Cetacean Mass Stranding Best Practices

Executive Summary

"Mass strandings" describes a simultaneous stranding of two or more cetaceans (same or mixed species) at the same time and place (other than cow-calf pairs) (Geraci *et al.* 1999). Mass stranding responses are more complex than responses to single animals, and the best mass stranding outcomes occur when response personnel are trained and prepared for unforeseen and changing conditions, and equipped to make challenging decisions. This document brings together the best practices and standardized protocols that the National Marine Fisheries Service (NMFS) recommends to make the most informed decisions and determine the best course of action during responses to mass cetacean strandings.

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 cetacean mass 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.

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1. Introduction

1.1 Background

In 1992, the Marine Mammal Health and Stranding Response Program (MMHSRP), under the National Marine Fisheries Service (NMFS), was established by Congress under Title IV of the Marine Mammal Protection Act (MMPA). The MMHSRP serves to coordinate marine mammal stranding response efforts in the United States by working to standardize regional network operations and define national stranding response policy.

NMFS published the guidance document "Standards for Release" in 2009 as part of the broader Policies and Best Practices: Marine Mammal Stranding Response, Rehabilitation, and Release. The Standards for Release give detailed protocols for making determinations about when a rehabilitated marine mammal can be released back to the wild, but there are no detailed guidelines for response to mass stranded cetaceans prior to admission to rehabilitation. The MMHSRP also holds a MMPA/Endangered Species Act (ESA) research and enhancement permit that allows the program to authorize qualified individuals to conduct interventions for ESA-listed cetaceans for which there is a health concern. Most non-ESA species responses can be conducted under Stranding Agreements (SAs). One exception is that hazing/deterrent activities are not authorized in every SA. Therefore, if the responder is not authorized under their SA, then the hazing/deterrence would be conducted under the MMPA/ESA permit or by a government employee acting under MMPA Section 109(h).

1.2 Legislation Pertinent to Marine Mammal Strandings

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

> 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 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, who oversees NMFS, and the Secretary of the Interior, who oversees the United States Fish and Wildlife Service (USFWS). NMFS has jurisdiction over cetacean and pinniped species (with the exception of walrus), and USFWS has jurisdiction over walrus, polar bears, sea otters, and manatees. The 1992 amendments to the MMPA included Title IV of the MMPA, which established the MMHSRP under NMFS to collect and disseminate information about the health of marine mammals and health trends of marine mammal populations through the collection of stranding data.
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> 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. The MMHSRP holds a MMPA/ESA research and enhancement permit that allows the program to authorize qualified individuals to conduct interventions on ESA-listed cetaceans for which there is a health concern.

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.

The United States Marine Mammal Stranding Network (the Stranding Network) has developed protocols and procedures for responding to live marine mammals that are stranded and/or otherwise in distress to ensure the health, welfare, and safety of both the human responders and animals. For more information on general stranded marine mammal rescue and rehabilitation, the reader should consult references such as *Marine Mammals Ashore* (Geraci *et al.* 2005) and the *CRC Handbook of Marine Mammal Medicine* (Gulland *et al.* 2018).

These Cetacean Mass Stranding Best Practices (Best Practices) highlight general protocols and procedures specific to events when groups of cetaceans strand. Additionally, these Best Practices are designed to be paired with more specific Regional Annexes that include species-specific issues that are more appropriately addressed at regional or state levels. For further information on general protocols and procedures specific to events involving single animals, the reader should refer to NMFS' Small Cetacean Intervention Best Practices and/or NMFS' Live and Dead Large Whale Emergency Response Best Practices.

1.4 Funding

The John H. Prescott Marine Mammal Rescue Assistance Grant Program provides funding for eligible members of the Stranding Network through an annual competitive grant process. These grants support the rescue and rehabilitation of stranded marine mammals (including cetacean mass stranding response), data

collection from living or dead stranded marine mammals for health research, and facility operation costs. However, as these grants are limited and competitive, individual Stranding Network members often also support many of the costs for normal operations. Determining whether funding is available for a response is an important first consideration, as lack of funds or available in-kind donations (*e.g.*, boat use) may limit options for response.

2. Planning for Mass Strandings

"Mass strandings" describes a simultaneous stranding of two or more cetaceans (same or mixed species) at the same time and place (other than cow-calf pairs) (Geraci *et al.* 1999). Types of mass stranding responses include Live-Stranded: in Surf and/or High and Dry; Live-Out of Habitat (nearshore milling, near mass stranding); Dead-Stranded: in Surf and/or High and Dry; both Live-Stranded and Dead-Stranded: in Surf and/or High and Dry. These events can include stranded cetaceans all in one area or scattered in the same general geographic region, and animals can be high and dry, in surf, and milling near shore. Mass strandings typically require more coordination than a stranding event involving a single animal, as depending on the time of year, location, and size of the event, there will be multiple animals to assist, and they often generate more attention (*e.g.,* public and media). The main response components (*i.e.*, initial assessment, securing the scene, providing supportive care [if necessary], staff assessment, and decision-making) are similar to a single response event, however, group responses can be larger and require more logistical planning and permit approvals.

2.1 Authorization, Training and Safety

Generally, a mass stranding response can be conducted under a Stranding Agreement (by the Stranding Agreement holder) or by a government employee acting under MMPA Section 109(h). However, for ESA species, mass stranding responses are conducted under a MMPA/ESA permit that is issued to the MMHSRP. Only responders who have been authorized by NMFS and who have the training, experience, equipment, and support needed should attempt a mass stranding response. Authorized response efforts may also rely on partners at tribal, local, state, and federal agencies (including law enforcement agencies and the United States Coast Guard (USCG)), non-governmental organizations, fishermen, and other groups to assist with the event.

Stranding Network members are trained or have experience in proper techniques for safe response, assessment, handling and restraint, sampling, and release (if needed). Training workshops have been offered to members of the Stranding Network. Depending on the role that the individual may fulfill, different levels of training (both required and recommended) will be necessary. Others are mandated to ensure activities are conducted safely, such as recognizing and minimizing the risk of injuries and physical hazards associated with a live or dead mass stranding response operation. Basic Incident Command System (ICS) training should be encouraged to all personnel, as a baseline understanding of the principles and tenets will benefit everyone involved in the response. Free ICS courses are available

online:

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

Some responders may be required to hold other 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, all respondents should be trained in First Aid, cardiopulmonary resuscitation (CPR), boat safety, and live animal handling. It is important to emphasize that **human safety comes first**, during both training and responses.

Human and animal safety is the top priority for NMFS and the Stranding Network. Responding to multiple animals at once can be very stressful and physically and emotionally draining for everyone involved, which could lead to compromised safety during response operations. It is important for teams to recognize and understand an individual's capabilities and limits, and for responders to communicate before their limits are reached. It is also important to have a debriefing after the event to discuss topics such as what went well and lessons learned.

Each event is unique and there are multiple possible hazards that responders should take into consideration such as:

- dangerous substrates (*e.g.*, mud, shells, rocks, ice) or wave conditions,
- remote or difficult to access locations,
- changeable weather conditions,
- tidal changes,
- time of day (*e.g.*, close to sunset limiting light)
- thrashing animals,
- predators (*e.g.,* sharks, killer whales, bears, alligators)
- exposure to infectious diseases, and
- accidental injury from response tools (*e.g.*, needles, medications, knives, etc.).

Responders should always be aware of immediate surroundings, follow instructions, know the location of the safety equipment (*e.g.*, first aid kit, eye wash, sharps containers, flash lights, radios, etc.), and wear the appropriate personal protection equipment (PPE) specific to the event and responder role.

2.2 Mass Stranding Structure and Roles

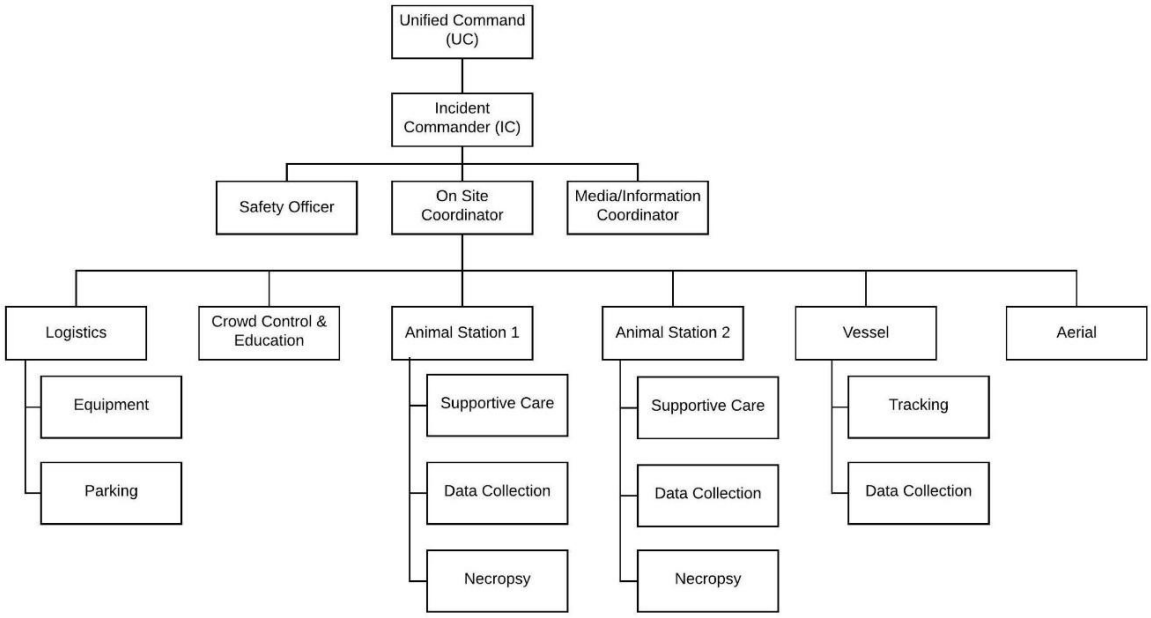
2.2.1 *Incident Command Center (ICS) Overview*

ICS is defined by the Occupational Safety and Health Administration (OSHA) as "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" (OSHA 2008). The ICS allows for flexibility on scene, a clear chain of command, and consistency when working with other stranding response organizations and other federal agencies. The ICS is an effective way to manage stranding response efforts, particularly when integrating individuals from multiple response groups. The overall flexibility allows for the incorporation of certain roles and processes currently used during stranding response, while providing a common vocabulary and operating picture for all of the potential responders. A response typically grows from a small, localized approach with a single organization to fit the level necessary for a specific incident. Developing a full ICS structure takes time and should ideally be developed prior to an event 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 should be filled, and in some cases one person can fill more than one role. Organization levels (*e.g.*, section chiefs, coordinators) should be kept as small as possible to accomplish ICS objectives and maximize effectiveness.

An example of a basic ICS organizational structure for a mass stranding event:



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

- **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.

2.2.2 *Unified Command*

The ICS structure may expand to become a Unified Command (UC). The UC is an expansion of the ICS organization 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 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 decisions 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. To be effective, the number of personnel should be kept to a minimum.

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 headquarters 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)
- State Stranding Coordinator, if applicable
- Local Stranding Network responder
- Necropsy Team Leader (NTL)

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

2.2.3 *Command Staff*

The Safety Officer, 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. 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 PIO 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 Incident Commander 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 *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 Incident Commander 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.

2.2.5 *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 mass stranding 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 few to tens to hundreds of animals. 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, Carcass Disposal, Veterinary Support, etc. More details on specific operational needs for specific response types are listed in subsequent sections (*i.e.*, sections 4, 5 and 7).

2.2.6 *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 the response activities. 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 or Aerial Coordinator (may be located off-site) who is responsible for identifying and coordinating vessel or aerial support.

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.

2.2.7 *Categories of Personnel*

Similar to the different personnel classifications of Stranding Network organizations, there are different levels of personnel or resource teams that can be involved in a response; each level has different requirements for skills, training, knowledge, abilities, and responsibilities. Some of these personnel or team classifications can oversee different areas of the response, while others will perform specific tasks. These classifications (Table 1) roughly break down into the following:

Table 1: Examples of categories of personnel and/or team classification

Personnel/Team 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 Working Group on Unusual Mortality Events members), the Shore-side Security Branch (law enforcement agencies), the Waterside Safety Branch (USCG), 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 Branch Director and ultimately Incident Commander while projecting operational needs into the next period.
Group Supervisor	Assigned to the lead staff member with 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, mass stranding 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.

2.3 Communication and Media

2.3.1 *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. It is important to be prepared for how the situation is to be communicated (*e.g.*, information provided is consistent). There should always be a primary designated spokesperson when interacting 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. Distributing informational brochures 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 have 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).

2.3.2 *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 clear and accurate information, and emphasize the message you are trying to get across. The PIO serves as the coordinator for all media - traditional and social. The media team, with representatives from many or all of the participating partner agencies, can help manage the media and be responsible for responding to media inquiries during an event. This Coordinator/Team can proactively reach out to the press, post updates on social media accounts, and create and drive the media strategy for providing consistent information and coverage during an event.

During high-profile events, additional media coordination takes place between the IC, MMHSRP, RSC, and the NMFS Office of Communications, as necessary. Media interview requests should be coordinated through the Public Information Officer or designated individual, who will work with a NOAA Office of Communications Public Affairs Communications 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.”

2.3.3 *Elected Officials*

It is important to make sure elected officials at all levels (mayors, council representatives, state representatives, etc.) are communicated with when there is a large mass stranding 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 help with expediting approvals needed to necropsy and dispose of multiple carcasses on a particular beach for examination.

2.3.4 *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 (Army Corps of Engineers, other Department of Defense Agencies, the United States Coast Guard, USFWS, National Parks Service, etc.), state agencies (State wildlife or environmental departments, state park agencies, etc.), and other county or local environmental agencies. There are times when, for example, USCG is needed to help regulate or secure an area around a mass stranding of cetaceans or a state wildlife agency is needed to help verify the location or condition of the animals, 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 (Regional Stranding Coordinator) 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 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.).

2.3.5 *Stranding Networks*

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 organization in the closest proximity to the stranding site, nearby stranding network members should be notified as they may be able to supply additional responders, equipment, and experience. It is also helpful to notify all nearby response organizations as soon as possible in case they receive calls about the same event. Being able to

collaborate quickly and effectively saves time and decreases duplicate work. In some cases, NMFS will request or require that a Necropsy Team Leader Co-investigator be in charge of the dead animal response, especially for ESA responses, and this individual may be from outside the immediate geographic area.

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

During mass stranding 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 animals, including age class length cut-offs, normal range, etc. Early communication with researchers that maintain catalogs of individuals of the specific cetacean species will help ensure that the appropriate images (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 mass stranding 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.

2.3.7 *Feedback mechanism to provide data and information to resource managers* (*i.e., SARS, 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 (*i.e.*, Stock Assessment Reports (SARs), Take Reduction Teams (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 (*i.e.*, Google Drive folder). Having 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.

2.4 Logistics

When planning for a mass stranding response, in addition to assembling the appropriate team members with the correct expertise (as discussed above), several other logistical considerations need to be addressed. Below are some typical questions to consider when planning logistics.

- Vessels: Are vessels needed? If so, how many (at least two should be required for safety after the

initial observations), what type of vessel (*e.g.*, motor, kayak, paddleboard), how many people are available, do vessels have navigation lights if the return trip is after dark?

- Aerial Assets: Are aerial assets needed? If so, how many, what type of aerial asset (*i.e.*, planes, helicopters or UAS), how many people are available or can partners (*e.g.*, USCG) supply planes?

- Equipment: Is thee access to communication equipment (*i.e.*, marine radios, cell phones, satellite phones, etc.), stretchers, marking and tagging equipment, sampling equipment, transport vehicles, and euthanasia capabilities whenever possible? Also, while a particular course of action may be deemed the most likely based upon the assessment and planning, it is important to be as prepared as possible for any eventuality, to have the maximum flexibility. Preparation and flexibility are essential.

- Environmental conditions: At what stage is the tide cycle? What is the sea state? Is it a gently sloping beach or is there a steep drop-off? Is the substrate and weather (*e.g.*, thunderstorms, snow, etc.) in the area conducive to safely responding to the animals? What time of day is it (*i.e.,* close to sunset)?

- Accessibility: Is there access to the beach for vehicles or trailers? Are there boat launches or other access points available for the vessels to use? How far away are the access points from the stranding location(s)? If access is tidally dependent, how much time will the team have at the stranding location(s)?

- Team availability: How many responders are needed? Are there an appropriate number of experienced responders available? Are there role-specific experienced members?

2.5 Equipment and Supplies

Each type of mass stranding response (Live-Out of Habitat; Live-Stranded: in Surf and/or High and Dry; Dead-Stranded: in Surf and/or High and Dry; both Live-Stranded and Dead-Stranded: in Surf and/or High and Dry) requires specific equipment. Table 2 below summarizes general equipment used for the various types of responses.

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 - Stranded (in Surf and/or High and Dry)	Dead - Stranded (in Surf and/or High and Dry)	Both Live-Stranded and Dead - Stranded (in Surf and/ or High and Dry)
Communications	Marine radio, cell phone, satellite phone	X	X	X	X
Data Collection Supplies	Datasheet forms, clipboards, pencils	X	X	X	X
Safety equipment/Personal Protective Equipment and clothing	Coveralls, raingear, life vests, non-permeable gloves, knee pads, eye wear, footwear, sunscreen, sharps container	X	X	X	X
Medical equipment for humans	First aid kit, Automated External Defibrillator (AED)	X	X	X	X
Medical equipment for animals	Palliative care supplies (tents, sheets), wound care kit, blood collection, IV fluids, antibiotics, anti-inflammatories, antioxidants, field blood analyzers, ballistics, euthanasia solutions	X	X		X
Sampling and tagging equipment	Measuring kit (tape measurer, calipers, rulers), tagging kit (suction cup tags, satellite tags, tagging equipment), marking kit (paint stick), breath and fecal sampling supplies, coolers, ice packs	X	X	X	X
Vehicles	Response vehicles	X	X	X	X
Vessels	Kayak, motor boat	X	X	X	X
Local sedation equipment	Hand inject, pole syringe		X		X
Remote sedation equipment	Dart projector, darts		X		X
Recording equipment	Cameras, GoPro, SD cards, batteries	X	X	X	X
Cleaning/disinfectant supplies	Dawn, hand sanitizer, disinfectant solution, garbage bags, buckets, brushes	X	X	X	X

Capture/Restraint/Towing equipment	Ropes, nylon straps, stretchers	X	X	X	X
Transport equipment	Cetacean carts, mats, stretchers, transport trailers		X	X	X
Beach equipment	Cranes, front-end loaders, bulldozers		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, ruler, measuring tape, DMSO vial			X	X

2.6 Records, Data Collection Protocols and Documentation

It is important that each event is fully documented, and the appropriate data collected. Many mass strandings span over several days so data should be collected consistently on every day of the event. Information should be collected not only to document the stranding, but also to evaluate the successes and challenges of the responses. This feedback will be informative, and used to improve protocols and modify techniques for future events. This information can also be valuable for other stranding network members for use in similar situations. It is a continuous cycle of preparation, response, assessment, disposition, evaluation, and protocols/training, as new tools and techniques are developed and tested.

Data is typically gathered 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, record the day, time and location, and condition of the animal(s) being monitored (*i.e.*, respiration rates, abnormal behavior, etc.). The animals should be documented with photographs and/or video, as photo-documentation can help identify individual animals and assess their condition for future release/transfer to rehabilitation facilities or euthanasia determinations. Recording the animal(s) behavior is helpful in assessing and determining the best course of action. At a minimum, collect field information to complete NOAA's Level A data form. This will include a unique identifying number for each animal (*i.e.*, Field ID#, per Regional Stranding Network protocols) and a unique identification number for the mass stranding event (*i.e.*, Group Event#, per Regional Stranding Network protocols). Live animals and group events must also be indicated in the appropriate section of the Level A form. Level A forms may be completed electronically via direct entry into the National Stranding Database. See Appendix A for examples of standardized datasheets and forms that can be used during a mass stranding response.

2.7 Transportation

Some mass strandings require animal(s) to be transported for relocation, release, or rehabilitation. Transport can occur via a cart or stretcher to the transport vessel or vehicle/trailer. See Appendix B for photo examples of various transportation methods. Stranded cetaceans are generally transported using dry transport (*e.g.*, closed or open cell foam pads or similar padding). Since cetaceans cannot thermoregulate efficiently out of water, rescuers must continually monitor their temperature by palpating their dorsal fin, pectoral flippers, or flukes, or by using a rectal thermometer, and providing the appropriate care (application of water via bucket, sprayer, etc. to cool a warm animal, being careful of the blowhole, or dry blankets to warm a cold animal). It is important to remember that dolphins do not have to be wet at all times, and in cases when they are exposed to cold air temperatures during a stranding, wetting the animal(s) may cause additional damage to the skin and be counterproductive in attaining normothermia. In some non-emergencies, including transport for releases, "wet transport" (*e.g.*, water-filled boxes) may be used for cetacean transport. Depending on the situation, an animal also may be transported in a stretcher in the water alongside a boat or in a boat to transfer the animal to a more suitable release location. When transporting, animals should be kept calm to avoid struggling or thrashing, which may cause overheating, stress, or physical trauma. All necessary equipment and supplies for maintaining the animal's body temperature and safety should be available. For more specific information on how to transport marine mammals safely, refer to the Pinniped & Cetacean Transport Best Practices or section 4.6 for more information on Supportive Care.

2.8 Carcass Disposal

All carcass disposal should follow local, state, and federal laws and regulations. An animal euthanized by physical methods (*e.g.*, ballistics or exsanguination) can be disposed of by being left in place, beach burial, landfill, towed out to sea, rendering, composting, or incinerating. An animal euthanized by chemical agents that can cause secondary poisoning needs to be disposed of in a manner that minimizes risk to potential scavengers and avoids animal food supply chains. Carcasses containing high concentrations of pentobarbital euthanasia solutions should be incinerated, rendered, composted, or buried in licensed landfills that accept pentobarbital carcasses to prevent accidental poisoning of scavengers (Geraci *et al.* 2005). For more detailed information on marine mammal carcass disposal, the Marine Mammal Carcass Disposal Best Practices.

2.9 Decision Making to Intervene

Mass stranded animals may be beached in surf or shallow inlets, high and dry, and/or milling nearshore (near mass stranding). The reason for the stranding event could be due to various causes such as natural disasters (*i.e.*, hurricanes or atypical weather), oceanographic barriers or conditions, anthropogenic causes (*e.g.*, sonar), disease, social structure, etc. When making the decision to respond, be aware of the different causes as well as other assessment considerations (*i.e.*, behavior, body condition, size, number, injuries,

rehabilitation space, human safety, accessibility, etc.) that make each event unique.

The decision of whether (or not) to intervene is made by NMFS, after discussions between multiple parties – the local stranding network organizations that have "boots on the ground" responsibility for response, the NMFS RSC, and other MMHSRP staff. Ideally, these consultations include marine mammal veterinarians and experts in the biology and life history of the affected species. The decision to intervene takes into consideration the following questions, as well as others pertinent to the situation:

- What field observations have been reported?
- What is the health status of the animals?
- How many animals?
- Where are the animals located?
    - Is it accessible?
    - Are there protected/sensitive habitats that should be avoided?
- Is there a medical diagnosis?
- What are the potential causes of the animals' observed condition?
- What is the estimated or known life history (sex, age, size)?
- What is the conservation status/reproductive potential?
- Are there safety concerns (for the responders, public, and/or animals)?
- Is a response believed to be feasible?
- What resources are available?
- Are there risks to other species?
- Is there a contingency plan in place if response is not successful?

3. Prevention

There are times when it may be necessary to attempt to prevent marine mammals from encountering or persisting in a potentially harmful situation, such as an oil spill or a group of cetaceans entering shallow water that are likely to mass strand (*e.g.,* in Cape Cod Bay). For mass strandings, preventative measures can sometimes be used, but only if there is advance notice of cetaceans swimming close to shore or in areas considered out of habitat. The goal of mass stranding prevention efforts is to safely encourage animals to move away from a dangerous, or potentially dangerous location, into deeper, open water by utilizing vessel movement, acoustics, or other deterrents (*i.e.*, hazing).

All prevention measures are initiated and suspended based upon three variables:

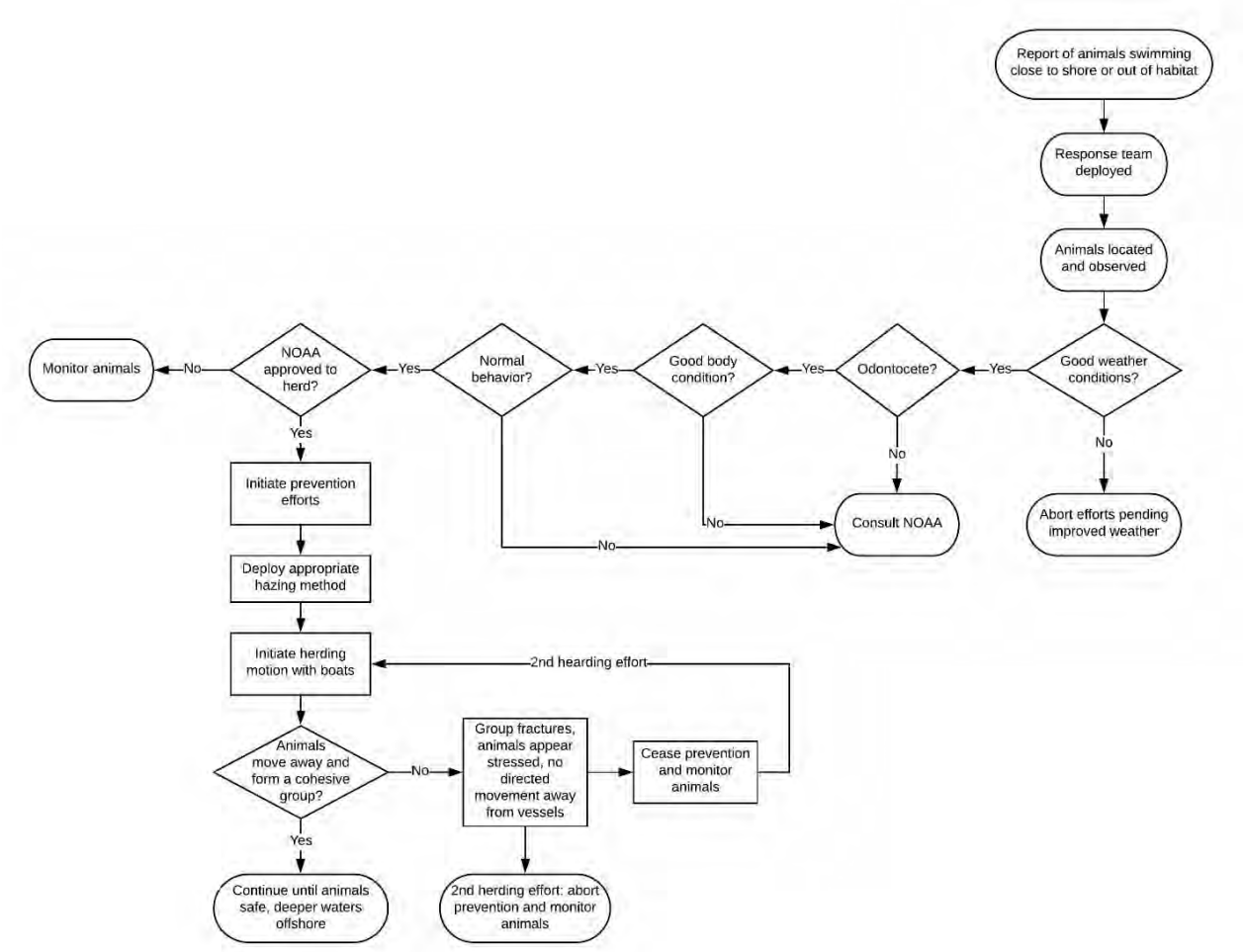
1) Approval from NMFS to initiate
2) Safe operations - is it safe to conduct these operations?
3) Animals' response to efforts

The decision to employ deterrence methods or hazing is a cost/benefit analysis of the potential harm to

the animals from remaining in the negative situation, the potential harm to the animals from the deterrence technique(s) that would be employed (including potential harm to non-target animals), the potential risks to the responders that would be conducting the deterrence, the costs (financial and logistical) of conducting the deterrence, and the believed efficacy. There is no one hazing technique that will work in all situations or for all species. Most hazing activities are conducted under the MMHSRP's MMPA/ESA permit, and require approval from the permit Principal Investigator (PI) (*i.e.*, the MMHSRP coordinator). There are, however, limited instances where hazing operations may be conducted under the authority of the SA. To be conducted under the SA, the hazing must be for individuals or small groups of non-ESA listed small cetaceans, and must use only non-lethal deterrence techniques (85 FR 53763).

3.1 Decision Tree

The decision tree below illustrates the flow of events and decision-making processes involved in mass stranding prevention. It is impossible to articulate every possible scenario, thus these protocols strive to provide a basic understanding of the principles and actions involved in successful mass stranding prevention.



3.2 Herding

Herding is performed via vessels that help safely encourage free-swimming cetaceans to move from shallow water to deeper water or away from a hazardous situation. This tactic can take several hours to produce results, may not produce any results, or may worsen the situation. Responses from animals are often unpredictable. In addition, vessel traffic and communication issues can complicate coordination efforts as well as the sea state and environmental conditions.

Smaller, more maneuverable vessels should have a propeller guard and all vessels should have appropriate PPE (*i.e.*, personal floatation devices, first aid kit). Communication is extremely important during the operation, and each vessel should be able to communicate with each other and with spotters on land (*i.e.,* by cell phone, walkie-talkie, marine VHF radio, etc.). The herding event should be documented via photo and/or video in addition to comprehensive notes.

In most narrow coastal estuaries, two vessels may be sufficient for herding animals in areas less than 300 feet wide, though three are optimal in areas greater than 300 feet. Herding animals in large, open spaces can be extremely difficult. As the width of the estuary increases, the number of boats may be increased to ensure sufficient coverage. Additional vessels, jet skis, or kayaks may be strategically posted at the mouth of small tributaries to deter animals from entering them as they are herded out (International Fund for Animal Welfare (IFAW) personal communications). A *hukilau* may also be used to help herd the animals in a narrow estuary with either personnel on land or between two vessels. The primary challenge in adding additional vessels is communication, which makes it important to have experienced personnel navigating vessel operations around the animals and experienced responder(s) monitoring animals on the vessel. A lead vessel must have radio communication with all other vessels involved in the herding effort and must direct everyone's actions. A coordinated effort is key to success. In addition, starting with a minimalist approach and increasing intensity (*e.g.,* number of vessels, type of vessel movements, addition of acoustic or visual deterrents, etc.) in response to a lack of cooperation from the animals increases the chances of success. The principles of operant conditioning should be applied: reinforcing the animals for movement in the proper direction by decreasing stimuli, and increasing stimuli when they head in the wrong direction.

When herding, stay a safe distance (50-100 feet) behind the group of animals. Swing the vessel(s) in a coordinated, crescent-shaped pattern, back and forth behind the animals to urge them to swim away from the vessel towards open water. If multiple vessels are necessary, each vessel should be assigned a section of the larger herding arc: left or right with two vessels; left, center, or right with three. Dividing the area into these sections, or flight zones, allows each vessel to cover their assigned area by making sweeping motions. Be prepared to react to changes in animal behavior such as splintering of the group or changes of direction or speed. Progress, or lack thereof, should be assessed at frequent intervals (every 10 minutes) to ensure that the desired outcome is being achieved and the animals are not becoming unduly stressed by

the herding efforts. If progress is not being made, herding efforts should be paused to allow the animals a break while the herding team decides on the next best step. This could include a different herding tactic, addition of visual or acoustic deterrents, or ending herding operations altogether. If the animals move toward open water, the vessels should slowly, in a coordinated manner, move forward. Once the animals reach a safe distance into deeper, open water and are no longer in danger of stranding (*e.g.*, no longer in a tidally influenced area), herding measures can be discontinued. If possible, the vessels should remain to observe the animals' behavior and movement, in order to ensure the animals' safety and to prevent the animals from returning to the dangerous location. (IFAW personal communications). See Appendix C for example diagrams of herding techniques.

3.3 Acoustic Deterrence

Pingers, which are typically used in the commercial fishing industry, produce high-frequency pulses of sound to deter animals. Generally, 2-3 pingers are sufficient in an area less than 600 feet wide. Wider areas may require more pingers; however, it is important to remember that sounds can travel great distances through water and may attenuate at different distances based on bathymetry, bottom composition, temperature, etc. When the vessels are positioned behind the animals, the pingers can be deployed. It is best if the pingers are initially deployed when the vessels are stationary to better evaluate the animal's response. Pingers may also be used by personnel standing on land, a bridge, etc. Success of pingers may vary with the species and specific situation (IFAW personal communications).

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 behind the animal(s) 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 animals from a specific unwanted area and/or influence the cetaceans' direction of travel.

If the acoustic deterrence method used results in the animals responding positively, by forming a cohesive group and moving away from the moving vessels, continue efforts until animals are in safer waters. Deterrents can be removed once animals are progressing in the desired direction. However, if the animals show signs of stress (*i.e.*, increased respiration, excessive chuffing or tail slapping) or the group begins to separate into sub-groups or individuals, the prevention team should step down incrementally until the animals exhibit normal or positive behavior. If negative responses continue, efforts may need to be aborted.

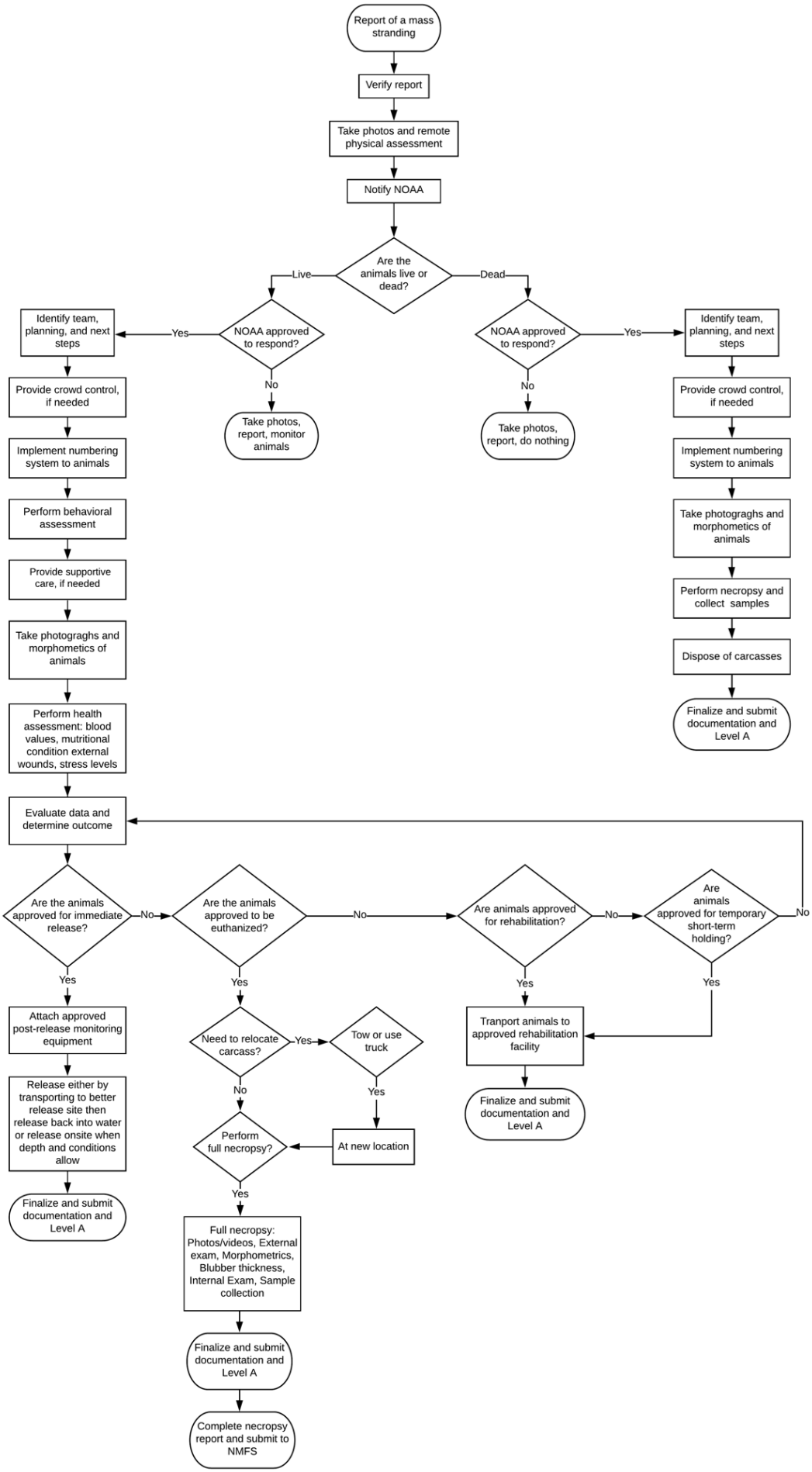
4. Live Mass Stranding

Logistical planning begins with the first report of live cetacean mass stranding. Plans need to be made that take into account available resources, accessibility of the stranding location, weather and tidal conditions,

transport (if applicable), necropsy, palliative care, sampling, disposal, resources (heavy equipment and experience of team members), and handling the media. Additionally, responders should document and avoid damaging protected and sensitive habitats (*i.e.*, marsh, seagrass, coral reefs, oyster reefs) as much as possible.

4.1 Decision Tree

The decision tree below illustrates the flow of events and the decision-making process involved in a mass stranding event. It is impossible to articulate every scenario, thus these protocols strive to provide a basic understanding of the principles and actions involved in successful mass stranding response.


Report of a mass stranding
Verify report
Take photos and remote physical assessment
Notify NOAA
Are the animals live or dead?
Live
Dead
NOAA approved to respond?
Yes
No
Identify team, planning, and next steps
Provide crowd control, if needed
Implement numbering system to animals
Perform behavioral assessment
Provide supportive care, if needed
Take photograghs and morphometics of animals
Perform health assessment: blood values, mutritional condition external wounds, stress levels
Take photos, report, monitor animals
NOAA approved to respond?
Yes
No
Identify team, planning, and next steps
Provide crowd control, if needed
Implement numbering system to animals
Take photograghs and morphometics of animals
Perform necropsy and collect samples
Dispose of carcasses
Finalize and submit documentation and Level A
Take photos, report, do nothing
Evaluate data and determine outcome
Are the animals approved for immediate release?
No
Yes
Attach approved post-release monitoring equipment
Release either by transporting to better release site then release back into water or release onsite when depth and conditions allow
Finalize and submit documentation and Level A
Are the animals approved to be euthanized?
No
Yes
Need to relocate carcass?
Yes
No
Tow or use truck
Yes
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
Complete necropsy report and submit to NMFS
Are animals approved for rehabilitation?
No
Yes
Tranport animals to approved rehabilitation facility
Finalize and submit documentation and Level A
Are animals approved for temporary short-term holding?
No
Yes

4.2 Photo Documentation

Most photographic data are in digital format and it is necessary to designate cameras and photo cards for documenting responses, prior to the event. A placard that includes identifiers, such as stranding number, date, and a scale should appear in the photos, when feasible. It is 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). Fixed-wing airplanes, helicopters, and/or UAS can be used to collect aerial images. The use of UAS has been increasing due to their quiet sound footprint, ability for increased travel range, increased safety, and cost effectiveness. UAS operations can be permit-dependent and may require additional permissions to be used, depending on the scenario (*i.e.*, species, distance, etc.).

4.3 Behavioral Observations

In each event, every animal should be assessed through physical, behavioral, and environmental observations. These observations will enable better decision-making and ensure the appropriate course of action is followed. Additionally, these observations will provide important baseline information that can be used in future cases. Important behavioral observations include overall responsiveness, demeanor (calm or fractious), activity (arching or thrashing), hyperesthesia (exaggerated responsiveness to touch), fluttering or twitching of tail, and vocalizations. These behavioral observations assist in the overall health assessment of the animal, inform the best way to handle individuals, and may pertain to disposition decisions (*e.g.,* a fractious animal may not be the best candidate for relocation and release if it cannot be safely handled by personnel). Behavioral evaluations are part of a comprehensive health assessment and may indicate underlying disease. It is important to make note of behaviors and take video, if possible, to help inform immediate supportive care or health assessment needs.

4.4 Health/Physical Assessments

A health assessment is necessary in order to determine the best outcome (*i.e.*, rehabilitation, euthanasia, or release) for the animals. Mass stranded animals often do not have chronic pre-existing illnesses or injuries (Bogomolni *et al.* 2010). However, the trauma of the stranding event itself can compromise the animal's health. Therefore, health assessment and in particular evaluation of shock, are extremely important for stranded cetaceans. A comprehensive health assessment includes all available history information (duration of stranding, number of times stranded, etc.), physical examination data, behavioral observations, and environmental considerations. The animals should be monitored throughout the stranding event for trends in their condition: whether they are stable, improving, or declining, and this information must be considered when making disposition decisions for the animals. Advanced diagnostics including in-field blood analysis, ECG, and ultrasonography can provide additional data points to inform

disposition decisions but are not always feasible. In larger mass stranding events (greater than 10, but especially greater than 20 animals, or if personnel are limited), it may not be logistically feasible to perform comprehensive health assessments on each animal. A triage approach must be undertaken, meaning that a quick visual assessment may be all that is possible for some animals, with more focused assessments performed on animals with decreased body condition, overt evidence of shock or trauma, or behavioral markers of significant stress.

A thorough health assessment includes evaluation of the following categories (although not all may be available at every response):

- Blood values
- Nutritional or body condition
- Vital signs (respirations, heart rate, temperature)
- External wounds
- Behavior and stress level

A standardized health form ***may*** be available. If so, it should capture all necessary information. The sooner this assessment can be performed, the sooner the best course of action can be determined for each individual animal, which ultimately may increase some animals' chance of survival. After a health assessment is performed, technical specialists will coordinate with the site coordinator to discuss the best option for each animal based on each animal's assessment.

4.4.1 *Blood Values*

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 bloodwork and banking. In stranded cetaceans, blood is typically drawn from the dorsal fluke periarterial venous rete (PAVR) or the paired superficial ventral caudal peduncle veins. Blood can also be collected from the dorsal fin or pectoral flipper PAVR, or by using a lateral approach to the peduncle targeting the caudal vascular bundle contained within the chevron canal. 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 will usually be processed after the animal is off the beach (*e.g.*, released, in rehabilitation or euthanized). 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) (1 or 3ml) is taken and refrigerated until analysis.

- Chemistry Profile: Standard serum chemistry profiles will 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 rescue and/or rehabilitation facility.

4.4.2 *Nutritional and Physical Condition*

When conducting a comprehensive physical exam to determine the best course of action for the animal, Technical Specialists should evaluate these areas in detail (IFAW personal communications):

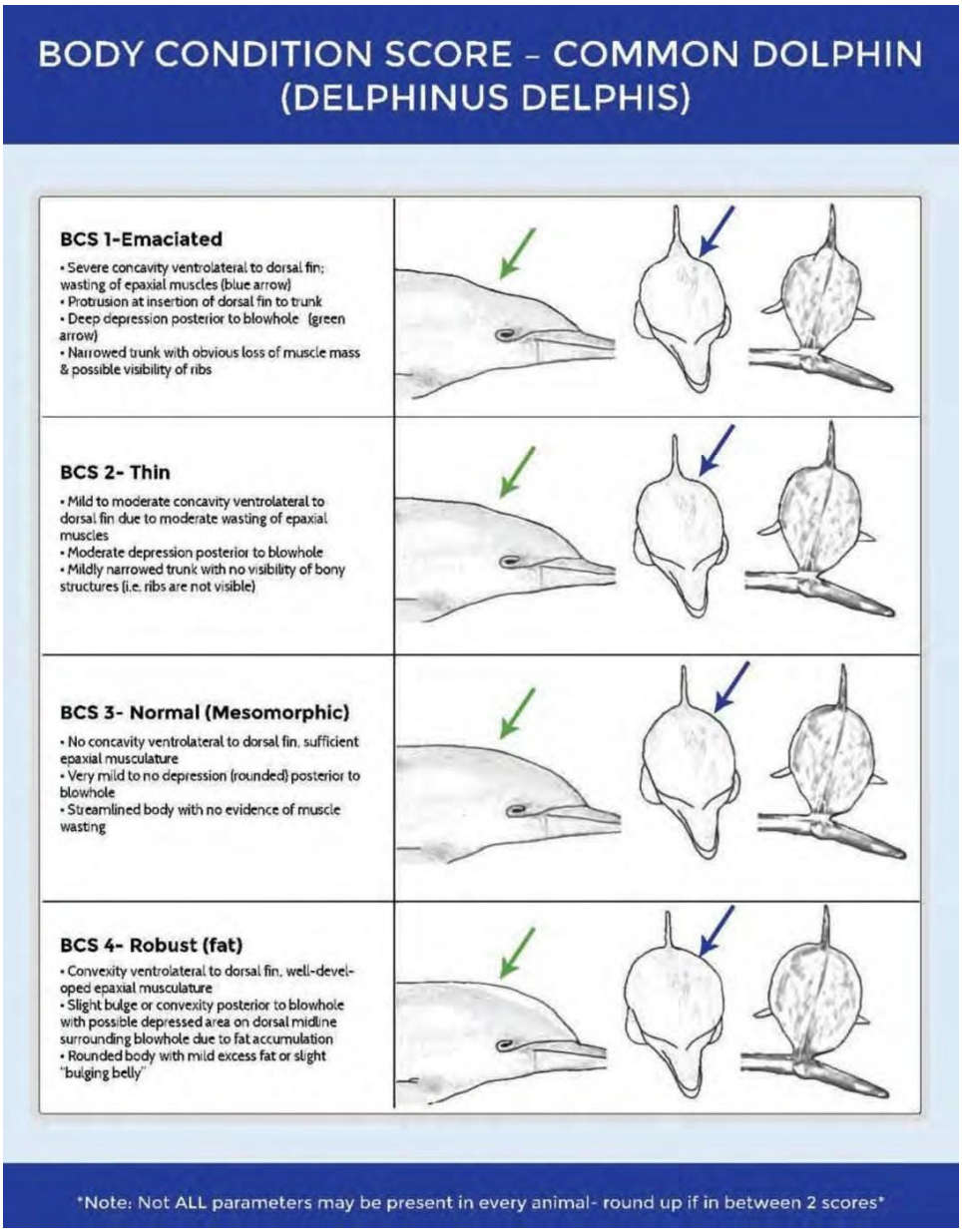
1. Body Condition

    a. Is the animal emaciated (very sunken post-nuchal fat pad/prominent neck, sunken epaxial muscles), thin, or robust?

        i. Note: post-nuchal fat pad can be seen on the dorsal surface (top) of the body just caudal to the blowhole. Sunken epaxial muscles can be observed along the right and left dorsolateral body.

    b. What is the degree of emaciation, if present? The body condition scoring system can be used to evaluate the degree (Figure 1).

Figure 1: Delphinid Body Condition Scoring (BCS) chart using common dolphins (*Delphinus delphis*) as an example. Sketches highlight the primary areas of interest. This chart is meant to serve as a field guide for determining body condition during a stranding triage (Joblon *et al.* 2015).



2. External Wounds / Lesions

    a. Are there any wounds, lesions, or abrasions (note location, size, depth, number; take photos if possible)?

    b. Do the wounds impact the animal's ability to swim, forage, or pose a significant threat due to infection?

    c. What is the skin condition (note any cracking, blistering, skin sloughing, or sunburn; percentage of body surface affected, and assign severity code (mild, moderate, severe) for each skin condition)?

    d. Any additional notes?

3. Mouth

    a. Are there any wounds or discharge?

    b. Is the mouth open or closed?

    c. Belching?

    d. What is the mucous membrane color?

	Color	Indication
Normal	Pink/light pink	Healthy
Abnormal	Pale/white	● Anemia ● Heart Failure ● Blood loss ● Hypothermia ● Hypodynamic shock
	Bright red	Hyperdynamic shock
	Blue/purple	Poor oxygenation

    e. What is the capillary refill time (CRT)?

	Time	Indication
Normal	1-2 seconds	Healthy
Rapid	Less than 1 second	Compensated shock
Delayed	Greater than 2 seconds	● Hypovolemia ● Hypodynamic shock

    f. Any notes about the teeth (*e.g.*, erupted, worn, missing, etc.) and tongue (*e.g.*, lesions, lingual papillae, etc.)?

4. Blowhole
    a. Is there abnormal discharge, froth, blood, and/or wounds?
    b. Any additional notes?
5. Eyes
    a. Are there wounds, abnormalities, or abnormal discharge?
    b. Assess palpebral reflex (normal, decreased, absent, exaggerated)
    c. Is vision impaired in one or both eyes?
    d. What is the pupil size?
6. Feces
    a. What is the color, amount, and consistency of any feces produced and any parasites?
    b. Is there flatulence, vomiting, or foamy feces?
    c. Any additional notes?
7. Urogenital
    a. What is the color, clarity, and amount of urine produced?
    b. Any lesions on genital slit or penis?
    c. Any additional notes?
8. Human Interaction (HI)
    a. Is human interaction suspected (describe and document as much as possible)?
    b. Has the HI form been completed?
    c. Is there thorough documentation through photos, evidence retention, and completion of datasheets?
9. Heart Rate
    a. What is the number of heart beats in one-minute (if it is not possible to count heart beats for an entire minute, count for 15 seconds and multiply by 4)?

b. Is the heart rate rhythmic, irregular, or erratic (if apparent)?

c. Monitor and record heart rate every 10-15 minutes.

Rate and Rhythm	Indication
Split*	Normal sinus arrhythmia
No Split	Stress (no sinus arrhythmia)
Other Rhythms	● Sneakers in a dryer (atrial fibrillation) ● Premature beats (+/- tachycardia SVT or ventricular in origin ● Conduction delays (bradycardia)
Abnormal Sounds	● Murmur ("swish" instead of "lub dub") ● Need to listen to multiple locations, ventrally
*Spilt=fastest after breath, slows as animal hold breath (as if diving)	

10. Respirations

a. Are there breaths (one breath=blowhole will open and an exhalation will be followed by an inhalation)?

b. Count breaths for a 2-minute period.

c. Are there any harsh breath sounds, gurgling, sputtering, leakage of air after the blowhole closes, double breaths, chuffing, or any other irregular breaths?

d. Are breaths grouped together or spread apart?

e. Are the respirations short and crisp or long and drawn out?

f. Is there blood, froth, fluid, or obvious odor coming from the blowhole?

g. Monitor and record respirations every 10 minutes (more often if conditions surrounding the animal change).

Auscultations	Indication
Normal	● Fast, deep breaths ● Same sound throughout entire lung field
Abnormal	● Harsh ● Wheezes ● Crackles ● Rales ● Decreased or absent lung sounds

11. Additional clinical parameters to be assessed by Technical Specialists

    a. What is the hydration status of the animal?

    b. What is the core body temperature?

    c. Are reflexes normal?

    d. Is the animal pregnant? Is the animal lactating?

    e. Is the animal a dependent calf or geriatric (*e.g.*, severely worn teeth)?

    f. Collect blood for in-the-field and laboratory tests.

4.5 Tagging and Marking

Tagging or marking during a mass stranding, especially during large and/or multi-day events, can be an essential tool throughout the event. For a mass stranding response, only animals that are approved by NMFS for immediate release will be evaluated for tagging and marking. The decision about which technique(s) to use for tracking live stranded cetaceans for post-release monitoring will generally be made on a case-by-case basis. If the stranded animal is approved by NMFS as releasable, the animal(s) can be marked or be affixed with a NMFS approved tag to facilitate re-sightings and provide quick identification should the cetacean re-strand (Ziccardi *et al*. 2015). The tools available for evaluating post-release outcomes range from the re-sighting of natural or applied markings, to VHF/satellite tag tracking. Whenever tags are applied to stranded cetaceans, attention should be paid to proper disinfection of the intended tag site and tag as well as provision of local analgesia whenever possible.

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 involved. It is important to acquire a comprehensive series of species-relevant images of all such marks before release to enable recognition later. Use of natural markings alone for individual stranded animal identification may be appropriate in small populations of animals that have ongoing photo identification research efforts. For stranded small cetaceans from more dispersed and/or pelagic populations that may re-strand in a different agency's coverage area, natural markings alone may be an insufficient means of "marking" because a re-stranding would likely be missed.

Artificial marks are sometimes applied by Stranding Network responders during the response and release. Paint sticks (such as cattle paint stick markings) can be used on the dorsal fin to number stranded animals on the beach or free-swimming (but part of the stranding event). This type of marking can help with animal identification throughout the event. These marks are temporary, and will only last for a few days. Other methods to short-term mark animals also include affixing plastic livestock ear tags in the dorsal fin (for those species with a dorsal fin) or notching of the dorsal fin to create a distinctive fin, which can last for many months to years.

An electronic tag is another type of applied tag. These tags use either VHF (radio) or are satellite-linked and can provide near real-time location data. 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 Low Impact Minimally Percutaneous External-electronics Transmitter (LIMPET) tags.

Several types of monitoring can be used in tandem. For example, photos of natural markings can be coupled with applied marks or tags to increase the likelihood of re-sighting animals at multiple time periods (*i.e.,* short-term and long-term) to assess post-release outcomes. Marking and tagging should only be conducted by trained individuals. 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.

4.6 Supportive/Palliative Care

Supportive care should be provided to live animals as soon as possible following the stranding event. The goal is to minimize stress, combat the effects of shock, prevent injury, and increase the likelihood of survival.

For those that ultimately do not survive, the animals are kept as comfortable as possible while alive to alleviate suffering. General supportive care (Table 3) can include minimizing noise around the animal(s), keeping birds away, monitoring behavior, moderating body temperature, minimizing handling, preventing sunburn (*i.e.*, keeping animals wet), and enforcing crowd control.

It is important to provide palliative care while assessments and decisions are being made for next steps. Basic monitoring should be conducted while supportive care is provided, including obtaining respiration rates and behavior. Cetaceans in shallow water are less encumbered than cetaceans that are high and dry because 1) cetaceans can regulate their temperature in the water, and 2) cetaceans are adapted to life in the water not on land, so responders do not have to worry about the pressure of the animal's body weight in a non-buoyant environment. However, responders must ensure that animals in shallow water are kept ventral-side-down and are capable of clearing their blowhole easily to breathe. Some species (*e.g.*, beluga) may have natural behaviors for dealing with live strandings including moving and digging in soft mud to create pools of water, dig trenches for pectoral fins and flukes, and/or alleviate pressure. In water, responders must ensure that the animal can breathe without support. If the current is rocking the animal from side to side, responders can help stabilize the animal(s) by placing a hand gently on the leading edge of the dorsal fin.

For animals high and dry, it is necessary to make sure the animal(s) rest on their ventrum to minimize breathing difficulties and to prevent unilateral muscle cramping that may lead to scoliosis. When exposed in warm conditions, the animal(s) should be kept moist by pouring buckets of water over the animal (ensuring water is not poured near the blowhole) to prevent overheating. To prevent sunburns, tarps can be used to provide overhead shading, light colored sheets can be draped directly on the animal, or zinc oxide can be applied to exposed skin. Moist towels can be used to place over the animals to protect the skin from the sun, ensuring towels are kept moist throughout the duration of the event. In colder weather, animals should be sheltered from the wind and precipitation by covering the animal with blankets. During any type of care, human safety takes precedence and responders should always check for hazards initially and throughout the event as the situation may change.

Table 3: Supportive Care Checklist

On Land	
	Check scene for safety
	Get animal in an upright position
	Protect from surf
	Rinse sand and debris from eyes
	Protect from sun and wind
	Place on padding or remove sharp or irritating objects
	Cover with a light-colored sheet or towel
	Dig trenches for pectoral flippers
	Maintain body temperature or treat for hyper- or hypothermia
In the Water	
	Check the scene for safety
	Protect from surf
	Keep blowhole above water
	Support the animal with appropriate hand placement
General	
	Minimize handling and contact
	Approach from the front/side
	Monitor condition

4.7 Sample Collection

A variety of samples may be collected from live-stranded marine mammals during a mass stranding response, and may differ depending on the species, animal's stress level, physical condition of the animal, and likely outcome of the animal (*e.g.,* immediate release, transfer to rehabilitation, etc.). These samples include, but are not limited to, morphometrics (*e.g.*, length and girth measurements); skin for genetics; blood for I-Stat, CBC, blood chemistry and/or serology; and swabs (*e.g.*, oral, nasal, blowhole, fecal).

Collecting diagnostic samples helps assess the overall health of the animal and determine the best course of action. Additional samples may be collected for research purposes, depending on the event, permit conditions, and welfare of the animals.

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, including the location and start/end time. Monitoring the animal(s) is essential. Obtain good photographs and/or video of the animals because it can help identify individuals and aid in assessing their condition for further determinations. Recording the animals' behavior is also helpful, as it can aid in the overall assessment of the animal's condition and help determine the best course of action. At a minimum, field information necessary for completion of NOAA's Level A data and human interaction forms 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.

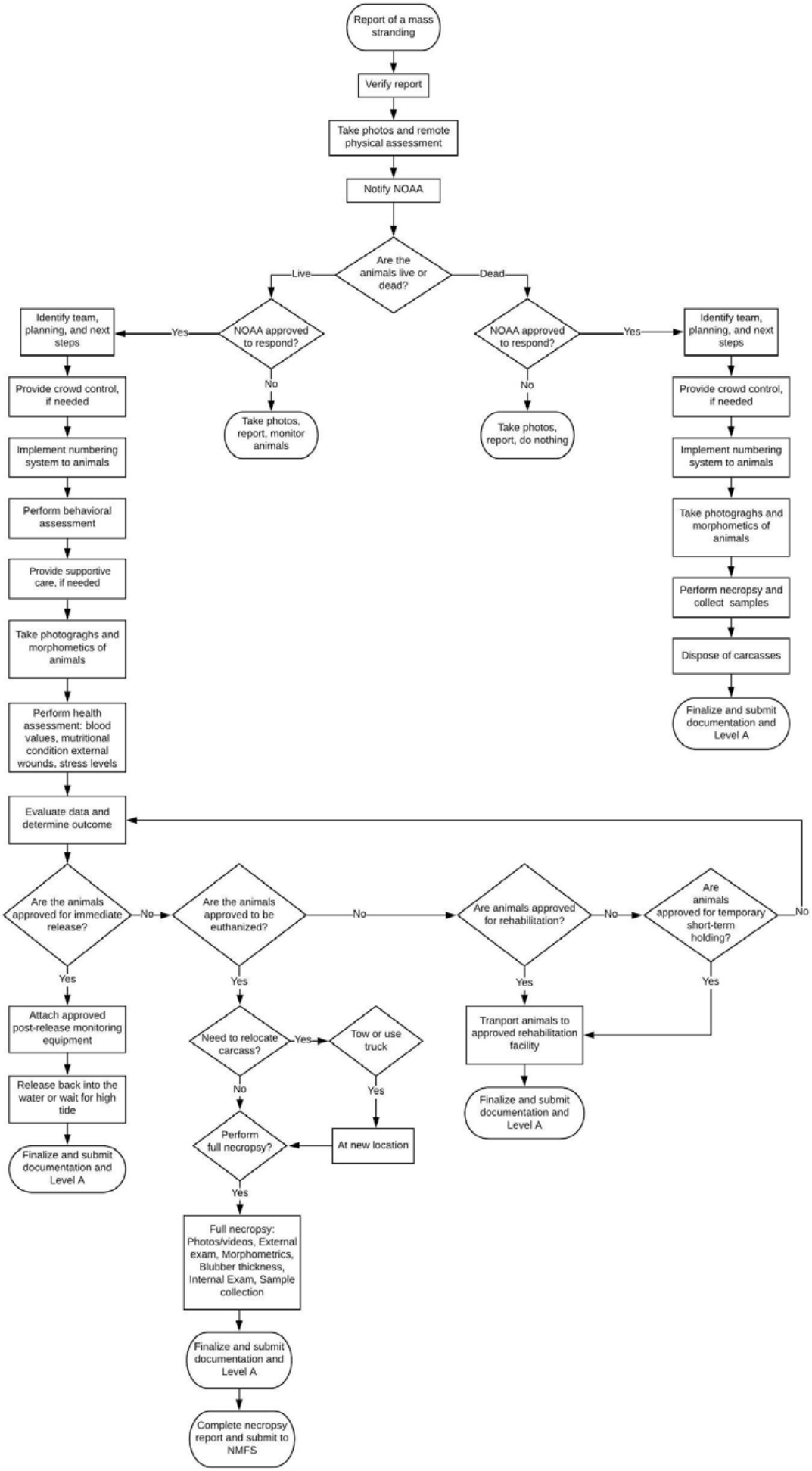
A sample list or log should be created to document the samples collected. Photo logs are a record of each photo taken, which helps to identify the photographer and date/time taken. During data collection, photos should be taken with a label that has the ID number, date, species, log number, and should 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 and their disposition should be recorded.

5. Dead Mass Stranding

Logistical planning begins with the first report of mass stranded dead cetaceans. Plans need to be made regarding carcass location, tides and weather conditions, transport (if applicable), necropsy, sampling, disposal, resources (heavy equipment and experience of team members), and the media.

5.1 Decision Tree

The decision tree below illustrates the flow of events and the decision-making process involved in a mass stranding event. It is impossible to articulate every scenario, thus these protocols strive to provide a basic understanding of the principles and actions involved in a successful mass stranding response.


Report of a mass stranding
Verify report
Take photos and remote physical assessment
Notify NOAA
Are the animals live or dead?
Live
Dead
NOAA approved to respond?
Yes
No
Identify team, planning, and next steps
Take photos, report, monitor animals
NOAA approved to respond?
Yes
No
Take photos, report, do nothing
Identify team, planning, and next steps
Provide crowd control, if needed
Implement numbering system to animals
Perform behavioral assessment
Provide supportive care, if needed
Take photograghs and morphometics of animals
Perform health assessment: blood values, mutritional condition external wounds, stress levels
Provide crowd control, if needed
Implement numbering system to animals
Take photograghs and morphometics of animals
Perform necropsy and collect samples
Dispose of carcasses
Finalize and submit documentation and Level A
Evaluate data and determine outcome
Are the animals approved for immediate release?
No
Are the animals approved to be euthanized?
No
Are animals approved for rehabilitation?
No
Are animals approved for temporary short-term holding?
No
Yes
Attach approved post-release monitoring equipment
Release back into the water or wait for high tide
Finalize and submit documentation and Level A
Yes
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
Complete necropsy report and submit to NMFS
Yes
Tranport animals to approved rehabilitation facility
Finalize and submit documentation and Level A
Yes

5.2 Sample Collection and Photo Documentation

A variety of samples may be collected from dead-stranded marine mammals during a mass stranding response. These samples include, but are not limited to, morphometrics (length and girth measurements), tissues for histopathology, samples for genetics, pathogen, or contaminant analyses, and collection of parasites. It is recognized that it is not possible or practical to collect maximal samples and data in all cases; the effort must be tailored to the conditions (Perrin and Geraci 2009).

The necropsy is extremely important; it provides valuable insight into the health of these animals, could also indicate why they stranded, and the data collected may help animals in the future. A necropsy sample inventory list (Appendix D) is helpful during the necropsy to ensure that all the samples collected are stored appropriately. The quantity and quality of samples taken may diminish as carcass decomposition progresses, so it is important to understand the priority of samples to be collected (Table 4). When in doubt, collect it, and unnecessary samples can be disposed of at a later time (Pugliares-Bonner *et al.* 2007).

Table 4: Example of sample analysis collected per decomposition code (Pugliares-Bonner *et al.* 2007)***:**

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

*Code 1 is not included as it refers to live animals.

A necropsy report should be completed if partial or complete necropsies are performed, and, at a minimum, a Level A form is required to be completed for each animal. A human interaction form is required for code 2 or 3 animals. A sample list or log should be created to document the samples collected. Photo logs are a record of each photo taken, which helps to identify the photographer and date/time taken.

During necropsies, photos should be taken with a label that has the ID number, date, species, log number, and should 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.

5.3 Necropsy

Animals can be necropsied onsite or, depending on the situation and available resources, transported to another location or facility. Some facilities have freezer or cold room space to store carcasses, allowing for delayed necropsies of small cetaceans, if necropsy on arrival is not possible, though freezing will impact some samples collected. The necropsy process begins with 1) photos and videos, 2) human interaction and external evaluation, 3) morphometrics, 4) blubber thickness, 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, including a ruler in the photo when possible. Work with the dedicated photographer/data recorder to make sure all needed photos are obtained. Some species require specific images; for example, a right whale needs images of all callosities, scars, flukes, and flippers; humpback whales require ventral fluke images, bottlenose dolphins need images of the dorsal fin and beluga whales need images of lateral sides. 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 (vessel strike wounds/scars, entanglement marks or scars, entanglement gear, etc.). When examining for human interaction, 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 for all code two and three animals.

3. **Morphometrics:** Depending on the location of the carcass, it may be hard to measure the total length of the animal. In some cases, some of the carcass may be underwater so a reasonable "estimate" will suffice. If the carcass is high and dry, the total length can be measured by laying the tape next to the carcass.

4. **Blubber thickness:** If the carcass is fresh and not bloated, at minimum, measure blubber thickness at the axilla, midline, and ventrally.

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 (code 2 or 3), 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).

6. **Necropsy report:** Refer to section 5.2 and to *Marine Mammal Necropsy: An Introductory Guide for Stranding Responders and Field Biologists* (Pugliares-Bonner *et al.* 2007).

5.4 Carcass Disposal

The cause of death influences the options available for carcass disposal. Animals that expire naturally can be disposed of in a number of ways. If the animal is euthanized with chemicals known to cause secondary poisoning in scavengers (*e.g.*, pentobarbital), disposal options may be more limited (*e.g.*, deep burial, rendering, incineration). Certain chemical euthanasia methods, such as saturated potassium chloride solutions in conjunction with heavy sedation, have a low risk of secondary toxicity for scavengers and can be used when preferred methods of disposal of chemically euthanized remains (*e.g.*, deep burial, rendering, incineration) are not available (AVMA 2020, Harms *et al.* 2014, Barco *et al.* 2016). For more information, refer to the Marine Mammal Carcass Disposal Best Practices.

6. Animal Disposition Options

Responding to a cetacean mass stranding involves balancing different factors. Generally, the process involves initial observations, decisions from NMFS whether to intervene, assessing the animals to determine their health status (including collecting all of the necessary samples), and finally identifying the best disposition option for each animal. There are four options for an animal's disposition: immediate release, temporary short-term holding, rehabilitation, and euthanasia.

6.1 Immediate Release At-Site, Relocation and Release

Immediate release is when an animal is rescued, assessed, and approved to be released back into the wild during the same event. Before an animal is released and whenever possible, a hands-on physical assessment is performed by the response team, the stranding is documented, and the animal is often marked or tagged for post-release monitoring (to determine if the same animal strands again later). Most animals that strand as part of a mass stranding event are healthy (Bogomolni *et al.* 2010; Jefferson *et al.* 2011), and can be released together as a group, depending on the context of the stranding. Because much of cetacean behavior is learned, mass stranded juveniles should be released with adults or in the presence of conspecifics, and mothers should be released with their dependent young, when feasible.

Immediate release is an option if the following factors are met:

- The animal is healthy or medically stable, and able to function normally as determined by NMFS, the capture lead, and the stranding network veterinarian (on-site or via phone consultation);
- Social requirements can be met (*e.g.,* maternal care for young); and
- It is highly recommended the animal be marked or tagged in some manner prior to release, using NMFS approved methods such as:
    - Marking – paint stick/crayon marking;

- Notching or freeze-branding of the dorsal fin; or
- Tagging - a single-bolt rototag or livestock ear tag or a single-pin radio or satellite tag (if available).

The animal may be released at the stranding site if:

- Beach and environmental conditions are favorable;
- The animal is believed unlikely to strand/re-strand; and
- The location of capture is near the animal's natural habitat.

The animal may be relocated to a different site and released immediately if:

- A different beach site is a more suitable site for release;
- The animal is manageable and adequate logistical support is available, including transport vehicles; and
- The new site is believed to improve the chances of a successful release for the captured cetacean, and reduce the likelihood of a stranding.

6.2 Short-term holding (less than 96 hours)

During the event, it may be decided that an animal needs short-term holding. Short-term holding is defined as holding an animal in an authorized facility for less than 96 hours. The facility should hold a Stranding Agreement that specifies that it has met minimum standards for rehabilitation and has specific accommodations available. During an emergency and with approval from NMFS, it is also possible that a facility not previously approved for short-term holding or long-term rehabilitation can serve as a temporary stabilization location; however, the facility must comply with all requests and recommendations for stabilization care from NOAA or consulting veterinary experts. These facilities need to meet the minimum standard of appropriate veterinary medical care. The attending veterinarian should be available on-call 24 hours a day. When drafting a release plan, the veterinarian needs to consult with the MMHSRP permit PI and RSC. The MMHSRP permit requires that the PI approve release determinations for all rehabilitated threatened and endangered marine mammals. For more information on the minimum standards for marine mammal rehabilitation facilities refer to the *NMFS Final Standards for Rehabilitation Facilities*.

6.3 Rehabilitation

Rehabilitation, per 50 CFR 216.3, is defined as treatment of beached and stranded marine mammals taken under Section 109(h)(1) or 112 (c) or imported under Section 109(h)(2) of the MMPA, with the intent of restoring the marine mammal's health (including normal behavior). An authorized animal care facility provides treatment with the goal of releasing the animal back to the wild. Rehabilitation is an appropriate option when:

- The onsite examination by the veterinarian determines that the animal needs more medical

treatment than can be provided in a short handling session;

- NMFS approved facilities are available and equipped for the species and number of animals involved;
- Arrangements can be made for a safe and expeditious transport to the rehabilitation facility;
- There are sufficient funds and staff to provide care for a reasonable amount of time; and
- There is a good chance that the animal can be restored to health and successfully released back to the wild.

6.4 Euthanasia

There are many situations that could call for the consideration of euthanasia, such as severe injury or illness. Each scenario should be evaluated on a case-by-case basis to provide the most humane and best outcome for the individual animal.

Euthanasia is an option when:

- The veterinarian determines that euthanasia is the most humane course of action to take given the animal's prognosis:
    - The animal(s) is deemed to be critically injured or ill with little chance of recovery;
    - The animal(s) is suffering or unlikely to survive if released; and
    - It is necessary to end the suffering of an animal.
- No rehabilitation facilities are available and immediate release is deemed inhumane or unlikely to succeed.

The decision to euthanize is made in consultation with the RSC and the procedure must be conducted by:

- A Stranding Network veterinarian;
- An experienced, trained and authorized stranding network member;
- An appropriately trained local, state, tribal, or federal law enforcement, wildlife or animal control agent; or
- A non-marine mammal veterinarian in consultation with an experienced Stranding Network veterinarian.

For more detailed information on marine mammal euthanasia, see Marine Mammal Euthanasia Best Practices, Marine Mammal Euthanasia, *Marine Mammals Ashore* (Geraci *et al.* 2005), and the *CRC Handbook of Marine Mammal Medicine* (Gulland *et al.* 2018).

7. Other Categories of Mass Stranding Scenarios

7.1 Trapped/Out of Habitat (*e.g.*, Natural Disasters)

An animal is considered out of habitat if it is not in the typical range (*i.e.*, melon-headed whales (*Peponacephala electra*) in Hanalei Bay, Kaua'i, Hawai'i in 2004, Southall *et al.* 2006) of that species, including offshore waters, coastal waters, or bays, sounds, estuaries, and rivers. Most typically for cetaceans, out of habitat animals are found in an inlet, creek, river, or other body of water that may only be connected with the ocean (or bay/sound/estuary) at certain tidal cycles, or under certain conditions. Out of habitat cetaceans may occur after severe weather events, such as hurricanes or tropical storms, when animals have been reported many miles inland, presumably washed in with storm surge and then left behind as the storm waters have receded.

Typically, animals of concern have an initial assessment conducted in coordination with NMFS, the local stranding network, and other experts. This initial assessment will consider the animal's size, age, body condition, behavior, habitat (including environmental parameters such as salinity), social context (juveniles or cow/calf pairs), prey availability, and the overall health risk. In addition, NMFS evaluates whether the animals are prevented from leaving the area, either by a physical barrier or a perceived barrier. If the animals are not in imminent danger, NMFS, in coordination with the local stranding network, will continue to monitor the situation for any significant changes.

Once animals have been deemed out of habitat, the next step is to determine if response is necessary. When evaluating whether to intervene, NMFS generally considers the likelihood of the animals leaving on their own, chances of survival if no intervention occurs, if the environment will allow for the capture to be safe for both the response team and animals, if there are protected/sensitive habitats (*i.e.*, seagrass, coral reefs, and oyster reefs) that should be avoided during the intervention, and whether it is possible to relocate or rehabilitate the animal. NMFS generally consults with marine mammal behavior experts, veterinarians, scientists, and other experts when determining the best course of action.

NOTE: For severe weather associated with displaced animals, the timeliness of the response is essential. Therefore, NMFS may intervene without an initial monitoring period as soon as is feasible and appropriate.

7.2 Oil Spill

During oil spills, there may be efforts to capture and move cetaceans, which may pose significant challenges. Herding methods may initially be used to haze cetaceans away from oil. If those efforts fail, intervention and relocation may be considered. Moving or relocating healthy animals to areas that are not oiled poses significant health and safety concerns for the animals and is not guaranteed to provide a greater chance of survival than leaving them in their natural habitat. Relocating animals involves capturing a free-swimming animal, which should only be attempted as a measure of last resort due to the risks to the safety of the rescue personnel and animals. Other issues that would need to be considered

before moving cetaceans away from an oiled area are:

- Relocation could overcrowd areas with more cetaceans than the habitat can support;
- Relocations could alter the infectious disease ecology of the population or individuals; and
- Relocations might subject cetaceans to poor-quality habitats with insufficient food and shelter needs.

Rescuing healthy animals to place them in rehabilitation facilities to prevent potential impacts from oil is not desirable because it causes stress to the animal and may introduce health problems that could cause the animal's condition to deteriorate. Thus, proactively catching healthy animals could do more harm than good. However, in specific cases, including for threatened and endangered species, and in very specific locations, or for particular types of hazardous material spills, capture and relocation or capture and short-term holding may still be implemented. In-depth and specific information regarding cetaceans and oil spills can be found in the NMFS Marine Mammal Oil Spill Guidelines (Ziccardi *et al.* 2015).

8. Conclusion

The Stranding Network is often faced with complex events that require consideration of a variety of different factors. No one event is the same, and each has their own aspects to consider. This document outlines the decision-making process during cetacean mass strandings and provides guidance on responding to these complex events. There may be regional and state differences in response methods used, as well as differences in response methods based upon the species present (*e.g.*, threatened and endangered).

9. Acknowledgements

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Appendix A: Example Datasheets

The below datasheet is an example provided by IFAW.

Field #

Marine Mammal Rescue and Research

Cetacean Mass Stranding Health Assessment

ifaw

IFAW#_____

Date: _____ **Stranding Location:**_____ **Lat/Long:** _____ GPS GE Cell

Time Init Rpt: _____ **Init Rpt'd:** □ swimming □ stranded (□ dry □ in some wtr) **Est. Time Stranded:** _____

On-scene @: _____ **Admit @:** _____ **Loc in Veh:** _____ **# Animals:** _____ □ Susp Mom/calf

Str. Length: _____cm **Max Width:**_____cm

Sex: M F CBD NE **Weight:** _____kg

Photos: □ pre-tagging □ post-tagging □ lesions

Species: _____ **HI:** N Y CBD □ HI form

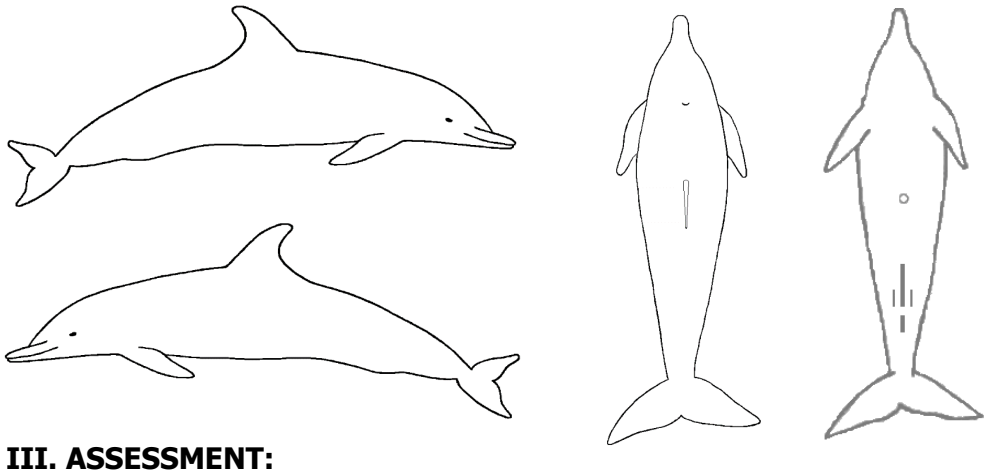
I. SUBJECTIVE:

		Abnormal/Normal
Attitude	BAR QAR lethargic non-responsive	A / N
Disposition	calm but responsive arching thrashing hyperesthetic tail fluttering vocalizing	A / N
Body condition	emaciated (1) thin (2) slightly thin (3) mesomorphic (4) robust (5)	A / N
MM Color	pink pale pink white gray cyanotic (purple) injected (bright red) N/E	A / N

II. OBJECTIVE:

Rectal Temp: _____°F **HR** (bpm): _____ /_____ @ ___:____ **RR** (bpm)**:** ____ @ ____:_____

Post-Nuchal Fat Pad	Concave (1) Spongy (2) Firm (3) Convex (4)	A / N
Neurologic	Alert Dull Stuporous **Nystagmus** (repetitive eye motion)**:** N Y (vert OR horiz / bilat OR unilat) **Strabismus** (abnormal eye position): N Y (dorsally ventrally cranially caudally) **Other Abnorm**:	A / N
Ophthalmic OD (right eye)	**Palpebral:** NE, 0, 1, 2 **PLR:** NE, 0, 1, 2 **Blepharospasm** (squinting): + / - **Visual Tracking**: + / - **Globe Intact**: N Y **Discharge:** N Y (describe): If corneal lesion, stain uptake: NE NA N Y (describe/draw):	A / N
Ophthalmic OS (left eye)	**Palpebral:** NE, 0, 1, 2 **PLR:** NE, 0, 1, 2 **Blepharospasm** (squinting): + / - **Visual Tracking**: + / - **Globe Intact**: N Y **Discharge**: N Y (describe): If corneal lesion, stain uptake: NE NA N Y (describe/draw):	A / N
Oral (mouth, tongue, teeth)	**Dentition** (broken, worn, missing, partially erupted teeth): **Lesions/Masses/Other**:	A / N
Cardiovascular	**Heart Rate** (bpm): _____(Brad) _____ (Tach) @ ____:____ **ECG Tracing:** N Y **Rhythm:** Sinus arrhythmia ("split") OR Normal sinus rhythm (steady = "no split") Tachycardia (fast, sustained) Bradycardia (slow, sustained) Other Abnorm: _____ **Murmur**: NMA Murmur (note systole vs diastole, Grade 1-6):	A / N
Respiratory	**Respiratory Rate** (bpm): _____ @ ____:____ **Malodorous Blow:** N Y **Blowhole Seal Intact:** N Y **Blowhole Discharge**: N Y (describe): **Character:** WNL Full Shallow Apneustic Uniform Rapid Double breathing (freq occ) Exhale only (freq occ) Chuffing (freq occ) Blowhole Leaking (freq occ) **Lung sounds** (note affected lung field and % lung for abnormalities): R: Clear (NBVS) Harsh (crackles, wheezes, increased BVS) Absent L: Clear (NBVS) Harsh (crackles, wheezes, increased BVS) Absent	A / N
Gastrointestinal	**Feces:** N Y (describe color, amt, blood present, consistency (FOAMY?), parasites): **Flatulence:** N Y **GI Sounds Auscultated:** N Y NE **Vomiting:** N Y	A / N
Urogenital	**Sex:** M F NE **Urine:** N Y (Describe color, amt, USG): **Lactating:** NE NA N Y (describe): **Lesions/Discharge:**	A / N
Musculoskeletal:	**Scoliosis:** N Y ("C" shape open to: L R / mild moderate marked) **Other Abnorm:** N Y	A / N
Integument (skin)	**Rake Marks:** N Y (fresh healed) **Skin sloughing:** N Y (mild, mod, marked) **Lesions:** N Y (describe and draw on reverse):	A / N



***Example Conditions** (not all-inclusive):*
- *Shock (foamy feces, unresponsive, pale mm, rapid HR)*
- *↑ HR/no split*
- *↑RR, harsh lung sounds*
- *Anemia*
- *Elevated liver values (ALT, GGT, TBili)*
- *Elevated muscle enzymes (CK, AST)*
- *Dehydration (mild ↑BUN, creatinine, hemoconcentrated)*
- *Scoliosis*
- *Ruptured globe (eye)*
- *Significant wounds/scav dam*
- *Single strander/release*
- *Pregnant*

III. ASSESSMENT:

MASTER PROBLEM LIST:

1. _____ 4. _____
2. _____ 5. _____
3. _____ 6. _____

CONDITION DURING TRANSPORT: □ Stable □ Improving □ Declining

RELEASE CRITERIA: *good=0, fair=1, poor=2, grave=3* ***Dependent calves should be scored '6' on the social component***

PE____+ Behavior____+ Blood____+ Social____ = _____ *(0-2 = good release candidate, 3-5 = borderline, 6-12 DNR)*

IV. PLAN:

DIAGNOSTICS:

Bloodwork: Draw Time: _____ Site: DFL VCP DFN IC Method: Syr / Vac / Pico

In-House: □ CG4+ □ HM5 □ Vetscan / □ CHEM 8+ IDEXX: □ Dolphin Profile □ CBC/Chem

Ultrasound: □ L side □ R side □ Brief □ Full □ Thoracic □ Abdominal □ Blubber Thickness

Results: □ WNL □ Renal Gas □ Pulmonary Lesions □ Pregnant (1st, 2nd, 3rd trimester, CBD) Initials:_____

Other DX: □ ECG □ capnography □ AEP □ blowhole swab □ rectal swab □ skin □ other:_____

TREATMENTS: (*E/Se (2.5mg/mL Se): 0.06mg/kg Se IM)*

E/Se: _____mL Time:_____ Inj Site:_____ / Other: _____ Time:_____ Inj Site:_____

Fluids: _____mL Type: □LRS □0.9% NaCl Site(s): VCP / DFL / DFN *(22.5 mL/kg IV bolus in 30 min, can repeat once)*

1st bag: Start Time: _____ End Time: _____

2nd bag (only if indicated): Start Time: _____ End Time: _____

DISPOSITION: **Tag:** Roto / Caisley Tag #: _____ Sat. Tag #: _____ Pin length: _____mm □ Not tagged

□ **Reloc/ Rel** Site:_____ □ **Released at site** □ **LAS** Time: _____ Total # dolphins: _____

Release Conditions (great=0, 3=bad):_____

Animal Release Score (How well did the animal swim off? well=0, 3=badly)_____

□ **Euthanized** Staff Init: _____ Vet Init: _____ Bottle #: _____ Volume: _____mL Inj time: _____ TOD: _____

□ **Died** TOD: _____ Notes:_____

Tagging & Disposition Justification:_____

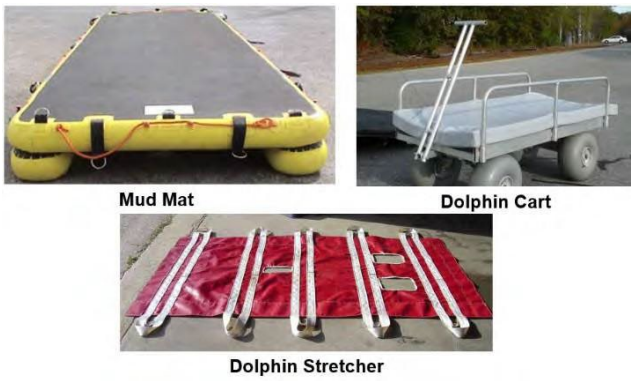
OVERALL PROGNOSIS: → Tally scores from above: Release Criteria + Release Conditions + Animal Release Score = _____

→ *(0-3 = good, 4-8 = borderline/fair, 9+ = poor)*

Primary examiner: _____ Signature: _____ □ vet consult _____

Appendix B: Photos of various transportation methods

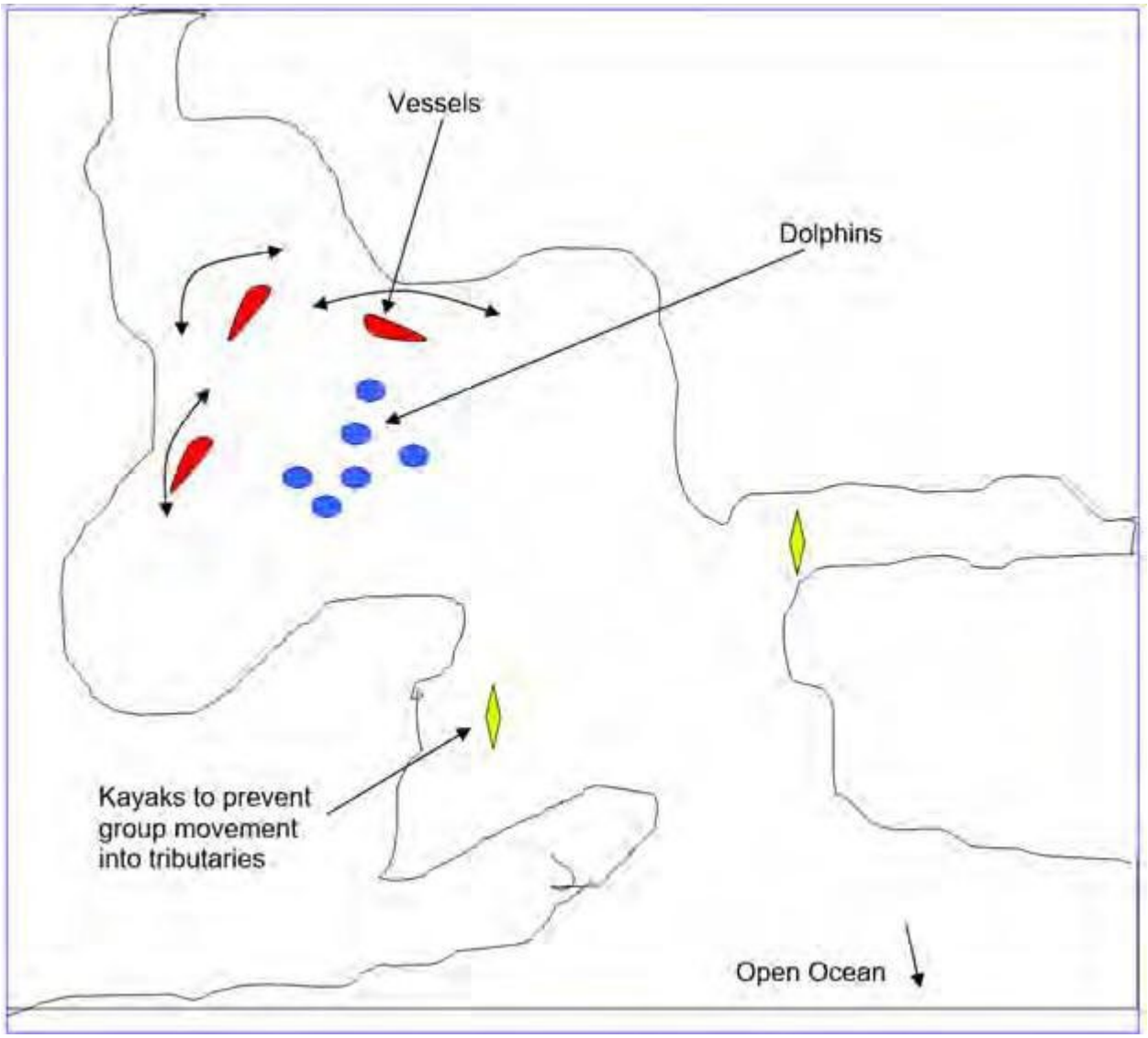
Photo credits: IFAW



Transport of numerous carcasses during a mass stranding.

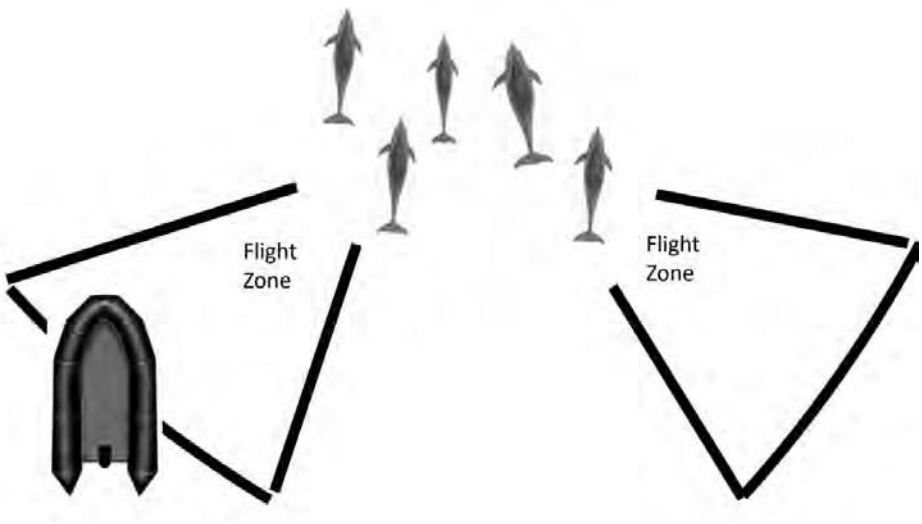
Appendix C: Example diagrams of herding techniques

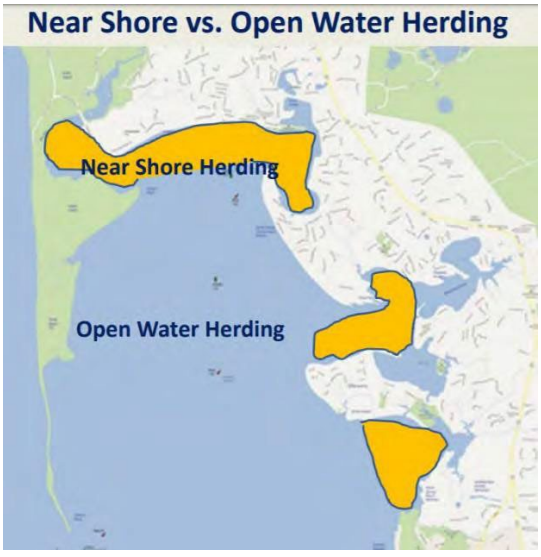
Images and information provided by IFAW.

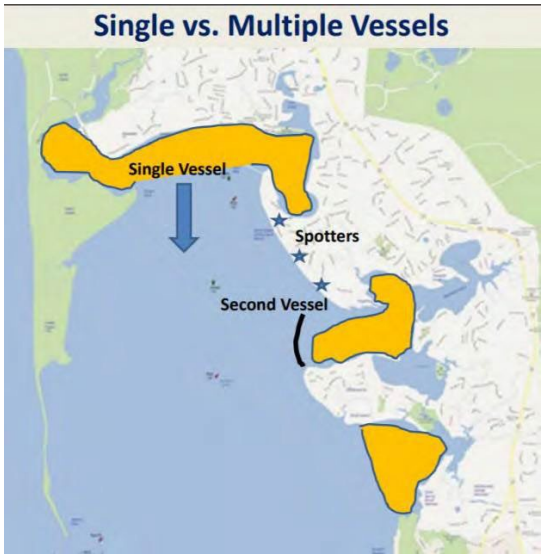


Note: The red vessels move back and forth (along the arrows) behind the animals, driving them toward open water. The yellow kayaks (or small vessels) can be used to deter animals from moving into smaller tributaries during the herding process. These vessels can use pingers or just banging on the sides of the boat to deter the animals. It is very important that these vessels NOT deploy pingers until the animals have moved just seaward of them or are attempting to travel into the tributary.

Example flight zones and herding techniques (images provided by IFAW):







Appendix D: Example necropsy sample list

This is only an example and sampling should not be limited to this list (Pugliares-Bonner *et al.* 2007).

		Standard Samples				Pinn. Only			UME ONLY
		Life History	Genetics	Contam.	Histo.	Herpes	Morbilli	Brucella	Biotox
Tissue		(Frozen or fixed as below)	(Frozen &/or DMSO)	(Foil wrapped and frozen)	(2 sets in 10% NBF)	(Frozen)	(Frozen)	(Frozen)	(Frozen -80º)
Skin			☐☐		☐☐				
Teeth		FR ☐							
Oral mucosa						☐			
Blubber				☐	☐☐				
Muscle				☐	☐☐				
Liver				☐	☐☐	☐		☐	☐
Kidney (R)				☐	☐☐	☐		☐	☐
Kidney (L)					☐☐				
Stomach					☐☐				
Lung (R)					☐☐			☐	
Lung (L)					☐☐		☐		
Tracheobronchial Lymph					☐☐		☐	☐	
Spleen					☐☐		☐	☐	
Blood/Serum						☐	☐		☐
Esophagus					☐☐				
Trachea					☐☐				
Prescapular Lymph					☐☐		☐	☐	
Heart					☐☐				
Diaphragm					☐☐				
Pancreas					☐☐			☐	
Mesenteric Lymph					☐☐		☐	☐	
Intestine					☐☐				
Adrenal (L)					☐☐				
Adrenal [R]					☐☐				
Colon					☐☐				
Bladder					☐☐				
Testis		FX ☐			☐☐			☐	
Uterus		FX ☐			☐☐			☐	
Ovary		FX ☐			☐☐			☐	
Feces									☐
Stomach Contents		CH ☐							☐
Urine									☐
Aqueous humor									☐
Milk/Mammary Discharge		FR ☐							
Brain					☐☐			☐	
Other:									
Lesions (list)		FR ☐			☐☐				
Fungal growths		FR ☐ SW ☐			☐☐				
Parasites (EtOH)		☐							
Culture (swab)		SW ☐	List sites:						

Appendix E: Cetacean Mass Stranding Questions and Answers

Q: What are mass strandings?

A: "Mass strandings" describes a simultaneous stranding of two or more cetaceans (same or mixed species) at the same time and place (other than cow-calf pairs) (Geraci *et al.* 1999).

Q: What are the types of mass stranding responses?

A: Mass strandings can occur as live-stranded or dead stranded animals, or a combination of the two. These events can include live or dead stranded cetaceans all in one area or scattered in the same general geographic region, and animals can be high and dry, in the surf, and milling near shore.

Q: Why do marine mammals mass strand?

A: Mass strandings have been documented globally and historically. While the cause of many mass strandings is unknown, investigation by trained and authorized responders aims to determine the cause when possible. Causes of some mass strandings have included oceanographic barriers (*e.g.*, trapped in bays), infections, biotoxins, human interactions, and malnutrition.

Q: How are mass strandings different from single marine mammal strandings?

A: Since mass strandings involve two or more animals and can sometimes include tens to hundreds of animals, they require more coordination and resources than a stranding event involving a single animal. Depending on the time of year, location, and size of the event, there will be multiple animals to assist, and they often generate more attention (*e.g.,* public and media). Mass stranding responses are more complex than responses to single animals, and the best mass stranding outcomes occur when response personnel are trained and prepared for unforeseen and changing conditions and are equipped to make challenging decisions. The main response components (*i.e.*, initial assessment, securing the scene, providing supportive care [if necessary], staff assessment, and decision-making) are similar to a single response event, however, mass stranding responses will be larger and require more logistical planning and approvals.

Q: Can mass strandings be prevented?

A: There are times when it may be warranted to attempt to prevent marine mammals from encountering or persisting in a potentially harmful situation, such as an oil spill, or a group of cetaceans entering shallow water that are likely to mass strand. For mass strandings, preventative measures can sometimes be used, if there is sufficient advance notice of cetaceans swimming close to shore or in areas considered out of habitat for that particular species. The goal of mass stranding prevention efforts is to safely encourage animals to move away from a dangerous, or potentially dangerous, location into deeper, open water by utilizing vessel movement, acoustics, or other deterrents (*i.e.*, hazing). These efforts are occasionally successful.

Q: What role does NOAA Fisheries play in mass strandings?

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 stranded marine mammals including mass strandings. Each NOAA Region (Alaska, Pacific Islands, West Coast, Southeast, and Greater Atlantic) has a Regional Stranding Coordinator that oversees the Stranding Network responders. For contact information for your Regional Stranding Coordinator please visit: https://www.fisheries.noaa.gov/contact-directory/marine-mammal-stranding-network-coordinators.

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: Who should people contact if they encounter stranded marine mammals 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 small cetaceans 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, attempting to rescue marine mammals is dangerous, and should only be performed by trained professionals.

Here are the steps to follow:

- Stay in the boat or on the shore—***never get in the water*** to help a whale, dolphin, seal, sea lion, or sea turtle.
- Note the GPS coordinates of the location of the stranded marine mammal 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 marine mammal 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.

Q: How is the decision made to respond to mass strandings?

A: Deciding when a mass stranding needs a response, and what kind of response will be attempted, is complex and requires consideration of a variety of different factors. When making the decision to respond, Stranding Network responders consider the potential causes of the stranding, as well as other assessment considerations (*i.e.*, behavior, body condition, size, number, injuries, available rehabilitation space, human safety, accessibility/location, etc.) that make each event unique. The decision of whether (or not) to respond is made by NOAA Fisheries, after discussions between the Stranding Network, the Regional Stranding Coordinator, and NOAA Fisheries' Marine Mammal Health and Stranding Response Program.

Q: What are the options for mass stranded marine mammals once the animals are in hand?

A: Once the animals are in hand, there are generally four options to consider for the animal: 1) immediate release (at the site or after relocation to a different site from the original stranding location), 2) temporary short-term holding, 3) rehabilitation, or 4) euthanasia. The decision on which option is appropriate and practicable for each marine mammal within a mass stranding event is made by NOAA Fisheries, after discussions between the Stranding Network, the Regional Stranding Coordinator, and NOAA Fisheries' Marine Mammal Health and Stranding Response Program.

Q: When is immediate release an appropriate option for marine mammals?

A: Immediate release is when an animal is rescued, assessed, and approved to be released back into the wild during the same event. Immediate release is an option if the following factors are met:

- The animal is healthy or medically stable, and is able to function normally as determined by NOAA Fisheries, the response lead, and the attending veterinarian (on-site or via phone consultation) or authorized responder. Certain situations (*e.g.*, thunderstorms, hurricanes, stressed animals) may have time constraints and the only option may be transport/immediate release.
- Social requirements can be met (*e.g.*, maternal care for young)
- Beach and environmental conditions are favorable;
- The animals are unlikely to strand/re-strand; and
- The location of capture is near the animals' natural habitat.

Q: What is temporary short-term holding?

A: Short-term holding is defined as holding an animal in an authorized facility for less than 96 hours. The facility should have a Stranding Agreement that specifies that it has met minimum standards for short-term holding and has specific accommodations available.

Q: What is rehabilitation?

A: Rehabilitation is when a marine mammal is rescued and transported to a facility to receive care and/or be transported between facilities for care. The facility should have a Stranding Agreement that specifies that it has met minimum standards for short-term holding or long-term rehabilitation and has specific accommodations available. An authorized animal care facility is to provide treatment with a goal of releasing the animal back to the wild.

Q: When is rehabilitation an appropriate option for mass stranded marine mammals?

A: Rehabilitation is an appropriate option when:

- The onsite examination by the veterinarian determines that the animal needs more medical treatment than can be provided in a short-term holding setting;
- NOAA Fisheries-approved rehabilitation facilities are available and equipped for the species and number of animals involved;
- Arrangements can be made for safe and expeditious transport;
- There are sufficient funds and staff to provide care for a reasonable amount of time; and
- There is a good chance the animal can be restored to health and released back to the wild.

Q: What is euthanasia?

A: The term "euthanasia" is rooted in Greek 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 that is suffering (AVMA 2020).

Q: When is euthanasia an appropriate option for mass stranded marine mammals?

A: Euthanasia is an option when:

- The attending veterinarian (on-site or via phone consultation) determines that euthanasia is the most humane course of action to take given the animal's prognosis:
    - The animal is deemed to be critically injured or ill with little chance of recovery;
    - The animal is suffering or unlikely to survive if released; and
    - It is most humane to end prolonged suffering of an animal.
- No rehabilitation facilities are available and immediate release is deemed inhumane or unlikely to succeed.
- Appropriate disposal options are available based on the chosen euthanasia method.
- The euthanasia procedure won't jeopardize human safety.

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

Q: When does the Stranding Network consider euthanasia?

A: Before deciding euthanasia is the most appropriate course of action, it is important to fully assess the health of the individual animal. 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 the animal is in hand and 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. 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.

Q: Are marine mammals from mass strandings ever transported?

A: Some mass strandings require marine mammal(s) to be transported for relocation, release, or rehabilitation. Transport can occur via a cart or stretcher to the transport vessel or vehicle/trailer. Stranded cetaceans are generally transported using dry transport (*e.g.*, closed or open cell foam pads or similar padding). In some non-emergencies, including transport for releases, "wet transport" (*e.g.*, water-filled boxes) may be used for cetacean transport. Depending on the situation, an animal also may be transported in a stretcher in the water alongside a boat or in a boat to transfer the animal to a more suitable release location.

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

A: Tagging or marking during a mass stranding, especially during large and/or multi-day events, can be an essential tool throughout the event. For a mass stranding response, NOAA Fisheries will approve the tagging and marking of animals. The decision about which technique(s) to use for tracking live stranded cetaceans for post-release monitoring will generally be made on a case-by-case basis. If approved by NOAA Fisheries, the marine mammal(s) can be marked (*e.g.*, paint stick) or be affixed with a NOAA Fisheries-approved tag to facilitate re-sightings and provide quick identification should the cetacean re-strand (Ziccardi *et al.* 2015). The tools available for evaluating post-release outcomes range from the 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 marine mammals 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.

Q: Why is documentation of mass stranding events important?

A: It is important that each mass stranding is fully documented, and the appropriate data

collected. Information should be collected not only to document the stranding, but also to evaluate the successes and challenges of the responses. This feedback will be used to improve protocols and modify techniques for future events. This information can also be valuable for other Stranding Network members for use in similar situations. It is a continuous cycle of preparation, response, assessment, disposition, evaluation, and protocols/training, as new tools and techniques are developed and tested.

Q: Is supportive care provided to marine mammals during a mass stranding?

A: From the time animals first strand, and then continuing throughout the event, there is a period of time in which live animals will ideally be provided with supportive care by trained responders. The goal of supportive care is to minimize stress, combat the effects of shock, prevent further injury, and increase the animals' likelihood of survival. General supportive care can include minimizing noise around the animal(s), keeping birds away, monitoring changes in behavior, moderating body temperature, minimizing handling, providing protection from the elements (*e.g.*, sun, wind, etc.), and managing crowd control.

Q: Are health/physical assessments performed during a mass stranding?

A: A health assessment is necessary to determine the best option (*i.e.*, rehabilitation, euthanasia, or release) for the animals. Mass stranded marine mammals often do not have chronic pre-existing illnesses or injuries (Bogomolni *et al.* 2010). However, the trauma of the stranding event itself can compromise the animal's health. Therefore, health assessment and in particular evaluation of shock, are extremely important for stranded cetaceans. A comprehensive health assessment includes evaluating all available history information (duration of stranding, number of times stranded, etc.), physical examination data, behavioral observations, and environmental considerations. The sooner this assessment can be performed, the sooner the best course of action can be determined for each animal, which ultimately may increase some animals' chance of survival. In larger mass stranding events (>10, but especially >20 animals, or if personnel are limited), it may not be logistically feasible to perform comprehensive health assessments on each animal. A triage approach must be undertaken, meaning that a quick visual assessment may be all that is possible for some animals, with more focused assessments performed on animals with decreased body condition, overt evidence of shock or trauma, or behavioral markers of significant stress.

Q: Are samples collected during a mass stranding and why?

A: A variety of samples may be collected from live-stranded marine mammals during a mass stranding response, and may differ depending on the species, animal's stress level, the physical condition of the animal, human safety, feasibility and the likely outcome of the stranding event (*e.g.,* immediate release, transfer to rehabilitation, etc.). These samples include, but are not

limited to, morphometrics (*e.g.*, length and girth measurements); skin for genetics; blood; and swabs (*e.g.*, oral, nasal, blowhole, fecal). Collecting diagnostic samples helps assess the overall health of the animal, and in determining the best course of action. Additional samples may be collected for research purposes, depending on the event, permit conditions, and welfare of the animals.

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, and 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: Necropsy personnel include qualified and experienced Stranding Network members that have been trained in 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 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) remove it from the environment. 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.