogs for the species or stock to determine if this is a known individual. The identification characteristics for the species may include the size, coloration, rostrum and callosities, fluke, pectoral flipper, and dorsal fin. Is this a known individual? If so, what do we know about the individual, behavior and normal habitat?

- Estimate the total length, estimate the age class, and potential weight (using weight charts).

- Note the body condition. If able to determine, is there an indentation behind the cranium (peanut head)? Are ribs and/or scapula visible? Is the animal concave or convex in the epaxial region on a longitudinal view? Are there any skin lesions or wounds? If the animal is out of habitat in lower salinity areas, evaluate the skin for freshwater lesions and mat formation.

- If possible, count respirations (number of respirations per minute), note respiratory effort, is there any respiratory exudate, odor, abnormal sound? (Normal breathing intervals for large

whales are once every fifteen to twenty minutes (Geraci *et al.* 2005))

- Are there any other animals in the area? How many? Is the animal frequently in close association with any of them (*e.g.*, mom/calf, bachelor pair, etc.)?

- Take photos and/or video to document injuries, disease or behavioral changes

Following remote observations, it is critical to share the information and have a discussion with a group of experts (*e.g.*, marine mammal veterinarians, biologists with experience with a given species, etc.). This is possible when the case is not immediately life threatening and the animal's behavior/sighting history is somewhat predictable in the habitat such that the animal can be relocated for future interventions.

4.1.5.1.1. Breath Sampling

Breath sampling is sampling from the cloud of "blow" (Figure 1) from a whale when they exhale as they reach the surface. They may blow several consecutive times between dives and some species may start an exhalation underwater and the second breath may be easier to target. It is appropriate to collect several breaths from an individual being assessed. For mom/calf pairs, it may be difficult to focus the collection to only one of the two if they are surfacing together especially in shallow water. This sampling is non-invasive and can be collected easily. There are different ways a breath sample can be collected (Table 6) (Hunt *et al.* 2013):

- Long poles positioned over the blowholes which can have nylon fabric suspended across a 15-centimeter ring or a plastic framework, an inverted funnel, and/or Petri dishes

- A remote-controlled helicopter/unmanned aircraft system (UAS) with Petri dishes

Figure 1: Respiratory vapor samples ("blow") from large whales can be collected by a variety of pole-based or remote-controlled helicopter-based methods. This photograph shows collecting "blow" droplets

from a North Atlantic right whale (*Eubalaena glacialis*) using a nylon-fabric sampler suspended on the end of a carbon-fiber pole. (Photo: Amy Knowlton, New England Aquarium, SARA Permit #325863, NMFS Permit #14233, Hunt *et al.* 2013.)

Nitrile gloves should be worn by anyone involved with sample collection and should be changed after accidental contact with skin, surfaces or saltwater to avoid contamination. Gloves should also be changed between sampling different animals.

The exhaled breath and condensate should be collected on at least two sterile Petri dishes with no media. Sampling multiple exhaled breaths on the same plates is ideal. Samplers should collect a small volume of surface seawater (minimum one milliliter) on a plate in the vicinity of the whale.

Samples should be processed onboard if conditions allow, or kept cool until they can be processed on land. Sampling will not provide immediate information for decision making and may need to be sent to a lab for analyses unless cytology would be informative.

Sample processing (one example below, sample collection may differ based upon situation):

Plate #1:

a. Collect one swab to prepare smears on three glass microscope slides. Label and place the slides in a secure area and air dry.
b. Collect two swabs in transport media for bacteriology (Ames), keep chilled. Do not freeze.
c. Collect two swabs for fungal culture. Keep the swabs for fungal culture dry and in separate sterile containers. Keep chilled. Do not freeze.
d. Collect two swabs and place in RNA Later® or a dry sterile container for pathogen testing (*e.g.*, viral, etc.). Ok to freeze.

Plate #2: To avoid contamination, do not collect this sample from a Petri plate that has been previously swabbed:

a. Using a sterile pipette, transfer a minimum of 0.1 milliliters of blow into a sterile Nalgene cryovial

Table 6: Breath sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Respiratory vapor ("breath")	• Pole-based samplers • Remote-controlled devices possible (?) • Different methods for droplets, exhaled breath condensate, and gases (these provide different types of information)	Medium	• Non-invasive • Targeted biomarker sampling possible • Repeated sampling possible • Wide range of metabolites can be studies simultaneously • Mostly requires remote laboratory analyses and little real time data	• Novel technique; many validations remain to be done • Target biomarkers at trace concentrations • Advanced detection strategies needed for quantitative analysis	• Several hormones detectable • May contain a large variety of other detectable compounds (?) • May be proxy for blood, as has been observed in human studies • Respiratory microbiome • Host immune response

4.1.5.1.2. Fecal Sampling

Fecal sampling (Figure 2) can be collected from well-formed floating semi-solid clumps to a more fluid, dispersed plume which can be scooped from the water surfaces using a fine-mesh nylon dipnet, draining off as much seawater as possible (Hunt *et al.* 2013). Refer to Table 7 below for more information on the fecal sampling technique.

Figure 2: NOAA researchers collecting fecal samples. Photo taken under federal research permit. Photo credit: NWFSC.

When collecting fecal samples:

a. Place replicate samples of 2-4 milliliters of feces in three separate sterile containers

b. Place one sample of 1.0 milliliters of feces in a sterile container for molecular analysis and possible electron microscopy

c. Swab the fecal sample. Place the swab either in RNA Later® or a dry sterile container

Table 7: Fecal sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Feces	• Locate visually or with a dog • Surface collection with scoop or net; subsurface collection with divers • Not possible in some environments and conditions and not applicable in all large whales	• Low without dog • Medium with dog	• Non-invasive • Extremely high steroid content (easily detectable) • Well-established steroid hormone technique Long 'sampling time frame' may enable study of chronic stress • Repeated sampling possible	• Low sampling rate • Targeted sampling difficult • Individual not always known (cannot always be genotyped due to DNA degradation) • Cannot sample fasting seasons	• Diet analysis • Endoparasites • Lipophilic hormones • Fatty acid and stable isotope analysis of diet • Toxin exposure (*e.g.*, domoic acid) • Gut microbiome and relationships to stress, immunity, and disease • Some immunoglobulins and other hormones may be detectable (?)

4.1.5.1.3. Photogrammetry (UAS or Other)

Photogrammetry is a laser system that allows for quantitative measurements (morphometrics) from photographs. It adjusts pixel measurements to real size by an estimate of scale (distance/focal length). Fixed-wing airplanes, helicopters, and/or UAS are used to collect vertical images from precisely-measured altitudes directly above the whale. There has been great success using UAS because of the quiet sound footprint, vessel standoff, ability for increased range, increased safety, and cost effectiveness. Table 8 provides more information on the photographic analysis technique.

Table 8: Photographic analysis technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Photographic analysis	• Lateral view with boat-based photography • Dorsal view/body outline with airplanes or remote-control devices • Infrared thermography	• Very high	• Non-invasive • Best sampling rate • Repeated sampling possible	• External appearance only • Airplane-based photography has cost/safety issues	• Blubber reserves/nutritional state • Epidermal lesions • Ectoparasites • Entanglement and injury • Thermal physiology (infrared) • Watercraft wound analysis

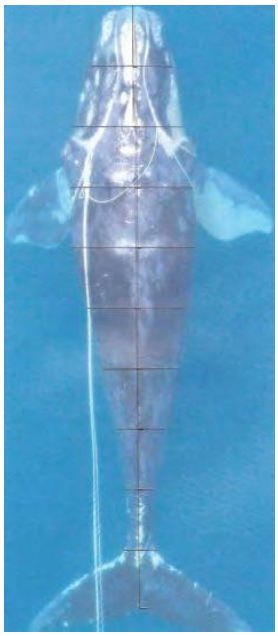


Figure 3: Example of aerial photography. This image was marked for length-to-width ratio analysis to access likely body weight prior to dosing with sedatives for disentanglement efforts (Hunt *et al.* 2013).

4.1.5.1.4. Sample Collection (Biopsy or Other)

Responders may collect biological samples (Table 9) such as biopsy and/or skin samples in the course of responding to an entangled animal. These samples can be used to assess some aspects of the health of the animal. Skin can be collected through the use of a remote dart, the collection of tissues from the removed gear or line, or the collection of sloughed skin from the water. Biopsy sampling typically involves discharging a projectile dart with a hollow tip that collects a small plug of skin and blubber. Higher-powered delivery devices, such as compound crossbows or black-powder Larsen guns, are more likely to be

used at a distance of more than twenty meters from the vessel (typically used when targeting large baleen whales). Lower-powered delivery devices such as recurve crossbows or adjustable-power guns are used at shorter ranges (less than twenty meters) from small vessels. Responders may sample the area from the dorsal flank (well behind the blowhole). After the biopsy dart hits the animal, it bounces off as its penetration is limited by a stopper, and floats at the surface of the water where the biopsy sample/dart can be retrieved.

Responders may also use a handheld pole with a dart tip on the end to manually collect a biopsy sample if the disposition and behavior of the entangled animal is conducive to a closer vessel approach (*i.e.,* the whale is anchored in place). In this instance, the responder would slowly and cautiously approach the animal, to within one body length, to quickly jab the pole into the dorsal surface or flank of the animal, while avoiding more sensitive areas such as the head, eyes, and the area around the blowhole.

Table 9: Biopsy sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Epithelium and blubber biopsies	• Biopsy dart used with crossbow, pole, or pneumatic rifle • Sloughed skin may also be collected	Medium/high	• Good sampling rate • Many archived samples available • Tissue sample obtained; living cells present; properly handled high protein and nucleic acid content	• Invasive causes small wound • Permit restrictions • Repeat sampling not always possible if animal is not visible • 'Lag' time of blubber hormones unknown	• Lipophilic hormones in blubber • Lipid/fatty acid analysis of contaminant load (POPs, lipophilic cpds and some metals), diet, age, sex, identity, etc. • Epidermal microbiome, skin lesions and epidermal diseases • Epidermal proteomics (CYP450-related enzymes for contaminants, SRPs for stress studies) • Transcriptomic and genomic approaches possible (?)

4.1.5.2. Medical Intervention Strategies

4.1.5.2.1. Sedation

Typically for an out of habitat situation, there is no need to administer sedatives unless the animal is also seriously injured or entangled. Refer to Sections 4.2.4.2.1 and 4.3.4.3.1 if the large whale is seriously

injured or entangled.

4.1.5.2.2. Medications

Antibiotic, analgesic, or other drug therapy can be administered depending on the scenario and the clinical assessment of the animal. For out of habitat large whale response, typically antibiotics are not needed unless the animal is seriously injured or entangled, or seriously debilitated with respiratory or other signs. Refer to Sections 4.2.4.2.2 and 4.3.4.3.2 if the large whale is seriously injured or entangled.

4.1.5.2.3. Tagging and Marking

The decision on which technique(s) to use for tracking an out of habitat, live injured or entangled whale, marking a carcass, or tagging or marking for post-release monitoring will generally be made on a case-by-case basis. Gathering data on the survival of large whales that have been released after a live stranding is an essential part of the intervention. Without the data on post-release outcomes, one cannot assess the value of the overall response, nor evaluate the combined suite of protocols employed. The tools available for monitoring post-release outcomes range from the re-sighting of natural or applied markings, to VHF/satellite tag tracking.

Natural Markings are typically used for out of habitat whales. Some species have specific criteria for identification and some also have catalogs so that if matched to a known individual more information about the animal can be obtained. These include pigmentation patterns on the fluke or body, callosity shape and size, dorsal fin shape and notches, or other skin marking depending on the species involved. It is important to acquire a comprehensive series of species-relevant images of all such marks before release to enable recognition later.

Applied marks are those artificial markings applied by the Stranding Network responders during the intervention and release. They may be very temporary, such as livestock paint stick markings that last only a few days. Short-term marks could include plastic livestock ear tags in the dorsal fin (for those species with a dorsal fin), that can last for many months.

An electronic tag, with options including VHF (radio) and satellite, is another type of applied mark. Tag attachment options include suction cup tags, single pin attachments in the trailing edge of the dorsal fin (for those species with a dorsal fin), or LIMPET tags.

All these types of monitoring can be used in tandem, so photos of natural markings can be coupled with applied marks or tags to increase the likelihood of re-sighting whales at multiple time periods (*i.e.,* short-term and long-term) to assess post-release outcomes. See Table 4 for the pros and challenges of each

tagging/marking type. For more specific details on tagging and marking, refer to the Report of the Joint US Office of Naval Research, International Whaling Commission and US National Oceanic and Atmospheric Administration Workshop on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices (IWC, NOAA, ONR. 2020).

Table 4: Pros and challenges of each tagging/marking type

Marking Type	Pros	Challenges
Natural Markings	• Natural markings tend to persist after healing and have more lasting value, especially where the individual's markings are archived from stranding event images • Many areas have Photo-ID catalogs for various whale species or stocks Re-sights may occur over many years, allowing for long-term information on the success of the intervention	• The whale appearing in an area where photo-id or re-sights may occur for recognizing applied or natural marks • Belonging to a species that has an existing photo-id catalog that can be used for matching • Appropriate photos being collected during the stranding event to match with the photo-id catalog (*i.e.,* fluke photos of humpback whales may be difficult to obtain when they are on a beach) • Communication between researchers with photo-id catalogs and the Stranding Network responders may be challenging, particularly over large geographic distances (multi-country ranges of most migratory large whales) • Data on re-sights may not occur in the short term (days/weeks/months), leading to uncertainty Lack of re-sight data may not necessarily mean the intervention wasn't successful – the fate of the whale remains unknown
Applied Markings	• Easy to apply (paint sticks require no training) • Inexpensive and readily available (on hand with many/most Stranding Network responders)	• Situations allowing for safe application to out of habitat whales are not very common • Re-sight information depends upon high level of effort (especially boat-based, but could be shore-based) to identify free-swimming whale ("success")

Electronic Tags	• Allow for longer term tracking (days/weeks/months)
	• Allow for targeted tracking over a large geographic area, with the tag aiding in the ability to locate and re-sight the free-swimming animal (radio or satellite)
	Allow for remote tracking (satellite)
		• An appropriate tag available with a trained applicator
		• A suitable permit to tag in hand (tagging can be conducted under the national MMHSRP permit with pre-approval)
		  ◦ Funding for the tag acquisition or replacement
		  ◦ Time to focus on the tagging plan while rescue process is ongoing
		  ◦ Potential for added impact or stress to the whale

4.1.5.2.4. Deterrence Methods

While more commonly used to prevent mass strandings, herding or deterrence actions may be appropriate for single or small groups of out of habitat animals. Various methods of deterrence have been used by experienced individuals but efficacy is low, including:

- Vessel action, close approaches, percussive slaps on the water from motorized vessel
- Pingers or other acoustic devices (*e.g.*, pipes)
- *Hukilau*, Oikomi pipes, streamers, non-entangling nets

For a more in-depth discussion of various non-lethal deterrence options, see the NMFS Marine Mammal Non-Lethal Deterrence Guidance (85 FR 53763; https://www.govinfo.gov/content/pkg/FR-2020-08-31/pdf/2020-18718.pdf).

4.1.5.2.4.1. Fire boat

A fire boat (Figure 4) is a specialized boat that can pump and spray water from the hoses attached to the boat. It is typically used for shoreline or dock fires, but it has also been used to deter large whales from a specific area or direction. It can create a water column disturbance/barrier (*e.g.*, bubble curtain) and/or surface disturbance.

Advantages: It is an available resource through fire departments and can safely be used.

Disadvantages: This method may not work for all large whale species. It may also not be successful if used for a long duration or consistently in an individual incident due to the possibility that the whale may eventually ignore the deterrence.

Figure 4: Fire boat (Photo by Paul Chinn, San Francisco Chronicle)

4.1.5.2.4.2. Oikomi pipes

Oikomi pipes, also known as “Banging Pipes”, are about eight feet long metal pipes with a cap on the top that can be lowered into the water from the side of a vessel (Figure 5) and struck with a hammer to make a loud noise. Numerous pipes can be used in multiple lines. The expected end result is to deter the whales from a specific unwanted area and/or move the whales’ direction of travel. The Oikomi pipes have been tested to ensure that they do not cause permanent damage to the whales’ hearing (Washington State Department of Ecology 2018).

Advantages: Shown effective for some species of toothed whales and dolphins (in particular, orca); safe; little training or experience required; high public acceptance level

Disadvantages: Not as efficacious for very large area; requires coordination of multiple vessels; could be dangerous at night or during poor sea conditions; tactic requires a high degree of seamanship, not effective for all species of marine mammals; generally not effective for mysticetes

Figure 5: Deployment of Oikomi pipe (Washington State Department of Ecology 2018)

4.1.5.2.4.3. Other Methods.

Refer to NMFS Marine Mammal Non-Lethal Deterrence Guidance (85 FR 53763; https://www.govinfo.gov/content/pkg/FR-2020-08-31/pdf/2020-18718.pdf) for other non-lethal deterrence options.

Some other methods that have been considered and implemented but not proven effective include:

- Disturbance from boat traffic can create a noise barrier and surface disturbance.
- Acoustic deterrents could be used but not proven effective for baleen whales.

These methods could benefit from additional testing, and it is possible that they could be effective for

different species/life stages/sexes, or could be improved by using modified equipment (*e.g.*, more powerful underwater speakers) or changing operational practices (*e.g.*, where the boats or speakers are located relative to the whale). More work should be done.

Some other methods that have been discussed in theory but never implemented with a live large whale include:

- Creation of bubble curtain using air and PVC or other piping/tubing
- Creation of an electric field

These methods could be explored, but would need to be much more fully developed and tested, and authorized under the MMPA/ESA permit before they could be implemented.

4.2. At Sea (seriously injured or moribund/floating)

Collisions between watercraft and cetaceans can have adverse effects on the health of individual animals as well as the population status of endangered species (Kraus *et al.* 2005). For watercraft injuries the trauma can be sharp-force and/or blunt-force. The severity and type of this trauma depends on several factors, including vessel speed and size, the type of propulsion system, severity of interaction with the propulsion system, and where the injury occurs on the animal's body (Rommel *et al.* 2007). Entanglements and fishery interactions can also result in serious injury or mortality, and represent a significant population-level threat to endangered and threatened marine mammals. Entangling material can cause lacerations, partial or complete fin amputation, organ damage, muscle damage, infection, and interfere with mobility, feeding, and breathing. Chronic tissue damage from line under pressure can compromise a whale's physiology. For more information on entanglements, refer to Section 4.3 below, and/or the Large Whale Entanglement Response Best Practice. In addition to vessel strikes and entanglement injuries, other commonly seen injuries in small cetaceans include gunshot wounds, bite wounds, and stab wounds, although these are rarely reported in large whales. Additionally, large whales may become moribund due to natural causes such as illness and disease leading to malnutrition and other health impacts that could lead to floating behavior.

Responders should do an initial assessment of the animal's behavior, environment, and condition of the wounds. The local Stranding Network should consult with NMFS to determine the severity of the wound(s) or illness and how likely the injury or illness is to impact the animal's quality of life. If the wounds or illness are considered to be serious or life-threatening, response to the animal may be considered in certain circumstances.

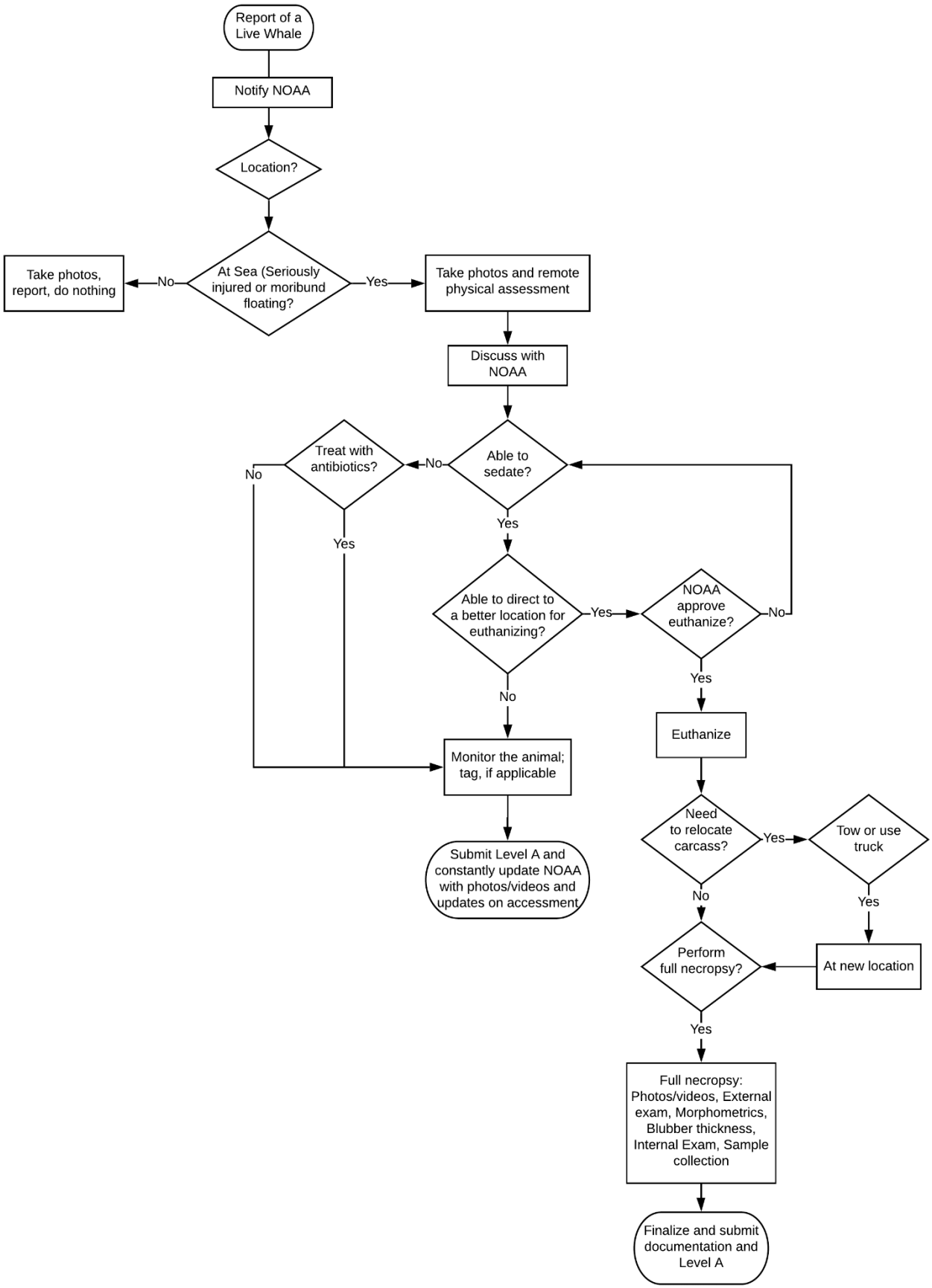
4.2.1. *Decision Trees and Triage Criteria for Response*

For live, free-swimming, injured marine mammals that are not entangled or out of habitat, response options are very limited (*e.g.,* remote injection of medications), and the decision to intervene would come from NMFS after discussion with experts.

The decision of whether (or not) to intervene is made by NMFS, after discussions between multiple parties – the local Stranding Network or response organizations that have "boots on the ground" that are responsible for response, the NMFS RSC, the MMHSRP at OPR HQ, and other parties that may have jurisdiction (*e.g.*, tribes, NPS, state, etc.). Ideally, these consultations also include marine mammal veterinarian(s) and experts in the biology and life history of the affected species. The decision to intervene is made by NMFS after taking into consideration the following minimum questions (others questions may be developed) that help evaluate the benefits and risks based upon the specific situation:

- What field observations have been reported and how recently have they been reported?
- What is the health status of the individual?
- Is there a medical diagnosis?
- What are the potential causes of the animals' observed condition?
- What is the estimated or known life history (*e.g.*, sex, age, size)? Is it a known individual?
- What is the conservation status/reproductive potential?
- Are there safety and logistical concerns for intervention (for the responders and/or animals)?
- What resources are available and is an intervention logistically feasible?
- What potential risks are there for conspecifics or other species?
- Is there a contingency plan in place if intervention is not successful (*i.e.,* if the animal dies in the course of intervention, if the intervention is unsuccessful, or if the animal requires rehabilitation)?
- What are the environmental conditions (*i.e.,* tidal cycle, are there protected/sensitive habitats that should be avoided, etc.)?

Below is a decision tree that can help when deciding the appropriate action for an at-sea (seriously injured or moribund/floating) response:


Report of a Live Whale
Notify NOAA
Location?
At Sea (Seriously injured or moribund floating?
No
Take photos, report, do nothing
Yes
Take photos and remote physical assessment
Discuss with NOAA
Able to sedate?
No
Treat with antibiotics?
No
Yes
Yes
Able to direct to a better location for euthanizing?
Yes
NOAA approve euthanize?
No
Yes
No
Euthanize
Monitor the animal; tag, if applicable
Submit Level A and constantly update NOAA with photos/videos and updates on accessment
Need to relocate carcass?
Yes
Tow or use truck
Yes
No
Perform full necropsy?
At new location
Yes
Full necropsy: Photos/videos, External exam, Morphometrics, Blubber thickness, Internal Exam, Sample collection
Finalize and submit documentation and Level A

4.2.2. *Specific Training and Qualifications (including CI letters)*

Most free-swimming large cetacean responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. In very particular circumstances for non-ESA listed species, a response can be conducted under a SA (by the SA holder after consultation with the Regional Stranding Coordinator) or by a government employee acting under MMPA Section 109(h). Therefore, only responders who have been authorized by NMFS and who have the training, experience, equipment, and support needed should attempt large cetacean interventions. Authorized response efforts may also rely on partners at tribal, local, state and federal agencies (including law enforcement agencies and the USCG), non-governmental organizations, fishermen, and other groups to assist with some responses.

The Stranding Network members are trained or have experience in proper techniques for safe capture, restraint, and removal of gear from various marine mammal species. Training workshops have been offered to members of the Stranding Network. Additionally, opportunities for apprenticeships or assistant roles to gain the necessary hands-on expertise can be arranged. Specific training issues or requirements may exist for certain activities (*e.g.*, in-water captures) and are more appropriate to address at regional or state levels by working with your RSC.

The Stranding Network is made up of individuals who have been evaluated on their qualifications and past experience, and for certain activities are issued a CI letter under the MMPA/ESA permit for large whale response. A CI remains authorized to respond to large whales as long as their CI letter is valid (which is typically the life of the MMPA/ESA permit, with some exceptions). These CIs are expected to coordinate to the extent possible with the NMFS Large Whale Coordinators and the MMHSRP. However, given the uncertain communication abilities at sea, and the need for quick decision-making, CIs are empowered to use their best judgment and act independently if the situation requires it. All response actions are reviewed after the event with the participating responders and MMHSRP staff. Table 10 and 11 below provides an example of the suggested number of personnel and roles required for a typical large whale at sea severely injured or ill response effort.

If the animal needs to be euthanized, euthanasia should only be carried out by an experienced and approved Stranding Network member or veterinarian who has training on proper euthanasia methods. Currently animals may only be safely euthanized once they have beached on land or ice. No safe at sea euthanasia methods currently exist for large whales that the Stranding Network are authorized to use. All of the Stranding Team should be trained to understand the general aspects of euthanasia, animal handling during euthanasia, general first aid/CPR, and interfacing with the public and media. It is the responsibility of the team lead to know the team's experience, skill and limitations, and to continually assess the safety of the

situation (Barco *et al.* 2016).

Table 10: Suggested number of personnel and roles required for a typical large whale at sea severely injured or ill first response effort.

Team member roles	Number of personnel required
Incident Commander/Safety Officer	1-2
Vessel Captain (also may represent Safety Officer)	1-2
Crew (vessel dependent)	1-3 (roles can be shared with other roles)
Data Collector	1
Documenters	1-3 (roles can be shared with other roles)
Biopsy Sampling	1 (roles can be shared with other roles)
Veterinary Staff (remote administration of medications)	1-3
Tagger	1-2
Communications Person	1 (role can be shared with other roles)
Optional – UAS Pilot (see UAS; Section 6)	2-3 (roles can be shared with other roles)

Table 11: Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*e.g.*, IC and SO; 2º documentation and data collection).

Team Member Role	Role Description	Role Qualifications
Incident Commander (IC)	The IC, working closely with shoreside (or otherwise remote) authorizing parties (*e.g.*, NMFS Regional Stranding Coordinator [RSC]/ HQ), is responsible for the on-scene oversight and supervision of the first response operation. The IC may participate directly in the operation depending on circumstances, but typically does not directly participate (*i.e.,* hands-on) in the operation. This enables the IC to remain focused on the larger picture of the response and objectively ensure that safety is maintained for responders, the public, and animals.	Completion of the ICS free or paid courses, experience with close-approach assessment of large whales, including hazing, tagging and biopsying. Must be trained and/or experienced in protocols, procedures, risks, and risk mitigation in all aspects of the first responder mission being carried out. Must have the authority to carry out operations.
Safety Officer (SO)	The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate with the team and adjust the strategy of the response as needed. The SO works very closely with the IC. Under certain circumstances and depending on experience, the role of the SO can overlap with that of the vessel operator of the support or approach vessels, and if necessary and otherwise appropriate, the role of IC and SO can be performed by one person.	Experience in previous large whale entanglement response efforts, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e.,* not adhering to protocols, presence of other animals, incoming environmental or weather changes, and time of day considerations). Willingness and ability to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.
Vessel Operator(s)	Operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the vessel operator role whether on the transit, support, or approach vessels is one of the most important roles beyond that of the IC.	Experience, training, and in some cases certifications (*e.g.*, USCG license, NOAA certified components course) in order to "captain" a vessel. Vessel operators should have experience operating the vessel around large whales and all aspects of the response operation.

Team Member Role	Role Description	Role Qualifications
Data Collector	The data collector is essential in recording all aspects of the response. This person is responsible for ensuring all data is complete on data sheets and data loggers, including the assessment of the animal, recording identity of associated documentation, behavior of animal (*e.g.*, respirations, changes due to response), the response efforts (*e.g.*, an outline of response steps taken, risk factors encountered, who was involved), and sampling if any.	Familiarity with procedures and data sheet/dataloggers, attention to details. Ability to accurately and completely compile a great deal of information. Lacking a disposition to seasickness is valuable.
Documenter(s)	This person(s) is/are responsible for obtaining and maintaining (*e.g.*, identifying and safe storage) still and video imagery on all aspects of the response. They work closely with the Data Collector and the vessel operator. This person may also serve as the data collector. Under certain circumstances, responders with other roles may take on, in part, the role of documenter, through use of helmet or vessel-mounted POV cameras. However, such persons must maintain focus on their primary role and maintain safety. POV cameras should be turned on and forgotten by the user and instead either tended to or operated remotely by a dedicated documenter.	Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response.
Biopsy Sampling	This role is responsible for maintaining biopsy gear (*e.g.*, crossbow or air guns, darts, and collection vials), safely obtaining the sample, and its storage and processing (*e.g.*, labeling).	The person needs to be trained and otherwise familiar with the safe use of the crossbow or pneumatic gun. Additional training, like gun handling, is recommended. The person obtaining the biopsy sample must work closely with the helmsperson and the data person.
Veterinary Staff	This role is responsible for veterinary operations including remote administration of medications (*e.g.*, antibiotics or sedation). This person has experience with marine mammal medications and medicine. The veterinarian or veterinary technician may or may not administer the drug remotely but will be responsible for drawing up the medications safely and providing the loaded dart to the trained darter.	The person needs to be experienced and authorized to administer sedating drugs or other veterinary medications, and experienced with use of delivery equipment (if the darter).
Taggers	This role is responsible for the pre-deployment preparation, including the testing of the transmitters and receivers and setup of the telemetry tag, the appropriate deployment of telemetry, receiving Argos, GPS and real-time VHF fixes, and the interpretation and forecasting of telemetry data towards use in relocating the animal for future efforts.	These persons need to be trained or otherwise familiar with the appropriate preparation (*i.e.,* testing, tuning, and mounting to the telemetry buoy) of telemetry gear, deployment, reception, and interpretation of telemetry. The two-person team attaching a tag must work closely with a vessel operator. Both persons - one making the attachment (*e.g.*, dart gun, crossbow, pole) and the other person dedicated towards documenting the tag placement via photography, need to be physically capable, trained and experienced in the procedure, and familiar with all risk factors.
Communications Person	This person is responsible for maintaining all-important communications aboard vessels, between vessels (*e.g.*, a supporting partner vessel) and to shoreside contacts, including float plan contact and NMFS authorizing agents (*e.g.*, Regional and/or National LWERCs). Shoreside contacts typically take on the role of further disseminating information, including to agency partners/leads, any other authorizing agencies, and media coordinators. Communications at this stage do not involve the media as this is the role of media coordinator and others at later stages.	Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response.
Optional – UAS Pilot (see UAS; Section 6)	If permitted to operate a UAS during the response, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success or safety of the operation, or causing disturbance to any animals.	Pilots must have an FAA Part 107 license, follow all existing FAA and other regulations, and be trained and/or experienced operating a UAS over water from a vessel during response operations. More detail on UAS use is addressed in Section 6.

4.2.3. *Data Collection Protocols*

Data collection is typically performed by qualified individuals and depending on the level of response and capacities may determine the amount of data collected. It is important to document the event by recording the location and time of each sighting. Monitoring the animal(s) is essential and data can be collected on a form such as the Free Swimming Whale Assessment Form and Monitoring Datasheet (see example in Appendix C). Obtaining good photographs and/or video of the animal can help identify individual animals and assess their condition. Recording the animal(s) behavior when observed is helpful to aid in the assessment and in determining the best course of action. For any large whale response, at minimum, field information necessary for completion of NOAA's Level A form must be collected. This will include the assignation of a unique identifier (Field ID#, per Regional Stranding Network protocols). Live animals must also be indicated in the appropriate section of the Search Effort Log on the Level A form. Level A forms may be completed electronically via direct entry in the National Stranding Database.

Anytime samples are collected and/or handed-over they should be recorded. Photo logs are a record of each photo taken, which helps to identify the photographer and date/time taken. During data collection, photos should be taken with a label with ID, date, species, log number, and have a size scale. With all the data collected, a report should be finalized with the photos documented, complete recording of all pertinent findings, and all samples collected.

4.2.4. *Available Tools and Techniques*

4.2.4.1. Remote Physical Assessment (including respiration rate and behavior)

Each case/event should be assessed through physical, behavioral, and environmental observations. Some of these observations include body condition, open wounds, lacerations, buoyancy issues, lethargy, and surface behaviors. These observations and data will improve decision-making and adaptive management of the situation to determine the appropriate course of action for that particular individual and situation (refer to the Mass Stranding Best Practices for information on groups of animals). Careful planning and adaptive management will also provide important information that can be used to inform decision making for future cases. Lessons learned from each situation through thorough debriefing also is critical to inform tools and techniques. A standardized health assessment form ***may*** be available, depending on the region and taxa. If so, it should capture all necessary information. If there is no form available then the questions below should be determined (Cape Cod Stranding Network 2008) in order to more generally assess the whale's status and condition. Below are examples of some questions that might inform decision making. In the future, regional health assessment forms, if not already available, may be developed.

- Determine the species involved and use identification characteristics and catalogs for the species or stock to determine if this is a known individual. The identification characteristics for the species may include the size, coloration, rostrum and callosities, fluke, pectoral flipper, and dorsal fin. Is this a known individual? If so, what do we know about the individual, behavior and normal habitat?
- Estimate the total length, estimate the age class, and potential weight (using weight charts).
- Note the body condition. If able to determine, is there an indentation behind the cranium (peanut head)? Are ribs and/or scapula visible? Is the animal concave or convex in the epaxial region on a longitudinal view? Are there any skin lesions or wounds?
- If possible, count respirations (number of respirations per minute), note respiratory effort, is there any respiratory exudate, odor, abnormal sound? (Normal breathing intervals for large whales are once every fifteen to twenty minutes (Geraci *et al.* 2005)
- Are there any other animals in the area? How many? Is the animal frequently in close association with any of them (*e.g.*, mom/calf, bachelor pair, etc.)?
- Take photos and/or video to document injuries, disease or behavioral changes

Following remote observations, it is critical to share the information and have a discussion with a group of experts (*e.g.*, marine mammal veterinarians, biologists with experience with a given species, etc.). This is possible when the case is not immediately life threatening and the animal's behavior/sighting history is somewhat predictable such that the animal can be relocated for future interventions. In an emergency case (*e.g.*, an animal is in imminent danger of death, such as a lethal vessel strike), immediate intervention (following approval from NMFS) may be warranted.

4.2.4.1.1. Breath Sampling

Breath sampling is sampling from the cloud of "blow" (Figure 1) from a whale when they exhale as they reach the surface. They may blow several consecutive times between dives and some species may start an exhalation underwater and the second breath may be easier to target. It is appropriate to collect several breaths from an individual being assessed. For mom/calf pairs, it may be difficult to focus the collection to only one of the two if they are surfacing together especially in shallow water. This sampling is non-invasive and can be collected easily. There are different ways a breath sample can be collected (Table 6) (Hunt *et al.* 2013):

- Long poles positioned over the blowholes which can have nylon fabric suspended across a 15-centimeter ring or a plastic framework, an inverted funnel, and/or Petri dishes
- A remote-controlled helicopter/UAS with Petri dishes

Figure 1: Respiratory vapor samples ("blow") from large whales can be collected by a variety of pole-based or remote-controlled helicopter-based methods. This photograph shows collecting "blow" droplets from a North Atlantic right whale (*Eubalaena glacialis*) using a nylon-fabric sampler suspended on the end of a carbon-fiber pole. (Photo: Amy Knowlton, New England Aquarium, SARA Permit #325863, NMFS Permit #14233, Hunt *et al.* 2013.)

Nitrile gloves should be worn by anyone involved with sample collection and should be changed after accidental contact with skin, surfaces or saltwater to avoid contamination. Gloves should also be changed between sampling different animals.

The exhaled breath and condensate should be collected on at least two sterile Petri dishes with no media. Sampling multiple exhaled breaths on the same plates is ideal. Samplers should collect a small volume of surface seawater (minimum one milliliter) on a plate in the vicinity of the whale.

Samples should be processed onboard if conditions allow, or kept cool until they can be processed on land. Sampling will not provide immediate information for decision making and may need to be sent to a lab for analyses unless cytology would be informative.

Sample processing (one example below, sample collection may differ based upon situation):

Plate #1:

a. Collect one swab to prepare smears on three glass microscope slides. Label and place the slides in a secure area and air dry
b. Collect two swabs in transport media for bacteriology (Ames), keep chilled. Do not freeze.
c. Collect two swabs for fungal culture. Keep the swabs for fungal culture dry and in separate

sterile containers. Keep chilled. Do not freeze.

d. Collect 2 swabs and place in RNA Later® or a dry sterile container for pathogen testing (*e.g.*, viral, etc.). Ok to freeze.

Plate #2: To avoid contamination, do not collect this sample from a Petri plate that has been previously swabbed:

a. Using a sterile pipette, transfer a minimum of 0.1 milliliter of blow into a sterile Nalgene cryovial

Table 6: Breath sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Respiratory vapor ("breath")	• Pole-based samplers • Remote-controlled devices possible (?) • Different methods for droplets, exhaled breath condensate, and gases (these provide different types of information)	Medium	• Non-invasive • Targeted biomarker sampling possible • Repeated sampling possible • Wide range of metabolites can be studies simultaneously • Mostly requires remote laboratory analyses and little real time data	• Novel technique; many validations remain to be done • Target biomarkers at trace concentrations • Advanced detection strategies needed for quantitative analysis	• Several hormones detectable • May contain a large variety of other detectable compounds (?) • May be proxy for blood, as has been observed in human studies • Respiratory microbiome • Host immune response

4.2.4.1.2. Fecal Sampling

Fecal sampling (Figure 2) can be collected from well-formed floating semi-solid clumps to a more fluid, dispersed plume which can be scooped from the water surfaces using a fine-mesh nylon dipnet, draining off as much seawater as possible (Hunt *et al.* 2013). Refer to Table 7 below for more information on the fecal sampling technique.

Figure 2: NOAA researchers collecting fecal samples. Photo taken under federal research permit. Photo credit: NWFSC.

When collecting fecal samples:

a. Place replicate samples of 2-4 milliliter of feces in three separate sterile containers

b. Place one sample of 1.0 milliliters of feces in a sterile container for molecular analysis and possible electron microscopy

c. Swab the fecal sample. Place the swab either in RNA Later® or a dry sterile container

Table 7: Fecal sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Feces	• Locate visually or with a dog • Surface collection with scoop or net; subsurface collection with divers • Not possible in some environments and conditions and not applicable in all large whales	• Low without dog • Medium with dog	• Non-invasive • Extremely high steroid content (easily detectable) • Well-established steroid hormone technique • Long 'sampling time frame' may enable study of chronic stress • Repeated sampling possible	• Low sampling rate • Targeted sampling difficult • Individual not always known (cannot always be genotyped due to DNA degradation) • Cannot sample fasting seasons	• Diet analysis • Endoparasites • Lipophilic hormones • Fatty acid and stable isotope analysis of diet • Toxin exposure (*e.g.*, domoic acid) • Gut microbiome and relationships to stress, immunity, and disease • Some immunoglobulins and other hormones may be detectable (?)

4.2.4.1.3. Photogrammetry (UAS or Other)

Photogrammetry is a laser system that allows for quantitative measurements (morphometrics) from photographs. It adjusts pixel measurements to real size by an estimate of scale (distance/focal length). Fixed-wing airplanes, helicopters, and/or UAS are used to collect vertical images from precisely-measured altitudes directly above the whale. There has been great success using UAS because of the quiet sound footprint, vessel standoff, ability for increased range, increased safety, and cost effectiveness. Table 8 provides more information on the photographic analysis technique.

Table 8: Photographic analysis technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Photographic analysis	• Lateral view with boat-based photography • Dorsal view/body outline with airplanes or remote-control devices • Infrared thermography	• Very high	• Non-invasive • Best sampling rate • Repeated sampling possible	• External appearance only • Airplane-based photography has cost/safety issues	• Blubber reserves/nutritional state • Epidermal lesions • Ectoparasites • Entanglement and injury • Thermal physiology (infrared) • Watercraft wound analysis

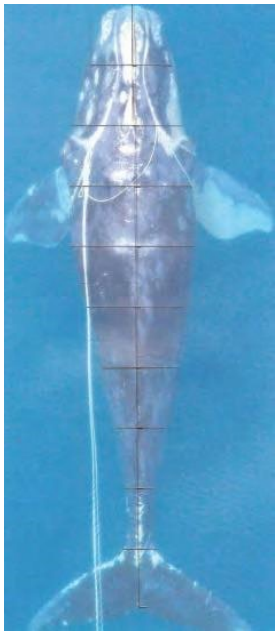


Figure 3: example of aerial photography. This image was marked for length-to-width ratio analysis to assess likely body weight prior to dosing with sedatives for disentanglement efforts (Hunt *et al.* 2013).

4.2.4.2. Medical Intervention Strategies

4.2.4.2.1. Sedation

If a whale is seriously injured or ill at sea, the scenario needs to be assessed to decide if sedation is the best course of action. At sea sedation has rarely been used for injured or ill whales, but could be used to slow a whale down to administer antibiotics or be able to relocate a whale to a suitable and humane area to euthanize. If using sedatives, it is important to obtain the right dosage because if too much is administered there is risk that the whale could inhale water because it is still swimming and diving (Moore *et al.* 2010) and possibly drown. To administer the sedative, a pole syringe, dart gun or crossbow has been used depending upon the size of the whale and its behavior. Midazolam and butorphanol (Table 12) have been successfully used in sedating large whales. For more details on the procedure for sedating large whales please see the Large Whale Entanglement Best Practices.

Table 12: Large whale sedative dosage (Moore *et al.* 2010, Moore *et al.* 2012)

Sedation Drug	**Dosage**
Midazolam (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Butorphanol (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Reversal Drug	**Dosage**
Naltrexone (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution

4.2.4.2.2. Medications

After discussion with NMFS and experts, administering antibiotic, analgesic, or other drug therapy may be considered depending on the scenario and if the treatment could lead to the improved condition of the whale. Typically, a long-acting antibiotic, such as ceftiofur or cefovecin, is administered by remote dart to free-ranging live whales and may require a series of treatments, if possible. Antibiotics may be used to treat live whales with injuries to help prevent septicemia.

4.2.4.2.3. Tagging and Marking

The decision on which technique(s) to use for tracking a live injured whale will generally be made on a case-by-case basis. Gathering data on the survival of large whales that have been released after a live stranding is an essential part of the intervention. Without the data on post-release outcomes, one cannot

assess the value of the overall response, nor evaluate the combined suite of protocols employed. The tools available for monitoring post-intervention outcomes range from the re-sighting of natural or applied markings, to VHF/satellite tag tracking.

Natural Markings are typically used for identification. Some species have specific criteria for identification and some also have catalogs so that if matched to a known individual more information about the animal can be obtained. These include pigmentation patterns on the fluke or body, callosity shape and size, dorsal fin shape and notches, or other skin marking depending on the species involved. It is important to acquire a comprehensive series of species-relevant images of all such marks before release to enable future recognition.

Applied marks are those artificial markings applied by the Stranding Network responders during the intervention and release. They may be very temporary, such as livestock paint stick markings that last only a few days. Short-term marks could include plastic livestock ear tags in the dorsal fin (for those species with a dorsal fin), that can last for many months.

An electronic tag, with options including VHF (radio) and satellite, is another type of applied mark. Tag attachment options include suction cup tags, single pin attachments in the trailing edge of the dorsal fin (for those species with a dorsal fin), or LIMPET tags.

All these types of monitoring can be used in tandem, so photos of natural markings can be coupled with applied marks or tags to increase the likelihood of re-sighting whales at multiple time periods (*i.e.,* short-term and long-term) to assess post-release outcomes. See Table 4 for the pros and challenges of each tagging/marking type. For more specific details on tagging and marking, refer to the Report of the Joint US Office of Naval Research, International Whaling Commission and US National Oceanic and Atmospheric Administration Workshop on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices (IWC, NOAA, ONR. 2020).

Table 4: Pros and challenges of each tagging/marking type

Marking Type	Pros	Challenges
Natural Markings	• Natural markings tend to persist after healing and have more lasting value, especially where the individual's markings are archived from stranding event images • Many areas have Photo-ID catalogs for various whale species or stocks Re-sights may occur over many years, allowing for long-term information on the success of the intervention	• The whale appearing in an area where photo-id or re-sights may occur for recognizing applied or natural marks • Belonging to a species that has an existing photo-id catalog that can be used for matching • Appropriate photos being collected during the stranding event to match with the photo-id catalog (*i.e.,* fluke photos of humpback whales

Marking Type	Pros	Challenges
		may be difficult to obtain when they are on a beach) ● Communication between researchers with photo-id catalogs and the Stranding Network responders may be challenging, particularly over large geographic distances (multi-country ranges of most migratory large whales) ● Data on re-sights may not occur in the short term (days/weeks/months), leading to uncertainty Lack of re-sight data may not necessarily mean the intervention wasn't successful – the fate of the whale remains unknown
Applied Markings	● Easy to apply (paint sticks require no training) ● Inexpensive and readily available (on hand with many/most Stranding Network responders)	● Situations allowing for safe application to out of habitat whales are not very common ● Re-sight information depends upon high level of effort (especially boat-based, but could be shore-based) to identify free-swimming whale ("success")
Electronic Tags	● Allow for longer term tracking (days/weeks/months) ● Allow for targeted tracking over a large geographic area, with the tag aiding in the ability to locate and re-sight the free-swimming animal (radio or satellite) Allow for remote tracking (satellite)	● An appropriate tag available with a trained applicator ● A suitable permit to tag in hand (tagging can be conducted under the national MMHSRP permit with pre-approval) ● Funding for the tag acquisition or replacement ● Time to focus on the tagging plan while rescue process is ongoing ● Potential for added impact or stress to the whale

4.3. Entangled

For entangled cetaceans (for specific information refer to Large Whale Entanglement Response Best Practice), NMFS, in consultation with experts and veterinarians, determines if the entanglement is an actual serious injury and life-threatening. This is achieved through field observations by biologists/researchers/veterinarians, analysis of photos and/or videos, the animal's behavior, and prior experience with similar entanglements. NMFS Serious Injury Guidance (NMFS 2007) may be consulted to assess the injury (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-policies-guidance-and-regulations#distinguishing-serious-from-non-serious-injury-of-marine-mammals).

If the entanglement is determined to be life threatening, the next step is to determine the appropriate type of intervention effort. Responders must ensure that the logistical and resource requirements can be met for a safe and effective intervention. These requirements include the availability of trained personnel, equipment,

and the animal's behavior, sighting history, and location, including whether it is an appropriate location (*e.g.*, water depth, sea state, weather, will not adversely impact protected/sensitive habitats, etc.). If intervention is not an option, the animal may be monitored, usually by the Entanglement and/or Stranding Network or trained biologists, to determine whether a response may be possible at a later date (*e.g.*, the animal moves to a more suitable area for rescue, the animal live strands, the animal becomes lethargic and easily approachable).

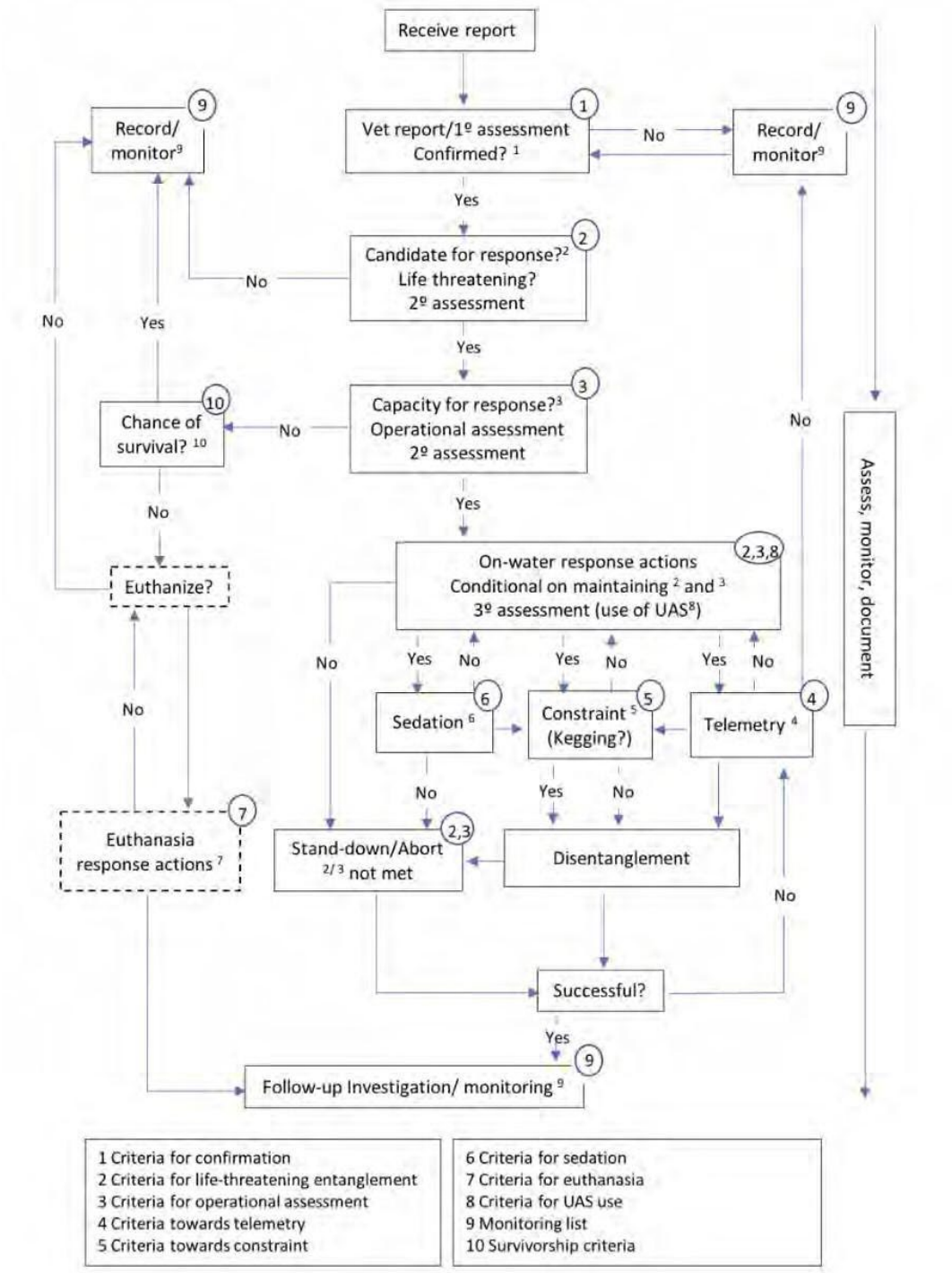
4.3.1. *Decision Trees and Triage Criteria for Response*

The decision of whether (or not) to intervene is made by NMFS, after discussions between multiple parties – the local Entanglement Network organizations that have "boots on the ground" that are responsible for response, the NMFS RSC, and the MMHSRP at OPR HQ or authorized responders may have pre-approval from NFMS to respond in real-time without consultation. Ideally, these consultations also include marine mammal veterinarian(s) and experts in the biology and life history of the affected species.

Communication is essential before, during, and after an entanglement response. There must be clear communication when planning for the response, and among team members during the response (*e.g.*, between boat operators, between boat operators and shore personnel, between response team and emergency personnel, members of the public, law enforcement, harbor masters, native communities, etc.).

Below is a decision tree adapted from the Welfare Issues Associated with Entanglement of Large Whales Workshop 2010 report that can help when deciding the appropriate action for an entangled response.

Refer to the Large Whale Entanglement Best Practices for more detailed information.



4.3.2. *Specific Training and Qualifications (including CI letters)*

The Large Whale Entanglement Response Network (the Entanglement Network) is made up of individuals who have been evaluated on their qualifications and past experience, and then issued a CI letter under the MMPA/ESA permit for certain levels of entanglement response to large whales (*e.g.,* Level 3, 4 and 5). In order to become a CI, applicants must provide NMFS with a resume summarizing any previous experience

with entanglement response, including the roles they played in each event, their vessel experience around large whales, entanglement response training history, and any other pertinent information. This resume is reviewed by the regional NMFS Entanglement Response Coordinators and relevant subject matter experts who are already authorized within the Stranding Network. The review panel provides comments, and a confidential recommendation to the MMPA/ESA permit PI, on whether the individual should be authorized as an entanglement responder (and therefore a MMPA/ESA permit CI), and at which level of responsibility. Refer to the Large Whale Entanglement Response Best Practices for more detailed information on the five levels of responders and their roles and responsibilities. After the review, the MMPA/ESA Permit PI decides if a candidate should receive a CI letter. Each level of responder must have completed different levels of certifications to qualify for the role.

Responder Qualifications:

Level 1= Completed Level 1 classroom or virtual training and demonstrated equivalent knowledge and experience (submit resume)

Level 2= Completed Level 2 on-water or training and demonstrated equivalent knowledge and experience (submit resume)

Level 3= Completed Level 1 & 2 certifications; basic Level 3 training or Advanced Level 3 training (apprenticeship with an approved trainer) and experience in the following elements, which will be evaluated:

- Large whale species identification and behavior, and the ability to safely follow a free swimming, entangled whale
- Boat handling and safety including basic seamanship, driving, and close approaches to whales
- Line handling and safety including knowledge of knots, handling lines under pressure, and an understanding of how working lines behave
- Follows instructions and response plans

Level 4= Basic or Advanced Level 3 certification; direct experience in a supervised (by Entanglement Network coordinators or NMFS) large whale disentanglement, documentation of that experience, and a positive evaluation from NMFS using information provided by Entanglement Network Coordinators and any hard documentation (*e.g.*, video); and when possible, commitment

to consultation as detailed in Level 5 below

Level 5= Level 4 certification; experience with right whale behavior and/or includes a person on the team directly involved in the whale disentanglement (in the boat with the whale) that is experienced in right whale behavior; documented participation in a right whale disentanglement and/or NMFS review of video of participation in a right whale disentanglement that followed NMFS protocol; commitment to consultation which include:

- Immediate Consultation: when possible, use satellite/cell phones to bring in additional ideas/experience from other Level 5s and Level 4s (and vets and behaviorists if appropriate) while on scene with an entangled right whale
- Action Plan Development: For a tagged right whale, consultation required with NMFS, Level 5s and Level 4s, veterinarians, behaviorists, etc.

More details about qualifications and team member roles (Table 13 and 14) can be found in the Large Whale Entanglement Response Best Practices. At present, a CI remains authorized to respond to entangled large whales as long as their CI letter is valid (which is typically the life of the five-year MMPA/ESA permit, with some exceptions). These CIs are expected to coordinate to the extent possible during responses with the NMFS Entanglement Response Coordinators and the MMHSRP. However, given the uncertain communication abilities at sea, and the need for quick decision-making, CIs are empowered to use their best judgment and act independently if the situation requires it. All entanglement response actions are reviewed after the event with the participating responders, the MMHSRP staff, and high level responders (optional). At any time, members of the Large Whale Entanglement Response Network may be called upon to respond to ESA-listed or non-listed entangled large whales. Large whale entanglement response efforts may include physical or chemical restraint, attachment of scientific instruments (*i.e.,* satellite tags), biological sampling for health studies, and disentanglement. Refer to the Large Whale Entanglement Best Practices for specific details.

Table 13: Suggested number of personnel required for a typical large whale entanglement response effort (not including sedation).

Team member roles	Number of personnel required
Incident Commander (IC)	1
Safety Officer (SO)	1 (dedicated role)
Vessel Captain (also may represent Safety Officer)	1
Crew (vessel dependent)	1-3 (roles can be shared with other roles)

Team member roles	Number of personnel required
Disentanglers	2-3 (roles can be shared, but not concurrently)
Data Collector	1 (role can be shared with other roles)
Documenters	1-3 (roles can be shared with other roles)
Biopsy Sampling	1 (role can be shared with other roles)
Gear Person	1 (role can be shared with other roles)
Tagger (familiar with tag setup and deployment; takes 2 people, along with helm position to deploy)	2 (roles can be shared with other roles)
Communications Person	1 (role can be shared with other roles)
Optional – UAS PIC and VO (see UAS; Section 6)	2-3 (roles can be shared with other roles)

Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*e.g.*, IC and SO; 2º documentation and data collection).

Table 14: Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*e.g.*, IC and SO; 2º documentation and data collection).

Team Member Role	Role Description	Role Qualifications
Incident Commander (IC)	The IC, working closely with shoreside (or otherwise remote) authorizing parties (*e.g.*, NMFS RSC/ LWERCs, National LWERC), is responsible for the on-scene oversight and supervision of the first response operation. The IC may participate directly in the operation depending on circumstances, but typically does not directly participate (*i.e.,* hands-on) in the operation. This enables the IC to remain focused on the larger picture of the response and objectively ensure that safety is maintained for responders, the public, and animals.	The IC needs to be at least a level 3 or higher for any close-approach assessment or tagging operations, a level 4 for overseeing the disentanglement of all large whales except right whales, and a level 5 for right whales (unless otherwise authorized). Under Heightened Consultation protocol tagging required a level 4 designation, the disentanglement of other species beyond right whales a level 5 designation. If unable to consult RLWERC or experts, right whale disentanglement efforts must be aborted. The IC must be trained and/or experienced in protocols, procedures, risks, and risk mitigation in all aspects of the first responder mission being carried out. Must have the authority to carry out operations.
Safety Officer (SO)	The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate with the team and adjust the strategy of the response as needed. The SO works very closely with the IC. Under certain circumstances and depending on experience, the role of the SO can overlap with that of the helmspersons of the support or approach vessels, and if necessary and otherwise appropriate, the role of IC and SO can be performed by one person.	Experience in previous large whale entanglement response efforts, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e.,* not adhering to protocols, presence of other animals, incoming environmental or weather changes, and time of day considerations). Willingness and ability to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.

Team Member Role	Role Description	Role Qualifications
Helmsperson/Vessel Captain	This person(s) is/are responsible for the safe transit and operations of the vessel(s), including the safe maneuvering around and approach to entangled whales and the trailing gear that might exist. Helms persons should have experience operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the helmsperson role whether on the transit, support, or approach vessels is one of the most important roles beyond that of the IC.	Experience, training, and in some cases certifications (USCG license, NOAA certified components course) in order to "captain" a vessel. Helmspersons should have experience operating the vessel around large whales and all aspects of the response operation.
Vessel Operator(s)/Crew	This person(s) is/are responsible for the safe transit and operations of the vessel(s), including the safe maneuvering around and approach to whales. Vessel operator(s) should have experience operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the vessel operator role whether on the transit, support, or approach vessels is one of the most important roles beyond that of the IC.	Experience, training, and in some cases certifications (*e.g.*, USCG license, NOAA certified components course) in order to "captain" a vessel. Vessel operators should have experience operating the vessel around large whales and all aspects of the response operation.
Disentanglers	These persons are responsible for cutting the animal free. The role involves, as appropriate, the establishment of a working line, the safe handling of the working lines and entangling gear towards additional assessment (3º assessment) and accessing the animal and entanglement, the adding of constraint - kegging buoys and sea anchors, and the handling of various knives towards safely cutting the animal free. This higher-risk role may overlap with other roles only to a limited extent. For instance, documentation through use of a pole, vessel or helmet-mounted POV camera, communications, or operating the helm position. However, focus needs to be maintained on the animal, the gear, and the other members of the team. The best-case scenario is to have a dedicated experienced helmsperson who can cover communications, with two dedicated, experienced, trained and approved disentanglers.	At least two of the disentanglers in the approach/task vessel need to be experienced in their roles and/or have level 3 designation or higher. Disentangling right whales requires even greater experience and/or designation of a level 4 or higher. Disentanglers should be familiar with the tools and procedures they will use, the vessel they are working from, and the entangling gear and the species of whale they are working on.
Data Collector	The data collector is essential in recording all aspects of the entanglement response. This person is responsible for ensuring all data is complete on data sheets and data loggers, including the assessment of the animal, recording identity of associated documentation, the entanglement (*e.g.*, nature of the entanglement, gear type), behavior of animal (*e.g.*, respirations, changes due to response), the response efforts (an outline of response steps taken, risk factors encountered, who was involved), and telemetry (*e.g.*, tag identity, frequency of VHF, fine tuning).	Familiarity with procedures and data sheet/data loggers, attention to details. Ability to accurately and completely compile a great deal of information. Lacking a disposition to seasickness is valuable.
Documenter(s)	This person(s) is/are responsible for obtaining and maintaining (*e.g.*, identifying and safe storage) still and video imagery on all aspects of the response. They work closely with the data collector and the helmsperson. This person may also serve as the data collector. Under certain circumstances, responders with other roles may take on, in part, the role of documenter, through use of helmet or vessel-mounted POV cameras. However, such persons must maintain focus on their primary role and maintain safety. POV cameras should be turned on and forgotten by the user, and instead either tended to or operated remotely by a dedicated documenter.	Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response

4.3.3. *Data Collection Protocols*

Data collection is typically performed by qualified individuals and depending on the level of response and capacities may determine the amount of data collected. It is important to document the event by recording the location and time of each sighting. Monitoring the animal(s) is essential and data can be collected on a form such as the Free Swimming Whale Assessment Form and Monitoring Datasheet (see example in Appendix C). Obtain good photographs and/or video of the animal because it can help identify individual animals and assess their condition. Recording the animal(s) behavior when observed is helpful to aid in the assessment and in determining the best course of action. For any large whale response, at minimum, field information necessary for completion of NOAA's Level A form must be collected. This will include the assignation of a unique identifier (Field ID#, per Regional Stranding Network protocols). Live animals must also be indicated in the appropriate section of the Search Effort Log on the Level A form. Level A forms may be completed electronically via direct entry in the National Stranding Database.

Disentanglement and sampling equipment and data needs must be well thought out prior to the start of any entanglement response program. Data forms and instructions should be completed during a response. Capture and sampling equipment checklists should be developed and used. Important forms for preparation prior to response may include: applicable permits; Level A and Human Interaction Forms; gear checklists; disentanglement forms; remote sedation worksheets; and drug interaction forms. Every effort should be made to retain all or representative sections of entangling gear (where possible), documented on the Level A and Human Interaction Form, and stored in a centralized location or submitted to the regional or appropriate gear identification team. If the situation allows, full photo/video documentation of the entanglement prior to gear removal should also be retained and submitted to the regional or appropriate gear identification team.

Ideally, when samples or gear are transferred between parties, it should be done under Chain of Custody if there is the potential of an enforcement action or litigation. These forms should start as soon as possible, and especially when samples are transferred from the field responders to the analyzers or storage facility, and at every subsequent transfer. The form is signed by both parties, and the original form should remain with the sample/gear and a copy (*e.g.*, a photo/scan) may be kept by the releasing party. Photo logs are a record of each photo taken, which helps to identify the photographer and date/time taken. During data collection, it is helpful to take an initial photo that contains a label with ID, date, species, location, and any other pertinent information (photographer's name or vessel). For any photos documenting samples or gear removed from the animal, a label and a size scale should be included in the photo. With all the data collected, a report should be finalized with the photos documented, complete recording of all pertinent findings, and all samples collected.

4.3.4. *Available Tools and Techniques*

Depending on the situation, an entangled large whale may be either physically or chemically restrained. Physical restraint may be used to slow down an animal, provide responders with greater control, and to help maintain large whales at the surface. Physical restraint is accomplished by attaching or determining if any part of the entanglement can be used as control line(s); attaching floats or buoys, and/or sea anchors to the entangling gear with a grappling hook or other means (*e.g.*, skiff hook deployed from pole); or by attaching new gear (*e.g.*, tail harnesses) to the animal to support it. The drag and buoyancy from small boats may also be used to slow down an animal and maintain it at the surface. Remote sedation may also be used to restrain the animal. Remote administration of chemical agents (*e.g.*, antibiotics) may be used to improve the animal's prognosis. More details on both types of restraint can be found in the Large Whale Entanglement Response Best Practices.

4.3.4.1. Remote Physical Assessment (including respiration rate and behavior)

Each case/event should be assessed through physical, behavioral, and environmental observations. Some of the observations that may be related to being entangled include thrashing, seeing gear on the animal, breaching (surface behaviors), length of dive times, increased respirations, and body condition. These observations and data will improve better decision-making and adaptive management of the situation to determine the appropriate course of action for that particular individual and situation (refer to the Mass Stranding Best Practices for information on groups of animals). Careful planning and adaptive management will also provide important information that can be used to inform decision making for future cases. Lessons learned from each situation through thorough debriefing also is critical to inform tools and techniques. A standardized health assessment form ***may*** be available, depending on the region and taxa. If so, it should capture all necessary information. If there is no form available then the questions below should be determined (Cape Cod Stranding Network 2008) in order to more generally assess the whale's status and condition. Below are examples of some questions that might inform decision making. In the future, regional health assessment forms, if not already available, may be developed.

- Determine the species involved and use identification characteristics and catalogs for the species or stock to determine if this is a known individual. The identification characteristics for the species may include the size, coloration, rostrum and callosities, fluke, pectoral flipper, and dorsal fin. Is this a known individual? If so, what do we know about the individual, behavior and normal habitat?
- Estimate the total length, estimate the age class, and potential weight (using weight charts)
- Note the body condition. If able to determine, is there an indentation behind the cranium (peanut

head)? Are ribs and/or scapula visible? Is the animal concave or convex in the epaxial region on a longitudinal view? Are there any skin lesions or wounds?

- Note entanglement (*e.g.*, type of gear, location, etc.)
- If possible, count respirations (number of respirations per minute), note respiratory effort, is there any respiratory exudate, odor, abnormal sound? (Normal breathing intervals for large whales are once every fifteen to twenty minutes (Geraci *et al.* 2005))
- Are there any other animals in the area? How many? Is the animal frequently in close association with any of them (*e.g.*, mom/calf, bachelor pair, etc.)?
- Take photos and/or video to document injuries, disease or behavioral changes

Following remote observations, it is critical to share the information and have a discussion with a group of experts (*e.g.*, marine mammal veterinarians, biologists with experience with a given species, etc.). This is possible when the case is not immediately life threatening and the animal's behavior/sighting history is somewhat predictable such that the animal can be relocated for future interventions. In an emergency case (*e.g.*, an animal is in imminent danger of death, such as an anchored animal), immediate intervention (following approval from NMFS) may be warranted.

4.3.4.1.1. Breath Sampling

Breath sampling is sampling from the cloud of "blow" (Figure 1) from a whale when they exhale as they reach the surface. They may blow several consecutive times between dives and some species may start an exhalation underwater and the second breath may be easier to target. It is appropriate to collect several breaths from an individual being assessed. For mom/calf pairs, it may be difficult to focus the collection to only one of the two if they are surfacing together especially in shallow water. This sampling is non-invasive and can be collected easily. There are different ways a breath sample can be collected (Table 6) (Hunt *et al.* 2013):

- Long poles positioned over the blowholes which can have nylon fabric suspended across a 15-centimeter ring or a plastic framework, an inverted funnel, and/or Petri dishes
- A remote-controlled helicopter/UAS with Petri dishes

Figure 1: Respiratory vapor samples ("blow") from large whales can be collected by a variety of pole-based or remote-controlled helicopter-based methods. This photograph shows collecting "blow" droplets from a North Atlantic right whale (*Eubalaena glacialis*) using a nylon-fabric sampler suspended on the end of a carbon-fiber pole. (Photo: Amy Knowlton, New England Aquarium, SARA Permit #325863, NMFS Permit #14233, Hunt *et al.* 2013.)

Nitrile gloves should be worn by anyone involved with sample collection and should be changed after accidental contact with skin, surfaces or saltwater to avoid contamination. Gloves should also be changed between sampling different animals.

The exhaled breath and condensate should be collected on at least two sterile Petri dishes with no media. Sampling multiple exhaled breaths on the same plates is ideal. Collect a small volume of surface seawater (minimum one milliliter) on a plate in the vicinity of the whale.

Process the samples on board if conditions allow, or keep the plates cool until they can be processed on land. Sampling will not provide immediate information for decision making and may need to be sent to a lab for analyses unless cytology would be informative.

Sample processing: (one example below, sample collection may differ based upon situation) Plate #1:

a. Collect one swab to prepare smears on three glass microscope slides. Label and place the slides in a secure area and air dry.

b. Collect two swabs in transport media for bacteriology (Ames), keep chilled. Do not freeze.

c. Collect two swabs for fungal culture. Keep the swabs for fungal culture dry and in separate sterile containers. Keep chilled. Do not freeze.

d. Collect two swabs and place in RNA Later® or a dry sterile container for pathogen testing (*e.g.*, viral, etc.). Ok to freeze.

Plate #2: To avoid contamination, do not collect this sample from a Petri plate that has been previously swabbed:

a. Using a sterile pipette, transfer a minimum of 0.1 milliliter of blow into a sterile Nalgene cryovial

Table 6: Breath sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Respiratory vapor ("breath")	• Pole-based samplers • Remote-controlled devices possible (?) • Different methods for droplets, exhaled breath condensate, and gases (these provide different types of information)	Medium	• Non-invasive • Targeted biomarker sampling possible • Repeated sampling possible • Wide range of metabolites can be studies simultaneously • Mostly requires remote laboratory analyses and little real time data	• Novel technique; many validations remain to be done • Target biomarkers at trace concentrations • Advanced detection strategies needed for quantitative analysis	• Several hormones detectable • May contain a large variety of other detectable compounds (?) • May be proxy for blood, as has been observed in human studies • Respiratory microbiome • Host immune response

4.3.4.1.2. Fecal Sampling

Fecal sampling (Figure 2) can be collected from well-formed floating semi-solid clumps to a more fluid, dispersed plume which can be scooped from the water surfaces using a fine-mesh nylon dipnet, draining off as much seawater as possible (Hunt *et al.* 2013). Refer to Table 7 below for more information on the fecal sampling technique.

Figure 2: NOAA researchers collecting fecal samples. Photo taken under federal research permit. Photo credit: NWFSC.

When collecting fecal samples:

a. Place replicate samples of 2-4 milliliters of feces in three separate sterile containers.

b. Place one sample of 1.0 milliliter of feces in a sterile container for molecular analysis and possible electron microscopy.

c. Swab the fecal sample. Place the swab either in RNA Later® or a dry sterile container.

Table 7: Fecal Sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Feces	• Locate visually or with a dog • Surface collection with scoop or net; subsurface collection with divers • Not possible in some environments and conditions and not applicable in all large whales	• Low without dog • Medium with dog	• Non-invasive • Extremely high steroid content (easily detectable) • Well-established steroid hormone technique • Long 'sampling time frame' may enable study of chronic stress • Repeated sampling possible	• Low sampling rate • Targeted sampling difficult • Individual not always known (cannot always be genotyped due to DNA degradation) • Cannot sample fasting seasons	• Diet analysis • Endoparasites • Lipophilic hormones • Fatty acid and stable isotope analysis of diet • Toxin exposure (*e.g.*, domoic acid) • Gut microbiome and relationships to stress, immunity, and disease • Some immunoglobulins and other hormones may be detectable (?)

4.3.4.1.3. Photogrammetry (UAS or Other)

Photogrammetry is a laser system that allows for quantitative measurements (morphometrics) from photographs. It adjusts pixel measurements to real size by an estimate of scale (distance/focal length). Fixed-wing airplanes, helicopters, and/or UAS are used to collect vertical images from precisely-measured altitudes directly above the whale. There has been great success using UAS because of the quiet sound footprint, vessel standoff, ability for increased range, increased safety, and cost effectiveness. Table 8 provides more information on the photographic analysis technique.

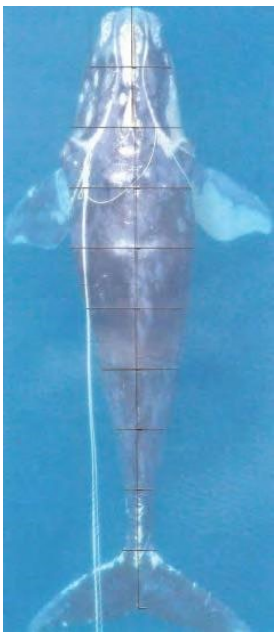


Figure 3: Example of aerial photography. This image was marked for length-to-width ratio analysis to access likely body weight prior to dosing with sedatives for disentanglement efforts (Hunt *et al.* 2013).

Table 8: Photographic analysis technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Photographic analysis	• Lateral view with boat-based photography • Dorsal view/body outline with airplanes or remote-control devices • Infrared thermography	• Very high	• Non-invasive • Best sampling rate • Repeated sampling possible	• External appearance only • Airplane-based photography has cost/safety issues	• Blubber reserves/nutritional state • Epidermal lesions • Ectoparasites • Entanglement and injury • Thermal physiology (infrared) • Watercraft wound analysis

4.3.4.1.4. Sample Collection (Biopsy or Other)

Responders may collect biological samples (Table 9) such as biopsy and/or skin samples in the course of responding to an entangled animal. These samples can be used to assess some aspects of the health of the animal. Skin can be collected through the use of a remote dart, the collection of tissues from the removed gear or line, or the collection of sloughed skin from the water. Biopsy sampling typically involves discharging a projectile dart with a hollow tip that collects a small plug of skin and blubber. Higher-powered delivery devices, such as compound crossbows or black-powder Larsen guns, are more likely to be used while targeting large baleen whales at a distance of more than twenty meters from the vessel (typically used when targeting large baleen whales). Lower-powered delivery devices such as recurve crossbows or adjustable-power guns are used at shorter ranges (less than twenty meters) from small vessels. Responders may sample the area from the dorsal flank (well behind the blowhole). After the biopsy dart hits the animal, it bounces off as its penetration is limited by a stopper, and floats at the surface of the water where the biopsy sample/dart can be retrieved.

Responders may also may use a handheld pole with a dart tip on the end to manually collect a biopsy sample if the disposition and behavior of the entangled animal is conducive to a closer vessel approach (*i.e.,* the whale is anchored in place). In this instance, the responder would slowly and cautiously approach the animal, to within one body length, to quickly jab the pole into the dorsal surface or flank of the animal, while avoiding more sensitive areas such as the head, eyes, and the area around the blowhole.

Table 9: Biopsy sampling technique information (Hunt *et al.* 2013)

Sample Type	Typical collection methods	Typical sampling rate	Positive aspects	Potential limitations	Information relevant to conservation physiology
Epithelium and blubber biopsies	• Biopsy dart used with crossbow, pole, or pneumatic rifle • Sloughed skin may also be collect	Medium/high	• Good sampling rate • Many archived samples available • Tissue sample obtained; living cells present; high protein and nucleic acid content	• Invasive causes small wound • Permit restrictions • Repeat sampling not always possible if animal is not visible • 'Lag' time of blubber hormones unknown	• Lipophilic hormones in blubber • Lipid/fatty acid analysis, of contaminant load (POPs, lipophilic cpds and some metals), diet, age, sex, identity, etc. • Epidermal microbiome, skin lesions and epidermal diseases • Epidermal proteomics (CYP450-related enzymes for contaminants, SRPs for stress studies) • Transcriptomic and genomic approaches possible (?)

4.3.4.2. Entanglement Response

Whale disentanglement involves small boat handling, ropes under tension, and sharp knives/blades which makes the response complex and dangerous. There are safety and legal protocols, and a number of detailed assessments that must be made including condition of the animal, nature of the entanglement, weather and conditions, and available resources. The goal of an entanglement response is to safely remove all detrimental gear from the whale. It is important to document each event and obtain the gear so responders can continue to learn from the events and help prevent entanglements from occurring. More details on tools and techniques needed for a safe entanglement response can be found in the Large Whale Entanglement Response Best Practices.

4.3.4.2.1. Tools and Techniques

Techniques are largely based on historic whaling methods and are inherently dangerous. All techniques are conducted from small, maneuverable vessels. Work in "safe zones" with long reaching tools. Cutting tools on the end of telescoping or long poles are most often used to cut the entanglement; however, specialized crossbow tips fitted with cutting blades can be used to cut ropes remotely. These are rarely used, but are always used by skilled sharpshooters when there is no alternative available to access the entanglement. Cutting of lines and possibly flesh (when the line is embedded and not accessible) may occur during disentanglement through the typical use of pole-mounted and remotely-delivered cutting tools.

4.3.4.2.2. Tagging and Marking

The decision on which technique(s) to use for tracking a live injured or entangled whale, marking a carcass, or tagging or marking for post-release monitoring will generally be made on a case-by-case basis. Gathering data on the survival of large whales that have been released after a live stranding is an essential part of the intervention. Without the data on post-release outcomes, one cannot assess the value of the overall response, nor evaluate the combined suite of protocols employed. The tools available for monitoring post-release outcomes range from the re-sighting of natural or applied markings, to VHF/satellite tag tracking.

Natural Markings are typically used for identification. Some species have specific criteria for identification and some also have catalogs so that if matched to a known individual more information about the animal is possible. These include pigmentation patterns on the fluke or body, callosity shape and size, dorsal fin shape and notches, or other skin marking depending on the species involved. It is important to acquire a comprehensive series of species-relevant images of all such marks before release to enable future recognition.

Applied marks are those artificial markings applied by the Network responders during the intervention and release. They may be very temporary, such as livestock paint stick markings that last only a few days. Short-term marks could include plastic livestock ear tags in the dorsal fin (for those species with a dorsal fin), that can last for many months.

An electronic tag, with options including VHF (radio) and satellite, is another type of applied mark. Tag attachment options include suction cup tags, single pin attachments in the trailing edge of the dorsal fin (for those species with a dorsal fin), or LIMPET tags. Large whales may be tagged with buoys, telemetry devices or other scientific instruments to monitor their location and enhance the probability of relocating the individual. Similar to physical restraint, tethered buoys are typically attached to the entangling gear, and may use Very High Frequency (VHF), Global Positioning System (GPS), and/or satellite-linked tags to track the animal. As responses may occur over several days, the attachment of scientific instruments allows responders to quickly locate the entangled whale on subsequent days.

Additionally, types of monitoring can be used in tandem, so photos of natural markings can be coupled with applied marks or tags to increase the likelihood of re-sighting whales at multiple time periods (*i.e.,* short-term and long-term) to assess post-release outcomes. See Table 4 for the pros and challenges of each tagging/marking type. For more specific details on tagging and marking, refer to the Report of the Joint US Office of Naval Research, International Whaling Commission and US National Oceanic and Atmospheric Administration Workshop on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices (IWC, NOAA, ONR. 2020).

Table 4: Pros and challenges of each tagging/marking type

Marking Type	Pros	Challenges
Natural Markings	● Natural markings tend to persist after healing and have more lasting value, especially where the individual's markings are archived from stranding event images ● Many areas have Photo-ID catalogs for various whale species or stocks Re-sights may occur over many years, allowing for long-term information on the success of the intervention	● The whale appearing in an area where photo-id or re-sights may occur for recognizing applied or natural marks ● Belonging to a species that has an existing photo-id catalog that can be used for matching ● Appropriate photos being collected during the stranding event to match with the photo-id catalog (*i.e.,* fluke photos of humpback whales may be difficult to obtain when they are on a beach) ● Communication between researchers with photo-id catalogs and the Stranding Network responders may be challenging, particularly over large geographic distances (multi-country ranges of most migratory large whales) ● Data on re-sights may not occur in the short term (days/weeks/months), leading to uncertainty Lack of re-sight data may not necessarily mean the intervention wasn't successful – the fate of the whale remains unknown
Applied Markings	● Easy to apply (paint sticks require no training) ● Inexpensive and readily available (on hand with many/most Stranding Network responders)	● Situations allowing for safe application to out of habitat whales are not very common ● Re-sight information depends upon high level of effort (especially boat-based, but could be shore-based) to identify free-swimming whale ("success")
Electronic Tags	● Allow for longer term tracking (days/weeks/months) ● Allow for targeted tracking over a large geographic area, with the tag aiding in the ability to locate and re-sight the free-swimming animal (radio or satellite) Allow for remote tracking (satellite)	● An appropriate tag available with a trained applicator ● A suitable permit to tag in hand (tagging can be conducted under the national MMHSRP permit with pre-approval) ● Funding for the tag acquisition or replacement ● Time to focus on the tagging plan while rescue process is ongoing ● Potential for added impact or stress to the whale

4.3.4.3. Medical Intervention Strategies

4.3.4.3.1. Sedation

Sedation has been used during entanglement responses to help slow down the animal to remove the gear

instead of trying to tire and restrict movement of the whale by using buoys, drogues and small boats (Moore *et al.* 2010). To administer the sedative, a pole syringe or dart gun or crossbow syringe has been used. Midazolam and butorphanol (Table 12) have been successfully used in sedating large whales. For more details on the procedure for sedating large whales please see the Large Whale Entanglement Best Practices.

Table 12: Large whale sedative dosage (Moore *et al.* 2010, Moore *et al.* 2012)

Sedation Drug	**Dosage**
Midazolam (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Butorphanol (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Reversal Drug	**Dosage**
Naltrexone (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution

4.3.4.3.2. Medications

The Entanglement Network can consider administering antibiotic, analgesic, or other drug therapy depending on the scenario and if the treatment could likely improve the condition of the whale. Typically, the long-acting antibiotic, such as ceftiofur or cefovecin, is administered by dart to the free-ranging live whales and may require a series of treatments, if possible. Antibiotics can be used to treat live whales with concerning injuries from the gear entanglement to help prevent septicemia.

4.4. Stranded (In Surf or High and Dry)

It is important to note that beached cetaceans should not be pushed back out to sea without first being examined by a NMFS-approved marine mammal veterinarian or qualified responder and the action approved by NMFS (Ziccardi *et al.* 2015). When a whale strands onshore a primary concern is that gravitational effects (increased pressure from being out of water) can lead to respiratory and cardiovascular decompensation (Geraci *et al.* 2005). The animal can also experience severe skin blistering (sunburn), predation, hyperthermia, muscle damage (myopathy), distress and serious injury, and physical trauma from rocks and or high energy beach. In general, the first step in the response, while carrying out a medical evaluation and assembling the team/resources, is to keep the animal as comfortable as possible while it is stranded by administering supportive or hospice care for the first 1-2 tidal cycles. If the live animal remains on shore after 1-2 tidal cycles without refloating (either naturally or with intervention), euthanasia may be

considered. In certain circumstances euthanasia may be administered prior to 1-2 tidal cycles (*e.g.*, severe injuries, poor body condition, evidence of significant disease, dependent calf). The decision to euthanize is not taken lightly and will be discussed by the RSC, local stranding response group, MMHSRP staff and the attending veterinarian.

If return to the open ocean is the approved course of action, re-sighting of the released individual is a priority and could be done by recognizing natural markings, and/or applying marks (including VHF/satellite tags) during the intervention and release. Gathering data on the survival of large whales that have been released after a live stranding is an essential part of the intervention.

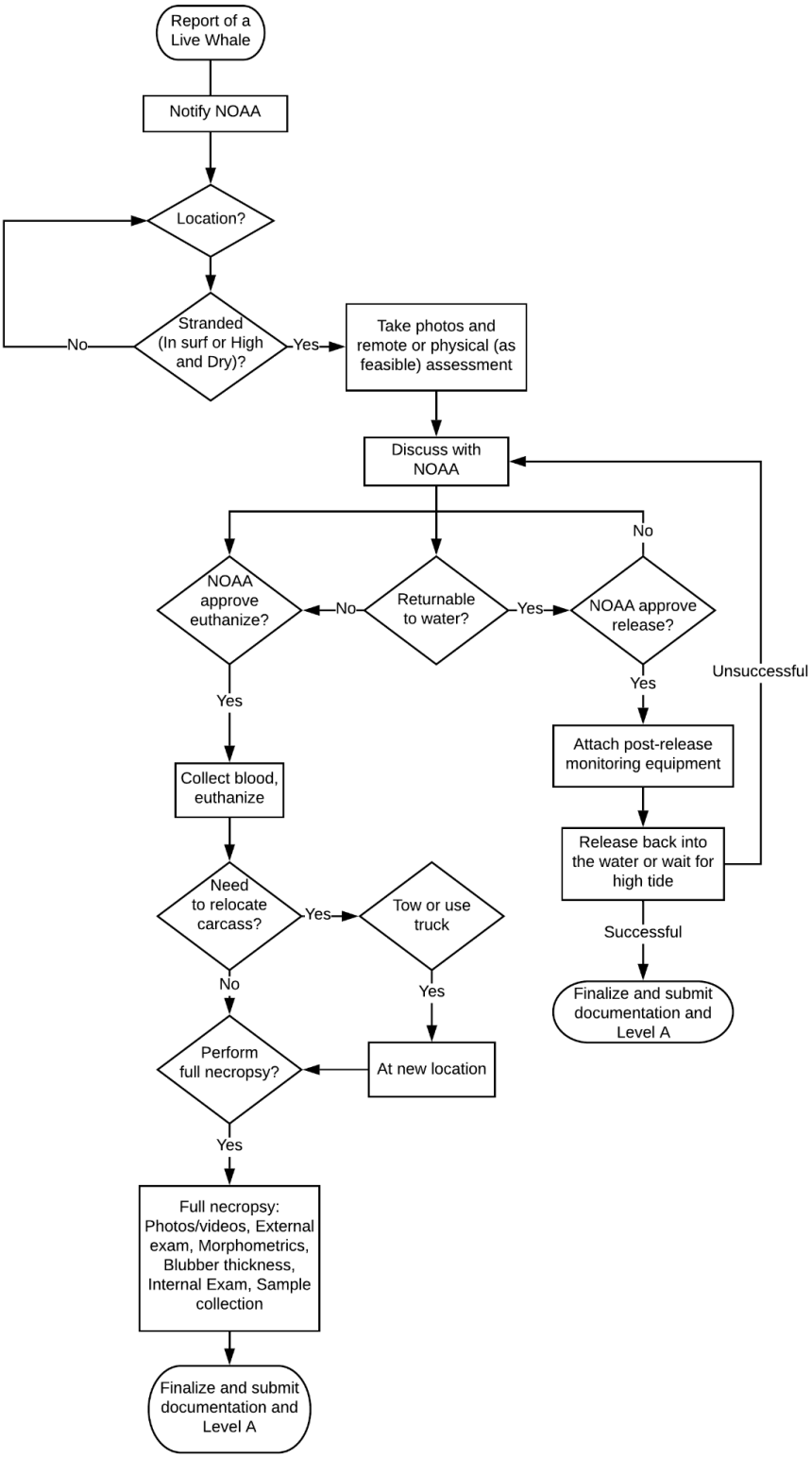
4.4.1. *Decision Trees and Triage Criteria for Response*

A stranded live whale is generally an emergency situation. However, there are scenarios where it is not safe for personnel to approach the whale (*e.g.,* in high surf, remote location) therefore, the decision of whether (or not) to intervene is made by NMFS, after discussions between multiple parties – the local Stranding Network or response organizations that have "boots on the ground" that are responsible for response, the NMFS RSC, the MMHSRP at OPR HQ, and other parties that may have jurisdiction (*e.g.*, tribes, NPS, state, etc.). Ideally, these consultations also include marine mammal veterinarian(s) and experts in the biology and life history of the affected species. The decision to intervene is made by NMFS after taking into consideration the following minimum questions (others questions may be developed) that help evaluate the benefits and risks based upon the specific situation:

- What field observations have been reported and how recently have they been reported?
- What is the health status of the individual?
- Is there a medical diagnosis?
- What are the potential causes of the animals' observed condition?
- Are some behaviors/conditions an artifact of active stranding? Could they resolve themselves post-release?
- What is the estimated or known life history (*e.g.*, sex, age, size)? Is it a known individual?
- What is the conservation status/reproductive potential?
- Are there safety and logistical concerns for intervention (for the responders and/or animals)?
- What resources are available and is an intervention logistically feasible?
- What potential risks are there for conspecifics or other species?
- Is there a contingency plan in place if intervention is not successful (*i.e.,* if the animal dies in the course of intervention, if the intervention is unsuccessful, or if the animal requires rehabilitation)?
- What are the environmental conditions (*i.e.,* tidal cycle, are there protected/sensitive habitats that should be avoided, etc.)?

Below is a decision tree that can help when deciding the appropriate action for a stranded (in surf or high

and dry) response:



4.4.2. *Specific Training and Qualifications (including CI letters)*

Endangered or threatened large cetacean stranding responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. In very particular circumstances for non-ESA listed species, a response can be conducted under a SA (by the SA holder after consultation with the Regional Stranding Coordinator) or by a government employee acting under MMPA Section 109(h). Therefore, only responders who have been authorized by NMFS and who have the training, experience, equipment, and support needed should attempt stranded large cetacean interventions. Authorized response efforts may also rely on partners at tribal, local, state and federal agencies (including law enforcement agencies and the USCG), non-governmental organizations, fishermen, and other groups to assist with some responses.

The Stranding Network members are trained or have experience in proper techniques for assessment, supportive care, euthanasia and/or refloating of large whales. Training workshops have been offered to members of the Stranding Network. Additionally, opportunities for apprenticeships or assistant roles to gain the necessary hands on expertise can be arranged. Specific training issues or requirements may exist for certain activities (*e.g.*, in-water captures, euthanasia) and are more appropriate to address at regional or state levels by working with your RSC.

The Large Whale Response Network is made up of individuals who have been evaluated on their qualifications and past experience, and for ESA responses may be issued a CI letter under the MMPA/ESA permit for responding to large whale scenarios, especially for necropsy of certain ESA whales such as North Atlantic right whales. Tables 15 and 16 provide more details on team member roles and qualifications. A CI remains authorized to respond to large whales as long as their CI letter is valid (which is typically the five-year life of the MMPA/ESA permit, with some exceptions). These CIs are expected to coordinate to the extent possible with the NMFS RSCs and the MMHSRP. All response actions are reviewed after the event with the participating responders and MMHSRP staff.

Table 15: Suggested number of personnel and roles required for a typical large whale at sea severely injured or ill first response effort.

Team member roles	Number of personnel required
Incident Commander (IC)	1
Safety Officer (SO)	1
Security/Crowd Control	Variable
Sample Collector	1
Data Collector/Photographer	1-2
Veterinary Staff/Trained Biologists	1-3
Animal Husbandry Team	1-4
Communications Person	1

Team member roles	Number of personnel required
Optional – UAS Operator (see UAS; Section 6)	1

Table 16: Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*e.g.*, IC and SO; 2º documentation and data collection).

Team Member Role	Role Description	Role Qualifications
Incident Commander (IC)	The IC is responsible for the overall operation, including the performance of the response, and does not generally participate directly in the operation. This enables the IC to remain focused on the larger picture of the event and objectively ensure that the response is safe for responders, the public, and animals. In some small cetacean responses, the IC may be combined with the SO position.	Completion of the ICS free or paid courses, and the ability to remain objective to ensure safe operations. Must have the authority to carry out operations.
Safety Officer (SO)	The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate to the team and adjust the strategy of the response as needed.	Experience in previous live whale or live cetacean responses, ability to continually watch over all personnel involved, communicate with the team to adjust strategy or call off the effort as necessary, and watch for hazards. Willingness to stop operations if there is a safety concern, despite momentum (and pressure) to move forward.
Security/Crowd Control	The IC should ensure that the proper authorities in the area have been notified of the response and, if possible, the area is closed to public access during the response.	Knowledge of proper authorities to notify.
Sample Collector	The sample collection technician is responsible for assisting the veterinarian/biologist in collecting any animal samples during the response.	A veterinary technician or personnel trained in veterinary sample collection.
Data Collector	The data collector is essential in recording all aspects of the data for the response. This person is responsible for ensuring all data is complete on data sheets, the animal is given an identifying number, all marks are recorded, and all samples are properly recorded and labeled.	Familiarity with data sheet and information to be recorded and ability to accurately record data legibly.
Photographer or Videographer	This person is responsible for operating still or video photography to document the response. This person may also serve as the data collector.	Experience using photographic equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and video including dorsal fin pictures, and ability to post-process photos/video after the capture.
Veterinary Staff/Trained Biologists	The licensed experienced veterinarian, veterinary technician or trained biologist is responsible for the health and monitoring of the live whale and for euthanasia activities if performed. All sedation and euthanasia should be conducted under supervision (direct or indirect) of a licensed veterinarian.	A licensed Doctor of Veterinary Medicine (DVM) or equivalent, veterinary technician or trained biologist who is experienced in cetacean medicine and euthanasia.
Animal Husbandry Team	The animal husbandry team members are responsible for monitoring the live stranded animal and providing palliative care (*e.g.*, shade, water, etc.) to ensure the comfort of the whale on the beach.	Responders must be trained by experienced personnel in working with stranded marine mammals on the beach, monitoring, etc. Advancement requires hands-on experience under the direct supervision of experienced

Team Member Role	Role Description	Role Qualifications
		response staff. This handling experience may occur in a captive display or rehabilitation hospital setting or research field setting. Handlers should also be able to remain calm under pressure, respond effectively to rapidly changing conditions, and work well in a team environment.
Communications Person	The Communications Officer or dedicated person is responsible for communicating information about the response to the public and media. For high profile cases or cases conducted under the permit, messages should be coordinated and cleared with NMFS.	Effective communicator in writing and speaking. Communication should be clear, concise, accurate, coherent, and courteous.
Optional – UAS Operator (see UAS; Section 6)	If permitted to operate a UAS during the response, the UAS operator must have no other duties. The operator/pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success of the response or causing disturbance to the target or other animals.	A certified pilot's license, a permit to operate during a capture, follow all existing FAA and other regulations, and experience operating a UAS during previous small cetacean field operations. More detail on UAS use is addressed in Section 6.

4.4.3. *Data Collection Protocols*

Data collection is typically performed by qualified individuals and depending on the level of response and capacities may determine the amount of data collected. Monitoring the animal(s) is essential. Obtain good photographs and/or video of the animal can help identify individual animals and assess their condition. Recording the animal(s) behavior when observed is helpful to aid in the assessment and in determining the best course of action. For any large whale response, at minimum, field information necessary for completion of NOAA's Level A form must be collected. This will include the assignation of a unique identifier (Field ID#, per Regional Stranding Network protocols). Level A forms may be completed electronically via direct entry in the National Stranding Database.

Photo logs are a record of each photo taken, which helps to identify the photographer and date/time taken. During data collection, photos should be taken with a label with ID, date, species, log number, and have a size scale. With all the data collected, a report should be finalized with the photos documented, complete recording of all pertinent findings, and all samples collected.

See Sections 5.1.3 and 5.2.3 for more details of data collection if the whale is euthanized.

4.4.4. *Available Tools and Techniques*

4.4.4.1. Photography including Photogrammetry (UAS or Other)

Digital cameras and Go Pros are used during a stranding response. Most photographic evidence is in digital format and it is necessary to designate cameras and photo cards to the event. A placard that includes identifiers, such as stranding number and pathology accession numbers, date, and a scale should appear in the photos. It is a good practice to begin each case with a photo placard labeled "start" and the time, and end the photographic series for a case with a placard labeled "end" and the time. It is critical that photos remain unaltered and sequential. While photos may be reviewed on the camera to ensure that necessary parts of the image were captured and are in focus, do not delete any photos on the camera (even if they do not provide useful evidence).

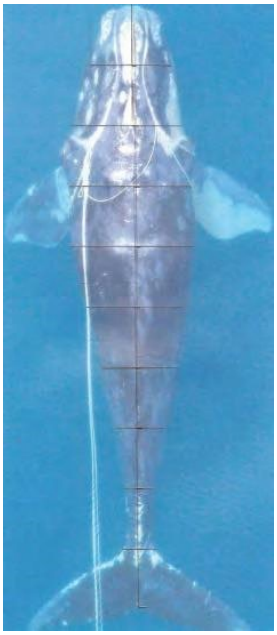


Figure 3: Example of aerial photography. This image was marked for length-to-width ratio analysis to access likely body weight prior to dosing with sedatives for disentanglement efforts (Hunt *et al.* 2013).

4.4.4.2. Remote Physical Assessment (including respiration rate and behavior)

Each case/event should be assessed through physical, behavioral, and environmental observations. These observations and data will improve better decision-making and adaptive management of the situation to determine the appropriate course of action for that particular individual and situation (refer to the Mass Stranding Best Practices for information on groups of animals). Careful planning and adaptive management will also provide important information that can be used to inform decision making for future cases. Lessons learned from each situation through thorough debriefing also is critical to inform tools and techniques. A standardized health assessment form *may* be available, depending on the region and taxa. If so, it should capture all necessary information. Generally, small cetacean health assessment and monitoring

forms can be used to capture essential data. If there is no form available then the questions below should be determined (Cape Cod Stranding Network 2008) in order to more generally assess the whale's status and condition and inform decisions. In the future, regional health assessment forms, if not already available, may be developed.

- Determine the species involved and use identification characteristics and catalogs for the species or stock to determine if this is a known individual. The identification characteristics for the species may include the size, coloration, rostrum and callosities, fluke, pectoral flipper, and dorsal fin. Is this a known individual? If so, what do we know about the individual, behavior and normal habitat?
- Measure total length, estimate the age class, and calculate weight (using weight charts or WhaleScale app[1])
- Note the body condition. If able to determine, is there an indentation behind the cranium (peanut head)? Are ribs and/or scapula visible? Is the animal concave or convex in the epaxial region on a longitudinal view? Are there any skin lesions or wounds?
- If possible, count respirations (number of respirations per minute), note respiratory effort, is there any respiratory exudate, odor, abnormal sound? Stranded whale respiratory rates may range from one to four per minute (depending on size, age, stress and shock, and health) (IFAW pers comm 2020).
- Are there any other animals in the area? How many?
- Take photos and/or video to document injuries, disease or behavioral changes.

Following remote observations, it is critical to share the information and have a discussion with a group of experts (*e.g.*, marine mammal veterinarians, biologists with experience with a given species, etc.). This is possible when the case is not immediately life threatening and the animal's behavior/sighting history is somewhat predictable such that the animal can be relocated for future interventions. In an emergency case (*e.g.*, an animal is in imminent danger of death, such as an anchored animal), immediate intervention (following approval from NMFS) may be warranted.

4.4.4.2.1. Physical Examination

After an initial remote assessment, if the behavior of the whale permits it, a safe closer approach can be attempted for a more thorough physical examination. Care should be taken to remain cranial to the peduncle of the animal at all times. In animals with long and mobile pectoral flippers, responders must be mindful of their position relative to these appendages. Animals within the surf line may become more mobile (intentionally moving with the assist of the waves, or merely being moved from wave action), so scenarios like this should warrant extra caution. Human safety is of the utmost importance when conducting this assessment. Additional PPE, such as helmets, may be necessary to protect responders working closely to

[1]The WhaleScale App can be downloaded via the Apple Store (https://apps.apple.com/us/app/whalescale/id1190640888), or the Android Store (https://play.google.com/store/apps/details?id=edu.ncsu.whalescale&hl=en_US&gl=US)

the whale. A spotter should monitor both the veterinarian/biologist as they conduct their assessment and the whale in order to ensure their safety.

The whale's reflexes can be tested to evaluate for level of consciousness and potential evidence of neurological dysfunction. The palpebral reflex can be tested by palpating on the skin just cranial and caudal to the eye, the animal should blink in response. The animal should follow the responder with its eyes if it is alert and responsive. Horizontal nystagmus (a pendulous, unconscious swinging of the eye back and forth) has been noted in numerous stranded large whales. The etiology of this finding is not known, possible causes include neurological dysfunction (either pre-existing or due to the stranding), electrolyte imbalance or other causes. In one case, nystagmus was observed to resolve after flotation of a live stranded minke whale, and from post-release monitoring, it was determined that the animal survived the stranding (IFAW 2021, personal communications). The whale's lips and blowhole should retract in response to manipulation.

In large animals, lung and heart sounds may be difficult to detect with a stethoscope, but depending on the animal's position, heart beat can occasionally be observed just caudal to the axilla or sternally between the pectoral flippers. In certain cases, EKG/ECG can also be used to better evaluate the heart rate. Visual observation of respiration rate, character, and depth, as well as blow odor can also be evaluated. The physical examination can also aid in evaluation of injuries or wounds if present.

4.4.4.2.2. Blood Work

Following the general examination and when feasible, getting blood results as soon as possible will help determine the health of the animal and the next steps. If there is time and the animal's condition permits, blood samples should be drawn for blood work and banking. In large whales it is almost always too dangerous to attempt to draw blood from the flukes or caudal peduncle vessels. Alternatively vascular access can be achieved in a much safer manner via dorsal fin vessels or in the pectoral flipper between the radius and ulna (IFAW personal communications 2020). In the field, blood can be evaluated in real-time using an I-Stat or other portable patient-side blood machine. Blood can also be collected for baseline blood work that can include a complete blood count (CBC) and standard serum chemistry tests; these samples are usually processed upon the team's arrival back at the facility at the end of the response. For more details on blood collection (including necessary supplies) and normal blood values for marine mammal species refer to Gulland *et al.* 2018.

Standard Blood Tests include:

- I-Stat Blood: Depending upon the cartridge type, blood can be collected to evaluate hematocrit,

glucose, lactate and other parameters that can be useful to evaluate an animal's status. Two to three milliliters of whole blood in a heparinized syringe or blood tube.

- Complete Blood Cell (CBC): A standard CBC will include the following - White cell blood count, red cell blood count, hemoglobin, hematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), a differential cell count, platelet and reticulocyte counts. One full lavender-top tube (EDTA) (one or three milliliters) is taken and refrigerated until analysis. Chemistry Profile: Standard serum chemistry profiles will/should include albumin, alkaline phosphatase, bicarbonate, bilirubin (total and direct), BUN, calcium, chloride, cholesterol, CK, creatinine, globulin, glucose, phosphorus, potassium, total protein, sodium, AST (SGOT), ALT (SGPT), GGT, and ratios of albumin:globulin, BUN:creatinine, and sodium:potassium. Blood should be placed in a serum separator tube or red top tube, allowed to clot, centrifuged within two hours of collection, and refrigerated prior to analysis. Excess serum can be saved and banked (frozen) at the rehabilitation facility.

4.4.4.3. Medical Intervention Strategies

4.4.4.3.1. Supportive/Palliative Care

If a large whale is stranded in tide or high and dry, it is important to provide supportive/palliative care while assessments and decisions are being made for next steps. When exposed to sunlight, it is important to keep the skin protected by providing overhead shade with a tarp or umbrella, light-colored sheets placed directly on the animal, or applying zinc oxide to the exposed skin. Since cetaceans cannot thermoregulate efficiently out of water, it is essential for responders to constantly monitor their temperature and thermoregulate for the animal by using water buckets to prevent the whale from overheating if warm, or blankets to protect the animal from cold air temperature. Basic monitoring should be conducted on heart rate, respirations, and other behavioral conditions.

4.4.4.3.2. Sedation/analgesia

In beached whales, sedation has been used to reduce resistance during procedures to limit the risk to responders (Moore *et al.* 2010) or used prior to administering euthanasia. Below are Tables 17 and 18 outlining drug combinations for use in live stranded whales that may be released and sedation drugs to be used prior to euthanasia.

<u>Protocol for sedation prior to euthanasia in large baleen whales (IFAW based on Harms *et al*. 2014):</u>

Option 1: For smaller baleen whales (sub-adult minkes, humpback calves), sedation & sodium

pentobarbital. This may be utilized if the carcass can be disposed of properly to minimize secondary poisoning and environmental contamination.

Sedation and traditional pentobarbital euthanasia:

- Midazolam +/- Butorphanol 0.2 mg/kg IV/IM
- Wait 10-20 min, then acepromazine 0.2 mg/kg IV/IM
- Wait 20+ min, then Xylazine 2-4 mg/kg IV (IM)
- Wait 5 min (until sedation apparent) then sodium pentobarbital 1ml/10lbs (87mg/kg) IV

Option 2: For larger baleen whales. If leaving a carcass *in situ* after using this option, all IM injection sites should be excised and disposed of properly.

Sedation and intra-cardiac KCL chloride:

- Midazolam +/- Butorphanol 0.2 mg/kg IV/IM
- Wait 10-20 min, then acepromazine 0.2 mg/kg IV/IM
- Wait 20+ min, then Xylazine 2-4 mg/kg IV (IM)
- Wait 5 min – assess sedation level, if not unconscious repeat dosing as needed
- Once the whale is unresponsive (no palpebral reflex, no menace response, no jaw tone, no blowhole tone, no flipper tone, no nociception/pain), inject 100 mg/kg supersaturated KCL solution via appropriate length intracardiac needle.

Table 17: Large whale sedative dosage administered IM or IV for whales that might be released (Moore *et*

al. 2010, Moore *et al.* 2012).

Sedation Drug (can use either regular or compounded concentration, depending upon availability)	Dosage (example calculation)
Midazolam (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Midazolam (regular conc.)	0.1 mg/kg x 10,000 kg = 1000mg = 200 ml of 5mg/ml solution
Butorphanol (compounded conc.)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Butorphanol (regular conc.)	0.1 mg/kg x 10,000 kg = 1000 mg =100 ml of 10mg/ml solution
Reversal Drug (can use either regular or compounded concentrations, depending upon availability)	**Dosage (example calculation)**
Naltrexone (compounded conc.; reversal for Butorphanol)	0.1 mg/kg x 10,000 kg = 1000 mg = 20 ml of 50mg/ml solution
Flumazenil (reversal for Midazolam)	0.01 mg/kg x 10,000 kg = 1,000 ml of 0.1 mg/ml solution

Table 18: Large whale sedative dosage administered IM or IV prior to euthanasia (IFAW based on Harms *et al.* 2014).

Sedation and Euthanasia Drugs Option 1 – Smaller Whales that can be removed for proper carcass disposal	Dosage (example calculation)
Midazolam (compounded conc.)	0.2 mg/kg x 2,500 kg = 500 mg = 10 ml of 50mg/ml solution
Midazolam (regular conc.)	0.2 mg/kg x 2,500 kg = 500 mg = 100 ml of 5mg/ml solution
Butorphanol (compounded conc.)	0.2 mg/kg x 2,500 kg = 500 mg = 10 ml of 50mg/ml solution
Butorphanol (regular conc.)	0.2 mg/kg x 2,500 kg = 500 mg = 50 ml of 10mg/ml solution
Acepromazine	0.2 mg/kg x 2,500 kg = 500 mg = 50 ml of 10mg/ml solution
Xylazine	2-4 mg/kg x 2,500 kg = 5,000-10,000 mg = 50-100 ml of 100mg/ml solution
Pentobarbital	87 mg/kg x 2,500 kg = 217,500 mg = 558 ml of 390mg/ml solution
Sedation and Euthanasia Drugs Option 2 – Larger Whales (any IM injection sites should excised after euthanasia if the carcass is to remain in place).	**Dosage (example calculation)**
Midazolam (compounded conc.)	0.2 mg/kg x 10,000 kg = 2,000 mg = 40 ml of 50mg/ml solution
Midazolam (regular conc.)	0.2 mg/kg x 10,000 kg = 2,000 mg = 400 ml of 5mg/ml solution
Butorphanol (compounded conc.)	0.2 mg/kg x 10,000 kg = 2,000 mg = 40 ml of 50mg/ml solution

Sedation and Euthanasia Drugs Option 1 – Smaller Whales that can be removed for proper carcass disposal	Dosage (example calculation)
Butorphanol (regular conc.)	0.2 mg/kg x 10,000 kg = 2,000 mg = 200 ml of 10mg/ml solution
Acepromazine	0.2 mg/kg x 10,000 kg = 2,000 mg = 200 ml of 10mg/ml solution
Xylazine	2-4 mg/kg x 10,000 kg = 20,000-40,000 mg = 200-400 ml of 100mg/ml solution
Potassium chloride (KCL saturated soln ~300mg/ml.)	100 mg/kg x 10,000 kg = 1,000,000 mg= 3,333 ml of 300mg/ml solution

For more information on sedation, refer to the Marine Mammal Euthanasia Best Practices (Appendix XIII).

4.4.4.3.3. Medications

Depending on the scenario, live stranded large whales are typically not given antibiotics, analgesics, or other drug therapy due to most animals being euthanized. For NMFS-approved releasable animals, antibiotics, analgesics, and/or other drug therapy could be considered on a case-by-case basis. Antibiotic or other drug therapy will only be approved for the Stranding Network to administer depending on the scenario and if the treatment could likely improve the condition of the whale after release. Typically, long-acting antibiotics, such as ceftiofur or cefovecin, are administered by needle and syringe. Antibiotics can be used to treat live whales with concerning lacerations to help prevent septicemia; however, with an animal already stranded it may be the best course of action and most humane to euthanize instead. Additionally, IV fluids can be administered to stranded large whales to treat dehydration and/or shock that developed during stranding. Large volumes of fluids are needed for clinical effect (IFAW personal communications 2020).

4.4.4.3.4. Euthanasia

Qualified veterinarians may recommend that euthanasia is the most humane option for the whale based on the condition or age of the animal, the circumstances, and available resources. If a stranded large whale is in overall poor condition (*e.g.*, emaciated, malnourished, severe internal or external injuries, dependent calf with no adult present) and/or remains onshore after 1-2 tidal cycles euthanasia will be considered.

The weight of a large whale onshore can result in pressure necrosis on the underlying muscles and their lungs can collapse when a whale is not supported by water. Even if a whale was able to free itself during a subsequent incoming tide it would not likely survive the stranding following an extended period out of the water. Qualified veterinarians may recommend that euthanasia is the most humane option for the whale based on the condition of the animal, the circumstances, and available resources. Euthanasia will be discussed on a case by case basis and the decision will be made by the NMFS RSC in consultation with the local Stranding Network group, attending veterinarian, and MMHSRP. If a decision is made to euthanize a

large whale, the procedure will be conducted by qualified personnel under the authorization of the SA or MMHSRP permit.

Many options of euthanasia have been considered but have significant limitations and concerns.

- **Pentobarbital:** Requires large volumes for large whales, high secondary poisoning potential, environmental concerns, high aquatic persistence, and proper carcass disposal needed (*e.g.,* incineration, rendering)
- **Ballistics:** Not currently recommended for large cetaceans over 4-8 meters (AVMA 2020)
- **Explosives:** Requires specialized training, limitation of access to explosives, lack of public acceptance, not authorized in the United States
- **Exsanguination:** Considered inhumane unless performed on heavily sedated, unconscious, or moribund animals (AVMA 2020)
- **Potassium Chloride (KCL) Method:** Currently the preferred method for euthanasia of large whales in the United States when carcasses need to be buried or remain in place. The KCL method has proven successful in several cases with little risk of secondary poisoning for scavengers, the ability to use various carcass disposal methods, and a fairly reasonable cost (approximately $1000 per case)

For more information on marine mammal euthanasia procedures refer to PEIS Marine Mammal Euthanasia in Chapter 4, as well as the following cetacean papers: Barco *et al.* 2016; Moore 2010, and Harms *et al.* 2018.

4.4.4.4. Tagging and Marking

For a stranded (in surf or high and dry) response, NMFS should be consulted prior to tagging and marking individuals. The decision on which technique(s) to use for tracking a live stranded cetacean for post-release monitoring will generally be made on a case-by-case basis. Gathering data on the survival of large whales that have been released after a live stranding is an essential part of the intervention. Without the data on post-release outcomes, one cannot assess the value of the overall response, nor evaluate the combined suite of protocols employed. If the stranded animal is approved by NMFS as releasable, the whale should be marked or be affixed with a NMFS approved tag to facilitate re-sightings or quick identification if the cetacean should re-strand (Ziccardi *et al.* 2015). The tools available for monitoring post-release outcomes range from the re-sighting of natural or applied markings, to VHF/satellite tag tracking.

Natural Markings are typically used for identification. Some species have specific criteria for identification and some also have catalogs so that if matched to a known individual more information about the animal is possible. These include pigmentation patterns on the fluke or body, callosity shape and size, dorsal fin shape and notches, or other skin marking depending on the species involved. It is important to acquire a comprehensive series of species-relevant images of all such marks before release to enable future recognition.

Applied marks are those artificial markings applied by the Stranding Network responders during the intervention and release. They may be very temporary, such as livestock paint stick markings that last only a few days. Short-term marks could include plastic livestock ear tags or notching in the dorsal fin (for those species with a dorsal fin), that can last for many months to years.

An electronic tag, with options including VHF (radio) and satellite, is another type of applied mark. Tag attachment options include suction cup tags, single pin attachments in the trailing edge of the dorsal fin (for those species with a dorsal fin), or LIMPET tags.

All these types of monitoring can be used in tandem, so photos of natural markings can be coupled with applied marks or tags to increase the likelihood of re-sighting whales at multiple time periods (*i.e.,* short-term and long-term) to assess post-release outcomes. See Table 4 for the pros and challenges of each tagging/marking type. For more specific details on tagging and marking, refer to the Report of the Joint US Office of Naval Research, International Whaling Commission and US National Oceanic and Atmospheric Administration Workshop on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices (IWC, NOAA, ONR. 2020).

Table 4: Pros and challenges of each tagging/marking type

Marking Type	Pros	Challenges
Natural Markings	• Natural markings tend to persist after healing and have more lasting value, especially where the individual's markings are archived from stranding event images • Many areas have Photo-ID catalogs for various whale species or stocks Re-sights may occur over many years, allowing for long-term information on the success of the intervention	• The whale appearing in an area where photo-id or re-sights may occur for recognizing applied or natural marks • Belonging to a species that has an existing photo-id catalog that can be used for matching • Appropriate photos being collected during the stranding event to match with the photo-id catalog (*i.e.,* fluke photos of humpback whales may be difficult to obtain when they are on a beach) • Communication between researchers with photo-id catalogs and the Stranding Network responders

Marking Type	Pros	Challenges
		may be challenging, particularly over large geographic distances (multi-country ranges of most migratory large whales) ● Data on re-sights may not occur in the short term (days/weeks/months), leading to uncertainty Lack of re-sight data may not necessarily mean the intervention wasn't successful – the fate of the whale remains unknown
Applied Markings	● Easy to apply (paint sticks require no training) ● Inexpensive and readily available (on hand with many/most Stranding Network responders)	● Situations allowing for safe application to out of habitat whales are not very common ● Re-sight information depends upon high level of effort (especially boat-based, but could be shore-based) to identify free-swimming whale ("success")
Electronic Tags	● Allow for longer term tracking (days/weeks/months) ● Allow for targeted tracking over a large geographic area, with the tag aiding in the ability to locate and re-sight the free-swimming animal (radio or satellite) Allow for remote tracking (satellite)	● An appropriate tag available with a trained applicator ● A suitable permit to tag in hand (tagging can be conducted under the national MMHSRP permit with pre-approval) ● Funding for the tag acquisition or replacement ● Time to focus on the tagging plan while rescue process is ongoing ● Potential for added impact or stress to the whale

4.4.4.5. Physical Intervention

Moving large whales has serious safety risks for the whale and for the Stranding Network responders involved. Trying to pull or push a large whale from the beach can also be very resource intensive as specialized equipment is required, which may or may not be readily available within the critical 24-36 hours after the stranding. Towing live whales by the tail can result in a serious injury including, but not limited to, dislocation of the tail (causing paralysis), drowning, and is therefore considered inhumane. Below are some options to possibly move live whales once approval has been received from NMFS to attempt to release a whale. There are other rescue techniques that have been considered, but not tested successfully at this point in time. Techniques are being developed to increase resources and tools for live large whale response.

4.4.4.6. Floats

For a whale that is deemed releasable, there are multiple methods that might be used to try to assist the

animal off the beach. Floats are one technique that may be used in a stranded response to help produce only a small amount of lift to achieve clearance from the bottom and allow the whale to be moved. A pontoon system is getting a stretcher around the whale and the pontoon floats outside of the stretcher to be able to lift the whale slightly in order to move. Inflated mat/bags can also be used. The bag has an excavation bar in front that clears a path for the bag as it goes. Once the bag is in place, it is inflated with air and the sand collapses under the bag and the whale becomes neutrally buoyant for the bag to be pulled to move the whale. Currently pontoon systems are weight limited with the largest whale that can be moved being a juvenile killer whale or animal weighing approximately 4,500lbs (2000kg). The position of the stranded animal, and any potential obstruction to the blowhole, should be considered before any floats are inflated.

It is possible to work with tow boat companies to provide equipment and capabilities to assist in moving a stranded whale back in the open ocean, however to date the methods described below have not been used with a live whale. Some tow boat companies provide service in salvaging boats and have experience moving large stranded objects. Companies such as Tow Boat US, have tubular float bags (8-ton lift capacity) and pillow-shaped float bags (possibly work in pairs) (Figure 6) that have potential in assisting in this situation although to date these have not been tested on a live whale. Two tubular float bags could be pulled snugly on either side of the whale with multiple broad straps (at least three) underneath the whale partially to support the whale and partially to hold the bags close providing direct support (also restrain pectoral flippers close to the body). It is also possible to use the floats to support the whale while removing sand/sediment underneath. To be more tolerant of the procedure, it is suggested to possibly sedate the whale to increase human and animal safety. Pre-planning and previous practice using a dead whale or other surrogate would be required before this option could be used.

Figure 6: Picture of the tubular float bags and pillow-shaped float bags

4.4.4.7. Harness

Creating a harness to put around the pectoral flippers to pull the animal forward or better position the animal onshore could be a good option but still has multiple complications; changing the position of the whale onshore is difficult, the harness needs to be safely released so the animal is not entangled, and this quick release harness is under development and will need to undergo testing before being utilized on the beach. Most importantly, this method should only be considered for an animal in good overall condition and when post-release monitoring is available to determine the success of the response efforts. If a harness is not available, it is possible to make one out of some dyneema or other aramid/HMPE and floats (Figure 7). Other lines, such as vectran, spectra, polysteel, could work with varying limitations (*e.g.*, UV resistance, abrasion resistance, elastic modulus, etc.). Again, any harness must be tested out on a dead whale or surrogate object prior to use in a live whale to determine if the quick release and other equipment will work as designed. If a harness or line is applied to the animal for rescue efforts, it is recommended a team trained and authorized in entanglement response is on standby, or on the water, in case the harness/line does not release from the whale once it is free swimming.

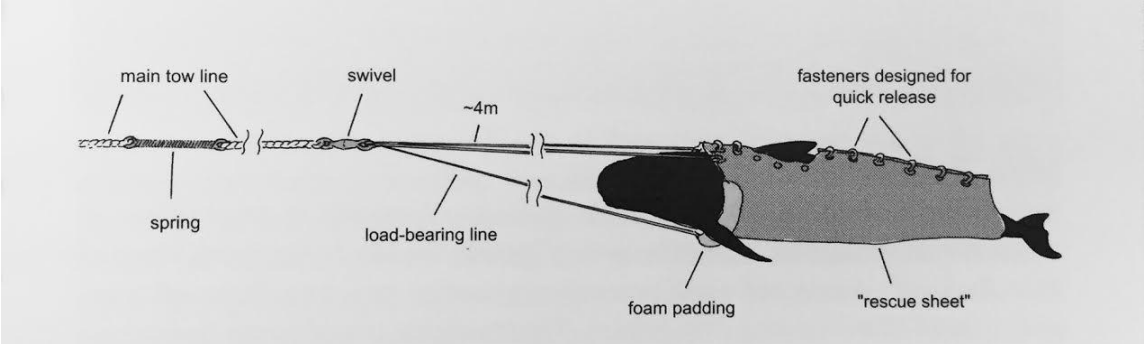


Figure 7: A method for towing utilizing a "rescue sheet" with quick release fasteners, a swivel between lines from a sling and main tow-line to reduce twisting, and a spring in the main tow-line to dampen speed surges.

4.4.4.8. Dredging

Dredging to remove sediment or sand around a stranded whale has not been tried very often due to resource limitations and potential environmental impacts/approval process. Dredging would require availability of an appropriate vessel as well as the necessary authorization to be given quickly in an emergency situation, within 24-hours if possible. Dredging to help one animal can also result in significant unintended environmental consequences and may negatively impact other species in the area. Furthermore, dredging can decrease the surface area the whale is resting on, and in some cases put more pressure on the body and

organs, which can potentially put the animal at greater risk. Anecdotally, previous attempts to dredge the area around a whale have ended with the whale rolling into the dredged "hole" and then, unable to right itself to breathe, drowning.

4.4.4.3 *Necropsy (Including data collection and sampling)*

If an animal is euthanized then the necropsy is extremely important; it provides valuable insight into the health of these animals and the data collected may help animals in the future. Once the animal is at the necropsy site, the necropsy will begin with 1) photos and videos, 2) human interaction evaluation (if applicable), 3) morphometrics, 4) blubber thickness, and 5) internal examination, 6) and a completed necropsy report (see example in Appendix E).

1) **Photo and videos:** Make another careful assessment of the external condition, noting swellings, scars, lacerations, contusions and other lesions. If abnormalities are found, take as many photos as needed to document. Work with the dedicated photographer team member to make sure all needed photos are obtained and help direct the photographers in any additional photos wanting to document. Some species require specific images; for example, a right whale needs images of all callosities, scars, flukes, and flippers; and humpbacks require ventral fluke images. Ensure images are taken of all aspects that will assist with photo-identification of the individual as well as record the standard suite of measurements (Pugliares-Bonner *et al.* 2007).

2) **Human interaction evaluation:** The carcass should be examined for evidence of human interaction (*e.g.*, watercraft wounds/scars/vessel strike, entanglement marks or scars, entanglement gear, etc.). When examining for evidence, any suspect evidence should be fully documented (*i.e.,* photos) and the area sampled for histology if possible. A Human Interaction form should also be filled out if there is evidence or suspected evidence. Propeller wound measurements should be collected when feasible, but require adequate training.

3) **Morphometrics:** Depending on the location of the carcass, it may be hard to measure total length of the animal. If in a tide, some of the carcass may be underwater so a reasonable "estimate" will have to be obtained. Significant injuries (*e.g.*, large propeller wounds) may also deform the carcass and require estimation of total length. If the carcass is high and dry, the total length can be measured by laying the tape along the carcass in addition to other body measurements.

4) **Blubber thickness:** If the carcass is fresh and not bloated, at minimum measure blubber thickness at the front of the dorsal fin dorsally, midline and ventrally. For right whales (*Eubalaena*) and whales without dorsal fin blubber thickness, it should be determined which side of the animal has

the most complete blubber and then should be measured at 9 different landmarks (ear, angle of mouth, eye, blowhole, flipper insertion, umbilicus, genital slit, anus, and fluke notch to anus) along the length of the whale, measured around the animal's girth (McLellan *et al.* 2004).

5) **Internal examination:** Report all areas of hemorrhage, edema, swelling and abscessation. Look for focal changes in color pattern and texture of organs. If the carcass is fresh to moderately decomposed, take histology samples of identifiable as well as suspect tissues. Proceed logically through the carcass using a gross necropsy report form as a prompt to ensure all organ systems are examined (Pugliares-Bonner *et al.* 2007). Whenever possible, right whale necropsies should follow the protocol and use the datasheets outlined in McLellan *et al.* 2004.

6) **Necropsy report:** Refer to Section 5.2.3. Also for examples for more specific necropsy protocols specific to right whales (*Eubalaena*), refer to the Right Whale Necropsy Protocol report by McLellan *et al.* 2004.

4.4.5. *Disposal (depends of euthanasia method)*

There are a lot of considerations (*e.g.*, available resources, location, land ownership, cause of death) when determining options for disposal. If the animal has a cause of death other than euthanasia, it allows for more options due to eliminating the concern for secondary poisoning to scavengers due to use of barbituates. If the whale is euthanized via a barbiturate (*e.g.*, pentobarbital), the carcass needs to be disposed of in a responsible manner (*e.g.*, rendering, incineration) that removes the risk of secondary poisoning to scavengers from the environment. Certain chemical euthanasia methods, such as saturated KCL solutions in conjunction with heavy sedation, have a low risk of secondary poisoning for scavengers and can be used when leave in place methods of disposal are used (AVMA 2020, Harms *et al.* 2014, Barco *et al.* 2016). For more information, refer to the Marine Mammal Carcass Disposal Best Practices.

5. Dead Large Whale Emergency Response

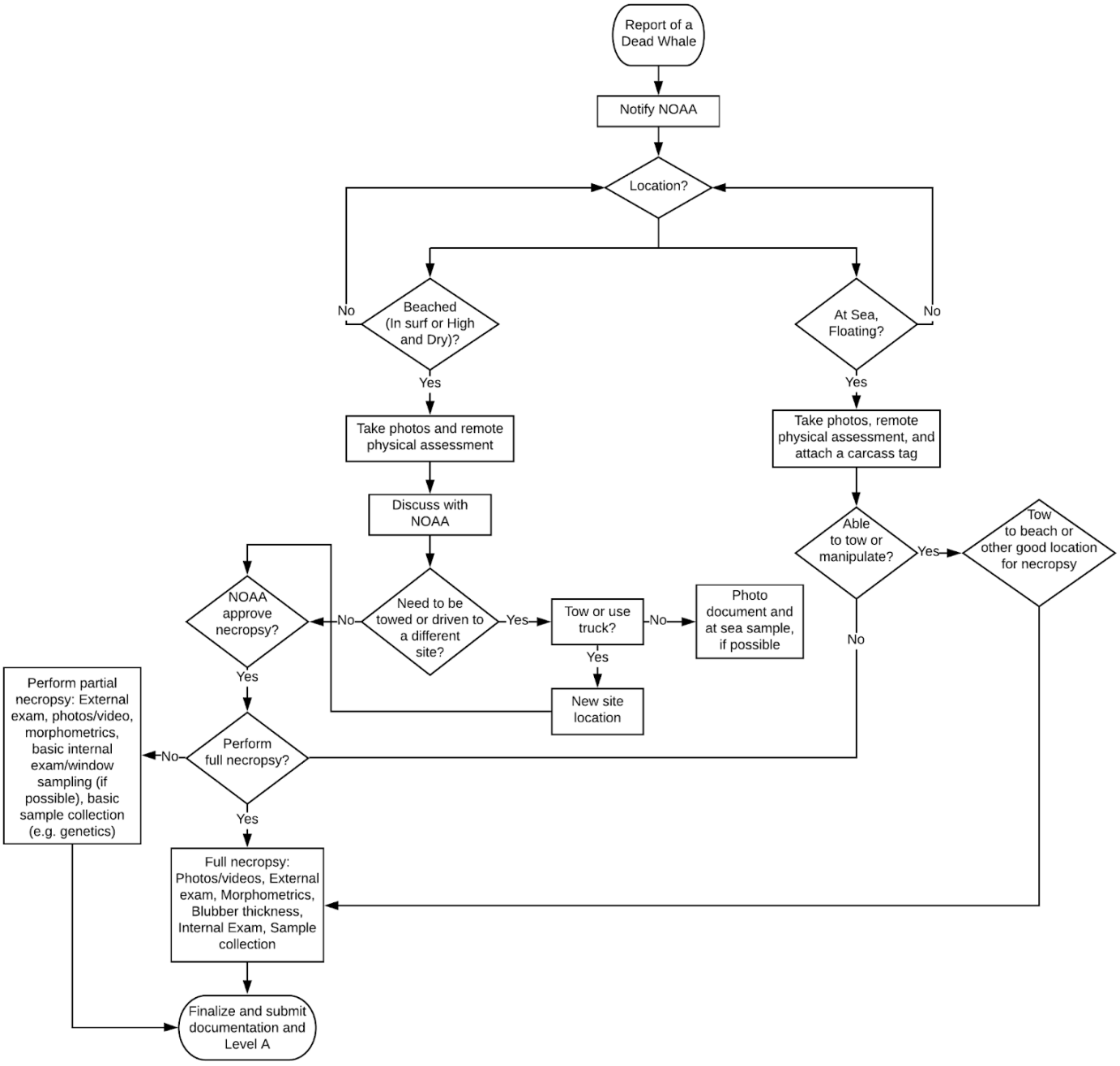
5.1. At Sea, Floating

5.1.1. *Decision Trees and Triage Criteria for Response*

Logistical planning begins with the first report of the carcass. Whenever possible, the reporting vessel should stay with the carcass until a response vessel (tagging and/or towing) arrives on scene. It is important to keep details of every sighting, report, and location to help track the carcass and be able to respond.

Depending upon species, location and carcass condition not all at sea whales will be responded to or will land on shore. Certain species (*e.g.,* right whales) may be prioritized for assessment, documentation, at-sea sampling, satellite tagging and/or towing operations. A printed map of the initial location and recent sighting with weather predictions for the following few days should be on hand until the carcass is finally recovered. For certain species (*e.g.,* right whales) NMFS may request a drift model from USCG or NMFS Office of Response and Restoration. Also aerial assets (*e.g.,* USCG, NOAA or private planes) may be used to help re-sight the carcass. If aerial assets are used it is best to also launch a small boat at the same time in a coordinated effort, so the plane can direct the small boat to the whale for at sea assessment (including assessment for towing), photo-documentation (photographs, underwater video, UAS, etc.), at-sea sampling if needed, and tagging if a carcass tag (*e.g.,* a GPS satellite buoy) is available. Once recovered, a necropsy can be performed. See Section 5.2.6 for necropsy details and for necropsy protocols specific to right whales (*Eubalaena*), refer to the Right Whale Necropsy Protocol report by McLellan *et al.* 2004. If a carcass is unable to be recovered, a Level A form still needs to be submitted.

Below is a decision tree that can help when deciding the appropriate action for a carcass at sea response:



5.1.2. *Specific Training and Qualifications (including CI letters, NTL)*

Endangered or threatened large cetacean stranding responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. In very particular circumstances for non-ESA listed species, a response can be conducted under a SA (by the SA holder after consultation with the Regional Stranding Coordinator) or by a government employee acting under MMPA Section 109(h). Therefore, only responders who have been authorized by NMFS and who have the training, experience, equipment, and support needed should attempt

large cetacean interventions. Authorized response efforts may also rely on partners at tribal, local, state and federal agencies (including law enforcement agencies and the USCG), non-governmental organizations, fishermen, and other groups to assist with some responses.

The Stranding Network members are trained or have experience in proper techniques for safe capture, restraint, and necropsy of various marine mammal species. Training workshops have been offered to members of the Stranding Network. Additionally, opportunities for apprenticeships or assistant roles to gain the necessary hands on expertise can be arranged. Specific training issues or requirements may exist for certain activities (*e.g.*, watercraft wound analysis) and are more appropriate to address at regional or state levels by working with your RSC.

The Large Whale Response Network is made up of individuals who have been evaluated on their qualifications and past experience, and for ESA responses may be issued a CI letter under the MMPA/ESA permit for responding to large whale scenarios, especially for necropsy of certain ESA whales such as North Atlantic right whales. Tables 19 and 20 provide more details on team member roles and qualifications. A CI remains authorized to respond to large whales as long as their CI letter is valid (which is typically the five-year life of the MMPA/ESA permit, with some exceptions). These CIs are expected to coordinate to the extent possible with the NMFS RSC's Large Whale Coordinators and the MMHSRP. All response actions are reviewed after the event with the participating responders and MMHSRP staff.

NTL is a NMFS approved, qualified and experienced team leader who is responsible for all aspects of the necropsy. This includes managing the necropsy team, assigning tasks during necropsy and being responsible for the gross and final necropsy report. A NTL must have experience with a number of large whale necropsies, facility with HI forensics, and approval from NMFS in order to be qualified. Cross-training responders is important in gaining experience to become a NTL. Specific NTL duties may include: conducting and assigning tasks during the necropsy; ensuring NMFS necropsy protocols are followed; sample collection; gear collection; photo-documentation; writing the draft and final gross necropsy report (and reviewing the case report for right whales); and sample dissemination and tracking, including following chain of custody procedures, if applicable. NTLs that regularly necropsy ESA large whales will also be CIs under the NMFS MMHSRP MMPA/ESA Permit. A NTL must have experience with a number of large whale necropsies and approval from NMFS in order to be qualified. The NTL reports to the Operation Safety Chief. For specifics on how to become a NTL see Appendix F.

Technical Specialists report to the NTL and are people with specialized skills or knowledge (*e.g.*, trained biologists, veterinarians or pathologists). These Specialist roles can include the Cutter(s) who assists the NTL and is responsible for examining the carcass and organs, collecting samples, and dismembering the

carcass; Sample Coordinator who is responsible for sample tracking and recording during the event; the Photographer who is responsible for taking photographs of the carcass, lesions, unusual markings, or injuries for the veterinary assessment team; and the Data Recorder is responsible for recording all information related to gross observations noted during the necropsy, morphometrics, and filling out any associated datasheets.

Table 19: Suggested number of personnel required for an at sea, dead whale response.

Team member roles	Number of personnel required
Incident Commander (IC)	1
Safety Officer (SO)	1
Vessel Operator(s)	1-2
Crew (vessel dependent)	1-3 (roles can be shared with other roles)
Sample Collector (if needed)	1
Data Collector/Photographer	1-2
Aerial Operations	1-3
Security/Crowd Control	Variable
Necropsy Team Lead (if carcass towed to shore for necropsy)	1-2
Technical Specialists Necropsy Staff (*e.g.*, cutters, photographer, data collector, sample coordinator, etc.)	Variable, 2-4 (depending upon location, carcass condition, whale species, etc.)
Tagger (if needed)	1
Communications Officer (optional)	1
Optional – UAS Operator (see UAS; Section 6)	1

Table 20: Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*i.e.,* documentation and data collection).

Team Member Role	Role Description	Role Qualifications
Incident Commander (IC)	The IC is responsible for the overall operation, including the performance of the response, and does not generally participate directly in the operation. This enables the IC to remain focused on the larger picture of the event and objectively ensure that the response is safe for responders, the public, and animals. In some large whale responses, the IC may be combined with the Operations Section Chief position.	Completion of the ICS free or paid courses, and the ability to remain objective to ensure safe operations. Must have the authority to carry out operations.

Team Member Role	Role Description	Role Qualifications
Safety Officer (SO)	The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate to the team and adjust the strategy of the response as needed.	Experience in dead whale responses, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e.,* waves, other animals). Willingness to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.
Vessel Operator(s)/Crew	For responses to dead floating whales, the vessel operators are an essential component to a successful operation. The vessel operators are responsible for ensuring that the vessels are in the proper placement to relocate and document the floating carcass, that the vessel can be safely maneuvered around animal(s) in the water, and that the vessel can be safely handled in all types of weather and sea state conditions such as currents, tides, kelp, wind, etc. Vessel operators should be experienced with floating animal approaches, photo-documentation of carcasses, carcass tagging, rigging for towing and towing, if needed.	USCG boat training or equivalent. Because many of these duties are outside the scope of normal boat operations, skills should be practiced prior to working with large whale carcasses around the boat. Experience driving vessels around large whales. Experience maneuvering in tight spaces, rigging and towing, and the ability to remain calm under pressure.
Sample Collector	The sample collector is responsible for collecting any animal samples during the at sea response. This may include skin or blubber samples.	A person trained in sample collection for large whales or cetaceans.
Data Collector	The data collector is essential in recording all aspects of large whale carcass data for the response. This person is responsible for ensuring all data is complete on data sheets, the animal is given an identifying number, all marks or other identifiers are recorded, and all samples are properly recorded and labeled.	Familiarity with data sheet and information to be recorded and ability to accurately record data legibly.
Photographer or Videographer	This person is responsible for operating still or video photography to document the floating carcass, including underwater go pros. This person may also serve as the data collector.	Experience using photographic equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and video including head or fluke photos for identification, and ability to post-process photos/video after the capture.
Aerial Operations	Aerial operations may be used in certain responses to locate the carcass and lead the documentation vessel to the carcass. Aerial operations would consist of photo-documentation of the carcass and relaying carcass location to the ground and vessel crews. Depending upon the operation one to two persons are needed along with a pilot to photo document the carcass. Sometimes other aerial assets are used (*e.g.,* USCG) and therefore aerial operations may consist of communication with the outside parties and discussion of search/flight plans for relocation the carcass. Aerial operations should coordinate with the IC about obtaining appropriate drift models for creation of the search grid.	Experience with flight operations, aerial search grids, taking aerial photographs, and communicating with ground and vessel crews.
Security/Crowd Control	The IC should ensure that the proper authorities in the area have been notified of the response and, if possible, the area is closed to public access during the response. For floating responses, crowd control may be conducted by local marine law enforcement, USCG, etc.	Knowledge of proper authorities to notify and coordination with law enforcement assets.

Team Member Role	Role Description	Role Qualifications
Necropsy Team Lead (NTL)	If the floating carcass is towed to shore for necropsy then a NTL is needed to conduct the necropsy. The NTL is a NMFS approved, qualified and experienced team leader who is responsible for all aspects of the necropsy. This includes managing the necropsy team, assigning tasks during necropsy and being responsible for the gross and final necropsy report. Specific NTL duties may include: conducting and assigning tasks during the necropsy; ensuring NMFS necropsy protocols are followed; sample collection; gear collection; photo-documentation; writing the draft and final gross necropsy report (and reviewing the case report for right whales); and sample dissemination and tracking, including following chain of custody procedures, if applicable.	A NTL must have experience with a number of large whale necropsies and approval from NMFS in order to be qualified. The necropsy team leader reports to the Operations Section Chief. NTLs that regularly necropsy ESA large whales will also be co-investigators under the NMFS MMHSRP MMPA/ESA Permit. For specifics on how to become a NTL see Appendix F.
Technical Specialist Necropsy-Cutter	This person is responsible assisting the NTL and is responsible for examining the carcass and organs, collecting samples, and dismembering the carcass.	Experience conducting marine mammal necropsies. Knowledge of cetacean anatomy and necropsy techniques.
Technical Specialist Necropsy-Photographer	This person is responsible for operating still or video photography to document the necropsy, specifically taking photographs of the carcass, lesions, unusual markings, or injuries for the necropsy team.	Experience using photographic equipment and experience documenting cetacean necropsies. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and video including head and flukes for identification, lesions, injuries, and ability to post-process photos/video after the capture.
Technical Specialist Necropsy-Data Collector	This person is responsible for recording all information related to gross observations noted during the necropsy, morphometrics, and filling out any associated datasheets.	Experience collecting data for marine mammal necropsies. Experience with large whale necropsy data forms.
Technical Specialist Necropsy-Sample Coordinator	This person is responsible for sample processing, tracking and recording during the event.	Experience collecting samples at marine mammal necropsies. Experience with sample data collection forms and procedures.
Tagger	The carcass tagger is responsible for attaching a carcass tag to the floating whale if one will be used.	A person who is experienced working on small boats, handling line and rigging, and can attach the tag to the carcass (*i.e.,* to tail or flipper). Attachment may require cutting into the flipper, so knowledge of whale anatomy or necropsy is encouraged.
Communications Person (Optional)	The communications officer is responsible for communicating information about large whale response to the public and media. For high profile cases or cases conducted under the permit, messages should be coordinated and cleared with NMFS.	Effective communicator in writing and speaking. Communication should be clear, concise, accurate, coherent, and courteous.
Optional – UAS Operator (see UAS; Section 6)	If permitted to operate a UAS during the large whale response, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success of the response or causing disturbance to the target or other animals.	A certified pilot's license, a permit to operate during a capture, follow all existing FAA and other regulations, and experience operating a UAS during previous small cetacean field operations

5.1.3. *Data Collection Protocols and Documentation*

Data collection is typically performed by qualified individuals and depending on the level of response and capacities may determine the amount of data collected. It is important to document the event by recording

the location and time of each sighting. Monitoring the animal(s) is essential. Obtain good photographs and/or video of the animal can help identify individual animals and assess the level of decomposition. At minimum, field information necessary for completion of NOAA's Level A form must be collected. This will include the assignation of a unique identifier (Field ID#, per Regional Stranding Network protocols). Level A forms may be completed electronically via direct entry in the National Stranding Database. A Human Interaction form should also be filled out if there is evidence or suspected evidence.

Conduct a complete (as possible) external examination before handling or moving the carcass. This will help to differentiate existing marks and possible human interaction from the marks resulting from the towing, landing, and transporting of the carcass as well as the degree of scavenging and level of decomposition (Pugliares-Bonner *et al.* 2007). When examining for evidence, any suspect evidence should be fully documented (*i.e.,* photos) and the area sampled for histology if possible. Propeller wound measurements should be collected when feasible, but require adequate training.

If assessing and/or sampling the carcass at sea, collecting morphometrics can be challenging and may have to be estimated measurements. Sometimes the measuring tape can be pinned on the carcass in the blubber to hold it in place. Other times the carcass can be measured by the length of the vessel. For sampling, sometimes skin or blubber can be sampled safely at sea. For turbulent sea state, no assessment may be safely possible beyond photo-documentation. During these times and if the equipment is available, it may be possible to use UAS for photos and an underwater pole cam video to help with the external exam. For data collection, the goal is to try and obtain as much data as possible from the carcass as safely as possible. Human safety comes first.

A necropsy report should be completed if partial or complete necropsies are performed. See Appendix E for an example of a large whale necropsy form. If fishing gear is present, gear should be collected, documented on the Level A and Human Interaction Form, stored in a centralized location or sent to a gear repository, and documented using Chain-of-Custody forms if transferred. Check with your RSC and local OLE Officer to determine how gear will be stored. These forms start in the field and when samples are transferred signatures are required by both parties, the original form must remain with the animal/sample. Photo logs are a record of each photograph taken, which helps to identify the photographer and date/time taken. During necropsies, photographs should be taken with a label with ID, date, species, log number, and have a size scale (see examples in Appendix D). With all the data collected, a report should be finalized with the photographs documented, complete recording of all pertinent findings, and all samples collected.

5.1.4. *Tagging and Marking*

With a carcass at sea that will be left or to be sunk, it is important to document any natural markings the carcass has. These markings can be used to determine the individual carcass if there is a photo-identification catalog for that species or if it happens to beach or is reported again. Natural markings include pigmentation patterns on the fluke or body, callosity shape and size, dorsal fin shape and notches, or other skin marking depending on the species. It is important to acquire a comprehensive series of species-relevant images of all such marks before release to enable recognition later. Applied marks, such as livestock paint sticks, can also be used and will only last a few days. These marks are applied by the Network responders before disposal/release. If there are no natural markings, it is possible to attach a short-term mark, which may include plastic livestock ear tags in the dorsal fin (for those species with a dorsal fin) or notching of the dorsal fin or other body parts. All of these types of markings and tags can be used in tandem, if necessary, so photographs of natural markings can be coupled with applied marks or tags to increase the likelihood of identifying whale carcasses if they happen to beach or are re-sighted if they drift or don't sink.

In certain cases (*e.g.,* for towing) reusable GPS carcass tags/buoys can be attached to the floating dead whale via rigging around the tail or through a flipper. The tags link to software that provide a latitude and longitude position for tracking, relocating for towing or data for use in drift modeling. The tags are solar powered, reusable and can be recovered and used on multiple carcasses.

5.1.5. *Sampling*

Sampling of the carcass even just limited sampling of skin for genetics is important and can help with identification for certain species as well as determination of sex if that is not able to be assessed visually. Partial or full necropsies are extremely important; they can provide valuable insight into the health of these animals and the data collected may help animals in the future. A necropsy sample inventory list is helpful during the necropsy to ensure that all the samples are collected and stored appropriately. A sample inventory list can be found in Appendix E. It is important to understand the priority of samples to be collected based upon carcass condition, primary rule-outs and time available for sampling (Table 21).

When in doubt, collect it, and unnecessary samples can be disposed of at a later time (Pugliares-Bonner *et al.* 2007).

Table 21: Example of sample analysis collected per decomposition code (Pugliares-Bonner *et al.* 2007)

Condition Code	Samples Analysis
Code 2: **Fresh Carcass**	Histology, cytology, pathogens (swabs or tissue), parasitology, contaminants, biotoxins, life history, genetics
Code 3: **Moderate Decomposition**	Histology (limited), pathogens (swabs or tissues), parasitology, contaminants, biotoxins, life history, genetics
Code 4: Advanced Decomposition	Histology (limited), biotoxins, life history, genetics
Code 5: Mummified/Skeletal Remains	Life history, genetics

In some cases, it has been possible to obtain internal samples from free-floating large whale carcasses when there is minimal sea state. If possible, secure lines around the flipper and tail stock to secure the vessel alongside the whale. If attaching lines is not possible, two persons each with a whale hook on either end of the vessel (bow and stern) can hold the whale and vessel together if the vessel is small (Pugliares-Bonner *et al.* 2007). Since most carcasses present ventral side up, samples may be obtained from the colon, and small intestine in addition to skin, muscle, and blubber. The number one importance in sampling a whale carcass at sea is **safety**. It is not safe to collect samples by standing on top of the carcass, in a small inflatable boat, or when sharks are around the carcass. Fortunately, there are some technologies that help to obtain some sample collection without risking safety. GoPros have been used to record video while sampling and by using it (or another type underwater video camera) on a pole to be able to record the animal's external condition that cannot be visible via boat. They can also document underwater entanglements and injuries. UAS have also been used to take pictures or video of the carcass.

5.1.6. *Carcass Recovery*

Locating a floating carcass can be challenging and therefore a coordinated effort with aerial and vessel support teams is recommended to cover an area more extensively and to minimize overall search time.

If aerial assets are used it is best to also launch a small boat at the same time in a coordinated effort, so the plane can direct the small boat to the whale for at sea assessment (including assessment for towing), photo-documentation (photographs, underwater video, UAS, etc.), at-sea sampling if needed, and tagging if a carcass tag (*e.g.,* a GPS satellite buoy) is available.

For recovery of a carcass floating at sea, it is best to be prepared for different scenarios. Depending on the level of decomposition, it may not be feasible to tow the carcass to a more suitable necropsy location and limited sampling or only photo-documentation can be performed at sea. Shark scavenging of the peduncle can result in relatively fresh carcasses not being easily towable. Thorough at-sea examination can help

determine that. Where distance offshore, cost, carcass condition or other factors preclude towing a large whale carcass to shore for examination, there is some benefit to the limited examination that can be undertaken at sea in certain situations (Pugliares-Bonner *et al.* 2007). After the documentation and/or limited sampling at-sea and depending on the situation, the carcass may be left at sea or sunk. If a carcass can be towed to shore, then the necropsy can be performed at the determined site which will also allow for planning different disposal method options. Before a carcass is towed to shore, carcass condition, carcass location (*e.g.*, distance from shore), time of year (*e.g.*, nesting endangered species), environmental conditions (*e.g.*, tide cycle, weather conditions, risk of attracting predators, etc.), available equipment and resources, landing site permissions, disposal plan, and safety precautions should all be taken into consideration.

5.1.6.1. Necropsy Site Location

It may be necessary to transport the carcass from sea to a more suitable necropsy location (if applicable). Often, on both state, federal, and privately owned properties, there needs to be coordination with the land owners/authorities in facilitating the necropsy and disposal (Pugliares-Bonner *et al.* 2007). Additionally, when choosing a landing site, protected/sensitive habitats such as seagrass, oyster reefs, and coral reefs should be accounted for and avoided. Transporting the carcass to a large marina, state, or federal site (*e.g.*, State Sanitation District, Army Corps, USCG, etc.) that have travel-lifts, boat-lifts or heavy equipment can be an easy way to be able to load a carcass on a transport truck (preferably a large dump-trailer, if possible) if needed to transport to a new site. Carcasses can also be towed directly to an approved beach location for landing and an examination on shore with beach burial or transport off the beach post-necropsy. Again, coordination with the beach owner is necessary to receive approval for landing of the carcass.

5.1.6.2. Towing

If the carcass is in a good enough condition, in certain cases the carcass can be towed to a more suitable area for necropsy. It is important to evaluate the condition of the carcass, select the appropriate equipment (*e.g.*, vessel, towing line, etc.), assess environmental conditions (including high tide), distance to shore, appropriate landing site, disposal plan, etc.

When towing, the vessel should be significantly longer in length than the whale. A towing bridle makes hooking up to a carcass much easier (Figure 8). Using a boathook, push the float ball (a) under the narrowest part of the tail (b) until it floats up the other side of the whale. Pass the float and line it is attached to through the eye splice on the opposite end of the heavy line (c). Cinch it tight. Use the short rope tail (d) on that splice to tie the splice to the heavy line that passes through it to ensure that the bridle does not slip off the whale when no tension is applied. Use the smaller line with the float (a) attached to catch the line

when hooking up a tow line to the larger rope. Alternatively, a sinking line with a weight attached can be thrown over the upstream side of the peduncle, the whale will then drift in to this line making it stream out below and behind the moving carcass, allowing one to catch the line with a boathook and draw it up to encircle the peduncle (Pugliares-Bonner *et al.* 2007). A short tail bridle (*e.g.*, lifting strap) can also be used and will not come off when the line is slacked (*e.g.*, maneuvering in a surf zone). The size, type, and strength of line used to tow a carcass is dependent on the situation (*e.g.,* species being towed, sea condition, etc.). No matter the size, type, and strength of line used, the tow line should be removed from the carcass when the tow in complete. If it is not possible to fully remove the tow line after the tow is complete, the line should be cut as short as possible to prevent accidental entanglement of scavengers. Sometimes the tail is damaged and the whale cannot be towed by the tail, depending upon the vessel size smaller carcasses may be able to be towed alongside the vessel to shore.

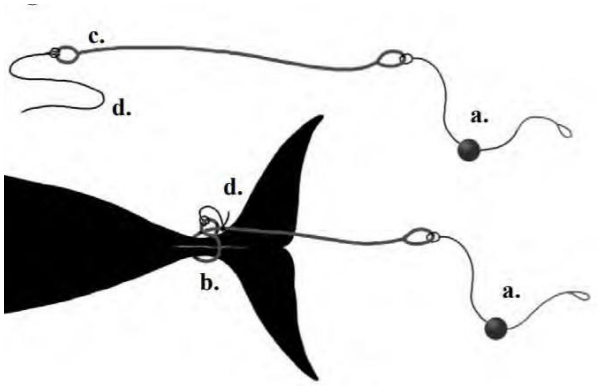


Figure 8: Drawing by Scott Landry, Provincetown Center for Coastal studies

Towing Vessel Capabilities – For short tows (less than two miles) in calm condition (beaufort less than three) small boats (19-22 feet) with outboard power (75-150 horsepower) are adequate to move carcasses to shore. Animals may be secured around the peduncle for towing and towed tail first at slow speed (less than three knots). For longer tows or sea surface conditions of beaufort 3+, larger vessels are recommended. For long tows (greater than ten miles) vessels such as tugs or work boats with deck equipment (winches, frames, cranes) with lifting capacity on the order of twenty tons and main propulsion horsepower of 700+ are suggested. For large vessels conducting long tows, the whale can be secured by the peduncle and lifted alongside of the vessel so that the majority of the flukes are lifted from the water to reduce drag. The ends of the flukes may be docked (cut off) to reduce the amount of lift necessary to clear the flukes above the surface. With vessels of sufficient size and horsepower towing in the tail up configuration can be accomplished at speeds approaching six knots.

5.1.6.3. Carcass Landing

Carcass landing is where the floating whale eventually drifts and lands on the beach. However, there are times when a floating carcass will be towed to a suitable landing site. At the landing site, it is necessary to have the appropriate equipment/resources in order to haul the carcass onto land, which depends on the nature of the site and the size of the whale. Additionally, there is often a need for a secondary vessel (*e.g.*, small boat, jet ski, kayak, etc.) that can bring the tow rope from the tow vessel to shore for attachment to the heavy equipment to land the carcass (Figure 9). A lightweight float line with a buoy can also be attached to the towline and thrown into the surf to be carried to shore, where the towline can be pulled in. Heavy straps, ropes, chains or cables of 90-ton breaking strength are critical for dragging the carcass. Depending on the situation, different characteristics may be important (*e.g.*, floating vs. sinking line, abrasion resistance, elastic modulus, etc.). The safety margin (working strength) for rigging is usually calculated as ⅓ or ⅕ of its breaking strength. Dragging an object up a slope (*e.g.*, beach or boat ramp) can exert as much as half the full weight of the object, depending on the slope angle. Extreme care must be used when selecting the strength (*e.g.*, breaking vs working strength) and material composition (*e.g.*, HMPE vs nylon vs steel cable) of the rigging being used. Any connectors (*e.g.*, metal shackles) being used to connect lines should have capacities that exceed the lines being used. If the line breaking strength is approached or exceeded, or the condition of the rigging is in question, the carcass should not be moved. When feasible, line dampeners should always be placed on both ends of the line for safety. Whenever possible, use rigging that does not require knots that weaken the rigging (*e.g.*, bury-tuck eye splices, soft shackles, etc.). If the necropsy site is on a dock or paved area or if the site is away from the landing area requiring transport, a crane or boat hoist (travel-lift) is a good option for moving the carcass (depending on size) onto the dock or into the transport truck (Pugliares-Bonner *et al.* 2007). While not always optimal, with adequate anchoring a carcass towed into shore can be anchored just offshore or to the beach to ensure it is not lost while additional logistics are arranged, next daybreak, or weather window is waited for. Note that anchoring a carcass in nearshore waters may require certain measures to avoid navigational hazards (*e.g.*, rigging with lights/strobes and radar reflecting panels). When the carcass is very large and heavy or landing equipment is insufficient to completely extract the carcass from the water, the incoming tide can be used as a mechanical advantage to drag the carcass up the beach and anchor it before the tide recedes. This provides a tidal cycle window for an examination. High tide can also be used as a mechanical advantage to tow a whale off of a beach, when relocation is necessary.

Carcass landing conditions may vary depending on the site selected, available equipment and resources, and the level of decomposition; however, human health and safety remains the top priority when landing a large whale carcass on shore. Safety considerations include, but are not limited to, keeping people back and out of the water (due to multiple safety risks, including predators), wearing appropriate PPE (*e.g.*, PFDs,

helmets, etc.), and selecting appropriate equipment *(e.g.*, vessel, tow line, etc.).

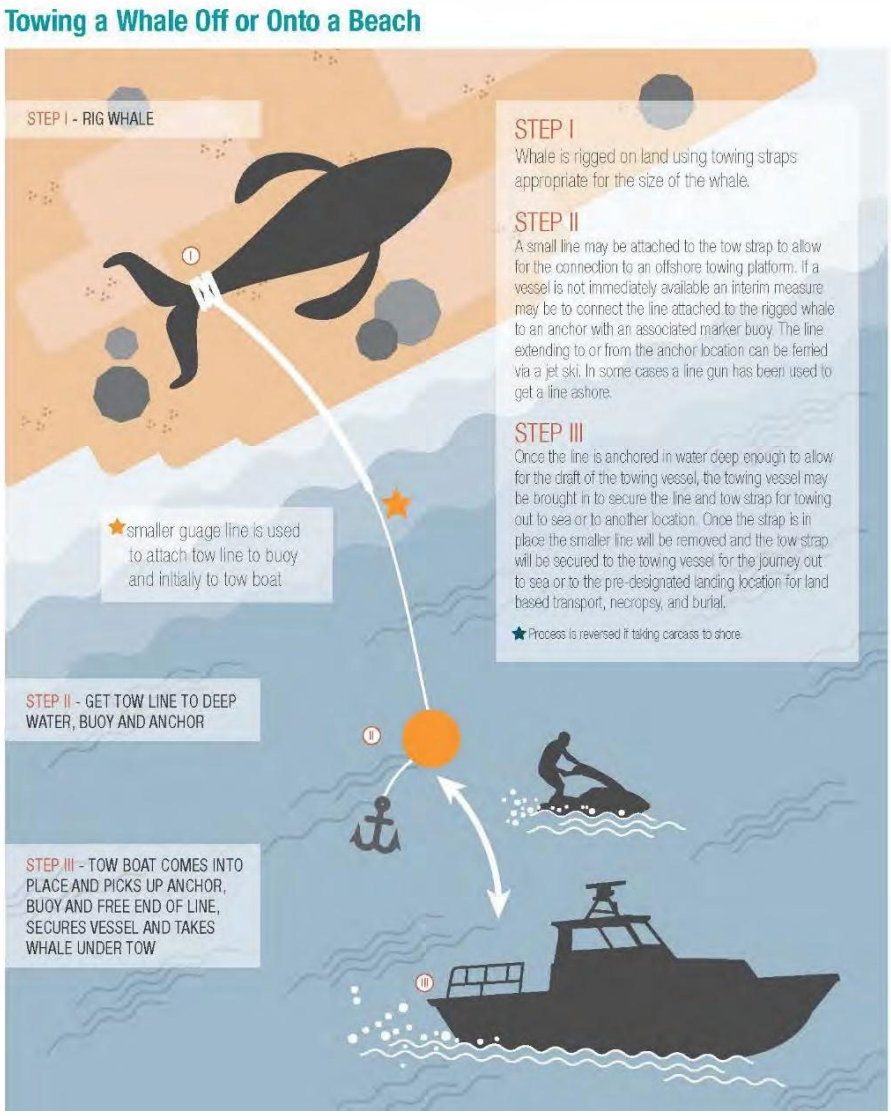


Figure 9: Towing a whale off or onto a beach

5.1.7. *Disposal (If not recovered)*

For details on specific carcass disposal methods please refer to the Marine Mammal Carcass Disposal Best Practices.

5.1.7.1. Remain in Place

The Remain in Place method is the most basic disposal method for at-sea carcasses, especially those that cannot be towed in due to decomposition state, lack of landing sites or lack of funds for towing. Since this

method requires leaving the carcass floating at sea to where it may float for a while but will eventually sink, it is recommended that the body cavity of the animal is pierced. This will aid sinking, as the carcass can off-gas more easily. Accelerating the sinking will help prevent the carcass from re-stranding. This method allows marine mammal carcasses to remain in the environment and contribute the nutrients contained within the animal to the environment. Care must be taken to ensure that the carcass will not be pushed back onshore by winds and currents. This is to prevent the carcass from re-stranding, and also to reduce the possibility of human-shark interactions, as floating carcasses have been known to attract sharks (Fallows *et al.* 2013).

5.1.7.2. Sink

With the carcass floating at sea, it is possible to dispose of it by sinking. This method has a benefit that the location where the carcass is sunk can be chosen and therefore controlled, which can maximize its benefits to the environment.

When selecting a site to sink a carcass, you must ensure that the carcass is submerged in deep enough water that it does not become a hazard to navigation. The USCG may have restrictions on where a carcass can be sunk, and they should be consulted when planning to sink a carcass. Release at sea methods generally require authorization from the EPA since this agency regulates ocean disposal of marine mammals. The EPA has issued a general permit under the MPRSA to authorize the transport and disposal of marine mammal carcasses in ocean waters under specified conditions. More information on the EPA process can be found here: https://www.epa.gov/ocean-dumping/ocean-disposal-marine-mammal-carcasses.

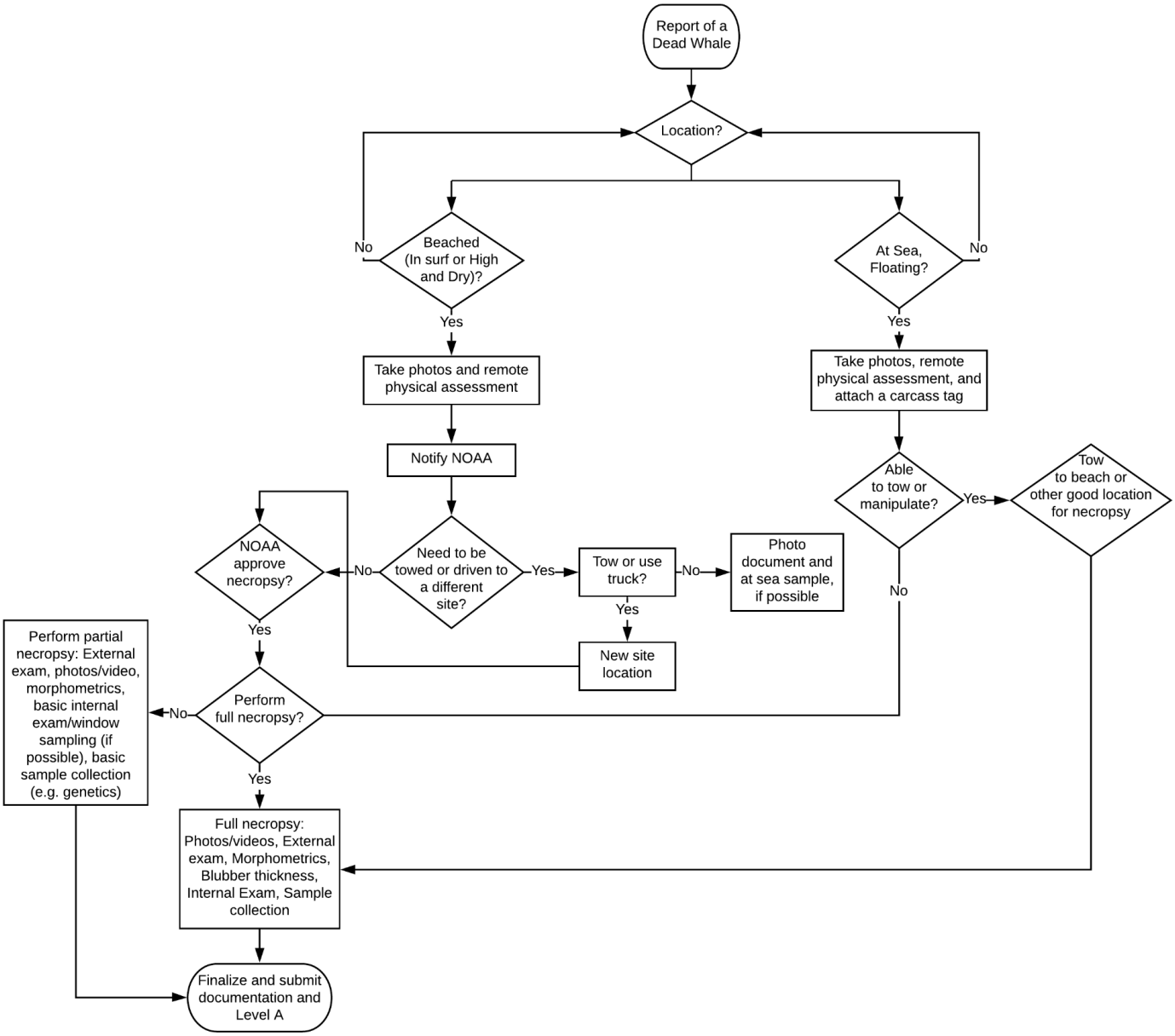
When sinking a carcass a responder will need to decide how the carcass will be weighted down. Even when the body cavity is pierced to allow for more efficient off-gassing, without weights, the carcass could float for some time. Therefore, weights need to be used to hold down the carcass on the seafloor until it is more decomposed. A wide range of weights can be used to ensure the carcass does not refloat, including chains and concrete blocks. If possible, materials that will slowly degrade when submerged in the marine environment, such as zinc or iron should be used as weights. Information on the types of items that can be used for sinking carcasses can be found here: https://www.epa.gov/ocean-dumping/ocean-disposal-marine-mammal-carcasses#What_type. The whale carcass will only need to be weighed down for a limited amount of time, so using weights that do not break down over time will become marine debris once the whale carcass has decomposed.

5.2. Beached/In the Surf or High and Dry

5.2.1. *Decision Trees and Triage Criteria for Response*

Logistical planning begins with the first report of the carcass. It is important to keep details of every sighting, report, and location to help track the carcass and be able to respond. A printed map of the carcass location with weather predictions for the following few days will be helpful when developing a plan. Plans need to be made for, documentation, transport (if applicable), necropsy, sampling, disposal, resources (*e.g.*, heavy equipment and experienced team members), and for the media. See Section 5.2.6 for necropsy details and for more specific necropsy protocols specific to right whales (*Eubalaena*), refer to the Right Whale Necropsy Protocol report by McLellan *et al.* 2004. If a carcass is unable to be assessed (*i.e.,* beached in a remote location), a Level A form still needs to be submitted.

Below is a decision tree that can help when deciding the appropriate action for a dead large whale beach response:



5.2.2. *Specific Training and Qualifications (including CI letters, NTL)*

Endangered or threatened large cetacean stranding responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. Most large ESA cetacean responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. In very particular circumstances for non-ESA listed species, a response can be conducted under a SA (by the SA holder after consultation with the Regional Stranding Coordinator) or by a government employee acting under MMPA Section 109(h). Therefore, only responders who have been authorized by NMFS and who have the training, experience, equipment, and support needed should attempt large cetacean interventions. Authorized response efforts may also rely on

partners at tribal, local, state and federal agencies (including law enforcement agencies and the USCG), non-governmental organizations, fishermen, and other groups to assist with some responses.

The Stranding Network members are trained or have experience in proper techniques for safe capture, restrain, and necropsy of various marine mammal species. Training workshops have been offered to members of the Stranding Network. Additionally, opportunities for apprenticeships or assistant roles to gain the necessary hands on expertise can be arranged. Specific training issues or requirements may exist for certain activities (*e.g.*, watercraft wound analysis) and are more appropriate to address at regional or state levels by working with your RSC.

The Large Whale Response Network is made up of individuals who have been evaluated on their qualifications and past experience, and for ESA responses may be issued a CI letter under the MMPA/ESA permit for responding to large whale scenarios, especially for necropsy of certain ESA whales such as North Atlantic right whales. Tables 22 and 23 provide more details on team member roles and qualifications. A CI remains authorized to respond to large whales as long as their CI letter is valid (which is typically the five-year life of the MMPA/ESA permit, with some exceptions). These CIs are expected to coordinate to the extent possible with the NMFS RSC's Large Whale Coordinators and the MMHSRP. However, given the uncertain communication abilities at sea, and the need for quick decision-making, CIs are empowered to use their best judgment and act independently if the situation requires it.

All response actions are reviewed after the event with the participating responders, RSC and MMHSRP staff.

NTL is a NMFS approved, qualified and experienced team leader who is responsible for all aspects of the necropsy. This includes managing the necropsy team, assigning tasks during necropsy and being responsible for the gross and final necropsy report. A NTL must have experience with a number of large whale necropsies, facility with HI forensics, and approval from NMFS in order to be qualified. Cross-training responders is important in gaining experience to become a NTL. Specific NTL duties may include: conducting and assigning tasks during the necropsy; ensuring NMFS necropsy protocols are followed; sample collection; gear collection; photo-documentation; writing the draft and final gross necropsy report (and reviewing the case report for right whales); and sample dissemination and tracking, including following chain of custody procedures, if applicable. NTLs that regularly necropsy ESA large whales will also be CIs under the NMFS MMHSRP MMPA/ESA Permit. A NTL must have experience with a number of large whale necropsies and approval from NMFS in order to be qualified. The NTL reports to the Operation Chief Safety. For specifics on how to become a NTL see Appendix F.

Technical Specialists report to the NTL and are people with specialized skills or knowledge (*e.g.*, trained

biologists, veterinarians or pathologists). These Specialist roles can include the Cutter(s) who assists the NTL and is responsible for examining the carcass and organs, collecting samples, and dismembering the carcass; Sample Coordinator who is responsible for sample tracking and recording during the event; the Photographer who is responsible for taking photographs of the carcass, lesions, unusual markings, or injuries for the veterinary assessment team; and the Data Recorder is responsible for recording all information related to gross observations noted during the necropsy, morphometrics, and filling out any associated datasheets.

Table 22: Suggested number of personnel required for a beached, dead whale response.

Team member roles	Number of personnel required
Incident Commander (IC)	1
Safety Officer (SO)	1
Security/Crowd Control	Variable
Necropsy Team Lead	1-3
Technical Specialists Necropsy Staff (*e.g.*, cutters, photographer, data collector, sample coordinator, heavy equipment supervisor, etc.)	Variable, 2-30 (depending upon location, carcass condition, whale species, etc.)
Communications Officer (optional)	1
Optional – UAS Operator (see UAS; Section 6)	1

Table 23: Specific team member roles and qualifications for each role are listed below. In some circumstances, roles can be combined (*i.e.,* documentation and data collection).

Team Member Roles	Role Description	Role Qualifications
Incident Commander (IC)	The IC is responsible for the overall operation, including the performance of the response, and does not generally participate directly in the operation. This enables the IC to remain focused on the larger picture of the event and objectively ensure that the response is safe for responders, the public, and animals. In some large whale responses, the IC may be combined with the Operations Section Chief position.	Completion of the ICS free or paid courses, and the ability to remain objective to ensure safe operations. Must have the authority to carry out operations.
Safety Officer (SO)	The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate to the team and adjust the strategy of the response as needed.	Experience in dead whale responses, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e.,* waves, other animals). Willingness to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.
Security/Crowd Control	The IC should ensure that the proper authorities in the area have been notified of the response and, if possible, the area is closed to public access during the response. For beached responses, crowd control may be conducted by local law enforcement, etc.	Knowledge of proper authorities to notify and coordination with law enforcement assets.

Team Member Roles	Role Description	Role Qualifications
Necropsy Team Lead (NTL)	The NTL is a NMFS approved, qualified and experienced team leader who is responsible for all aspects of the necropsy. This includes managing the necropsy team, assigning tasks during necropsy and being responsible for the gross and final necropsy report. Specific NTL duties may include: conducting and assigning tasks during the necropsy; ensuring NMFS necropsy protocols are followed; sample collection; gear collection; photo-documentation; writing the draft and final gross necropsy report (and reviewing the case report for right whales); and sample dissemination and tracking, including following chain of custody procedures, if applicable	A NTL must have experience with a number of large whale necropsies and approval from NMFS in order to be qualified. The necropsy team leader reports to the Operations Section Chief. NTLs that regularly necropsy ESA large whales will also be co-investigators under the NMFS MMHSRP MMPA/ESA Permit. For specifics on how to become a NTL see Appendix F.
Technical Specialist Necropsy-Cutter	This person is responsible assisting the NTL and is responsible for examining the carcass and organs, collecting samples, and dismembering the carcass.	Experience conducting marine mammal necropsies. Knowledge of cetacean anatomy and necropsy techniques.
Technical Specialist Necropsy-Photographer	This person is responsible for operating still or video photography to document the necropsy, specifically taking photographs of the carcass, lesions, unusual markings, or injuries for the necropsy team.	Experience using photographic equipment and experience documenting cetacean necropsies. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and video including head and flukes for identification, lesions, injuries, and ability to post-process photos/video after the capture.
Technical Specialist Necropsy-Data Collector	This person is responsible for recording all information related to gross observations noted during the necropsy, morphometrics, and filling out any associated datasheets.	Experience collecting data for marine mammal necropsies. Experience with large whale necropsy data forms.
Technical Specialist Necropsy-Sample Coordinator	This person is responsible for sample processing, tracking and recording during the event.	Experience collecting samples at marine mammal necropsies. Experience with sample data collection forms and procedures.
Technical Specialist Necropsy-Heavy Equipment	If heavy equipment is used then this person is responsible for overseeing the operation of heavy equipment used for landing and necropsying the large whale. This role may be filled by the incident commander or NTL for certain responses.	Experience guiding heavy equipment, understanding of rigging, and risks associated with heavy equipment. Good communication skills for working with heavy equipment operator and NTL. Knowledge of how the equipment operates, how rigging may change under different loads, and troubleshooting.
Communications Person (Optional)	The communications officer is responsible for communicating information about large whale response to the public and media. For high profile cases or cases conducted under the permit, messages should be coordinated and cleared with NMFS.	Effective communicator in writing and speaking. Communication should be clear, concise, accurate, coherent, and courteous.
Optional – UAS Operator (see UAS; Section 6)	If permitted to operate a UAS during the large whale response, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success of the response or causing disturbance to the target or other animals.	A certified pilot's license, a permit to operate during a capture, follow all existing FAA and other regulations, and experience operating a UAS during previous small cetacean field operations

5.2.3. *Data Collection Protocols and Documentation*

Data collection is typically performed by qualified individuals and depending on the level of response and capacities may determine the amount of data collected. It is important to document the event with recording the location and time. Obtain good photographs and/or video of the animal can help identify individual

animals and can allow for more post-necropsy assessments. For situations such as a carcass in a remote area, at minimum, field information necessary for completion of NOAA's Level A form must be collected. This will include the assignation of a unique identifier (Field ID#, per Regional Stranding Network protocols). Level A forms may be completed electronically via direct entry into the National Stranding Database. A Human Interaction form should also be filled out if there is evidence or suspected evidence.

Conduct a complete (as possible) external examination before handling or moving the carcass. This will help to differentiate existing marks and possible human interaction from the marks resulting from the towing, landing, and transporting of the carcass as well as the degree of scavenging and level of decomposition (Pugliares-Bonner *et al.* 2007). When examining for evidence, any suspect evidence should be fully documented (*i.e.,* photos) and the area sampled for histology if possible. Propeller wound measurements should be collected when feasible, but require adequate training.

A necropsy report should be completed if partial or complete necropsies are performed. See Appendix E for an example of a large whale necropsy form. If fishing gear is present, gear should be collected, documented on the Level A and Human Interaction Form, stored in a centralized location or sent to a gear repository and documented using Chain-of-Custody forms if transferred. Check with your RSC and local OLE Officer to determine how gear will be stored. These forms start in the field and when samples are transferred signatures are required by both parties, the original form must remain with the animal/sample. Photo logs are a record of each photograph taken, which helps to identify the photographer and date/time taken. During necropsies, photographs should be taken with a label with ID, date, species, log number, and have a size scale (see examples in Appendix D). With all the data collected, a report should be finalized with the photographs documented, complete recording of all pertinent findings, and all samples collected.

5.2.4. *Necropsy Site Location Determination*

Conducting a large whale necropsy on-site where the carcass washed ashore is often the most logistically and financially feasible option. However, the stranding site of where the whale washes up needs to be evaluated for particular logistics, including if it is a safe place to perform a necropsy, and to decide whether or not the carcass should be relocated. A few questions to think about when determining whether the necropsy can be conducted on-site:

- Can the site be easily accessed from land?
- Is it easy to get equipment or personnel to the site?
- Are the conditions at the site safe for people?

If all the answers to these questions are yes, then the necropsy can be carried out at the current site.

However, some carcasses wash ashore in an unsuitable location (*e.g.*, rocky, highly public beach, bad current, tides, etc.) and need to be moved to a new location (via towing or heavy equipment) for necropsy and disposal. When moving carcasses, avoid traversing and/or damaging protected/sensitive habitats (*e.g.*, seagrass, coral reefs, and oyster reefs). For information related to relocating a carcass, refer to Section 5.1.6.2 for towing or Section 5.1.6.3 for carcass landing.

A majority of the time both state, federal, and privately owned properties, the land owners/authorities are eager to remove the carcass and are very cooperative in facilitating the necropsy and disposal (Pugliares-Bonner *et al.* 2007). An additional issue when determining necropsy site location is also thinking about the disposal options.

5.2.5. *Necropsy (Including data collection and sampling)*

The necropsy is extremely important; it provides valuable insight into the health of these animals and the data collected may help animals in the future. Once the animal is at the necropsy site, the necropsy will begin with 1) photos and videos, 2) human interaction evaluation (if applicable), 3) morphometrics, 4) blubber thickness, and 5) internal examination, 6) and a completed necropsy report.

1) **Photo and videos:** Make another careful assessment of the external condition, noting swellings, scars, lacerations, contusions and other lesions. If abnormalities are found, take as many photos as needed to document. Work with the dedicated photographer team member to make sure all needed photos are obtained and help direct the photographers in any additional photos wanting to document. Some species require specific images; for example, a right whale needs images of all callosities, scars, flukes, and flippers; and humpbacks require ventral fluke images. Ensure images are taken of all aspects that will assist with photo-identification of the individual as well as record the standard suite of measurements (Pugliares-Bonner *et al.* 2007).

2) **Human interaction evaluation:** The carcass should be examined for evidence of human interaction (*e.g.*, watercraft wounds/scars/vessel strike, entanglement marks or scars, entanglement gear, etc.). When examining for evidence, any suspect evidence should be fully documented (*i.e.,* photos and measurements) and the area sampled for histology if possible. A Human Interaction form should also be filled out if there is evidence or suspected evidence, and is required for all fresh dead and moderately decomposed animals (codes 2 and 3). Propeller wound measurements should be collected when feasible, but require adequate training.

3) **Morphometrics:** Depending on the location and position of the carcass, it may be hard to measure

the total length of the animal and other body measurements. If in a tide, some of the carcass may be underwater so a reasonable "estimate" will have to be obtained. If the carcass is high and dry, the straight length can be measured by laying or holding the measuring tape along the carcass from the tip of the rostrum to the fluke notch.

4) **Blubber thickness:** If the carcass is fresh and not bloated, at minimum measure blubber thickness at the front of the dorsal fin dorsally, midline and ventrally. For right whales (*Eubalaena*) and whales without dorsal fin blubber thickness, it should be determined which side of the animal has the most complete blubber and then should be measured at 9 different landmarks (ear, angle of mount, eye, blowhole, flipper insertion, umbilicus, genital slit, anus, and fluke notch to anus) along the length of the whale, measured around the animal's girth (McLellan *et al.* 2004).

5) **Internal examination:** Report all areas of hemorrhage, edema, swelling and abscessation. Look for focal changes in color pattern and texture of organs. If the carcass is fresh to moderately decomposed take histology samples of identifiable as well as suspect tissues. Proceed logically through the carcass using a gross necropsy report form as a prompt to ensure all organ systems are examined (Pugliares-Bonner *et al.* 2007). Whenever possible, right whale necropsies should follow the protocol and use the datasheets outlined in McLellan *et al.* 2004.

6) **Necropsy report:** Refer to Section 5.2.3. Also for examples for more specific necropsy protocols specific to right whales (*Eubalaena*), refer to the Right Whale Necropsy Protocol report by McLellan *et al.* 2004.

5.2.7 Disposal (depends of euthanasia method)

Depending on the cause of death of the whale determines the options for disposal. If the animal has a cause of death other than euthanasia, it allows for more options due to eliminating the concern for secondary poisoning to scavengers from barbituate drugs. If the whale is euthanized via barbiturates (*e.g.*, pentobarbital), the carcass needs to be disposed of in a responsible manner (*e.g.*, rendering, incineration) that removes the risk of secondary poisoning to scavengers. Certain chemical euthanasia methods, such as saturated KCL solutions in conjunction with heavy sedation, have a low risk of secondary poisoning for scavengers and can be used when remain in place methods of disposal are used (AVMA 2020, Harms *et al.* 2014, Barco *et al.* 2016). For details on specific carcass disposal methods please refer to the Marine Mammal Carcass Disposal Best Practices.

6. Future Needs

6.1. Research

Emergency response-related research is an important aspect of the MMHSRP, as the program continues to work towards improving current rescue, response, assessment, and surveillance activities. Specifically for large whale responses, research into more effective herding or hazing techniques, improved remote administration of medications techniques, as well as propeller wound analysis for large whales is needed. Additionally, collecting real-time data by utilizing carcass tags on floating dead whales could help to improve both drift and hind-case models.

6.2. Tool/Technique Development

Tool development and training projects, such as UAS testing, typically only affect a small number of animals and allow the MMHSRP to test and train responders on a range of new and improved emergency response tools. Other examples of technologies and/or methods that may be tested in these small-scale projects could include improved remote drug delivery devices and drug dosages, and disentanglement, tagging, or deterrents technologies. Watercraft wound analysis tools and techniques are essential to develop as human interaction increases. It is useful to have techniques to help determine watercraft impact information for both live and dead whales to provide guidance on management strategies into ESA and MMPA actions, refine activities implemented for species recovery, identifying threats, and assessing effectiveness of implemented recovery actions Additionally, testing of refloating technologies on dead stranded whales or other surrogates could be useful to determine what techniques may be used in future cases that are candidates for refloating, etc. Contact the MMHSRP for more specific details and requirements for tool/technique development.

6.3. Training

Increased training in current hazing and herding techniques would be beneficial for groups dealing with out of habitat large whales. Once developed, training in remote sedation techniques could be useful for certain areas that deal with difficult entanglements (*e.g.*, mouth). Continued training in large whale euthanasia techniques (including landmarks, equipment and drug dosages) is needed to expand veterinarians and trained biologists in this technique. This could be through virtual training, workshops or “hands-on” during necropsy events. Continued training in large whale necropsy techniques (including limited and full as well as with or without heavy equipment) is needed to increase capacity and train the next generation of necropsy team leaders. This could be through virtual training, workshops or “hands-on” during necropsy events. Consistent wound analysis training is needed to increase the Network’s knowledge gap and capacity

on performing accurate analysis. This could be through virtual training along with required “hands-on” training during necropsy events and/or workshops.

7. Acknowledgements

We would like to thank the many people who contributed information, protocols, and expertise to this Best Practices document. We would like to especially thank International Fund for Animal Welfare, The Marine Mammal Center, Sarah Sharp, Alex Costidis, Craig Harms, Kristin Wilkinson, and Bill McLellan.

8. Literature Cited

American Veterinary Medical Association. (2020). AVMA Guidelines for the euthanasia of animals: 2020 edition. https://www.avma.org/sites/default/files/2020-01/2020_Euthanasia_Final_1-15-20.pdf.

Barco, S.G., Walton, W.G., Harms, C.A., George, R.H., D'Eri, L.R., Swingle, W.M. (20160. Collaborative Development of Recommendations for Euthanasia of Stranded Cetaceans. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-OPR-56, 83 p.

Cape Cod Stranding Network. (2008). Cetacean Health Assessment Guidelines. A Project of the International Fund for Animal Welfare.

Fallows C, Gallagher AJ, Hammerschlag N. (2013) White Sharks (*Carcharodon carcharias*) Scavenging on Whales and Its Potential Role in Further Shaping the Ecology of an Apex Predator. PLoS ONE 8(4): e60797. https://doi.org/10.1371/journal.pone.0060797

Geraci, J.R. and V.J. Lounsbury. (2005). Marine mammals ashore: a field guide for strandings 2nd Edition. National Aquarium in Baltimore, Baltimore, MD.

Gulland FMD, Nutter FB, Dixon K, Calambokidis J, Schorr G, Barlow J, Rowles T, Wilkin S, Spradlin T, Gage L, Mulsow J, Reichmuth C, Moore M, Smith J, Folkens P, *et al.* (2008). Health assessment, antibiotic treatment, and behavioral responses to herding efforts of a cow-calf pair of humpback whales (Megaptera novaeangliae) in the Sacramento River Delta, California Aquatic Mammals. 34: 182-192.

Gulland, F. M., Dierauf, L. A., & Whitman, K. L. (Eds.). (2018). *CRC handbook of marine mammal medicine*. CRC Press.

Harms, C.A., McLellan, W.A., Moore, M.J., Barco, S.G., Clarke III, E.O., Thayer, V.G. and Rowles, T.K., 2014. Low-residue euthanasia of stranded mysticetes. Journal of wildlife diseases, 50(1), pp.63-73.

Harms C.A., Greer L.L., Whaley J., Rowles T.K, 2018. Euthanasia. In: Gulland FMD, Dierauf LA (Eds.).

Marine Mammal Medicine, 3rd ed. CRC Press, Boca Raton, Florida. Chapter 28, pp. 675-691.

Hunt KE, Moore MJ, Rolland RM, Kellar NM, Hall AJ, Kershaw J, Raverty SA, Davis CE, Yeates LC, Fauquier DA, Rowles TK, Kraus SD. (2013) Overcoming the challenges of studying conservation physiology in large whales: a review of available methods. *Conservation Physiology*, Volume 1, Issue 1, 2013, cot006, https://doi.org/10.1093/conphys/cot006

IWC, NOAA, ONR. Report of the Joint US Office of Naval Research, International Whaling Commission and US National Oceanic and Atmospheric Administration Workshop on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices. Journal of Cetacean Research and Management 21 (Suppl.), 2020.

Kraus S. D.*et al*. (2005). North Atlantic right whales in crisis. *Science* 309:561–562.

McLellan WA, Rommel S, Moore M, Pabst DA. (2004) Right whale necropsy protocol. Final report to NOAA Fisheries for contract #40AANF112525. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.296.8760&rep=rep1& type=pdf (accessed 28 Aug 2018)

Moore, M.J., and J.M. van der Hoop (2012). The painful side of trap and fixed net fisheries: chronic entanglement of large whales. Journal of Marine Biology 2012: ID 230653

Moore M, Walsh M, Bailey J, Brunson D, Gulland F, Landry S, *et al*. (2010) Sedation at Sea of Entangled North Atlantic Right Whales (*Eubalaena glacialis*) to Enhance Disentanglement. PLoS ONE 5(3): e9597. https://doi.org/10.1371/journal.pone.0009597

NMFS. (2007). Differentiating Serious and Non-Serious Injury of Marine Mammals. Report of Serious Technical Workshop.

NRT. (1996). ICS/UC Technical Assistance Document

Pugliares-Bonner, Katie & Bogomolni, Andrea & Touhey, Kathleen & Herzig, Sarah & Harry, Charles & Moore, Michael. (2007). Marine Mammal Necropsy: An Introductory Guide for Stranding Responders and Field Biologists. Woods Hole Oceanog. Inst. Tech. Rept. WHOI-2007-06. 10.1575/1912/1823.

Rommel SA, Costidis AM, Pitchford TD, Lightsey JD, Snyder RH, Haubold EM (2007) Forensic methods for characterizing watercraft from watercraft-induced wounds on the Florida manatee (Trichechus manatus latirostris). Mar Mamm Sci 23:110–132

Washington State Department of Ecology - Spill Prevention Preparedness and Response Program. (2018). Curriculum Plan for a Killer Whale Deterrence Program. Publication number 18-08-006.

Ziccardi, M., S. Wilkin, T. Rowles, and Shawn Johnson. (2015). Pinniped and Cetacean Oil Spill Response Guidelines. NOAA Tech. Memo. NMFS-OPR-52.

Appendix A: Example Incident Action Plan (IAP)

Incident Briefing (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Any whale		Date: *06/25/20* Time: *12:00*

4. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment):

5. Situation Summary (for briefings or transfer of command)**:**

6. Prepared by: Position Title: _____ Signature: _____

Date/Time: _____

Incident Briefing (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Any whale		Date: ***06/25/20*** Time: ***12:00***

7. Current and Planned Objectives:
1. Ensure the safety of the public and responders in accordance with established protocols;
2. Deploy resources to document the animal location, condition and attach bouy to motior movement.
3. Secure landing location to conduct necropsy and the required equipment to tow animal to landing site.
4. Compile a team to reciveven the animal at the landing site, secure it to land and collect initial Level A data.
5. Once animal is secured conduct necropsy and dispose of animal in accordance with established protocols.
6. Provide timely and accurate information and updates to agencies involved, the public and media.

8. Current and Planned Actions, Strategies, and Tactics:

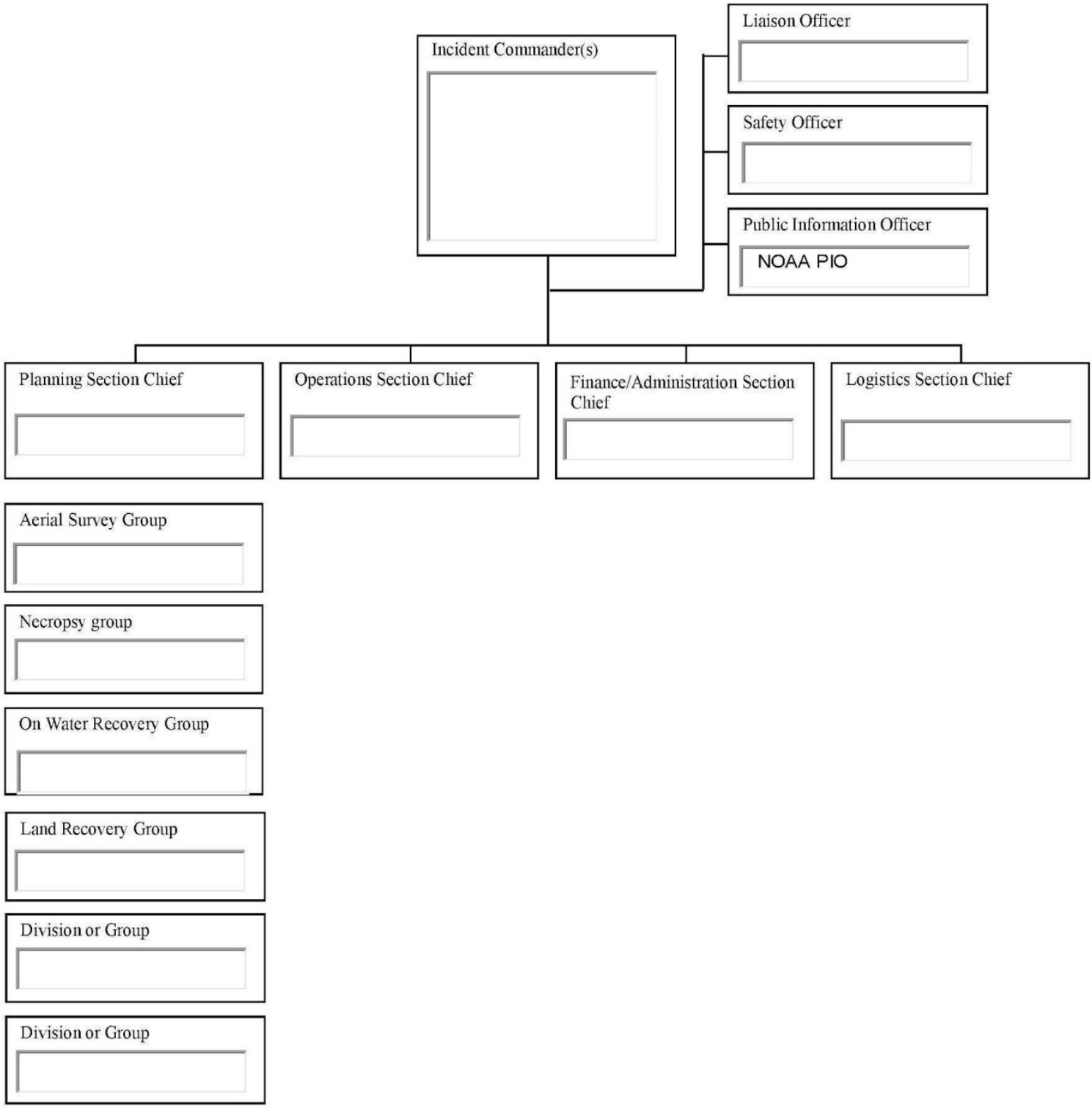
Time:	Actions:
	Notify local stranding network partner, carcass documentation, id landing site, establish ICS structure and positions
	Coordinate with local assets to confirm location, document animal, attach buoy and tow animal to landing site
	Deploy team to receive tha animal being towed and begin initial examination
	Deploy Necropsy NTL and team to conduct necropsy in accordance with accepted protocols.
	Develop a media/outreach strategy to provide updates and information to media and the public

6. Prepared by: ***Rob DiGiovanni***	Position Title: ***IC***	Signature:
ICS 201, Page 3	Date/Time:	

Incident Briefing (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Any whale		Date: *06/25/20* Time: *12:00*

9. Current Organization (fill in additional organization as appropriate):



6. Prepared by: *Rob DiGiovanni*	Position Title: *IC*	Signature:
ICS 201, Page 3	Date/Time:	

Incident Briefing (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Any whale		Date: ***06/25/20*** Time: ***#######***

10. Resources Summary:

Resource	Resource Identifier	Date/Time Ordered	ETA	Arrived	Notes (location/assignment/status)
Incident Commander	IC	06/25/2020 0800	1300	☐	
Operation section	OCS	06/25/2020 0800	1300	☐	
Logistic section chief	LSC	06/25/2020 0800	1300	☐	
Public info officer	PIO	06/25/2020 0800	1300	☐	
Liaison officer	LO	06/25/2020 0800	1300	☐	
Safety officer	SO	06/25/2020 0800	1300	☐	
Plannig section chief	PSC	06/25/2020 0800	1300	☐	
Aerial Survey team				☐	
On water recovery team				☐	
Land recovery team				☐	
NTL				☐	
Necropsy team				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	

6. Prepared by: ***Rob DiGiovanni***	Position Title: ***IC***	Signature: ______
ICS 201, Page 3	Date/Time: ______	

Appendix B: Example Large Whale Supportive Care Equipment List

Item	# per kit
Action Packer (lockable latch storage box)	1
Sheets	4 to 6
Towels	4
Zinc Oxide	2
5-gallon Buckets	4
Collapsible Shovel	1
Helmets	2
Waders	2
Life Vest	2
Nitrile Powder Free Gloves (med and large)	2
Eye Protection	2
Hand Sanitizer (large bottle)	1
Sample jar for parasites/skin biopsy	4
Sample tubes (fecal sample)	5
Sterile petri dish - blow sample	Pack of 5
Paint Stick	2
Pump sprayer	1
16x20 tarp (in lieu of tent)	2
Measuring Tape 100 ft	1
Small Ruler (wounds)	1
Stakes (perimeter)	1 pack of 12
Rebar stake and rope	2

Item	# per kit
Carabiners	2
Mallet	1
Sharpie	2
Monitoring sheet	5
Reflex testing instructions and data sheet	5
Laminated ID card with scale (write in rain)	2
Dry erase marker	2
Protocol	1

Appendix C: Example Free Swimming Whale Assessment and Monitoring Datasheet

Marine Mammal Rescue and Research

Free-swimming Whale Assessment and Monitoring Datasheet

IFAW

Whale ID: _____ IFAW#: _____ **Date:** _____ **Location:** _____

Response Vessel:_____ **Examiner:** _____ **Recorder:** _____**Other Responders on Vessel:**_____**UAV used?** Y N

Species: *M. novaengliae* *E. glacialis* *B. physalus* *B. acutorostrata* *B. borealis* **Estimated Length:**_____ft **Age Class:** C J SA A CBD

Est. Str. Length: _____**(ft)** (**Method:** compared to vessel / photogrammetry / other) **Est. Weight:** _____**(kg)** **Sex:** F M CBD

Body Condition: 1 (emaciated) 2 (thin) 3 (slightly thin) 4 (mesomorphic) 5 (robust) **BCS Notes:** _____

Skin Condition: Excellent Good Fair Poor N/E **Cyamid Coverage:** mild moderate severe N/E **Cyamid color:**_____

Wound Location (if present): Head Mouth Flipper (R L) Body Peduncle Flukes **star locations with associated wounds and describe below*

Wound Description: _____

Initial Time on Animal: ☐ Time off Animal: ☐

Time of Surfacing or Activity/ Procedure (HH:MM:SS)	**Resps / Surfacing**	**Resp Rate /5 minutes**	**Respiratory Quality**	**Response to Vessel** (evasive (E) / approachable (A) / No Response NR)	**Swim Direction** (with respect to vessel)	**Swim Speed** (est. in knots or – fast, moderate, slow, stopped)	**Time of Dive** (HH:MM:SS)	**Comments / Activity / Procedure** **Whale activity:** At surface (S)/ just below surface (SS)/at depth (D), floating (F)/ logging (L) /actively swimming (AS) / slowly swimming (SS), feeding (FE), socializing (SZ), fluke slapping (FS), pec slapping (PS). **Procedures:** close vessel approach (CA), UAV flying, other

Marine Mammal Rescue and Research

Free-swimming Whale Assessment and Monitoring Datasheet

Time of Surfacing or Activity/ Procedure (HH:MM:SS)	**Resps / Surfacing**	**Resp Rate /5 minutes**	**Respiratory Quality**	**Response to Vessel** (evasive (E) / approachable (A) / No Response NR)	**Swim Direction** (with respect to vessel)	**Swim Speed** (est. in knots or – fast, moderate, slow, stopped)	**Time of Dive** (HH:MM:SS)	**Activity / Procedure Notes** Whale activity: At surface (S)/ just below surface (SS)/at depth (D), floating (F)/ logging (L) /actively swimming (AS) / slowly swimming (SS), feeding (FE), socializing (SZ), fluke slapping (FS), pec slapping (PS). Procedures: close vessel approach (CA), UAV flying, other.

Appendix D: Examples of Photo and Ruler Sheet

Photo and ruler sheets/labels are used when taking photographs. When using these, it is important to make sure it is properly calibrated before printing for use. For larger structures and/or animals, especially in the field, Example 2 sheet is not useful when photographing due to lack of visibility of the tiny lines. A proper photo scale, similar to Example 1, with large black and white bars should be used on anything other than close-ups or macro photography.

Example 1:

FIELD ID: Date:

SPECIES:

LOCATION:

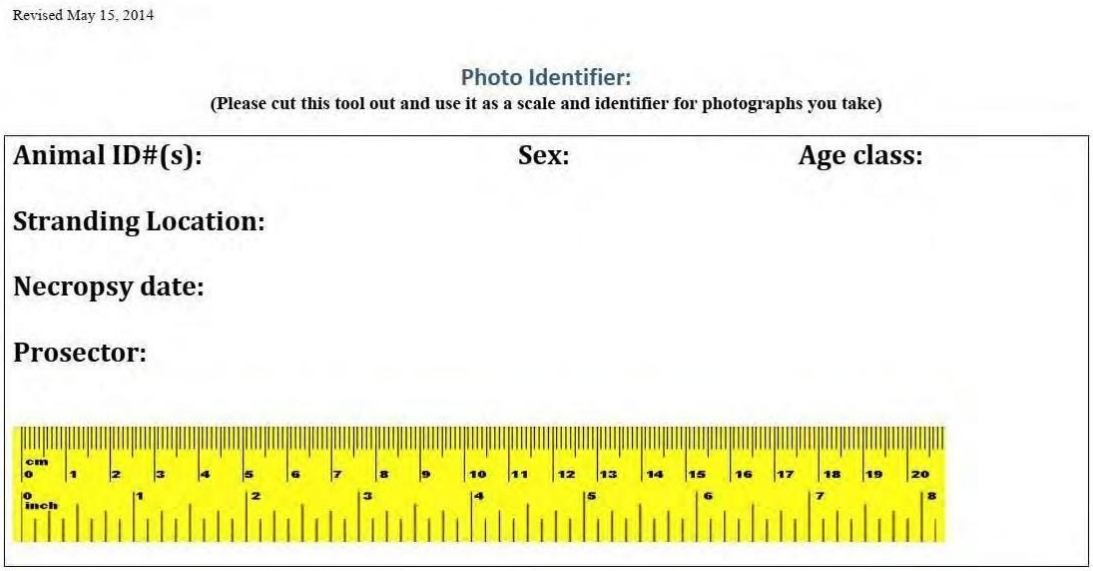
OBSERVER:

Alaska Veterinary Pathology Services

Eagle River, AK

Bars are 1 cm wide

Example 2:



Revised May 15, 2014

Photo Identifier:

(Please cut this tool out and use it as a scale and identifier for photographs you take)

Animal ID#(s): **Sex:** **Age class:**

Stranding Location:

Necropsy date:

Prosector:

Appendix E: Example Large Whale Necropsy and Sample List Datasheet

This is an example datasheet for large whale necropsies. Within the datasheet it includes a sample collection list. The list is an example and will depend upon species, UME, etc. as different samples may need to be collected.

LARGE WHALE NECROPSY FORM	Examination Date & Time:
TMMC Field ID #:	Initial Observation Date:
Other ID No.s:	Form Completed By:
Common Name:	Exam Participants:
Scientific Name:	Location :
Age Class: Sex:	Lat and Long (DD):
State of Decomp:	Total Length (cm):

*** Photographs: *Include lateral views of dorsal ridge (both sides) and fluke edges for photo ID.*

*** Check dorsum for potential tag sites, if any, photograph and sample for histology: No tags observed

History prior to necropsy:

External Nutritional Condition: (*Describe nuchal crest, scapula/ spine visibility; photo lat & rostral views)*

Any unusual smell noted?

External wounds: (*Describe, draw, photo & collect labeled histo samples).* **Signs of HI?**

Musculoskeletal system:
Respiratory System:
Gastrointestinal system:
Liver:
Circulatory system:
Urinary system:
Reproductive tract:

Distribution of internal fat: (*Describe and photograph)*

Subcutaneous:	Mesenteric:
Omental:	Perirenal:

Other: N

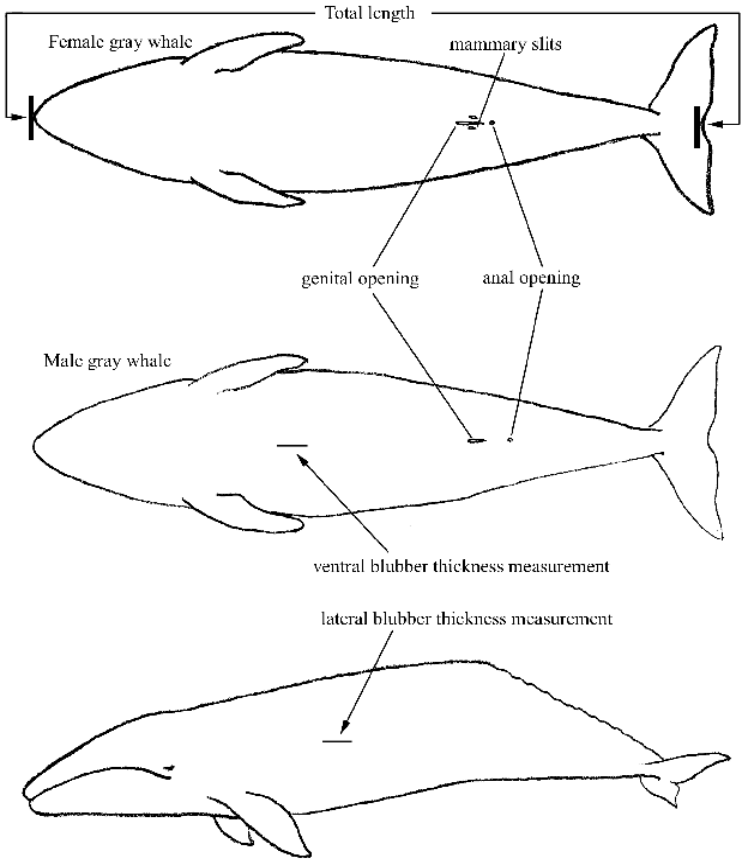
Stomach contents: (*weight, texture, color, smell*):

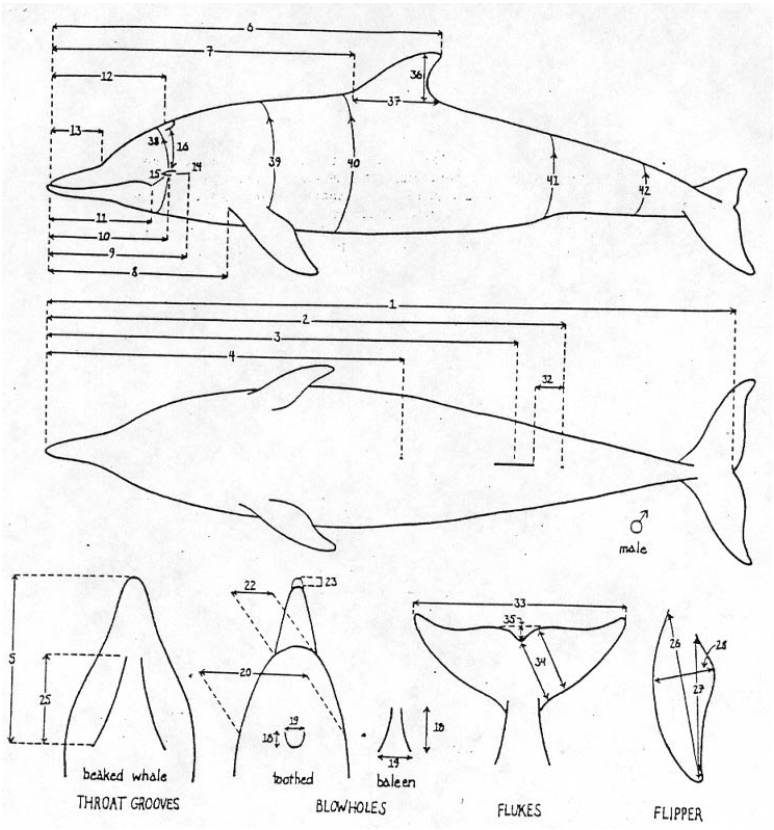
Intestinal contents (*texture, smell*):

Parasites External:
Internal:

Preliminary cause of death:

Topography	**Morphology**	**Etiology**





MEASUREMENTS (specify units:_____)

1. Total length			26. Flipper length, anterior		
2. Snout to anus			27. Flipper length, posterior		
3. Snout to genital slit.			28. Flipper width, maximum		
4. Snout to umbilicus			29. Mammary slit length	R	L
8. Snout to flipper			Number of mammary slits.	R	L
9. Snout to ear			Slit length:	Genital	Anal
10. Snout to eye.			32. Perineal length (males)		
11. Snout to gape			33. Fluke width		
12. Snout to blowholes.			34. Fluke depth at	lobe	notch
14.Eye to ear			38. Girth at eye		
15. Eye to gape			39. Girth at axilla... (half)		
16 Eye to blowhole edge (L/R)	L	R	40. Maximum girth..(half).		
18. Blowhole	length	width	41. Girth at anus.....(half)..		
19. Diameter ear opening			42. Girth midway anus to notch.		
20. Head diameter at eyes			43.Height midway anus to notch		
21. Length of eye opening			44. Thickness midway anus to notch		
22. Rostral width at melon apex			Blubber thickness at axilla:		
			Dorsal	Lateral	Ventral

Histology Samples: (*bold if taken*)

Lung	Stomachs	Kidney	Thyroid	Gonad	Liver
Trachea	Duodenum	Ureter	Eye	Ileum	Lymph node:
Heart	Muscle	Urethra	Vagina	Cervix	Thymus
Aorta	Fat: _____	Urinary Bladder	Uterus	Tonsil	Tongue
Pulmonary artery	Blubber	Mammary Gland	Colon	Pancreas	Prepuce/ Penis
Esophagus	Brain	Spinal cord	Skin		

Sample	**9. Storage**	**# Samples needed**	**# Samples collected**	**Project**
Tongue ulcer, lymph node, lung, or any abnormal tissue (paired with histo)	Whirlpak, -80º C	1 each		Infectious Archive
Liver	4 cm^3 in whirlpak, -80º C	2		Infectious Archive
Kidney	4 cm^3 in whirlpak, -80º C	2		Infectious Archive
Urine	Cryovial, -80º C	2		Biotoxin concentration
Feces	Cryovial, -80º C	2		Biotoxin concentration
Stomach contents	Cryovial, -80º C	2		Biotoxin concentration
Aqueous humor	Cryovial, -80	1		Infectious Archive
Skin/ muscle	DMSO, -20	1		SWFSC: cetacean genetics
Skin	Whirlpak, -80º C	2		Archive
Blubber 5cm x 5cm x full thickness with skin (Collect from lat & dorsal measurement site. Trim off dorsal/right, cranial corner to mark orientation)	Whirlpak, -80º C	2		Infectious Archive
Blubber 5cm x 5cm x full thickness with skin (Collect from lat & dorsal measurement site. Trim off dorsal/right, cranial corner to mark orientation)	Teflon, -20º C	2		Toxicology
Pelvic Bones Bulla	Ziploc, -20º C	2 1		CAS: museum
Ear plug, Bulla, large plate of baleen down to the gumline and 50 grams of blubber (try to get epidermis to muscle interface or aliquot from mid layer) **get anything you can**	Ziploc, -80º C	1 each		Trumble: Life history
Whole Eye	Formalin	1		Murphy:UCD:Sclera thickness
Lens	Whirlpak	1		TMMC: Aging
Parasites	Any, in salt water in bag: Transfer to 70% ethanol	Any		Williams: NMLC: parasitic disease
Baleen, longest plate	Trash bag, -20º C	1		Jacobsen: HSU:mysticete physiology
Baleen Plates Humpback	Trash bag -20º C	5		Pierson:SF Whaletours: Education
Baleen Plates Blue Whale	Trash bag -20º C	5		Pierson:SF Whaletours: Education
Mandible	Trash bag -20º C	1		Pierson:SF Whaletours: Education

Pennella	Any Species (see protocol), -20º C	1-2		Alps: CICRU: Pennella biology
Throat Groves (see protocol)	Trash bag	Any		Will Gough
Stomach contents	Vials provided	1 kg per gut region		Matthew Savoca
Blubber/skin	Whirl pac	10 grams		Matthew Savoca
Small rib	Trashbag	1 each		Lauren Rust
Blubber, liver, lung, gonads	Ziplock	1 each		Godard: Texas Tech: mysticete hormones

*** CHECK CURRENT REQUESTS: HARD PARTS AND APPROVED TISSUE SAMPLES – RECORD ON BACK OF FORM

Appendix F: Large Whale Necropsy Team Leader Duties, Categories, and Qualifications

Introduction

The Large Whale Necropsy Team Leader (NTL) is NMFS approved and responsible for all aspects of the large whale necropsy including conducting the necropsy; ensuring NMFS necropsy protocols are followed; collecting samples and recording data; photo-documenting the animal; and writing the gross necropsy report (and reviewing case reports for right whales and other whales, as needed). For non-ESA large whales (*e.g.,* gray whales, humpback whales), the NTL may be someone designated by the Regional Stranding Coordinator (RSC) with the skill to lead and conduct the necropsy (the individual must be familiar with identification of signs of human interaction) and write the gross necropsy report. For ESA species, and especially for North Atlantic right whales, the NTLs will be determined and appointed, according to the criteria below, by the Regional Stranding Coordinator (RSC) and Marine Mammal Health and Stranding Response Program (MMHSRP) Headquarters Team along with input from existing ESA species NTLs. All ESA large whale responses should be conducted under the MMHSRP MMPA/ESA Permit and NTLs that conduct ESA necropsies on a regular basis should be covered with a Co-Investigator (CI) letter under the MMHSRP MMPA/ESA permit. These CI letters are issued by the MMHSRP Headquarters Team. During a response the NTL reports to the Operations Section Chief under the ICS structure.

NTL Levels

1) Apprentice NTL
2) Non-ESA Species NTL
3) ESA Species NTL

1. Apprentice NTL

The Apprentice NTL assists a Non-ESA NTL or ESA NTL during a large whale stranding response and necropsy. During the necropsy, the Apprentice NTL may be a cutter, sample collector, data recorder, photographer, or perform other duties as assigned.

<u>Pre-requisite Experience & Knowledge:</u>

- The candidate must regularly lead or have led small cetacean/marine mammal necropsies (10-20 per year, or more than fifty total) and be familiar with the protocols for identifying signs of human interaction.
- All candidates for the Apprentice NTL should be knowledgeable in large whale ecology and cetacean anatomy, including the skeletal system, central nervous system, reproductive systems, major vessels, and lymph nodes.

- In areas that use heavy equipment, the Apprentice NTL should have a basic working knowledge of large equipment and especially the safe operating loads of many differing types of line, chain and wire rope.

Physical Requirements and Time Commitment:

- Apprentice NTLs must recognize that large whale necropsies are physically strenuous and may result in exposure to zoonotic agents. Because immune compromised individuals have higher susceptibility to zoonotic diseases, it is required that all candidates for Apprentice NTL be physically fit and in good health.
- The Apprentice NTL must be familiar with necropsy safety precautions and personal protective equipment, and have access to gear for extreme weather conditions.
- The Apprentice NTL must be affiliated with a National Stranding Network organization. This qualification can be waived with recommendations from Stranding Network organizations or RSC (*e.g.,* local veterinarian, whale biologist).
- The Apprentice NTL must be familiar with, and willing to work with and follow NMFS sampling protocols. The candidate must also be willing to work in conjunction with, respect the authority of, and assist local Stranding Network organizations.
- The Apprentice NTL must have an interest in becoming a NTL and have previously attended at least three large whale necropsies/stranding events.
- The Apprentice NTL must be available to attend up to three large whale necropsies per year, with 24 to 48 hours' notice, and write necropsy reports for cetaceans/marine mammals that they have necropsied.
- The Apprentice NTL must acknowledge that NTL responsibilities are very time consuming and can extend for a considerable time after the necropsy is finished. Therefore, the Apprentice NTL must have approval from his/her institution for such a time commitment.

Advancement to Non-ESA NTL:

- Apprentice NTLs may be advanced to becoming a Non-ESA NTL after meeting the criteria outlined below, being recommended by a Non-ESA or ESA NTL to NMFS, and after subsequent approval by the NMFS RSC and MMHSRP Headquarters Staff.

2. Non-ESA NTL

For non-ESA large whale (*e.g.,* gray whales, humpback whales) responses, the Non-ESA NTL oversees all aspects of the necropsy and data collection, including: conducting and assigning tasks during the necropsy; ensuring NMFS necropsy protocols are followed; sample collection; gear collection (if applicable); photo-documentation; writing the draft and final gross necropsy report and case report; and sample dissemination and tracking, including following chain of custody procedures, if applicable.

- The Non-ESA NTL reports to the Operations Section Chief or the Incident Commander if there is no Operations Section Chief.
- The Non-ESA NTL oversees technical specialists (*i.e.,* personnel with specialized skills or knowledge, such as veterinarians or pathologists, cutters, the sample coordinator, photographers, and data recorder).
- In areas that use heavy equipment (*e.g.*, certain areas along the Atlantic coast), the Non-ESA NTL also uses and/or directs operators of heavy machinery in order to coordinate the cutting and disarticulation of the carcass with the sample collection.
- Non-ESA NTLs may lead necropsies on all species of large whales except for ESA species. Occasionally NMFS may request a Non-ESA NTL to lead an ESA species necropsy, especially if the area is remote or the carcass condition is advanced.

Pre-requisite Experience & Knowledge:

- The Non-ESA NTL must have all of the qualifications listed for an Apprentice NTL.
- The Non-ESA NTL must have assisted during at least ten large whale necropsies/stranding events, including writing reports and sample dissemination (to the satisfaction of NMFS, other NTLs, and contracted pathologists).
- The Non-ESA NTL must have been an Apprentice NTL with a Non-ESA NTL or ESA NTL during at least two of those large whale necropsies.
- The Non-ESA NTL must demonstrate proficiency with protocols for identifying signs of human interaction, including identifying signs of fishery interaction, signs of vessel strike, and proficiency at measuring propeller wounds.
- In areas where heavy equipment is normally used (*e.g.*, certain areas along the Atlantic coast), a Non-ESA NTL must have worked with heavy equipment during at least three stranding events and directed heavy equipment use during at least one stranding event.

Willingness to Train:

- Non-ESA NTL will be asked to train Apprentice NTLs.
- NMFS Regional personnel, in collaboration with current NTLs, will identify interested, potential apprentice NTLs and provide training opportunities for these individuals at large whale necropsies.

Advancement to ESA NTL:

- Non-ESA NTLs may advance to an ESA NTL after meeting the criteria outlined below, recommendation and review by other ESA NTLs, and after subsequent approval by the NMFS RSC and MMHSRP Headquarters Staff.

3. ESA NTL

ESA NTLs have the same roles and responsibilities as Non-ESA NTLs, but may also perform this role during responses to ESA whales (*e.g.*, Bryde's, Fin, etc.), including North Atlantic right whale stranding responses.

Pre-requisite Experience & Knowledge:

- The ESA NTL must be a current Non-ESA NTL, and must have led at least twenty-five large whale necropsies on multiple species in multiple environmental conditions.
- If the ESA NTL works on the east coast or plans to necropsy North Atlantic right whales, they should also have experience assisting with or leading at least five North Atlantic right whale necropsies. These five necropsies can be part of the twenty-five necropsies listed above.
- The ESA NTL must also have written necropsy reports and coordinated sample dissemination (to the satisfaction of recommending ESA NTLs, NMFS, and contracted pathologists).

Willingness to Train:

- ESA NTLs will be asked to train Apprentice NTLs and Non-ESA NTLs.

Appendix G: Live and Dead Large Emergency Response Questions and Answers

General Large Whale Live Emergency Response:

Q: Why do whales strand alive?

A: Large whales may strand alive for several reasons. In many instances, whales have underlying serious health conditions including natural toxins such as domoic acid or saxitoxin poisoning, disease, emaciation, and human-caused injuries. In some cases, a relatively healthy animal may strand due to topographic and oceanographic conditions, weather, or acute disturbance (generally human-caused). Each case is different, and the U.S. Marine Mammal Stranding Network responds to large whale strandings (as appropriate, feasible, and safe) to assist the whale when possible and to better understand what factors may have contributed to the stranding.

Q: What are the different emergency responses to large whale events?

A: The National Marine Mammal Stranding Network responds to whales that are alive and dead in U.S. waters. Different responses are possible for live whale stranding scenarios, depending on whether the whale is live on the beach or surf, entangled, seriously injured at sea (*e.g.*, boat strike), or out of habitat. Dead whales can either be on the beach or ice, or found or floating at sea. Logistical planning begins with the first report of large whale stranding. Plans need to take into account available resources, logistics of the stranding location (*e.g.*, accessibility, protected/sensitive habitats such as seagrass and corals that should be avoided, etc.), transport (if applicable), palliative care, euthanasia (if applicable), necropsy, sampling, carcass disposal, resources (*e.g.*, heavy equipment and experience of team members), and working with the media.

Q: How are the Marine Mammal Stranding Network responders authorized?

A: The Marine Mammal Stranding Network is composed of cooperating scientific investigators and institutions, volunteer networks, and individuals. Other organizations involved are local, state, tribal, and federal agencies, and law enforcement. Each non-governmental Stranding Network group is authorized by NOAA Fisheries to respond to marine mammal strandings within a specific geographic response area through a Stranding Agreement. The Marine Mammal Protection Act authorizes local, state, tribal or federal government officials to respond in the normal course of their duties under 50 CFR 216.22.

Q: What role does NOAA Fisheries play?

A: NOAA Fisheries' Marine Mammal Health and Stranding Response Program was formalized by the 1992 Amendments to the Marine Mammal Protection Act and NOAA Fisheries was

designated as the lead agency to coordinate related activities to large whale strandings. Each Region (Alaska, Pacific Islands, West Coast, Southeast, and Greater Atlantic) has a Regional Stranding Coordinator that oversees Stranding Network responses. For contact information for the Regional Stranding Coordinators please visit: http://www.nmfs.noaa.gov/pr/health/coordinators.html

Q: Who should people contact if they encounter a live or dead large whale floating or stranded on the beach and what can they do?

A: Immediately contact your local Stranding Network, local authorities, or the NOAA Fisheries 24-hour Stranding Hotline to report a live or dead-stranded marine mammal:

- For the Southeast Region, call 877-WHALE HELP (877-942-5343)**.**
- For the Northeast Region, call (866) 755-6622
- For the West Coast Region, call (866) 767-6114
- For the Alaska Region, call (877) 925-7773
- For the Pacific Islands Region, call (888) 256-9840

Members of the public should NOT attempt to help live large whales themselves and should instead immediately call authorized professional responders. Only responders who have been authorized by NOAA Fisheries and who have the training, experience, equipment, and support needed should attempt to assist live marine mammals. Response efforts also rely on support from many state and federal agencies (including law enforcement agencies and the United States Coast Guard), non-governmental organizations, and others working together to respond to live marine mammals.

The NOAA Fisheries Office of Protected Resources coordinates marine mammal response efforts around the country through the National Marine Mammal Health and Stranding Response Program.

Regardless of the species, responding to large whales is dangerous, and should only be performed by trained professionals. **Only trained and authorized responders should attempt to help or closely approach a live large whale.** Whales are unpredictable and attempting to help them is extremely dangerous.

Here are the steps to follow:

- Stay in the boat or on the shore—***never get in the water*** to help a whale.
- Note the GPS coordinates of the location of the large whale and direction of travel.
- Call your local responder via the national Stranding Network.
- Wait for trained, authorized personnel—do not attempt to free a marine mammal on your own.
- You can also download the Dolphin & Whale 911 Stranding App (iOS) to help report a

stranding.

- Monitor the situation—if a response is possible, authorities may ask that you stand by and watch the large whale from a safe distance (greater than 100 yards and not directly behind the animal).
- Note the number of animals if possible and if there are animals swimming nearby.
- Document—if possible take photos and video of the animal from a safe and legal distance (*e.g.*, 100 yards). This can provide valuable information to Stranding Network responders.
- Do not touch the marine mammal.
- Don't allow pets to approach the cetacean.

Live Whale At Sea (seriously injured or moribund/floating):

Q: How do live whales become seriously injured or sick at sea?

A: There could be a number of reasons (*e.g.*, watercraft collisions, entanglements, natural causes/illnesses/disease) on how live whales become seriously injured or sick at sea. Collisions between watercraft and cetaceans can have adverse effects on the health of individual animals including death; for endangered species, these effects can be at the population level as well (Kraus *et al.* 2005). Entanglements and fishery interactions can also result in serious injury or death and represent a significant population-level threat to endangered and threatened marine mammals. Additionally, large whales may become sick due to natural causes such as illness and disease leading to malnutrition and other health impacts that could lead to floating behavior.

Q: What are the options for responding to a free-swimming large whale that has an injury, unusual behavior, or is ill?

A: There are very few options for treating a free-swimming large whale. The Stranding Network may consider administering antibiotics via remote injection (using a needle on a pole or a dart containing the medications fired from a crossbow or air rifles) on a case-by-case basis if the cause or contributing factors include infectious disease and/or the treatment might improve the condition of the whale. However, in many cases, antibiotic administration may not address the underlying reason for the animal's debilitation or injury and may not help the animal in the long term. Currently, euthanasia of large free-swimming whales at sea is not possible as the tools to do so safely and humanely are not available at this time.

Q: Can't you just give the whale antibiotics for the wound?

A: After discussion with NOAA Fisheries and experts, administering antibiotics, analgesics, or other drug therapy may be considered depending on the scenario and if the treatment could lead to the improved condition of the whale. Typically, a long-acting antibiotic is administered by remote dart to free-ranging live whales and may require a series of treatments, if possible.

Antibiotics may be used to treat live whales with injuries to help prevent septicemia. However, if the injury is serious enough, euthanizing may be the best and most humane course of action if possible (*e.g.*, if the animal strands).

Q: When is sedation needed in a live large whale emergency response?

A: Typically there is no need to administer sedatives unless the animal is also seriously injured or entangled. If a whale is seriously injured or ill at sea, the scenario needs to be assessed to decide if sedation is the best course of action. Sedation has been used during entanglement responses to help slow down the animal to remove the gear instead of trying to tire and restrict movement of the whale by using buoys, drogues, and small boats (Moore *et al.* 2010). In beached whales, sedation has been used to reduce resistance during procedures to limit the risk to responders (Moore *et al.* 2010) or used prior to administering euthanasia.

Q: What is photogrammetry, how is it used with live whales?

A: Photogrammetry is a laser system that allows for quantitative measurements (morphometrics) from photographs. It adjusts pixel measurements to real size by an estimate of scale (distance/focal length). It can provide data on body condition (e.g. thin or fat), pregnancy, age of a whale (based upon length), and wounds/injuries. Fixed-wing airplanes, helicopters, and/or unmanned aircraft systems (UAS, commonly known as drones) are used to collect vertical images from precisely- measured altitudes directly above the whale. There has been great success using UAS because of the quiet sound footprint, vessel standoff, ability for increased range, increased safety, and cost-effectiveness.

Live Whale Stranded (in the surf or high and dry):

Q: How common is it for a large whale to strand alive and what are their chances of survival?

A: Between 2006-2019, 128 large whales stranded alive on the shores of the United States. A majority of these whales died onshore due to underlying health concerns and the negative gravitational effects from being on the beach. In many cases, the whales were euthanized by veterinarians or the Stranding Network to prevent further suffering. Only fifteen large whales refloated/returned to the sea and of those, nine self-released, where the whale refloated itself off the beach (typically during a high tide following stranding at low tide). There has been only one confirmed successful rescue and refloating of a live-stranded large whale. The success was determined through post-release monitoring with a telemetry tag that was applied by Stranding Network members.

Q: What are the limitations to responding to a live large whale stranding?

A: Some of the challenges and limitations include logistics particularly for remote locations,

environmental conditions such as weather, tidal state, and wave conditions, animal size and behavior, public spectators and busy locations, resource limitations, and options for the disposal of the carcass if the animal dies. In many cases the whale is not fully on land but remains in the surf zone or partially submerged in the water allowing it to roll or move, making it challenging and risky for Stranding Network members to approach closely for examination and intervention. Many considerations and risks need to be evaluated to guide a response such as the welfare of the animal, personnel safety, and the availability of trained and authorized individuals**.**

Q: Why can't a whale be pulled off of the beach?

A: It is important to note that beached cetaceans should not be pushed back out to sea without first being examined by a NMFS-approved marine mammal veterinarian or qualified responder and the action approved by NMFS (Ziccardi *et al.* 2015). Moving large whales has serious safety risks for the whale and for the Stranding Network responders involved. People can be seriously injured or killed by movements of the whale such as rolling or sudden movements of the flippers or flukes. Trying to pull or push a live large whale from the beach can also be very resource-intensive as specialized equipment is required, which may or may not be readily available within the critical 24-36 hours after the stranding. Pulling a debilitated whale back to sea can also result in the whale re-stranding in a more difficult to access location, or subject the whale to risks such as potential drowning. Towing live whales by the tail can result in seriously injuring or dislocating the tail, causing paralysis, and is therefore considered inhumane. It can injure tail muscles, reducing the ability of the whale to swim, feed, and avoid predators. In the worst-case scenario, this process could break the spinal cord paralyzing the animal. Creating a harness to put around the pectoral flippers to pull the animal forward or better position the animal onshore would be a better alternative but this method still has multiple complications; changing the position of the whale onshore is difficult due to weight and size of the animal and the harness needs to be safely released so the animal is not entangled. A quick-release harness is under development but will need to undergo testing before being utilized on the beach with a live stranded large whale. Most importantly, refloating large whales should only be considered for an animal in good overall condition and when post-release monitoring is available to determine the success of the response efforts.

Q: Can the area around the animal be dredged so it can swim away?

A: Dredging to remove sediment or sand around a stranded whale has not been tried very often due to resource limitations and potential environmental impacts/approval process. Dredging would require the availability of an appropriate vessel as well as the necessary authorization to be given quickly in an emergency situation, within 24 hours if possible. Dredging to help one animal can also result in significant unintended environmental consequences and may negatively impact the environment and other species in the area. Anecdotally, some previous attempts to dredge the area around a whale have ended with the whale rolling into the dredged "hole" and

drowning, as it was unable to right itself to breathe.

Q: How is the decision made to euthanize a live whale stranded in the surf or beached?

A: Qualified veterinarians may recommend that euthanasia is the most humane option for the whale based on the condition or age of the animal, the circumstances, and available resources. Euthanasia will be considered if a stranded large whale is in overall poor condition (emaciated), has severe internal or external injuries, is a dependent calf with no adult present, and/or remains onshore after 1-2 tidal cycles. The decision to euthanize is not taken lightly and will be discussed by the NOAA Fisheries Regional Stranding Coordinator, local stranding response group, Marine Mammal Health, and Stranding Response Program staff, and the attending veterinarian.

Q: What can be learned from large whale strandings?

A: Every year there are thousands of reports of stranded marine mammals (including whales, dolphins, porpoises, seals, and sea lions) throughout the United States. Each case can hold important information about the species that can contribute to scientific research or public education. Opportunities to collect health information from free-swimming whales are relatively limited due to the logistical constraints, expense, and need to remotely collect samples (although this is improving with recent technological developments). Stranded live whales provide a rare opportunity to obtain this information. For dead whales, the Stranding Network conducts necropsies (animal autopsies) on large whales that have stranded to better understand the cause of death by collecting a range of samples for analysis. The analysis of these samples may take weeks or even months, but as results become available, we can share those results with members of the public or the media if requested. The necropsy is extremely important; it provides valuable insight into the health of these animals and the data collected may help animals in the future.

Q: What tags and marks can be used and when are they used?

A: The decision on which technique(s) to use for tracking an out of habitat, live injured or entangled whale, or tagging or marking for post-release monitoring will generally be made on a case-by-case basis. Gathering data on the survival of large whales that have been released after a live stranding is an essential part of the intervention. Without the data on post-release outcomes, one cannot assess the value of the overall response, nor evaluate the combined suite of protocols employed. The tools available for monitoring post-release outcomes range from photo-identification (re-sighting of natural or applied markings) to VHF/satellite tag tracking.

All these types of monitoring can be used in tandem, so photos of natural markings can be coupled with applied marks or tags to increase the likelihood of re-sighting large whales at multiple time periods (*i.e.*, short-term and long-term) to assess post-release outcomes. For more specific details on tagging and marking, refer to the Report of the Joint US Office of Naval Research, International Whaling Commission, and US National Oceanic and Atmospheric Administration Workshop on Cetacean Tag Development, Tag Follow-up, and Tagging Best

Practices.

Out-of-Habitat:

Q: What does it mean when a whale is out of habitat?

A: An animal is considered out of habitat if it is not in the typical range for that species, including offshore waters, coastal waters, bays, sounds, estuaries, and rivers. Typically for large whales, an out of habitat animal is found in an inlet, creek, river, coastal, or other body of water that may be directly connected to the continental shelf or open ocean, connected through river mouths, but may only be connected with the ocean (or bay/sound/estuary) at certain tidal cycles, at some distance, or under certain conditions.

Q: When is there a concern about a large whale being out of habitat?

A: Once an animal has been deemed out of habitat, the next step is to determine if intervention is necessary and to gather information on how long the animal may have been in the area. When evaluating whether to intervene, NOAA Fisheries generally considers the likelihood of the animal leaving on its own or leaving after hazing, the animal's chances of survival if no intervention occurs, if the environment will allow for the intervention to be safe for both the response team and animal, and whether it is possible to relocate or rehabilitate the animal (rehabilitation would only be considered for certain age classes of ESA species (*e.g.*, killer whales)). NOAA Fisheries generally consults with marine mammal behavior experts, veterinarians, scientists, and other experts when determining the best course of action. The Stranding Network should only intervene (*e.g.*, haze, etc.) under the following conditions which are not mutually exclusive:

- If the animal is suffering from a life-threatening condition; or
- Evidence suggests the animal is unlikely to survive in its immediate surroundings and is prevented from returning to its natural habitat by a physical or perceived barrier (*e.g.*, unable to feed or forage appropriately, animals displaced to inland waters due to hurricanes, trapped, etc.); and
- It is safe for responders involved in the intervention.

Q: What are some available tools and techniques when responding to an out of habitat animal?

A: Deterrent, hazing, and herding strategies, techniques, and equipment could be considered as tools that can be useful in out of habitat situations to help guide, lead (attractant), or force (deterrent) the animals out of dangerous areas. Deterrents seek to exclude animals from areas by discouraging them from entering into an area or encouraging them to leave an area through either acoustic or physical means. Attractants may include playing sounds from conspecifics (particularly those associated with feeding) in the downstream or "open" area in an attempt to

encourage the animal to move in that direction to investigate the sounds. Acoustic deterrence methods vary from the most basic, such as slapping the water with paddles to the use of targeted acoustical deterrents (generally not effective for baleen whales), such as oikomi pipes or commercially available pingers used in fisheries. A visual deterrence may be used to help herd animals away from a specific area, such as the *hukilau* which is used to create a visual barrier. Physical deterrents can also be useful in some situations. These methods include but are not limited to, fireboats with hose spraying, and bubble nets (Gulland *et al.* 2008).

Entanglement:

Q: How does NOAA Fisheries respond to large whale entanglements?

A: The threat of entanglement to large whales is typically not immediately life-threatening, thereby providing opportunities to potentially disentangle the animals. However, the process of cutting such a large animal free that is likely stressed, mobile and doesn't realize you are there to help it, poses many risks to the animals and the rescuers alike. As a result, NOAA Fisheries coordinates and authorizes under their Marine Mammal Health and Stranding Response Program (permit no. 18787-06) a Large Whale Entanglement Response Network made up of trained, experienced and well-equipped teams who may attempt to free entangled large whales throughout U.S. waters, but at the same time garner valuable information. The gaining of information is a primary goal towards better understanding and reducing what is a broad-based threat to animals and humans alike. As such, NOAA Fisheries maintains regional entanglement reporting hotlines that allow reports of entangled whales to quickly be relayed to the appropriate responders, and are working to increase the capacity of the Entanglement Response Network by expanding training efforts in high priority geographic areas. Responding to entanglements is extremely difficult, dangerous, and should only be attempted by trained and authorized teams. Well-intentioned, would-be rescuers, as well as, authorized and trained responders have been killed.

Q: What does the U.S. Large Whale Entanglement Response Network do and who is responsible for disentangling large whales?

A: The U.S. Large Whale Entanglement Response Network documents entangled large whales and may be able to remove entangling gear when feasible, safe, and appropriate. Through documenting entanglements, the Network gains valuable information, including the impact of entanglements, identity of the gear, and the source of entanglements towards reducing the threat.

Only responders who have been authorized by NOAA Fisheries and who have the training, experience, equipment, and support needed should attempt to disentangle marine animals. Entanglement response efforts also rely on the support of many state and federal agencies (including law enforcement agencies and the United States Coast Guard), non-governmental

organizations, and others working together to respond to, and ultimately prevent, entanglements. Many members of the on-water community act as first responders by appropriately reporting, documenting and assessing entangled large whales.

The NOAA Fisheries Office of Protected Resources coordinates marine mammal entanglement response efforts around the country through the National Marine Mammal Health and Stranding Response Program.

Regardless of the species, disentangling marine animals is dangerous, and should only be performed by trained professionals.**Only trained and authorized responders should attempt to disentangle or closely approach an entangled large whale.** Whales are unpredictable and attempting to remove an entanglement is extremely dangerous.

Q: Who do people contact if they encounter an entangled large whale and what can they do?

A: NOAA Fisheries maintains regional entanglement reporting hotlines that allow reports of entangled whales to quickly be relayed to the appropriate responders: trained and experienced members of the Large Whale Entanglement Response Network. **Members of the public should NOT attempt to disentangle whales themselves and should instead immediately call authorized professional responders.** Disentangling large whales is a dangerous activity that requires years of training, specialized knowledge and skills, and customized tools and equipment to ensure the safety of the animals and the response teams. In addition, authorized Network responders can typically remove more of the entangling gear than members of the public, which leads to better outcomes for the individual whale and gaining better information towards reducing entanglement threats and impacts in the future. If you encounter an entangled large whale the best way to help the animal is to immediately relay the report and provide an initial assessment from a safe and legal distance, to your regional hotline:

Regional Entanglement Hotlines	
Maine through Virginia	1-866-755-6622
North Carolina through Texas	1-877-942-5343
California, Oregon, and Washington	1-877-SOS-WHALe (1-877-767-9425)

Alaska	1-877-925-7773
Hawaii	1-888-256-9840
United States Coast Guard (nationwide)	VHF Channel #16

Here are the steps to follow:

- Stay in the boat—***never get in the water*** to attempt to help an entangled large whale.
- Note the GPS coordinates of the location of the entangled large whale, the direction and speed of travel, and whether it is solitary or with other whales.
- Call your local responder via the national Entanglement Response and Stranding Network.
- Wait for trained, authorized personnel—do not attempt to free a large whale on your own.
- Monitor the situation—if a response is possible, authorities may ask that you stand by and watch the animal from a safe and legal distance (*e.g.*, greater than 100 yards and not directly behind the animal).
- Document the entanglement—if possible take photos and video of the animal from a safe and legal distance (high-quality camera preferred). Note behavior of the whale, approximate size, presence, color and markings on any buoys or other gear on the large whale.

Q: When to intervene if a whale is reported entangled?

A: The first stages of any response is to determine, one, that the report truly represents an entangled whale (*i.e.,* is confirmed), and if so, is the entanglement life-threatening, or likely to become so. In other words, a risk assessment is done on the animal to determine whether a response is needed. Second, an operational risk assessment is done to determine whether conditions and resources might allow a response - is response warranted. The decision of whether (or not) to intervene is made by the NOAA Regional Entanglement Coordinator in consultation with members of the response network that might be conducting response activities, the NOAA Regional Entanglement Coordinator or NOAA Fisheries Regional Stranding Coordinator, and the NOAA Fisheries' Marine Mammal Health and Stranding Response Program. Responders must ensure that the logistical and resource requirements can be met for safe and effective intervention. These requirements include the availability of trained personnel, equipment, and the animal's behavior, sighting history, and location, including whether it is an appropriate location (*e.g.*, water depth, sea state, weather, will not adversely impact protected/sensitive habitats, etc.). If intervention is not an option, the animal may be monitored, usually by the Entanglement and/or Stranding Network or trained biologists, to determine

whether a response may be possible at a later date (*e.g.*, the animal moves to a more suitable area for rescue, the animal live strands, the animal becomes lethargic and easily approachable).

Q: Do you need to have certain qualifications to respond to an entangled whale?

A: The U.S. Large Whale Entanglement Response Network is made up of individuals who have been evaluated on their qualifications and past experience, including but not limited to previous entanglement response experience, working on vessels, experience around live large whales, experience with logistics of emergency responses, and responding in high stress situations. Following a review and evaluation of prior experience, members are issued a Co-investigator letter under the NOAA Fisheries Marine Mammal Protection Act/Endangered Species Act permit for certain levels of entanglement response to large whales (*e.g.,* Level 3, 4 and 5).

Q: What type of gear is used for disentanglement?

A: Each case/event is assessed through physical, behavioral, and environmental observations to determine which types of response efforts are appropriate. Large whale entanglement response efforts may include photo-identification (to help determine outcome and impact), physical or chemical restraint, attachment of scientific instruments (*i.e.,* satellite tags), biological sampling for health studies, disentanglement, and gear investigation towards prevention. Physical restraint may be used to slow down an animal, provide responders with greater control, and help maintain large whales at the surface. Physical restraint is accomplished by attaching or determining if any part of the entanglement can be used as control line(s); attaching floats or buoys, and/or sea anchors to the entangling gear with a grappling hook or other means (*e.g.*, skiff hook deployed from pole); or by attaching new gear (*e.g.*, tail harnesses) to the animal to support it. The drag and buoyancy from small boats may also be used to slow down an animal and maintain it at the surface. Cutting tools on the end of long poles are most often used to cut the entanglement as well as cutting grapples. There are risks to the animal and authorized responders from the effort, including, from the physical restraint of kegging and telemetry, to knives cutting the animals, especially in cases where the gear is embedded and not otherwise accessible.

Euthanasia:

Q: What is euthanasia?

A: The term ”euthanasia” comes from Greek roots and means “a good death.” It is typically used in veterinary medicine to describe the humane ending of the life of an individual animal in a way that minimizes or eliminates pain and distress (AVMA 2020). Euthanasia reflects the veterinarian or authorized responder’s desire to do what is best for the animal and serves to bring about the most appropriate outcome for an animal (AVMA 2020).

Q: When does the Marine Mammal Stranding Network consider euthanasia on marine

mammals?

A: Before deciding euthanasia is the most appropriate course of action, it is important to fully assess the health of the individual animal and evaluate the logistics of response. Situations that may necessitate the consideration of euthanasia include animals suffering with severe injuries (*e.g.*, internal or external) or illness (*e.g.*, disease or poor body condition). If an animal has a serious injury or illness from which recovery is unlikely, euthanasia may be the best and most humane course of action to alleviate its prolonged suffering; however, each scenario will be carefully evaluated on a case-by-case basis to provide the most humane outcome for the individual animal. Once euthanasia has been determined to be necessary, then it is important to decide the best euthanasia method that has the ability to induce loss of consciousness and death with the minimum pain and distress, while having little to no negative environmental impact that cannot be mitigated. Selection of the most appropriate method of euthanasia depends on the situation, including:

- species and number of animals involved
- animal size(s)
- available resources (including means of animal restraint)
- skill of personnel
- available carcass disposal method
- safety in administering the methods
- need for biological samples for diagnostic testing or other purposes

The decision to euthanize a marine mammal is made by the NOAA Fisheries Regional Stranding Coordinator, the local Stranding Network group, the attending veterinarian, the Marine Mammal Health and Stranding Response Program staff, and/or other management agencies, depending upon the circumstances.

Q: What means of euthanasia are available for large whales?

A: Many options for humanely euthanizing animals have been considered in order to weigh risks (to the responders, the whale, and the broader environment) with animal welfare concerns. Currently, the preferred method for euthanasia of large whales is through a chemical dose of potassium chloride administered directly into the heart via an intracardiac needle. This method has been used successfully in several cases with little secondary poisoning risk to animals that may scavenge the carcass afterwards (thus allowing for natural carcass disposal). It is a relatively safe and inexpensive method for resource-limited Stranding Networks. Since this method first involves administering deep sedation drugs, the animal is fully unconscious (or "asleep") before the potassium chloride is administered. The location and condition of the stranded animal (shallow vs. deeper water; wet vs. dry) may impact the ability of a Stranding Network veterinarian to safely approach the whale to administer the potassium chloride solution, in which case other euthanasia methods may be used.

Q: Does euthansia cause pain to large whales? How do they react when euthanized? How long does euthanasia take?

A: When using potassium chloride chemical euthanasia, large whales are first given a high dose of a strong sedative to reduce their pain and stress before administering the dose of potassium chloride to stop their heart. The initial doses of sedatives are given with long, skinny needles that do not cause much pain, similar to a vaccine shot. The sedatives will result in the animal being unconscious or "asleep" prior to euthanasia. After the sedatives have taken effect, the potassium chloride is then delivered through a large intracardiac needle that reaches the heart. Potassium chloride works by inhibiting the ability of the heart muscles to contract and effectively stops the heart when administered. When delivering the potassium chloride, the veterinarian needs to get backflow from the needle to make sure it is in the right place. This process may cause the whale to bleed at the injection site, which can look much worse than it is since a relatively small amount of blood can mix with the nearby water, and can be noticable.

As it dies, the whale may react by opening its mouth or raising its pectoral flippers or flukes. This is always difficult to witness. Since the animal is sedated and unconscious, its suffering is minimized.

The time of death varies for each case; in past cases using only sedation, the time to death ranged from ~50 minutes to 2.5 hours given the immense size of large whales and how slow their metabolism is compared to smaller cetaceans. When potassium chloride is used, the time to death ranges from ~4 minutes to 10 minutes after administration of the drug.

Stranding Network veterinarians and/or NOAA Fisheries designate authorized responders that have the experience and training to relieve unnecessary pain and suffering through euthanasia, if the recovery and return to the wild of a stranded marine mammal is not possible. The goal of euthanasia is to make the death of an animal as painless, quick, and free of distress as possible by using the best and most effective method for the specific situation. Species-specific sedation and euthanasia protocols are available for some species and should be used whenever possible to provide the best euthanasia process for each animal.

Dead Large Whale Emergency Response:

Q: What is a necropsy (animal autopsy)?

A: A necropsy is the examination of an animal after death. The purpose of a necropsy is to determine the possible cause of death.The necropsy is extremely important; it provides valuable insight into the health of these animals and the data collected may help animals in the future.

Q: What can we learn from dead marine mammals, why is a necropsy performed?

A: Marine mammals are important sentinels of the marine environment. Since they are mammals like us, swim in many of the same waters we use, and eat many of the same fish that we consume, monitoring their health can help inform us of potential threats in the ocean that could impact people. Responding to and investigating dead stranded marine mammals is important to

fundamentally determine cause of death, and whether it is natural vs. human-caused.

In some cases, the animal may be too decomposed to collect some types of samples or thoroughly investigate its health. There are other times, we can perform necropsies (animal autopsies), collect samples, investigate health, collect reproductive biology data, life history information (diet, age, number of pregnancies), exposure to contaminants, and other biological and physiological information.

By performing necropsies, we can also document human interaction cases that may include vessel collisions, entanglements, marine debris, fishery interactions, and gunshot injuries. Data collected from stranding responses help NOAA Fisheries monitor and understand wild marine mammal stocks and populations, as well as make more informed decisions for their management and conservation. Various publications have been written by the Stranding Network on the data collected from stranded marine mammals and more information can be viewed at the NOAA Fisheries Marine Mammal Protection website (https://www.fisheries.noaa.gov/topic/marine-mammal-protection).

Q: Who performs the necropsy and do they need training?

A: For large whales, a Necropsy Team Leader is a NOAA Fisheries approved, qualified and experienced team leader who is responsible for all aspects of the necropsy. This includes managing the necropsy team, assigning tasks during necropsy, and being responsible for the gross and final necropsy report.

Q: What samples are collected during a necropsy?

A: The samples collected highly depend on the condition and access to the carcass. For a fresh carcass a full suite of tissue and swab sampling will be collected (*e.g.*, histology, cytology, pathogens, parasitology, contaminants, biotoxins, life history, genetics). For carcasses in more advanced states of decomposition, or in a location where it is hard to recover the carcass, limited samples may be collected such as samples from the colon, small intestine, skin, muscle, teeth, and blubber.

Q: What if the carcass cannot be moved to a better necropsy location site?

A: Depending on the level of decomposition and location of the carcass, it may not be feasible to tow the carcass to a more suitable necropsy location. Therefore, limited sampling or only photo documentation may be performed.

Q: What are the options for disposing of a marine mammal carcass?

A: There are two broad choices in disposing of a marine mammal carcass: (1) leave it in the environment, or (2) removal. Leaving the animal in the environment to decompose naturally can

occur at the original stranding site or following relocation (depending on local restrictions). Removing the carcass from the environment may not always be possible and often depends on the location and size of the animal. Removal can be time-consuming, and may involve heavy equipment (*e.g.*, bulldozers) which can be expensive or restricted in certain locations. For larger whales, pre-selected sites for relocation may or may not be available depending on the time of year or available resources.

Q: What are the different options for leaving a marine mammal carcass in the environment?

A: If the marine mammal carcass is large, inaccessible, or cost-prohibitive to move, the animal will be left to decompose naturally. These methods include:

- *Remain in place* – the carcass is left above ground, in the tidal zone, or in shallow water areas, either in the original stranding location or moved to another site for natural decomposition.
- *Burial*– the carcass is buried on site above the high tide line. The carcass should be buried deeply to prevent scavenging and reduce the likelihood of disease transmission. This is one of the more cost-effective disposal options.
- *Release at sea* – the carcass is towed offshore and released floating at sea and requires an ocean dumping permit from the Environmental Protection Agency (requirements may differ per state).
- *Sinking* – the carcass is towed offshore and sunk. This also requires an ocean dumping permit from the Environmental Protection Agency. This is an extremely costly option and will be utilized only if there are the resources to do so.