Large Whale Entanglement Response Best Practices

Photo Credit: J. Straley/ NOAA MMHSRP permit # 932-1489

Executive Summary

Entanglement in, and ingestion of, actively-fished gear, marine debris, and non-fishery-related gear, is a global problem affecting many marine species, including large whales. It has been estimated that hundreds of thousands of cetaceans die each year as a result of entanglements worldwide, representing a significant anthropogenic threat. Entanglement for large whales can result in serious injury and mortality. Entanglement also impacts fisheries and poses risks to responders that might attempt to free the animals. Responding to an entangled large whale is a challenging and dangerous undertaking. The likely mobility of the animal, unfavorable weather and sea-state conditions, lack of experienced and trained responders, along with support and resources (*e.g.*, vessels, equipment), the animal's large size, and its stressed and unpredictable nature, compound the challenges and safety concerns surrounding large whale entanglement response. People have been seriously injured and killed. This document provides Best Practices guidance towards safe and effective large whale entanglement response. It represents a set of proven currently used protocols and techniques, along with associated tools and technology, to safely free some (not all), large whales from life-threatening entanglements. However, the risk reduction in these Best Practices goes beyond that of animal welfare and human safety concerns represented by disentanglement efforts, and also considers the broader effort of gathering valuable information - "entanglement response", that may ultimately mitigate the threat (and risks) of entanglement for large whales. Therefore, it includes necessary preparation and planning, as well as risk assessment and mitigation for animal and human safety, and the criteria and authorizations that need to be followed. The principal resources of large whale entanglement response are the trained, well-equipped, and experienced responders. Human safety is paramount; therefore, all large whale entanglement response efforts in the United States involving close approach are authorized, overseen, and permitted, under NOAA Fisheries' Office of Protected Resources and their Marine Mammal Health and Stranding Response Program (MMHSRP).

Although this document includes known/existing Best Practices, responders should never stop striving for innovative and new methods to increase the safety and success of an entanglement response. These protocols are meant as overall Best Practices and should not limit advances in techniques for improving animal welfare or increasing the safety, efficiency, or effectiveness of the response.

Objectives

The objectives of this document are to provide Best Practice principles and guidelines, to identify the hazards and risks associated with large whale entanglement response, and to safely and effectively mount warranted and authorized response efforts to large whales with life-threatening entanglements under NOAA's Marine Mammal Health and Stranding Response Program. The objectives of large whale entanglement response are to first, safely free some whales from life-threatening entanglements. Secondly, increase awareness and appropriate stewardship, thus minimizing the potential risks of response to members of the well-meaning public, as well as for trained, authorized responders. Finally, and most importantly, gain valuable information towards preventing entanglements and minimizing their impacts. The latter, if successful, has the advantage of reducing the overall risk posed by large whale entanglements.

Dedication and Recognition

This document is **dedicated** to the memory of Joe Howlett of Campobello Island, Canada. Joe was a fisherman and conservationist. He was also an experienced, dedicated and passionate member of the Campobello Entanglement Response team who on July 10, 2017, tragically died while attempting to disentangle a North Atlantic right whale in the Gulf of St. Lawrence. This unfortunate incident should remain a reminder to all those that are a part of large whale entanglement response efforts worldwide, of the risks involved, and is an important motivation for these Best Practices in order to prevent similar tragedies in the future.

As such this document also **recognizes** the risks and efforts of all who have been and are presently part of the global large whale entanglement response effort. Their dedication, and in many cases initiative, is to be acknowledged. Organized entanglement responses were begun by Jon Lien in Newfoundland, Canada, in the late 1970s, Dr. Charles "Stormy" Mayo and David Mattila in the Northeast region of the United States in the 1980s, and by others from other regions around the globe (esp. Australia, Canada, New Zealand and South Africa as it relates to early efforts). Much of the content within these Best Practices originates from their early response efforts and others since then, and similar best practices and risk assessment documents. One example that compiles the experience of those across the globe is the IWC international consensus Principles and Guidelines for large whale entanglement response (see Appendix C), a document based upon the overarching principles developed by international experts and endorsed by the 89 countries of the IWC, including the United States.

Disclaimer

The Best Practices principles and guidelines outlined in this document are primarily meant for use by authorized responders and managers, as well as, members of federal and state agencies, non-governmental organizations (NGOs), researchers, industries (fisheries, tour), and others from the on-water community that might provide authorized large whale entanglement response support under NOAA's Marine Mammal Health and Stranding Response Program (MMHSRP). They do not represent a manual for the general public on how to disentangle a large whale. As well-intentioned as the public might be, the disentanglement of a large whale is extremely challenging and dangerous. Only trained, experienced, and well-equipped personnel, working under the MMHSRP, should attempt to disentangle large whales.

While the goals of these Best Practices are to minimize the risks from the threat and its associated response, large whale entanglement response is inherently complex, unpredictable, and potentially a dangerous endeavor. Following these Best Practices does not guarantee the safety of responders, an animal's successful release, nor the timely and successful garnering of information towards reducing the threat and its impacts.

The National Marine Fisheries Service's (NMFS) Office of Protected Resources (OPR), the authors, and other contributors, do not warrant that the information in this document is free from errors or omissions, nor do they accept any form of liability for any actions taken as a result of these guidelines and principles. While there are criteria and principles outlined that are required (*i.e.*, obligatory) as part of the MMHSRP's authorized response efforts, there is <u>no obligation</u> to initiate, or to be a part of those efforts. All responsibility is upon the responder to undertake safe activities using their best judgment. Again, this is not an instruction manual.

The content presented in this document, in part, attempts to compile the cumulative experience of knowledgeable responders, and similar Best Practices and risk assessment documents provided by other networks. However, the NMFS' OPR, the authors, and other contributors do not take responsibility for the opinions or actions of others arising from the use of content within this document. In addition, these Best Practices represent a living document, intended to evolve as new information and experience is gained.

Statement of Inclusivity

The Best Practices principles and guidelines outlined in this document are primarily meant for use by authorized and trained responders and managers, as well as, members of federal and state agencies, NGOs, researchers, industries (fisheries, tour), and others from the on-water and coastal communities that might provide authorized large whale entanglement 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. Large Whale Entanglement Response Network as a whole for the conservation of large whales. 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. Large Whale Entanglement 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

Entanglement in and ingestion of actively-fished gear, marine debris, and non-fishery-related gear is a global problem affecting many marine species, including large whales (Laist 1997; Gall & Thompson 2015). Entanglement is considered a significant anthropogenic source of large whale injury and mortality (Lien *et al.* 1989; Robbins and Mattila 2004; Kraus 1990, Knowlton & Kraus 2001, Johnson *et al.* 2005, 2007; Kraus *et al.* 2005, 2016; Glass *et al.* 2010; Pace *et al.* 2014).

Worldwide mortality of cetaceans from fisheries bycatch, the unintended catch or entanglement of non-targeted species, has been estimated to be in the hundreds of thousands annually (Read *et al.* 2006; Reeves *et al.* 2013).

Entangled humpback whale off Alaska (A. Jensen/ NOAA AKPRD/ MMHSRP permit # 923-1489)

Large whales entangled in gear are impacted at both the individual and population level. Individual impacts include physical trauma resulting from wounds (Lyman & Mattila 2010), weakening of the immune system (Hunt *et al.* 2006; Rolland *et al.* 2017) and infections (Knowlton & Kraus, 2001; Cassoff *et al.* 2011; Moore *et al.* 2013). Entanglement can also hinder a whale's mobility, impacting feeding (Clapham *et al.* 1999; Coughran 2004), and increasing energy expenditures from dragging gear (Moore *et al.* 2013; van der Hoop *et al.* 2014), which in turn can affect the animal's condition, including emaciation (Cassoff *et al.* 2011; Moore & van der Hoop 2012). Restricted mobility may result in drowning (Moore *et al.* 2013), and can contribute to other threats, such as whale-vessel collisions (Laist *et al.* 2001).

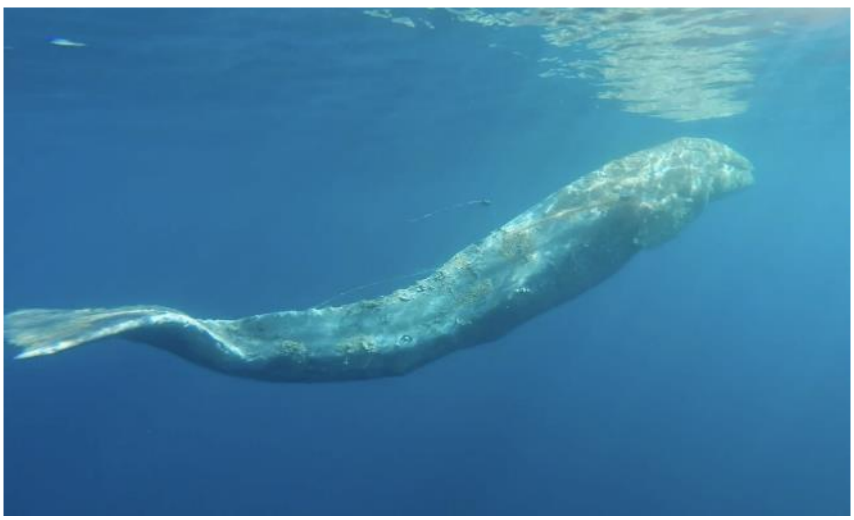
Any of these can result in death (Cassoff *et al.* 2011; Clapham *et al.* 1999; Moore *et al.* 2013). Other associated impacts include behavioral, such as disruptions to nursing (Stewart *et al.* 2021) and an increase in predatory attacks (Mazzuca *et al.* 1998; Moore *et al.* 2013). Impacts to individuals raise animal welfare concerns, as they are considered a source of pain and suffering (Moore & van der Hoop 2012). Population-level impacts resulting from mortalities may decrease population size (Caswell *et al.* 1999). Entanglement may reduce recruitment through reduced calving rates (Van der Hoop & Corkeron & Moore. 2016; Rolland *et al.* 2016), reduced calf fitness and survivorship, and higher incidence of juvenile entanglement (Lien 1994; Mazzuca *et al.* 1998; Robbins 2012; Knowlton *et al.* 2012).

Entangled North Atlantic right whale in poor condition (NOAA NEFSC/ MMHSRP permit # 18786)

In some populations, entanglements may be a major depressing factor, affecting their ability to recover, as is the case with the critically endangered North Atlantic right whale (Kraus *et al.* 2005; Knowlton & Kraus 2001; Caswell 1999; NMFS 2005, Moore & van der Hoop 2012).

Large whale entanglements also pose risks and impacts to fishermen, and the fishing and aquaculture industries. The risks include: injury and loss of life from dealing with a whale in their gear; loss of equipment (including their vessel), the catch, and time, all equating to money; increased regulations; and bad public perception *(i.e.*, all fishermen are bad; fishing is bad).

Between 2007 and 2020, an average of 72.3 large whales were confirmed entangled in U.S. waters annually (NOAA 2022). However, reporting underestimates the magnitude of the threat as many animals will not be observed for various reasons, including: the expansiveness and observational challenges (*e.g.,* effort, conditions) of the world's oceans, and animals can carry all or parts of the gear over broad expanses and over time (*i.e.,* across ocean basins and away from effort). The cryptic nature of gear, as well as the fact that the animals spend much of their time submerged, gear being shed (*i.e.,* self-released), and animals falling victim to the entanglement (*i.e.*, dying with the carcass sinking), translates to an decreased probability of the animal being observed. In addition, the sources of reports are not typically dedicated and directed in nature, but opportunistic. Sources of reporting can be from on-water, aerial and land-based sources and can include governmental and military patrols, research and monitoring efforts (*e.g.*, observer programs), tour industry, fishermen, and the general public.



Entangled gray whale calf (NOAA PRD-WCR/ MMHSRP permit # 932-1905)

While all species of large whales have been reported entangled within U.S. waters and/or by U.S. sources, the most commonly reported are minke whales (*Balaenoptera acutorostrata*), humpback whales (*Megaptera novaeangliae*), gray whales (*Eschrichtius robustus*), and North Atlantic right whales (*Eubalaena glacialis*; NOAA 2022). Right whales are of considerable concern, (Moore *et al.* 2006; Rolland *et al.* 2016) due to their critically Endangered status, and the impacts entanglement has had and continues to have on the species (NMFS 2017).

Scar analysis studies of wounds resulting from recent and non-lethal entanglements, indicate that the rate of entanglement for many large whale populations is much higher than sighting reports and known disentanglement efforts would suggest. Data from scar studies performed on humpback whales in the North Atlantic indicate that only 7% of the humpback whales that get entangled on an annual basis are ever observed, and thus reported (Robbins & Mattila 2004). Analysis of scarring in North Atlantic right whales indicated that 84.7% may have been recently entangled (Knowlton *et al.* 2018). Scar studies for humpback whales in the Gulf of Maine and parts of Southeast Alaska suggest non-lethal entanglement rates of around 50% (Robbins & Mattila 2001, 2004; Neilson *et al.* 2009; Robbins *et al.* 2009, 2012). Scar rates for humpback whales in Hawaii over the last eight years have averaged 21% (Lyman, pers.

comms.). Entanglement scar analysis has been done on a variety of other species, including, bowhead whales (George *et al.* 2017), gray whales (Bradford *et al.* 2009), and minke whales (Northridge *et al.* 2010). Scar analysis also illustrates that many animals given time will release the gear on their own. This has response implications, as an animal that is assessed as likely self-releasing, will likely not warrant a response. However, scar analysis, like reporting, does not give us the complete picture of the threat, as some animals will fall victim to the entanglement or otherwise never be observed. Humpback whales in the Gulf of Maine have been shown to have had an estimated mortality from entanglements of approximately 4%, and for every one animal observed and reported dead, nine others likely fell victim (Robbins *et al.* 2009).

Line-scarred humpback whale (Chad Kruzic)

In addition, long-term sighting histories, and knowledge of entanglement outcomes and inferences from annual entanglement wound analysis, suggest annual mortality rates for some species and populations could be significantly impacting growth rates, and therefore hindering the recovery of some populations (*e.g.,* North Atlantic and North Pacific right whales).

Large whales have been recorded entangled in just about anything and everything found in the world's oceans (*i.e.,* actively-fished gear; marine debris, constituting lost or abandoned fishing gear; and non-fishery-related gear). The sources of these entanglements are extensive and diverse.

However, a majority of the known gear entangling whales is believed to be actively-fished gear (Meÿer *et al.* 2011). Many types of fishing gear (*e.g.,* gillnets, longlines, and pot/trap lines) are known to cause entanglements (Baird *et al.* 2002; Johnson *et al.* 2005; Read *et al.* 2006; Song *et al.* 2010; Benjamins *et al.* 2012). Gear entangling the animals will vary over regions and time based on fisheries and their seasonality, along with the animals' distribution and abundance changes. Much of this gear however is fixed, that is, it is set and left for a period of time (Johnson *et al.* 2005). The identification of the gear -

the source of the entanglement, poses many challenges and biases, including the identifiable nature of the gear and the different impacts it might pose. As an example, Bering Sea crab pot gear contains robust, long-lasting surface buoy systems that generally equate to the gear being more identifiable for a greater length of time. This gear may also pose differential risks represented by the higher risk posed by the greater breaking strengths compared to the potentially lower risks from the larger diameter lines providing some chafe protection to the animal. As far as why large whales get entangled, it is likely due to a number of possibilities. In some cases, the entanglement may be from intentional contact/interaction, representing attempts to depredate the catch, playing with the gear, and/or use of the gear (*e.g.*, rubbing on it to remove parasites). The animal is aware of the contact with the gear, and possibly attracted to it. In other cases, the contact with the gear is unintentional (*i.e.*, they have stumbled into it). Examples include: inattention during feeding, breeding, or other behaviors; inability to detect the gear due to its cryptic nature (*e.g.*, gillnet); environmental characteristics (*e.g.*, water clarity, time of day); and the novelty of the gear (*e.g.*, the inexperience of younger animals, a new fishery opening). Whether the initial contact with the gear is intentional or not, the entanglement itself is unintentional and can have serious consequences.

Humpback whale entangled in marine debris off Hawai'i (NOAA HIHWNMS/ MMHSRP permit # 932-1489)

Entanglement threat is very dynamic, as changes in the gear, the animals' distribution and fishing effort influence the rate and impact of entanglement. However, recent environmental changes may further reflect the dynamic nature of entanglement threat by providing new and different habitat, and even greater changes in fishing effort, that will further affect large whale entanglements, and associated reporting (Lyman *et al.* 2019). Continued monitoring and investigation is needed to understand, and thereby potentially mitigate, what is a continually evolving threat - a moving target.

Due to their large size, the impact of entanglement for whales is typically not immediate. As such, and in many cases, there is time to potentially free the animal. Animals have been known to remain entangled for months and even years (Moore *et al.* 2006). However, responding to an entangled large whale is a challenging and dangerous undertaking due to the inaccessibility and likely mobility of the animal, weather and sea state conditions, availability of resources, the size of the animal, the fact that the animal likely doesn't realize responders are there to help it, and the paucity of cases that warrant response providing little opportunity for responders to gain hands-on experience. People have been seriously injured and killed during large whale disentanglement efforts. However, there is a great deal of value in responding to an entangled large whale. While dangerous, the disentanglement of an animal and associated efforts (hence referring to the overall effort as "large whale entanglement response"), may not only free an animal from a life-threatening entanglement and thereby have animal welfare benefits, but contribute towards the broader conservation and risk reduction goals.

Authorized response team attempting to free an entangled humpback whale off New England (CCS/ NOAA MMHSRP permit # 18786)

For instance, entanglement has broader impacts, including to fisheries, and responders that might be tasked to free the animal. Organized entanglement responses were begun by Jon Lien in Newfoundland Canada in the late 1970s, and a number of advances in tools and protocols for working with free-swimming entangled whales were developed by Dr. Charles "Stormy" Mayo and David Mattila at the Center for Coastal Studies in the 1980s (Moore *et al.* 2018). Other regions around the globe developed large whale entanglement response efforts, and associated tools and procedures; however, much of the large whale entanglement response and response network in the United States today has its origins with the Center for Coastal Studies.

NOAA Fisheries' Office of Protected Resources (NMFS OPR) and their Marine Mammal Health and Stranding Response Program (MMHSRP), built upon these initial regional efforts of partnering with state and federal agencies, non-governmental organizations (NGOs), researchers, the fishing industry, members of the community and many others, to establish a network of trained, experienced, well-equipped responders throughout the United States. The principal resource of large whale entanglement response is the network of authorized responders. Human safety is paramount. The Network follows protocols and techniques that have been proven over time, and can mitigate the risks posed by the response to an entangled large whale. It is for risk reduction - to humans and animals - that all large whale entanglement response efforts involving close approach are authorized, overseen, and permitted, under NMFS OPR and their MMHSRP.

Response team attempts to cut free entangled humpback whale off Alaska (S.Lewis/ NOAA MMHSRP permit # 932-1905)

While the Network's efforts to free large whales from lethal entanglements are authorized and overseen, risks still exist and not every whale will be freed (just as not all the marine debris can be removed from the world's oceans). Thus, the primary goal of the Network is prevention. By responding to reports of life-threatening entanglements, authorized network response provides valuable information that guides the effort to prevent future entanglements. Information gained from large whale entanglement response efforts will help to better understand the threat of large whale entanglement, (*e.g.*, the need for mitigation and the evaluation of implemented mitigating measures) and its associated impacts into the future. Much of the information provided above (*i.e.*, within the Background) has been gained through these efforts.

The Network's response hopefully also reduces risk to the well-intentioned general public that might attempt to free an animal on their own, which, in addition to being dangerous, may be illegal. In most cases, well-meaning rescue attempts fail to completely free the animal, leaving lethal wraps behind that may make the situation worse. In addition, such efforts fail to garner information to reduce the threat and its impacts. Immediate reporting and authorized response is the best way to help the animal and reduce risk to the public.

This document provides Best Practice guidance towards large whale entanglement response. It represents a set of proven and currently used protocols and techniques (*i.e.*, standard operating procedures [SOPs]), along with associated tools and technology, which have proven themselves over time to safely free some large whales from life-threatening entanglements. The risk reduction in these Best Practices goes beyond that of animal welfare and freeing entangled whales, as it also emphasizes reducing risk through increasing awareness and includes the gathering of valuable information that may ultimately mitigate the threat (and risks) of entanglement for large whales.

Mitigating the threat of large whale entanglements will require a collaborative effort from resource managers, scientists, conservation organizations, industries (fishing, tour, etc.), NGOs, local communities, including indigenous, as well as local, state and federal governments. Accordingly, these Best Practices represent the collaborative efforts of many to pool expertise and knowledge.

1.2 Marine Mammal Health and Stranding Response Program

The Marine Mammal Health and Stranding Response Program (MMHSRP), under the National Marine Fisheries Service (NMFS), was established in 1992 by Congress, under Title IV of the Marine Mammal Protection Act (MMPA) to protect and preserve marine mammals and their ecosystem. The MMHSRP coordinates emergency response to stranded and/or entangled cetaceans and pinnipeds (excluding walrus)[1] in the United States working with stranding and entanglement networks as well as local, tribal, state, and federal government agencies. The MMHSRP works to standardize regional network operations and define national entanglement and stranding response policy to ensure that all activities performed are safe for both responders and animals. Since 1999, large whale disentanglement response, now referred to as "large whale entanglement response," has been under the MMHSRP as a permitted activity to maintain a safe and effective response to whales in life-threatening entanglements, and further reduce risk through the ultimate goal of prevention - entanglement threat mitigation.

https://www.fisheries.noaa.gov/national/marine-life-distress/marine-mammal-health-and-stranding-response-program

1.3 Legislation Pertinent to Large Whale Entanglement Response

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 is responsible for the protection and conservation of all cetacean and pinniped species (with the exception of walruses), and their habitat and USFWS oversees the management of walruses, polar bears, sea otters, and manatees, and their habitat. 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.

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" with certain exceptions, which

[1] Polar bears, walrus, sea otters, and manatees fall under the jurisdiction of the United States Fish and Wildlife Service.

means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (16 U.S.C. § 1531).

1.4 Best Practices Purpose and Intended Uses

NMFS and the MMHSRP have developed Best Practices for the warranted and authorized response to large whales that are observed with life-threatening entanglements. It is intended to provide best practice guidelines to identify the hazards and risks associated with large whale entanglement response, as to safely and effectively respond to large whales with life-threatening entanglements under NMFS' MMHSRP. The health, welfare, and safety of both human responders and animals are the top priority for NMFS and the Marine Mammal Stranding and Entanglement Response Networks they oversee.

Trained response team frees entangled gray whale off California (NOAA PRD-WCR/ MMHSRP permit # 18786-02)

The Best Practices outlined here focus on the broad nature of large whale entanglement response. They should only be used as guidance towards the response of entangled large whales. Protocols and procedures addressing entanglement and associated response (*e.g.*, entrapment) to small cetaceans and pinnipeds can be found in the NMFS Best Practice Guides for Small Cetacean or Pinniped Entanglement Response. In addition, these Best Practices are meant for trained, experienced and authorized personnel operating under the oversight and authorization of NMFS MMHSRP in their pursuit to mitigate risks of large whale entanglement response in the United States.

These Best Practices have been compiled from the cumulative experience of many large whale entanglement responders, and from other large whale entanglement response Best Practices and Risk Assessments from around the world (see Acknowledgements). For instance, these U.S. Best Practices are consistent with and strive to expand upon the IWC international consensus Principles and Guidelines for large whale entanglement response (see Appendix C), a document endorsed by 89 countries, including the United States, and itself compiled from past efforts of similar documents. They represent a suite of proven and currently used protocols and techniques (*i.e.,* SOPs), along with associated tools and technology, to safely pursue freeing some large whales from life-threatening entanglements.

These Best Practices balance the need for standardized procedures, while allowing flexibility to address specific needs of different situations resulting from different species, age class, and condition of the whale; gear type, complexity of the entanglement and its impact to the animal, the environment, weather conditions, resources and support available, as well as unforeseen circumstances. Large whale entanglement response is complex, having many variables. Every case, and thus response, is unique. These guidelines cover the basics and delve into some of the variation (see broad outline under Structure); however, they will likely require continued evaluation by the Network (NMFS and higher-level responders) not only to determine how to respond, but whether or not to respond. Making the decision to not initiate, or to abort a response mission is a viable option. There is no obligation for authorized individuals or partner organizations to conduct a response (they can always "opt out" at any time and for any reason), but if a response is undertaken, there is an obligation to maintain the safety of all involved.

Additionally, these practices are designed to complement regional guidance to address slight differences and details resulting from regional variation, including species-specific issues (*e.g.*, critically endangered North Atlantic right whales), the remoteness of the environment, and differences in gear types.

Assessment during a response operation is ongoing and the same holds for the SOPs that might define the overall mission. Best Practices have evolved over time with continued (risk) assessment and should continue to do so with increased knowledge and advancements in techniques, changes in protocols, and/or new technology. Managers and responders involved in the MMHSRP's network response to entangled large whales, along with other similar network efforts worldwide, should never stop striving for innovative methods to increase the safety and success of an entanglement response. Advances and changes, however, should be thoroughly assessed and tested in order to mitigate any risks.

1.5 Structure

These Best Practices cover the broader components of large whale entanglement response – not just the disentanglement of an animal. The components addressed within the body of the document include: Incident Command System and how it fits within large whale entanglement response (Section 2.2), required authorizations under the MMHSRP and otherwise (Section 2.3), all-important responder roles and their requirements (Section 2.4), the resources required for safe and effective response (Section 2.5), communication (Section 2.6), the gathering of information (Section 2.7), the value and types of training (Section 2.8), the environmental and weather conditions that are required (Section 2.9), preparation and planning (Section 2.10), the different procedures that make up large whale entanglement response (Section 2.11), risk assessment and mitigation (Section 2.12), and finally the intervention criteria and decision matrices (Section 2.13) that are used to help responders mitigate risk. Some of the broader roles of large whale entanglement response are addressed as First Response, including tethered telemetry tagging (Section 3.0); cutting a whale free - Disentanglement (Section 4.0); the use of sedation (Section 5.0); Unmanned Aircraft Systems (UAS) use (Section 6.0); and after-action mitigation – including debriefs and investigation (Section 7). Another way to look at the structure of the document is that it addresses what are generally considered the five steps of risk assessment. Figure 1 illustrates the cyclical nature of the five steps resulting from the continuous nature of risk assessment.

Figure 1: Five steps of risk assessment

The five steps are:

1. **Identifying the risk factors**, which is covered in Section 2.12, but also within the Risk and Mitigation sections for each of the broad roles.

2. **Who and what can be harmed**, also covered in Section 2.12 and respective broad roles.

3. **Evaluating the risk and mitigation**, addressed within Section 2.13, and again, within the broad roles.

4. **Record the finding and implement (mitigation measures)**, which in many ways, the entire document addresses, but specific examples lie in Sections 2.12, 3.10, 4.10, 5.10, and 6.10.

5. **Monitor and review**, which is literally the take-home message towards mitigating large whale entanglement threat, and completes the circle.

Other components such as outreach and awareness, reporting and associated vetting, decision matrices and establishing an Incident Action Plan, risk assessment/Green-Amber-Red checklists (GAR), different monitoring techniques and tools, and specific resource requirements (*e.g.,* specialty tools) are also covered and/or as provided examples in the appendices. This document also addresses funding (Section 8), conclusions (Section 9), acknowledgements (Section 11), literature cited (Section 12), and appendices (Section 13). The appendices include associated forms and examples of report forms, datasheets, checklists, criteria, and more, that have been used during entanglement response efforts throughout the country.

Some of the specific topics/techniques addressed are:

- Required and recommended safety gear (*e.g.*, PFDs, helmets, gloves, safety knives)
- Use of different vessel types and the roles of those vessels (*e.g.*, large vs small)
- Recommended skill sets and experience, as well as, established criteria and roles of responders
- Risk factors (*i.e*., hazards), risk assessment and decision matrices
- Using physical restraint or not (*e.g.*, kegging, cutting-on-the-fly, and sedation)
- Use of different knives under different circumstances (*e.g.*, pole-mounted flying vs fixed)
- Use of knives for different gear types (*e.g.*, ropes vs nets vs cables)
- Use of technology (*e.g.*, telemetry, UAS, POV cameras)
- Debriefs and follow-up (*e.g.*, debrief reports and gear investigation)

2. Planning for Large Whale Entanglement Response

2.1 Outreach and Education

In its broadest sense, large whale entanglement response efforts under the MMHSRP start with outreach and education - it is the foundation of the effort. Increasing awareness and promoting stewardship helps reduce entanglement threat, increase reporting and associated information, and promote public safety (*i.e.*, outlining what roles the public can play). Promoting stewardship and working together with the public, industry, and stakeholders - the community, is instrumental towards mitigating entanglement in large whales. In many cases when there is no awareness, there are no reports, but as soon as people know of the issue, what can be done, the value of information towards reducing the threat, and the hotline number(s) to call to report entangled whales, reports suddenly occur. Large whale entanglement response is very much based on reporting effort.

Below is an example of a rack-style reporting card used along the U.S. West Coast, that provides the regional Hotline number to report an entangled whale, or otherwise distressed marine mammal, and a list of information needed (*i.e.*, a checklist; Figure 2). This allows the Network to confirm the report, make an initial assessment, and if conditions and resources allow, perhaps make an authorized response. Reporting is also valuable in locating entangled whales, as they end up being large needles in an even larger haystack - the world's oceans.

Immediately reporting an entangled whale, as opposed to trying to free it on one's own, is the best way for the public (or otherwise untrained and inexperienced persons) to help the animal.

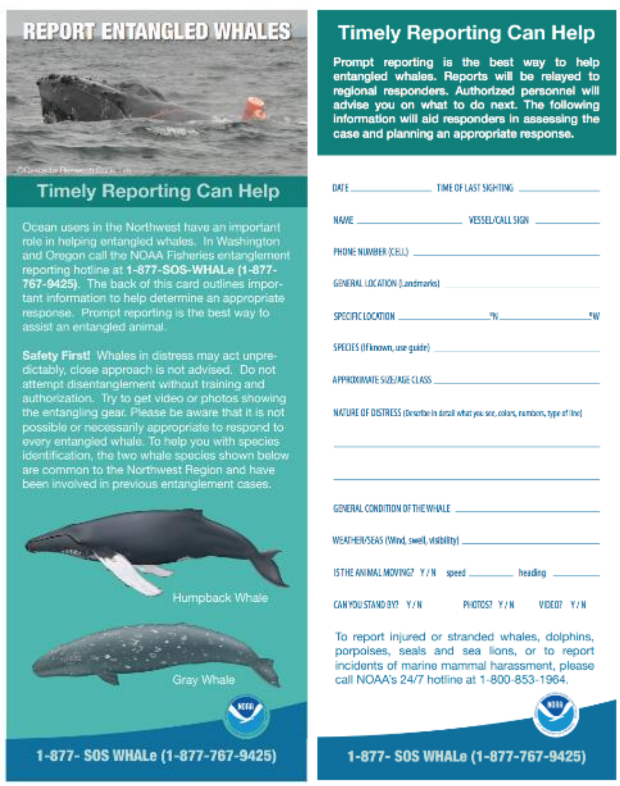


Figure 2: U.S. West Coast large whale entanglement response reporting rack card

For a list of all regional Hotline numbers in order to report entangled or injured marine mammals throughout the United States, please see https://www.fisheries.noaa.gov/report. It is important to enlist the community, especially the on-water community, to safely and legally locate, report, and garner information on the threat of entanglement to large whales.

2.2 Incident Command System

Response to large whales entangled in gear can be challenging and complex, and often involves multiple organizations and agencies. Variables such as closely approaching a large, unpredictable animal that is under stress and likely in discomfort, the complexity of the entanglement, the availability of resources, the experience of the response team, the environment and weather, all pose challenges and significant risks to the animals and responders. In order to plan, coordinate, and minimize risks, large whale entanglement response under NMFS MMHSRP's oversight and authorization adheres to the Incident Command System (ICS).

Teams free an entangled humpback whale off the West Coast (WET/ NOAA MMHSRP permit # 18786)

ICS is a standardized and structured approach to establish common processes for planning and managing a response. It enables a coordinated effort among all responders, and allows for the integration of equipment, personnel, procedures, and communications among responders. ICS is based on decades of lessons learned, and helps to minimize risks to responders and animals. It also increases the achievement of response objectives, and provides for the efficient use of resources. ICS uses standard terminology and common terms to ensure understanding and coordination among all responders. It establishes roles based on training and experience, chain of command, and ensures integrated communications, accountability, and organizational structure. As such, ICS's structured and disciplined management system is applied to numerous operational components of large whale entanglement response and is featured heavily in these Best Practices.

ICS has a modular structure that can be expanded or contracted depending on the size and complexity of the operation. By using ICS, each team member knows their exact role in the response, the response plan, and any mitigation measures, should an emergency arise during the response. An **Incident Action**

Plan (IAP) documents these incident goals and objectives, disseminates information about the response, and is revised on a regular basis to maintain consistent, up-to-date guidance. These Best Practices outline many of the components of large whale entanglement response that are part of ICS and can be part of an IAP.

ICS is typically divided into four components or primary roles:

Incident command falls under the **Incident Commander (IC)**, who is responsible for the overall management and the performance of the response operation. While usually found onsite with the response team, the IC does not generally participate directly in the operation. This enables the IC to remain focused on the larger picture of the response. Generally speaking, for a large whale entanglement response effort, the IC will be the highest-level or most experienced Co-Investigator (under the MMHSRP permit) involved in the response.

NMFS MMHSRP's ICs are established through level designations based on their experience and training (see level designation roles and criteria; Section 13, Appendix B). IC's can also be determined on a case-by-case basis, and are dependent on the assessed risk level (see GAR risk assessment; Section 13, Appendix L) of a particular response. Since large whale entanglement response is a permitted activity under the MMHSRP, level-designated ICs are listed under the permit as co-investigators (CIs), linking the permit and its listed activities to ICS.

Operations falls under the **Operations Officer** (OO) who is responsible for the deployment of resources and control of operations in accordance with the IAP. A good example of an OO would be an experienced captain of the support vessel and/or a Vessel Operations Coordinator associated with the effort.

Planning falls under the **Planning Officer** (PO) who is responsible for supporting the incident by collecting and analyzing incident information, (risk) assessment, outcome predictions, acquisition of personnel and resources, strategies to manage the incident, and preparation of the IAP. A good example of a PO might be a Regional Stranding Coordinator (RSC) or Large Whale Entanglement Response Coordinator (LWERC).

Logistics falls under the **Logistics Officer** (LO) who is responsible for supporting the incident by providing transportation, communications, equipment maintenance, fueling, food and medical services, as well as any other logistical needs. A good example of a LO is an Operations Manager or similar person involved in the effort.

ICS can expand and contract depending on the scale of the emergency, and can even change for a single case if the response gets more or less complex. For a local, single day, simple response effort for an entangled whale (*e.g.*, a basic assessment mission), all of these roles may be filled by just a few experienced people. For a multi-day response happening hundreds of miles offshore, perhaps with a sedation attempt, each role would be a different person and could be subdivided further into discrete areas of responsibility.

For more information about ICS and how to take a free course, see https://training.fema.gov/emiweb/is/icsresource/TrainingMaterials.htm.

2.3 Authorization

Large whale entanglement response and associated research are conducted under the oversight and authority of NMFS' MMHSRP as a permitted activity. The enhancement and research permit is issued to NMFS and their MMHSRP, with Teri Rowles D.V.M., Ph.D., listed as the Principal Investigator. The permit's authority is pursuant to the provisions of the MMPA (16 U.S.C 1374 et seq.); the regulations governing the taking and importing of marine mammals (50 CFR Part 216); the ESA (16 U.S.C. 1531 et seq.); the regulations governing the taking, importing and exporting of endangered and threatened species (50 CFR Parts 222-226); and the Fur Seal Act of 1966 (16 U.S.C. 1151 et seq.).

NMFS, along with appropriate high-level (level 4 or higher) responders, through a standardized and intensive review process, certify individuals as CIs to conduct entanglement response activities under their authorization. This certification (*i.e.*, CI letter) is not a blanket authorization to individual Network members. Therefore, all activities of Network members that may require federal authorization must be done under the continuous permission and supervision of NMFS *(i.e.*, the PI), and personnel listed as CIs under the MMHSRP permit must have otherwise met all criteria of the permit and of the MMHSRP large whale entanglement response program. Permission can be granted on a case-by-case basis as needed during an event. Authorization for disentanglement of ESA-listed species will be limited to appropriately trained and experienced individuals and is designated through different levels of participation as outlined by NMFS in their "NOAA Fisheries Criteria for Disentanglement Roles and Training Levels - May 1, 2003" (see Incident Command and Appendix B). Entanglement response should only be attempted if the entanglement is deemed to be causing, or has the potential to cause, a life-threatening injury (see pp 34-35 NMFS Serious Injury Procedure (Anderson *et al.* 2008) for details), and if the response effort is assessed to represent little to no risk to the responders or animal.

NMFS OPR, or Regional Stranding, or LWERCs must be consulted to review risk assessment. An IAP, or direct communications on an action plan, must be provided and approved prior to conducting entanglement response activities (see heightened consultation; Appendix P), euthanasia, or necropsy of an ESA-listed cetacean. If communications cannot be established, response activities can be conducted by a designated level responder at a role one step lower than their designation. For instance, a level 4 responder, who could normally disentangle a humpback whale, and was unable to notify their chain-of-command, would be authorized (all other criteria being met) to tag the whale (a level 3 activity). All procedures requiring sedation or euthanasia must be performed under the supervision of a veterinarian.

Response efforts may also fall under the additional authority of state and federal agencies (*e.g.*, Federal Aviation Administration [FAA] in regard to Unmanned Aircraft Systems [UAS aka aerial drones] activities, reserves and other marine protected areas [MPAs], towards access), the military (*e.g.*, military installations or during exercises), restricted access due to human safety (*e.g.*, unexploded ordinances), and Indigenous waters.

In addition to the authorization provided under the MMHSRP and otherwise, there may be criteria and requirements outlined by a responder's employer. Roles and activities outlined by the responder's employer (*i.e.*, the response effort is written into the job description) may address liability and injury coverage. Lastly, there is the personal decision of whether or not a responder feels comfortable with their individual role or task. Remember, there is no obligation to respond.

2.4 Team Member Roles

Whale rescue is complex, unforgiving work that is dependent on the commitment of trained, well-informed, well equipped, and highly skilled people. Even support roles require a great deal of experience. Tools and techniques change and each entanglement provides new and unique challenges. A responder's anticipated range of tasks (*i.e.*, roles) is based on their experience and associated training, which is broadly classified as a level-designation within the Network. Network level designations are determined on an individual basis through an application process and committee review that includes existing level 4 and 5 responders. Certification is based on a variety and combination of factors including, but not limited to[2]:

- Pre-existing large whale entanglement response experience and skillset
- Training
- Location (availability)
- Commitment to be on call and respond as needed (availability)
- Associated experience
- Availability of associated resources (*e.g.*, use of an appropriate response vessel, telemetry, tools)
- Willingness and commitment to build experience and improve skills

[2] Note, roles can be established on a case-by-case basis independent of a predetermined designation, based on required reporting. This can occur prior to response for review and approval by NMFS leads, and/or high-level responders (*i.e.*, levels 4 or 5).

Below are the general roles and their descriptions, and where applicable their level designations (More detail is provided in Appendix B):

First Responder is a general term that is used to describe anyone in the Network with varying levels of training who may respond to an entanglement report under Network protocols and authorization. At a minimum, they will voluntarily attempt to standby with an entangled whale and, depending on training, experience, authorization and equipment available, may also assess and perhaps tag the whale. Under certain conditions and authorization, First Responders may assist in disentanglement.

The First Response Team's primary mission is rapid on-site response for assessment, documentation, monitoring, and if appropriate, telemetry tagging the whale for relocating the whale later. Since most entangled large whales, when first reported, are not in imminent danger of death, the immediate issue is locating the animal and determining the nature and severity of the emergency. This may require only one or two experienced Network members. If a whale is then determined to require assistance (*e.g.*, has a life-threatening entanglement), a Large Whale Entanglement Response IC and listed CI under NOAA's MMHSRP permit will coordinate with the First Response Team to mount an effort, if resources and conditions allow.

Courtesy of FL-FWC (MMHSRP permit # 932-1489)

Primary First Responders are generally referred to as individuals with higher Network rank (levels 3 - 5). Primary First Responders participate in and can lead first responder roles as authorized. Level 4 and 5 Primary First Responders generally can lead in disentanglement efforts under certain conditions and authorization, while level 3 Primary First Responders typically assist in disentanglement efforts under the direction of designated level-4 or 5 ICs.

Primary Disentanglers are individuals who can perform all of the responsibilities of a primary first responder, but who also meet the criteria used by NMFS for selecting individuals who may undertake the very dangerous activity of disentangling (*i.e.*, attaching to, stopping, and cutting) a large whale. Primary Disentanglers must have the experience, training, support, and proper equipment to conduct a full disentanglement with a high likelihood of success. Primary Disentanglers are those rated at Level 4 or Level 5 in the Network.

Detailed descriptions of team member roles and responsibilities are described in greater detail within each of the entanglement response method sections below. All personnel should be familiar with the MMHSRP permit and the minimum qualifications for each role. In general, roles and responsibilities might include but are not limited to:

1. Incident Commander (IC) – responsible for on-site oversight of the response effort. They are typically the highest level-designated CI under the permit on site;

2. Safety Officer (SO) – can be IC or vessel operator, but valuable to be a dedicated person/role;

3. Vessel operators - helmspersons for both support and approach vessels; typically acts as SO or OO;

4. Vessel crew – assist with the operation of the transit/support vessel; will typically overlap with other roles;

5. Communications Officer – maintains communications with shoreside contacts;

6. Data Manager – responsible for recording and maintaining all data associated with response;

7. Documenters – responsible for the photo-documentation (*e.g.*, still and video) of animal, entanglement and response, as well as monitoring of camera (*i.e.*, POVs, batteries to prevent lapse in camera recording ability);

8. Disentanglers – experienced and generally higher designated personnel responsible for roles associated with cutting the animal free;

9. Biopsy sampler – responsible for obtaining biopsy samples; is trained and experienced in use of sampling equipment (*e.g.*, crossbow and pneumatic gun);

10. Tagger – responsible for setup, deployment and use of telemetry to remotely track the animal;

11. Unmanned Aircraft System (UAS) pilot – experienced, UAS pilot responsible for safe flight of UAS platforms, if not FAA Part 107 Remote Pilot certified, they must have direct oversight by onscene FAA Part 107 Remote Pilot certified Pilot in Command;

12. Pilot in Command (PIC) – experienced, FAA Part 107 Remote Pilot certified pilot and designated person overseeing UAS flights on scene. May also directly pilot the UAS platform(s);

13. Observers – responsible for maintaining lookout for animals during transit, response, and UAS

operations;

14. Darter (sedation) – experienced person authorized to administer sedating drugs, and experienced with use of delivery equipment;
15. Mission Commander (MC) – responsible for the safe execution of any UAS operations. Does not have to be on-site;
16. Planning Officer (PO) – responsible for incident support. May or may not be on-site. Typically filled by RSC or LWERC; and
17. Principle Investigator (PI) – responsible for all activities performed under the MMHSRP permit. is typically off-site.

2.5 Resources

Large whale entanglement response is a unique, complex, and potentially dangerous mission. Having the resources (*e.g.,* tools, vessels, Personal Protective Equipment [PPE], and emergency gear) is critical to accomplishing the mission and reducing risks. Like any piece of equipment or tool, they demand upkeep and continued familiarization by those that will use them. Some equipment is unique, having been modified or specially designed for their task, and may require testing and approvals before being used in response efforts. Due to the nature of large whale entanglement response (*i.e.,* not knowing when the call might come in), there is a considerable benefit to strategically locating and maintaining caches of equipment.

Each type of response (*e.g.,* approach for assessment and documentation, tagging, physical constraint – kegging, close approach to assess and cut, and sedation) requires specific equipment. Much of the equipment is outlined in individual sections later in this document. Appendix D contains a sample equipment checklist. Below is a description of the primary equipment and their general uses.

Vessels:

Support and approach vessels in Hawaii (Kern)

Vessel support represents the most important tool or resource. Vessel(s) provide transit for crew and gear, including a secondary approach vessel, and act as a platform for assessment, documentation, monitoring, tagging, biopsy sampling, UAS operations, and safety support for a secondary close approach vessel (*e.g.*, disentanglement task team). Vessel support requires an experienced and well-qualified helmsperson. The helm position is critical, and must be filled by someone with experience operating around whales and gear. An inexperienced helmsperson can add risk to what is already a high risk operation. The two primary vessels – the response support vessel, and the close approach task vessel, are discussed below.

Support vessels can act as rapid response vessels, and transport crew and gear; they can also act as a platform for assessment, documentation, monitoring, tagging, biopsy sampling, UAS operations, and safety support for a secondary close approach vessel (*e.g.*, disentanglement task team).

However, the primary role of the support vessel, once a secondary task vessel for close approach (to the whale and gear) has been launched, is safety support. Any other roles must coincide with, or not impact, the primary mission of safety support. For instance, UAS operations should be done from an alternative platform once the primary vessel is in its support role. In addition, crew aboard the primary support vessel in safety support roles also need to focus on their roles and not be distracted by other roles. It is extremely important that the support vessel and support crew continue to maintain safety for the approach (task) team or any team at higher risk. Support vessels can, and do take on other roles once relieved of their safety support role.

The support vessel needs to be of appropriate size, for seaworthiness and range, and capable of holding gear and personnel. The operational limits (range) need to be defined based on the speed, size and operating range of the vessel, sea conditions, mission load, vessel safety equipment, and distance as to ascertain response time, but more importantly, time to receive advanced medical attention in the event of an emergency.

At least one appropriate support vessel should be used. Additional support vessels may be used;

however, only the primary safety support vessel should be in proximity of the animal and approach team. An appropriate distance and position is approximately 70 meters abeam, or off the quarter of the animal/team. Such a distance will reduce stress on the animal, be less likely to get unintentionally involved with the animal or trailing gear, and yet be close enough to quickly lend assistance to the approach vessel/team should it be needed. If additional support vessels are needed for other support roles (*e.g.,* UAS operations), they should remain further off (*e.g.,* 300 meters) than the primary safety support vessel. In regard to safety support vessels, more may not be better. In several cases, entangled whales have become more stressed as support vessels encroached upon the animal.

Partner agencies, organizations and the private sector may provide support vessels and safety support roles. Examples include: United States Coast Guard, NOAA Office of Law Enforcement, NOAA Science Centers, state agencies, harbormasters, Ocean Safety, fishermen, and researchers. However, vessels still need to be operated by appropriate crew trained and familiar with the mission.

In summary, the primary considerations and criteria of a support vessel are:

- Use of appropriate number of support vessels (minimum of one; there can be too many, especially if encroaching on animal);
- Use of appropriate support vessel (size, range, seaworthiness, speed, safety equipment, uncluttered deck space for operations, etc.);
- Maintain appropriate distance (~70 meters) and position (off beam or quarter) to animal, trailing entangling gear, and an existing approach vessel to avoid complicating the operation, but at the same time lend assistance should it be needed;
- Maintain communication within and between platforms;
- Use of experienced vessel operator (experience with vessel, maneuvering around animal, and with operation);
- Use of experienced and trained crew in all necessary roles and procedures, and maintaining focus aboard the support vessel; and
- Do not attach or bring into the vessel (other than a bight of line) gear (*e.g.*, line and attached tools) that may still be attached to the animal.

The **approach or task vessel's** primary task is to provide an appropriately-sized platform as to hold the approach team, and be manageable, responsive, clean (as in no snag points), have an easily liftable engine, preferably minimal drag, be stable, and easily accommodate line handling and viewing. Typical platforms that make excellent approach vessels are soft-bottom inflatables between 4 and 7 meters (12 – 21 feet) in length. Such platforms typically accommodate closer approach work due to their responsiveness and simple layout.

The approach vessel should be as free of snag points as possible. Gear should be stowed or, if not necessary, removed and stowed on a support vessel. Only the gear that is required for that part of the mission should be in the vessel. The same holds for personnel. All crew, especially the helmsperson, should be very familiar with the vessel and its safe operation. Vessels should be used in training to increase familiarization with the tool. Like the support vessel, the helmsperson role on the approach vessel is critical. It is one of the most important roles.

The smaller, inflatable platforms may also provide a safe means to "tow" behind the animal once a working line is attached or established, allowing grapples to firmly attach to already existing gear (*i.e.*, set the hook), and for assessment of the animal (*e.g.,* its behavior and strength) and nature of the entanglement (*e.g.,* gear movement). Finally, they can act like an additional drag, similar to a "kegging" buoy if kegging constraint is required (see Sections 2.13.5 or 4.9).

When towing behind the whale (*i.e.*, Nantucket sleigh ride), the line attached to the whale is not secured (*i.e.*, tied, belayed, wrapped, etc.) to the vessel, but instead, in the case of an inflatable vessel, is placed over the surface area of the sponson (aka tube) at or near the bow as to use the friction of the material to allow the vessel to be towed. In such cases, the line is not brought into the vessel, but bent over the bow and back over the side of the vessel again. Towing should not be done from larger vessels as the extra drag provides force (*e.g.*, lines under load) and can result in lack of control that is dangerous for the animal and responders.

With the availability of longer pole systems, and other more remote means of working on the animals (*e.g.*, cutting grapples), larger platforms can be safely used as approach vessels. This is especially the case under circumstances in which a closer approach may not be required, and the advantages of the smaller platform are not realized (*e.g.,* no kegging). In some situations, a larger approach platform may be more beneficial, due to increased (yet still acceptable) sea conditions, the value of a higher and more stable platform, better angle of attack, and being otherwise safer (*e.g.,* from a companion animal, mother and calf, sharks, distance from shore).

In many cases the preferred platform may not be available, and the mission may have to be adjusted to match the vessel (tool) and its crew's experience. Vessels are one of the most important tools and, like any tool, the operator needs to know how to use it, or the tool itself will incur additional risk to what is already a high-risk operation.

In summary, the following are the primary considerations and criteria of an approach or task vessel:

- Use of appropriate approach vessel (size, uncluttered deck space for operations, easily liftable engine);
- Appropriate operating range and safety equipment for the location working in;
- Avoid or minimize time within the "danger zone" where probability of contact with animal and/or gear is greatly increased;

- Maintain communication within and between platforms;
- Use of experienced vessel operator (experience with vessel, maneuvering around animal, and with mission);
- Use of experienced and trained crew in all necessary roles and procedures, and maintaining focus aboard the approach vessel; and
- Do not attach or bring into the vessel (other than a bight of gear) gear (*e.g.,* line and attached tools) that may still be attached to the animal.

Aerial support:

While not discussed in any detail, aircraft (fixed-wing and rotary-bladed) may also represent valuable assets to a large whale entanglement response. Aerial assets can be used towards locating, assessing, documenting, monitoring (albeit limited), transport of crew and gear, and medical evacuation. UAS can represent a relatively low-cost means of providing efficient aerial assessment and documentation. If used appropriately (*i.e.*, not incurring additional risks), the use of UASs can also reduce risk by reducing the number of close vessel approaches by personnel. See Section 6 for more details on the use of UAS in large whale entanglement response.

Grabbing tools (grapple/skiff hook):

The most frequently used tool to gain access to the entangled animal, at least initially, is the **grab grapple.** It is used to attach a line to an entangled whale, that is otherwise inaccessible, by attaching to the gear entangling the animal. The grab grapple is a fairly remote tool, being thrown up to approximately 20 meters from the responders' approach vessel. It is used to attach the telemetry package, establish a working line, and attach kegging buoys and sea anchors. It functions by pinching the line between the tine(s) and the shaft, and is typically good for moderate holding times. For more accuracy and longer term holding, the pole-deployed **skiffhook** can be used. Once deployed, a line attached to the carabiner clip provides access. The skiffhook attachment is typically used as a secondary line (*i.e.*, after the grapple has established a line), where certain placement is required, in order to avoid additional trauma to the animal (*e.g.*, additional drag force to a tightly wrapped and traumatized limb), to avoid working with a line under extreme load (*i.e.*, from trailing gear or kegging buoys), and to leapfrog past or avoid gear that should not be handled (*e.g.,* gillnet or longline, or a tool that cannot be cleared). Once these tools are attached, the team should maintain heightened awareness while working directly behind the animal as to avoid having the tools attached to the working line be behind the response team as doing so poses a dangerous entangling situation for the approach team.

Telemetry:

In addition to specially designed tools that provide access, and help to constrain and thus free large, entangled whales, there are satellite transmitters that allow the Network to remotely track and monitor an entangled animal over time. The science is called telemetry, which is an important tool in large whale entanglement response efforts. Telemetry can be used to track and re-locate entangled whales that cannot otherwise be freed during the initial response due to limited resources (*e.g.*, experience of on-site personnel, proper equipment), and/or condition restraints (*e.g.*, weather, sea state, time of day, remoteness of location). Telemetry is also useful in those cases where an effort has been initiated, but terminated early due to sea condition considerations, or the behavior of the animal has made it dangerous for the rescue team, or for the welfare of the animal, to proceed.

Telemetry may also prove that an animal has been able to self-release (*i.e.*, rid itself of the gear), by potentially tracking the location of the shed gear. As such, telemetry increases the safety of entanglement response operations, and may assist in its overall success.

The Network presently uses a combination of Argos (polar-orbiting satellites), GPS-based (geo-stationary satellites) and VHF radio transmitters housed in a single cylinder, as its primary telemetry package to track entangled whales for response purposes. The telemetry package is secured within a telemetry buoy (a 14" trawl buoy held within a stainless-steel collar), and attached to the entangling gear. The buoy is ballasted to maintain the transmitter in an upright position, clear of the water, and towed from a bail that allows the buoy to clear itself should it become fouled with debris or kelp.

A lower drag buoy is currently being developed and tested by The Nature Conservancy that also utilizes cutting edge technological hardware to maximize the responder's ability in relocating the tagged, entangled whale. However, in the meantime and in addition to, the Ross timed-release clips can be used to attach the buoys to the entangling gear, providing a predetermined time that the buoy will remain attached. Should a response not be possible, and the telemetry buoy remain attached, the telemetry buoy should detach at a specified point in time. The Ross timed-release clips use predetermined galvanic releases built into the clips, like the loop of a pelican hook, to hold the clip closed until they dissolve and weaken in the saltwater. They can also be used for attaching moderate-sized kegging buoys for longer-term use. However, the clips are not strong enough for the full kegging process. For additional details, see the Ross timed-release user manual in Appendix K).

The development of any new tool or technique presents safety and logistical usage concerns that need to be well thought out and tested. For this reason the MMHSRP permit (as described under "Training and Tool Development" in Appendix 4 of the permit) requires that any newly proposed tool and technique be thoroughly defined and tested prior to approval in a field setting.

In addition to the telemetry buoy and transmitter, telemetry kits include VHF receivers, antennas, and more recently Argos Goniometers. The VHF receiver will initially be used when initiating the tag to ensure a signal is being transmitted and to confirm (*i.e.,* fine-tune) the VHF tag frequency (VHF tag frequencies can drift over time and fine-tuning frequencies can gain miles of receiving range). The remote access of satellite-obtained fixes, along with the line-of-sight, real-time positioning obtained from the VHF receiver and connected antenna, allow for the re-location and monitoring of an entangled whale. Some teams have use of Argos Goniometers that detect the strength of the transmission and the direction towards the platform along with any GPS positions, for real-time, in-the-field relocation of an entangled animal. See Appendix J for sample telemetry instructions.

Other types of transmitters, such as penetrating, surface anchoring and suction-cup tags, have and can also be used. Such transmitters and their use may require additional approvals and safeguards.

Poles:

Over the years, poles have become lighter, longer and stronger; they allow the user to maintain a greater distance from the animal to avoid the danger zone. The danger zone is that area around the animal that a responder is at higher risk of being hit by the animal (*i.e.,* within reach of flippers and/or tail), or can become directly or indirectly (*e.g.,* the vessel) entangled in trailing gear. Poles are typically telescoping or come as separate units that can be secured to each other. Pole lengths can vary from 2 to 11 meters (~7 to 35 feet). However, 8.5 meters (28 feet) is typically the maximum that can be handled, with the longer lengths being used from a larger, more stable platform (*i.e.,* primary vessel). The greater pole length in part allows for the use of larger platforms, even though they may be less responsive (*i.e.*, maneuvering and tilting engines out of the water). Poles can range from off-the-shelf general painter's and utility poles, to the more expensive, and higher quality, carbon-fiber poles. Poles may attach to specially designed sockets which are used for deploying flying knives and grapples. Poles can also be used to mount point-of-view (POV) cameras, such as GoPros, to obtain underwater documentation towards assessment, or with a knife to document a cut. When poles are used, helmets should be worn by the person handling the pole, as well as those team members in proximity (*e.g.,* on the bow of the large vessel or within the smaller task vessel). Note: poles become directly connected to and an extension of the animal at the point of tool attachment or when cuts are being made, until such time the tool has cleared or the cut has been made.

Constraining gear (kegging buoys and sea anchors):

In those cases where the entangled animal has a limited surface interval, is fast moving, evasive, or otherwise inaccessible; and/or its movements are unpredictable and potentially aggressive; and otherwise appropriate for the animal (*e.g.*, not causing additional injury or a radical negative response), constraining techniques may be used. Such techniques have the goal of slowing the whale down (but not necessarily stopping it), keeping it at or near the surface, and controlling its movements somewhat (as much as one can control a multi-ton animal). The primary constraining technique is 'kegging,' a modification of an old whaling technique, in which harpoons attached to barrels (kegs) were thrown at the whale to add drag and buoyancy in order to slow and keep the whale at the surface.

Response team "kegs" whale to gain access to the animal and entanglement (CWR/ NOAA MMHSRP permit # 18786)

In large whale entanglement response, polyball buoys (typically A3s and A4s) are methodically added to the established working line to create drag and buoyancy forces. Under certain circumstances, a sea anchor, a funnel-like device, may be attached to provide more drag. Sea anchors should have their attachment straps stitched along the entire length of the sea anchor and, for most species, have a meter-wide mouth or less. Right whales and blue whales may require large-mouthed sea anchors. Multiples of both kegging buoys and/or sea anchors, and combinations of the two, can be used. However, they should be added methodically (approximately every 20 minutes as a rule), and one at a time, to reduce stress on the animal, and decrease the chances of any unwanted radical response (*e.g.*, thrashing) from the animal that might increase risk for the animal and response team. The key is being patient, and using the number of buoys needed. Be aware of the load forces on the 'loaded' line, and its potential impacts to the animal and the response team. Avoid loading a line that is attached to deeply embedded wraps as they may cause additional trauma and discomfort to the animal and a negative response. Whale limbs have been amputated from the kegging process. Since loaded lines represent additional risk to the response team, if possible, attach or establish an unloaded line as a new and separate access line towards handling. As with the attachment of the telemetry buoy, the Ross timed-release clips can be used, but note they can only handle so much force. As with the tools themselves, avoid getting between the kegging buoys and/or sea anchor, and the whale, as the loaded line is typically not safe to handle.

Cutting tools:

Most of the knives used to free whales are hooked, presenting dull outer surfaces that protect the animal with an inner blade(s), angled to facilitate efficient cuts, while using the mechanical advantage of pulling and/or simple drag and buoyancy forces to make cuts. Most hooked knives are deployed by use of a pole system. Some remain **fixed** (*i.e.*, remain affixed to the pole), while others are meant to be placed and released **(flying),** with a line attached to the knife allowing the team to fall back away from the animal, and provide a more remote and safer means of cutting. In general, fixed knives are more appropriate for entanglements that lie further back on the body (*i.e.*, generally behind the dorsal fin), are less complex, and when the entanglement/animal are more accessible. In this case, overall risks are reduced so that they might allow a responder to remain behind the animal in a safer zone (see zones of response). Flying knives are more appropriate for entanglements that involve the mouth, pectoral flippers and body wraps ahead of the dorsal fin, which are more complex, involving multiple lines or cordages of line, less accessible, and in general, exhibit higher risk as they may place the responder alongside or above the animal for a period of time – the danger zone. However, due in part to the death of Joe Howlett, and the continued effort to reduce risk, as well as the unpredictable nature of large whale entanglement response, the use of flying knives should be prioritized (*i.e.*, a flying knife can be held in position and operated as a fixed knife and released if circumstances dictate). While hooked knives generally work well cutting lines, they tend to bind when attempting to cut finer mesh nets (*e.g.*, gillnets). To maintain contact, provide enough action, and yet not bind the gear, slightly serrated, longer, and minimally curved blades are more appropriate for gillnets. A good example is the **Spyderco "Whale Knife" (aka Coughran blade)**. Pole-deployed knives generally reduce risk by reducing proximity and time near the animal, but also provide some accuracy of knife deployment.

Thrown knives, such as a **cutting grapple** (*i.e.*, a grapple with knife blades incorporated in its tines), decrease proximity to the animal and gear, and thereby decrease risk, but also generally reduce accuracy in deployment. Cutting grapples cannot only be used as a disentanglement tool, but can also be used as a safety tool, for they can be rapidly and remotely deployed to sever an unanticipated and dangerous connection between the whale and the team.

Many specialty knives have been developed and tested over the years. For instance, Scott Landry, from the Provincetown Center for Coastal Studies (PCCS), came up with the idea of using a broadhead arrow deployed from a crossbow (the Turkey Guillotine), to cut otherwise inaccessible lines that might be under tension (*e.g.*, a tight wrap, under load, around the head of a North Atlantic right whale). The knife has been used successfully on three response efforts. Chris Slay, of Coastwise Consulting, developed a pole-deployed, guillotine-type knife towards the use of embedded lines. The "Slay" blade has also been used to successfully free numerous entangled whales.

Documentation gear:

Digital single lens reflex (DSLR) cameras, video cameras, GoPros and other point-of-views (POVs), along with cameras flown from UASs, can be used to document response efforts. DSLRs, video cams or comparable cameras with a variety of lenses accommodate distant and close fields of view, as well as, still and video imagery. POV cameras (*e.g.,* GoPros) mounted on helmets, parts of the vessel, and poles provide different perspectives, are somewhat hands-free, remote, and can accommodate documentation during response efforts (*e.g.,* a helmet cam documenting the attachment of a grapple to trailing gear from the thrower's perspective). If conditions and environment allow, pole-mounted POV cameras and/or housed DSLRs can be placed in the water to provide full-body, entanglement configuration, and gear identity imagery. However, members of the response team should never get in the water to document the animal and entanglement directly. Live-streaming, pole-mounted POVs, in combination with a pole-mounted knife, may aid in making more accurate cuts to entangling gear (*i.e.,* like a surgeon during an operation). The use of UASs or aerial drones provides an aerial view of the animal and entanglement, providing information on the condition of, and impact to, the whale (*e.g.,* photogrammetry and wound analysis), configuration of the gear, and behavior of the animal. If used appropriately, aerial drones can reduce response risk by remotely providing assessment and thus reducing the need for responders to closely approach by vessel in order to assess the whale and entanglement. However, aerial drones can have their own risks and regulations exist for their use (see Section 6 for additional details on aerial drone use in large whale entanglement response). Images and video obtained during a response can be valuable for follow-up assessment and as training tools. As is the case with all documentation gear, it is only useful if fully-charged batteries and memory cards are available. This is a valuable role that the Documenter or Equipment Manager functions in.

Sampling gear:

A biopsy sample or the attachment of a monitoring tag is typically done after the animal has been cut free or the effort otherwise terminated. Biopsy samples are typically obtained with the use of bolts or darts shot from crossbows or air rifles. In addition, tags with a variety of sensors (*e.g.,* depth, location, acoustics, pitch and roll, and/or video feeds) can be attached to the animal to better understand the impact of and behaviors associated with entanglement. Aerial drones can (and are) also used to collect whale exhalant and tissue samples towards genetics, body condition analysis and stress indicators.

Personal protective gear:

The most important resources in large whale entanglement response efforts are the people – the response team. Human safety is paramount and as such personal protective equipment (PPE) is a critical component. Typical PPE includes an appropriate PFD, gloves, helmet, and a safety knife. Additional protective gear might be warranted due to environmental or operational needs (*e.g.,* sedation attempt, infectious environment). While not protective gear, adequate hydration and food are also important to providing protection (*e.g.,* a dehydrated body is prone to injuries).

PFDs will vary depending on role and environment. For colder environments, drysuits, full worksuits or float jackets may be required, while for warmer climes, type III work vests are more appropriate. Beware that large whale response can be strenuous, and overheating is a concern.

Remember, if a responder is thrown or falls overboard, that as long as they remain afloat, the support vessel should recover them in short order. However, in all cases the PFD needs to fit well, and if used in the approach vessel where the wearer is likely to be handling gear attached to the animal, should be as free as possible of snag points. Water-activated (only) yoke-style PFDs, should not be used within the smaller approach vessel.

Gloves, like PFDs, should fit well and protect potential line handlers and cutters from rope burns and cuts. To provide dexterity, the glove fingers can be cut off to the second knuckle from the index, third and fourth fingers, and still provide adequate protection. In colder climes, reinforced neoprene or thermal gloves may be needed.

Helmets provide protection and should be worn by any member of the team that approaches the animal and/or is using poles, or are in the proximity of a team member using poles. Remember that pole work represents an extension of the animal for a period of time while a clip is snapped in or a line is cut. Whether a grazing contact from the animal or a wayward pole, a well-fitted, high-quality helmet may save a response member’s life.

Safety knives represent any high-quality knife that can be easily operated with one hand. Their primary purpose is to cut the vessel, a piece of equipment, a teammate or oneself free of any inadvertent gear that might also be attached to the animal. Safety knives should not be used as utility knives but maintained for their specific purpose. Safety knives should be attached on one’s person to be readily available. Recoilers can be used but should be of such a material (*e.g.,* nylon and not stainless steel), so the lanyard itself can be readily cut if necessary.

PPE will vary depending on one’s role and the environment. Proper clothing and footwear, sun protection, and eye protection should be used as necessary. Additional gear such as knee pads and visor add-ons to helmets can be beneficial. In addition to PPE that might help protect a responder, jewelry, loose clothing, and long hair, needs to be removed or otherwise addressed.

2.6 Communication

Clear communication is essential throughout an entanglement response. It is important to maintain clear communication from receiving the report, planning for the response, during the response and after the response. Examples of initial communications are vetting the report with the primary observer, coordinating standby support, providing an initial alert to the response team, and arranging for rapid first response. If the report is confirmed and response is warranted, planning communications involve notifying regional coordinator(s) and getting any required approvals (*e.g.,* providing an initial IAP), arranging resources (*e.g.,* OO; vessel support), coordinating logistics, alerting and coordinating a response team (pre-mission briefs), and giving NOAA media leads a heads-up. During a response, communications need to be maintained among team members (*e.g.,* within and between vessels), between the on-site response team and shoreside and coordinating contacts, and between associated support parties. It is the role of the on-scene Communications Officer to relay information to a shoreside contact who then relays the information to other appropriate parties. Examples of post-response communications involve debrief calls and reports, investigation towards prevention, and dissemination of information, including appropriate and cleared communications with the media (*e.g.,* news outlets, website updates, and social media).

The use of authorized, members-only entanglement response websites provide near real-time alerts of reports, case reviews towards preparation, and a repository of past cases (though they do not represent or replace official databases) and associated resources (*e.g.,* checklists and manuals) towards increasing responders' understanding of and preparedness for large whale entanglement response activities.

Common means of on-water/on-site communications include handheld very high frequency (VHF) marine radios, satellite phones, cell phones, and two-way radios (*e.g.,* walkie talkies). Some applications for phones (*e.g.,* Zello) allow a cell phone to be used as a walkie talkie and send group texts. Some communication equipment is geared towards emergency use, like EPIRBs (Emergency Position Indicating Radio Beacons) and satellite-based communications (*e.g.,* InReach). All communications equipment should be checked and verified to be functioning, and appropriate personnel trained (*i.e.,* familiar) on their use. This is especially important in the event of an emergency.

U.S members-only password-protected websites:

Atlantic Large Whale Disentanglement Network: https://alwdn.org

North Pacific Large Whale Entanglement Response Website: https://www.whaledisentanglement.org/

Sharing of information with general public - news outlets and social media:

The IC must coordinate with the National LWERC or MMHSRP lead, Regional Stranding/LWERCs, and the NMFS Office of Communications/media leads concerning higher-profile entanglement response events. NMFS Office of Communications and otherwise assigned media leads will take point and coordinate media response/efforts. If responders are contacted by the media for an interview, they should work with the NOAA Office of Public Affairs and/or assigned media leads in responding. Some media (*e.g.*, social media) will need to be approved before posting. All media interviews should be considered "on the record." Media personnel should never be part of the approach or support teams (*i.e.*, aboard support or approach vessels) and are rarely on-site.

Always remember that the entanglement response comes first. Responders are NOT required to speak to the news media. See Appendix E, *Media Guidance document created for the West Coast Region*, for more detail on how to work with NMFS on Media.

2.7 Data Collection

The collection of data is a critical component of large whale entanglement response, as gaining information to reduce the threat, testing existing mitigation measures, and increasing the safety and efficiency of response for humans and the animals, are the primary and ultimate goals. Data collection starts on receiving the entanglement report to confirm and obtain an initial risk assessment (see Appendix F for examples of reporting data forms) and proceeds throughout the effort.

Additional data forms and checklists corresponding to different aspects of the response (*e.g.*, obtaining samples, photo-documentation, telemetry, sedation, UAS operations) or dataloggers, are used to garner as much information on and from the effort as possible. Data needs must be well thought out prior to the start of any entanglement response effort.

Data forms geared towards evaluating the animal and entanglement, along with operational risk assessment are typically used in early stages of the response, as they will be used to produce an IAP. Checklists should be developed and used. Checklists are data forms that help evaluate, assess and share the information in hand as to make informed decisions. Floatplans, risk assessment GARs, and decision matrices are all good examples. See Appendices D, F, I, L, M, and T for examples of checklists. Important forms for preparation prior to response may include: applicable permits; reporting forms (Appendix F), Level A and Human Interaction Forms (Appendix A); gear checklists (Appendix D - Gear Checklist); response data forms (Appendix F); response checklists (Appendix I); telemetry instructions (Appendix J); Photo-documentation (Appendix R); biological sampling (Appendix S); UAS use checklist (Appendix T); sedation worksheets (Appendix U - Remote Sedation Worksheet); and media checklist (Appendix E – Media Form). A data manager is typically assigned the role of coordinating and managing the collection of information during a response. All entangling gear should be retained, documented on the Level A and Human Interaction Form, and stored in a centralized location.

The imagery obtained during response is another example of documentation. Not only does it have great value, but it is required under the MMHSRP permit. Documentation helps confirm reports, assist in evaluative and operational assessment during response, and researchers and managers assess the impacts of the entanglement and any mitigation measures. Additionally, its use in outreach and education promotes awareness and stewardship, and its use in debriefs and future training reduces risk.

The documenting vessel should maintain a safe distance and avoid getting in the path of the animal and effort. The best location is typically beside and slightly behind the animal and/or primary approach vessel. If an effort is underway, the documenting vessel should maintain at least 70 meters (75 yards) distance from the animal and approach vessel. If possible/safe, and while maintaining the above, the documenting vessel should work with the vessel helmsperson to ensure a good view and minimize glare. A good location on the vessel should be selected that allows flexibility, stability, personal safety, and avoids obstructions (*e.g.*, antennas). Documenters must watch themselves and avoid getting caught up so much with documenting the event that they put themselves at risk. Furthermore, documenters are in a role that allows for assessing the overall operation. If they see someone doing something wrong/unsafe, or any risk, they must point it out. Appendix R has documentation instructions. The following represents some of the primary aspects of large whale entanglement response that should be documented:

Animal:

- Identity (species as well as individual)
- Health (body condition, cyamids, blisters, color and texture of skin)
- Wounds (location, severity, identity of source)
- Behavior

*Document the entire animal and its behaviors beyond what is outlined above and what might at the time appear associated with the entanglement, as others may be able to glean additional information from the comprehensive documentation.

Association with other animal(s):

- Conspecifics
- Other species (*e.g.*, dolphins)
- Predation threat (*e.g.*, sharks)

The entanglement:

- Gear type (*e.g.*, buoys, configuration of gear, close-ups of line)

- How entangled (*e.g.,* origin, # of wraps, how tight, where it is not entangled)

The rescue operation:

- Initial approach
- Assessment
- Documentation (photograph the other guy taking pictures)
- Establish a working line (*e.g.,* grapple throws)
- Line handling and Nantucket sleigh ride of approach vessel
- Attaching telemetry
- Kegging (attaching as well as towing buoys)
- Use of sea anchor
- Cutting (fixed knife and flying knife cuts)
- Safety (personnel with PFDs and helmets)
- Retrieval of gear
- Team image (*i.e.,* to illustrate that it is a team effort)

Sampling is another category of information. This can represent a biopsy sample of skin and blubber for genetics, health assessment, and stress analysis. Biopsy samples are typically obtained with the use of bolts or darts shot from crossbows or air rifles, and require additional training. In addition, tags with a variety of sensors (*e.g.,* depth, location, acoustics, video feed) can be attached to the animal to better understand the impact of and behaviors associated with entanglement. However, disentanglement operations and safety should be prioritized over any additional sampling. In many cases, the biopsy sample or the attachment of a monitoring tag is done after the animal has been cut free or the disentanglement effort otherwise terminated. The most important sample to obtain from a disentanglement effort, if safe to do so, is the removal and recovery of the entangling gear.

2.8 Training

Responders in Alaska conduct training (D. Gann/ NOAA PRD-AKR)

Training is an important aspect of large whale entanglement response. It provides a better understanding of the complexity and risks when responding to an entangled large whale, and at the same time allows for greater familiarization and strengthening of the skills and tools required of particular roles, and their culmination into a safe and efficient team effort. Trainings also have the added advantage of testing equipment, which, due to the nature of entanglement response, may be infrequently used. Ongoing trainings or refreshers, not only help maintain skill sets and familiarization, but also help responders remain current with any changes in gear, protocols and technology, as well as promoting team communication, coordination and overall team cohesiveness.

Large whale entanglement response trainings involve basic first responder, which provides background on the threat and first responder roles, and more advanced, multi-day classroom, and on-water firsthand examples and simulations, led and supervised by an experienced, higher-level responder(s). Responders are typically trained in proper tools, protocols and techniques of planning and logistics, approaching an entangled animal, assessment and documentation, safely attaching transmitters and other means of monitoring the animal, continuous risk assessment and communications, the on-site decision-making process, cutting the animal free or standing down, collecting valuable animal and entangling gear information, and the debriefs and post event investigation that might further reduce both operational and evaluative risks associated with large whale entanglements and their authorized response (see Appendix H for example of a training agenda).

First responder trainings have also been provided in CD format, and most recently as an online course developed as a partnership between NMFS and The Nature Conservancy (see below for links to the different regional online first responder training courses). Trainings may focus on specific skill sets or roles (*e.g.,* documentation, telemetry, data, sedation), or be required or recommended for specific activities/roles (*e.g.,* firearm awareness for biopsy and sedation roles, UAS piloting for effective entanglement response documentation and assessment). Training should evolve with the experience of the trainee and information gained. The use of life-size models, albeit representing parts of the animal, like a peduncle and/or fluke, will elevate the level of the training and provide more scenario-based training exercises (*e.g.,* close reach vs far, tight wraps vs loose, inaccessible weighted lines vs accessible buoyant lines). Some training focus on general preparedness and emergency response, and may be required depending on their role and regional response protocols (CPR and first aid, ditch training). Training opportunities may also include longer term (*e.g.,* weeks to months) apprenticeships to allow the trainee to immerse themselves, and potentially receive supervised hands-on experience in an actual response, as well as general animal behavior and close approach techniques. Since skill sets need to be maintained, training should be continuous in the form of refreshers. However, much of the training is through supervised, hands-on experience, in actual response efforts, as opportunities might arise, starting in lower-level support roles (*e.g.,* documenter, data person, communications). Training, along with hands-on experience, are major requirements towards receiving level designation within MMHSRP's large whale entanglement response network.

Responders hone their skills during scenario-based response trainings and refreshers (NOAA HIHWNMS)

Level 1-2 online first responder training links:

- Pacific Islands online first responder training: https://pacific-islands-training.whaledisentanglement.org/
- Alaska online first responder training: https://alaska-training.whaledisentanglement.org/
- West Coast online first responder training: https://west-coast-training.whaledisentanglement.org/
- East Coast online first responder training: https://east-coast-training.whaledisentanglement.org/#/

Potential responders from around the globe undergo response training as part of CCS' apprenticeship program

More than anything, whether increasing or maintaining skills and proficiency in a particular role or with a particular piece of equipment, training helps mitigate risks, and should remain a regular component of large whale entanglement response efforts. While these Best Practices provide review and guidance towards large whale entanglement response, they are not meant to replace actual trainings, but to complement them. As such, the contents of these Best Practices do not represent an instruction manual on how to best free an entangled whale.

Responders in Hawai'i use a fabricated life-size whale tail wrapped in lines to train (NOAA HIHWNMS)

2.9 Environment and Weather

By its very nature, large whale entanglement response occurs on the ocean with limited protection, sometimes in remote locations, and is easily influenced by weather conditions, which typically pose risks that need to be considered and addressed (*i.e.*, part of an IAP risk assessment).

Consideration of weather forecasts is essential prior to response. Responders should consider wind, precipitation, fog, sea state, and any forecasted or probabilities of changes in weather. Environmental conditions that should be assessed include tides and currents, as well as air and water temperatures. The remoteness of the site is an important consideration, especially as it applies to proximity of a safe port (harborage), and medical attention (facilities). Length of day and time of day (*i.e.*, amount of daylight remaining), are also critical considerations. During the winter, the length of day may limit certain response efforts, especially if compounded by other environmental factors like remoteness and weather considerations. The same holds true for what response actions are possible based on the time of day. For instance, while length of day remaining might not accommodate a full disentanglement effort, it might allow for the assessment and tagging of an animal towards a future response.

In addition, the assessment of weather and other environmental conditions, through forecasting and real-time/on-scene assessment, is a continuous and ongoing process. Considerations for the near-term, and the long-term, may all have bearing on operations. A good example is, once again, the attachment of a transmitter to track the animal towards future efforts. Considerations in the near term would involve being able to mount an effort to assess and potentially tag the animal, while in the longer term, it is about having a weather window to safely mount a follow-up effort. If a hurricane is approaching, it may not be a good idea to tag what is likely a migrating animal (*i.e.,* it may move out of an area of response within the week).

Assessment of environmental conditions may dictate never initiating a response mission, limiting its scope, or otherwise tailoring the mission as conditions might allow (*e.g.*, tagging an entangled whale rather than continuing disentanglement efforts) or aborting a mission that is underway.

Environmental conditions not only influence the decision on when to mount or abort a response mission, but in those cases in which assessment has determined a response is possible, it will have a bearing on what resources are needed. For instance, a midday effort, offshore in a Beaufort 4, may allow an assessment effort, but would likely require a larger vessel to handle the range and sea state conditions (*i.e.*, "As conditions and resources allow"). See Procedures and Mission Complexity (Section 2.11 and in other sections) for more examples and details.

2.10 Preparation and Planning

Prior to response:

While some large whale entanglement reports might involve long-term standby support, an animal that has been tagged, or an anchored animal allows time to further plan and prepare for a response. In many cases the response to entangled large whales represents being on-call, and if conditions and resources allow, potentially mounting a rapid response. As such, proper planning and preparation is typically that much more critical to mission success and safety. As much as possible, resources, including vessels, response equipment, medical and emergency gear, documentation and communication equipment, and personal response gear (*i.e.*, PPE) need to be maintained, organized and readily available during times in which reports are likely to be received and conditions generally warrant response efforts (*i.e.,* within season). Planning and preparation lays the foundation towards a more efficient and safer response.

Some of the key points that should be addressed at the various stages of pre-report planning and preparation, offsite pre-response planning, on-site pre-response planning, response operations (or standing down), and post-response operations and planning, are:

Pre-report planning and preparation:

- Outreach and education (increase awareness and promote stewardship towards reducing the threat and increasing reporting of entangled whales);
- Equipment readiness/checks (maintained, available, batteries charged, etc.);
- Personnel availability and readiness (roles, contacts, authorizations);
- Trainings (review of roles/procedures and use of equipment);
- Authorizations/permitting; and
- Pre-season briefs (review important and/or new protocols, equipment, procedures)

Response (see Section 2.11 below for general procedures on large whale entanglement response)

Post-response operations and preparation/planning**:**

- Safeguard data collected and pursue/investigate to garner additional information;
- Clean, charge, repack and otherwise prepare gear for next mission (the next call could come in the next day);
- Work with the media coordinator to prepare, authorize, compile and disseminate approved documentation and messages for media (social, network, cable, etc.);
- Perform debrief and compile reports (*e.g.,* update level A); and
- Remedy deficiencies (acquire new gear, repairs, trainings).

Additional details regarding preparation and planning are addressed within specific operations. Examples of response checklists are provided in the appendices.

2.11 Procedure – Mission Complexity

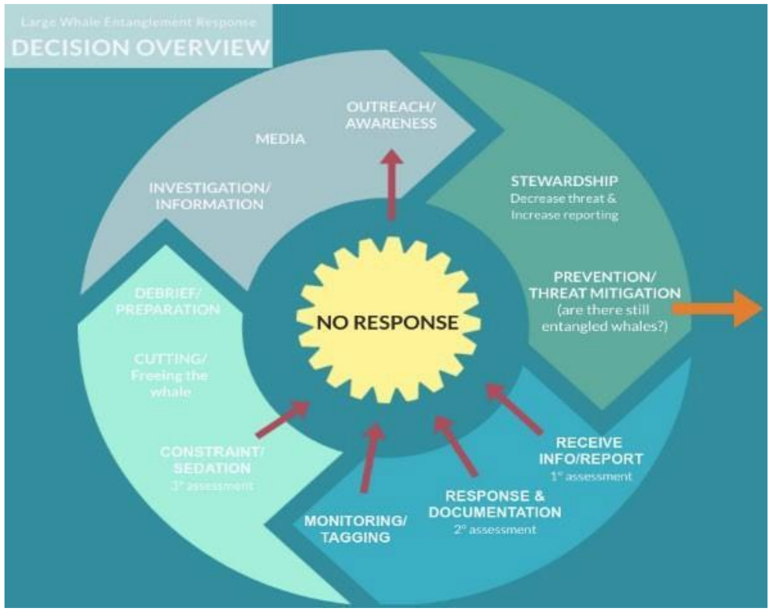


Figure 3: Large whale entanglement response procedure and decision overview

Procedures will vary depending on the type of entanglement response. However, there are certain common themes to any response effort and SOPs that will apply across all types of efforts. While greater details regarding specific procedures are presented in the sections below, the general sequence of events is outlined here:

1. On receiving the report, assessment begins, and will continue throughout the broader response. The first or 1º assessment represents confirming the report, and if confirmed, determining whether the entanglement is life-threatening, or that the animal is otherwise a candidate for response (*i.e.*, evaluative assessment of the animal).

2. Determine if there is appropriate capacity to respond - operational assessment. Do conditions and resources allow?

3. If the above criteria are met, along with any additional reporting and authorization requirements, a response may be mounted. Concurrently, monitoring efforts may have been implemented (*e.g.*, standby support may be requested for an immediate response, a response targeted over days might implement tethered-tag monitoring, and potential longer term response might alert the on-water community to appropriately monitor).

4. Once on scene, 2º assessment and documentation is obtained. Is the animal truly entangled? Is the entanglement indeed life-threatening?

5. If criteria for evaluative and operational assessment are still met, continued response will use 3º

assessment and decision matrices to determine what actions can and should be done. Whether to cut on the fly – no constraint, sedate, or constrain the animal? Whether to use a fixed knife or a flying knife? Whether to approach from a smaller and more maneuverable vessel, or a larger, higher, more stable vessel? One very important action is inaction, or aborting an effort or mission due to safety concerns. Many of these actions, their decision processes, risk assessment and mitigating measures are outlined in more detail in later sections.

6. If all criteria are met, then disentanglement of the animal may be carried out (or again, the mission aborted).

7. Whether successful or not, debrief to review lessons learned, remedy deficiencies, and prepare for the next effort.

8. With knowledge gained from response and further investigation, pursue overall risk mitigation (*e.g.*, risk to animals, risk to fishing industry, risk to public, and risk to responders). Share information and findings within the Network and with partners.

9. Sharing appropriate information with the Media as a means to continue outreach and education, completing the cycle until information gained reduces the threat and its associated risks, and entanglement threat is no longer deemed a concern (or leave the cycle of response as depicted in Figure 3).

Note at any point, efforts can be terminated. See Figures 3 and 4 for illustrated depictions of large whale entanglement response primary actions and decision processes.

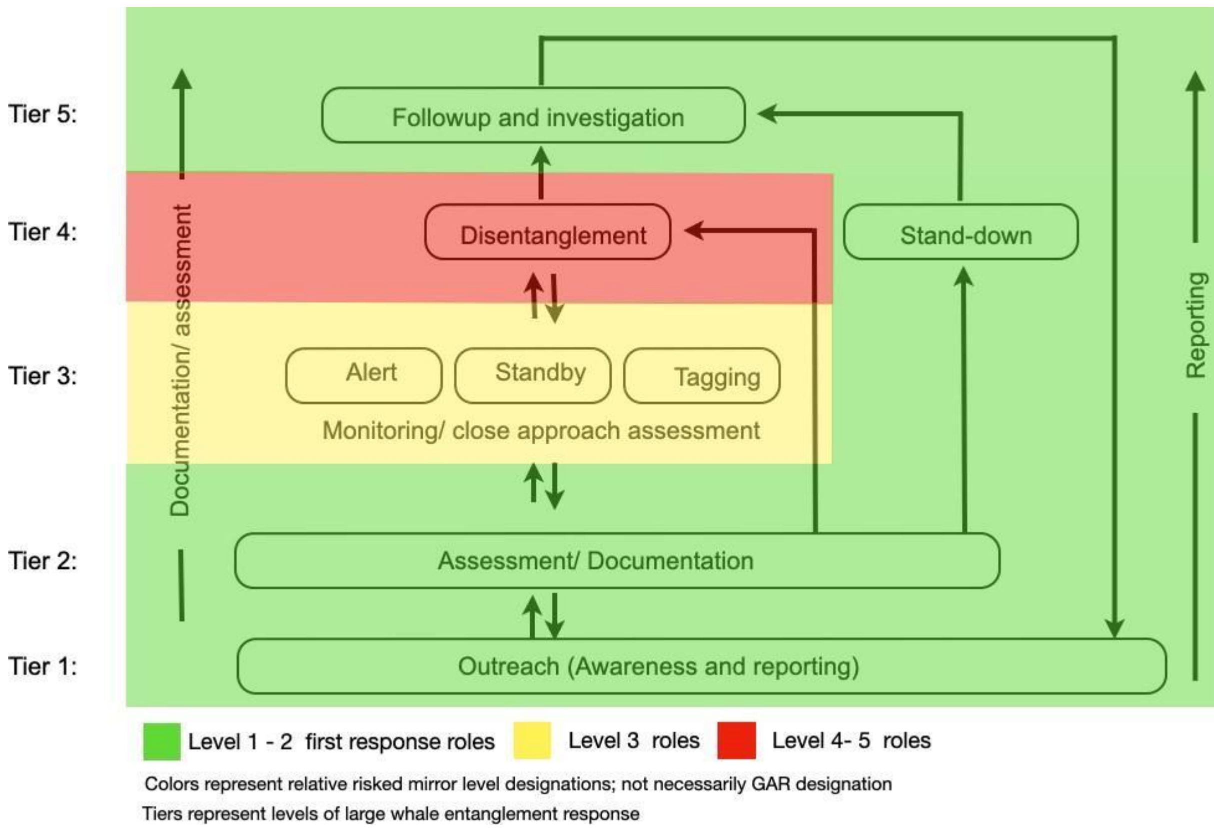


Figure 4: Large whale entanglement response flow diagram

Some details that combine general procedures of large whale entanglement response efforts with that of continued planning:

<u>Pre-response planning:</u>

- Vet (1º assessment) report (is the entanglement confirmed; likely life-threatening?)
- Check availability of rapid response/nearby appropriate first response and/or monitoring
- Check weather and other environmental conditions (*i.e.*, conditions conducive towards response?)
- Availability of response team (authorized IC/CI? alert team; fill roles)
- Acquire gear, including PPE; load response vessel
- Setup and turn on telemetry for initial testing (notify shoreside contact)
- Draft initial IAP and conduct GARs
- Ensure authorizations (*e.g.*, contact NMFS OPR, Regional Stranding and Entanglement Response Coordinators, appropriate agency leads – state and federal, sanctuaries, reserves, parks, etc.)
- Establish shoreside contacts; post floatplans
- Establish initial roles; crew responsibilities (CI, SO, communications, data, telemetry)
- Continued communications with on-site observer, potential monitors, NMFS, and leads

- Conduct safe transit (*e.g.,* appropriate speed, maintain observers, range limits based on load and medical attention)
- Prepare appropriate gear enroute (*e.g.,* cameras, telemetry, safety gear; start collecting data)

Response planning:

- Locate animal and conduct 2º on-site evaluative assessment
- Conduct on-site risk assessment *(i.e.,* operations GAR)
- Consult decision matrix – prior to operations and on scene, determine if conditions allow for safe operations, and make a final decision about response
- Update IAP, including establishing roles for any engagement of animal
- Update shoreside contacts on IAP, GAR
- Launch inflatable (*i.e.*, approach vessel) and/or last step equipment readiness
- Conduct safety briefing/review checklists Response operations:
- Safely and methodically follow prescribed procedures and protocols provided by GARs, decision matrices, authorizations and any on-site supervision (*i.e.,* CI and SO)
- Maintain vigilance and conduct continued risk assessment (personnel, resources, weather, animal). Changes in conditions, resources, and assessment may dictate changes in procedure (*e.g.*, concerns over fatigue may require rotating personnel), including termination (*i.e.*, abort mission)
- Maintain communications throughout (including shoresides)
- Collect data/information (including tissue samples when appropriate and recovery of removed or discarded entangling gear)
- Document all aspects of animal, entanglement and operations
- Abort mission if necessary; no obligation

2.12 Risks and Mitigation

Large whale entanglement threat and its impacts, along with the associated response, are complex and potentially dangerous. In order to mitigate risks of large whale entanglement response to humans and animals, comprehensive entanglement response safety plans, risk assessment documents, and decision matrices should be drafted and implemented. These, along with safety plans and risk assessments specific to partner agencies and organizations (*e.g.,* USCG) that may provide support, are all instrumental towards maintaining a safe and productive response.

Considering the five steps of risk assessment, safety briefings and pre-mission briefs should occur prior to any entanglement response effort to identify the risk factors. In addition, risk analysis and decision matrices to determine who/what might be harmed, along with evaluating the risk factors and possible mitigation, should be completed to guide responders and managers in making safe, informed decisions regarding the authorized response to entangled large whales under NOAA's MMHSRP. Incident Action

Plans (IAPs) should be drafted to record the risk factors and their mitigating measures, and implemented within the response. Lastly, monitor and review the mitigating measures, one of the primary goals of this document, as to determine their effectiveness. Good data is needed to make informed decisions towards risk mitigation.

Figure 5: Five Steps of Risk Assessment

Responders should prepare, plan, and practice for possible risks and identify mitigation measures for these risks prior to any response. Trainings, especially more advanced, scenario-driven simulation trainings, can be an excellent means to identify and mitigate risks. On completion of any response, thorough debriefs or after-action reports should be drafted, outlining risks incurred, lessons learned, and additional mitigating measures that can be applied to the next response and/or shared with others.

The variability in entanglement type, entanglement configuration, animal state and condition, location and conditions, experience and availability of responders and resources, causes risk evaluations to be dependent on circumstances. It is crucial to large whale entanglement response operations that response risk be continuously monitored throughout (in real time) to minimize the likelihood of negative consequences and uphold safe operations. Risk assessment and its mitigation is an ongoing process; it is never complete, as there is always room for improvement. Safety plans, risk assessment documents, and even these Best Practices should be updated continually and frequently (hence the cyclical depiction of the five steps of risk assessment in Figure 5).

However, there is one principal risk factor that always applies to both the animal and the responders-the approach, and resulting proximity, of the entangled whale and responders to each other. This higher risk area is referred to as the "Danger Zone" and represents the area around the animal in which harm to the whale and/or responders is more likely. It is the area in which direct contact can occur to the animal from a vessel or to the responders from an animal's flipper, tail or other part of the body. Contact can also occur indirectly from responders or the approach vessel getting caught in trailing gear entangling the whale. Figure 6 shows the "Danger Zone" around an entangled whale and the other operational zones depending on the plan and the approach vessel's role (*e.g.,*1º assessment, documentation, and tagging vs monitoring and standby support).

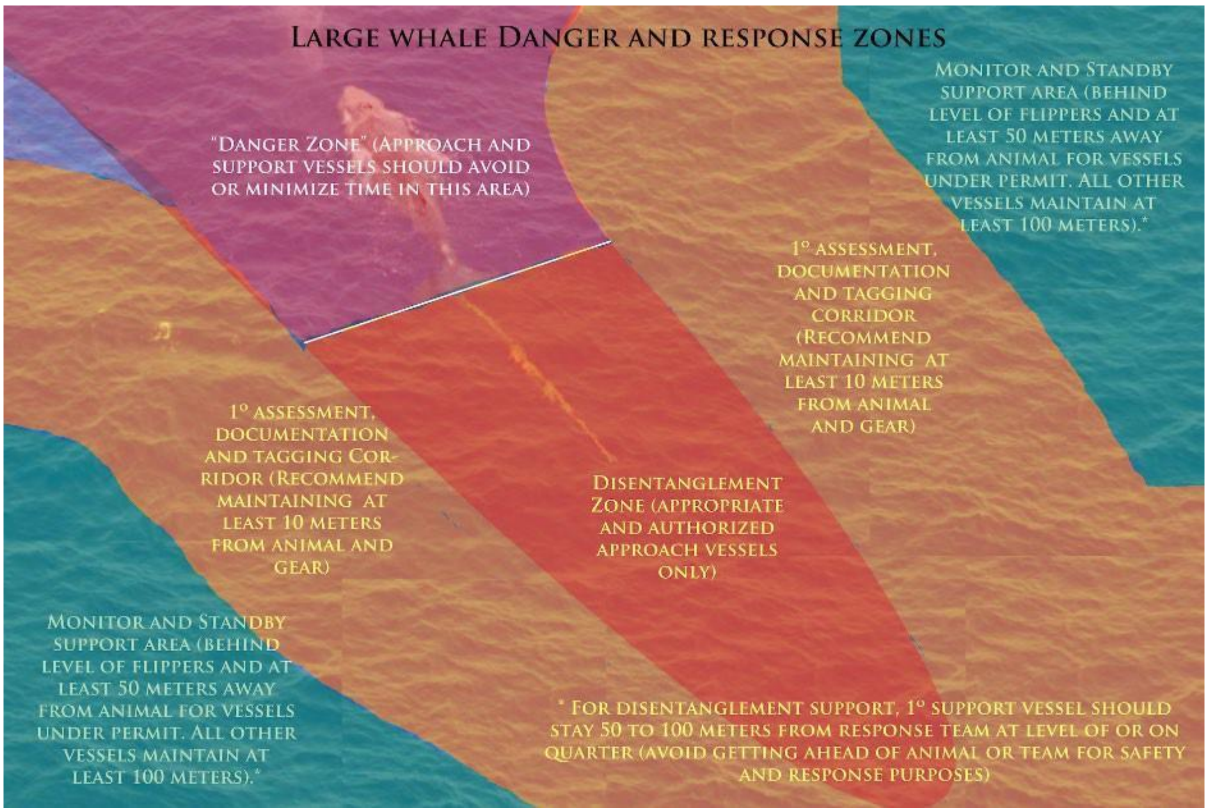


Figure 6: Large Whale Entanglement Response Danger and Response Zones

The point being, all entangled whales should be approached with caution. Whether assessing, monitoring, and/or attempting to free the whale, the animal's size, mobility, and unpredictable nature (considering it is stressed and very likely does not realize you are there to help), all pose significant risk factors on approaching an entangled whale. Be extremely wary in interpreting behaviors as docile, accommodating, or lethargic based on assessed impacts. Make no assumptions; even an animal severely impacted by what appears to be a long-term entanglement, poses significant risk (SAWDN, 2017). This holds true for procedures meant to change a whale's behavior in order to provide accessibility to the animal (*i.e.,* sedation; see Section 5). In regard to an approach, make no assumptions that procedures like constraint (*i.e.*, kegging) and sedation, will provide an accommodating, risk-free environment (*i.e.*, whale), as it will not. They may provide additional accessibility, but risks will remain.

Species-specific differences should also be considered when approaching whales. For instance, right whales should be approached with greater caution, as they are considered by many to have more power and stamina, and more likely to exhibit aggression towards an approach (Canadian Whale Institute, 2018; NMFS 2009). Approach risk can also vary over time. For instance, an entangled whale may be more accommodating to initial approaches (*i.e.*, initial approaches are typically the more productive approaches); however, over time as the animal responds to the cumulative approaches, its behavior may become more evasive and/or aggressive. Another example of possible changes in behavior over time, are those that occur between breeding/calving and feeding grounds over a greater expanse of time. A mother whale with a recent calf on calving grounds may be more aggressive or protective of an entangled calf. An entangled adult male whale on the breeding grounds may exhibit a more energetic, or even aggressive, behavior, than the same animal while on the feeding grounds. Similarly, newly entangled whales may behave differently from those carrying long-term entanglements, and should only be approached with great care (IWC 2015).

Risks associated with large whale entanglement and response can be broken down into two categories. The one category focuses on the individuals involved - humans (*i.e.*, the responders), while the other focuses on the animal. In many cases, the risks affecting the two are related. For instance, the risks of entanglement are generally greater for the smaller, sub-adult animals, yet due to their generally more unpredictable nature, they also pose greater risk to responders.

Personnel

Human safety is the primary concern in all large whale entanglement response efforts. Risks to personnel may involve exposure to environmental conditions, contact with the animal, injuries consistent with sharp knives, handling lines under heavy load, including getting caught in gear, impact with equipment, exertion and general vessel-related injuries. Responders should only perform roles (*i.e.*, procedures) for which they meet minimum qualifications and training, as doing otherwise significantly increases risk for that person and the entire mission.

Below is a list of the hazards/risk factors associated with large whale entanglement response affecting human safety. The hazards and their risks within the list generally run from least severe to more severe, based on the consequence and probability of encountering risk during entanglement response efforts (adapted from Lyman & Mattila 2014).

- Psychological or emotional stress.

- Exposure to environmental conditions (*e.g.*, sun stroke, dehydration, hypothermia, drowning).
- Operation of vessel (*e.g.*, approach to whale, collision and operation).
- Physical stress (*e.g.*, exertion and fatigue; especially as it contributes to other risks).
- Use of disentanglement equipment, including knives, poles and lines (*e.g.*, risk of injury, entanglement or from heavy equipment).
- Contact or other negative interactions with the animal (*e.g.*, physical trauma or drowning).

RISKS TO HUMANS

Risk: Injury or death to personnel from contact with whale. Direct contact from the animal has the highest risk, especially when cutting the final line of the entanglement and freeing the animal (Lyman and Mattila, 2010).

***Mitigation*:**

- All personnel should avoid proximity to the animal – the danger zone surrounding the animal, especially at times when there may be a change in the animal's behavior, such as when making final cuts that may cause gear to shift or elicit a pain response.

- All personnel should wear appropriate PPE such as PFDs and helmets as necessary. The use of helmets is required for those using poles and other responders that are in the vicinity (*i.e.*, within the extended radius of the pole's 360° sweep). At the moment of attachment (*i.e.*, before a clip releases) the pole becomes an extension of the animal and poses additional risk.

- Designated safety persons should be assigned to continually watch over all personnel involved, warning the team of hazards such as changes in behavior of the animal and presence of other animals, and be able to communicate to the team to adjust strategy or call off the effort as necessary.

- Designated personnel should prioritize the use of flying knives (*i.e.*, knives that slip off poles) or thrown knives (*i.e.*, cutting grapple) to minimize time near the animal.

- Distressed animals are unpredictable; continuously monitor for signs of stress (*e.g.*, abrupt headrises; suddenly producing wheezie or trumpeting blows; changes in respiration, speed, or dives; bubble streams and blasts otherwise out of context; pronounced close approaches, especially belly towards [*i.e.*, a maintained rollover]).

- Teams should approach the animal as methodically and consistently as possible, giving time for the animal to habituate to the presence of the approach vessel (Ledwell & Huntington 2018).

Risk: Injury or death to personnel due to getting harmed by or entangled in the gear entangling the animal.

***Mitigation*:**

- All personnel handling gear attached to the animal (*e.g.*, attaching tethered telemetry) should wear protective gloves to avoid chafe (*i.e.*, rope burns) impact.
- All personnel handling gear attached to the animal should carry a one-handed, safety knife.
- Support vessel team should remain alert and prepared (*e.g.*, cutting grapple ready to sever any links).
- Certain gear types, such as the pane of a gillnet or the mainline of a longline should not be directly handled (*e.g.*, securing telemetry directly to the entangling gear).
- Avoid the area close to and around the whale - the "danger zone." This includes the area behind the animal, as the approaching vessel getting caught in the trailing gear is more likely.
- Any vessel closely approaching the animal (*i.e.*, in the danger zone) should be as free as possible of snag points, especially the engines and hull, and other areas of the vessel where gear might be handled.
- Small vessels with minimal open deck space, that will closely approach the whale and entangling gear, should only carry the necessary gear for that particular operation (even safety gear can be covered by the support vessel).
- All personnel handling gear attached to the animal should wear PFDs and protective clothing that are "clean" (*i.e.*, free of snag points).
- Do not get in the water near an entangled whale.
- Do not pull line/gear into the vessel that might still be attached to the animal.
- During line handling, only have a single bight of line in the vessel at any one time, as to reduce threat to personnel (*e.g.*, grabbing the trailing gear to attach a telemetry buoy).
- Always farelead the lines attached to the animal, especially if under load, to the outboard side of a vessel and outboard of all personnel to avoid being stripped or forced off a vessel (*e.g.*, during the

process of deploying the telemetry buoy).

- All personnel should remain clear of gear being attached/deployed to the animal/entanglement (*e.g.*, clips, grapples, telemetry buoy) to avoid personally getting entangled.
- Make sure gear being attached to animal/entanglement is deployed from the vessel on the team's terms. Do not let the animal pull gear off the vessel (*i.e*., make sure the telemetry buoy is deployed off the vessel as opposed to the whale taking it off the vessel).
- Do not wrap net or line around hands or fingers. Line handlers, like those deploying telemetry, should remove entanglement hazards (*e.g.*, rings, watches), and keep feet clear of lines and nets. Use a five-gallon bucket or other receptacle to hold the telemetry buoy's tether line as it is being deployed.
- Responders handling gear should be familiar with the entangling gear, its associated risks (*e.g.*, a longline with gangions). Certain gear like gillnet and longline should not be directly handled.

Risk: Injury or death to personnel due to getting cut by one of the knives.

***Mitigation*:**

- All personnel handling knives should wear appropriate gloves to lend protection (*e.g.*, kevlar gloves).
- Keep knives sheathed until ready to use.
- Only carry the tools, including knives, you need for a particular task.
- All personnel deploying flying (*i.e*., pole-delivered) or thrown knives (*e.g.*, cutting grapple) to a loaded line (*i.e*., while being towed, being kegged, or otherwise applying load), should maintain distance from such knives once delivered and stay out of the line of fire (*i.e*., do not remain directly behind and inline with the tool).

Risk: Injury or death to personnel due to contact with tools.

***Mitigation*:**

- All personnel using disentanglement tools, especially poles, should wear appropriate helmets.

Personnel in the vicinity of the person using a pole should also wear helmets.

- During line handling, keep grapples and clips attached to the working line well in front (~2 meters) of personnel to avoid contact. If the line is under load, distance between tools and personnel should be even greater (~5 meters).
- All personnel should remain clear of gear being attached to the animal (*e.g.,* knives, clips, grapples, telemetry buoy).
- Make sure gear being attached to animal/entanglement is deployed from the vessel on the team's terms. Do not let the animal pull gear off the vessel.

Risk: Injury or death to personnel due to overall response (*e.g.,* fatigue, exposure, falls, strains).

***Mitigation*:**

- Monitor personnel exertion and fatigue levels. Have enough experienced responders to avoid fatigue. Do not push oneself or team to the limits.
- Responders should have appropriate attire and protection to minimize exposure.
- Communicate responder movements between vessels to helmspersons (*i.e.,* "stepping over").
- Monitor emotions or desire to "save the animal." Emotions can, and do cloud judgement(s).
- Terminate/abort effort if risk factors (*e.g.,* fatigue, emotion) become a concern and cannot otherwise be resolved.

As always, one major all-encompassing mitigating measure is standing down, or aborting a procedure or entire operation/mission. There is no obligation to respond.

Some primary points related to human safety that might not fall under the examples above or apply to all are:

- While there is no obligation to respond, there are obligations to meet certain criteria and protocols under the MMHSRP and its permit, if initiating a response.
- Obtain necessary authorizations as they are there primarily for safety.
- Ensure first aid kits and automated external defibrillators (AED) are available and located with

each response group.

- Create a written safety protocol with emergency numbers to be kept with first aid kits.
- Do not put the whale's rescue above human safety.
- Never initiate an action that has not been thoroughly thought through and discussed.
- Review worst-case scenario protocols; have an exit strategy for each procedure. Consider the “what ifs.”
- When in doubt, tag (if the tagging decision matrix is met), regroup (*i.e.*, attempt another day with more assistance, better conditions, and/or new tools and procedures) or entirely abort the mission. Aborting a response is a viable option.
- All members of the team should understand and agree upon response actions.
- Pre-mission briefs should be conducted.
- Responders should only conduct procedures for which they meet minimum qualifications and training.
- Responders should maintain proficiency and focus on their respective role(s).
- Personnel should wear appropriate PPE such as, non-slip footwear, gloves, and protective clothing as necessary.
- Do not get in the water near an entangled whale.
- Avoid the area close to and around the whale, including directly in front and behind, as this represents a danger zone in which contact with the animal or entanglement in the gear is more likely.
- Distressed animals are unpredictable; therefore, it is important to continuously monitor a response to anticipate any risk and maintain safety.
- Communication within and between the disentanglement teams, including briefings, is critical to minimize risk and avoid hazards.
- If drugs are used, all responders should be familiar with the drugs and reversals, including symptoms of accidental exposure and if/when/how to treat prior to the arrival of medical

personnel.

- Assess the probability of success of the mission relative to the risks posed.

Animal:

Risks to the entangled animal may include drowning, starvation, degeneration of health, systemic infections, physical trauma, and/or a general reduction in fitness. Entanglement may also result in reduced production (*i.e*., calving) or even death. The outcome of the entanglement depends on its severity; whether the animal is reported, a response effort mounted, and the success of the effort; and whether the animal self-released or succumbed to the entanglement. In addition, the actual response effort may pose additional risks to the animal (Lyman & Mattila 2014). For instance, unintentional contact with a vessel and physical trauma from drag forces (*e.g.*, telemetry, kegging, Nantucket sleighride of approach vessel). Minimizing these risks provides for a safer response effort, as it minimizes the distress of the animal and risk for responders alike. The following are some of the primary hazards and considerations for minimizing risk of entanglement response efforts to the animal:

- Use decision matrices (see Sections 2.13.8, 3.11, 4.11, 5.11 and 6.11) prior to large whale entanglement response efforts to ensure risks and mitigation are planned and accounted for by all responders.

- Minimize the stress that comes with large whale entanglement response, especially constraint and cumulative approaches.

- Appropriately evaluate the need for attaching telemetry.

- To avoid injuries, be aware of vessel operations so to minimize disturbance and unintentional contact with the animal.

- Minimize injuries due to knives and lines (*i.e.*, a working line becoming part of the entanglement).

- Use appropriate sedatives and sedation delivery techniques with appropriately trained personnel and attending veterinarian(s) to minimize negative effects.

- Confer with veterinarians or other experts prior to removing deeply embedded gear. It may be more beneficial for the animal, and safer for the response team to trim deeply embedded wraps.

- Be methodical and consistent, as to reduce stress and negative response to effort (*e.g.*, avoid shifting in and out of gear, or revving engines).

The following outlines the assessed risks and mitigating factors towards the broader scope of large whale entanglement response for the entangled whale. As is the case for human risk mitigation, one major risk mitigating measure is standing down from the response. Remember, there is no obligation to respond, only an obligation to minimize risk. Additional risks and their mitigating measures are outlined for each response section (see Sections 3.10, 4.10, 5.10 and 6.10).

RISKS TO ANIMALS

Risk: Injury or death to whale due to contact with response vessels.

***Mitigation*:**

- Use prop guards around propellers (may also reduce catching trailing gear).
- Have experienced and knowledgeable operators at helm that are familiar with vessel, maneuvering around whales, and the operations.
- Avoid operating in the danger zone. Doing so not only reduces risk to responders, but also to the whale.
- Be methodical and as consistent as appropriate in approach as to be predictable to whale.
- Only approach the whale if necessary/ minimize the number of approaches.

Risk: Injury or death to whale due to drag forces (*i.e.*, kegging, tethered telemetry, towing approach vessel - Nantucket sleighride).

***Mitigation*:**

- Use of constraint (addition of kegging buoys/sea anchors) only when deemed necessary (see decision matrix).
- Use of telemetry when pros outweigh cons (see telemetry decision matrix).
- Use lower drag telemetry buoys.
- Use weaklinks or timed-release clips to avoid long-term attachments.

- Methodical use of kegging as to reduce stress and only use constraint when required for mission objectives.

- Avoid applying force to gear or tethered working line that conveys force to a vulnerable, traumatized parts of the body (*i.e.*, to a deeply embedded wrap on a body appendage).

- Avoid applying force to entangling gear that involves strong, small diameter lines or rolled-up gillnet as both can produce significant and rapid trauma, especially if wraps are involved.

- Understand the type of entangling gear involved and its associated hazards.

Risk: Injury or death to the whale due to contact with equipment (other than vessels).

***Mitigation*:**

- Use of hooked knives with dull outer surfaces by experienced responders.

- Appropriate use of drones (UAS) by FAA-licensed and experienced pilots.

Risk: Injury or death to animal due to use of sedation.

***Mitigation*:**

- Have only experienced and trained responders administer drugs.

- Confer with veterinarians or other experts prior to administering drugs.

- Provide drugs as early as possible to avoid fight or flight response.

- Have reversing drugs available and ready to administer.

Risk: Injury or death due to removal of gear.

***Mitigation*:**

- Confer with veterinarians or other experts prior to removing deeply embedded gear. It may be more beneficial for the whale and safer for the response team to trim such deeply embedded wraps.

As always, one major all-encompassing mitigating measure is standing down or aborting a procedure or the entire operation/mission. There is no obligation to respond.

Other risks:

Other risks include the animal and entanglement being a "hazard to navigation" (*e.g.*, a vessel getting caught in the trailing gear); well-intentioned public attempting to free the animal and getting injured; resources being lost or damaged during a response (*e.g.*, loss of telemetry buoy, approach inflatable being cut); and an unsuccessful mission causing stress (emotional and otherwise) to managers, responders and the community in general. These risk factors affect response risks either indirectly or directly, and should not be ignored when addressing risk mitigation.

2.13 Intervention Criteria/Decision Matrices

There are two main tools or checklists that help determine or quantify the risk factors associated with a particular response – GAR models or checklists, and decision matrices that help determine the nature of the response, including whether to respond at all, or abort – Go/No Go decision matrices.

The Risk Factor or GAR (Green-Amber-Red) checklist allows for time-critical risk assessment and involves all members of the team. These risk assessment checklists can be done for different aspects of the response. For instance, a GAR may be done for vessel operations, specifically for the entanglement response, or refined for a particular aspect of the entanglement – like sedation. The GARs not only involve entire teams, but are shared among teams, including shoreside contacts, to identify risks and appropriate mitigation measures. This model/checklist is not entirely a simple Go/No Go model. While high (red) risk levels for the overall GAR, as well as, a high-risk value for any particular category, do dictate not initiating or aborting a response, a No-go, lower level may allow continued response. If the summed risk levels across multiple areas (*e.g.*, team composition, mission complexity) are within the cautionary yellow range, teams must work with the IC and/or contact the permit principal investigator (*i.e.*, the MMHSRP), prior to acting to discuss mitigation measures or stand down. Figure 7 depicts a GAR checklist for general large whale entanglement response; Appendix L contains the entire GAR table and instructions on how to use it (designed by Jamison Smith for the 2010 IWC Report of the Workshop on Welfare Issues Associated with Entanglement of Large Whales).

Key considerations or questions to be asked in the risk factor analyses (GAR):

- **Is the entanglement life-threatening?** Entanglement response should only be attempted if the entanglement is deemed to be causing, or has the potential to cause, a life-threatening injury, and if the potential risks of response for the whale and human responders are minimized (see pp 34-35 NMFS Serious Injury Procedure (Anderson *et al.* 2008) for details).

- **Is there an appropriate level-designated CI for the response that can act as IC (*i.e.*, Supervision)?**

- **Are there appropriately trained and experienced personnel for the roles required by the mission (*i.e.*, Team selection and fitness)?** Are there adequate responders to safely complete the mission and address unforeseen situations?

- **Are there appropriate resources to safely and efficiently conduct the mission (*i.e.*, Resources)?** Is all necessary gear functional, available, and ready? This includes, vessels, tags, sampling gear, instrumentation, disentanglement tools, and emergency equipment.

Disentanglement Risk Assessment

OPERATIONAL DISENTANGLEMENT RISK ASSESSMENT		
		Comments
Weather Conditions		
Max score = 5		
Responder Experience Level		
Max score = 5		
Complexity of Operation		
Max score = 5		
Animal Behavior		
Max score = 5		
Disentanglement Gear Condition		
Max score = 5		
Operating Area		
Max score = 5		
Resources Available		
Max score = 5		
Boat & Crew Fitness		
Max score = 5		
TOTAL RISK	0	
Max Total Score = 40		
WHALE RISK ASSESSMENT		
		Comments
Age Class of Animal		
Max score = 5		
Number of Lines		
Max score = 5		
Number of Wraps		
Max score = 5		
Lines Cutting In		
Max score = 5		
Additional Weighting of Gear		
Max score = 5		
Degree of Cyamid Coverage		
Max score = 5		
Body Parts Involved		
Max score = 10		
TOTAL RISK	0	
Max Total Score = 40		
GREEN = 0 - 14 (Go, Low Risk)		
AMBER = 15 - 28 (Use Extra Caution)		
RED = 29 -40 (Stop, High Risk)		

Figure 7: A GAR large whale disentanglement risk assessment table

- **Does weather pose a threat to the animal or responders (*i.e.*, heat stress or hypothermia or threatening storms)?** If so, is there a way to mitigate it?

- **Are the conditions (*i.e.*, Environment) conducive to safely and efficiently mounting a response?** Medical facilities nearby or other animals present?

- **What is the Mission complexity and can associated risks be mitigated?** What are risks posed to the whale and humans?

Decision matrices represent a systematic series of questions, typically representing risk factors, that help determine how and whether to respond. Like the risk assessment GARs, there can be different decision matrices for different aspects of the response (*e.g.*, one matrix for overall entanglement response and another on how and whether to use telemetry). Below, in Figure 8, is a generalized decision matrix/flow diagram that integrates criteria lists (listed as footnotes and also included below) for the different actions listed (adapted from 2010 IWC Report of the Workshop on Welfare Issues Associated with Entanglement of Large Whales).

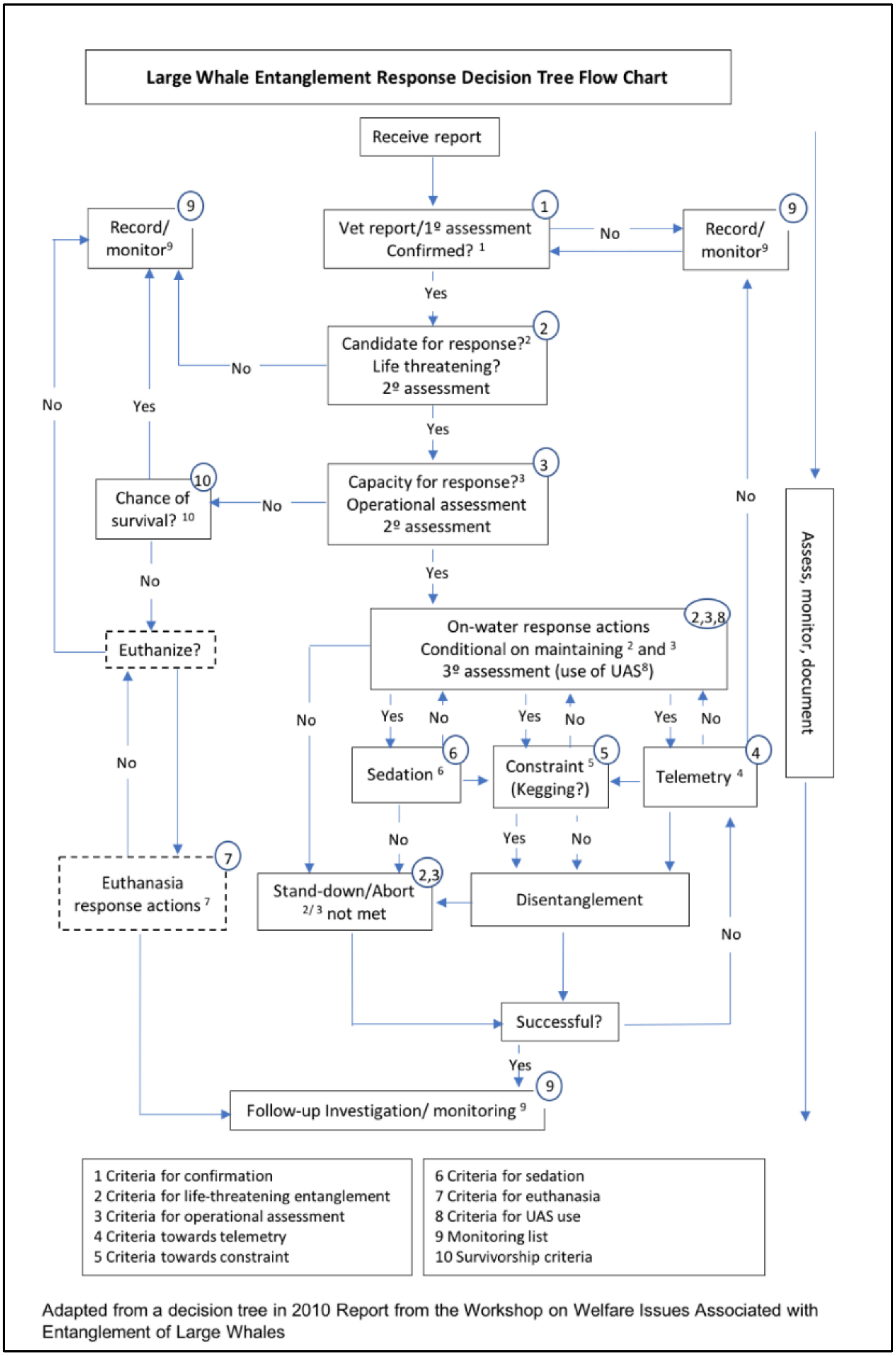


Figure 8: Large whale entanglement response decision tree/flowchart

2.13.1 Confirmation of Large Whale Entanglement Cases/Reports

Since the primary source of large whale entanglement reports is opportunistic (*e.g.*, tour vessels, fishermen, and other members of the on-water community), reports of entangled whales may not be reliable and thus confirmed. Determining whether a report represents a confirmed entanglement is thus the first step in determining whether a response might be mounted and the initial decision within many large whale entanglement response decision matrices - "Is the whale entangled?" In 2016 NMFS instituted a standardized definition of what represents a "Confirmed" large whale entanglement case, and provided criteria (*i.e.*, decision matrix) to make those determinations.

Under the National guidance, a **Confirmed** report represents an animal with "attached human-made materials" (may include rope, net, monofilament line, or debris), with or without associated materials (hooks, buoys, pots/traps, etc.). Relative severity of the entanglement (minor - life-threatening) does not matter for case confirmation.

Criteria to deem a report "confirmed" can include:

- Photographic or video evidence (*IDEAL*);
- NOAA staff has direct visual observation;
- The report came from a trusted source (trained or professional observer);
- A follow-up interview of the reporting party was conducted by an experienced network member (Level 3+), or agency expert, using non-leading questions, and the network member/agency expert believes that the whale was entangled; or
- Corroborated, independent, and multiple sources of reports have been received with detailed descriptions of the animal and entanglement.

For additional details, including criteria for "Unconfirmed" and "Not Entangled," see National Criteria for Determination of Large Whale Case Confirmation in Appendix N.

2.13.2 Criteria to Determine Whether an Entangled Whale is a Candidate for Response - Evaluative Assessment

The primary criteria in determining whether an entangled large whale is a candidate for response is determining whether the entanglement is **life-threatening** or is likely to become life-threatening.

Additional and associated criteria are listed below:

- Impact on species, population or stock
    - Endangered status/population level
    - Population in decline
    - Sex of animal (*i.e.*, productivity concerns)

- Existing or present impacts
    - Severity of injuries (*e.g.*, lines cutting in to body)
    - Body condition (*e.g.*, emaciated, nuchal depression)
    - Stress indicators (*e.g.*, cyamid coverage, light or rough skin)

- Potential for future impacts:
    - Age class (*e.g.*, younger animals more susceptible)
    - Nature of entanglement (*i.e.*, tight wraps, # of wraps, amount of gear involved and trailing, multiple body regions involved)
    - Mobility (*e.g.*, affecting feeding, predator avoidance, breathing)
    - Location/time considerations (*e.g.*, amount of time fasting, energy expenditures)
    - Reproductive status (*e.g.*, pregnant, lactating)
    - Gear configuration (*e.g.*, gear type, condition of gear)
    - Potential to self-release

Risk Factor and levels		Table 1. Risk Factors Specific to Response to Animal		
		1 Low	**3 Medium**	**5 High**
Impact on Species/ Population	**Endangered status/pop'n**	Least concern/Near threatened	Vulnerable/ Endangered	Critically endangered
	Pop'n stability	Increasing	Appears to be stable	Critically low/ declining
	Sex of animal (productivity concerns)	Male or unknown sexed animal	Known female of any age	Known productive female in prime
Existing or Present Impacts	**Severity of injuries**	Minimal-superficial Injuries - epidermal or dermal	Moderate injuries - dermal or deeper	Severe injuries - deep subdermal. Threaten appendages/rostrum

	Body condition	Good - not emaciated	Fair to moderate - slightly emaciated	Poor-emaciated
	Stress indicators	None to minimal light-colored and rough skin, along with cyamids	Patches of light-colored and rough skin; low to moderate light-colored cyamid coverage; some red cyamids	Large areas of light-colored/rough skin with heavy cyamid coverage, esp. red cyamids
Potential for Future Impacts	**Age class**	Adult	Juvenile/ Yearling	Calf/older individ.
	Nature of entanglement	Simple, single, loose wraps or drapes that are more likely to come off over time	Multiple loose to moderately tight wraps, and minimal to moderate gear involved/ trailing.	Tight/ large # of wraps; large amt. of gear and/or trailing; multiple body regions involved
	Mobility	Frees-swimming; no or minimal impairment	Animal mobile (*e.g.*, amt. and weight of gear) threatening future mobility. Feeding impaired.	Mobility severely impaired (*e.g.*, anchored). Inability to feed.
	Location/time considerations	On feeding grounds; known resident	Migrating from breeding grounds.	Migrating to or on breeding grounds
	Reproductive status			Pregnant/lactating female
	Gear configuration	No to low impact	Minimal to moderate impact (*e.g.*, weak to moderate gear, strength and lifespan)	Severe impact (*e.g.*, strong, long-lasting, small diameter)

This table complements the operational GAR

2.13.3 Capacity for Response - Operational Assessment

The capacity to respond depends on meeting a broad range of criteria that cover everything from the animal, environmental conditions of its location, the gear and complexity of the entanglement and the availability of resources. These criteria mirror those found in operational risk assessment GARs and those outlined under ICS. As is the case in determining (*i.e.*, assessing) whether the animal is a candidate for response, there is a principal overlying criteria for determining whether to respond - human safety. Human safety is paramount and nearly all the different criteria point to human safety.

In addition, there is another comparison to be made between the criteria for determining whether the animal is a candidate for response, and whether there is the safe capacity to respond, and that is many of the criteria are comparable between the two. For instance, a calf or a juvenile whale typically has a higher probability of being impacted by the entanglement, but at the same time, those animals typically represent a greater risk to the responders trying to free them. This comparison can be made for species status, mobility, the existence of tight and/or embedded lines, location on the body, and gear type.

- The entangled whale
  - Endangered status/population level (*i.e.*, affects emotional level - desire to save species)
  - Behavior differences (*e.g.*, disposition and temperament)
  - Morphological differences (*e.g.*, size and appendage differences, mobility, strength, stamina)
  - Condition (*e.g.*, healthy and strong vs poor condition and weak)
  - Mobility (*e.g.*, free-swimming, anchored)
  - Age class (*e.g.*, calves with mothers, juveniles more unpredictable; emotions)
- Nature of the entanglement (*i.e.*, complexity)
  - Number of wraps
  - Location on body (*e.g.*, forward and deep typically less accessible; dangerous)
  - Number of body regions involved
  - Tightness of wraps/embedded (*e.g.*, challenges in accessing; responses from animal)
  - Amount of gear
  - Any trailing gear, amount trailing, and/or weighted?
  - Gear type (*e.g.*, gillnet and longlines generally have higher handling risk)

Risk level based on location of entangling gear on animal:



Photos courtesy of CCS

Higher ---------------------------- Impact to animal/ difficulty of response------------------------- Lower

- Environment/conditions
  - How remote/offshore (*e.g.*, transit distance and distance to medical attention)
  - Time of day and length of day (*e.g.*, how much time for mission?)
  - Weather and sea state
- Availability of resources

- Vessel support, including support vessels
- Disentanglement tools
- Associated documentation, data collection, communications, gear, etc.
- Appropriate supervision (*e.g.*, IC)
- Responder experience (*e.g.*, experienced and trained; level designations)
- Roles filled
- Team fitness (*e.g.*, on call and accounting for fatigue levels)

- Likelihood of success (apply risks to animal in assessing risk to responders)

Risk Factors and levels		**Table 2. Risk Factors Specific to Operational Assessment**		
		1 **Low**	**3** **Medium**	**5** **High**
The Entangled Whale	**Endangered status/ pop'n level**	Least concerned - less emotion involved	Vulnerable and endangered species - concern to save animal	Critically endangered - high concern to save animal
	Behavior differences	Normal, non-aggressive response, predictable	Evasive, unpredictable, moderately agitated	Highly agitated, unpredictable. Exhibiting surface active behaviors
	Morphological differences	Smaller, low stamina and mobility	Moderate size, stamina and mobility	Large, high stamina and mobility
	Condition	Lethargic/ weak	Moderate health and strength	Healthy and strong (*e.g.*, recently entangled)
	Mobility	Animal accessible - Slow free-swimming predictable	Moderate accessibility - Fast swimming, evasive, unpredictable	Mobility extreme or non-existent (*e.g.*, highly mobile or anchored animals
	Age class	Adults (generally more predictable)	Independent juveniles (generally more unpredictable)	Calves/ yearlings with mothers(unpredictable)
Nature of Entanglement	**Number of wraps**	None to few	Moderate	Many (*e.g.*, > 5)
	Location on body	Posteriorly located and dorsal	Mid-body wraps	Forward on body and ventrally located
	# of body regions involved	One	Two	More than two

	Tightness of wraps/ embedded	Draped or loose	Tight to extremely tight	Embedded to deeply embedded
	Amount of gear	Minimal	Moderate	Substantial
	Trailing gear	Substantial	Moderate	Minimal
	Gear type	Clean (*e.g.*, no gangions or netting) moderate diameter lines	Other netting	Gillnet or Longline
Environment/ Conditions	**Remoteness**	Close to shore and medical facilities	Somewhat close to shore and medical facilities	Far from shore and medical facilities
	Time of day and length of day	Early in day and long days	Midday reports/ response during a moderate length day (*e.g.*, between 8 - 12 hours day)	Late in the day and/or short length of day
	Weather and sea state	Good conditions/ Beaufort 0 - 3	Moderate conditions/ Beaufort 4 - 5	Inclement weather, Beaufort >5
Availability of Resources	**Vessel support, including support vessels**	Appropriate vessels with experienced helmspersons	Appropriate, but not preferred vessels (*e.g.*, helmsperson experienced, but not familiar with particular vessel being used)	Inappropriate vessel support with inexperienced helmspersons and crew
	Disentanglement tools	All tools available and operational	Tools available, not all operational, some unfamiliar	Minimal tools, unfamiliar with kit
	Documentation, Data collection, Communications, Gear	All gear available and operational	Most gear available/ operational	Key items not available or operational
	Appropriate supervision (IC)	High-level, experienced IC	Moderately experienced IC or case-by-case approval of higher level activities *(e.g.*, disentanglement with a level 3 as IC)	No IC or lower level, less experienced IC
	Responder experience	All roles experienced	All core roles experienced	Some core roles not as experienced
	Roles filled	All roles filled	Critical roles filled; Some responders in dual roles	Minimal roles filled
	Team fitness	Entire team 100%	Some team not 100%, core at 100%	Core team members not at 100% (e.g., tired)

2.13.4 Criteria Towards Determining Whether to Tag

Telemetry, for the purpose of tracking an entangled whale, is typically used when the above - capacity to respond, is not or can no longer be met. For instance, weather, environment, the behavior of the animal, lack of appropriate tools, or experienced responders, dictate an IAP that points to the use of telemetry. However, the use of telemetry still relies on the probability that the entanglement, within the timeframe of the tag's attachment, will remain a confirmed entanglement (1), the animal will remain a candidate for response - a life-threatening entanglement (2), and there will be a capacity to respond - resources and conditions are forecasted to allow a future response (3).

However, all that said, there are some specific criteria that are forecasted (probabilities) in deciding to use tethered telemetry to relocate an entangled whale for additional response efforts. These are:

- Probability of impacts to the animal from the tag package?
    - Trauma to the attachment point on animal resulting in wounds, infection or amputation
    - Long-term energetic costs from drag resistance of gear
    - Additional mobility concerns
    - Tether becoming part of the entanglement
    - Tethered tag increasing probability of picking up other gear or involving another animal (*e.g.*, calf)
- Probability of impact to humans from pursuing tagging
    - Risk from deployment
    - Risk from follow-up response
    - Associated costs (*e.g.*, response, Argos, tag and buoy)
    - Sense of obligation to pursue and/or remove a long-term tag
- Probabilities of follow-up response?
    - Environment (*e.g.*, remoteness)
    - Weather
    - Availability of resources
- Probability of success
    - Better conditions
    - More resources
    - New, tested, and approved gear
    - New, tested and approved procedure
    - A better IAP
    - Temporal aspect of survivorship (*e.g.*, Can the animal survive? Is it worth the risk?

Value of tagging for future necropsy)

Risk Factors and Levels		Table 3. Risk Factors Specific to Tagging		
		1 Low	3 Medium	5 High
Probability of impacts to animal from tag package	**Trauma to the attachment point on animal resulting in wounds, infection or amputation**	Origin of tether and resulting force having little to no impact to animal	Origin of tether represents a wrap, but not tight. no immediate or severe impact	Origin of tether tight, embedded, threatening appendage or health of animal
	Long-term energetic costs from drag resistance of gear	Little to know energetic impact	Moderate injury and temporal impact	Animal already severely impacted and/or drag long-term
	Additional mobility concerns	Low	Moderate	High likelihood and
	Tether becoming part of the entanglement	Low	Moderate	High
	Tethered tag increasing probability of picking up other gear or involving another animal	Low	Moderate	High
Probability of impact to humans from pursuing tagging	**Risk from deployment**	Low	Moderate	High
	Risk from follow-up response	Low	Moderate	High
	Associated costs	Low	Moderate	High

	Sense of obligation to pursue and/or remove a long-term tag	Low	Moderate	High
Probability of follow-up response	**Environment**	Easily accessible		Very remote
	Weather	Clear forecast	Moderate conditions	Challenging conditions
	Availability of resources	Readily available		Resources missing or not functional
Probability of success	**Better conditions**	Low	Moderate	High
	More resources	Low	Moderate	High
	New, tested, approved gear	Low	Moderate	High
	New tested approved procedure	Low	Moderate	High
	A better IAP	Low	Moderate	High
	Temporal aspect of survivorship	Low	Moderate	High

In addition to the above, there is a risk factor associated with attaching a telemetry package on an entangled whale (beyond that of the procedure itself). This involves a sense of obligation to respond once the tag is attached. This is exacerbated by the ability to respond since the animal's location is known, and especially as time passes, the desire to remove something that a response team has added (and the potential impacts it carries). Remember, there is no obligation to respond; however, during a response there is an obligation to meet those criteria to maintain human safety.

There are efforts underway to design and fabricate telemetry packages that have lower drag, are more efficient, and cost less. In addition, timed-release clips that use galvanic releases have been designed to allow a tag package to release after a certain amount of time. See Appendix K for additional information on timed-release clip.

2.13.5 Criteria Towards Constraint

Deciding to constrain an entangled whale is a matter of looking at the costs and benefits. On the one hand, constraining a whale due to mobility, and short surface intervals may make it more accessible for additional assessment and disentanglement. It may also reduce the unwanted movements (*e.g.*, a tail slash) of a whale, and thereby reduce the risks to responders. However, on the other hand, the extra drag forces may cause or exacerbate wounds, or provide added stress to the animal. This stress may translate to aggressive or evasive maneuvers that may add risk to the responders.

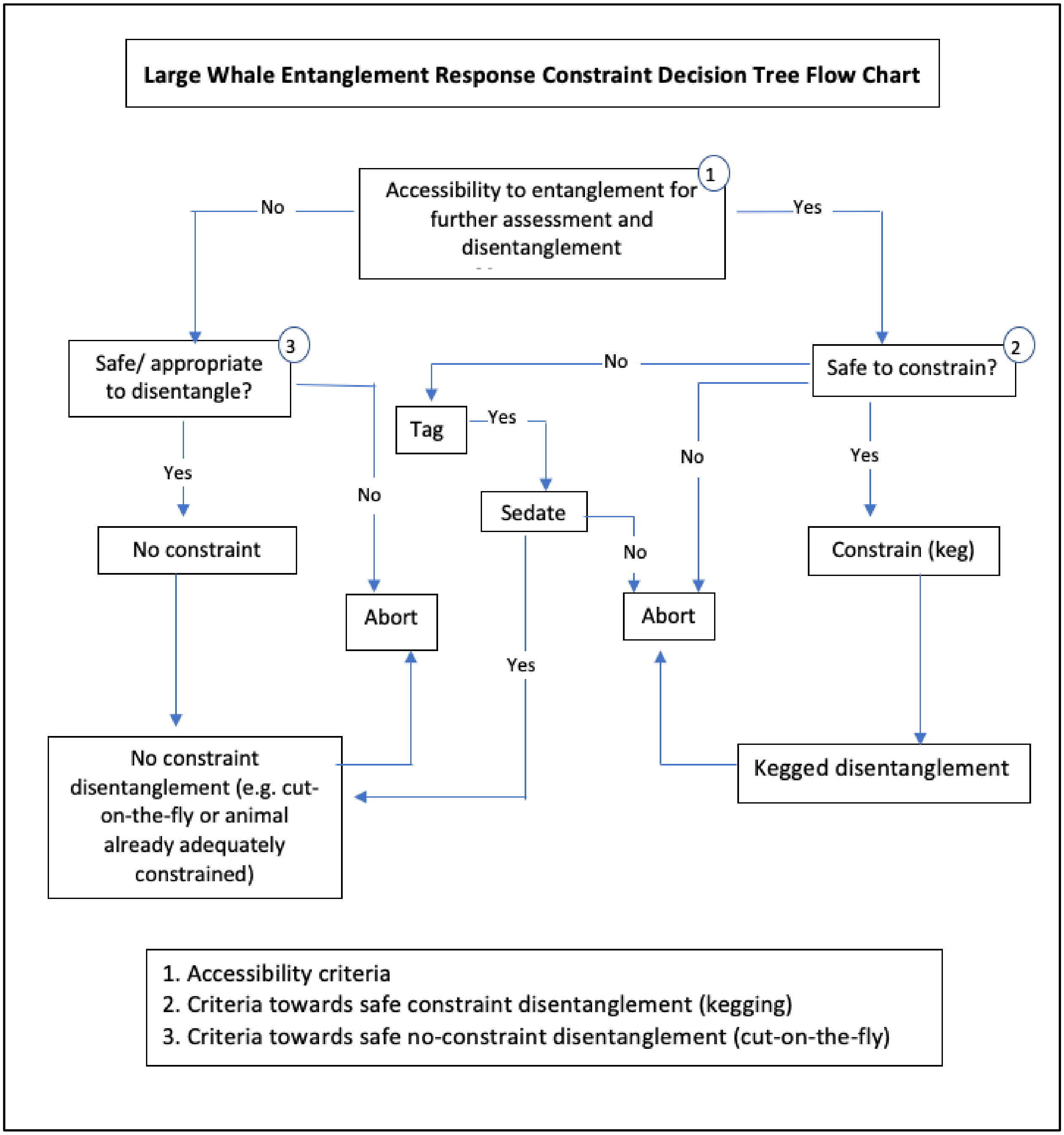


Figure 9: Large Whale Entanglement Response Constraint Decision Tree Flowchart

Criteria:

1. Accessibility of animal/entanglement:

- Animal is fast moving
- Animal is evasive/unpredictable
- Animal is aggressive
- Animal is exhibiting short surface intervals

- Entanglement is deep (*e.g.*, weighted gear around a deep-lying tail) and/or forward on body (*e.g.*, mouth entanglement)

2. Safe to constrain animal

- Drag force will not overtly affect mobility (*e.g*., prevent surfacing behavior)
- Drag force to body likely not more traumatic than entanglement (*e.g.*, increase life-threatening wounds, amputation of limb; exacerbated by strong, small-diameter line on body part)
- Tether line (*i.e.*, the working line) likely to not complicate the entanglement (*e.g.*, become part of or pick up additional gear)
- Animal not likely to become more perturbed or aggressive (*i.e.*, animal and entanglement likely to become less accessible as opposed to more accessible)
- Constraint likely to provide safer accessibility to animal and entangling gear (*i.e.*, slow the whale down, keep it at surface)

3. Safe to approach without constraint

- Animal is slow moving
- Animal is predictable (*e.g.*, linear travel)
- Animal calm
- Animal/entanglement at surface long enough to access
- Resources (*e.g.*, long pole system or tools [*e.g.*, cutting grapple] allow for more remote access)
- Responder experience allows approach sans constraint (*e.g.*, experienced helmsperson and responder wielding pole-mounted knife)
- Conditions allow

Cons/Risks:

- Potential impact to animal
    - Trauma to the attachment point on the animal, can result in wounds or amputation
    - Impact
    - Added energetic costs from drag resistance of kegging buoys/sea anchors
    - Working line becoming part of the entanglement
- Potential impact to responder

  - Elicit negative behavioral response from animal (*e.g.*, aggressive, evasive)
  - Working with lines under load and attached to animal

Necessity of great accessibility (*e.g.*, animal too mobile, erratic behavior, short surface intervals). The topic of constraint is also addressed in Section 4.9.

2.13.6 Criteria Towards Sedation

Sedation in large whales is still being pursued. It has been used on three entangled North Atlantic right whales with mixed results. The drug delivery system has evolved over time with more recent drug delivery devices performing well in the field on both stranded and free-swimming animals. Sedation will be most effective if the animal is not excited (*i.e.*, minimizing the flight or fight response), prior to the administration of the drug(s). The ideal scenario would be to sedate the animal on the first approach of the day, when the animal may be less excited and the greatest effect of the drug(s) may be achieved.

Criteria for sedation:

- Entanglement is life-threatening;
- Traditional (non-chemical) disentanglement means not possible or warranted;
- Conditions and resources available towards sedation;
- Availability of experienced/trained responders; and
- Approvals obtained

Sedation is covered in more detail in Section 5.0.

2.13.7 Criteria Towards Euthanasia

Euthanasia should only be considered if an entanglement is likely to lead to death and there are extreme individual welfare concerns. It should only be pursued in consultation with a veterinarian who has large whale experience, and after approval. If the animal cannot be disentangled, the decision to euthanize should be made on a summed appraisal of the following criteria:

- Animal is stranded;
- Animal cannot swim;
- Severe fluke injury, or loss or imminent loss of fluke;
- Compromised respiration, or a seal of the blowhole, or such compromise of seal is imminent; and
- Severe constriction of gear that cannot be removed from a vital body part, or such constriction is imminent.

This may be evaluated by scoring the health status of the animal. A positive answer to only one of the evaluation criteria may not be sufficient cause (IWC 2010).

2.13.8 Criteria for UAS Use

Use of an aerial drone or UAS can have substantial benefits towards assessing the animal (*e.g.*, condition and impact), the entanglement, documenting the effort for later evaluation, and education and outreach. However, the use of aerial drones also provides its own risks, and as in other procedures, requires experienced, trained and certified pilots, as well as support staff. Below are the current criteria on using UAS or drones for large whale entanglement response efforts under the MMHSRP permit (Appendix 5 of the MMHSRP permit):

- To the maximum extent practicable, UAS altitude adjustment and horizontal movements should be made away from the animals or conducted slowly when above the animals to minimize disturbance.
- The UAS should hover over an individual only long enough to obtain the needed data or samples to achieve the permitted objectives.

It is important to recognize that the UAS platform is considered an aircraft and thus, unless flying over 330 meters (1000 feet, which is not allowed in the United States. due to FAA regulations limiting UAS operations to 400 feet AGL and less), will automatically be under permit.

1. For NOAA employees (*Some of these requirements may also apply to non-NOAA staff operating from NOAA vessels):
    a. FAA, Remote Pilot Part 107 license.
    b. OEM or manufacturer's training for the approved UAS platform(s).
    c. Experienced pilot (*i.e*., logbook documentation of flying over water and over animals, familiar with response effort and that particular drone).
    d. Approved airspace (under 120 meters [400 feet]).
    e. Notice of intent to fly (NTIF) submitted.
    f. Availability of appropriate launching and recovery platform (*e.g.,* clear deck space free of obstructions). NOTE: if launching and recovering from a NOAA vessel, additional requirements may exist.

g. An airworthy drone.

2. For non-NOAA employees:

    a. FAA, Remote Pilot Part 107 license.

    b. Experienced UAS pilot (*i.e*., logbook documentation of flying over water and over animals, familiar with response effort and that particular drone).

    c. Approved airspace (under 120 meters [400 feet] as per FAA Part 107 regulations.

    d. Availability of appropriate launching and recovery platform (*e.g.,* clear deck space free of obstructions).

    e. An airworthy drone.

See Appendix T for UAS use checklist. There are additional criteria if flying from a NOAA vessel (*e.g.,* Line Office approval) that must be adhered to. For the latest on UAS operations under NMFS' MMHSRP permit, contact the MMHSRP.

While GAR risk assessments and decision matrices may be performed prior to a response, assessment and risk mitigation is again an ongoing effort. It should be noted that the process of gaining information towards establishing the level of risk, may in itself incur risk (*i.e.*, the close approach to an animal to determine the severity of an entanglement). The use of UAS in large whale entanglement response efforts is covered in more detail in Section 6.0.

3. First Response – Assessment, Documentation, Monitoring (Levels 1 - 3)

3.1 Overview

First Response represents the initial response, whether directed or not, to the report of an entangled whale in order to provide valuable assessment and documentation (*i.e.*, the hardcopy of assessment). The information gained during first response is foundational, as it allows for initial risk assessment - both evaluative for the animal and operational for the responders. That risk assessment and other information gained is instrumental in making an informed decision on how to proceed, or whether to proceed at all (*i.e.*, populate the decision matrices). First response may also involve monitoring the animal, if further response has been deemed likely (*i.e.*, response is warranted, authorized; conditions and resources are available). Under certain circumstances monitoring may involve tagging the whale (directly on the animal or indirectly via attachment to trailing gear) to remotely track the animal. First response may represent the mission or may be the precursor (*i.e.*, the foundation) to the broader mission of disentangling a large whale (Section 4).

A **First Responder** is anyone within the Network directed to respond to an entanglement report under Network protocols and authorization. At a minimum, they will voluntarily provide assessment and documentation, attempt to standby with an entangled whale and, depending on training, experience, authorization and equipment available, may also tag the whale.

Primary First Responders are Network members that have additional training and experience, and typically have higher level designations (*e.g.*, level 3 - 5). As such, Primary First Responders, under certain conditions and authorization, may attempt disentanglement as part of a first response, or assist as part of an associated full disentanglement effort. These individuals typically have rapid access to vessels and specialized equipment, and are on call. Due to the possibility of higher risk activities and their association with large whale disentanglement, primary first responders and their roles are covered in more detail under the disentanglement section (Section 4).

3.2 Preparation and Training

The first responder role is broad in scope, ranging from lower risk monitoring of the whale from a safe and legal distance (*e.g.*, 100m or more), to closer approaches for assessment, documentation, monitoring, including polework and tagging, and in some cases they may assist directly with disentanglement activities. Whether monitoring from a distance or making a close approach, any approach to a large whale entangled in gear has inherent risks for both the responders and the animals, which dictates preparation and training. Responders should at least have level 1-2 first responder training, and otherwise be qualified and/or trained for the various roles required (*e.g.*, maneuvering a vessel, documentation). If the response involves close approach assessment (*i.e.*, within 100m, polework), or attaching telemetry, then responders should have level 3 or higher response training - both classroom and hands-on, and additional experience. Level 3 or higher training is required for the IC, while the person in charge of the telemetry should be well versed in its use and safe attachment. Skillsets and familiarization with the protocols and procedures needs to be maintained through response opportunities or continued training (*i.e.*, refreshers). See Authorization regarding Heightened Consultation protocols for tagging, and other close-approach procedures when reporting on a response effort and requesting authorization.

On-line large whale entanglement response first responder trainings:

- Pacific Islands online first responder training: https://pacific-islands training.whaledisentanglement.org/
- Alaska online first responder training: https://alaska-training.whaledisentanglement.org/
- West coast online first responder training: https://west-coast-training.whaledisentanglement.org/
- East Coast online first responder training: https://east-coast-training.whaledisentanglement.org/#/

3.3 Authorization and Supervision

First responders that are not directed to respond (*e.g.*, a tour boat that reports the animal and/or stands by) and do not approach the entangled animal within 100m, maintaining a safe and legal distance, are not under the authorization of the MMHSRP and their permit. However, due to the unpredictable nature of an entangled animal and undetermined trailing gear, risks exist. Any effort that represents approaching the entangled animal within 100m, or is otherwise directed, will require authorization under the MMHSRP as a permitted activity. Activities that represent close approach assessment, and/or tagging, will require at least one level 3 or higher responder to act as IC (unless authorization is received). Authorization is also dependent on consulting Regional Stranding or LWERCs to receive approval as part of Heightened Consultation*. In the event that Heightened Consultation cannot be met (*e.g.*, no cellular service, unable to relay via VHF radio, no satellite phone), activities requiring close approach, including tagging, will require a level 4 responder.

Heightened Consultation policy (Required reporting and consultation for level-designated roles, and **case-by-case** authorizations):

- Provide a detailed assessment of entanglement and animal.
- Provide an IAP, including available resources, personnel, and conditions.

If consultation contact cannot be reached:

- Level 3s are only authorized to document above water; no pole cameras, tagging or cutting (*i.e.*, close approach)
- Level 4s are authorized to document and apply tag, but no cutting
- Level 5s are authorized to document, tag, cut anything on any species except right whales
- Right whales will be authorized on a case-by-case basis

3.4 Team Member Roles

While first response may represent lower risk, non-permitted activity, it may also involve an unintentional, or directed close approach to an unpredictable, and likely stressed animal possibly trailing an undetermined amount of gear in the water. Thus, approaching a large whale entangled in gear is inherently risky for both the responders and the animal, and warrants adherence to ICS and the planning it embraces. Clarifying team member roles and responsibilities ahead of time, and ensuring that responders meet minimum qualifications for each role is essential for a safe and successful response. The recommended roles that follow are based, in part, on implementation of the ICS. The number of responders needed for a response varies widely depending on the vessel, the amount and type of documentation needed, whether tagging is involved and the length of the mission, to name a few variables (Table 4). For instance, using Table 4, even on a small vessel, while attempting to assess and tag an entangled whale, the mission should represent at least a team of six, and preferably eight, qualified response crew.

Table 4. Suggested number of personnel and roles required for a typical large whale entanglement first response effort.

Team member role	Number of personnel required
Incident Commander/Safety Officer	1-2
Vessel captain (may also represent Safety Officer)	1-2
Crew (vessel dependent)	1 - 3 (roles can be shared with other roles)
Data collector	1
Documenters	1 - 3 (roles can be shared with other roles)
Communications person	1 (role can be shared with other roles)
Tagging (familiar with tag setup and deployment; takes 2 people, along with helm position to deploy)	2 (roles can be shared with other roles)
Optional – UAS pilot (see UAS; Section 6)	2 - 3 (roles can be shared with other roles)

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

- **<u>Incident Commander (IC)</u>** - The IC, working closely with shoreside (or otherwise remote) authorizing parties (*e.g.*, NMFS Regional Stranding Coordinator [RSC]/ LWERCs, National LWERC), is responsible for the on-scene oversight and supervision of the first response operation. The IC may participate directly in the operation depending on circumstances, but typically does not directly participate (*i.e.*, hands-on) in the operation. This enables the IC to remain focused on the larger picture of the response and objectively ensure that safety is maintained for responders, the public, and animals.

  - **<u>Qualifications</u>** – Completion of the ICS free or paid courses, level 3 or higher for any close-approach assessment or tagging operations (Level 4 or higher in cases of not meeting

Heightened Consultation protocol). Must be trained and/or experienced in protocols, procedures, risks, and risk mitigation in all aspects of the first responder mission being carried out.

- **Safety Officer (SO)** – The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate with the team and adjust the strategy of the response as needed. The SO works very closely with the IC. Under certain circumstances and depending on experience, the role of the SO can overlap with that of the helmspersons of the support or approach vessels, and if necessary and otherwise appropriate, the role of IC and SO can be performed by one person.
    - **Qualifications** – Experience in previous large whale entanglement response efforts, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e*., not adhering to protocols, presence of other animals, incoming environmental or weather changes, and time of day considerations). Willingness and ability to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.
- **Helmsperson(s)** – This person(s) is responsible for the safe transit and operations of the vessel(s), including the safe maneuvering around and approach to entangled whales, and the trailing gear that might exist. Helmspersons should have experience operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the helmsperson role whether on the transit, support, or approach vessels is one of the most important roles beyond that of the IC.
    - **Qualifications** – Experience, training, and in some cases certifications *(e.g.,* USCG license, NOAA certified components course) in order to "captain" a vessel. Helmspersons should have experience operating the vessel around large whales and all aspects of the response operation.
- **Data collector** – The data collector is essential in recording all aspects of the entanglement response. This person is responsible for ensuring all data is complete on data sheets and data loggers, including the assessment of the animal, recording identity of associated documentation, the entanglement (*e.g.*, nature of the entanglement, gear type), behavior of animal (*e.g.,* respirations, changes due to response), the response efforts (*e.g.,* an outline of response steps taken, risk factors encountered, who was involved), and telemetry (*e.g.,* tag identity, frequency of VHF, fine tuning).
    - **Qualifications** – Familiarity with procedures and data sheet/dataloggers, attention to details. Ability to accurately and completely compile a great deal of information. Lacking a disposition to seasickness is valuable.

- **<u>Documenter(s)</u>** – This person(s) is/are responsible for obtaining and maintaining (*e.g.*, identifying and safe storage) still and video imagery on all aspects of the response. They work closely with the Data Collector and the helmsperson. This person may also serve as the data collector. Under certain circumstances, responders with other roles may take on, in part, the role of documenter, through use of helmet or vessel-mounted POV cameras. However, such persons must maintain focus on their primary role and maintain safety. POV cameras should be turned on and forgotten by the user and instead either tended to or operated remotely by a dedicated documenter.
    - **<u>Qualifications</u>** – Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response (see an example of media guidance in Appendix E and documentation pointers in Appendix R).
- **<u>Communications</u>** – This person is responsible for maintaining all-important communications aboard vessels, between vessels (*e.g.*, a supporting partner vessel) and to shoreside contacts, including floatplan contact and NMFS authorizing agents (*e.g.*, Regional and/or National LWERCs). Shoreside contacts typically take on the role of further disseminating information, including to agency partners/leads, any other authorizing agencies, and media coordinators. Communications at this stage do not involve the media as this is the role of media coordinator and others at later stages (see Appendix E for media guidance along the West Coast).
    - **<u>Qualifications</u>** – Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response.
- **<u>Telemetry taggers</u>** - This role is responsible for the pre-deployment preparation, including the testing of the transmitters and receivers and setup of the telemetry buoy, the appropriate deployment of telemetry, receiving Argos, GPS and real-time VHF fixes, and the interpretation and forecasting of telemetry data towards use in relocating the animal for future efforts.
    - **<u>Qualifications</u>** – These persons need to be trained or otherwise familiar with the appropriate preparation (*i.e.*, testing, tuning, and mounting to the telemetry buoy) of telemetry gear, deployment, reception, and interpretation of telemetry. The two-person team attaching a tag must work closely with a helmsperson. Both persons - one making the attachment (*e.g.*, throwing a grapple) and the other person dedicated towards making sure the telemetry buoy is deployed cleanly off the vessel, need to be physically capable, trained and experienced in the procedure, and familiar with all risk factors. At least someone on the team needs a level 3 designation or approval to proceed otherwise. Heightened Consultation criteria may require

Level 4 designation.

- **<u>Unmanned Aircraft System (UAS)</u>** - If permitted to operate a UAS during the response, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success or safety of the operation, or causing disturbance to any animals.
    - **<u>Qualifications</u>** – Pilots must have an FAA Part 107 Remote Pilots license, follow all existing FAA and other local/state regulations, and be trained and/or experienced operating a UAS over water from a vessel during response operations. More detail on UAS use is addressed in Section 6.

3.5 Communications

Communications between team members on a particular vessel, between vessels and to shoreside contacts have serious implications towards maintaining safety. While communications involve all members of the team, it is especially important for the IC, the SO, the Communications person, and the primary shoreside contact to maintain a strong working relationship. Well-established and consistent communications on the water will have strong operational bearing on maintaining an efficient and safe working environment, while communications with the shoreside will facilitate authorization and reporting requirements. Shoreside contacts typically take on the role of further disseminating information, including to agency partners/leads, any other authorizing agencies, and media coordinators. On-water/on-site direct communications do not involve the media, as this is the role of media coordinator(s) and others at later stages.

Some examples of key communications are:

- Alerting and approval of helmsperson of an action (*e.g.*, movements aboard, on and off vessels);
- Alerting and approval of helmsperson on the deployment of gear (*e.g.*, deploying the telemetry);
- Notification and acknowledgement of UAS deployments and recoveries;
- Providing risk assessments and IAP to Regional or National LWERCs;
- Providing regular status updates to all shoreside contacts for further dissemination;
- Communications between documenters and data collector on imagery taken;
- Alerting the response team of a change in behavior from the animal and;
- Alerting team members of hazards (*e.g.*, gear in the boat, line in the water near engines).

3.6 Data Collection

Data collection is essential in recording all aspects of the entanglement response, including the assessment of the animal, recording identity of associated documentation, the entanglement (*e.g.*, nature of the entanglement, gear type), behavior of animal (*e.g.*, respirations, changes due to response), the response efforts (*e.g.*, an outline of response steps taken, risk factors encountered, who was involved), and telemetry (*e.g.*, tag identity, frequency of VHF, fine tuning). The information gained has benefits towards evaluating the threat (*i.e.*, the animal risk assessment) and the operational risk assessment (*i.e.*, assessment of the risks and impacts posed by the response to humans and animals).

It is important that data-forms and/or data loggers are prepared and maintained (*e.g.*, batteries charged), and appropriate team members are familiar with their use prior to the start of any entanglement response. During a response, data collection needs to be maintained (the role of a dedicated data collector), and appropriate communications are on-going with the entire team to collect all data required. Some examples of data collected are:

- General response narrative (*e.g.*, when departed, on-scene, a procedure performed, the whale is freed and gear collected);
- Cataloging of imagery;
- Animal behavior, including response to procedures;
- Risks posed to responders (in the case of injury or worse, incident reports will need to be completed);
- Telemetry setup (*e.g.*, PTT ID, VHF frequency and fine tuning);
- Personnel and supporting agencies, along with their roles;
- Information on the entanglement (*e.g.*, how entangled, gear description and markings); and
- Information on the animal (*e.g.*, condition, sex, age class, impacts, fluke ID).

3.7 Resources

The primary resources of first response, beyond the team itself, are vessel support, safety gear, personal safety gear, data collection gear (*e.g.*, imagery and data forms), and telemetry and equipment towards deployment. A breakdown of each of these is provided below.

Vessel Support:

- Appropriately sized, equipped, and operated within the speed and range to safely respond.
- Have capacity for at least four to six response crew to fulfill all roles (six based on deployment of telemetry).
- If making closer approaches, vessel should have greater maneuverability, which may be related to size of vessel (*e.g.*, smaller size typically increases responsiveness and

maneuverability).

- For documentation, safe access for documenters with a clear unobstructed field of view.
- If deploying telemetry, clear deck space, preferably forward, with low gunwale/rail system and limited snag points to accommodate deploying telemetry, including the clean deployment of the telemetry buoy.
- Accommodate communications between members of the team, especially involving the helm position (*e.g.*, flybridge and center consoles).

Response Equipment:

- Tether (*i.e.*, for telemetry/working lines) to initiate accessibility and/or constraint under "Disentanglement" (Section 4).
- Attachment tools (*e.g.*, grab grapples and pole-mounted skiff hooks).
- Receptacles (*i.e.*, a five-gallon bucket) to hold and cleanly deploy lines/tethers.
- Cutting grapple for remote cuts, but also for a safety tool.

Telemetry Gear:

- Transmitters (*e.g.*, Telonics whale tag)
- VHF receivers
- Antennas and associated cables
- Telemetry buoy
- Timed-release clips

Documentation:

- DSLRs, video cams or comparable cameras with a variety of lenses.
- POV cameras (*e.g.*, GoPros) to mount on helmets, parts of the vessel, and poles.
- Drones or UAS platforms for aerial documentation.
- Enough batteries and cards to complete the mission.

Data Collection:

- Data forms, checklists and/or data loggers (*i.e.*, Level A, response report form, photo-documentation forms, telemetry data forms).
- Watch/timer
- Binoculars
- Memory cards for various cameras.

Personal Safety Gear and Protective Clothing:

- Appropriate footwear (*e.g.*, closed-toe shoes or boots).
- Protective clothing (*e.g*., wetsuits, work suits, UV protective wear).
- Chafe and cut-resistant gloves (*e.g.*, Lamars, Atlas) that fit well.
- Appropriate Personal Floatation Device (PFD; Will depend on environment, but also role). Personnel making close approaches and handling gear attached to the animal need to also wear PFDs with limited risk of getting caught in gear (*i.e*., fits well, is simple, and has few snag points).
- Appropriately fitted and protective helmets (*e.g.*, Gath, Team Wendi, AquaSport). Helmets can have integrated eye and face protecting visors. Helmets are required for those using poles, in the vicinity of poles, or in the vicinity of animal and gear.
- Personal, one-handed safety knife for personnel that are handling gear or in a position to possibly handle or interact with gear, especially if it might be attached to the animal.
- Optional - eyewear, knee pads, sunscreen, hat.

Medical and Safety Equipment:

- First aid kit
- AED
- Backboards, neck collar, splints (immobilization gear) If further offshore, remote or removed from medical attention:
- Lift cages and harnesses
- Oxygen kit
- Satellite phone
- An appropriately trained person (advanced medical training, EMT) to use more advanced medical equipment and provide additional emergency care.

3.8 Environment and Weather

The scope of first response and its actions is fairly broad, and as such, so are the conditions it can be performed under. The use of larger vessels towards rapid first response may allow a greater response range due to the vessel's range and speed, and ability to handle adverse conditions. A faster vessel, along with the typically shorter duration first response missions, may allow for initiating efforts later in the day. In addition to larger vessels, the generally less complex and involved missions of first response also typically allow for higher sea states. While dependent on other variables, the typical cutoff on first response is Beaufort 5. However, any environmental limitations are based on safe operating conditions, and are affected by range, distance from medical attention, travel time, daylight affecting operations and transit, air and water temperature, visibility (*e.g.*, fog, heavy precipitation, darkness), certain types of precipitation (*e.g.*, snow, sleet, hard rain), and other environmental factors (*e.g.*, lightning, approaching hurricanes). Assess the following environmental conditions prior to mounting an effort/approaching the animal:

- Weather conditions (*e.g.*, rain, snow, fog, wind, approaching storm systems, heat, cold).
- Environment (*e.g.*, remoteness, exposure to higher sea states).
- Time of day (*i.e.*, close to sunset).
- Conspecifics (*e.g.*, other potentially interacting whales in the area).
- Predators (*e.g.*, sharks, killer whales).

3.9 Procedure and Mission Goals/Complexity

Response team assess an entangled gray whale in order to formulate an action plan (PMMC/ NOAA MMHSRP permit # 932-1905)

First response represents either opportunistic or directed efforts with a primary mission to provide assessment and documentation, and under certain circumstances, attach tethered telemetry towards disentanglement operations. First response can be from safe (at least 100 meters) and legal distances (where they apply, and thus not a permitted activity [levels 1 - 2]), or represent closer approaches that fall under the MMHSRP permit (level 3). First response may represent the entire mission by meeting all mission objectives required and warranted based on risk assessments and decision matrices, or it may represent the initial stages of a much more involved effort including telemetry and/or the attempted disentanglement of the animal (Section 4).

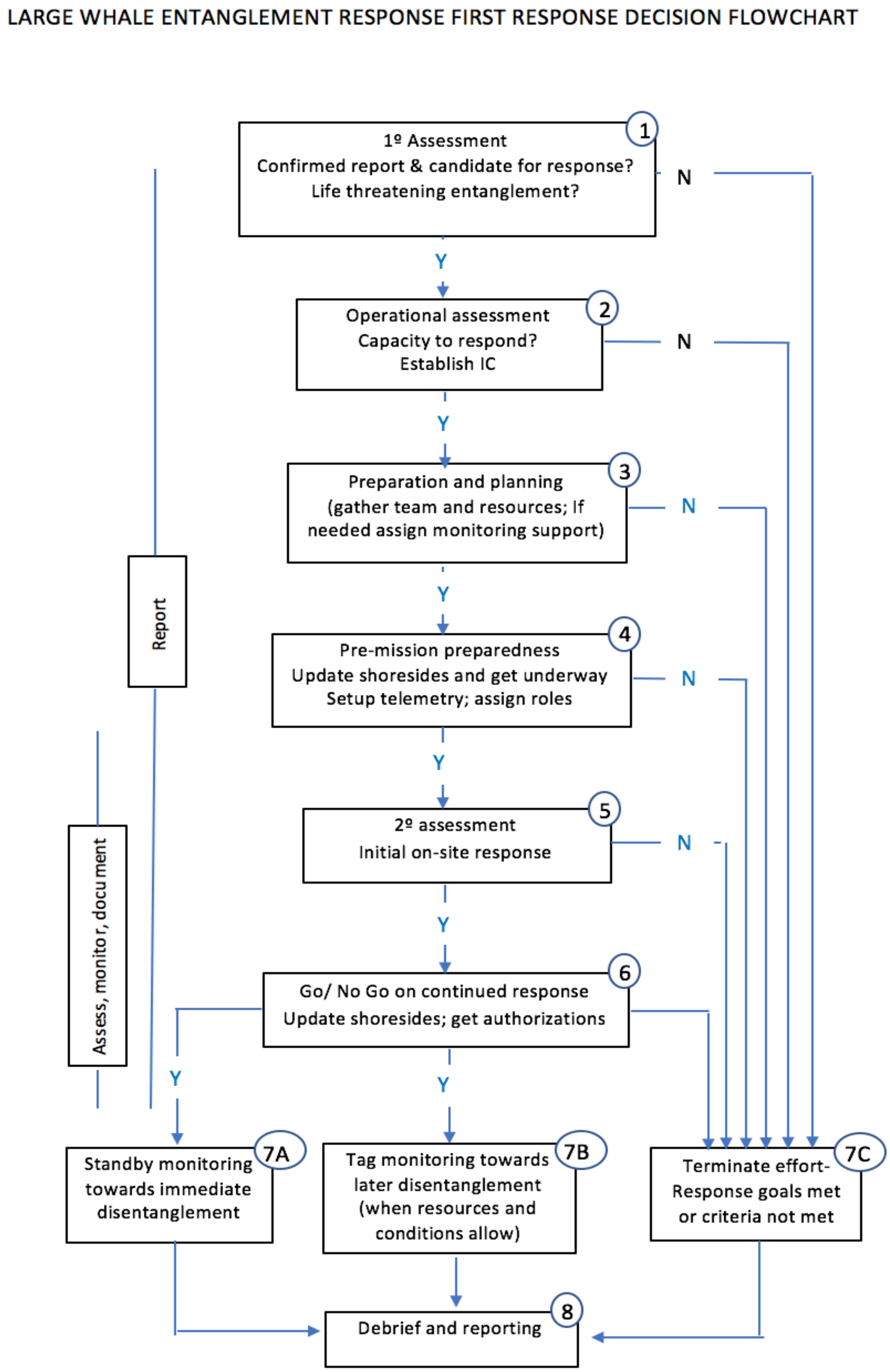


Figure 10: Large Whale Entanglement Response First Response Decision Flowchart

Generalized outline of first response, including attaching telemetry:

Step 1: On obtaining an initial assessment and determining that report represents a confirmed case and animal is a candidate for response (*e.g.*, a life-threatening entanglement).

Step 2: Establish an IC and perform an operational assessment (*i.e.*, is there the capacity to respond and do conditions allow?). First response, like any large whale entanglement response effort, requires use of decision matrices and appropriate risk assessment.

Step 3: Response preparation (*e.g.*, gather team and resources, assign roles) and planning (*i.e.*, draft initial IAP). As part of planning and preparation, as it does require time, consider this time, as well as the transit time to the animal, as part of the response IAP. Is the animal anchored, otherwise immobile, on a predictable heading and speed? Is there historical data suggesting the animal will stay in the area? Is there standby support monitoring the animal, and/or are there resources (aerial support) to otherwise relocate the animal? After just two hours, the search area of even a slow moving (3 knots) entangled whale can grow to nearly 255 sq. nms.

Step 4: Perform initial pre-mission briefs (*e.g*., standard vessel and response operations) and GARs with team. Update NMFS on status and establish shoreside contacts. Get underway. Maintain vessel operational requirements (*e.g*., captain or qualified person at helm, observers), refine roles (*e.g.*, who gets what camera), and prepare response resources, including telemetry if it has possibility of use. Turning on the telemetry early will make sure it is fully operational well before the decision is made to deploy it. Safely transit to the last known or predicted position of animal.

Step 5: Arrive on scene (*i.e.*, animal passed off by standby vessel or otherwise relocated). Approach as needed, appropriate, and authorized to obtain additional (2º assessment) and documentation. The documentation person should ensure all photo and video equipment is on and recording. Information to include the animal (*e.g.*, species, age class, condition and impacts, the ID), the gear (*e.g.*, gear type, how entangled, status of gear, gear ID), and the conditions. Safety persons maintain a watchful eye on animal(s), the team, and actions (*i.e.*, the overall environment).

Be methodical and slow in approaching the whale and entangling gear. Avoid using reverse or sudden throttle changes, and be predictable on the approach. Approach from the side and slightly behind as to avoid any trailing gear (*e.g.*, net and line). Maintain a safe distance, avoiding the 'danger zone.' While initial approaches are typically the most productive, never assume it is safe to closely approach the animal. Remember, the animal's behavior may be temporarily consistent, but can change for the worse in a moment's notice. Only approach the animal as needed and authorized. Back off if the animal shows signs of stress. Maintain operational assessment and mitigate risks to responders at all times.

Response team off Kodiak, Alaska assess an entangled humpback whale prior to engaging (NOAA MMHSRP permit # 932-1905)

Step 6: Update shoreside contacts. Consult with National or Regional LWERCs and/or response experts, and use results of 2º assessment to determine continued actions and their authorization (*i.e.*, will disentanglement be pursued, animal tagged, or operations terminated?). Criteria will be based on authorization requirements and decision matrices - Go/No Go determination. If operations are to proceed, especially if close approaches may be required, the first response team should attempt to limit their approaches to minimize the effect on the animal (*i.e.*, animals typically become more evasive over time). Save some of the initial approaches for other activities (*e.g.*, tagging and cutting the animal free).

Step 7a: If monitoring while additional resources (*e.g.*, additional tools and personnel towards disentanglement) arrive on scene, fall back at least 100 meters to a position abeam or off the quarter of the animal. Make sure team members are assigned to monitoring the animal and not doing other roles.

Tips on standby monitoring:

- Time the sounding dives, and estimate heading in order to determine the pace of the animal.
- Don't rely solely on the entanglement to identify the entangled animal. These may change (*e.g.*, an air-filled buoy not recovering after a dive, or a line no longer draped over the back).
- Use identifying features of the animal to track it (*e.g.*, pigmentation differences, scars, age class).
- If the whale does not surface within the time that you expect, assume that you missed the surfacing.

Assessing stress and warning signs (*i.e.*, when to back off or terminate a response):

- Evasive maneuvers (*e.g.*, changes in direction, time between dives)
- Trumpeting or wheezy-like blows
- Headrises
- Tail slashing and swishing

- Surface-active behaviors (*e.g.*, breaches)
- Changes in respiration

Step 7b: If tagging has been determined appropriate, make final preparations of gear (*i.e.*, tag is operational, secured to buoy and ready for deployment). Responders handling lines, telemetry buoy, and/or deployment gear (*e.g.*, clip on a pole, a grapple hook), should have appropriate attire and PPE on (*e.g.*, helmets, gloves, PFDs, jewelry removed). Establish and review all roles with the team, including all procedures, mitigating measures – any emergency response, and confirm team members fully understand, are capable, and are mentally prepared. Discuss when response should be aborted and who makes the decision. Review animal warning signs, and the appropriate emergency response actions. Re-evaluate operational assessment and mitigating measures using decision matrices. Update IAP, review with team, and get approvals from shoresides as required. The inability to consult with regional coordinators or experts (*i.e.*, Heightened Consultation) regarding tagging (a level 3 activity) and its IAP, may require the IC to have a greater level designation. If met, tagging may proceed, but otherwise, the effort will need to be terminated. The IC should ensure all personnel and equipment are ready and perform the final Go/No Go determination.

Telemetry buoy with transmitter trailing behind entangled animal (NOAA AKPRD)

The three primary steps to prep and deploy a tethered telemetry package:

- Tag package is operational:
  - Initial GPS fix received
  - VHF frequency fine-tuned
- Tag secured to buoy
- Tag secured to animal (via the entanglement)

See Appendix J for more detail on maintaining and preparing telemetry for use in Hawaii.

Tagging is typically used when disentanglement response cannot or should not be mounted immediately, or needs to be temporarily suspended. As such, it represents an alternative to proceeding with disentanglement or aborting the mission.

The use of tethered tags provides:

- Time to gather resources.
- Rapid response of moderately experienced teams (*i.e.*, they may not be able to disentangle the animal, but they can assess and tag it for potential follow-up).
- Multiple efforts over time.
- Safety (*i.e.*, that alternative when conditions and resources do not allow or warrant further response - tag it and go home).
- Proof of later release or self-release of gear (allowing for gear recovery).

Step 7c: If evaluative and operational assessments, including Heightened Consultation, and their corresponding decision matrices are not maintained, then first response activities must be terminated, or fall back to activities in which they would be met.

Step 8: No matter what path the first response leads to, the entire response team needs to review the response for any operational risks and means of mitigation (*e.g.*, a change in protocol and new tool). It is important to discuss as soon as possible while memories of the event are fresh. Debrief reports should be drafted. Ensure all datasheets and reports are complete and reporting requirements met (*e.g.*, incident reports, permit reports, debrief reports).

Appendix I provides an example of a generic first response checklist for large whale entanglement response under NOAA's MMHSRP. Figure 11 below depicts that portion (shaded in green) of the overall response that might represent a first response. First response generally refers to tier 1 through tier 3, but can support tier 4. Everyone has an investment in tier 5 in as much as it represents the gathering of information to better understand and mitigate the large whale entanglement threat.

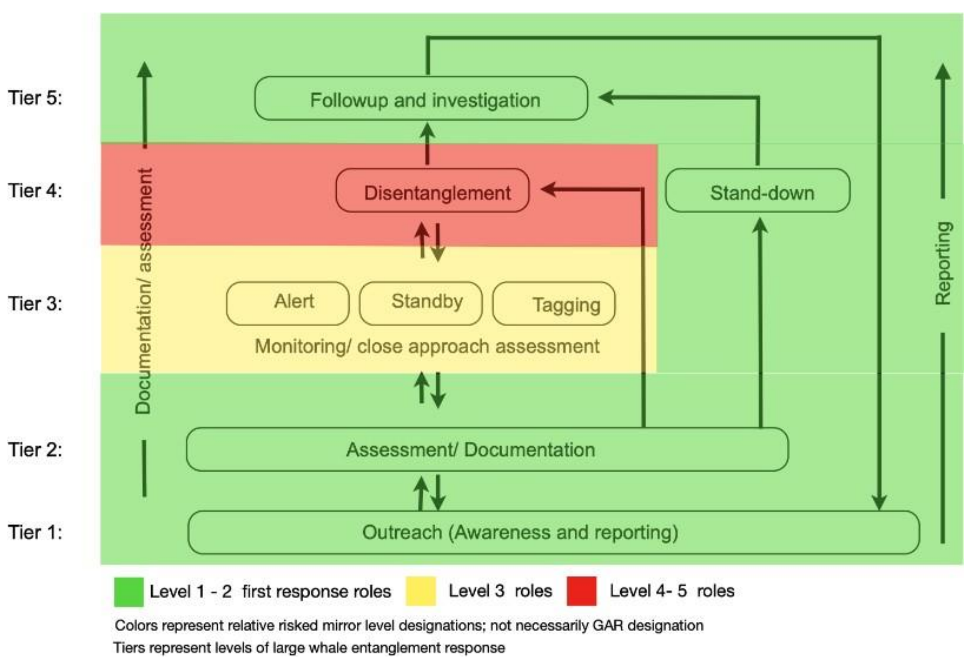


Figure 11: Large Whale Entanglement Response Flowchart

3.10 Risk and Mitigation

Risk mitigation should be no different for first response than that of a more involved operation, like disentanglement. Even the simple task of approaching a large whale to obtain an ID (*e.g.*, a fluke ID of a humpback whale) can incur risk as the vessels' outboards have become entangled in the trailing gear. First response still represents approaching or just being in the vicinity of a likely mobile, stressed, unpredictable, entangled large whale, while the team is in a relatively small boat in the open ocean. Experienced and trained responders still need (and are required) to be prepared, plan, and be aware of the risk factors and their mitigations. The adherence to protocols and application of decision matrices still need to be met. Don't make assumptions of what might be perceived as a lower level of risk of first response, as things can and do change.

RISKS TO HUMANS

Risk: Injury or death to personnel from contact with a whale. Direct contact from the animal has the highest risk, especially when cutting the final line of the entanglement and freeing the animal (Lyman & Mattila 2010).

Risk assessment prior to mitigation: II/ E High Risk

***Mitigation*:**

- All personnel should avoid proximity to the animal – the danger zone surrounding the animal, especially at times when there may be a change in the animal's behavior, such as when making final cuts that may cause gear to shift or elicit a pain response.

- All personnel should wear appropriate PPE such as PFDs and helmets as necessary. The use of helmets is required for those using poles and teammates that are in the vicinity (*i.e.*, within the extended radius of the pole's 360º sweep). At the moment of attachment (*i.e.*, before a clip releases) the pole becomes an extension of the animal and poses additional risk.

- Designated safety persons should be assigned to continually watch over all personnel involved, warning the team of hazards such as changes in behavior of the animal and presence of other animals, and be able to communicate to the team to adjust strategy or call off the effort as necessary.

- Designated personnel should prioritize the use of flying knives (*i.e.*, knives that slip off poles) or thrown knives (*i.e.*, cutting grapple) to minimize time near the animal.

- Distressed animals are unpredictable; continuously monitor for signs of stress (*e.g.*, abrupt headrises; suddenly producing wheezie or trumpeting blows; changes in respiration, speed, or dives; bubble streams and blasts otherwise out of context; pronounced close approaches, especially belly towards (*i.e.*, a maintained rollover).

- Teams should approach the animal as methodically and consistently as possible, giving time for the animal to habituate to the presence of the approach vessel (Ledwell & Huntington 2018).

  Risk Assessment following mitigation: I/E Moderate Risk

Risk: Injury or death to personnel due to getting harmed by, or entangled in the gear that the animal is entangled in.

Risk assessment prior to mitigation: II/ D Moderate Risk

***Mitigation*:**

- All personnel handling gear attached to the animal (*e.g.*, attaching tethered telemetry) should wear protective gloves to avoid chafing (*i.e.*, rope burns) and impact.

- All personnel handling gear attached to the animal should carry a one-handed safety knife. Note: Do not use the safety knife as a utility knife.

- Support vessel team should remain alert and prepared (*e.g.*, cutting grapple ready to sever any links).

- Certain gear types, such as the pane of a gillnet or the mainline of a longline should not be directly handled (*e.g.*, while securing telemetry directly to the entangling gear).

- Avoid the area close to and around the whale - the “danger zone.” This includes the area behind the animal, as the approach vessel can get caught in the trailing gear.

- Any vessel closely approaching the animal (*i.e.*, in the danger zone) should be as free as possible of snag points, especially the engines and hull, and areas of the vessel where gear might be handled.

- For small vessels with minimal open deck space that closely approach the whale and entangling gear, only carry the necessary gear for that particular operation (even safety gear can be covered by the support vessel).
- All personnel handling gear attached to the animal should wear PFDs and protective clothing that are "clean" (*i.e.*, free of snag points).
- Do not get in the water near an entangled whale.
- Do not pull line/gear into the vessel that might still be attached to the animal.
- During line handling, only have a bight of line in the vessel at any one time as to reduce threat to personnel (*e.g.*, grabbing the trailing gear to attach a telemetry buoy).
- Always farelead the lines attached to the animal, especially if under load, to the outboard side of a vessel and of all personnel as to avoid being stripped off the vessel (*e.g.*, during the process of deploying the telemetry buoy).
- All personnel should remain clear of gear being attached/deployed to the animal/entanglement (*e.g.*, clips, grapples, telemetry buoy) to avoid personally getting entangled.
- Make sure gear being attached to animal/entanglement is deployed from the vessel on the team's terms. <u>Do not</u> let the animal pull gear off the vessel (*i.e.*, make sure the telemetry buoy is deployed off the vessel as opposed to the whale taking it off the vessel). Use a dedicated person to deploy telemetry or kegging buoys.
- Do not wrap net or line around hands or fingers. Line handlers, like those deploying telemetry, should remove entanglement hazards (*e.g.*, rings, watches), and keep feet clear of lines and nets. Use a five-gallon bucket or other receptacle to hold the telemetry buoy's tether line as it is being deployed.
- Responders handling gear should be familiar with the entangling gear, its associated risks (*e.g.*, a longline with gangions). Certain gear like gillnet and longline should not be directly handled.

Risk Assessment following mitigation: I/C Low Risk

Risk: Injury or death to personnel due to contact with tools. Risk assessment prior to mitigation: III/ C Moderate Risk

***Mitigation*:**

- All personnel using disentanglement tools, especially poles, should wear appropriate helmets. Personnel in the vicinity of the person using a pole should also wear helmets.
- During line handling, keep grapples and clips attached to the working line well in front (~2 meters) of personnel to avoid contact. If the line is under load, the distance between tools and personnel should be even greater (~5 meters).
- All personnel should remain clear of gear being attached to the animal (*e.g*., knives, clips, grapples, telemetry buoy). An animal eliciting a negative response to the tool, may throw it a long distance (*e.g.*, from a tail slash).
- If deploying tools from poles, test animal's behavior prior to committing to the use of the tool (*i.e.*, touch the whale with the back of a clip or knife prior to attachment and immediately clear - lift the pole, to see if there is a response).
- Clear poles (*e.g.*, lift or pull back and stow) after use.
- Make sure gear being attached to animal/entanglement is deployed from the vessel on the team's terms. Do not let the animal pull gear off the vessel. Use a dedicated person to deploy gear (*e.g.*, buoys).

Risk Assessment following mitigation: II/B Low Risk

Risk: Injury or death to personnel due to overall response (*e.g.*, fatigue, exposure, falls, strains). Risk assessment prior to mitigation: IV/ B Low Risk

***Mitigation*:**

- Monitor personnel exertion and fatigue levels. Have enough experienced responders to avoid fatigue. Do not push oneself or team to the limits.

- Responders should have appropriate attire and protection to minimize exposure.

- Communicate responder movements between vessels to helmspersons (*i.e.*, “stepping over”).

- Monitor your fellow responders.

- Monitor emotions or desire to “save animal.” Emotions can and do cloud judgement(s).

Risk Assessment following mitigation: III/A Minimal Risk

As always, one major all-encompassing mitigating measure is standing down or aborting a procedure or the entire operation/mission. There is no obligation to respond.

Some primary points related to human safety that might not fall under the examples above or apply to all are:

- While there is no obligation to respond, there are obligations to meet certain criteria and protocols under the MMHSRP and its permit, if initiating a response.

- Obtain necessary authorizations as they are there primarily for safety.

- Ensure first aid kits and AED are available and located with each response group.

- Create a written safety protocol with emergency numbers to be kept with first aid kits.

- Do not put the whale's rescue above human safety.

- Never initiate an action that has not been thoroughly thought through and discussed

- Review worst-case scenario protocols; have an exit strategy for each procedure. Consider the “what ifs.”

- When in doubt, tag (if decision matrix met), regroup (*i.e.*, attempt another day with more assistance, better conditions, and/or new tools and procedures) or entirely abort the mission. Aborting a response is a viable option.

- All members of the team should understand and agree upon response actions.

- Pre-mission briefs should be conducted.

- Responders should only conduct procedures for which they meet minimum qualifications and training.

- Personnel should wear appropriate PPE such as strong, non-slip footwear, gloves, and protective clothing as necessary.
- Do not get in the water near an entangled whale.
- Avoid the area close to and around the whale, including directly in front and behind, as this represents a danger zone in which contact with the animal or entanglement in the gear is more likely.
- Distressed animals are unpredictable; therefore it is important to continuously monitor a response to anticipate any risk and maintain safety.
- Communication within and between the disentanglement teams, including briefings, is critical to minimize risk and avoid hazards
- If drugs are used, all responders should be familiar with the drugs and reversals, including symptoms of accidental exposure and if/when/how to treat prior to the arrival of medical personnel.

RISKS TO ANIMALS

Like human safety, first response still carries risks for the animal. The response team needs to adhere to protocols, apply decision matrices, and assess and mitigate any risks to the animal(s) relative to that of the threat.

Risk: Injury or death to animal due to contact with response vessels. Risk assessment prior to mitigation: II/ B Low Risk

***Mitigation*:**

- Use propeller guards around propellers (may also reduce catching trailing gear).
- Have experienced and knowledgeable operators at helm that are familiar with vessel, maneuvering around whales, and the operation.
- Avoid operating in the danger zone. Doing so not only reduces risk to responders, but also to the animal.
- Be methodical and as consistent as appropriate in approaching the animals as to be

predictable.

Risk Assessment following mitigation: I/A Minimal Risk

Risk: Injury or death to animal due to drag forces (*i.e.*, kegging, tethered telemetry, towing approach vessel - Nantucket sleigh ride).

Risk assessment prior to mitigation: III/ C Moderate Risk

***Mitigation*:**

- Use of constraint (addition of kegging buoys/sea anchors) only when deemed necessary (see decision matrix).
- Use of telemetry when pros outweigh cons (see telemetry decision matrix).
- Use lower drag telemetry buoys.
- Use weaklinks or timed-release clips to avoid long-term attachments.
- Methodical use of kegging as to reduce stress and use only constraint when required for mission objectives.
- Avoid applying force to gear or tethered working lines that convey force to a vulnerable, traumatized part of the body (*i.e.*, to a deeply embedded wrap on a body appendage).
- Avoid applying force to entangling gear that involves strong, small diameter lines or rolled up gillnet, as both can produce significant and rapid trauma, especially if wraps are involved.
- Understand the type of entangling gear involved and its associated hazards.

Risk Assessment following mitigation: II/C Low Risk

Risk: Injury or death to animal due to contact with equipment (other than vessels). Risk assessment prior to mitigation: II/ B Low Risk

***Mitigation*:**

- Use of hooked knives with dull outer surfaces by experienced responders.
- Appropriate use of drones (UAS) by FAA Part 107 Remote Pilot licensed and experienced pilots.

Risk Assessment following mitigation: I/A Minimal Risk

As always, one major all-encompassing mitigating measure is standing down or aborting a procedure or the entire operation/mission. There is no obligation to respond.

Other risks:

Other risks include the animal and entanglement being a "hazard to navigation" and a vessel getting caught in the trailing gear; well-intentioned public attempting to free the animal and getting injured; resources being lost or damaged during a response (*e.g.*, loss of telemetry buoy, approach inflatable being cut); and an unsuccessful mission causing stress (emotional and otherwise) to managers, responders and the community in general. These risk factors affect response risks either indirectly or directly, and should not be ignored when addressing risk mitigation.

3.11 Intervention Criteria/Decision Matrix (Go/No Go)

A risk intervention tool or decision matrix (Appendix M – Decision Matrix [Go/No Go]) should always be used prior to any response. Factors that should be considered include environmental, team selection and fitness, animal condition, permission, resources, and mission complexity.

Table 5. First Response Risk Assessment Coding under Five Steps of Assessment

Step 1. Identify Risk Factors			Step 2. Access Hazards (who/ what?)	Step3. Evaluate Risk and Mitigate		Step 4. Record and Implement	Step 5. Monitor and Review
Response Categories	Hazards/ Risks	Causes	Initial RAC	Develop Controls	Residual RAC	How to Implement	How to Monitor

During first response, disentanglement, sedation	Injury or death to personnel from contact with whale	Operating in danger zone, loss of situational awareness, startle or pain response from animal	II/ E = High Risk	Avoid danger zone, only experienced personnel in close proximity, dedicated SO	I/ E = Moderate Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO	IC/CI will ensure compliance at scene. PI ensure compliance under program
During first response, disentanglement, sedation	Injury or death to personnel due to getting harmed by, or entangled in the entangling gear	Operating in the danger zone, loss of situational awareness, abrupt changes in animal's behavior	II/ D = Moderate Risk	Avoid danger zone, only experienced personnel in close proximity, use of safety knives, dedicated SO	I/ C = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO	IC/CI will ensure compliance at scene. PI ensure compliance under program
During first response and disentanglement	Injury or death to personnel due to contact with tools	Lack of situational awareness, too close to tools under load, abrupt response from animal	III/C = Moderate Risk	Use experienced personnel, wear PPE, stay clear of tools under load or being deployed	II/B = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO	IC/CI will ensure compliance at scene. PI ensure compliance under program
During first response, disentanglement, sedation	Injury or death to personnel due to overall response	Inexperience of personnel, too much emotion, fatigue	IV/ B = Low Risk	Use experienced personnel, wear PPE, maintain methodical approach and fatigue levels	III/ A = Minimal Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO and focus on big picture	IC/CI will ensure compliance at scene. PI ensure compliance under program
Response Categories	Hazards/ Risks	Causes	Initial RAC	Develop Controls	Residual RAC	How to Implement	How to Monitor
During first response, disentanglement, sedation	Injury or death to animal due to contact with response vessels	Lack of experience and situational awareness, too many vessels approaching or in danger zone, fast transit	II/ B = Low Risk	Use experienced helmsperson(s). Avoid operating in danger zone. Maintain observers and prudent/safe speed	I/ A = Minimal Risk	Adhere to all criteria and guidelines established for vessel use around animals	IC/CI will ensure compliance at scene. PI ensure compliance under program

During first response and disentanglement	Injury or death to animal due to drag forces (*i.e.*, kegging, tethered telemetry, towing approach vessel	Inappropriate use of telemetry (animal not a candidate), attachment to an embedded wrap.	III/C = Moderate Risk	Use risk assessment and decision matrices. Adhere to criteria.	II/C = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During disentanglement	Injury or death to animal due to contact with equipment (other than vessels)	Inappropriate use of equipment, lack of situational awareness.	II/ B = Low Risk	Use experienced personnel, maintain methodical approach	I/ A = Minimal Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program

Hazard Severity:

Category A – Negligible: The hazard presents little to no threat to personnel, animal, equipment, vessels, and environment (*e.g.*, minor sunburn, minor chafe/rope burn; additional chafe wounds to animal).

Category B – Minor: The hazard may cause minor injury/impact to personnel and animal, minor damage to equipment and/or vessels that is easily repaired, minor impact to environment (*e.g.*, superficial cut, twisted ankle, snapped utility blade; superficial wounds to animal due to kegging).

Category C – Moderate: The hazard may cause moderate injury to personnel and animal, moderate damage to equipment and vessels, and moderate impact to environment (*e.g*., deeper cut, but no threat to function of body, loss of gear that can be replaced with minimal cost and effort; deeper dermal laceration wounds to animal due to kegging).

Category D – Major: The hazard may cause major injuries to personnel and whale, loss of expensive equipment and/or major damage to vessel, and/or major impact to environment (*e.g.*, deep cut or impact to head requiring professional medical attention, loss of equipment compromising safety/mission, high cost and effort of replacement, impact to whale possibly life-threatening).

Category E – Catastrophic: The hazard poses a life-threatening threat to personnel and whale, loss or complete destruction of equipment and/or vessels, impact to environment is extreme (*e.g.*, loss of life – personnel and/or animal, another animal struck and killed enroute to respond, vessel stove in and sunk, major oil slick).

Likelihood:

Category I. – Very unlikely: Not likely to occur at all or very unlikely over broad expanse of time.

Category II. – Unlikely: Not likely to occur over a broad expanse of time.

Category III. – Possible: Might occur in time over duration of response lifespan (*i.e.*, time average person remains active in response, lifespan of equipment).

Category IV. – Likely: Expected to occur several times to personnel, animal or equipment over the response lifespan (*i.e.*, duration of multiple efforts).

Category V. – Very likely: High probability of occurring frequently or within a short period of time.

Table 6. Large Whale Entanglement Response Risk Matrix

Likelihood \ Severity	A Negligible	B Minor	C Moderate	D Major	E Catastrophic
V. Very likely	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
IV. Likely	Minimal Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
III. Possible	Minimal Risk	Low Risk	Moderate Risk	High Risk	High Risk
II. Unlikely	Minimal Risk	Low Risk	Low Risk	Moderate Risk	High Risk
I. Very unlikely	Minimal Risk	Minimal Risk	Low Risk	Moderate Risk	Moderate Risk

4. Disentanglement (Level 3 and Higher)

4.1 Overview

Disentanglement involves the authorized Network response under NOAA's MMHSRP to safely free entangled large whales from life-threatening entanglements. However, it represents only one part of the broader effort that tries to gain information on the threats associated with large whale entanglements, and mitigate those threats and impacts in the future.

The disentanglement of large whales is entirely vessel-based. There is NO in-water component. The overall process of freeing a multi-ton, likely free-swimming, stressed whale from entangling gear is based principally on accessibility to the animal to safely assess it, and possibly cut it free. While the process is disciplined, it is also varied, and as such flexible. It represents a suite of tools and techniques (*i.e.*, SOPs) that have proven themselves over time. Many countries, with similar network efforts, also rely on them. It is estimated that over 1,400 large whales worldwide have been at least partially freed from life-threatening entanglements through similar efforts.

The primary techniques and tools are discussed throughout this section. Section 4.8 will cover the tools that are required, while Section 4.9 will provide some details on procedures. While there are some hard and fast rules/criteria under the MMHSRP's authorized response, the procedures outlined do not represent a comprehensive manual on how to cut a whale free. Many aspects represent guidelines.

In addition, there are some other (*i.e.*, beyond getting in the water) misconceptions regarding large whale entanglement response, including:

- Cutting the trailing gear is enough to save the animal (doing so may leave lethal wraps behind).
- The need to respond quickly (remember, the impacts are not typically immediate; the response generally has time).
- They are gentle giants (never assume that the whales realize you are trying to help them).
- A large whale cannot be spooked (They can and have. Whether a startle or a pain response, the outcome to responders may be the same).

Lastly, first response, or at least the assessment and possible tagging, that it addresses (Section 3.0), is typically the foundation or predecessor of a large whale disentanglement effort, and in many ways is very much part of the large whale disentanglement, or better yet, entanglement response. As such, the primary roles of **First Responder** and **Primary First Responder** still apply, along with Primary Disentanglers. These roles and their descriptions are listed below. More detail and greater breakdown of roles is provided in Section 4.4.

A **First Responder** is anyone within the Network directed to respond to an entanglement report under Network protocols and authorization. At a minimum, they will voluntarily provide assessment and documentation, attempt to standby with an entangled whale and, depending on training, experience, authorization and equipment available, may also tag the whale.

Primary First Responders are Network members that have additional training and experience, and typically have higher level designations (*e.g.,* level 3 - 5). As such, Primary First Responders, under certain conditions and authorization, may attempt disentanglement as part of a first response, or assist as part of an associated full disentanglement effort. These individuals typically have rapid access to vessels and specialized equipment and are on call. Due to the possibility of higher risk activities and their association with large whale disentanglement, primary first responders and their roles are covered in more detail under the disentanglement section.

Primary Disentanglers are individuals who can perform all of the responsibilities of a primary first responder, but who also meet the criteria used by NMFS for selecting individuals who may undertake the very dangerous activity of disentangling (*i.e.*, attaching to, stopping, and cutting), a large whale. Primary Disentanglers must have the experience, training, support and proper equipment to conduct a full disentanglement with a high likelihood of success. Primary Disentanglers are those rated at Level 4 or higher in the network.

4.2 Preparation and Training

Disentanglement operations require a broad scope of roles ranging from generally lower risk roles aboard a support vessel of helmsperson, safety officer, communications, data and gear persons, and documenters; to the higher risk roles of disentanglers and approach vessel helmsperson. Whether monitoring from a distance or making a close approach, any approach to a large whale entangled in gear has inherent risks for both the responders and the animals, which dictates preparation and training. Responders should at least have level 1-2 first responder training, and otherwise be qualified and/or trained for the various roles required (*e.g.*, maneuvering a vessel, documentation). If the response involves close approach assessment (*i.e.*, within 100m, polework) or attaching telemetry, then responders should have level 3 or higher response training and additional experience. Due to the more complex mission of whale disentanglement and the fact that responders may take on the additional roles of sampling (*i.e.*, biopsy), additional telemetry, drone operations, sedation, to name a few, additional, specialized training will likely be required or at least recommended. In addition, responders potentially involved in actual disentanglement efforts should have more advanced classroom and hands-on, on-water training. These trainings should be scenario-based (*e.g.*, tight vs loose wraps, near vs far reaches, fixed vs flying knives, kegging vs cutting-on-the-fly), and address the "what ifs," and mitigating risk through emergency response. While all roles need to remain current in their experience and training, this is especially true of the higher-risk role of large whale disentanglers. See Authorization regarding Heightened Consultation protocols for tagging, and other close-approach procedures when reporting on a response effort and requesting authorization.

4.3 Authorization and Supervision

Disentanglement activities require level 4 or higher designation involvement. The IC must be a level 4 for species other than right whales and a level 5 for right whales (unless authorization is otherwise received). Authorization is also dependent on consulting Regional Stranding or LWERCs to receive approval as part of Heightened Consultation*. In the event that Heightened Consultation cannot be met (*e.g.*, no cellular service, unable to relay via VHF radio, no satellite phone), disentanglement of species other than right whales will require a level 5 designated responder acting as CI and disentanglement efforts involving right whales will have to be aborted until criteria under Heightened Consultation can be met.

4.4 Team Member Roles

Disentanglement response represents higher-risk permitted activities. The approach to a large whale entangled in gear is inherently risky for both the responders and the animal and warrants adherence to ICS and the planning it embraces. Clarifying team member roles and responsibilities ahead of time, and ensuring that responders meet minimum qualifications for each role is essential for a safe and successful response. The recommended roles that follow are based, in part, on implementation of the ICS. The number of responders needed for a disentanglement response varies depending on the number of vessels involved, the duration of the effort, whether constraint or sedation is involved, and the use of biopsy sampling and/or UAS, to name a few. For instance, using Table 7, a full disentanglement effort involving both approach and support vessels should represent at least a team of six, and preferably eight or more, qualified response crew to reduce dual roles and provide depth on the bench towards reducing fatigue. If conducting sedation, UAS operations, biopsy sampling, or other additional tasks, the number of responders will need to increase. Sedation and UAS operations are covered in more detail in Sections 5 and 6, respectively.

Table 7. Suggested number of personnel required for a typical large whale entanglement first response effort.

Team member role	Number of personnel required
Incident Commander	1
Vessel captain	1 (may also represent Safety Officer)
Crew (vessel dependent)	1 - 3 (roles can be shared with other roles)
Disentanglers	2 - 3 (roles can be shared, but not concurrently)
Safety Officer	1 (dedicated role)
Data collector	1 (role can be shared with other roles)
Documenters	1 - 3 (roles can be shared with other roles)

Gear person	1 (role can be shared with other roles)
Communications person	1 (role can be shared with other roles)
Tagging (familiar with tag setup and deployment; takes 2 people, along with helm position to deploy)	2 (roles can be shared with other roles)
Biopsy sampling	1 (roles can be shared with other roles)
Optional – UAS PIC and VO (see UAS)	2 - 3 (roles can be shared with other roles)

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

- **Incident Commander (IC)** - The IC, working closely with shoreside (or otherwise remote) authorizing parties (*e.g*., NMFS RSC/LWERCs, National LWERC), is responsible for the on-scene oversight and supervision of the first response operation. The IC may participate directly in the operation depending on circumstances, but typically does not directly participate (*i.e*., hands-on) in the operation. This enables the IC to remain focused on the larger picture of the response and objectively ensure that safety is maintained for responders, the public, and animals.

    - **Qualifications** – The IC needs to be at least a level 3 or higher for any close-approach assessment or tagging operations, a level 4 for overseeing the disentanglement of all large whales except right whales, and a level 5 for right whales (unless otherwise authorized). Under Heightened Consultation protocols, tagging requires a level 4 designation, and for the disentanglement of other species beyond right whales, a level 5 designation. If unable to consult a regional LWERC or experts, right whale disentanglement efforts must be aborted. The IC must be trained and/or experienced in protocols, procedures, risks, and risk mitigation in all aspects of the first responder mission being carried out.

- **Safety Officer (SO)** – The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate with the team and adjust the strategy of the response as needed. The SO works very closely with the IC. Under certain circumstances and depending on experience, the role of the SO can overlap with that of the helmspersons of the support or approach vessels, and if necessary and otherwise appropriate, the role of IC and SO can be performed by one person.

    - **Qualifications** – Experience in previous large whale entanglement response efforts, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e*., not adhering to protocols, presence of other animals, incoming environmental or weather changes, and time of day considerations).

Willingness and ability to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.

- **Helmsperson(s)** – This person(s) is/are responsible for the safe transit and operations of the vessel(s), including the safe maneuvering around and approach to entangled whales and the trailing gear that might exist. Helms persons should have experience operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the helmsperson role, whether on the transit, support, or approach vessels, is one of the most important roles beyond that of the IC.

    - **Qualifications** – Experience, training, and in some cases certifications (USCG license, NOAA certified components course) in order to "captain" a vessel. Helmspersons should have experience operating the vessel around large whales and all aspects of the response operation.

- **Disentanglers** – These persons are responsible for cutting the animal free. The role involves, as appropriate, the establishment of a working line, the safe handling of the working lines and entangling gear towards additional assessment (3º assessment) and accessing the animal and entanglement, the adding of constraint - kegging buoys and sea anchors, and the handling of various knives towards safely cutting the animal free. This higher-risk role may overlap with other roles only to a limited extent. For instance, documentation through use of a pole, vessel or helmet-mounted POV cameras, communications, or operating the helm position. However, focus needs to be maintained on the animal, the gear, and the other members of the team. The best-case scenario is to have a dedicated, experienced helmsperson who can cover communications, with two dedicated, experienced, trained and approved disentanglers.

    - **Qualifications** – At least two of the disentanglers in the approach/task vessel need to be experienced in their roles and/or have level 3 designation or higher. Disentangling right whales requires even greater experience and/or designation of a level 4 or higher. Disentanglers should be familiar with the tools and procedures they will use, the vessel they are working from, and the entangling gear and the species of whale they are working on.

- **Data collector** – The data collector is essential in recording all aspects of the entanglement response. This person is responsible for ensuring all data is complete on data sheets and data loggers, including the assessment of the animal, recording identity of associated documentation, the entanglement (*e.g.*, nature of the entanglement, gear type), behavior of animal (*e.g.*, respirations, changes due to response), the response efforts (an outline of response steps taken, risk factors encountered, who was involved), and telemetry (*e.g.*, tag identity, frequency of VHF, fine tuning).

    - **Qualifications** – Familiarity with procedures and data sheet/data loggers, attention to details.

Ability to accurately and completely compile a great deal of information. Lacking a disposition to seasickness is valuable.

- **Documenter(s)** – This person(s) is/are responsible for obtaining and maintaining (*e.g.*, identifying and safe storage) still and video imagery on all aspects of the response. They work closely with the data collector and the helmsperson. This person may also serve as the data collector. Under certain circumstances, responders with other roles may take on, in part, the role of documenter, through use of helmet or vessel-mounted POV cameras. However, such persons must maintain focus on their primary role and maintain safety. POV cameras should be turned on and forgotten by the user, and instead, either tended to or operated remotely by a dedicated documenter.
    - **Qualifications** – Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response (see an example of a media checklist in Appendix E).
- **Communications** – This person is responsible for maintaining all-important communications aboard vessels, between vessels (*e.g.*, a supporting partner vessel) and to shoreside contacts, including float plan contact and NMFS authorizing agents (*e.g.*, Regional and/or National LWERCs). Shoreside contacts typically take on the role of further disseminating information, including to agency partners/leads, any other authorizing agencies, as well as media coordinators. Communications at this stage do not involve the media, as this is the role of media coordinator and others at later stages.
    - **Qualifications** – Experience using documentation equipment. Knowledge of how the equipment operates, how to change settings, troubleshoot, take clear and meaningful photos and videos, and ability to post-process photos/video after the response.
- **Gear person** – This person is responsible for maintaining, preparing, and dispensing all disentanglement tools (*e.g.*, attachment tools, working lines, means of constraint, and the different knives). They work closely with disentanglers to meet needs, with SO and helmspersons regarding communications, and data collector on noting what gear/tools were deployed/used.
    - **Qualifications** – Experience with and knowledge of disentanglement equipment. Knowledge of how the equipment operates, and risk factors associated with use of the equipment (see an example of a gear checklist in appendices).
- **Telemetry taggers** - This role is responsible for the pre-deployment preparation, including the testing of the transmitters and receivers and setup of the telemetry buoy, the appropriate deployment of telemetry,

receiving Argos, GPS and real-time VHF fixes, and the interpretation and forecasting of telemetry data towards use in relocating the animal for future efforts.

  - **<u>Qualifications</u>** – These persons need to be trained or otherwise familiar with the appropriate preparation (*i.e.*, testing, tuning, and mounting to the telemetry buoy) of telemetry gear, deployment, reception, and interpretation of telemetry. The two-person team attaching a tag must work closely with a helmsperson. Both persons - one making the attachment (*e.g.*, throwing a grapple) and the other person dedicated towards making sure the telemetry buoy is deployed cleanly off the vessel, need to be physically capable, trained and experienced in the procedure, and familiar with all risk factors. At least someone on the team needs a level 3 designation or approval to proceed otherwise. Heightened Consultation criteria may require Level 4 designation.

- **<u>Biopsy sampler</u>** - This role is responsible for maintaining biopsy gear (*e.g.*, crossbow or airguns, darts, and collection vials), safely obtaining the sample, and its storage and processing (*e.g*., labelling).

  - **<u>Qualifications</u>** – The person needs to be trained and otherwise familiar with the safe use of the crossbow or pneumatic gun. Additional training, like gun handling, is recommended. The person obtaining the biopsy sample must work closely with the helmsperson and the data person.

- **<u>Unmanned aircraft system (UAS)</u>** - If permitted to operate a UAS during the response, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success or safety of the operation, or causing disturbance to any animals.

  - **<u>Qualifications</u>** – Pilots must have an FAA, Part 107 Remote Pilot license, follow all existing FAA and other regulations, and be trained and/or experienced operating a UAS over water from a vessel during response operations. More detail on UAS use in large whale entanglement response is addressed in Section 6.

4.5 Communications

Communications between team members on a particular vessel, between vessels and to shoreside contacts, have serious implications towards maintaining safety. While communications involve all members of the team, it is especially important for the IC, the SO, the Communications person, and the primary shoreside contact to maintain a strong working relationship. Well-established and consistent communications on the water will have strong operational bearing on maintaining an efficient and safe working environment, while communications with the shoreside will facilitate authorization and reporting requirements. This is especially true of disentanglement efforts as they carry more risk and will generally garner greater interest. Shoreside contacts typically take on the role of further disseminating information, including to agency partners/leads, any other authorizing agencies, and media coordinators. On-water/on-site direct communications do not involve the media, as this is the role of media coordinator(s) and others at later stages.

Some examples of key communications are:

- Alerting and approval of helmsperson of an action (*e.g.*, movements aboard, on and off vessels);
- Alerting and approval of helmsperson on the deployment of gear (*e.g.*, deploying the telemetry);
- Notification and acknowledgement of UAS deployments and recoveries;
- Providing risk assessments, IAP, Heightened Consultation, updates to Regional or National LWERCs;
- Providing regular status updates to all shoreside contacts for further dissemination;
- Communications between documenters and data collector on imagery taken;
- Communication between documenters and helmsperson on positioning of the vessel;
- Communications between an approach and the support vessels ;
- Communication between disentanglers, SO, and gear person regarding gear needs;
- Alerting the response team of a change in behavior from the animal;
- Alerting team members of hazards (*e.g.*, gear in the boat, line in the water near engines); and
- Communicating actions (*e.g.*, line handling examples - "up-from-behind" to provide slack, "line-over-head" to establish a fairlead, and "walk-it-back" to control an exit while working the working line.

4.6 Data Collection

Data collection is essential in recording all aspects of the entanglement response, including the assessment of the animal, recording identity of associated documentation, the entanglement (*e.g.*, nature of the entanglement, gear type), behavior of animal (*e.g.*, respirations, changes due to response), the response efforts (an outline of response steps taken, risk factors encountered, who was involved), telemetry (*e.g.*, tag identity, frequency of VHF, fine tuning), and any samples obtained (*e.g.*, biopsy sample, removed and recovered entangling gear). The information gained has benefits towards evaluating the threat (*i.e.*, the animal risk assessment) and the operational risk assessment (*i.e.*, assessment of the risks and impacts posed by the response to humans and animals).

It is important that data-forms and/or dataloggers are prepared, maintained (*e.g.*, batteries charged), and appropriate team members are familiar with their use prior to the start of any entanglement response.

During a response, data collection needs to be maintained (the role of a dedicated data collector) and appropriate communications established with the entire team as to collect all data required. Some examples of data collected are:

- General response narrative (*e.g.*, when departed, on-scene, a procedure performed, the whale is freed and gear collected);
- Cataloging of imagery;
- Animal behavior, including response to procedures;
- Risks posed to responders (in the case of injury or worse, incident reports will need to be completed);
- Telemetry setup (*e.g.*, PTT ID, VHF frequency and fine tuning);
- Response to and logging of any samples obtained (*e.g.*, biopsy samples, recovered gear);
- Personnel and supporting agencies, along with their roles;
- Information on the entanglement (*e.g.*, how entangled, gear description and markings); and
- Information on the animal (*e.g.*, condition, sex, age class, impacts, fluke ID).

4.7 Resources

The primary resources of large whale disentanglement, beyond the team itself, are vessel support, disentanglement gear, safety gear, personal safety gear, documentation and data collection gear, telemetry and equipment towards deployment. These are the tools of the trade - large whale entanglement response, and like any tool, they must be maintained and used properly, or additional risk will be incurred. This is especially the case for large whale disentanglement, in which risk levels are already elevated.

A breakdown of the primary resources, their criteria and some operating parameters is provided below.

Vessel Support

For full disentanglement efforts, at least two vessels should be used - an approach or task vessel, and a secondary support or safety vessel. The **approach or task vessel** is typically a smaller (4 - 7 meters [12-21 feet]), more maneuverable, lower drag vessel, that lends itself to more responsive close approach work and less drag for allowing the team to tow and/or haul themselves up behind an animal for assessment and disentanglement purposes. Soft-bottom inflatables make great approach vessels as lines can be bent over the bow using the material as friction to tow the boat. Never secure a line attached to the whale to a vessel, or bring gear into a vessel that might still be attached to the animal. Soft-bottom inflatables also provide less drag and tack less - they are more forgiving on the tow. In addition, the approach vessel needs to be as free of snag points as possible, be a simple open design, and have appropriate deck space. Low gunwales accommodate the throwing and clearing of tools and gear. The outboard should be adequate to power the vessel, but small enough that with manual tilt is easily liftable. The approach vessel should accommodate at least three responders and the gear needed to complete a particular task. In fact, only that gear that is required for the next task should be transported in the approach vessel. Gear transport is the role of the support vessel. All vessels must be operated by experienced helmspersons that are familiar with the vessel, maneuvering around the animal, and the overall operation. The vessels are large tools and a tool is only as good as the person using it. An experienced operator will make the rest of the team look good, and make a significant contribution to creating a safe environment.

The support vessel is generally a larger platform to provide safety support for the smaller approach vessel and hold all additional personnel, equipment, and safety gear. Depending on circumstances (*i.e.*, risk assessment) a larger vessel may become the approach vessel. If so, like the approach vessel, characteristics such as adequate and simple deck space, lower gunwales or openings in rails for deploying gear, easy communications aboard the vessel, and responsiveness are beneficial.

Support vessels will typically place themselves between 70 and 100 meters from an approach vessel and animal in a position abeam or off the quarters. Such a position should minimize unintentional involvement with the animal and gear, and yet at the same time provide for timely response to the approach vessel and team should assistance be required. The following outlines some of the main characteristics of approach and support vessels during large whale entanglement response:

<u>Approach Vessel:</u>

- Typically a smaller (4 - 7 meters [13 - 23 feet]) vessel, preferably a soft-bottom inflatable, maximizing responsiveness and maneuverability;
- Less drag (also accommodated by a soft-bottomed inflatable) for allowing the team to tow and/or haul themselves up behind an animal for assessment and disentanglement purposes;
- Soft-bottom inflatables also allow lines to be bent over the bow using the material as friction to "hold" the boat;
- Low gunwales to accommodate the throwing and clearing of tools and gear, and access to gear that is in the water;
- The outboard should be adequate to power the vessel, but small enough to allow manual trim and tilt - it should be easily liftable; and
- Should accommodate at least three responders and the gear needed to complete a particular

task.

Support Vessel:

- Appropriately sized, equipped, and operated within the speed and range to safely respond and address an emergency situation;
- Have capacity for at least four to six response crew to fulfill all roles (six based on deployment of telemetry);
- If making closer approaches, vessel should have greater maneuverability, which may be related to size of vessel (*e.g.*, smaller size typically increases responsiveness and maneuverability);
- Accommodate communications between members of the team, especially involving the helm position (*e.g.*, flybridge and center consoles);
- For documentation, safe access for documenters with a clear, unobstructed field of view;
- If deploying telemetry, clear deck space, preferably forward, with low gunwale/rail system and limited snag points to accommodate deploying telemetry, including the clean deployment of the telemetry buoy;
- In the event of approaching a relatively immobile animal, vessel support allows for a haulback system or otherwise an exit strategy. Haulback systems can represent a secondary line (*i.e.*, independent of a working line) that is secured to a large enough vessel to pull the approach vessel away from danger. Alternatively, if it is determined there is no danger to the animal or risk of catching line and net at the surface, the approach vessel can be pulled up to the animal while the engine remains in idle reverse. If there is a need to move away, then the bow person just releases the working line and the approach vessel moves away; and
- Consider the use of propeller guards.

The following procedures should be adhered to when operating a vessel around an entangled whale:

- Never approach the whale directly from behind;
- Minimize your time in the danger zone of the whale (in the range of movement of the

whale, and where trailing gear might lie);

- Lift the outboard out of the water when close to and/or towing (Nantucket sleigh ride) behind the whale;
- Be as predictable as possible in operating the vessel. Avoid sudden maneuvers, changes in gear, throttle and course;
- Be aware of the whale's location and behavior changes. Know the signs of distress and head warnings. May require terminating or at least delaying effort; and
- Make sure inflatable approach vessels are adequately inflated and the proper shafted outboard is used to avoid cavitation.

Note, in cases in which the required vessel support cannot be accommodated, either tailor the response to the vessel - use the tool for what it can do, or otherwise terminate the effort.

Aerial support:

Aerial assets can be used towards locating, assessing, documenting, monitoring (albeit limited), transport of crew and gear, and medical evacuation. UAS can represent a relatively low-cost means of providing efficient aerial assessment and documentation.

Fixed-wing or rotary aircraft

UAS

- Approved UAS platforms
- Radio Controls
- Video Goggles
- Batteries
- Phone or Tablet for flight control software
- Chargers

Disentanglement tools:

Accessibility/ attachment tools:

- Grab grapples
- Skiff hooks Tethers and working lines:
- Floating polyblend line (7/16" - 9/16")

- Sinking line (⅜" - 7/16")
- Short tether lines for kegging buoys Constraint:
- Kegging buoys
- Sea anchors
- Carabiners Pole systems:
- Segmented poles adapted for surface work
- Segmented poles adapted for work at depth
- Slip adapters for flying tools
- Counter-weighted and unweighted high-visibility, buoyant safety ends for poles
- Attachments for POV cameras Cutting tools:
- Fixed hooked knives
- Flying hooked knives
- Long-bladed knives (Coughran "whale knife")
- Cutting grapples Documentation:
- DSLRs, video cams or comparable cameras with a variety of lenses
- POV cameras (*e.g.*, GoPros) to mount on helmets, parts of the vessel, and poles
- Enough batteries and cards to complete the mission

Appendix R contains a documentation checklist of those aspects of an entanglement that should be documented.

Data Collection:

- Data forms, checklists and/or dataloggers (*i.e.*, Level A, response report forms)
- Watch/timer
- Binoculars Sampling (including biopsy):
- Crossbow, pneumatic air rifle or other means of collecting a sample (*e.g.*, a sample net)
- Bolts or darts
- Cores or tips
- Associated sterilization and cleaning supplies
- Storage (*e.g.*, vials, preservatives, labels, ice chests)
- Maintenance (*e.g.*, tools, spare strings, nocks, stringer)
- Safety gear (*e.g.*, gloves, eye protection)

Personal Safety Gear and Protective Clothing

- Appropriate footwear (*e.g.*, closed-toe shoes or boots)
- Protective clothing (*e.g.*, wetsuits, worksuits, UV protective wear)

- Chafe and cut-resistant gloves (*e.g*., Lamars, Atlas,) that fit well
- Appropriate Personal Floatation Device (PFD; Will depend on environment, but also role).
- Personal, one-handed safety knife for personnel that are handling gear or in a position to
- Optional - eyewear, knee pads, sunscreen, hat

Medical and Safety Equipment

- First aid kit
- AED
- Backboards, neck collar, splints (immobilization gear) If further offshore, remote or removed from medical attention:
- Lift cages and harnesses
- Oxygen kit
- An appropriately trained person (advanced medical training, EMT) to use more advanced medical equipment and provide additional emergency care
- Satellite phone/In Reach

4.8 Environment and Weather


Responders freeing an entangled humpback whale in AK (Bracken/ PMMC/ MMHSRP permit # 932-1489)

The attempted disentanglement of a large whale by authorized response, due to the added complexity and risks involved, dictates that the criteria for conditions be conservative. While dependent on other variables, the typical cutoff for large whale disentanglement efforts is the low end of Beaufort 4, with extra caution being practiced at Beaufort 4 for larger vessel operations, and Beauforts 3 and 4 for small boat operations (See Figure 12 - Beaufort operational scale diagram). As in first response, tethered tagging, especially from larger vessels and attached by a thrown grapple, might allow Beauforts up towards 6, with the sea state being the very reason the team is tagging - safe disentanglement conditions no longer exist.

BEAUFORT SCALE AND LARGE WHALE ENTANGLEMENT RESPONSE RISK ASSESSMENT							
Beaufort Number	Name	Knots	Effects Observed on Water	Activities			
				Disentanglement from small approach boat; Sedation; Close pole work; suction-cup tagging	Disentanglement from larger boat; Drones; Biopsy darting	Tethered telemetry tagging (grapple throw)	Assessment only from larger vessel
0	Calm	Under 1	Sea like mirror.				
1	Light Air	1-3	Ripples with appearances of scales; no foam crests.				
2	Light Breeze	4-6	Small wavelets; crests of glassy appearance, not breaking.				
3	Gentle Breeze	7-10	Large wavelets; crests begin to break; scattered whitecaps.				
4	Moderate Breeze	11-16	Small waves, becoming longer; numerous whitecaps.				
5	Fresh Breeze	17-21	Moderate waves, taking longer form; many whitecaps; some spray.				
6	Strong Breeze	22-27	Larger waves forming; whitecaps everywhere; more spray.				
7	Near Gale	28-33	Sea heaps up; white foam from breaking waves begins to be blown in streaks.				
8-12	STAY HOME						

Figure 12: Beaufort large whale entanglement response operation scale diagram

As with first response, safe operating conditions are affected by range, distance from medical attention, travel time, daylight affecting operations and transit, air and water temperature, visibility (*e.g.*, fog, heavy precipitation, darkness), certain types of precipitation (*e.g.*, snow, sleet, hard rain), and other environmental factors (*e.g.*, lightning, approaching hurricanes). Due to the greater complexity and risks of disentanglement, transit time and/or time to more extensive medical attention, and time of day, become even more critical. In many cases, disentanglement efforts take nearly a full day, and at times span several days. Full disentanglement operations involving constraint are typically not initiated in those cases in which less than four hours exist. The following environmental conditions are some of the variables that need to be assessed:

- Weather conditions (*e.g.*, rain, snow, fog, wind, approaching storm systems, heat, cold).

- Environment (*e.g.*, remoteness, exposure to higher sea states).
- Time of day (*i.e.*, close to sunset).
- Conspecifics (*e.g.*, other animals in the area).
- Predators (*e.g.*, sharks, killer whales).

4.9 Procedure and Mission Goals/Complexity

Large whale entanglements are complex and varied. Many scenarios exist from the animal being mobile or stationary (*e.g.*, anchored), gear being forward on the body and/or posterior, gear represented by lines and/or netting, whether gear is trailing or not, and the diameter of the lines entangling the animal. These are just a few of the variables that make the disentanglement of a large whale as complex and diverse a process as the entanglement itself. The techniques used will depend heavily on the assessment and the use of decision matrices from first response (Section 3.0) or otherwise, that have likely already been performed.

Disentanglement procedures will utilize the on-site (risk) assessment (*i.e.*, 3º assessment) of the current entanglement, along with the risk assessment and use of decision matrices outlined (Sections 2.12, 2.13, 3.10, and 4.10), to determine the disentanglement portion of the IAP. The disentanglement IAP will rely on key assessment factors including:

- Is the animal restricted in its mobility, or how accessible is the animal towards an approach (*e.g.*, free-swimming vs anchored)?

- Where does the gear lie on the animal (*i.e*., forward vs posterior)? How complex (# of wraps) is the entanglement? What is the animal's behavior towards approach? What are the variables that have bearing on accessibility, through time spent in proximity to the animal, and that proximity - avoiding the danger zone.

- What type of gear is involved? Is it lines and/or netting? If net, is it open or rolled? If line, what is its strength and gauge? Is the gear buoyant or sinking? Is it weighted? Is there any gear trailing?

Answering these questions will have bearing on techniques and tools. Some are introduced here, but will be described in more detail further within this section. Risk mitigation for these tools and techniques is addressed in Section 4.10.

- Whether to constrain or not constrain (*e.g.*, cut-on-the-fly) the animal.

- Whether to use a hooked knife vs a long-bladed, open-face knife.

- Whether to use a fixed knife (*i.e.*, stays attached to the pole) or a flying knife that can detach and cut more remotely.
- Whether to use a towed or thrown sweep, a haulback system, and/or multiple working lines.
- To use a smaller vessel with more responsiveness and control, or a larger, more stable, higher platform as the approach vessel.
- Of course the most important decision is whether to proceed or not.

Due to the complexity already mentioned, it is challenging to create a flow diagram or even a step-by-step description of a generalized disentanglement response to a large whale. There are so many variables, and thus variations involved. However, here is an attempt at the primary steps:

1. Determining safe access/approach to the entangled animal. Should constraint, no constraint, and/or sedation be used? Is the animal mobile or stationary/anchored?
2. Determine the best knife and technique for using that knife (hooked vs open, fixed vs flying, thrown vs pole-mounted).
3. Determine the best vessel/access platform to use to implement use of the knife/making the cut (large vs small vessel?).
4. Perform a pre-disentanglement mission brief and obtain any additional authorizations (review roles, setup equipment, contact shoresides, do disentanglement GARs).
5. Disentangle or stand down (Go/No Go).
6. If "Go," attempt to safely cut the animal free, recover gear, and gather additional information.
7. Follow-up (perform debriefs, prepare for next response, write reports, pursue further investigations).

Starting with determining access, this leads to the potential use of constraint.

Use of Constraints:

In those cases where the entangled animal has a limited surface interval, is fast moving, evasive, or otherwise inaccessible; and/or its movements are unpredictable and potentially aggressive; and otherwise appropriate for the animal, constraining techniques may be used. The primary constraining technique is 'kegging,' a modification of an old whaling technique. Historically, kegging involved


Response team fuses kegging buoys to help free an entangled humpback whale in Glacier Bay National Park, AK (GBNP/ NOAA MMHSRP permit # 932-1905)

harpooning a whale, not necessarily to kill it, but to attach barrels or kegs - hence kegging - to add drag and buoyancy to slow the whale and keep it at or near the surface. However, the modern equivalent involves establishing a working line - whether adding one or determining if an existing trailing line is appropriate (*e.g.*, easy and safe to handle, strong and of adequate length, and minimal additional impact to the whale). If adding a working line, it is typically attached via a thrown grab grapple, but can also be deployed using a pole system with a skiff hook attached. The latter is typically used once the animal is more accessible, for when an accurate attachment is required (*e.g.*, to avoid impact to the animal), and/or to establish a secondary unloaded (*i.e.*, little drag force applied) working line.

Here is a list of scenarios in which two types of primary attachment tools - the grab grapple and the skiff hook, have advantages:

Grab grapple:

- Short and/or deep trailing gear
- Animal not as approachable
- Not safe to approach closely
- Best attachment means for first responders (addresses risk factors and experience level)
- Most used/safest means to attach a working line Skiff hook or flying hook:
- Animal is more approachable
- Safer to approach closely
- Accurate attachment required
- Attaching to tight wraps (grapple cannot access)
- Typically used to attach a secondary working line (a clean/unloaded line)

Main points on establishing a working line:

- In most cases a working line is initially established by throwing a grab grapple into the entanglement’s trailing gear. A typical throw is approximately 15 meters (50 feet), but distance will vary.

- Throws should be made just over the gear as to reduce the need to haul back line into the vessel and/or at your feet to set the grapple hook. Some gear may be paid out overboard, but even this has risks early on due to the threat of getting sucked up into jetdrive intakes or wrapped in propellers.

- If you can safely access the line by hand or with a boathook, do so. No throw is needed.

- A working line can also be established using a skiff hook attached to the end of a pole. This attachment technique has the advantage of greater accuracy of placement and is typically used to establish a secondary working line.

Team uses a "working" line to gain access to the entangled animal (CCS/ NOAA MMHSRP permit # 18786)

- On establishing the working line, make sure the gear is kept clear of personnel (*e.g.*, coil extra scope in a bucket) and make sure all gear (*i.e.*, the line and any terminus buoy) is deployed on the team's terms (*i.e.*, don't let the whale take the gear from the vessel).

- If necessary, establish a secondary working line to avoid handling lines under load that pose a threat to the animal (*e.g.*, physical impact to body), or pose some threat to the responders (*e.g*., gillnet and longline).

Once the working line is established, the polyball kegging buoys (ranging in size from A3 to A5) are methodically added to provide the necessary drag and buoyancy forces to slow the animal down (but not necessarily stop it), keep it at or near the surface, and control its movements somewhat (as much as one can control a multi-ton animal) for access. Under certain circumstances (*e.g.*, polyballs do not provide access), a sea anchor, may be attached to provide additional drag.

In addition to the risk and decision factors already provided, her are the parameters for using kegging:

- The animal is not easily approachable.
- The animal is more mobile.
- More assessment of entanglement is needed.

- Entanglement is complex.
- More control of the environment - the animal, is required.
- May increase documentation of animal, and entanglement or gear (*i.e.*, animal and gear more accessible).
- May increase gear recovery (*e.g.*, buoys may keep removed entangling gear afloat).

Here are the main procedural points associated with kegging:

- The initial kegging buoy can be the telemetry buoy, as early on in the process the animal will likely be sounding and the hard plastic telemetry buoy will surface sooner (*i.e.*, no need to recover from depth) and stay at the surface longer.

- Buoys should be added methodically one by one (recommended 20 minutes between), to reduce stress on the animal, and decrease the chances of any unwanted radical response (*e.g.*, thrashing) from the animal that might increase risk for the animal and response team.

- Typically, A3 polyballs are added initially and then if necessary, the larger A4s and A5s.

- Sea anchors are typically used later in the process as needed and provide force whether the animal dives or not.

- Polyballs and sea anchors can be attached to an established working line by using carabiner clips or by tying them on. If the latter, never get hands and fingers in the loops of line while making knots. Additional buoys can be attached by snapping in front of an existing buoy.

- Multiples of both kegging buoys and/or sea anchors, and combinations of the two, can be used.

- Right whales, due to their strength and stamina, typically require the larger buoys and potentially more of them, as well as the use of sea anchors. The same is likely true for blue whales.

- Right whales and blue whales may require large-mouthed sea anchors.

- Other species may require additional drag force due to life-cycle behavior differences (*e.g.*, a humpback whale on the breeding/calving grounds).

- Only use the number of buoys and/or sea anchors needed.

- However, if it takes three buoys to get the whale to a point in which it is safe to approach, then use three buoys.

- Larger whales will generally require more constraint. Though sub-adults can be unpredictable and energetic.

- For smaller whales, like minkes or the calves of other species, kegging should be avoided.

- Even anchored whales may require kegging buoys, as the scope of the anchor line may be great enough to allow considerable movement and animals can still sound when anchored.

- Avoid loading a line that is attached to deeply embedded wraps as they may cause additional trauma and a negative response. Limbs have been amputated from the kegging process.

- Be aware of the load forces on the ‘loaded’ line for the animal and for the team. Loaded lines represent additional risks to the response team. As with the tools themselves, avoid getting between the kegging buoys and/or sea anchor and the whale. If possible, attach or establish an unloaded line to handle (*i.e.*, use as a new working line).

- As with the attachment of the telemetry buoy, the Ross timed-release clips can be used, but note they can only handle so much force.

The number of buoys and the time it takes to keg the animal, if done correctly, is typically worth the time investment. The key is being patient and to always monitor the process the entire time.

As described under risk assessment and within decision matrices (Sections 4.10 and 4.11), there are times when “no constraint” approaches might be more appropriate. Such situations will require an additional set of criteria, outlined below. The actual act of cutting the whale free (*i.e.*, cutting-on-the-fly) will be covered in more detail later. This situation calls for:

- An extremely experienced and knowledgeable helmsperson to orchestrate a safe close approach to a free-swimming whale.

- A very experienced pole person or grapple thrower to make the cut(s).

- An approachable animal (*e.g.*, longer surface time, linear travel, entanglement accessible). Generally, a more predictable and safer animal to approach.

Sedation, the use of administered drugs to chemically constrain the animal, is yet another means to gain access to the animal and the entanglement. It has been used on four occasions - all involving North Atlantic right whales, to assist in large whale disentanglement efforts. Due to its own challenges and potential risks posed to animals and responders alike, sedation is covered in a separate section - Section

5.

Note: Just because an animal or an implemented approach technique may allow an approach, only make those close approaches with the utmost caution, and only when necessary and authorized.

Line Handling:

Once the working lines are established and kegging buoys attached, there is an opportunity for additional line handling. Appropriate line handing will provide the team access to the animal, but also the means to gain additional information. For instance, the strength of the animal and whether gear is shifting at the origin of the entanglement (*e.g.*, a mouth entanglement is shifting and thus may be able to be pulled from the animal's mouth). The act of towing behind the animal is not for a photo op. Line handling is one of the more dangerous activities if not done correctly. The following outlines some of the procedural steps and cautionary messages regarding line handling:

- The bow person position tends the working line, and is responsible for watching it and the whale.
- The bow position must stay at or near the bow of the approach vessel. This is especially important for rigid-hulled inflatables, whose keel will result in the vessel tacking greatly if the working line is held too far off the bow.
- Under certain circumstances positioning the line off the bow can orient the bow of the vessel to one's advantage.
- Bending the line over the bow of an inflatable approach boat provides for a Nantucket sleighride. This may allow setting the grapple hook, testing the working line, and determining the strength of the animal and nature of the entanglement (*e.g.*, line moving through the mouth, or around an appendage).
- Never tie off to the vessel.
- Once safe, hauling up on the working line provides access to the animal and entanglement.
- Do not bring the line into the vessel. Only bring a single bight of line into the vessel.
- Do not handle certain types of gear directly (*e.g.*, gillnet and longline). Possibly add a secondary working line to avoid handling these high-risk gear types.
- Do not get loops of line around responder body parts.

- Keep tools and lines away from the vessel and well in front of responders.

- Avoid working with a line that is under heavy load (*e.g.*, has several kegging buoys and/or sea anchors attached). Consider establishing an unloaded working line (*i.e.*, another line with very little drag on it) for responder access.

Like any procedure, things may not go as planned or actions need to be taken to mitigate risk. The following are some of the primary mitigating actions related to line handling:

- If the animal is moving fast or obviously sounding, let go of the working line. While an inflatable approach boat acts like a kegging buoy, it should not be treated as such. Let go, and let the dedicated kegging buoys and/or sea anchors do their job.

- If letting go of the working line from a small approach vessel and time allows, "walk out" by walking the boat as quickly as possible in a controlled manner along the working line until the terminus buoy is beside the boat (*i.e.*, on the boat's hip).

- If the working line loses its fairlead, or opposing forces along the line cross the vessel (*i.e.*, go abeam) as to potentially pinch the vessel, the bow person can initiate moving the working line to the other side of the vessel. In doing so, the bow person will call out the maneuver by yelling, "line overhead" and will get acknowledgement from the rest of the team in the approach vessel before carrying out the maneuver.

- If the bow person (in an inflatable approach vessel) is losing the battle in maintaining the bend at the bow in order to hold the vessel's position, they can yell, "up from behind" to have his or her teammates pull slack up from behind.

Note: If there is too much resistance at the terminus (*e.g.*, a large polyball) of a working line being handled, making line handling more dangerous, the above mitigating procedures will not work. It is thus important to not have too much drag force behind the response team while on the working line.

Polework:

Poles allow more remote access to the animal. They may be used initially to attach working lines, move buoys up the working line, and at later stages wield knives that may cut a whale free. They can keep responders out of the danger zone, or draw them into the danger zone. However, at certain points - as the carabiner is being snapped in, or a knife is being hooked on the gear to make the cut, the poles can become an extension of the whale. Polework is very complex, especially when combined with the use of flying knives. Here are some primary considerations when using poles during disentanglement operations:

- Even with the greater reach, responders will likely be in the danger zone.
- Poles can become an extension of the animal, and with a sudden response from the animal, become a dangerous projectile.
- Responders should test the animal's behavior prior to committing to an attachment or cut (*i.e.*, use the back of a clip or knife to test the response of the animal).
- Keep poles clear when not in use.
- Keep poles outboard of all users when being used.
- Be aware of members of the team (everyone in the approach vessel should be wearing helmets).
- If poles become entangled in gear or otherwise a risk factor, get rid of them (*i.e.*, throw them overboard and into the water). Floats can be attached to keep poles afloat so that the support vessel might recover.

Use of a long pole with a knife on the end to cut a North Atlantic Right Whale free (CCS/ NOAA MMHSRP permit # 18786)

Whether throwing a grapple or using a pole with a hook on the end to establish a working line, there are circumstances in which making the attachment can be challenging. Some of these are:

- The animal is not approachable (for throw or polework).
- Little or no gear is trailing.
- The gear is rotten or represents a pane of netting.
- The gear is trailing deep.
- The gear represents only tight wraps.
- The gear is of a small diameter, or hard lay line that the grapple cannot grab - pinch.

- The grapple is worn.

3º Assessment:

Tertiary assessment provides for the formulation of a disentanglement action plan towards cutting the animal free. The principal questions regarding how and what tools to use are:

- Which vessel to use - large vs small?
- How to approach - through use of constraint, sedation, or cutting-on-the-fly (no constraint)?
- Which knife (knives) to use - fixed vs flying, hooked vs open, thrown vs pole-mounted?
- Where to cut?

Removing line and gear from the whale:

Like the entire process to this point, there are a lot of variables, and the same holds true when it comes to cutting the whale free. Here are some of the general rules regarding the tools and the process:

- Use the best knife for the job.
- Generally cut from head to tail.
- Minimize the number of cuts (Remember, you may have only so many approaches).
- Cut so as to try and remove all gear.
- Cut so that the working line is maintained until the end.
- Strategically use drag and buoyancy forces to make cuts.
- If possible (*i.e.*, there is a choice), cut against the lay of the line. For instance, most lines in the United States are right-hand laid and will typically cut easier from the right side of the line (*i.e.*, a cutting grapple thrown off the starboard side of the vessel and over line originating from the animal) - the Bocek Principle.
- Cut as to maintain safety.
  - Minimize time in making cuts
  - Avoid the danger zone

Hooked vs long-bladed, open-face knives:

The use of these two knife types is primarily about addressing different types of gear. The hooked knives are generally better at cutting lines, but generally bind up when addressing nets. The open-face blades are typically used for netting, their open face providing more action and avoiding binding, but they generally provide less mechanical advantage. Both knives are used from poles. The hooked knives have the advantage of reaching forward, grabbing a line in the hook, and using the angle to maintain the blade on the gear and make the cut. Here are some of the general rules regarding the use of these tools and the process:

- Hooked knives are generally used to cut lines, including pot buoy lines, longline mainlines, net head and footlines.
- Open-face knives are generally better at cutting open netting as they reduce binding.
- Hooked knives can slip under tight, but not embedded, wraps.
- Angling the hooked knife to approximately 45º off the animal, provides greater visibility on deployment and reduces probability of catching or cutting the animal.

Fixed vs flying pole knives:

Responders throw a cutting grapple in an attempt to free a North Atlantic Right Whale of entangling gear (FWS/ NOAA MMHSRP permit # 932-1905)

The use of these two knives is more about the location of the entanglement on the animal and safety. While both knives are attached to poles, the fixed knife remains attached. As such it is better served for entanglements further back on the body (*i.e.*, in which the user is more likely to stay out of the danger zone), for smaller to moderate gauge lines (*i.e.*, shorter cut times), and fewer wraps (*i.e.*, fewer lines to cut and thus less time making cuts). In contrast, the flying knife is more appropriate for cutting lines further up on the body in which initial placement might put the responder in harm's way, larger gauge lines that will require more time and effort to cut, and more complex entanglements. The main point is that while fixed knives may provide more control, flying knives provide more safety by allowing the cut to be made more remotely. Due to the risks involved, flying knives should be prioritized. A flying knife can be held into its socket adapter making it a fixed knife and released if circumstances dictate. The flying knife has the added advantage of being able to be attached to buoys or sea anchors, and letting the resultant buoyancy and/or drag forces make the cut, more remotely and with less exertion.

Use of cutting grapples:

The use of thrown cutting grapples provides the most remote, and thereby potentially safer means of cutting an animal free. However, due to lack of accuracy in placement, there are limitations in their use, and risks to responders and animals still exist if not used properly. Cutting grapples can be used to remotely remove trailing gear or make cuts that are otherwise inaccessible (*e.g.*, used on a sweep to cut an anchoring or weighted line).

Use of the "Slay" knife on a sedated North Atlantic right whale (NOAA MMHSRP permit # 932-1905)

No constraint cutting - cutting on the fly:

In those cases in which cutting-on-the-fly is deemed appropriate (*i.e.*, safe), it is the flying knife or the cutting grapple that are typically used. While the use of flying knives or cutting grapples may reduce risk, they also impose some complexity, and thus risk. The use of flying knives and cutting grapples typically represents multiple responders working closely together and in communication with each other. The helmsperson will maneuver the approach vessel to get it in position - a key role, a person will be handling the pole or throwing the grapple, and a third person will be dedicated to getting line and the terminal buoy off the vessel safely. These tools generally cut easily and it is a good idea to leave at least 10 meters (30 feet) between the tool and the responders when applying force for the cut. The tools have been known to spring back seven to eight meters. Here are some key points on making cuts-on-the-fly:

- The animal is initially approachable.
- It is safe to approach.
- There is no need for additional assessment.
- Used in order to take advantage of an opportunity.
- Used to avoid any constraint to the animal.

In addition, due to its remote and potentially rapid use, the cutting grapple has a safety role. In the inadvertent scenario in which the approach vessel, or worse yet, one of the responders, has got caught in the gear entangling the whale, then breaking this connection as quickly as possible is imperative. One tool, if available, is the safety knife that each responder in the approach vessel should carry on their person. However, in some situations, the safety knife may not be readily available, or the person needing to use it, incapacitated. Under these circumstances, having a dedicated person (and with a good arm) with the cutting grapple on the bow of the support vessel at the ready to make an approach and use the cutting grapple to rapidly sever that link between vessel/person and whale.

Embedded lines:

Double-edged "Thompson" blade to cut embedded lines (HIHWNMS/ NOAA MMHSRP permit # 932-1905)

In some circumstances, wraps of line and netting may become tight and embedded. In these cases, the regular hooked and open-face knives do not work well. Hooked knives that are sharp on the outside as well as the inside face, allow cutting into the tight and embedded gear (*e.g.*, Thompson blade), while guillotine-style knives can be cocked to chop at a tight wrap (*e.g.*, Slay knife). On a number of occasions, a broadhead arrow shot from a crossbow has been used to nick, and thereby weaken, tight wraps under load on entangled North Atlantic right whales that were positioned on the body, (*i.e.*, near the head) as to otherwise pose additional risk to responders (Landry Gobbler Guillotine). These tools take additional training and pose their own risks (*e.g.*, shooting a crossbow). Here are some considerations regarding tight and embedded gear:

Gobbler Guillotine broadhead used to remove tight, life-threatening wraps of line around a right whale's head (CCS/ NOAA MMHSRP permit # 932-1905)

- Forcibly pulling embedded lines free, may open deep wounds and increase risk of infection possibly causing additional trauma (*e.g.*, open an artery).
- If lines do not pull free easily - leave them. If possible, trim as close as you can to minimize the risk from drag forces and of the entanglement getting worse.
- Veterinarians have indicated that it's best to let the animal's body eject such lines over time.
- Pulling an embedded line from a wound may also elicit a startle or pain response from the animal, posing additional risk to nearby responders.

Signs of distress:

Because whales are generally being approached closely and as time elapses, this increases the probability that an animal may exhibit an aggressive or otherwise dangerous response to a team making the approaches, it is important to read the animal's behaviors for signs of stress - warning signs. While these will vary from species to species and from individual to individual, here are some typical and general signs of stress to watch for and heed:

- Abrupt changes in speed and dive patterns exhibited from the animal.
- Abrupt approaches from the animal while rolling on its side or on its back.
- Flaring of an appendage before a strike.
- The animal produces forceful headrises.
- Trumpeting and/or wheezie-like blows from an animal that doesn't normally exhibit such blows.
- An animal producing bubble blasts or streams that are not otherwise in context or potentially a response to other animals.

Anchored whales - Whether to use a towed or thrown sweep, a haulback system, and/or multiple working lines:

In many ways anchored animals are more dangerous to address than free-swimming ones. First, the animals are likely somewhat restrained, and thereby more stressed. Just because they are anchored doesn't mean they are immobile. An anchored whale, depending on how it is anchored (*e.g.,* origin of anchoring line or scope of anchoring rope), can still be quite dangerous to approach. In many cases, access to the anchored animal is still needed as the attached gear may lie at depth. In such cases, thrown or towed sweeps can be used to sweep up the more vertically oriented lines. Typically, a much longer sinking line is used for the sweeps in order to facilitate having the grapple get to depth. However, establishing a working line on an anchored whale poses some risks. Instead of having the option to let go and have danger swim away as is the case for a mobile animal, the response team may be stuck next to an animal that has become a risk. Under such circumstances a haulback system is required to allow the team to pull themselves quickly out of the danger zone created (*i.e*., out of harm's way). A haulback system should be an additional or separate line from the working line that is attached to a larger vessel (or anchor system) that allows the response team to pull the approach vessel away from the animal or risk. Alternatively, if there is no gear at the surface and otherwise deemed safe, the outboard of the approach vessel can be left in idle reverse, and the approach vessel pulled up against this consistent force. In the event of danger, the bow person slacks the working line and the approach pulls away from the animal. As is the case for general approach to an animal, do not change gear or throttle while near the animal. Keep things predictable and consistent. Here are some main points regarding anchored whales:

- The animal may seem more approachable, but is likely stressed and more unpredictable.
- The animal may be less mobile, but still able to move. Risks still exist.
- The entanglement is likely more complex and involved.
- Some of the gear will be weighted and may decrease gear documentation and recovery.
- The access will still be difficult and dangerous.

Responders off California use a haulback line to safely free an anchored humpback whale (NOAA MMHSRP permit # 18786)

Sampling (gear recovery and biopsy sampling):

Gear Recovery:

On making cuts, whether partially or fully freeing an animal, the recovery of the gear is an important component of the disentanglement response. Not only does it remove the gear from the water column to reduce threat to other animals, but it represents a data point that will help better understand entanglement threat and reduce its impacts in the future. Some important reminders regarding the recovery of gear are:

- Do not initiate recovery (*i.e.*, haul gear into the boat) until it is certain that the whale is no longer attached. Whales have been known to lay motionless for extended periods of time below the surface.
- Be aware that the gear itself may pose risks (*e.g.*, weighted, have hooked gangions, and/or represent entangling gillnet).
- Document the gear as much as possible while on the animal and on-scene, including gear configuration and how it entangled the animal. Memories will fail the responders at a later time and date.
- Label gear as soon as possible.
- Obtain descriptive data (*e.g.*, length, line types, colors, gauge, materials).
- Log and safely store gear or at least a sample of the gear as able.

Biopsy sampling:

While there are many other samples that can be taken, biopsy sampling should be considered standard when resources and conditions allow. Samples are typically obtained through the use of a crossbow or pneumatic rifle, shooting a bolt or dart with a stainless steel core or tip that collects a sample of skin and plug of blubber (dermis) from the whale. As such, biopsy sampling imposes additional risks and should be performed only by those with specific training and experience. In some cases, samples may be obtained passively from skin having sloughed off the animal or residing within the gear (*i.e.*, the lay of the line) itself. Some critical points regarding biopsy sampling are:

- Crossbows or pneumatic rifles represent weapons and should be treated as such. Only load when necessary and always point away from other personnel.
- Keep safety on until ready to fire. Communicate with the rest of the team (*e.g*., “safety is off”).
- Biopsy sampler needs to work closely with the helm, documenter and data persons.
- Never rush a second shot.
- Appropriately label, log and store samples.
- Always maintain gear and do status checks (*e.g.*, make sure a crossbow string or bow is still in good condition).

To use a smaller vessel with more responsiveness and control, or a larger, more stable, higher

platform as the approach vessel:

The entire procedure is vessel-based, and what you do will be based on the vessel(s). There are certain situations where a larger vessel might have the advantage:

- Behavior of the whale suggests it may respect the larger platform more (*e.g.*, mother and calves, male whales on breeding grounds).
- The greater platform height and stability are advantageous.
- A greater sea state provides benefits of being on a larger vessel.
- There is no advantage of using a smaller vessel.
- Kegging is not likely due to risk to the whale or responders, thus no need for smaller vessel.
- The entanglement (*e.g.*, no or limited gear at the surface to pose risk) or animal (*e.g.*, more predictable) allows for the use of the larger, less responsive vessel.
- Availability of a long pole system, experienced pole person and helmsperson team.

Angle-of-attack. Represented by the following:

The angle of attack is a major theme throughout the disentanglement process. It applies to everything from the approach of the vessel, to how the poles are held, the angle of the blade on the knife, and the angle of that blade held against the animal when it is used. Here are some of the examples of angle -of-attack in whale disentanglement:

Responder attempts to free an unrestrained humpback whale calf cutting-on-the-fly from a higher-platformed large approach vessel (HIHWNMS/ NOAA MMHSRP permit # 932-1905)

- The angle of approach vessel to the animal and gear.
- The angle of the throw in attaching a working line.
- The angle of the knife blades towards providing efficient and fast cuts (*i.e.*, Bocek Principle).
- The angle of the pole-mounted knife based on the angle of the pole.
- The angle of the blade against the animal on making the cut.

Some of these are based on the manufacturing of the tool, while others are based on the responder, especially the helmsperson role.

Overall safety:

Again, safety - human safety, is a primary goal. The responders themselves are the most important resource. Here are some valuable reminders:

- Have cutting grapple and safety knives for inadvertent attachments.
- Be aware of the knives at all times.
- Watch yourself during last cuts.
- Standing down is a viable option.

Disentanglement - what is a success?

- All potentially lethal gear off the animal.
- Minimum injuries to the whale and none to rescuers.
- Documentation of the whale (*e.g.*, species, individual ID, condition, impact).
- Documentation of the entanglement (*i.e.*, how entangled).
- Retrieval of gear (*e.g.*, gear type, origin).

Wrap Up - authorized disentanglement:

- Is a proven suite of techniques developed from extensive experience?
- Involves minimal direct contact with the whale and therefore minimizes risk to rescuers - Respect the Animal!!
- It is a disciplined approach, but
- Has flexibility in its structure to address the variable nature of work.
- Most important resource and protocol is human safety. Put human safety before freeing the whale.

4.10 Risk and Mitigation

The disentanglement of large whales is challenging, complex, and potentially a dangerous undertaking. It involves multiple assets, concurrent actions, multiple teams with different roles, an unforgiving environment - the ocean, and a multi-ton animal entangled in gear that does not realize you are trying to help it. The operation requires preparation, planning, and the adherence of protocols based on the past and present assessment of risk factors and their mitigation. The goal of risk assessment and mitigation for humans is to entirely mitigate (*i.e.*, prevent) any risk factors and their impacts.

The response team - the most important response resource, with gear removed from an entangled whale. (NOAA HIHWNMS)

4.10.1 Human Safety

Risk: Injury or death to personnel from contact with a whale. Direct contact from the animal has the highest risk, especially when cutting the final line of the entanglement and freeing the animal (Lyman & Mattila 2010).

Risk assessment prior to mitigation: II/ E High Risk

***Mitigation*:**

- All personnel should avoid proximity to the animal – the danger zone surrounding the animal. It is particularly important to stay clear when there may be a change in the animal's behavior, such as when making final cuts that may cause gear to shift, or elicit a pain response.

- All personnel should wear appropriate PPE such as PFDs, and helmets as necessary. The use of helmets is required for those using poles and teammates that are in the vicinity (*i.e.*, within the extended radius of the pole's 360º sweep). At the moment of attachment (*i.e.*, before a clip releases), the pole becomes an extension of the animal and poses additional risk.

- Designated safety persons should be assigned to continually watch over all personnel involved, warning the team of hazards such as changes in behavior of the animal and presence of other animals, and be able to communicate to the team when to adjust a strategy, or call off the effort as necessary.

- Designated personnel should prioritize the use of flying knives (*i.e.*, knives that slip off poles) or thrown knives (*i.e.*, cutting grapple) to minimize time near the animal.

- Distressed animals are unpredictable; continuously monitor for signs of stress (*e.g.*, abrupt headrises; suddenly producing wheezie or trumpeting blows; changes in respiration, speed, or dives; bubble streams and blasts otherwise out of context; pronounced close approaches, especially belly towards [*i.e.*, a maintained rollover]).

- Teams should approach the animal as methodically and consistently as possible, giving time for the animal to habituate to the presence of the approach vessel (Ledwell & Huntington 2018).

Risk Assessment following mitigation: I/E Moderate Risk

Risk: Injury or death to personnel due to getting harmed by or entangled in the gear entangling the animal.

Risk assessment prior to mitigation: II/ D Moderate Risk

***Mitigation*:**

- All personnel handling gear attached to the animal (*e.g.*, attaching tethered telemetry) should wear protective gloves to avoid chafing (*i.e.*, rope burns).

- All personnel handling gear attached to the animal should carry a one-handed safety knife. Note: Do not use the safety knife as a utility knife.

- Support vessel team should remain alert and prepared (*e.g.*, cutting grapple ready to sever any links).

- Certain gear types, such as the pane of a gillnet, or the mainline of a longline, should not be directly handled (*e.g.*, while securing telemetry directly to the entangling gear).

- Avoid the area close to and around the whale - the "danger zone." This includes the area behind the animal, as the approach vessel can get caught in the trailing gear.

- Any vessel closely approaching the animal (*i.e.*, in the danger zone) should be as free as possible of snag points, especially the engines and hull, and areas of the vessel where gear might be handled.

- For small boats with minimal open deck space that closely approach the whale and entangling gear, only carry the necessary gear for that particular operation (even safety gear can be covered by the support vessel).

- All personnel handling gear attached to the animal should wear PFDs and protective clothing that are "clean" (*i.e.*, free of snag points).

- Do not get in the water near an entangled whale.

- Do not pull line/gear into the vessel that might still be attached to the animal.

- During line handling, only have a single bight of line in the vessel at any time as to reduce threat to personnel (*e.g.*, grabbing the trailing gear to attach a telemetry buoy).

- Always farelead the lines attached to the animal, especially if under load, to the outboard side of a vessel and of all personnel as to avoid being stripped off the vessel (*e.g.*, during the process of deploying the telemetry buoy).

- All personnel should remain clear of gear being attached/deployed to the animal/entanglement (*e.g.*, clips, grapples, telemetry buoy) to avoid personally getting entangled.

- Make sure gear being attached to animal/entanglement is deployed from the vessel on the team's terms. Do not let the animal pull gear off the vessel (*i.e.*, make sure the telemetry buoy is deployed off the vessel as opposed to the whale taking it off the vessel). Use a dedicated person to deploy telemetry or kegging buoys.

- Do not wrap net or line around hands or fingers. Line handlers, like those deploying telemetry, should remove entanglement hazards (*e.g.*, rings, watches), and keep feet clear of lines and nets. Use a five-gallon bucket or other receptacle to hold the telemetry buoy's tether line as it is being deployed.

- Responders handling gear should be familiar with the entangling gear and its associated risks (*e.g.*, a longline with gangions). Certain gear like gillnet and longline should not be directly handled.

Risk Assessment following mitigation: I/C Low Risk

Risk: Injury or death to personnel due to getting cut by one of the knives. Risk assessment prior to mitigation: III/ C Moderate Risk

***Mitigation*:**

- All personnel handling knives should wear appropriate gloves to lend protection (*e.g.*, kevlar gloves).
- Keep knives sheathed until ready to use.
- Only carry the tools, including knives, in the approach vessel that you need for a particular task.
- All personnel deploying flying (*i.e.*, pole-delivered), or thrown knives (*e.g.*, cutting grapple) to a loaded line (*i.e.*, while being towed, being kegged, or otherwise applying load), should maintain a safe distance from such knives once delivered. Do not remain directly behind and inline with the tool. In addition, a response from the animal may "throw" knives long distances.

Risk Assessment following mitigation: II/B Low Risk

Risk: Injury or death to personnel due to contact with tools. Risk assessment prior to mitigation: III/ C Moderate Risk

***Mitigation*:**

- All personnel using disentanglement tools, especially poles, should wear appropriate helmets. Anyone in the vicinity of the person using a pole should also wear helmets.
- During line handling, keep grapples and clips attached to the working line well in front (~2m) of personnel, to avoid contact. If the line is under load, the distance between tools

and personnel should be even greater (~5m).

- All personnel should remain clear of gear being attached to the animal (*e.g.*, knives, clips, grapples, telemetry buoy). An animal eliciting a negative response to the tool, may throw it a long distance (*e.g.*, from a tail slash).

- If deploying tools from poles, test animal's behavior, prior to committing to the use of the tool (*i.e.*, touch the whale with the back of a clip or knife prior to attachment and immediately clear - lift the pole, to see if there is a response).

- Clear poles (*e.g.*, lift or pull back and stow) after use.

- Make sure gear being attached to animal/entanglement is deployed from the vessel on the team's terms. <u>Do not</u> let the animal pull gear off the vessel. Use a dedicated person to deploy gear (*e.g.*, buoys).

- If obtaining a biopsy sample using a crossbow or air gun, treat devices as the weapon they represent.

Risk Assessment following mitigation: II/B Low Risk

Risk: Injury or death to personnel due to overall response (*e.g.*, fatigue, exposure, falls, strains). Risk assessment prior to mitigation: III/ C Moderate Risk

***Mitigation*:**

- Monitor personnel exertion and fatigue levels. Have enough experienced responders to avoid fatigue. Do not push oneself or any team member to the limits.

- Responders should have appropriate attire and protection to minimize exposure.

- Communicate responder movements between vessels to helmspersons (*i.e*., "stepping over").

- Monitor your fellow responders.

- Monitor emotions or the desire to "save the animal." Emotions can, and do cloud judgement(s).

Risk Assessment following mitigation: II/B Low Risk

As always, one major all-encompassing mitigating measure is standing down or aborting a procedure or the entire operation/mission. There is no obligation to respond.

Some primary points related to human safety that might not fall under the examples above or apply to all are:

- While there is no obligation to respond, there are obligations to meet certain criteria and protocols under the MMHSRP and its permit, if initiating a response.
- Obtain necessary authorizations as they are there primarily for safety.
- Ensure first aid kits and AED are available and located with each response group.
- Create a written safety protocol with emergency numbers to be kept with first aid kits.
- Do not put the whale's rescue above human safety.
- Never initiate an action that has not been thoroughly thought through and discussed.
- Review worst-case scenario protocols; have an exit strategy for each procedure. Consider the “what ifs.”
- When in doubt, tag (if decision matrix met), regroup (*i.e.*, attempt another day with more assistance, better conditions, and/or new tools and procedures), or entirely abort the mission. Aborting a response is a viable option.
- All members of the team should understand and agree upon response actions.
- Pre-mission briefs should be conducted.
- Responders should only conduct procedures for which they meet minimum qualifications and training.
- Personnel should wear appropriate PPE such as strong, non-slip footwear, gloves, and protective clothing as needed.
- Do not get in the water near an entangled whale.
- Avoid the area close to and around the whale, including directly in front and behind, as these represent danger zones in which contact with the animal or entanglement in the gear

is more likely.

- Distressed animals are unpredictable; therefore, it is important to continuously monitor a response to anticipate any risk and maintain safety.
- Communication within and between the disentanglement teams, including briefings, is critical to minimize risk and avoid hazards.
- If drugs are used, all responders should be familiar with the drugs and reversals, including symptoms of accidental exposure, and if/when/how to treat prior to the arrival of medical personnel.

4.10.2 Animal Safety

Like human safety, the authorized effort to free a whale from a life-threatening entanglement carries risks for the animal. The response team needs to adhere to protocols, and apply decision matrices, as well as assess and mitigate any risks to the animal(s) relative to that of the threat. While the goal for human risk reduction is to avoid (*i.e.*, prevent) risks entirely, that same goal for the animal(s) is to minimize risk from the actual operation.

Risk: Injury or death to animal due to contact with response vessels. Risk assessment prior to mitigation: II/ B Low Risk

***Mitigation*:**

- Use propeller guards around propellers (may also reduce catching trailing gear).
- Have experienced and knowledgeable operators at the helm that are familiar with the vessel, maneuvering around whales, and the operation.
- Avoid operating in the danger zone. Doing so not only reduces risk to responders, but also to the animal.
- Be methodical and as consistent as appropriate in approaching the animals as to be predictable.

Risk Assessment following mitigation: I/A Minimal Risk

Risk: Injury or death to animal due to drag forces (*i.e.*, kegging, tethered telemetry, towing approach vessel - Nantucket sleighride).

Risk assessment prior to mitigation: III/ C Moderate Risk

***Mitigation*:**

- Use of constraint (addition of kegging buoys/sea anchors) only when deemed necessary (see decision matrix).
- Use of telemetry when pros outweigh cons (see telemetry decision matrix).
- Use lower drag telemetry buoys.
- Use weaklinks or timed-release clips to avoid long-term attachments.
- Practice a methodical use of kegging, as to reduce stress. Additionally, only use constraint when required for meeting mission objectives.
- Avoid applying force to gear, or a tethered working line that conveys force to a vulnerable, traumatized part of the body (*i.e.*, to a deeply embedded wrap on a body appendage).
- Avoid applying force to entangling gear that involves strong, small diameter lines or rolled up gillnet as both can produce significant and rapid trauma, especially if wraps are involved.
- Understand the type of entangling gear involved and its associated hazards.

Risk Assessment following mitigation: II/C Low Risk

Risk: Injury or death to animal due to contact with equipment (other than vessels). Risk assessment prior to mitigation: II/ B Low Risk

***Mitigation*:**

- Use of hooked knives with dull outer surfaces by experienced responders.

- Appropriate use of drones (UAS) by FAA Part 107 Remote Pilot licensed and experienced pilots.

Risk Assessment following mitigation: I/A Minimal Risk

Risk: Injury or death to animal due to use of sedation. Risk assessment prior to mitigation: III/ D High Risk

***Mitigation*:**

- Have only experienced and trained responders administer drugs.
- Confer with veterinarians or other experts prior to administering drugs.
- Provide drugs as early as possible to avoid fight or flight response.
- Have reversing drugs available and ready to administer.

Risk Assessment following mitigation: II/D Moderate Risk

Risk: Injury or death due to removal of gear.

Risk assessment prior to mitigation: III/ D High Risk

***Mitigation*:**

- Confer with veterinarians or other experts prior to removing deeply embedded gear. It may be more beneficial for the animal, and safer for the response team to trim such deeply embedded wraps.

Risk Assessment following mitigation: II/D Moderate Risk

As always, one major all-encompassing mitigating measure is standing down, or aborting a procedure or the entire operation/mission. There is no obligation to respond.

Other risks:

Other risks include the animal and entanglement being a "hazard to navigation" which can result in a vessel getting caught in the trailing gear; well-intentioned public attempting to free the animal getting injured; and resources being lost or damaged during a response (*e.g.*, loss of telemetry buoy, approach inflatable being cut). In addition, an unsuccessful mission can cause stress (emotional and otherwise) to managers, responders and the community in general. These risk factors affect response risks either indirectly or directly, and should not be ignored when addressing risk mitigation.

4.11 Intervention Criteria/Decision Matrix (Go/No Go)

Risk intervention tools (*e.g.*, Appendix L – GAR Risk Assessment Checklist) or decision matrices (*e.g.*, Appendix M – Decision Matrix [Go/No Go] Risk Factor Table) should always be used prior to any response. Factors that should be considered include environment, team selection and fitness, animal condition, authorizations, resources, and mission complexity. Risk assessment is a team effort.

Table 8. Disentanglement Risk Assessment Coding under Five Steps of Assessment

Step 1. Identify Risk Factors			**Step 2. Assess Hazards (who/ what?)**	**Step3. Evaluate Risk and Mitigate**		**Step 4. Record and Implement**	**Step 5. Monitor and Review**
Response Categories	**Hazards/ Risks**	**Causes**	**Initial RAC**	**Develop Controls**	**Residual RAC**	**How to Implement**	**How to Monitor**
During first response, disentanglement, sedation	Injury or death to personnel from contact with whale	Operating in the danger zone, loss of situational awareness, startle or pain response from animal	II/ E = High Risk	Avoid danger zone, only experienced personnel in close proximity, dedicated SO	I/ E = Moderate Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program

During first response, disentangle ment, sedation	Injury or death to personnel due to getting harmed by, or entangled in the entangling gear	Operating in the danger zone, loss of situational awareness, abrupt changes in animal's behavior	II/ D = Moderate Risk	Avoid danger zone, only experienced personnel in close proximity, use of safety knives, dedicated SO	I/ C = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During disentangle ment	Injury or death to personnel due to getting cut by one of the knives.	Lack of situational awareness, too close to flying knives, abrupt response from animal	III/C = Moderate Risk	Use experienced personnel, wear PPE, maintain methodical approach	II/B = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During first response and disentangle ment	Injury or death to personnel due to contact with tools	Lack of situational awareness, too close to tools under load, abrupt response from animal	III/C = Moderate Risk	Use experienced personnel, wear PPE, stay clear of tools under load or being deployed	II/B = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During first response, disentangle ment, sedation	Injury or death to personnel due to overall response	Inexperienc e of personnel, too much emotion, fatigue	IV/ B = Low Risk	Use experienced personnel, wear PPE, maintain methodical approach and fatigue levels	III/ A = Minimal Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO and focus on big picture	IC/CI will ensure compliance at scene. PI ensure compliance under program
Response Categories	**Hazards/ Risks**	**Causes**	**Initial RAC**	**Develop Controls**	**Residual RAC**	**How to Implement**	**How to Monitor**

During first response, disentanglement, sedation	Injury or death to animal due to contact with response vessels	Lack of experience and situational awareness, too many vessels approaching, vessel(s) in danger zone, too fast of a transit.	II/ B = Low Risk	Use experienced helmsperson(s). Avoid operating in danger zone. Maintain observers and prudent/ safe speed.	I/ A = Minimal Risk	Adhere to all criteria and guidelines established for vessel use around animals.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During first response and disentanglement	Injury or death to animal due to drag forces (*i.e.*, kegging, tethered telemetry, towing approach vessel	Inappropriate use of telemetry (animal not a candidate), attachment to an embedded wrap.	III/C = Moderate Risk	Use risk assessment and decision matrices. Adhere to criteria.	II/C = Low Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During disentanglement	Injury or death to animal due to contact with equipment (other than vessels)	Inappropriate use of equipment, lack of situational awareness.	II/ B = Low Risk	Use experienced personnel, maintain methodical approach	I/ A = Minimal Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Maintain SO.	IC/CI will ensure compliance at scene. PI ensure compliance under program
During/ as a result of sedation	Injury or death to animal due to use of sedation	Miscalculation of extraneous variables, mis-dosage	III/D = High Risk	Use risk assessment and decision matrices. Adhere to criteria. Continuously monitor animal.	II/D = Moderate Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use.	IC/CI and onsite veterinarian will ensure compliance at scene. PI ensure compliance under program

During disentanglement	Injury or death due to removal of gear	Inadvertent or well-intentioned removal of embedded gear	III/D = High Risk	Use risk assessment and decision matrices. Adhere to criteria.	II/D = Moderate Risk	Adhere to all criteria, follow ICS, guidelines and proven SOPs on procedures and tool use. Consultation with veterinarians	IC/CI will ensure compliance at scene. PI ensure compliance under program,

Hazard Severity:

Category A – Negligible: The hazard presents little to no threat to personnel, animal, equipment, vessels, and environment (*e.g.*, minor sunburn, minor chafe/rope burn; additional chafe wounds to animal).

Category B – Minor: The hazard may cause minor injury/impact to personnel and animal, minor damage to equipment and/or vessels that is easily repaired, or minor impact to environment (*e.g.*, superficial cut, twisted ankle, snapped utility blade; superficial wounds to animal due to kegging).

Category C – Moderate: The hazard may cause moderate injury to personnel and animal, moderate damage to equipment and vessels, or moderate impact to the environment (*e.g.*, deeper cut, but no threat to function of body, loss of gear that can be replaced with minimal cost and effort; deeper dermal laceration wounds due to kegging).

Category D – Major: The hazard may cause major injuries to personnel and animal, loss of expensive equipment and/or major damage to vessel, and/or major impact to environment (*e.g.*, deep cut or impact to head requiring professional medical attention, loss of equipment compromising safety/mission, high cost and effort of replacement, impact to animal possibly life-threatening).

Category E – Catastrophic: The hazard poses a life-threatening threat to personnel and animal, loss or complete destruction of equipment and/or vessels, impact to environment is extreme (*e.g.*, loss of life –

personnel and/or animal, another animal struck and killed enroute to respond, vessel stove in and sunk, major oil slick).

Likelihood:

Category I. – Very unlikely: Not likely to occur at all or very unlikely over broad expanse of time.

Category II. – Unlikely: Not likely to occur over a broad expanse of time.

Category III. – Possible: Might occur in time over duration of response lifespan (time person active in response, lifespan of equipment).

Category IV. – Likely: Expected to occur several times to personnel, animal or equipment over the response lifespan (*i.e.*, duration of multiple efforts).

Category V. – Very likely: High probability of occurring frequently or within a short period of time.

Table 9. Large Whale Entanglement Response Risk Matrix

Likelihood / Severity	A Negligible	B Minor	C Moderate	D Major	E Catastrophic
V. Very likely	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
IV. Likely	Minimal Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
III. Possible	Minimal Risk	Low Risk	Moderate Risk	High Risk	High Risk
II. Unlikely	Minimal Risk	Low Risk	Low Risk	Moderate Risk	High Risk
I. Very unlikely	Minimal Risk	Minimal Risk	Low Risk	Moderate Risk	Moderate Risk

5. Sedation

5.1 Overview

The use of sedation - the administration of intramuscular anxiolytic and analgesic drugs, has been pursued as an alternative means to animal constraint (*i.e.*, kegging) or lack thereof, to reduce risks and increase effectiveness associated with large whale entanglement response. The goal is that the sedated whale will be more approachable (*e.g.*, less evasive and/or aggressive, or more predictable in behavior), improving the chances of an authorized response team freeing a whale from a life-threatening entanglement. Some species, such as North Atlantic right whales (NARW), are notoriously resistant to physical constraint methods, as well as more evasive to close vessel approaches, making entanglement response to these animals more difficult and dangerous. Across species, certain entanglement configurations are more challenging for rescuers, specifically those that require multiple head approaches to resolve. Additionally, by reducing the physical toll of the disentanglement process on whales by replacing kegging with chemical restraint, their stress levels and energy expenditure may be reduced and their overall survival may be improved in some cases.

However, like all procedures and tools, sedation is not without its risks (Brunson *et al.* 2002; Moore *et al.* 2010, 2013, 2018; van der Hoop *et al.* 2013). These include tissue damage caused by the impact of the sedative darts (acutely or chronically if the needles do not pull out as designed), organ damage or pneumothorax if dart is too long, other trauma if dart impact occurs at an undesired site, over-sedation, loss of sedative darts at sea, risk of human exposure to super-potent sedatives, etc. For each case in which sedation is considered, a cost-benefit analysis must be undertaken prior to employment of sedation. A systematic entanglement case review of entangled large whales on the east coast of the United States revealed that free-swimming whales with head/mouth entanglements, no trailing gear, and no control line established are less likely to be disentangled on the first attempt, and therefore more likely to benefit from sedation (S. Sharp 2018, pers. comms.). Compared to other large whale species, entangled NARWs were also found to be more commonly free-swimming, have head/mouth involvement, and their entanglements were less likely to be resolved on the first attempt. Whether or not an entanglement is life-threatening must also be taken into consideration when deciding whether or not sedation is indicated. Entanglements that show significant cutting into soft tissue and or bone, circumferential wraps of gear, or those that interfere with feeding have been shown to be serious injuries that are life-threatening (Moore *et al.* 2004, Sharp *et al.* 2019).

Sedation delivery at sea to facilitate disentanglement of terminally entangled large whales has been conducted three times in the past, each with NARWs. The first attempt was with an adult male NARW (Catalog #1102, “Churchill”) using a combination of midazolam and meperidine delivered from a cantilevered pole in 2001 (Moore *et al.* 2010). No appreciable level of sedation was visibly achieved with this animal despite multiple sedation attempts. The second case was the first field deployment of the current PaxArms remote sedation system and involved a chronically entangled six-year old male NARW (Catalog #3311, “Bridle”). Despite three sedation attempts with low doses of midazolam and butorphanol, only very minimal sedation effect was visibly achieved with no appreciable assistance to disentanglement efforts (Moore *et al.* 2010). The final case occurred in

2011 with a two year old female NARW (Catalog #3911, “Bayla”). She was darted with the Paxarms system using a combination of Butorphanol and Midazolam (at the current recommended doses) and sedation was appreciated through decreased boat avoidance, improved predictable behavior and an appreciable improvement in disentanglement operations was the result (Moore *et al.* 2013).

Clearly with so few large whale cases for which remote sedation has been deployed for disentanglement assistance, there is still a significant amount of work needed to improve protocols and efficacy of this tool. The following provides general information regarding the current best practices for large whale remote sedation, but this information is constantly evolving.

5.2 Preparation and Training

All participating field personnel must be currently certified in first aid and CPR training. New personnel should receive training on immobilization and anesthesia prior to working on projects involving the use of these drugs on whales. Wildlife immobilization courses such as those taught by the Canadian Association of Zoo and Wildlife Veterinarians, American Association of Wildlife Veterinarians, various veterinary schools, SafeCapture or Global Wildlife Resources are acceptable introductory or refresher immobilization training. However, additional supervised training in the field with experienced personnel should be required prior to administration of chemical capture of whales. A refresher course is recommended every five years especially if field responses have been limited, but may be taken more frequently as methods and procedures evolve or personnel work with different species. Remote drug delivery using the whale sedation projector requires specific training and practice with the specialized equipment. Biopsy darting whales at sea provides pertinent experience with regards to timing of dart deployment on a surfacing, however intimate knowledge of the sedation system and its performance is an absolute requirement prior to field deployment.

Monitoring whales after remote delivery of sedatives requires a veterinarian experienced in monitoring cetaceans under sedation. All personnel that handle controlled substances must receive training on safe handling of drugs. Vessel operators must be trained in small boat operations and have experience operating boats while whales are in the water near the vessel. If possible, inexperienced personnel should watch the process and participate in low-level aspects of the response to gain more experience.

Personnel should document their training and skills so the response coordinator who is choosing the team has a current list of team abilities. Although there are currently no formal national training programs in place, the NOAA MMHSRP can direct responders toward resources relevant to the species of interest, whenever available.

Prior to any operation

- Practice, practice, practice! The more the team practices ahead of time, the better prepared they will be for the unexpected. This includes both land-based target practice and gaining familiarity with the equipment as well as at-sea target practice.

- Evaluate the location of the operation with regards to the distance of the whale from shore and the safe range of identified vessels.

- Choose experienced team members and assign roles.

- Consult with the NMFS Regional Stranding Network Coordinator, the MMHSRP, and the NMFS West or East Coast Large Whale Disentanglement Coordinator regarding the plan for sedation.

- In coordination with NMFS officials and the local entanglement response team, establish an operational plan in accordance with the Incident Command System.

- Distribute safety protocols for responder review.

- Check equipment, communication, and medical supplies.

- Confirm the operation of all vessels (fuel and maintenance if needed).

- When necessary, arrange for additional personnel, better visualization of the entangled animal including UAS assessment.

- If using satellite transmitters, ensure transmitters are programmed and ready to deploy.

- Ensure all equipment is clean (or sterilized, as appropriate), organized, packed, and ready for operations.

24– 72 hours prior to operation:

- The marksman should practice with the equipment to be used for the upcoming incident. Practice should include ensuring the accuracy and precision of the projector and darts, the effective and consistent deployment of the dart contents, and any predicted shot scenarios for the outing (distance of shot, angle of shot from vessel platform, wind and wave conditions, etc.).

- All critical sedation gear should be tested for function, including the projector, darts to be deployed (especially important are the rubber seals that create a pressurized system for successful administration of sedatives and that can be adversely impacted from long-term storage), UASs (if to be used), etc.
- Check predicted marine conditions, weather and wind forecasts.
- Notify appropriate entities such as: NOAA Regional Stranding Coordinator (RSC), the MMHSRP, and the NMFS West or East Coast Large Whale Disentanglement Coordinator, law enforcement, EMS or local hospital, Native communities (where appropriate).
- Ensure appropriate authorization.

Immediately prior to operation:

- Conduct safety briefing.
- Re-check weather and marine forecasts.
- Consult decision matrix – prior to operations and on scene, determine if conditions allow for safe operations and make a final decision about response.

5.3 Authorization and Licensure

As with other components of whale entanglement response, whale sedation at sea is conducted under MMPA (and ESA, as appropriate) authorization through an MMHSRP permit. Therefore, only responders who have been authorized by NMFS and who have the appropriate training, experience, equipment, and support should attempt whale sedation for disentanglement. A veterinarian experienced in cetacean behavior and sedation is required to be on scene for large whale sedation operations. This veterinarian must hold a current Federal Drug Enforcement Administration (DEA) registration for dispensing Schedule II-V controlled substances. For operations within state waters, a veterinarian with the appropriate state veterinary license as well as state controlled substances license (if required by that state) must be on site for the operations.

Employment of remote sedation to facilitate disentanglement must first be approved on a case-by-case basis by NMFS. As soon as possible prior to the event, the NMFS Regional Stranding Network

Coordinator, the MMHSRP, and the NMFS West or East Coast Large Whale Disentanglement Coordinator must be consulted. All of the entanglement response activities (including sedation) will be under the direction of NMFS MMHSRP.

5.4 Team Member Roles

Sedating large whales at sea has inherent risk for both the responders and the animals. Clarifying team member roles and responsibilities ahead of time, and ensuring that responders meet minimum qualifications for each role is essential to a safe and successful response. It is extremely helpful if the team has previously worked together. If not, practicing with the system ahead of time together can help to ensure everyone is on the same page. It is recommended that remote sedation and potentially UAS operations are based on a separate vessel platform from the primary entanglement response vessel. The remote sedation operations are conducted under the umbrella of the overall entanglement response structure and effective communications with the entanglement response team are critical to success.

Suggested team member roles may vary with the vessel capacity and specific operation (Table 5-1). The recommended roles that follow are based, in part, on implementation of the Incident Command System as defined by the Federal Emergency Management Agency. This system provides a structure for clarity of communications and roles, and efficient management of resources. The system is scalable and can be modified to fit the needs of the operation. Safety is always at the center of any plan based on this system.

Table 10. Suggested number of personnel needed for a large whale remote sedation entanglement response (not including the separate entanglement response team). Responders can fulfill multiple roles and some roles are *optional.

Team member role	Number of suggested personnel
Safety Officer	1
Veterinarian	1-2
Marksman	1
Spotter	1
Animal monitor	1
Vessel operator	1
Data recorder	1
Photographer/videographer	1
*Optional – UAS pilot & catcher	2
*Optional- Communication Officer	1

- **<u>Safety Officer (SO)</u>** – The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate to the team and adjust the strategy of the response as needed.

    - **<u>Qualifications</u>** – Experience in previous remote sedation operations and whale entanglement response, ability to continually watch over all personnel involved, communicate with the team to adjust strategy or call off the effort as necessary, and watch for hazards. Willingness to stop operations if there is a safety concern, despite momentum (and pressure) to move forward.

- **<u>Veterinarian</u>** – The veterinarian is responsible for the health and monitoring of the entangled animal during sedation, disentanglement, +/- reversal, and recovery process, until the animal is deemed sufficiently recovered to swim off on its own.

    - **<u>Qualifications</u> -** A licensed Doctor of Veterinary Medicine (DVM) or equivalent who is EXPERIENCED in cetacean medicine. This individual maintains the proper registration to purchase, store, and administer controlled substances, experimental drugs, and other drugs required for remote sedation, including ensuring that the appropriate reversal agents are available in sufficient quantity. Any licensed practitioner who distributes, prescribes, or dispenses any controlled substances (narcotics and dangerous drugs that fall under the jurisdiction of the Controlled Substance Act) must be registered with the DEA. If operations are to be conducted in state waters, the veterinarian should hold the appropriate state license and any state-mandated controlled substance registrations (in addition to DEA Registration).

- **<u>Vessel operator</u>** – Boat operators should be experienced with whale close approaches, remote sedation methods, and entanglement response operations. Vessel operators should also be comfortable operating offshore and monitoring weather and sea conditions.

    - **<u>Qualifications</u>** – United States Coast Guard boat training or equivalent. Because many of these duties are outside the scope of normal boat operations, skills should be practiced prior to working with whales in or around the boat.

- **<u>Marksman</u>** – The marksman is ultimately responsible for safe and effective functioning of the remote sedation system, placement of the dart on the target animal, and follow-up security and cleaning of the darting equipment. The marksman determines the appropriate approach to the target as well as the optimal distance and angle of the shot attempt, communicating with and working closely with a Spotter and other personnel. Once the Spotter confirms that it is safe to attempt a shot (opens the shot window) and communicates this to the marksman, the marksman may make an attempt at their discretion until the Spotter closes the shot window. The marksman should have extensive practice using the dart projector prior to darting a live animal. Specifically, practice should be organized and methodical, with marksman shooting a target a) from various distances, b) with different pressures, c) in all types of weather conditions (*e.g.*, rain, snow, wind), and d) from different angles. The marksman should be well versed in how to safely handle the dart projector, darts, charges, pressurizing and depressurizing the projector, and be able to demonstrate accuracy in hitting a target under the various conditions described above.

    - **Qualifications** – Demonstrated proficiency in skills and experience described above. The marksman does not need to be a veterinarian and should work under the direction of a veterinarian regarding the drugs used in the darts. Thorough knowledge of the anatomy of the target species will increase safety and effectiveness of dart placement selection and delivery. Experience biopsy darting whales is helpful, but specific knowledge of and experience with the remote sedation system is required.

- **Spotter** – This person is paired with the marksman and is in charge of both opening and closing the shot window for the marksman. The Spotter uses a laser rangefinder to measure out distances to the target animal, ensures that the area immediately surrounding the target remains clear of non-target animals or other hazards, and communicates with other personnel to direct proper placement of the vessel for the marksman.

    - **Qualifications** – Ability to use a laser rangefinder, experience approaching and tracking whales, understanding of whale behavior, ability to communicate with marksman, communicate with personnel on vessels, and experience around dart projector and drugs.

- **Animal monitors** – Monitors the animal's behavior and respiration rate prior to, during, and after darting. This person may also be the data recorder.

    - **Qualifications** – Familiar with tracking large whales at sea and whale behavior.

- **Data recorder** – The data collector is essential in recording all aspects of the remote sedation event. This person is responsible for ensuring all data are complete on data sheets, the animal is given an identifying number, and any deployed tag numbers are recorded.

- **Qualifications** – Familiarity with whale behavior, ability to track whales at sea, familiarity with data sheet and information to be recorded and ability to accurately record data legibly.

- **Photographer/videographer** – This person is responsible for operating still and/or video photography to document the operation. This person should also monitor the status of camera batteries and memory to ensure there is no lapse in documentation coverage. While not ideal, this person may also serve as the data collector.
  - **Qualifications** – Experience using photographic equipment including at-sea footage. Knowledge of how the equipment operates, how to change settings, troubleshoot, and take clear and meaningful photos and video. Understanding of the remote sedation process and what images and video are of highest priority is important.

- **Unmanned Aircraft System (UAS; optional) -** If licensed and permitted to operate a UAS during the remote sedation process, the UAS pilot must have no other duties. The pilot must be in communication with the IC and immediately cease operation if the UAS is in any way negatively impacting the success of the operation or causing any disturbance to the target or other animals.
  - **Qualifications** – an FAA certified Part 107 Remote Pilot's license, a permit to operate during an entanglement response, and experience operating a UAS during previous large whale field operations.

- **Communication Officer (Optional)** – If there are an adequate number of responders available and room on the vessel, the communication officer can communicate information about whale remote sedation.
  - **Qualifications** – Effective communicator. Communication should be clear, concise, accurate, coherent, and courteous.

5.5 Communications

Communication between the remote sedation and entanglement response teams is absolutely essential to success. Both teams must be in agreement about the plan, including indications for sedation and a point at which remote sedation efforts may be called off in favor of a traditional disentanglement response. It is crucial that all team members understand that the situation is dynamic, with continually changing conditions of the animal, sea state, weather, and daylight. Communicating safety concerns among the teams, both human and animal, is critical to a safe operation. While this may be the primary role of the Safety Officer, safety must always be every responder's first priority.

The remote sedation team should have a satellite phone or other means of contacting NMFS officials and potentially additional veterinarians for consultations prior to, during, or following the remote sedation operation. Otherwise, all communications equipment for remote sedation efforts are the same as those for general disentanglement response. After the teams are safely back to land, a debriefing of the event with all appropriate parties should be held.

5.6 Data Collection

Supply checklists and data needs are well thought out prior to the start of any remote sedation response and data forms and instructions are available during a response. Important forms to have accessible specific to remote sedation efforts include: applicable permits; remote sedation gear checklists; whale monitoring forms (Appendix F - Free swimming whale monitoring forms); remote sedation worksheets (*e.g.*, Appendix U - Whale Sedation Datasheet); drug dosing sheets (*e.g.*, Appendix V – Drug Dosing Charts), and length-weight charts or formulas for the appropriate species.

If time and resources allow, and it is agreed upon in consultation with the on-site disentanglement team, the UAS can be deployed in order to better investigate the entanglement configuration, wound severity, and to obtain photogrammetric measurements (length and max width in relation to vessel length) for weight estimation. Ideally, this is done prior to close vessel approaches to the whale and in preparation for darting. All available information is relayed as soon as possible to the entanglement response team.

5.7 Resources

Data, observation, and recording supplies

- Datasheets as noted above (*i.e.*, whale monitoring, and sedation forms)
- Length-weight curves and calculations for appropriate species
- Pencils/clipboard
- Watch with timer
- DSLR camera and video camera (*e.g.*, GoPro)
- Laser Rangefinder
- Binoculars

Personal protective equipment

- Vessel-appropriate closed-toe footwear

- Protective clothing as appropriate for conditions, preferably waterproof outer layer
- PFD
- Helmets for each responder on the remote sedation vessel
- Non-permeable gloves (nitrile exam gloves, etc.)
- Eye protection (goggles, safety glasses, sunglasses, or face shield)
- Tyvek arm sleeves
- Cotton, neoprene, or Kevlar gloves for retrieving dart tether, handling lines
- Safety knives kept on the person of each responder

Human medical equipment

- First aid kit
- Human reversal for sedatives (Naloxone, flumazenil)
- Ambu bag, CPR mask
- Eye wash
- Antiseptic wipes
- Tourniquets
- If working in a remote area and emergency services are not readily available, automated external defibrillators (AED) can be included (not required) with kits if responders are experienced in their use.

Medical supplies

- Controlled drug kit including sedatives and reversals
    - Sedatives: compounded midazolam (50 mg/ml) and butorphanol (50 mg/ml), both available from zoopharm.net
        - Dosages of 0.1mg/kg have been previously used and believed effective to sedate free-swimming entangled right whales (Moore *et al.* 2010, Moore *et al.* 2012)
        - Bring sufficient volume to dose (and re-dose once) the expected size of whale (see dosage chart)
    - Reversals: compounded naltrexone (50 mg/ml; zoopharm.net) and commercially available flumazenil (0.1 mg/ml)
        - Bring sufficient volume of naltrexone to dose (and re-dose once) the expected size of whale (see dosage chart)

            - Top off naltrexone syringes with Flumazenil for a total volume of 57 ml, since higher concentrations of this drug are not available and at a mammal dose of 0.01 mg/kg, the volume of this drug makes appropriate dosing not possible with the current system)

- Medical kit (*e.g.*, injectable antibiotics)
    - Ceftiofur (200 mg/ml) is a commercially available, long-acting, broad-spectrum antibiotic that may be deployed using the remote sedation darting system, if indicated. Dosage is 6.6 mg/kg for smaller marine mammals (Meegan *et al.* 2013). Metabolic weight has been previously used to dose antibiotics in free-swimming humpback whales (Gulland *et al.* 2008). The decision to inject a dose of ceftiofur remotely to an entangled whale should take into consideration the costs and benefits, including additional close approaches to the animal, dart impact, potential dart complications, etc. Such a decision must be made in consultation with MMHSRP staff.
    - Other miscellaneous medical supplies:
        - Alcohol pads to aseptically prepare drug vials
        - Sterile gauze 4x4 pads
        - Sterile swabs
        - Nitrile gloves of varying sizes
        - Needles and syringes of varying sizes, appropriate for volumes of drugs needed
        - Label tape

Drug delivery system

- Projector (below, assembled with dart in barrel and tethered float attached) - Remotely delivered drugs may be administered by a custom-designed ballistic rifle (www.paxarms.com). This system was designed specifically for the purpose of delivering sedatives to free-swimming large whales and was adapted from an existing whale biopsy dart rifle configuration. The rifle operates using 0.22 caliber blank cartridges. The projector has a red dot sight, control valve, and a safety lock mechanism. Regular maintenance of the projector system is necessary to maintain it in safe, working condition.

Figure 13. Paxarms large whale custom-made remote sedation system with assembled dart loaded into projector barrel and tether/float attached to barrel. (Photo credit: IFAW)

- Darts and needles (below, assembled syringe/needle and float/tether) – Darts are custom-made to hold 57 ml of injectable drugs. Dart components consist of a syringe barrel, plunger, valve, needle, port sleeve, and stopper. Needles are tapered stainless steel with a carbon fiber liner for structural support on impact. There are currently three customized needle lengths – 6”, 9”, and 12” and the selected size is based on animal species, size, and estimated blubber thickness data. All needles have an outside diameter of 7 mm, a solid, tapered tip, and three side injection ports.

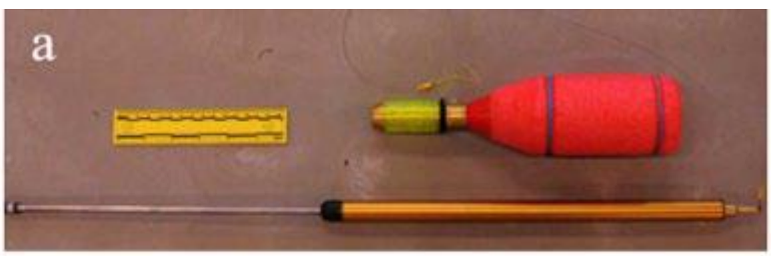


Figure 14. Paxarms whale dart (bottom) and tether and float (top) from Moore *et al.* 2013

- Dart tether and float (above, top) – 23 meters of monofilament line are wound onto a spool and on a foam float which attaches to the back end of the dart. The tether and float are used for three purposes: 1) to ensure retrieval of a loaded dart that is deployed but misses the animal; 2) for darts that make contact with the whale, to assist with dart extraction from the injection site by allowing light backward traction on the dart; and 3) to assist with straight and level flight characteristics of the dart. The float is attached to the rifle barrel and either self-deploys with the dart or can be maintained by the marksman if the whale is less than 23 meters from the vessel when the dart is fired.

- Dart box – a box capable of holding the assembled loaded darts until the marksman is ready to deploy the system. Can be lined with a sterile field.

- Splash box/bag/shield (custom-made splash box below) – for safe assembly of the darts while at sea, extra safety precautions should be taken to minimize the risk of human exposure to the concentrated sedatives. With whatever system is employed, persons should practice assembling the darts and handling the necessary medical equipment in it prior to deployment.

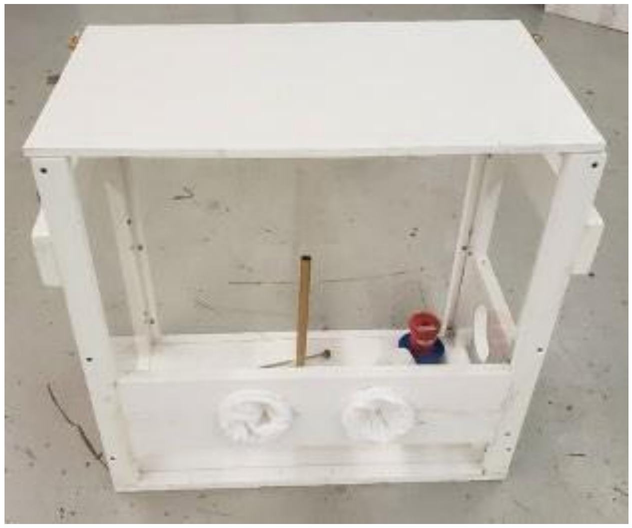


Figure 15. Custom-made splash box for safer at-sea dart loading (photo credit: IFAW)

- Additional darting equipment - pressurizer, magazine, threaded pliers, sleeve applicator, o-rings of various sizes, 0.22 caliber blank charges, rubber bands, ram rod, cold sterile solution, and silicone lubricant.

- All darting equipment should be maintained in waterproof pelican cases or similar. It is recommended that spares of key equipment are brought on board the vessel. Components that can be sterilized ahead of time should be. Cold sterile solution and sterile saline flush should be available on board for last-minute sterilization.

Cleaning/disinfecting supplies

- Antibacterial soap/hand sanitizer
- Disinfectant
- Spray bottle for disinfectant solution
- Garbage bag(s) or other container(s)

Vessels

The vessel used for remote sedation operations would ideally be separate from the primary entanglement response vessel in order to allow for more flexibility and fluidity of procedures during the event. The ideal vessel has a tower, bowsprit or pulpit, or other elevated darting platform that provides height above the water for improved whale tracking and an ideal shot angle. The vessel operator should be experienced in whale approaches, entanglement response operations, and should communicate well with the spotter and marksman. The UAS team may also operate out of this vessel with the understanding that darting operations take priority. The vessel size and design must allow it to be a relatively stable platform for darting while allowing it to be able to handle seas well, and provide protection from the elements appropriate to the response area. RHIBs (rigid-hulled inflatable boats) and SAFE boats are examples of good remote sedation platforms. The vessel should hold at least five responders.

5.8 Environment and Weather

Since the desired outcome is a more approachable animal for the purposes of disentanglement, the range of weather and environmental conditions considered for sedation should be the same as, or better than those considered for disentanglement operations. Additionally, available daylight hours must be sufficient to allow post-sedation recovery monitoring of the whale. Building seas and inclement weather will increase darting difficulty and reduce the ability to track an animal's recovery from sedation. Therefore, initiating remote sedation efforts under these circumstances should be discouraged.

5.9 Risk and Mitigation

To minimize the risk to human responders and whales, a comprehensive entanglement response safety plan should be implemented. A safety briefing should occur prior to each remote sedation operation. In addition, a decision matrix or Go/No Go criteria should be established to guide responders in making safe decisions regarding any remote sedation efforts for entangled whales. Responders should prepare, plan, and practice for possible risks and identify mitigation measures for these risks prior to any response. After each response, the team should conduct a thorough de-brief and come up with lessons learned that can be applied to the next response. When performing remote sedation on entangled whales, the list of risks and mitigations is never complete. There is always room for improvement and documents should be updated continually.

Additional possible risks and mitigation measures are listed below.

- All remote sedation attempts must be approved by NOAA Fisheries' Marine Mammal Health and Stranding Coordinator (MMHSC) staff and the permit PI, on a case-by-case basis, prior to attempting sedation.

- Approved remote sedation protocol documents, including drug protocols, equipment, and a list of trained personnel that must include a veterinarian, should be on file prior to any remote sedation attempt.

- As soon as the information is available and a remote sedation is being considered, situation specific documentation for large whale remote sedation attempts must be provided to the MMHSRP for approval (including species, size estimate, entanglement configuration, general location information, proposed date and time for remote sedation attempt, number of boats, number of personnel, and a specific personnel list).

- After each remote sedation attempt, a written report should be filed with the MMHSRP permit holder and appropriate staff within 72 hours of the capture attempt when feasible and within two to four weeks if the response was conducted remotely in the field. This written report must include a detailed description of the darting logistics (number of darts/shots, needle length, distance from target, dart impact location, when/how darts retrieved), effects of the drug combination on the whale including dose administered, time to effect, duration of effect, reversal agent if used and dosage, time to recovery, any negative impacts of the drug or darting, and any changes necessary to the remote sedation system or protocol.

RISKS TO ANIMALS

Risk: Human exposure to drugs by injection, absorption, or ingestion

The doses of immobilization and sedative drugs required to achieve an adequate response in large whales are all potentially lethal if accidentally injected into a human. Therefore, drug safety procedures must be carefully followed at all times.

Mitigation:

- Prior to using a particular chemical immobilizer or tranquilizer, it is each project leader’s responsibility to determine and document that all personnel are familiar with the human safety aspects of the drug. These instructions shall include knowledge of the symptoms following accidental injection; emergency treatment procedures, including cardiopulmonary resuscitation (CPR); and name, location, and dosage of a reversal agent (if any). Written instruction should be close by and easily accessible at all times during a response.

- PPE: Basic safety precautions must be taken by all personnel to prevent exposure to drugs. These include wearing gloves, waterproof clothing, and Tyvek sleeves when handling drugs/darts. Additional safety measures are required to prevent drug exposure across mucous membranes (eyes, mouth) when filling, charging, or disassembling darts. Equipment should include at least one of the following in addition to gloves: safety goggles, splash guard mask, splash box or safety screen.

- OSHA Universal Standards for handling sharps are used https://www.osha.gov/SLTC/etools/hospital/hazards/sharps/sharps.html.
- Marine radios, cell phones, and satellite phones ensure that emergency rescue personnel can be alerted should a team member be exposed to a drug. Local EMS should be notified prior to operations and informed of drug types and concentration, work locations, number of personnel, and safety equipment on board.
- All response staff are CPR certified.
- Reversal drugs are drawn up and kept readily available.

Risk: Injury or death to personnel by drowning, falling or other vessel-related hazards.

Mitigation:

- Appropriate personnel should decide if operations are safe under the current and expected sea and weather conditions.
- Wear appropriate PPE such as strong, non-slip footwear, gloves, PFDs, and helmets as necessary.
- Designated SO should be assigned to continually watch over all team members involved and be able to communicate to the team to adjust strategy or call off the effort as necessary.
- Designated SO should be watching for and warning the team of hazards.

Risk: Injury or death to personnel due to perceived safe approach to a sedated whale

Mitigation:

- Entanglement response team should be trained on the effect of sedatives in large whales, especially with regards to maintaining vigilance when approaching whales that have been sedated.

- The veterinary/remote sedation team will continue to monitor whale behavior and sedation plan during the entanglement response and notify responders of any observed or anticipated changes (*i.e.*, expected duration of sedative effects).

Risk: Loaded dart is lost at sea

Mitigation:

- Marksman practices sufficiently to ensure darting accuracy at sea.
- All darts are tethered with floats to increase the likelihood of their recovery if the target animal is missed.
- Handling of darts on-board the vessel should be minimized as much as possible. All loaded darts should be maintained in an appropriate dart box until loaded into the projector.

RISKS TO ANIMALS

Risk: Injury to animal from dart

Mitigation:

- Personnel should be trained in techniques that minimize injury to the animal including: knowledge of the desired impact location; dynamic adjustment of the firing velocity based on distance from target; and proper needle length selection.
- If possible, darts should be retrieved using the tether/float shortly after drug delivery is complete (~5 seconds after impact) to minimize shearing of the needle along the blubber-muscle interface.

Risk: Unintentional disturbance of non-entangled protected species

Mitigation:

- Evaluate the possibility of unintentional take of non-entangled animals before remote sedation is attempted. Do not attempt remote sedation if a negative impact on a non-target animal is likely.

- The safety officer(s) should continuously watch for the presence of non-entangled animals in and around the operational area throughout the event, and communicate with the team appropriately.

Risk: Animal appears overly sedate, receives an overdose of sedatives, or develops an adverse reaction to sedatives

Mitigation:

- Reversal agents should be administered under the direction of the veterinarian.
- Attempts should be made to continue to stimulate the whale with vessel approaches in order to disrupt the onset of sedation.
- If possible, a control line on the entanglement should be established by the entanglement response team to provide additional stimulation.

Risk: Non-entangled animal is hit with a loaded dart.

Mitigation:

- Every effort should be made to track the animal, administer a reversal agent, and monitor the animal. The entanglement response team should remain with the target animal, if possible and the remote sedation team can track the non-target whale (unless additional monitors are needed for the sedated animal).

Risk: Animal fatality.

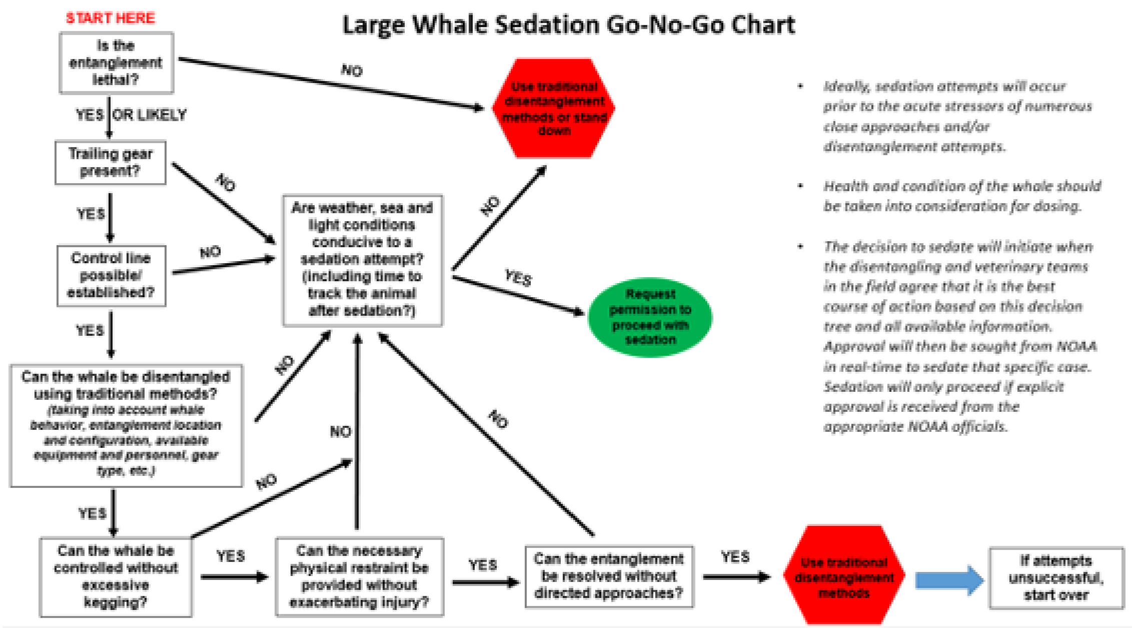
Mitigation:

- Every effort should be made to recover the carcass for necropsy.
- External documentation should be performed immediately upon carcass recovery.
- The Regional Stranding Coordinator and permit's Principle Investigator should be notified, a full

necropsy should be performed as soon as possible, and a final report sent to NOAA.

- Large whale remote sedation activities should immediately cease until necropsy is completed and new mitigation measures are approved by NMFS.
- Continual monitoring of respiration rates and behavior may decrease the likelihood of fatality from oversedation, allowing for earlier identification of potential complications and reversal of sedatives

5.10 Intervention Criteria/Decision Matrix (Go/No Go)



5.11 Procedure and Mission Goals/Complexity

As indicated on the decision matrix above, remote sedation of free-swimming, entangled large whales should only be undertaken under very specific circumstances dictated by the whale, entanglement configuration, personnel, equipment, weather and sea conditions. The whale must be an especially challenging disentanglement case either due to entanglement configuration, whale behavior, or both. Well-trained and well-prepared personnel including an experienced whale veterinarian and marksman must be available for the attempt. The necessary equipment must be well-maintained and operational. The entanglement responders and appropriate NOAA MMHSRP staff including the permit holder must be in agreement that remote sedation is indicated in each particular case.

Case selection criteria should be developed ahead of time specific to the species and entanglements in a given response region. On the east coast of the United States, remote sedation case selection criteria include: free-swimming whales, head/mouth entanglements, no trailing gear, and no control line established (S. Sharp, pers. comms.). Additionally, wrapping entanglements, those that cut into soft tissue and/or bone, or those that interfere with feeding have been shown to be serious injuries that are life-threatening (Moore *et al.* 2004, Sharp *et al*. 2019).

Traditional whale disentanglement efforts are incredibly complex in their own regard, and adding highly concentrated sedatives delivered remotely from a secondary vessel only increases the level of complexity for these operations at sea. The goals of remote sedation in this context are to enhance the efficiency and human/animal safety of large whale disentanglement response in selected cases where traditional disentanglement techniques may prove challenging or more dangerous than usual. Pharmacologically, the goal of these remote sedation attempts falls short of true sedation, essentially bringing about behavioral modification to desensitize the animal while preserving its ability to swim, respire and maintain equilibrium. The true desired effects are more properly termed anxiolysis (reduced anxiety) with the added benefit of mild analgesia (pain relief) rather than true sedation.

There are two primary scenarios for deployment of a large whale remote sedation team: 1) an entangled whale is satellite tagged by an entanglement response team and an assessment has already indicated that remote sedation will likely be a desired tool; or 2) a remote sedation team is deployed alongside the entanglement response team to respond to a report of an entangled whale. In either case, consultations with the entanglement response team, appropriate NMFS MMHSRP staff, and the primary permit holder should be initiated as soon as possible to discuss the plan and potential use of remote sedation.

With the understanding that every scenario will likely be slightly different, below is an outline of the large whale remote sedation procedure in brief.

Large Whale Remote Sedation Procedure Overview

- Prior to Deployment (also see: Preparation and Training 5.2)
    - Ensure that all darting equipment is operational, sterilized (as appropriate), and packed in sea-worthy cases.
    - Inventory and pack adequate sedatives and reversal agents for a minimum of two attempts per trip (this also accounts for possible loss of filled darts during attempts). An adequate volume of antibiotic should also be packed. All drugs will be maintained by a licensed veterinarian in a lock box when not in use.
    - Pack all equipment including locked projector case, remote sedation equipment cases, locked drug case, spares case, and any UAS equipment (if desired).

- Consult with the entanglement response team, appropriate NMFS MMHSRP staff, and the primary permit holder as soon as possible to discuss the plan and potential use of remote sedation. If permission is received for a remote sedation attempt (or at least a deployment for further assessment of remote sedation need), proceed with deployment.

- On-scene Assessment
    - Once on scene, evaluate and document the whale (visually and with UAS if approved by local Air Traffic Control [ATC]). Establish behavioral and respiration 'normals' for comparison to post-sedation data.
    - Apply the case selection criteria and Decision Matrix (Go/No-Go paradigm) to determine if sedation is indicated.
    - Estimate weight of the animal using best available data (visually estimated length, or UAS-derived photogrammetry)
        - Mn: Lockyer 1976, Stevick 1999, Trites and Pauly 1997, available stranding data
        - Eg: Miller *et al.* 2012, Fortune *et al.* 2012
    - Calculate the volume of drug necessary to sedate the animal and determine if sufficient drugs are on the vessel.
        - Sedative doses: Butorphanol 0.1 mg/kg and Midazolam 0.1 mg/kg
    - If sedation is indicated, contact the appropriate NMFS MMHSRP staff and primary permit holder (on cell/sat phone) to request permission to sedate, providing the indications for sedation, any situation-specific risks, and the plan.
    - If permission is received, proceed with a sedation plan.
- Sedation
    - Dart preparation
        - Draw up human doses of Naloxone and Flumazenil in separate syringes, clearly label and store in splash box or other readily accessible location. Notify all on-board where the human reversals are located.

- Fill dart(s) with appropriate sedative dose and top off with sterile saline for total dart volume of 57 ml. Straight mg/kg dosing is preferred. Label this dart clearly "SEDATIVE" and sedative name ("MID" or "BUT" or "MID + BUT"). If multiple sedative darts are needed, label them as "SEDATIVE 1/2" and "SEDATIVE 2/2" and so on. If multiple darts are needed, the current recommendation is to dart with the butorphanol dose first and then follow up with midazolam dose, since midazolam uptake is twice as fast (at least in terrestrial spp).

- Fill dart with dose of whale reversals (Naltrexone dose and top off with Flumazenil) for a total volume of 57 ml. Straight mg/kg dosing is preferred. Label this dart clearly "REVERSALS."

- If indicated, fill antibiotic dart with an appropriate dose. Label this dart clearly "ANTIBIOTIC." Metabolic scaling can be used for antibiotics (Gulland *et al.* 2008), but if animal size and drug volume allow, straight weight dosing is preferred.

- Store all loaded (unpressurized) darts in the dart box in sterile draping until deployment.

○ Darting

- Remove projector from locked case and check that the chamber is empty.

- Assemble the projector (without the barrel) and set the control valve to 15

  m. Load the magazine with a .22 blank charge and fire in a safe direction to clean out the chamber. Place the lever in half cock position until ready to fire. Secure the projector and always point it in a safe direction.

- Marksman and spotter ascend to the darting tower or platform with the projector, darts in a dart box and all necessary equipment (charges, pressurizer, etc). Attach safety tethers from personnel to the vessel, as appropriate.

- Communicate with primary disentanglement vessel that darting operations are about to begin and ensure that the plan is still a go.

- Once a darting approach is given the green light, take the first sedative dart out of the dart box, charge with the pressurizer to 130 psi, and check for leaks.

- Check that the projector chamber is empty, attach barrel and load dart ensuring that the tether is properly threaded in the groove and the tether float is affixed to the barrel.

- Load two cartridges in the magazine and insert into the projector. Remain half-cocked with safety engaged until ready to fire. Always point the barrel of the projector in a safe direction.

- Communicate with the entire team that the projector is now loaded and an approach will be attempted.

- Monitor whale behavior to determine when a darting approach is appropriate. Have spotter constantly calling out distance to the whale, sufficiently loud for both the marksman and the vessel operator to hear.

- The desired firing distance from the projector to the whale is 15 m. The target darting location is cranial to dorsal fin (more cranial preferred but sufficiently caudal to the skull), as close to dorsal midline as possible.

- When ready to take a shot, marksman notifies the boat operator and team.

- Once shot is fired, unload the projector, check that the chamber is empty, and store in a secure location.

- Data recorder and photographer document all actions thoroughly including dart impact location, angle of impact, and time of impact.

- If possible, marksman maintains the tether/float (or passes off to another crew member) and counts for a minimum of 5 seconds after the moment of impact prior to initiating traction in the opposite direction (180 degrees to angle of impact) on the tether line to retrieve the dart. If distance is too great between the whale and the vessel, the float is tossed overboard for later retrieval.

- If a second sedative dart is necessary due to the size of the animal, fall back from the whale to charge and load the dart while still maintaining behavioral and respiratory monitoring of the whale. Follow the above procedure until all sedative darts have been fired.

- Post-sedation

- Drop back off the animal to minimize stimulation and allow for the sedatives to take effect, but maintain a visual on the animal and track from a distance to monitor behavior and respiration rate. Data recorder and photographer should be documenting all events thoroughly.
- Monitor animal for 30-60 min to evaluate level of sedation. Sedation may increase for up to an hour and may be sustained for a few hours. If no or minimal sedation is appreciated by 60 minutes after the last sedative dart was fired, consider a second (1/2 dose of sedatives) and discuss with NOAA prior to re-darting.
- Document whale behavior and sedative effects thoroughly.
- Work closely with the disentanglement team to determine when disentanglement approaches can be made and when it is appropriate to retrieve darts.
- Retrieve darts with a boat hook. Ideally the darts are removed early in the process in order to minimize potential soft tissue damage by the dart, being mindful that additional approaches to the animal prior to the onset of sedation may delay sedative effects. Dart retrieval may be done by the entanglement response team or the remote sedation team, as appropriate. Treat any recovered darts as still loaded and pressurized and handle with the utmost caution and proper PPE: waterproof gloves, eye protection, and waterproof clothing.
- Depressurize the darts in a safe location (*i.e.*, splash box) and document the remaining contents to estimate dosage administered.
- Dart with reversals, if indicated (and recover darts).
- Dart with antibiotics, if indicated (and recover darts).
- If available and approved by NMFS MMHSRP and permit PI, attach a temporary, non-invasive tag (satellite transmitter, dtag, etc.) to the whale following sedation and disentanglement to track its longer term behavior and location.
- Continue monitoring whale after darting/disentanglement as long as practical and safe to monitor and record the depth and duration of sedation and recovery periods. Ideally track the whale until it is deemed sufficiently recovered to safely swim off on its own.
- Follow-up with NOAA MMHSRP staff regarding results.

6. Use of UAS

6.1 Overview

The advantages of UASs, for large whale entanglement response are numerous. They are a tool that provides a safe, cost-effective, low impact means to monitor, assess, and document entangled large whales. The deployment of UAS platforms may not only document authorized response activities, but will have bearing on those same activities (*e.g.,* how best to cut a whale free or towards estimating the necessary dosage to sedate an entangled animal [see Section 5]). They represent the perfect tool, if used correctly, for providing critical, time-sensitive, remote risk assessment. Risk assessment is a key component of authorized large whale entanglement response efforts. It helps minimize risks associated with the response and helps garner information on the animal and entanglement to reduce risks associated with the threat. If criteria is met, UAS can be deployed in order to provide information on the entanglement, behavior of the animal, and the animal's condition. However, assessment can be challenging. The close approaches typically needed for assessment can be difficult and in themselves dangerous. Animals may become evasive or aggressive. Large whale entanglement response efforts typically require multiple close approaches, and thus possible interactions, between authorized responders (in the vessel) and the animal. The use of UASs allows for close, detailed assessment without physically approaching the animal, thereby minimizing the number of physical close approaches towards obtaining much-needed assessment. This not only minimizes risk associated with obtaining the assessment by minimizing the interaction, but also minimizes risk associated with disentanglement, as the overall number of interactions with the animal has been reduced. Both significantly increase safety for the responders and the animal.

Disentanglement of humpback whale off Unalaska, Alaska (Dietrich, NOAA MMHSRP, permit # 18786-03)

6.2 Preparation and Training

Pilots flying as part of and under the MMHSRP's large whale entanglement response effort will require their FAA, Part 107 Remote Pilot's license, and be experienced with the approved UAS platform(s) being used in large whale entanglement response efforts and their over-water operation. For flights off NOAA vessels, operated by NOAA personnel or directed by NOAA personnel, an Original Equipment Manufacturer (OEM) training of the specific UAS platform is required in addition to the Part 107 license.

UASs are a tool that, like any tool, require maintenance, continued training, familiarization and evaluation to remain competent and confident in their use. The evaluation of UAS platforms and their use includes: vessel launch and recovery capability; stability allowing hand launch and catch recovery; electronic safety features (loss-of-link procedures, geo-fences, dynamic return-to-home function); quality of high-resolution imagery and video downlink; single pilot operation capability; battery status; functionality of digital and/or optical zoom and performance of the fully gimbaled camera system.

6.3 Authorization and Supervision

The use of UASs as part of large whale entanglement response is authorized under NMFS MMHSRP permit 18786 that allows animals to be taken through close approaches by UAS's for observations, assessments, monitoring, photo-identification, documentation, photogrammetry, behavioral observation and unintentional harassment. The NMFS' MMHSRP enhancement and research permit provides, to the maximum extent practicable, UAS altitude adjustment and horizontal movements should be made away from the animals or conducted slowly when above the animals to minimize disturbance. It also prescribes that the UAS should minimize the time it hovers over an individual to just that time required to obtain the necessary data or samples to achieve the permitted activities and objectives. UAS flights themselves fall under the jurisdiction of the FAA. All pilots need to have their FAA, Part 107 Remote Pilot's licenses, and adhere to FAA regulations on the operations of UAS platforms. For NOAA staff, all UAS operations will be conducted pursuant to NOAA Aircraft Operations Center (NOAA AOC). All missions will be flown under the NOAA/FAA MOA or Part 107 in Class G airspace under Part 107 VFR weather conditions, utilizing aircraft that have received NOAA certification of their airworthiness, and using pilots and crew members that have been qualified under NOAA Aircraft Operations Manual, UAS Policy 220-1-5.

For non-NOAA staff, all UAS operations will be conducted pursuant to FAA Part 107 regulations. All missions will be flown in Class G airspace under Part 107 VFR weather conditions, unless otherwise authorized through an FAA authorization or waiver. The number of flights flown per day would be restricted to daylight hours, environmental conditions, number of charged batteries available, and flight team fatigue. Additionally, permits and authorization may be needed for flights anticipated in restricted airspace, such as military areas, NOAA National Marine Sanctuaries, and National Parks.

6.4 Team Member Roles

The number of responders needed for UAS operations will depend on whether part of a first response effort or a dedicated platform during disentanglement operations. A dedicated operation, including UAS operations, will need to have adequate personnel to safely and effectively conduct the mission without having personnel fulfill numerous critical roles (*i.e.*, vessel captain and UAS pilot). There should be adequate personnel to fill each needed role.

Table 10. Suggested number of personnel required for a typical large whale entanglement first response effort.

Team member role	Number of personnel required
Incident Commander	1 (may be on another vessel)
Vessel captain	1 (may also represent Safety Officer)
Crew (vessel dependent)	1 - 2 (roles can be shared with other roles)
Mission Commander	1 (may be offsite)
Safety Officer	1 (dedicated role)
Data collector	1 (role can be shared with other roles)
Pilot in Command	1 (dedicated role)
Pilot	1 (additional pilot as backup/fatigue)
Visual Observer	1 (role can be shared with other roles)
Communications person	1 (role can be shared with other roles)

Clear roles and responsibilities need to be maintained during UAS operations to ensure safe and effective operations - whether as part of a supporting organization/ party, or as a NOAA UAS operations (*e.g.*, aboard NOAA vessels and/or using NOAA UAS pilots) Roles associated with UAS operations listed below are established for NOAA UAS operations.

- **Incident Commander (IC)** - The IC, working closely with shoreside (or otherwise remote) authorizing parties (*e.g.*, NMFS RSC/LWERCs, National LWERC), is responsible for the on-scene oversight and supervision of the first response operation. The IC may participate directly in the operation depending on circumstances, but typically does not directly participate (*i.e.*, hands-on) in the operation. This enables the IC to remain focused on the larger picture of the response and objectively ensure that safety is maintained for responders, the public, and animals.

    - **Qualifications** – The IC needs to be at least a level 3 or higher for any close-approach assessment or tagging operations, a level 4 for overseeing the disentanglement of all large whales except right whales, and a level 5 for right whales (unless otherwise authorized). Under the Heightened Consultation protocol, tagging requires a level 4 designation, and for the disentanglement of other species aside from right whales, a level 5 designation. If unable to consult LWERCs or experts, right whale disentanglement efforts must be aborted. The IC must be trained and/or experienced in protocols, procedures, risks, and risk mitigation in all aspects of the first responder mission being carried out.

- **The Mission Commander (MC)** – The MC is tasked with the overall responsibility for the safe execution of NOAA UAS missions. The Mission Commander will ensure that all flights have authorizations and permits, including Notice of Intent to Fly (NTIF)[if required], response permits, and airspace clearances, as required and as they pertain to UAS flights. This includes compliance with FAA regulations, NOAA AOC 220-1-5 policy (if applicable as a NOAA employee or operating from a NOAA vessel), and flight reporting requirements (SITREPS, NOTAMS, Incident/Accident reporting as required). The MC works in conjunction with the AOC UAS office, when the UAS operations are conducted by NOAA employees or operating from NOAA vessels, to ensure all crew members are properly trained and current, and has final oversight authority on the go/no-go decision.

    - **Qualifications** – While the MC does not have to be physically on-site of flight operations, he or she does need to be a federal government employee of NOAA or a partner agency. He or she must be familiar with the overall mission operating procedures and objectives. The MC will work closely with the PIC and IC that are on-site. For more details on MC qualifications and requirements, see NOAA UAS handbook and NOAA AOC 220-1-5 policy (FAA, 2016; NOAA 2017).

- **Pilot in Command (PIC)** – The PIC is in command of the UAS operation; they operate/pilot the aircraft, maintain visual contact with the aircraft, monitor the video feed and aircraft systems data (altitude, ground speed, heading, position, orientation relative to the pilot, and battery status) and make certain that non-flight operations personnel stay well clear of the launch and landing areas. The PIC is directly responsible for the operation of the UAS regardless of who is piloting the platform.

  - **Qualifications** – For operations in FAA National Airspace, at a minimum the PIC is required to have an FAA, Part 107 Remote Pilot's license for operating UAS, and be familiar with overall mission procedures, goals and parameters (*i.e.*, trained or have experience in LWER). For additional qualifications and requirements, see FAA regulations, NOAA UAS Handbook and NOAA AOC 220-1-5 policy. (FAA, 2016; NOAA 2017).

- **Visual Observer (VO)** – The VO is tasked with observing the aircraft and surrounding airspace throughout each flight and providing the PIC information on the aircraft's flight path and proximity to all aviation hazards necessary to prevent collision.

  - **Qualifications** – The VO must be familiar with the overall mission procedures and objectives (*i.e.*, trained or have experience in LWER). They must work closely with PIC/ pilot, and have excellent visual acuity.

- **Safety Officer (SO)** – The SO is responsible for continually watching over all personnel involved in a response and has the ability to communicate with the team and adjust the strategy of the response as needed. The SO works very closely with the IC. Under certain circumstances and depending on experience, the role of the SO can overlap with that of the helmspersons of the support or approach vessels, and if necessary and otherwise appropriate, the role of IC and SO can be performed by one person.

  - **Qualifications** – Experience in previous large whale entanglement response efforts, ability to continually watch over all personnel involved, communicate to the team to adjust strategy or call off the effort as necessary, and watch for hazards (*i.e.*, not adhering to protocols, presence of other animals, incoming environmental or weather changes, and time of day considerations). Willingness and ability to stop operations if there is a safety concern, despite momentum (or pressure) to move forward.

- **Helmsperson(s)** – This person(s) is/are responsible for the safe transit and operations of the vessel(s), including the safe maneuvering around and approach to entangled whales and the trailing gear that might exist. Helmspersons should have experience operating the vessel around the animal and all aspects of the response operation. They typically take on the key role of operational safety and may take on the role of SO. As such, the helmsperson role, whether on the transit, support, or approach vessels, is one of the most important roles beyond that of the IC.

- **Qualifications** – Experience, training, and in some cases certifications (USCG license, NOAA certified components course) in order to “captain” a vessel. Helmspersons should have experience operating the vessel around large whales and all aspects of the response operation.

6.5 Communications

As in any operation, UAS operations require communications prior to and during the operation. Prior to any NOAA UAS operation, the UAS team must have an approved NIF, check airspace requirements and obtain any FAA clearances/approvals needed, and notify any Airspace Managers as required. During operations, close communications need to be established between response vessels, as once the response has progressed beyond the focus of assessment, a dedicated vessel to UAS operations will be needed. Communications onboard the UAS platform will include notice of launches and recoveries, as well as, status updates on the UAS. In many cases, UAS operations will involve communications from the approach and support vessels to align the operations (*e.g.*, having the UAS document an approach to cut the animal free).

6.6 Data Collection

The primary goal of UAS use is assessment and documentation. The information gained has benefits towards evaluating the threat (the animal risk assessment) and the operational risk assessment (assessment of the risks and impacts posed by the response to humans and animals). In addition, its very use may reduce risk as it allows for risk assessment without physically approaching the animal (*i.e.*, avoiding the danger zone).

The flight crew will track flight information required by NOAA and FAA, and report to a designated contact at NOAA AOC as required. Numbers of animals taken will be tracked and submitted to the NOAA permits office in the annual MMHSRP permit report. All accidents will be reported to a designated contact at NOAA AOC, NMFS and FAA.

Some examples of data collected are:

- Information on the entanglement (*e.g.*, how entangled, gear description and markings)
- Information on the animal (*e.g.*, condition, sex, age class, impacts, fluke ID, photogrammetric assessment images)
- Animal behavior, including any observed response to procedures or UAS approaches
- Risks posed to responders (in the case of injury or worse, incident reports will need to be completed)
- Flight data (*e.g.*, number of flights, operational time of flights, pilot duty time)

- Animal approaches (*e.g.*, number of animals taken, overflight time, minimum altitude)
- Flight risk factors (*e.g.*, equipment malfunctions, the number and duration of lost link events)

6.7 Resources

The primary resources for UAS operations supporting large whale entanglement response, beyond the team itself, are the vessel for on-site operations, UAS platforms, controllers, goggles and heads-up displays, helmets, eye and face protection, gloves for safely handling the UAS and any threatening battery, and battery fire bags in the event of a LiPo battery fire threat. A separate support vessel is required once the mission diverges (*e.g*., approach vessel has been launched) to allow the primary response vessel to work unimpeded from UAS operations. A breakdown of the primary resources is provided below:

- Dedicated UAS platform (once primary response vessel role is support towards an approach team)
- Approved, airworthy UAS platforms
- Tablet or phone displays, heads-up glasses, and goggles showing Flight Control Software
- Radio remote controller (some UAS have the ability to use a second controller for camera control)
- Safety helmets or hard hats
- Gloves (Kevlar lined)
- Safety glasses or face visors
- Batteries and appropriate chargers
- Battery fire bags
- Memory cards

6.8 Environment and Weather

UAS operations require conditions (*i.e.*, environment and weather) conducive to safe operations and meeting mission goals. In the event that weather conditions are not suitable for UAS operations, as determined by the Mission Commander (MC), the Pilot in Command (PIC), and the IC, operations will be terminated. Flights shall be conducted under the following conditions:

- All flights will be conducted during daylight
- Under VFR conditions. Visibility 3 statute miles or greater
- Ceiling 300 m (1000 ft.) or greater
- Altitude limited to 120 meters (400 ft.) AGL
- Wind 20 knots or less

- No rain or visible moisture
- Over water and away from populated areas
- Away from non-participating vessels (150 meters or ~ 450 feet from the launch/recovery vessel)
- When operating within 5 nm from civil airports, monitor for any conflicting traffic and establish prior communication/approvals
- When operating in any other no-fly zones (*e.g.*, National Parks, Military areas, MPAs) either avoid or obtain prior approvals

6.9 Procedure and Mission Goals/Complexity


UAS-obtained image of an authorized disentanglement (L. James/ NOAA MMHSRP, permit # 18786-02)

One of the initial steps of large whale entanglement response is assessment and documentation. At this early stage, assessment is emphasized and prioritized, and as such the use of UAS is very much aligned. A vessel acting as the flight deck and the crew upon it (*e.g.*, helmsperson, PIC, VO, SO) can maintain their focus on their particular roles associated with the safe launch, photo-documentation of the animal and entanglement, and recovery. The use of UASs for risk assessment can reduce risk, but only if they are used correctly and do not incur additional risk. Thus, once or if the vessel takes on another role, such as acting as a support vessel for a team in an approach vessel, then UAS operations, if still occurring, should shift to an alternative, dedicated platform. This platform should also stand off the animal and the approach vessel by at least 150 meters to not stress the animal or inadvertently become involved (*e.g.*, get caught in trailing gear behind the animal). Risk assessment is ongoing, so there is value in UAS operations continuing as the response transitions from assessment to possible disentanglement. At later stages, when the animal has been cut free or the disentanglement effort otherwise terminated, UAS operations should once again carry out from the primary response vessel.

All missions will be flown under FAA Part 107 regulations, airspace and weather requirements. If operation in other airspace is required, the relevant controlling agency will be notified and, if required, any necessary permission obtained. For instance, acquiring any necessary authorizations within the boundaries of a NOAA National Marine Sanctuary (*e.g.*, Channel Islands National Marine Sanctuary) or National Parks (*e.g.*, Glacier Bay National Park and Preserve).

On site UAS response:

At this point, all permit, NIF, and airspace clearances (*e.g.*, FAA approved airspace or other restrictions) should be addressed. Pilots will have their FAA, Part 107 Remote Pilot licenses and required trainings, UAS platforms will have been approved and all equipment checked for readiness.

Pre-flight(s):

Flight goals and mission parameters will be reviewed with MC, PIC and IC/CI. Communications and updates will be maintained with shoreside contacts, including national/regional NMFS LWERCs.

Prior to the first flight of the day, a briefing will be held with all appropriate personnel (*e.g.*, helmsperson, PIC, VO, SO, IC) to discuss procedures and perform GAR risk assessment. If there are any objections by any member of the team, the mission will be postponed until deemed safe by all members or cancelled due to unfavorable conditions (*i.e.*, inclement weather such as high seas or winds).

Prior to any UAS flight, UAS operations will be briefed and objectives discussed with a minimum of the flight crew. Just as the use of UAS can provide additional and continuous assessment throughout the response process (*i.e.*, first response assessment, disentanglement, and post effort assessment), it also dictates continuous risk assessment on its use. Briefing topics include:

- Mission objectives
- Weather conditions and forecast
- Identification of roles
- Safety concerns and GAR
- UAS status
- Scheduled launch time
- Launch procedures
- Recovery procedures
- Limiting airspace factors

- Emergency procedures

All non-essential personnel will be kept at a safe distance from the flight crew and UAS operations as possible. Under circumstances in which the flight vessel is small enough such that crew/personnel not associated with flight operation cannot be kept at a safe distance, all personnel should wear protective headwear (*e.g.*, helmets) and eyewear. Everyone on the flight vessel should maintain vigilance. Just prior to launching, all systems will be reviewed for readiness.

Launching UAS (non-NOAA op) to assess an entangled large whale (HIHWNMS/ NOAA MMHSRP permit # 18786-03)

Launching:

The UAS flight vessel will be held stationary or head into the wind. The flight team will be in close proximity to each other with open and clear views of the horizon with no obstructions to interfere with safe operation of the UAS (*i.e.*, vessel VHF antenna). The PIC will coordinate with the helmsperson and VO and when ready to launch the UAS by hand by the VO or off the deck as appropriate. During these operations the VO will wear protective Kevlar gloves, a helmet, long sleeve protective clothing, and eye wear.

Flights:

One individual will act as Pilot in Command (PIC) of the aircraft. While not required under FAA Part

107 regulations, it is valuable to have a second individual acting as a Visual Observer (VO) to observe the aircraft and surrounding airspace throughout each flight. The VO provides the PIC information on the aircraft's flight path and proximity to all aviation hazards necessary to prevent collision. All flights will be conducted in the National Airspace (NAS) in accordance with FAA Part 107 and will be coordinated by contract and partner personnel. All flights will be conducted during daylight and under VFR conditions. All surveys will be flown in manual control with contingency plans in place in the event of loss of radio contact. Flights will be aborted and the UAS retrieved if there is any deficiency in the telemetry link, or evidence of worsening wind or sea state. The UAS will hover over an individual only long enough to obtain a photograph or video sequence. The majority of the flights will typically be of about 12-14 minutes duration and the aircraft will return to the launch site with at least 20% of battery capacity remaining.

Recovery:

At the terminus of the flight the PIC will manually pilot the UAS back to the flight vessel, or may initiate the 'automatic return home' procedure. The PIC needs to be aware that unless changed in the flight control software parameters, the home point is automatically recorded as the initial take off location, when operating from a vessel this location may be different due to movement of the vessel. To prevent an automatic landing of a UAS in the ocean at the initial takeoff location, the option to dynamically return to the controller should be selected in the flight control software. The PIC or the VO will alert the rest of the crew on the return of the UAS, and position themselves for hand or deck recovery. Proper Personal Protective Equipment (PPE) will be worn. Once safely recovered, the PIC will immediately power down the UAS. The PIC will initiate a post flight checklist and prepare for any subsequent flights.

All protocols will be adhered to as outlined in NMFS MMHSRP permit, by the FAA, and NOAA Unmanned Aircraft Systems Operations (Policy 220-1-5 as required by NOAA staff pilots or when operating from NOAA vessels).

6.10 Risk and Mitigation

The use of UAS allows for close, detailed assessment without a human physically approaching the animal, thereby obtaining much-needed information, while minimizing operational risk associated with obtaining that information. However, the UAS represents a tool, and as such, it must be maintained and used properly, or additional risk will be incurred. This is especially the case for large whale disentanglement, in which risk levels are already elevated.

All criteria regarding UAS platforms, procedures, and authorization need to be met. Operational risk management assessments will be conducted prior to each deployment and risk mitigation measures will be documented. Communications will be maintained between the flight team, and support and approach teams. Prior to flights, pre-mission briefs will be conducted by MC or PIC that include:

- Weather
- Safety
- Status of equipment and personnel
- Communications plan
- Objectives
- Other relevant information as necessary

Risk: Injuries caused by propellers - lacerations:

Risk assessment prior to mitigation: III/C Moderate Risk

***Mitigation*:**

- All personnel in the vicinity of launch and recovery operations (*e.g.*, foredeck or on a smaller vessel, the entire vessel) wear safety glasses or facial shields, and helmet or hard-hat during launch and recovery phases.

- Only allow the flight team within vicinity of the aircraft during operations.

- Operations vessel (*i.e.*, the launch and recovery platform) maintains only one mission (*e.g.*, support vessel that is lending support to an approach team cannot be a platform for UAS operations). Once disentanglement operations underway, a dedicated platform/vessel is required for UAS operations.

- Only allow VO to hand launch and hand recover aircraft.

- The VO or UAS handler will wear full PPE, including long sleeves, safety gloves, safety glasses or facial shields, and helmet or hard-hat during launch and recovery phases.

- VTOL is typically equipped with plastic propellers, but certain UAS models have carbon fiber propellers and extra caution needs to be shown with these UAS..

- Only experienced, FAA certified Part 107 Remote Pilots familiar with over-water flights and the overall large whale entanglement response mission.

- Use approved, air-worthy UAS platforms.

- Use smaller UAS platforms.

- Use less expensive UAS platforms that are otherwise appropriate (*i.e.*, less hesitation on safely ditching UAS platform).

  Risk Assessment following mitigation: II/B Low Risk

Risk: Impact injuries from UAS with personnel (*e.g.*, mis-recovery, loss of control): Risk assessment prior to mitigation: III/D High Risk

***Mitigation*:**

  - All personnel in the vicinity of launch and recovery operations (*e.g.*, foredeck or on a smaller vessel, the entire vessel) wear safety glasses or facial shields, and helmet or hard-hat during launch and recovery phases.

  - Only allow the flight team within vicinity of the aircraft during operations.

  - Operations vessel (*i.e.*, the launch and recovery platform) maintains only one mission (*e.g.*, support vessel that is lending support to an approach team cannot be a platform for UAS operations). Once disentanglement operations underway, a dedicated platform/vessel is required for UAS operations.

  - Only allow VO to hand launch and hand recover aircraft.

  - The VO or UAS handler will wear full PPE, including long sleeves, safety gloves, safety glasses or facial shields, and helmet or hard-hat during launch and recovery phases.

  - Alert all personnel in vicinity of UAS operations prior to commencing and immediately following each flight.

- PIC and VO will ensure that the UAS stays well clear of all personnel (VO: except during launch and recovery) and under no circumstances directly overfly personnel.

- If documenting the disentanglement effort of the approach team, UAS does not directly overfly personnel. UAS should be at least 5 meters (15 feet) horizontal distance and 10 meters vertical distance (30 feet) from the team at all times.

- Ensure there is a means to notify personnel if necessary to prevent potential injury following UAS malfunction.

- Brief personnel on potential hazards and the need for situational awareness during UAS operations.

- Only experienced, FAA certified Part 107 Remote Pilots familiar with over-water flights and the overall large whale entanglement response mission, pilot UAS platforms.

- Use approved, air-worthy UAS platforms.

- Use smaller UAS platforms.

- Use less expensive UAS platforms that are otherwise appropriate (*i.e.*, less hesitation on safely ditching UAS platform).

Risk Assessment following mitigation: II/C Low Risk

Risk: Impact injuries from UAS with whale (*e.g.*, mis-recovery, loss of control): Risk assessment prior to mitigation: II./ B Low Risk

***Mitigation*:**

- Operations vessel (*i.e.*, the launch and recovery platform) maintains only one mission (*e.g.*, support vessel that is lending support to an approach team cannot be a platform for UAS operations). Once disentanglement operations underway, a dedicated platform/vessel is required for UAS operations allowing the flight team to maintain focus.

- UAS should be at least 10 meters (30 feet) from the whale at all times.

- Only experienced, FAA certified Part 107 Remote Pilots familiar with over-water flights and the overall large whale entanglement response mission, pilot UAS platforms.
- Use approved, air-worthy UAS platforms.
- Use smaller UAS platforms.
- Use less expensive UAS platforms that are otherwise appropriate (*i.e.*, less hesitation on safely ditching UAS platform).

Risk Assessment following mitigation: II/A Minimal Risk

Risk: Impact with other vessels and other manmade structures:

Risk assessment prior to mitigation: III./ C Moderate Risk

Mitigation**:**

- UAS Operations will only occur over water, away from populated areas, never directly overflying non-participating personnel and vessels.
- PIC will suspend flight operations if a non-participating vessel approaches within a CPA (closest point of approach) of 150 meters (~ 450 feet) of the launch/recovery vessel.
- Alert all parties (support teams) involved with the mission and any non-participating parties that might approach UAS operations. If necessary, a perimeter can be established and enforced by USCG, OLE, and/or other enforcement agencies.
- Only experienced, FAA certified Part 107 Remote Pilots familiar with over-water flights and the overall large whale entanglement response mission, pilot UAS platforms.
- Use approved, air-worthy UAS platforms.
- Use smaller UAS platforms.
- Use less expensive UAS platforms that are otherwise appropriate (*i.e.*, less hesitation on safely ditching UAS platform).

- Have backup UAS platforms.

  Risk Assessment following mitigation: II/B Low Risk

Risk: Impact with aerial objects (*e.g.*, other UAS platforms and/or aircraft):

Risk assessment prior to mitigation: III./ C Moderate Risk

***Mitigation*:**

- VTOL flights will not exceed 400’ AGL and line of site from the flight crew.
- The VO will maintain a constant lookout for aircraft in the airspace surrounding the VTOL operations and notify the PIC of any aircraft in the vicinity.
- If an aircraft appears in the operation area the PIC will descend and automatically return the VTOL to home and land.
- When operating within 5 nm from civil airports, flight crew will have a dedicated aviation band radio tuned to local CTAF, monitoring for any conflicting traffic and establish prior communication/approvals as detailed in Ops Plan.
- Only experienced, FAA certified pilots familiar with over-water flights and the overall large whale entanglement response mission, pilot UAS platforms.
- Use approved, air-worthy UAS platforms.
- Use smaller UAS platforms.
- Use less expensive UAS platforms that are otherwise appropriate (*i.e*., less hesitation on safely ditching UAS platform).
- Have backup UAS platforms.

  Risk Assessment following mitigation: II/A Minimal Risk

Risk: Loss of control of UAS platform - fly-away:

Risk assessment prior to mitigation: III./ C Moderate Risk

Mitigation**:**

- ○ If the VTOL experiences "Lost Link" for more than 30 seconds, the UAS is programmed to return to the most recently updated home waypoint using GPS and altimeter.
- ○ If UAS begins to perform abnormally and becomes unresponsive to commands due to motor loss, motor failure, or prop damage the PIC will safely ditch the UAS in the water.
- ○ Frequently update home point and geo-fencing.
- ○ Only experienced, FAA certified Part 107 Remote Pilots familiar with over-water flights and the overall large whale entanglement response mission, pilot UAS platforms.
- ○ Use approved, air-worthy UAS platforms.
- ○ Use smaller UAS platforms.
- ○ Use less expensive UAS platforms that are otherwise appropriate (*i.e.*, less hesitation on safely ditching UAS platform).
- ○ Have backup UAS platforms.

Risk Assessment following mitigation: II/B Low Risk

Risk: Loss of propulsion of UAS platform:

Risk assessment prior to mitigation: III./ C Moderate Risk

Mitigation**:**

- Use only fully charged batteries when initiating a flight.
- Condition batteries and test prior to launch.
- Monitor the battery status throughout the flight.

- UAS Pilot will return to the launch platform with at least 20% battery capacity.

- Properly dispose of any batteries that show swelling.

  Risk Assessment following mitigation: II/B Low Risk

Risk: Loss of UAS platform - inadvertent or directed ditching:

Risk assessment prior to mitigation: III./ B Low Risk

***Mitigation*:**

- Personnel shall not enter the water (*i.e.*, take no additional risks) to recover the UAS.
- Use of less expensive platforms.
- Have backup UAS platforms to complete the mission as appropriate.
- Only experienced, FAA certified Part 107 Remote Pilots familiar with over-water flights and the overall large whale entanglement response mission, pilot UAS platforms.
- Use approved, air-worthy UAS platforms.
- Use smaller UAS platforms.

  Risk Assessment following mitigation: II/A Minimal Risk

Risk: Battery fires:

Risk assessment prior to mitigation: III./ C Moderate Risk

***Mitigation*:**

- VTOL operators will be familiar with batteries' condition and follow the manufacturer's recommendations.

- All personnel associated with UAS operations will be aware of response protocol should there be a battery fire.
- Only carry batteries needed for mission.
- Use only appropriate charging systems with monitoring safeguards.
- Have readily available fire suppression bags for LiPo batteries. LiPo fire can be suppressed and contained with water.
- Personnel shall be kept well clear of any smoke or fumes from the fire.
- Any battery that shows signs of damage or "puffiness" will be fully discharged in salt water and then disposed of.
- When not in use, batteries will be contained and charged in fire-resistant LiPo bags, and stored in a hard-sided container.
- Ensure Class D (or ABC Co2 or dry chemical) fire extinguishers are onboard the vessel and ready for use.

Risk Assessment following mitigation: II/B Low Risk

6.11 Intervention Criteria/Decision Matrix (Go/No Go)

Table 11. UAS Flight Risk Assessment Coding under Five Steps of Assessment

Step 1. Identify Risk Factors			Step 2. Assess Hazards (who/ what?)	Step 3. Evaluate Risk and Mitigate		Step 4. Record and Implement	Step 5. Monitor and Review
Response Categories	Hazards/ Risks	Causes	Initial RAC	Develop Controls	Residual RAC	How to Implement	How to Monitor

Flight phase, Launch and Recovery phase	Injury caused by propellers/ lacerations	Mishandling and impact from VTOL	III/C = Moderate Risk	Only allow flight team in vicinity of launch/recovery. PPE including safety gloves, glasses, and helmet	II/B = Low Risk	Make sure safety procedures implemented and complete	PIC and IC will ensure compliance
Flight phase, Launch and Recovery phase	Impact injuries from UAS with personnel	Loss of propulsion, improper control inputs	III/ D = High Risk	Alert personnel in vicinity of launch/recovery ops.	II/ C = Low Risk	Ensure that only essential crew will be present at launch or landing location.	PIC and IC will ensure compliance
During flight	Impact injuries from UAS with whale	Loss of propulsion, improper control inputs	III/ B = Low Risk	UAS should be at least 10 meters (30 feet) from the whale at all times.	II/ A = Minim al Risk	Only experienced, FAA certified pilots used	PIC and IC will ensure compliance
During flight	Impact with other vessels and other manmade structures	Loss of situational awareness of surroundings	III/C = Moderate Risk	Lookout maintained for vehicles. Terminate flight if vehicle CPA < 200 m.	II/B = Low Risk	VO will alert PIC if surface vessels are near.	PIC and IC will ensure compliance .
During flight	Impact with aerial objects	VO not alert/ multi-tasking.	III/C = Moderate Risk	Vigilant watch will be maintained, ops will not exceed 400 feet. If non-participating aircraft detected, flight ops will be terminated.	II/ A = Minim al Risk	VO will alert PIC if aircraft are near. PIC will maintain good comms with EO.	PIC and IC will ensure compliance .
During flight	Loss of control of UAS platform	PIC lacks experience, airworthiness compromised	III/C = Moderate Risk	VTOL programmed to return home after loss of link. After abnormal operations detected, PIC will initiate "come home" command.	II/ B = Low Risk	VO will alert PIC to any abnormal operations. Operations conducted in remote area.	PIC and IC will ensure compliance

During flight	Loss of propulsion of UAS platform	Battery voltage not monitored. Poor battery health.	III/C = Moderate Risk	PIC maintains proper battery health and continuously monitors batteries.	II/ B = Low Risk	PIC returns UAS to vessel at prescribed time; observes battery status.	PIC and IC will ensure compliance
During flight	Loss of UAS platform - inadvertent or directed ditching	Loss of control, power.	III/B = Low Risk	No personnel will enter water.	II/ A = Minim al Risk	Acceptable because of low costs.	PIC and IC will ensure compliance
Flight phase, Launch and Recovery phase, other phases	Battery fires	Poor battery health or condition. Improper storage.	III/C = Moderate Risk	Water and Dry Chem extinguisher available. Manufacturer's recommendation s will be followed	II/B = Low Risk	PIC will ensure proper extinguishers Safety Guidelines available in User Manual	PIC and IC will ensure compliance

Hazard Severity:

Category A – Negligible: The hazard presents little to no threat to personnel, animal, equipment, vessels, and environment (*e.g.*, minor sunburn, minor chafe/rope burn; additional chafe wounds to animal).

Category B – Minor: The hazard may cause minor injury/impact to personnel and animal, minor damage to equipment and/or vessels that is easily repaired, minor impact to environment (*e.g.*, superficial cut, twisted ankle, snapped utility blade; superficial wounds to animal due to kegging).

Category C – Moderate: The hazard may cause moderate injury to personnel and animal, moderate damage to equipment and vessels, and moderate impact to environment (*e.g.*, deeper cut, but no threat to function of body, loss of gear that can be replaced with minimal cost and effort; deeper dermal laceration wounds due to kegging).

Category D – Major: The hazard may cause major injuries to personnel and animal, loss of expensive equipment and/or major damage to vessel, and/or major impact to environment (*e.g.*, deep cut or impact to head requiring professional medical attention, loss of equipment compromising safety/mission, high cost and effort of replacement, impact to animal possibly life-threatening).

Category E – Catastrophic: The hazard poses a life-threatening threat to personnel and animal, loss or complete destruction of equipment and/or vessels, impact to environment is extreme (*e.g.*, loss of life – personnel and/or animal, another animal struck and killed enroute to respond, vessel stove in and sunk, major oil slick).

Likelihood:

Category I. – Very unlikely: Not likely to occur at all or very unlikely over broad expanse of time.

Category II. – Unlikely: Not likely to occur over a broad expanse of time.

Category III. – Possible: Might occur in time over duration of response lifespan (time person active in response, lifespan of equipment).

Category IV. – Likely: Expected to occur several times to personnel, animal or equipment over the response lifespan (*i.e.*, duration of multiple efforts).

Category V. – Very likely: High probability of occurring frequently or within a short period of time.

Table 12. Large Whale Entanglement Response Risk Matrix

Severity →

Likelihood ↑	A Negligible	B Minor	C Moderate	D Major	E Catastrophic
V. Very likely	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
IV. Likely	Minimal Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
III. Possible	Minimal Risk	Low Risk	Moderate Risk	High Risk	High Risk
II. Unlikely	Minimal Risk	Low Risk	Low Risk	Moderate Risk	High Risk
I. Very unlikely	Minimal Risk	Minimal Risk	Low Risk	Moderate Risk	Moderate Risk

7. After-Action Mitigation

Again, the primary goal of large whale entanglement response is gaining information towards reducing the overall threat of large whale entanglements - be it to the animal, the industries whose gear may be involved, the public that may try and free a whale, and the responders that are authorized to do so. As such and in many ways, this is the most important section. However, the data collected covers a broad range of topics and thus only some examples are provided here.

First, there is information collected towards reducing operational risk. These are typically represented by information in debrief, permit, and any incident reports. A **debrief or after-action report** is a thorough accounting of the response considering the review and assessment of procedures, personnel and their roles, equipment, the whale and conditions. It is a structured process that also evaluates the pre-mission risk assessments and outcomes of decision matrices, as well as, the success and failures of the mission. The information contained in debrief reports (or meetings/calls) provides for an assessment of performance that can further mitigate risks in the future. An example of a debrief report is provided in Appendix W. Debriefings (*e.g.*, reports or calls) typically include the following elements:

- Active participation of all involved
- A focus on lessons learned,
- A thorough review of events

- Recommendation and directives on remedying deficiencies, addressing needs, and making improvements (*e.g.*, additional training, a new piece of equipment)

An **incident report** is a tool that documents any event that may have caused injuries or otherwise harm to responders and/or the animals, or damage or loss of equipment, vessels, or other resources. An incident report can be used in the assessment and investigation of a response effort. It includes the perceived causal factors and corrective measures to reduce the risk factors under similar efforts in the future. Incident reports are required of fisherman in order to record any unintentional takes, and under the permit for response efforts. Under the MMHSRP permit, incident reports must be submitted within two weeks of a serious injury and mortality event or in case of exceeding authorized takes. Incident reports must contain a complete description of the incident and identification of steps that will be taken to mitigate that risk factor(s) or resolve exceeding take limits in the future.

Permit reports are required annually and cover everything from the number of animals taken under the response, other impacts to animals (*e.g.*, reactions to procedures), any follow-up monitoring, information on any incidents that occurred, and any additional or improved mitigation measures. In many ways, the permit report is both a debrief and incident report representing all permitted response efforts undertaken for the period and under NMFS MMHSRP permit.

Risk assessment workshops and meetings are another example of disseminating and evaluating the information gained towards reducing operational risk associated with authorized large whale entanglement response efforts. In 2018, NMFS OPR hosted a meeting of the Regional Network Coordinators and higher-level (*i.e.*, designated) responders under the MMHSRP Large Whale Entanglement Response Network. The focus of the two-day meeting was to assess past response efforts for risk factors, to review efforts in which there were injuries (albeit minor) or in which serious injury or mortalities could have occurred. Through these assessments and evaluations, risk factors were discussed that should be incorporated in future risk assessment and operational decision matrices to further reduce overall risk associated with large whale entanglement response efforts. Some of the common risk factors identified from the meeting were:

- Pressure (*e.g.*, presence of media, perception on need to save the animal)
- Fatigue (*i.e.*, physical and mental)
- Experience and training (i.e., lack of trained and experienced personnel was identified as a significant risk factor)
- Equipment (*e.g.*, having appropriate and functioning tools and safety gear)
- Animal behavior (*e.g.*, animals exhibiting sudden and unexpected changes in behavior)

Similar meetings have incorporated safety and risk reductions into their agendas. A workshop of the Global Whale Entanglement Response Network (GWERN) hosted by the IWC immediately after the

NMFS Risk Assessment meeting, reviewed other close-calls and accidents from other countries, new tools and procedures, and any implications towards large whale entanglement response risk reduction.

On July 10, 2017, a trained and experienced large whale entanglement responder was killed during disentanglement operations on a North Atlantic right whale in the Gulf of St. Lawrence, Canada. As a result, all large whale entanglement response activities conducted in the United States under the MMHSRP's permit were temporarily suspended while NMFS, coordinating with Canadian officials, convened a thorough review of the incident. As a result, NMFS drafted recommendations for a phased re-initiation of large whale entanglement response operations, and highlighted the following procedural and safety considerations:

- Emphasizing the case-by-case differences of large whale entanglement response
- The different risk levels of various tools (*e.g.*, fixed knife vs flying knife)
- The avoidance of the "Danger zone" (*i.e.*, proximity to the whale, particularly near flukes)
- The emphasis of qualifications for the helm position as far as experience and training in entanglement situations
- Standing down at any point in the operation is a viable option

Second, there is the continued garnering of information on entanglement rates, their impacts on the animals, the gear types and parts of gear involved, the spatial and temporal parameters of the entanglement, and the socio-economic impacts, such as loss of fishing gear and regulations that might impact fisheries (*i.e.*, answer the questions of who, where, when, why and how?). The data will help inform managers, scientists and conservationists of the level of and effects of entanglement on large whales, and provide monitoring on the effectiveness of any mitigation measures.

This dataset is an important part of and aligns with NMFS' National Bycatch Reduction Strategy objectives of:

- **Monitor and estimate** the rates of bycatch and bycatch mortality in fisheries to understand the level of impact and the nature of the interaction.

- **Conduct research** to improve our bycatch estimates, understand the impacts of bycatch on species and community dynamics, and develop solutions to reduce bycatch and bycatch mortality.

- **Conserve and manage** fisheries and protected species by implementing measures to reduce bycatch and its adverse impacts.

- **Enforce** fishery management measures, including those aimed at reducing bycatch and bycatch mortality, to ensure compliance with applicable laws.

- **Communicate** to develop a common understanding of bycatch, to share information on our efforts to address bycatch, and to identify areas where we can improve.

  * From NMFS National Bycatch Reduction Strategy Objectives: https://www.fisheries.noaa.gov/international/bycatch/national-bycatch-reduction-strategy

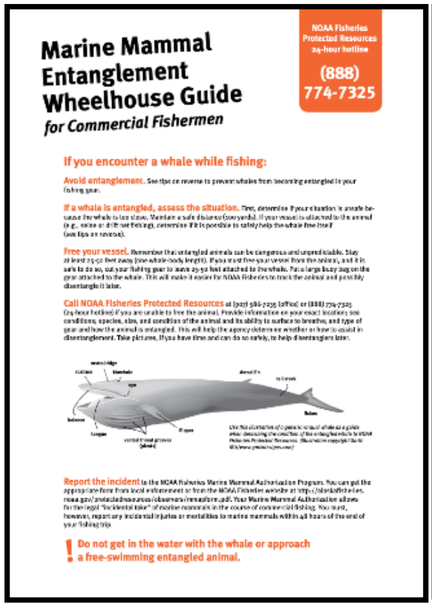
These strategies are very similar to those listed in the five steps of operational risk assessment and reduction outlined in Section 2.12 - Identify risk factors, who and what can be harmed, evaluate the risk and mitigate, record the findings and implement risk reduction, and monitor and review. This makes sense as the goal in both is to reduce the overall threat of large whale entanglement. Here are some examples of how the information gained from authorized response and monitoring efforts have been used to better understand and mitigate large whale entanglement threat:

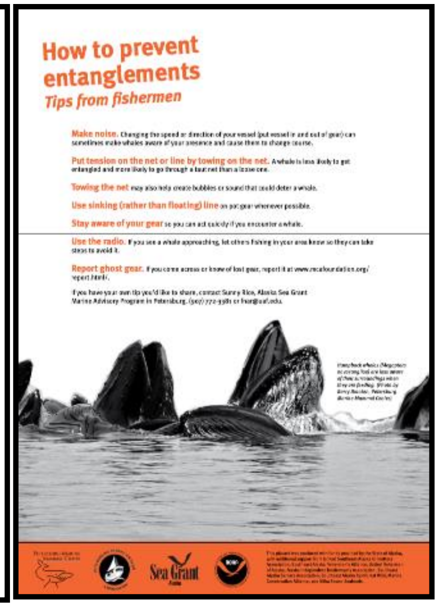
<u>Gear Investigation</u> - One of the most valuable pieces of data is identifying the gear that was entangling a whale as it provides information on the source of the threat. Knowing the identity may provide information on whether it was being actively-fished or ALDFG (Abandoned, Lost, or otherwise Discarded Fishing Gear); the gear type, part and configuration; where, when and how set; and how the whale might have become entangled and why (*e.g.*, due to movement patterns and distribution resulting in overlap of whales and gear). Since 1998, NMFS, along with others, have actively pursued the investigation of gear found on and recovered from entangled whales.

<u>Serious Injury Determinations</u> - Under the MMPA, NMFS is mandated to provide statistically reliable estimates of incidental mortality and serious injury of marine mammals, including the large whales, taken during commercial fishing operations and other human-caused entanglements (Section 107). This assessment of large whale entanglements in part is used to categorize commercial fisheries on their level of impact to marine mammals (Section 118). In 2007, a NMFS-convened workshop established uniform and consistent guidelines based on criteria for known outcome cases (Anderson *et al.*, 2008; NMFS 2012). The resulting assessments are incorporated into Stock Assessment Reports (SARs), and marine mammal conservation management regimes (*e.g.*, Take Reduction Teams [TRTs], Take Reduction Plans [TRPs], ship speed regulations).

<u>Bycatch Reduction and</u> <u>Fishermen Workshops</u> - The availability and dissemination of information allows managers, scientists, conservationists, and the fishing industry to better understand the threat and

work together to develop ideas to reduce large whale entanglements and their broad-based impacts. While the fishing industry may be part of the problem, they are also part of the solution. A Fishermen's Workshop in 2006 in Petersburg, AK, resulted in one of the first examples of fishermen providing Best Practices to other fishermen on how to reduce whale entanglements in fishing gear. This guide was recently updated in 2022. More recently, in 2016, the California Dungeness Crab Fishing Gear Working Group produced a Best Practices Guide to reduce whale entanglements caused by Dungeness Crab fishing gear. The most recent version is 2020/2021 as these Best Practices are updated annually.





Take Reduction Teams - Under the MMPA, Take Reduction Teams (TRT), may be formed to limit the impact of Category I and II fisheries on strategic marine mammal stocks. The teams are composed of fishing industry representatives, state and federal agencies, and scientific and conservation organizations, which meet on a regular basis to suggest mitigation measures for NMFS to consider. Analyzed recovered gear from disentanglement operations is frequently used in TRTs as it offers insight into particular fisheries that may be a greater threat and if mitigation measures are working appropriately.

8. Funding

Funding of NMFS MMHSRP large whale entanglement response is provided by a variety of sources. The primary one is from NMFS itself directly and through The John H. Prescott Marine Mammal Rescue Assistance Grant Program, which provides funding for eligible Network members and collaborators through an annual competitive grant process (subject to annual appropriation from Congress). These grants support the rescue and rehabilitation of stranded marine mammals (including large whale entanglement response), data collection from living or dead marine mammals for health research, and resource operation costs. Funds are also obtained from other federal and state agencies, through allocations, grants and private donations from NGOs, and private individuals. In addition, a great deal of in-kind support is provided by state and federal agency partners, the on-water community (tour and fishing industry), network organizations and the responders themselves.

9. Conclusions

There have been many advances in large whale entanglement response over the years. For instance, tools have become refined and engineered to precise specifications, and developed with specific goals of cutting a particular gear type, accessing gear on a certain part of the body, and different means of deployment (*e.g.*, pole-deployed, thrown, shot from a crossbow). Tools and techniques have advanced, reducing responders' time in proximity of the animal (longer and lighter poles, use of drones, POV cameras), minimizing constraint (lower drag telemetry buoys, less kegging) and increasing the accessibility of the animal over time (sedation, telemetry for remote tracking), all of which may reduce risk. The network response to entangled large whales has become more structured through the use of ICS, and the continued oversight, support, and risk mitigation of NMFS MMHSRP. As a result, along with the participation and support of federal and state agencies, NGOs, members of the on-water community, and others, a safer and more effective network response to large whales has grown in the United States. This growth has contributed to the establishment and development of similar authorized large whale entanglement response network efforts in other countries from around the globe.

However, even with these advances, large whale entanglement response remains a challenging and potentially dangerous undertaking. Again, within the greater global effort, people have been killed. We must remember Joe Howlett, who was killed during a response to an entangled North Atlantic right whale in 2017, both as a prime example of a dedicated and experienced responder, but also as a reminder to all that approaching these animals, whether to cut them free or gain information, poses risks. We need to maintain a balanced approach to continue reducing the risks posed to animals, and especially responders in our large whale entanglement response efforts.

The growth of network response efforts and the efforts of responders like Joe Howlett and many others, have contributed to our ultimate goal of garnering information to better understand the threat and applying it towards prevention. The network has emphasized this goal for decades – it is why we refer to the effort as "entanglement response" in order to emphasize the broader goals. While progress has been made, much more needs to be done. Managers, scientists, network responders, fishermen, and others, need to not only continue to work together, but increase that collaboration. By working together, we can mitigate large whale entanglements at the source and thereby reduce the risks and their impacts for animals and responders alike. Prevention is the key to solving what is a global problem affecting many species.

10. Final Thoughts

The disentanglement of a large whale is a challenging, complex, and potentially dangerous undertaking.

It involves multiple assets, concurrent actions, multiple teams with different roles, an unforgiving environment - the ocean, and a multi-ton entangled animal that almost certainly does not realize you are trying to help it. The operation requires preparation, planning, the adherence to protocols based on the past and present assessment of risk factors and their mitigation, and collaboration. The goal of risk assessment and mitigation for humans is to entirely mitigate (*i.e.*, prevent) any risk factors and their impacts, and at the same time minimize the risk factors and impacts for the animals. As such, in balancing our risks, human safety comes first. There is no obligation to respond. However, if one steps up to respond (*i.e.*, under the MMHSRP's authorization), there are obligations (*e.g.*, criteria) that need to be met in order to safely respond. The entire effort surrounding large whale entanglement response is about risk reduction.

11. Acknowledgements

These Best Practices have been compiled from the cumulative experience of many large whale entanglement responders, managers, and researchers from around the globe. It also benefits from similar and previously drafted large whale entanglement response Best Practices, Risk Assessments, and Field Operation Guides, including the following (alphabetically):

- Campobello Whale Rescue Team Whale Rescue Guidelines DRAFT (Canadian Whale Institute, 2018).
- Entanglement of cetaceans in pot/trap lines and set nets and a review of potential mitigation methods (Laverick *et al*. 2017).
- Fisheries and Oceans Canada Conservation and Protection Directorate Marine Animal Incident Response Standard Operating Procedures.
- Fisheries and Oceans Canada Marine Mammal Response Program Overview of Disentanglement Procedures and Safety Considerations (Cottrell 2014).
- Guidelines for the safe and humane handling and release of bycaught small cetaceans from fishing gear - DRAFT (Hamer 2019).
- Investigating Techniques, Procedures, Protocols, Technology and Tools used in Disentanglement of Large Whales in Fishing gear on the East Coast of North America (Coughran 2004).
- Large Whale Disentanglement Protocols and Training Program for the Newfoundland and Labrador Region DRAFT (Ledwell & Huntington 2018).
- Large Whale Entanglement Response Field Operations Guide (Folkens, personal communication)
- Large Whale Disentanglement Protocol (RABEN). 2016. CONANP, SEMARNAT, México 36 pp.
- Principles and Guidelines for Large Whale Entanglement Response Efforts (International Whaling Commission 2011).
- Risk Assessment for Disentanglement Activities and associated Efforts around the Main Hawaiian Islands DRAFT (Lyman & Mattila, 2010).

- South African Whale Disentanglement Network Operational Protocols (SAWDN 2017).

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Appendix A – Level A and Human Interaction Form

Level A forms, Human Interaction forms, and a complete and detailed examiners guide can be found online at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/level-data-collection-marine-mammal-stranding-events.

MARINE MAMMAL STRANDING REPORT - LEVEL A DATA

FIELD #:__________ **NMFS REGIONAL #**:__________ (NMFS USE) **NATIONAL DATABASE#**: __________ (NMFS USE)

COMMON NAME:__________ **GENUS**:__________ **SPECIES**: __________

EXAMINER Name:__________ Affiliation: __________

Address:__________ Phone: __________

Stranding Agreement or Authority: __________

Report Type: ☐ Stranded ☐ Live entangled, in-water **CONFIDENCE CODE** (Check ONE): ☐ Unconfirmed Public Report ☐ Confirmed Public Report ☐ Confirmed by Network

INITIAL OBSERVATION

☐ Same Information for Level A Examination

DATE: Year:______ Month:______ Day: ______

First Observed: ☐ OnBeach/Land/Ice ☐ Floating ☐ Swimming ☐ Anchored

LOCATION: State:______ County:______ City:______
Body of Water:__________
Locality Details:__________
Lat (DD):______.__________N
Long (DD):______.__________W
☐ Actual ☐ Estimated

How Determined: (check ONE)
☐ GPS ☐ Map ☐ Internet/Software ☐Other__________

CONDITION AT INITIAL OBSERVATION (Check ONE)
☐ 1. Alive ☐ 4. Advanced Decomposition
☐ 2. Fresh Dead ☐ 5. Mummified/Skeletal
☐ 3. Moderate Decomposition ☐ 6. Condition Unknown

LEVEL A EXAMINATION

☐ Restrand Examined? ☐ YES ☐ NO

DATE: Year:______ Month:______ Day: ______

First Examined: ☐ OnBeach/Land/Ice ☐ Floating ☐ Swimming ☐ Anchored

LOCATION: State:______ County:______ City:______
Body of Water:__________
Locality Details:__________
Lat (DD):______.__________N
Long (DD):______.__________W
☐ Actual ☐ Estimated

How Determined: (check ONE)
☐ GPS ☐ Map ☐ Internet/Software ☐Other__________

CONDITION AT EXAMINATION (Check ONE)
☐ 1. Alive ☐ 4. Advanced Decomposition
☐ 2. Fresh Dead ☐ 5. Mummified/Skeletal
☐ 3. Moderate Decomposition

LIVE ANIMAL INFORMATION

INITIAL LIVE ANIMAL DISPOSITION (Check one or more)
☐ 1. Left at Site ☐ 5. Died at Site
☐ 2. Immediate Release at Site ☐ 6. Died during Transport
☐ 3. Relocated and Released ☐ 7. Euthanized
4. Disentangled ☐ 8. Transferred to Rehabilitation:
☐ a. Partially
☐ b. Completely
Date: Year: ______Month: ______Day:______
Facility:__________
☐ 9. Other:__________

CONDITION/DETERMINATION (Check one or more)
☐ 1. Sick 7. Location Hazardous
☐ 2. Injured ☐ a. To animal
☐ 3. Out of Habitat ☐ b. To public
☐ 4. Deemed Releasable ☐ 8. Unknown/CBD
☐ 5. Abandoned/Orphaned ☐ 9. No Rehabilitation Options
☐ 6. Inaccessible ☐ 10. Other: __________

DEAD ANIMAL INFORMATION

CARCASS STATUS (Check one or more)
☐ 1 Frozen for Later Examination/Necropsy Pending
☐ 2. Left at Site ☐ 5. Landfill ☐ 8. Towed: Lat______Long______
☐ 3. Buried ☐ 6. Incinerated ☐ 9. Sunk: Lat______Long______
☐ 4. Rendered ☐ 7. Composted ☐ 10. Unknown/Other__________

DEAD ANIMAL EXAM ☐ YES ☐ NO
☐ Photos Only ☐ External Exam ☐ Partial Internal Exam ☐ Complete Internal Exam
☐ Carcass Fresh ☐ Carcass Frozen/Thawed

CARCASS CODE AT EXAM ☐ Code 2 ☐ Code 3 ☐ Code 4

EXAMINED BY: __________
Date: Year:______ Month:______ Day:______

PHOTOS/VIDEOS TAKEN: ☐ YES ☐ NO
Photo/Video Disposition:__________

MORPHOLOGICAL INFORMATION

SEX (Check ONE) **ESTIMATED AGE CLASS** (Check ONE)
☐ 1. Male ☐ 1. Adult ☐ 4. Pup/Calf
☐ 2. Female ☐ 2. Subadult ☐ 5. Unknown
☐ 3. Unknown ☐ 3. Yearling

☐ Whole Animal ☐ Partial Animal

Straight Length:______ ☐ cm ☐ in
☐ Actual ☐ Estimated ☐ Not Measured

Weight:______ ☐ kg ☐ lb
☐ Actual ☐ Estimated ☐ Not Weighed

SAMPLES COLLECTED (Check one or more)
☐ 1. Histology ☐ 2. Other Diagnostics ☐ 3. Life History
☐ 4. Skeletal ☐ 5. Other __________

PARTS TRACKING (Check one or more)
☐ 1. Scientific Collection ☐ 2. Educational Collection
☐ 3. Other:__________

OCCURRENCE DETAILS

Was the Marine Mammal Human Interaction Report completed? ☐ YES ☐ NO

Findings of Human Interaction: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)

Evidence of:
1. Vessel Interaction ☐ YES ☐ NO ☐ CBD
2. Shot ☐ YES ☐ NO ☐ CBD
3. Fishery Interaction ☐ YES ☐ NO ☐ CBD
4. Entangled ☐ YES ☐ NO ☐ CBD
5. Ingestion ☐ GEAR ☐ DEBRIS ☐ NO ☐ CBD
6. Other Human Interaction: __________

If YES, what was the likelihood that the human interaction contributed to the stranding event?
☐ Uncertain (CBD) ☐ Improbable ☐ Suspect ☐ Probable

Gear/HI Items Collected? ☐ YES ☐ NO Gear Disposition: __________
Other Findings Upon Level A: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)
If Yes, Choose one or more: ☐ 1. Illness ☐ 2. Injury ☐ 3. Pregnant ☐ 4.Other: __________
How Determined (Check one or more): ☐ Photos Only ☐ External Exam ☐ Partial Internal Exam
☐ Complete Internal Exam (Necropsy) ☐ Other: __________

GE# ______________________

(NMFS Use)

Group Event: ☐ YES ☐ NO

If Yes, Type: ☐ Cow/Calf Pair ☐ Mass Stranding ☐ UME # Animals:________ ☐ Actual ☐ Estimated

TAG DATA

Tags Were:

Present at Time of Stranding (Pre-existing):	☐ YES	☐ NO
Applied during Stranding Response/Release:	☐ YES	☐ NO
Applied during Rehabilitation/Release:	☐ YES	☐ NO
Absent but Suspect Prior Tag:	☐ YES	☐ NO

ID#	Color	Type	Placement* (Circle ONE)	Applied	Present	Removed
________			D DF L R LF LR RF RR V	☐	☐	☐
________			D DF L R LF LR RF RR V	☐	☐	☐
________			D DF L R LF LR RF RR V	☐	☐	☐
________			D DF L R LF LR RF RR V	☐	☐	☐

* D= Dorsal; DF= Dorsal Fin; L= Left Lateral Body R= Right Lateral Body LF= Left Front; LR= Left Rear; RF= Right Front; RR= Right Rear; V= Ventrum

ADDITIONAL IDENTIFIER: ____ **(**If animal is restranded, please indicate any previous field numbers here)

ADDITIONAL REMARKS:

DISCLAIMER

THESE DATA SHOULD NOT BE USED OUT OF CONTEXT OR WITHOUT VERIFICATION. THIS SHOULD BE STRICTLY ENFORCED WHEN REPORTING SIGNS OF HUMAN INTERACTION DATA.

DATA ACCESS FOR LEVEL A DATA

UPON WRITTEN REQUEST, CERTAIN FIELDS OF THE LEVEL A DATA SHEET WILL BE RELEASED TO THE REQUESTOR PROVIDED THAT THE REQUESTOR CREDIT THE STRANDING NETWORK AND THE NATIONAL MARINE FISHERIES SERVICE. THE NATIONAL MARINE FISHERIES SERVICE WILL NOTIFY THE CONTRIBUTING STRANDING NETWORK MEMBERS THAT THESE DATA HAVE BEEN REQUESTED AND THE INTENT OF USE. ALL OTHER DATA WILL BE RELEASED TO THE REQUESTOR PROVIDED THAT THE REQUESTOR OBTAIN PERMISSION FROM THE CONTRIBUTING STRANDING NETWORK AND THE NATIONAL MARINE FISHERIES SERVICE.

PAPERWORK REDUCTION ACT INFORMATION

PUBLIC REPORTING BURDEN FOR THE COLLECTION OF INFORMATION IS ESTIMATED TO AVERAGE 30 MINUTES PER RESPONSE, INCLUDING THE TIME FOR REVIEWING INSTRUCTIONS, SEARCHING EXISTING DATA SOURCES, GATHERING AND MAINTAINING THE DATA NEEDED, AND COMPLETING AND REVIEWING THE COLLECTION OF INFORMATION. SEND COMMENTS REGARDING THIS BURDEN ESTIMATE OR ANY OTHER ASPECT OF THE COLLECTION INFORMATION, INCLUDING SUGGESTIONS FOR REDUCING THE BURDEN TO: CHIEF, MARINE MAMMAL AND SEA TURTLE CONSERVATION DIVISION, OFFICE OF PROTECTED RESOURCES, NOAA FISHERIES, 1315 EAST-WEST HIGHWAY, SILVER SPRING, MARYLAND 20910. NOT WITHSTANDING ANY OTHER PROVISION OF THE LAW, NO PERSON IS REQUIRED TO RESPOND, NOR SHALL ANY PERSON BE SUBJECTED TO A PENALTY FOR FAILURE TO COMPLY WITH, A COLLECTION OF INFORMATION SUBJECT TO THE REQUIREMENTS OF THE PAPERWORK REDUCTION ACT, UNLESS THE COLLECTION OF INFORMATION DISPLAYS A CURRENTLY VALID OFFICE OF MANAGEMENT AND BUDGET (OMB) CONTROL NUMBER.

Marine Mammal Human Interaction Report

Exam Information *(fill in or circle most appropriate)*

1 Field #: ______________________ Species: ______________________

2 Examiner: ______________________ Recorder: ______________________

3 Date of exam: ______________________ Condition code (at exam): 1 2 3 CBD

4 Preservation: alive fresh frozen frozen/thawed Body condition: emaciated not emaciated CBD

5 Documentation: digital print slide video Image disposition: ______________________

6 Integument : normal abnormal decomposed % Skin missing: <10% 10-25% 25-50% >50%

7 Explanation of terms:
YES = I have examined the area and/or found signs of this pathology, natural marking, or human interaction
NO = I have examined the area and/or did not find signs of this pathology, natural marking, or human interaction
CBD = I have examined the area and could not determine whether there were signs of human interaction (*i.e.* the part was missing, degraded, or signs were ambiguous)
NE = I did not examine the area
NA = this animal doesn't normally have that part (*i.e.* seals have no peduncle, dolphins have no rear flippers)

	WHOLE BODY EXAM	YES	NO	CBD	NE	NA	Image taken
8	External pathology *(pox, tattoo lesion, abscess, fungal patches)*						
9	Natural markings *(scars, tooth rakes, unusual pigmentation)*						
10	Appendage(s) removed / Mutilation *(with instrument)*						
11	Pelt removed / Mutilation *(with instrument)*						
12	Body sliced / Mutilation *(with instrument)*						
13	Gear / Debris present on animal *(including tags)*						
14	Gear / Debris retained *(name & contact info in Comments)*						
15	HI lesions *(fishery, gunshot, propeller, healed HI scar, brand)*						

16 Predation / scavenger damage *(circle all anatomical areas where damage hinders evaluation; numbers coincide with anatomical areas below)*: 17 18 19 20 21 22 23 24 25 26 27 28 29 NONE

FILL IN TABLE FOR **ALL POSSIBLE FINDINGS OF HI**
Do not use for natural markings/pathology.

						Type of Lesion					Origin of Lesion									
											Gear- Line			Gear/Debris			Other			
	DETAILED EXAM OF ANATOMICAL AREAS	YES	NO	CBD	NE/NA	Impression/ Laceration	Penetrating wound	Healed HI scar	Abrasion	Other / CBD	Twine / line	Net	MO/MU/CBD*	Hook	Packing Band	Other / CBD	Propeller	Gunshot	Other / CBD	Image taken?
17	Rostrum/snout																			
18	Mandible																			
19	Head and/or neck																			
20	L Front appendage																			
21	R Front appendage																			
22	L Body																			
23	R Body																			
24	Dorsum/dorsal fin																			
25	Ventrum																			
26	Peduncle																			
27	L Rear appendage																			
28	R Rear appendage																			
29	Flukes/tail																			

* If Gear-Line is the lesion origin, mark the MO/MU/CBD column: "MO" for monofilament, "MU" for multifilament, and "CBD" if the type of line cannot be determined

Field #:______________________

	INTERNAL EXAM Date ____________	YES	NO	Partial	CBD	Image taken	Detailed Info *(circle all that apply)*
30	Internal exam conducted						*Details in Comments section -use line number*
31	Bruising/blunt trauma						*Details in Comments section -use line number*
32	Skeleton examined						*Details in Comments section -use line number*
33	Broken bones present						*Associated tissue reaction: YES NO CBD*
34	Mouth/GI tract examined *(circle contents)*						*intact prey partially digested hard parts only* ***debris/gear*** *empty other*
35	Lungs/bronchi examined						*Details in Comments section -use line number*
36	Lung/bronchi contents						*froth fluid air* (color:)
37	Bullet/projectile found						*found using: CT X-ray dissection (collected? Y N)*
38	Other lesions noted						*Details in Comments section -use line number*

39 **Comments** (*note line number from left margin before each comment*):

40 **Findings of Human Interaction:** ☐YES ☐NO ☐CBD

(Exam Type: ☐ Photos Only ☐ External Exam ☐ Partial Internal Exam ☐ Complete Internal Exam (necropsy))

41
☐ Entanglement (gear__ debris__ CBD__) ☐ Vessel trauma (sharp__ blunt__ both__)
☐ Hooking (recreational__ commercial__ CBD__) Gunshot ☐ Mutilation
☐ Ingestion (gear__ debris__ CBD__) ☐ Harassment ☐CBD/Other_________

42 **Stranding Event History/Circumstances:**

43 **INITIAL HUMAN INTERACTION EVALUATION:** If you marked YES above (line 40) evaluate the external exam, necropsy, carcass condition and circumstances surrounding the stranding event to answer the question below. *Remember to be conservative in your subjective evaluation*.

What is the likelihood that the finding of human interaction (line 40), contributed to the stranding event?

0: Uncertain (CBD) 1: Improbable 2: Suspect 3: Probable

44 **Justification:**

Final human interaction evaluation requires additional data from level B and C analyses as well as review by experts (e.g. a veterinary pathologist)

Appendix B – National Marine Fisheries Service (NMFS) Criteria for Large Whale Entanglement Response Roles and Training Levels

Levels of Participation in the Large Whale Entanglement Response Network – Definitions

Roles	Levels
First Responder	1-5
Primary First Responders	3-5
Primary Disentanglers	4-5

First Responder is a general term that is used to describe anyone in the Network with any level of training who may respond to an entanglement report under Network protocols and authorization. At a minimum they will voluntarily attempt to standby and document an entangled whale and, depending on training, experience, authorization and equipment available, may also assess and perhaps tag the whale. Individuals with higher Network ratings (Levels 3-5) may act as **Primary First Responders** in local areas. Primary First Responders direct efforts locally and may be given authorization to attempt removing gear during first response. These individuals have access to vessels and specialized equipment. Additionally, Primary First Responders may be on call full-time or at least during those times when there is a high likelihood of an entanglement report in their area of responsibility.

A First Responder's anticipated range of tasks is generally dependent on their classification in the Network. Classifications to various levels are determined on an individual basis and are based on a number of factors including, but not limited to the following:

- Preexisting experience and skills
- Willingness and commitment to build experience and improve skills
- Training
- Opportunity and available resources
- Location
- Availability

Commitment to safely respond and follow standard operating procedures established to reduce risk for animals and humans alike **Primary Disentanglers** are individuals who can perform all of the responsibilities of a first responder, but who also meet the criteria used by NMFS for selecting individuals who may undertake the very dangerous activity of entanglement response (i.e., assessing/documenting the entanglement, conducting risk assessment, gaining access, and/or cutting large whales free). Primary Disentanglers must have the experience, training, support and proper equipment at the time of the event to conduct a full disentanglement with a high likelihood of success. Primary Disentanglers are those rated at Level 4-5 in the Large Whale Entanglement Response Network. A summary of the various levels of certification follows.

LARGE WHALE ENTANGLEMENT RESPONSE NETWORK CERTIFICATION

LEVEL 1

Targeted Individuals: Professional mariners (*i.e*. fishermen, naturalists, Marine Patrol Officers) Boating experience and/or experience around whales is highly suggested (*i.e.* professional fishing, field biology, marine law enforcement, whale watching, etc.)

Responsibilities

<u>Level 1 activities</u>: report, standby, and document/assess (within experience)

- Rapidly alert Large Whale Entanglement Response Network of first-hand and/or second-hand knowledge of local entanglements
- Depending on experience, stand by an entangled whale and document the entanglement from a safe and legal distance until backup arrives, and/or
- Communicate with crew on the vessel that is directly standing by the entangled whale and offer to replace the stand by vessel until additional backup or the response team arrives (if needed and within experience)

Criteria for certification

- Completed Level 1 classroom training, or
- Taken the Level 1 Online Training for the appropriate region and demonstrated equivalent knowledge and experience (submit resume)

LEVEL 2

Targeted Individuals: Professional mariners (*i.e.* fishermen, naturalists, Marine Patrol Officers). There is a higher expectation of experience/knowledge and participation from Level 2 responders.

Responsibilities

<u>Level 2 activities</u>: report, stand by, and document and assess at a higher level (within experience)

- Provide a thorough assessment of the nature of the entanglement and the species, condition and behavior of the whale
- Provide local knowledge, transportation, and assistance to Primary First Responders, as needed, on a voluntary basis
- Availability to assist in planned entanglement response operations on telemetry tagged whales

Criteria for certification

Level 1 certification in addition to the following:

- Completed NOAA-sponsored Level 2 on-water training, and
- Taken the Level 1 Online Training for the appropriate region and demonstrated equivalent knowledge and experience (submit resume)

LEVEL 3

Targeted Individuals: Whale researchers and naturalists, fishermen, natural resource agency personnel, Marine Patrol Officers (*e.g.*, USCG, OLE, state agencies).

Responsibilities

Level 3 activities- report, stand by, assess, document and attach a telemetry buoy. Other activities may include:

- Available to respond if conditions allow (should alert NMFS Regional Entanglement Coordinator if you are unavailable for an extended period of time)
- Initiate and maintain preparedness with local fishing industry, Coast Guard, and other resources
- Prepare local entanglement response action plan
- Provide entanglement assessment, documentation and recommendations to Primary Disentanglers during events
- Lead efforts to attach telemetry equipment to entangling gear if needed and authorized
- May be asked (depending on experience) to attempt disentangle a minor entanglement with potential to adversely affect any whale other than right whales under the supervision/authorization of Level 4 or 5 network members. Authorization and supervision may be given over the phone or radio depending on the circumstances and level of experience.

Criteria for certification

Level 2 responders may be advanced to Level 3 after meeting the criteria outlined below. Additionally, they must be recommended by a current Level 4 or 5 responder to the NMFS Regional Entanglement Coordinator, and are subsequently approved by the NMFS Regional Entanglement Coordinator and MMHSRP Headquarters Staff. Candidates put forward for promotion will be evaluated for each element and any deficiencies must be supplemented with adequate training and/or experience before they can resubmit their application.

Level 1 and 2 certification and experience in the following elements:

- Large whale species identification and behavior, and the ability to safely follow a free swimming, entangled whale
- Boat handling and safety including basic seamanship, driving, and close approaches to

whales

- Line handling and safety including knowledge of knots, handling lines under pressure, and an understanding of how working lines behave
- Follows instructions and response plans
- Is identified as an ideal candidate by a current Level 4 or 5 responder for advancement
- Can properly document the entangled whale, associated gear, and collect photo identification images for review by the NOAA Regional Large Whale Entanglement Coordinator
- Follow established procedures towards reducing risk

Additionally, all Level 3 responders must have:

- Basic NOAA-sponsored Level 3 training or
- Advanced entanglement response training (*e.g.*, apprenticeship with the Center for Coastal Studies, Hawaiian Islands Humpback Whale National Marine Sanctuary training, etc.)
- Experience in at least 1 on-water entanglement response effort that included attaching a satellite tag to trailing gear (ideally as the person responsible for deploying the tag),
- Positive assessment by members of the entanglement response network of the temperament and attention to established safety protocols during prior entanglement responses or other similar high-pressure emergencies.
- Know when to stand down a response, even if pressure is high
- Commitment to Consultation to include:
    - Immediate Consultation: when possible, use satellite/cell phones to bring in additional ideas/experience from other Level 5s and Level 4s (and veterinarians and behaviorists if appropriate) while on scene with an entangled right whale
    - Action Plan Development: For a tagged right whale, consultation required with NMFS, Level 5s and 4s, veterinarians, behaviorists, etc.

Rationale for consultation: First assessments and strategies almost invariably change with more discussion or information. Consultation will likely help to increase human safety and critical choices regarding risks to whale health must be made with the best available information.

LEVEL 4

Targeted Individuals: Whale researchers and naturalists, experienced watermen and vessel operators, natural resource agency personnel, Marine Patrol Officers (*e.g.*, USCG, OLE, state agencies), members of Regional Stranding Networks

Responsibilities

Level 4 activities-

- Report, stand by, assess, document, attach a telemetry buoy, consult on an action plan and disentangle all large whales except right whales

- Report, stand by, assess, document and attach a telemetry buoy to right whales
- On a case by case basis and after consultation (see commitment to consult under Level 5 below), certain cuts on known entangled right whales may be permitted at level 4 ***if the proposed action is first approved by level 5 responders and NMFS***

Please Note: Entangled whale behavior varies considerably by species. However, Level 4 responders should routinely be able to attempt disentanglement of all large whales other than right whales.

Criteria for certification

Level 3 responders may be advanced to Level 4 after meeting the criteria outlined below. Candidates must be recommended by a current Level 4 or 5 responder to the NMFS Regional Entanglement Coordinator, and are subsequently approved by the NMFS Regional Entanglement Coordinator and MMHSRP Headquarters Staff. Candidates put forward for promotion will be evaluated for each element and any deficiencies must be supplemented with adequate training and/or experience before they can resubmit their application.

Basic or Advanced Level 3 Certification and:

- Direct experience in multiple supervised (by higher level responders or NMFS staff) large whale entanglement response efforts,
- Experience leading an entanglement response (under the supervision of a higher level responder)
- Documentation of prior experience (ideally video clips), and
- Positive evaluation from NMFS using information provided by higher level responders that supervised the candidate and any documentation of the candidate's experience (*i.e.* video) of the leadership, temperament, communication skills, and attention to established safety protocols during prior entanglement responses or other similar high-pressure emergencies.
- Ability to make quick decisions under pressure and know when to stand down a response, even if pressure is high
- Commitment to Consultation to include:
    - Immediate Consultation: when possible, use satellite/cell phones to bring in additional ideas/experience from other Level 5s and Level 4s (and veterinarians and behaviorists if appropriate) while on scene with an entangled right whale
    - Action Plan Development: For a tagged right whale, consultation required with NMFS, Level 5s and 4s, veterinarians, behaviorists, etc.

Rationale for consultation: First assessments and strategies almost invariably change with more discussion or information. Consultation will likely help to increase human safety and critical choices regarding risks to whale health must be made with the best available information.

LEVEL 5

Targeted Individuals: Level 4 Responders

Responsibilities

Level 5 activities - report, stand by, assess, document, attach a telemetry buoy, consult on an action plan and disentangle all large whales including right whales.

Please Note: Right whales are aggressive and therefore generally the most difficult whales to disentangle. North Atlantic right whales are among the most critically endangered large whales in the world. Certification at this level is highly selective and specialized.

Criteria for certification

Level 4 responders may be advanced to Level 5 after meeting the criteria outlined below. Candidates must be recommended by a current Level 5 responder to the NMFS Regional Entanglement Coordinator, and are subsequently approved by the NMFS Regional Entanglement Coordinator and MMHSRP Headquarters Staff. Candidates put forward for promotion will be evaluated for each element and any deficiencies must be supplemented with adequate training and/or experience before they can resubmit their application.

Level 4 certification and:

- Experience with right whale behavior and/or a person on the team directly involved in right whale entanglement response efforts (in the boat with the whale) that is experienced in right whale behavior
- Documented participation in multiple right whale entanglement response efforts
- Positive evaluation from NMFS using information provided by Level 5 responders that supervised the candidate in a right whale entanglement response and any documentation of the candidate's experience (*i.e.* video) of the leadership, temperament, communication skills, and attention to established safety protocols during prior right whale entanglement responses or other similar high-pressure emergencies.
- Ability to make quick decisions under pressure and know when to stand down a response, even if pressure is high
- Commitment to Consultation to include:
    - Immediate Consultation: when possible, use satellite/cell phones to bring in additional ideas/experience from other Level 5s and Level 4s (and veterinarians and behaviorists if appropriate) while on scene with an entangled right whale
    - Action Plan Development: For a tagged right whale, consultation required with NMFS, Level 5s and 4s, veterinarians, behaviorists, etc.

Rationale for consultation: First assessments and strategies almost invariably change with more discussion or information. Consultation will likely help to increase human safety and critical choices regarding risks to whale health must be made with the best available information.

Appendix C – IWC, Principles and Guidelines for Large Whale Entanglement Response Efforts

INTERNATIONAL
WHALING COMMISSION

Principles and guidelines for large whale entanglement response efforts

to read this guidance in Spanish or French please use the translate buttons at the top of this page.

DEDICATION

This document is dedicated to the memory of Tom Smith from Kaikoura, New Zealand. A kind and generous man, Tom was a fisherman and conservationist who tragically died during an attempt to disentangle a humpback whale while he was in the water. Particularly as a result of this and other human injuries recorded worldwide, an important motivation for these guidelines and principles is to try to prevent similar tragedies and to honour his family.

DISCLAIMER

While these principles and guidelines have been developed to try to maximise safe and successful operations, disentanglement operations are complex and can be unpredictable; following these guidelines does not necessarily guarantee personal safety, an animal's successful release, or operation in accordance with national rules and regulations (permits and/or letters of authorisation). All responsibility is upon the operator to undertake safe activities under their best judgment. The IWC and the authors of this document are not liable for any actions taken as a result of these guidelines and principles. This is a living document, intended to be dynamic and evolving as new information and experience is gained. It is **not** an instruction manual.

OBJECTIVE

Based on the most recent information, the objective of this document is to provide principles and guidelines for trained persons to safely and effectively respond to reports of entangled live whales at sea. The objective of an entanglement response is to remove all detrimental entangling gear safely from the whale and learn as much from the entanglement as possible to ultimately prevent entanglements from occurring. Actions by well meaning untrained persons can worsen an entanglement, through a lack of subject knowledge and experience.

For example, removing easily accessible trailing gear from entangled whales may leave the most critical components on a whale, making future, organised disentanglements more difficult or even impossible, potentially resulting in severe harm or death to the animal.

Regional entanglement response scenarios and complexities may require different techniques and strategies (see Annex F on capacity building and training).

GOALS OF ENTANGLEMENT RESPONSE

(a) Human safety

(b) Animal welfare

(c) Contribution to the conservation of large whale populations, recognising that prevention is the ultimate goal

(d) Data collection to assist with identifying key fisheries and whale populations and thus better specification of actual entanglement problems within a region to assist with mitigation and prevention.

(e) Awareness of issues at all levels to improve reporting and appropriate measures to address issues (a) to (d)

1. GENERAL SAFETY

(a) **At no time should an individual enter the water**. It is not necessary given the proper disentanglement training, tools and techniques. Over a thousand successful disentanglements have occurred with a boatbased technique without significant human injury, whereas human life has been lost during dive-based disentanglement attempts.

(b) Do not put the whale's rescue above human safety at any time

(c) Only trained and authorised operators should participate in disentanglement activities.

(d) Actions must be thoroughly thought through and planned, with full briefing to all **participants** and **team members**. All **participants** need to be clear on aims, objectives, operational procedure and roles.

(e) Do not secure a line from the whale to the vessel.

(f) In addition to focussing on the disentanglement itself, pay careful attention to the overall environment.

(g) Actions must not be pressured by weather, time of day, onlookers, media, or the perceived need to act.

(h) When in doubt about safety or the success of the operation, stand down, if possible attach a satellite telemetry device for tracking and/or try again on another day with better support, conditions, and/or resources.

2. PERSONNEL

(a) Human safety is the number one priority.

(b) Appropriately, trained, experienced and authorised personnel should be used for the roles required and actions/efforts must be based on the qualifications of personnel on hand.

(c) Roles must be assigned to team members based on their experience, training, and overall qualifications.

(d) Personnel should be monitored (e.g. for fatigue, dehydration, emotional state) at all times to maintain

(e) Team members must be encouraged to speak up if they are not comfortable with a particular action or the general situation. Leaders must respect any concerns raised and not instruct personnel to take a role or action that they are not comfortable with.

3. PERSONNEL EQUIPMENT

(a) Personnel working near or with entangling gear must carry emergency safety knives on their persons at all times.

(b) Gloves must be used when handling lines or netting under load (i.e. attached to whale).

(c) Helmets must be worn by personnel operating near the whale and/or using poles.

(d) Appropriate attire and personal floatation/protection must be worn at all times. Examples include PFDs, wetsuits, drysuits, worksuits that are snag-free (without straps, D-rings, and clips that can act as snag points for lines/ gear).

(e) Proper communication tools must be available (e.g. waterproof VHF handheld, cellular phones).

(f) Carry sufficient water and food.

4. PLATFORMS

Response efforts are generally conducted from two vessels, a primary response vessel and a support/safety vessel.

Primary response vessel (PRV)

(a) This vessel is the main operational platform to assess, perform the entanglement removal and monitor the situation. It is essential that only disentanglement staff and essential equipment be carried.

(b) It should be maintained by a helmsman, a specialist crew member at the bow and a third specialist crew person to ensure trailing lines are clear of the engine leg and to assist the crew at the bow.

(c) Its deck must be kept clear and free of loose objects and any other materials or equipment which may potentially interfere with the safe deployment of running lines during the operation.

Support/Safety Vessel:

A support vessel is needed to carry necessary personnel, equipment and to maintain adequate redundancy in communication systems (i.e. 'two is one, and one is none'). This includes human first aid and resuscitation equipment and qualified staff to deal with possible emergencies.

5. ASSESSMENT

The following factors are used to determine whether an animal is a response candidate through methodology outlined in IWC/62/15.

Animal and Entanglement Conditions

(a) Size

(b) Species

(c) Temperament

(d) Behaviour

(e) Health condition (Appendix IV, IWC/62/15): body profile, cyamid coverage, general skin condition

and colouration.

(f) Nature of injuries

(g) Company of other cohorts (pod members, calves) and the presence of sharks or other predators

(h) Mobility (anchored, small circles, big circles, free-swimming)

(i) Type and nature of gear (rope, line, pot, netting, chain, etc).

(j) Body part(s) affected and not affected

(k) Configuration and condition of gear

Environmental conditions

(a) Weather conditions and forecast

(b) Sea state

(c) Navigational constraints (e.g. rocks, ice, depth)

(d) Time of day (e.g. remaining daylight)

(e) Remoteness of location

(f) Availability of resources

Other conditions

(a) Visibility of event

(b) Media or public presence

(c) Surrounding vessel traffic

(d) Military operations

(e) High recreational use areas

6. SAFETY CONCERNS ON APPROACHING AN ENTANGLED WHALE

(a) Time spent in the danger zone (area immediately in front of and beside animal that is in range of tail flukes and/or flippers) must be avoided or at least minimised.

(b) A swimming entangled whale must never be approached in its wake, as unseen trailing gear may foul the approaching vessel's engines.

(c) Only the minimum required equipment and personnel should be present on the PRV (store non immediate gear on support vessel). The approach boat must be kept 'clean' in order to minimise the risk of lines getting caught on the boat or gear stowed on boat.

(d) Sudden boat manoeuvres (e.g. gear shifting or sudden velocity changes) must be avoided as these have a higher probability of startling the whale.

(e) Approaches should be methodical and consistent. Animals may avoid and respond unpredictably to any perceived threat. It should be assumed that an animal does not know the responders are there to help.

7. ENTANGLEMENT RESPONSE PROCEDURES

Disentanglement procedures generally involve some control of the animal, cutting away gear using specialised tools, and documentation and follow-up of the event. The details of disentangling a whale involve a specialised discipline that is dangerous for both the responder and the entangled whale; as noted in the introduction this is **not** an instruction manual; specific disentanglement procedures should be addressed through a thorough and strict training programme (see Annex F).

8. DOCUMENTATION AND DE-BRIEFING

Documentation gathered during disentanglements offers one of the best and only opportunities to understand the scope and extent of regional entanglement issues.

Documentation may include:

(a) Photographs of operations and of the animal before, during, and after a response

(b) Video from point-of-view cameras mounted to safety helmets

(c) Collection and documentation of gear removed

(d) Biological sampling (biopsy, skin in gear)

(e) Field observations (operational log, behavioural log, etc)

This information should be assembled into a full disentanglement case study and shared with regional and international entanglement response networks. Every attempt should be made to build documentation/data gathering into operational procedures. Data should identify species, individual, level of injuries, disentanglement activities and state of the animal and its entanglement at the end of an operation.

Effort should be made to monitor post-disentanglement behaviour and survival through the use of telemetry, genetics and or photo identification of individual animals.

Follow-up of an entanglement response is an opportunity to discuss the level of preparedness, the equipment,the process, and identify any changes to procedure or equipment that could be made to improve future disentanglement attempts.

NB: As discussed under Items 3 and 8 of this report, there is work underway on consideration of standardising to the extent practical data that are collected, methods of storing these and facilitation of sharing data.

Appendix D – Generic Gear Checklist

Hawaii Large Whale Entanglement Response Gear Checklist

Documentation	Personal PPE	Telemetry	Cutting Tools
☐ DSLRs and lenses (X3) ☐ Video cameras ☐ GoPros (X8) ☐ VR cameras ☐ Real-time streaming goggles ☐ Batteries ☐ Chargers ☐ Memory cards ☐ Housings ☐ Mounts	☐ Helmets (X8) ☐ Gloves ☐ Safety knives (X8) ☐ Knife retractor (X6) ☐ PFDs (X8) ☐ Eye protection ☐ Protective wear (wetsuits, UV wear, hat, knee pads, appropriate footwear, sunscreen)	☐ Transmitter ☐ Telemetry buoy ☐ VHF receiver (X2) ☐ Antennas & cables ☐ Headsets ☐ "Ross" timed-release clips	☐ Fixed hooked knife (X3) ☐ Flying hooked knife(X3) ☐ "Coughran whale knife" ☐ Cutting grapple (X2) ☐ Gobbler guillotine ☐ "Thompson" blade ☐ Spare blades (X3) ☐ Knife sharpeners ☐ "Wong" knife sheaths ☐ "Goodwin" cutting grapple sheath
Data	**Medical Emergency**	**Kegging**	**Pole System**
☐ Data forms/ Checklists ☐ iPad logger ☐ Timer/ Watch	☐ First aid ☐ AED ☐ Oxygen kit ☐ Backboard ☐ Neck brace ☐ Splints	☐ Polyballs (X5) ☐ Sea anchors (X2) ☐ Working lines (buoyant & sinking) (X6) ☐ Buckets (X3) ☐ Carabiners (X8) ☐ Pump (buoy & boat)	☐ Poles ☐ Short tool handle ☐ Slip joints ☐ Safety ends ☐ Jointed pole ext.
Communications	**Sampling**	**Misc.**	**Attachment Tools**
☐ Cell phones ☐ Waterproof VHF (X2) ☐ Satellite phone ☐ VOX radios & headsets ☐ GPS	☐ Crossbow ☐ Bolts (X8) ☐ Cores ☐ Vials w/ preservative ☐ Sample net	☐ Duct tape ☐ Electrical tape ☐ Wire ties ☐ Hose clamps ☐ Tools ☐ Utility knives ☐ Binoculars ☐ Hose clamps ☐ Tool kit (pliers, wrench, screwdrivers) ☐ Paperwork (permit, protocols, phone list) ☐ Permit flag	☐ Pole grapple (X2) ☐ Medium grapple (X2) ☐ Large grapple ☐ Skiff hook (X2) ☐ Carabiners ☐ Tine hook
Drone	**Sedation**		**Approach Boat**
☐ Drones ☐ Controller ☐ Monitor ☐ Safety glasses/ Face visors ☐ Goggles ☐ Batteries ☐ Charger ☐ Memory cards	☐		☐ Inflatable ☐ Outboard ☐ Fuel ☐ SCUBA tanks (X2) ☐ Foot pumps (X2) ☐ Inflation system ☐ Fuel line

July 7, 2020

Appendix E –Media Guidance for Information, Images, and Video 2020

Large Whale Entanglement Response Network

Media Guidance for Information, Images, and Video 2022

Introduction:

Along the West Coast, NOAA Fisheries' Protected Resources Division oversees the Large Whale Entanglement Response Network, which is comprised of whale biologists, researchers, the tour industry and their naturalists, veterinarians, veterinary technicians, whale watchers, the U.S. Coast Guard, and state agencies. Due to the dangerous nature of responding to entangled large whales, our responders go through extensive training and many years of apprenticeship to learn the proper techniques and protocols to ensure their safety and that of the animals. Responders are experts at understanding whale behavior, biology and health, vessel operations, handling ropes under tension, and coordinating entanglement response teams. This work is authorized under a permit (18786-06) held by NOAA's Marine Mammal Health and Stranding Response Program (MMHSRP).

Information Sharing:

Prior to releasing any media relating to high profile response events, you must coordinate with NOAA Fisheries. All information, press releases, images and video showing an entangled whale or response must be reviewed and cleared by NOAA Fisheries prior to publication. Multiple points of contact are listed below for review and clearance, NOAA understands this information needs to be reviewed in a timely manner and that our responders or partners may need review after hours.

Photography and Video Guidance:

Photographs taken under the authority of the MMHSRP permit may be maintained for training, research or educational use only and the permit number (NMFS Permit No. 18786-06) should be watermarked or listed in the metadata for every image or video. A copy of the photographs must be submitted to NOAA Fisheries upon request.

Image or Information Content	Appropriate for Release?
Fishing gear, tags, buoys, floats, etc.	Possibly – releasing these images may identify an individual fisherman and could lead to litigation. No buoy numbers should or can be readable in the image. May be approved on a case by case basis.
Response team	Yes – only if they are wearing the appropriate PPE such as a PFD, gloves, and helmet. Responder actions will be reviewed in this photograph as well.

Support vessel	Yes – this can show the perspective of a support vessel and the assistance they provide for the safety of the response vessel.
Response vessel	Yes – team should have appropriate PPE. Engine may be in the water at certain periods of time.
Specific Location (e.g., GPS points, map plot)	No – a general location such as county or a large geographic location can be shared. For example, Puget Sound, outer coast of Washington, Oregon Coast, etc. will be approved. Releasing a more specific location could lead to members of the public locating the whale and closely approaching the whale which will jeopardize our response or attempting to disentangle the whale themselves. **Releasing the location of anchored animals is strictly prohibited.**
Graphic Content	Possibly – while entanglements may show blood or serious injuries it is important to show how entanglements can severely debilitate or kill large whales. We may choose not to show an amputated limb, free blood flow, or an open wound showing extensive damage – considered on a case by case basis.
Entangling lines in the response vessel	No – all gear that is attached to the whale should be outside of the approach/response vessel and clear of the engine at all times.
Telemetry buoy	Yes – language explaining what the telemetry buoy is and why we use it should accompany the photograph.

Go Pro or Video Content	This will be reviewed on a case by case basis just like the photographs and images and will be approved if it meets the above considerations or can be edited to remove sections of concern. In instances where cursing or inappropriate language is used the audio should be removed from the video. Messaging that accompanies the video will also be reviewed for approval.
Stand By Vessel	Yes – if the stand by vessel would like recognition for their efforts while waiting for the response team to arrive, the name or a photograph of the vessel can be shared.

Use of Social Media:

Information, photos or video may be posted on social media after NOAA Fisheries reviews and clears the material. If multiple agencies are involved in the response effort we request you acknowledge their presence in the information you are sharing. **Information and images cannot be shared in real time.** Large whale entanglements are extremely complex and the safety of the response team is our number one priority. The permit number (NMFS Permit No. 18786-06) must be listed on every image.

Talking Points:

Please use the following approved talking points in materials intended for the media or public. These messages emphasize important points regarding entanglement responses and using them will speed review of any material developed for the public and the media.

Reporting: Prompt reporting is the best way to help entangled whales. Report entangled whales to our 24/7 Hotline by calling 1-877-SOS-WHALe (1-877-767-9425) or hailing the U.S. Coast Guard on VHF Channel 16. If an authorized response is to be mounted, please stay with the whale as long as it is safe to do so and you are able.

Attempting Disentanglement: **Never** attempt disentanglement, get in the water with the whale, or remove any gear without training and authorization from NOAA Fisheries. Stay 100 yards from the whale and beware that lines in the water could snag your vessel. Trained responders have been injured or killed, do not put your safety at risk.

Documentation: Video or photos showing the entangling gear are very useful to the response team, but your safety is the most important. If possible, take pictures or video of the gear, but remember to stay 100 yards from the whale and beware that lines in the water could snag your vessel. This information is vital to help identify the individual whale, gain information towards prevention and to encourage future re-sights.

Response Team: Forming a response to an entangled whale is very complex and requires a great deal of time and coordination. Please understand that it is not possible to respond to every entangled whale.

Prevention: Working groups of fishermen, researchers, fisheries managers in each of the West Coast states are trying to minimize the risk of entanglements. In California, for example, researchers are developing models that use oceanographic information to predict where whales are most likely to be feeding, so fishermen can account for that when setting crab traps and other gear. In Oregon, marine mammal scientists have teamed up with the U.S. Coast Guard to survey coastal waters for fishing gear that could entangle whales. In Washington, new commercial fishery regulations have been implemented in the Dungeness crab fishery in coastal waters that will limit the number of traps that can be fished during the summer, allow for earlier retrieval of lost or derelict crab gear during the season, and promote easier identification of WA Dungeness crab gear if involved in future entanglements.

Recognition: We greatly appreciate the work of response teams along the West Coast to respond to entanglements. Many responders have invested much of their own time in training for and responding to entanglements, and NOAA Fisheries thanks them for their commitment and support.

Results: Entanglements have increased in the last decade, which may reflect various factors including recovering whale populations and more overlap of whales with fishing areas. NOAA Fisheries produces an annual report detailing entanglements on the West Coast and what we and our partners are doing to address the issue. In addition, a NOAA Fisheries Technical Memorandum examines the rise in entanglements over the last decade. https://www.fisheries.noaa.gov/resource/document/large-whale- entanglements-us-west-coast-1982-2017

Review and Clearance Process:

Please contact the below individuals for review and clearance of information, photos, video or draft press releases for review and clearance. If you are not able to reach Justin or Kristin in a timely manner please feel free to reach out to Ed or Stephen.

Name	Email	Cell Phone Number
Kristin Wilkinson – Washington and Oregon Large Whale Entanglement Coordinator	Kristin.Wilkinson@noaa.gov	206-550-6208
Justin Viezbicke – California Large Whale Entanglement Coordinator	Justin.Viezbicke@noaa.gov	562-506-4315

Justin Greenman – California Large Whale Entanglement Assistant Coordinator	Justin.Greenman@noaa.gov	707-496-7230
Ed Lyman – Hawaii Large Whale Entanglement Coordinator	Ed.Lyman@noaa.gov	808-264-8023
Stephen Manley – National Large Whale Entanglement Coordinator	Stephen.Manley@noaa.gov	240-499-4420
Sadie Wright – Alaska Large Whale Entanglement Coordinator	Sadie.Wright@noaa.gov	907-586-7630

Outside of real-time emergency responses, the use of imagery for documentaries, films, brochures, marketing, fund raising, etc. needs to be approved by the Office of Protected Resources MMHSRP. Please submit your request, with attachments or links and the proposed imagery to nmfs.mmhsrp.hq@noaa.gov

NOAA Communications Team:

NOAA Fisheries' Regional Stranding Coordinators keep the NOAA Fisheries WCR Communications Team up-to-date on responses in the field. Media inquiries should be directed to Michael Milstein at 503-231-6268 or via email at Michael.Milstein@noaa.gov or Karen Edson at 562-400-9012 or via email at Karen.Edson@noaa.gov If there are questions regarding entanglements in Alaska, please contact Julie Fair at 907-586-7032 or via email at Julie.Speegle@noaa.gov

Media Resources:

Large Whale Entanglement FAQ's:
http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/entanglement_faq.html West Coast Region Large Whale Entanglement Response Program: https://www.fisheries.noaa.gov/west-coast/marine-mammal-protection/west-coast-large-whale- entanglement-response-program#large-whale entanglement
Annual Summaries for 2015-2021:
https://www.fisheries.noaa.gov/west-coast/marine-mammal-protection/west-coast-large-whale-entanglement-response-program#reports

Fishing Gear Guide:
https://www.fisheries.noaa.gov/west-coast/marine-mammal-protection/west-coast-large-whale-entanglement-response-program#causes

Appendix F – Reporting Forms

Hawaii Whale Response Reporting Data Form

WHALE RESPONSE REPORTING DATA FORM

Report:

Date of report: _________ Time: _______ Field ID: _________
Platform name: ______________ Homeport: ______________

Reporter/ contact #: _______________/ ____________ if different
Observer/ contact #: _______________/ ____________
Case status: New / Existing Source: shore/ surface / air

Nature of distress: entangled/ collision/ stranding/ floater
Out-of-habitat/ harassed/ other ________________________
Animal disposition: alive/ dead/ unc. Breathing: Y / N / unc

Detail:

Date of incident: ________ Time: ______
Location description: ____
Location latitude: ______________N/ ______________W
Report narrative: ____
____
____
Still on site: Y / N If yes, how long can stay? ____________
Are there other vessels that can assist? Y / N / Unc Name: _________
Documentation obtained: Y / N / unc. Doc disposition______________
Getting documentation from safe distance is important!!

Animal:

Species: _________________ Age: Adult/ juvenile / calf or pup
Sex: male / female / unc Identity: _______________________
Description of animal (if species uncertain): ___________________
____
General behavior (e.g. thrashing, logging): _____________________

Context/ role: ______________
Respiration: normal/ trumpeting / wheezie / gurgling
Posture: normal / vertical / hunched
Diving? Y / N / unc Fluking? Y/ N/ unc Speed: ________
Mobility? Mobile / circling / anchored / unc Heading: ______

Entanglement:

Where on body: head/mouth/body /rgt pec/ lft pec/stock/ tail/unc.
Description: ____
____
Full wraps: Y / N / unc Tight/ contricting? Y/ N/ unc
Trailing: Y/ N/ unc Distance? ___________ ft/m
Buoys? Y / N/ unc. Describe: ____________________________
Markings: ____________________

Type of line: _________________ Line color and size: _____________
Comments: ____

Condition:

Condition: Good / fair / poor / dead
Condition described: ______________________________________

Wounds? Y / N / unc Wound type: Laceration/ puncture
Blood: Y / N / unc. indent /
Wound described: ____
Emaciated: Y / N / unc Cyamids; Y / N / unc Loc.: _______
Skin: dark/ light / rough / smooth /sloughing/ pitted
Carcass cond.: fresh / moderate / decomposed

Contact:

Name of vessel involved: ______________ Homeport: _____________
Contact person: ___________________ Contact #: _________________
Company/ org.: ___________________ Vessel LOA: __________ ft/ m
Vessel detail (type and category): ______________________________
Vessel heading and speed at time of incident: _________/ _________
Incident description: ____

____________________________________Whale observers? Y/ N / unc

Case confirmed: Y / N / unc. Incident Threatening? Y / likely / possibly / not likely / N / unc Person filling form: _____________

Hawaii Whale Response - Response Data Form

WHALE RESPONSE – RESPONSE DATA FORM

Date: _______ Platform name/ type: _____________/ ______ 1º Platform contact #/ch.: _______ Depart location/ time: _________/______
Mission goal: assess / document / monitor / tag / sample / disentangle/ Investigation

CI/ lead:
Name: ________________________ Level: _____
Contact #: ______________ Affiliation: __________
Shore POC:
Name: ________________ Affiliation: __________
Contact #:_______________

Supporting agencies/ orgs:
Name: ___________ Role: __________ Platform type: ______
Name: ___________ Role: __________ Platform type: ______
Name: ___________ Role: __________ Platform type: ______
Name: ___________ Role: __________ Platform type: ______
Name: ___________ Role: __________ Platform type: ______

Conditions:
Weather: _______
Sea state: _______
Swell: _________

GAR: ___________

Team roles	Role	Captain	Comms	Safety	Doc	Doc	Tag	Gear	Detangler	Detangler	Doc	Crew
	Initials											
	Affiliation											
	Level											

Event Timeline	**Event**	**Time**	**Latitude**	**Longitude**
	On site			
	Animal located			
	Animal engaged			
	Mission complete/abort			

Data obtained: none / photo/ video/ resp. narrative/ beh. narrative/ respirations/ veterinarian/other ________________

Imagery types: surface/aerial /uw /pole/ helmet / vessel /other _______________

Gear / wound details	**Mouth**	**Head**	**Body**	**Lft Pec**	**Rgt Pec**	**Stock**	**Tail**
Gear wrapping (Y, N, Unk)							
Gear constricting (Y, N, U)							
Wound type							
Wound color/bleeding							
Tis. penetration (dpth/%)							
Line type ()							
Line color/ size							
Gear trailing (lgth,descry)							

Telemetry: none/tethered/penetrating/ suction/ other ____________________

GPS PTT: ________ VHF: _____ Tune:___
Tag time: ______ Loc: ______________
Loc. On/rel. to body: _______________

Sample obtained:none/biopsy /sloughed/ from gear / feces / resp. / other _________

Gear removed: _______ ft/m Gear recovered: ________ ft/m Gear remaining _______ ft/m:
Gear type: _____________Gear fishery: _________ Set loc.: ____________ Date lost: ______
Post mitigation behavior:

Resp. status: not loc./assessed/document/ monitored /totally freed/ part. freed/ unsuccessful / other _______________

IWC Entanglement Response Data Form

ENTANGLEMENT RESPONSE DATA FORM

Date: __________ **Event#:** ________ **Species:** ________________ **Individual ID:** ____________ **Arrival at scene:** ____ **Departure from scene:** ____

DD/MM/YY

Team details	Role					
	Initials					

Event timeline	Event	Time	Latitude	Longitude
	Whale located			
	Whale engaged			
	Whale released/lost			

INSERT WHALE BODY DIAGRAM

Draw entanglement configuration, wound sites and disentanglement cuts

Gear and wound details	Mouth	Head	Body	Left Flipper	Right Flipper	Peduncle	Tail
Gear wrapping (Yes, No, Unk)							
Rope color/size							
Gear constricting (Yes, No, Unk)							
Tissue penetration (Epidermis-only, Blubber, Muscle, Bone, Other, Unknown. For flippers and tail, also indicate percentage penetration)				____%	____%		___%
Wound profile (Flat, Depressed, Raised, Unknown)							
Wound color (1=white/yellow, (2=pink/red, 3=green/blue/black, 4=unk)							

Gear trailing: _____ ft or m **Trailing profile**: floating / sinking **Visible components:** _______________

Gear type/parts (if known):________________________________ **Anchored?** yes / no / unk

Gear type in area: _____________ **Whale movement**: stationary / circling / travel **Whale posture**: normal / hunched / head raised / tail raised / other

Estimated whale length: ______ ft or m **Class:** calf / juvenile / mature **Role (if applicable):** none / mother / other _________________

Body condition: normal / thin / emaciated **Odor detected?** breath / wound / gear Description: ____

Skin condition (for species): normal / pale / sloughing / pitted **Cyamid proliferation**: normal / at wounds / at blowholes / widespread

Other condition details (note species-specific indicators): ____

Whale activity time line	None	Low	Average	High	Evasive	Aggressive
Pre-approach						
At first approach						
During disentanglement						
At release						
Post release						

Bio samples obtained: none / biopsy / sloughed skin / skin from gear / scat / other

Other data collected: photos / video / ventilation rates / detailed ethology / veterinary procedures /

IFAW - Free-swimming Whale Assessment and Monitoring Datasheet

Marine Mammal Rescue and Research
Free-swimming Whale Assessment and Monitoring Datasheet

IFAW

Whale ID: ______________ IFAW#: ______________ Date: ______________ Location: ______________

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

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

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

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

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

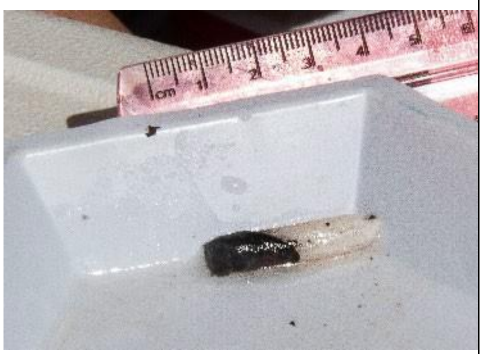
Entanglement Location: Head Mouth Flipper (R L) Body Peduncle Flukes **star locations with associated wounds and describe below*

Wound Description: ____

Initial Time on Animal: ______ **Sedation Attempted:** N Y (see Whale Sedation Datasheet) **Time off Animal:** ______

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

Appendix G – Tools and Techniques

Approach vessel (task boat) 	Typical platforms that make excellent approach vessels are soft-bottom inflatables between 3.5 and 5.5 meters (12 – 18 feet) in length. Such platforms typically accommodate closer approach work due to their responsiveness and simple layout.
Biopsy 	A sample of skin and blubber obtained for genetics, health assessment, and stress analysis. Biopsy samples are typically obtained with the use of darts shot from crossbows or air rifles.
Coughran "whale" knife 	Long-bladed knives.
Cut-on-the-fly 	No constraining of the animal prior to making a cut.
Cutting grapples 	A grapple with knife blades incorporated in its tines. These can be used as a disentanglement tool and as a safety tool, as they can be rapidly and remotely be deployed to sever an unanticipated and dangerous connection between the whale and the team.

Fixed knife 	A knife that remains attached to the pole. As such it is better served for entanglements further back on the body (*i.e.*, in which the user is more likely to stay out of the danger zone), for small to moderate-gauge lines (*i.e.*, shorter cut times), and fewer wraps (*i.e.*, fewer lines to cut and thus shorter time making cuts). Fixed knives may provide more control than a flying knife.
Flying knife 	The flying knife is appropriate for cutting: lines further up on the body in which initial placement might put the responder in harm's way, larger gauge lines that will require more time and effort to cut, and more complex entanglements. Flying knives provide more safety than fixed knives by allowing the cut to be made more remotely. A flying knife can be held into its socket adapter making it a fixed knife and released if circumstances dictate. The flying knife has the added advantage of being able to be attached to buoys or sea anchors, and letting the resultant buoyancy and/or drag forces make the cut, more remotely and with less exertion.
Grapple (jam, grab or flying) 	Grapples pinch a line between the tine(s) and the shaft, and are typically good for moderate holding times. A grab grapple is the most frequently used tool to get a hold of the animal via the entangling gear that otherwise is not accessible, at least initially.

Haulback system	In the event of approaching a relatively immobile animal, vessel support allows for a haulback system or an exit strategy. Haulback systems can represent a secondary line (*i.e.*, independent of a working line) that is secured to a large enough vessel to pull the approach vessel away from danger.
Kegging 	In those cases where the entangled animal has a limited surface interval, is fast moving, evasive, or otherwise inaccessible; and/or its movements are unpredictable and potentially aggressive; and otherwise appropriate for the animal, constraining techniques may be used. Such techniques have the goal of slowing the whale down (but not necessarily stopping it), keeping it at the surface, and controlling its movements somewhat (as much as one can control a multi-ton animal). The primary constraining technique is 'kegging,' a modification of an old whaling technique, in which harpoons attached barrels to add drag and buoyancy to slow and keep the whale at the surface. In this case, polyball buoys (typically A3 and A4) are methodically added to the established working line to create drag and buoyancy forces. Under certain circumstances, a sea anchor, a funnel-like device, may be attached to provide more drag.
Kegging buoys (Polyballs or Norwegian floats) 	Polyball buoys (typically A3 and A4), which are methodically added to the established working line to create drag and buoyancy forces.

Landry broadhead 	A broadhead arrow deployed from a crossbow (the Gobbler Guillotine), to cut a line forward on the body that might be under tension.
Ross timed-release clips 	Uses a predetermined galvanic releases built into the clips, like the loop of a pelican hook, to hold the clip closed until they dissolve and weaken in the saltwater. When used to attach the buoys to the entangling gear, they provide a predetermined defined time that the buoy will remain attached. Should a response not be possible, and the telemetry remain on, it should hopefully detach at a specified point in time.
Safety knife 	Personal, one-handed safety knife for personnel that are handling gear or in a position to possibly handle or interact with gear, especially if it might be attached to the animal.
Sea anchor/ drogue 	A funnel-like device that can be attached to provide more drag during the kegging process.

Skiff hook (mooring hook, flying carabiner) 	A skiff hook attached to the end of a pole can be used to establish a working line. This attachment technique has the advantage of greater accuracy of placement and is typically used to establish a secondary working line.
Slay whale knife	A pole-deployed guillotine knife for embedded lines.
Telemetry (package, buoy)   	The Network uses a combination of Argos (satellite), GPS-based and VHF radio transmitters housed in a single cylinder, as its primary telemetry package to track entangled whales for response purposes. The telemetry package is secured on a telemetry buoy (a 14” trawl buoy held within a stainless-steel collar), and attached to the entangling gear which typically is trailing behind the animal. The buoy is ballasted to maintain the transmitter in an upright position, clear of the water, and towed from a bail that allows the buoy to clear itself should it become fouled with debris or kelp.

Thompson blade 	Hooked knife that is sharp on the outside as well as the inside face, to allow cutting into tight and embedded gear.
VHF receiver and antenna  HIMB/ HIHWNMS/ NOAA Permit # 782-1438	Used to obtain real-time location of transmitter package.

Appendix H – Sample Training Agenda

Agenda
Large whale entanglement response training
Kodiak, AK
May 21 – 23, 2019

Classroom component:
Date: Tuesday, May 21, 2019
Start time: 09:00
End time ~ 13:00
~ 4.0 hours
Location: AK Fisheries Science Center (i.e. the touch tank) conference room

Hands-on components:
Date: Tuesday 21 (afternoon) and/or Wednesday 22, 2019 (morning)

Hands-on large whale response training
Timing: TBD based on weather and participants' schedules; typically, 3 – 6 hrs.
Location/ staging: Gibson Cove

Hands-on opportunity with whales (research and response)
Timing: Potential all day on Wednesday 22 and/or Thursday 23 (weather dependent)
Location/ staging: Gibson Cove, NOAA OLE vessel

Goals of response effort:

- Release some large whales from life threatening entanglements
- Provide experienced, authorized, well-equipped, and coordinated response - a safe, measured response that meets NOAA Fisheries safety standards.
- Increase awareness.
- Document/ gather information in order to assess impact and reduce risk.

Training objectives:

- Review of threat as background
- Review standard and proven operating procedures (including ICS)
- Provide framework to pool available resources, and best use of expertise and

Knowledge

- Hands-on with tools
- Continued capacity building w/ focus on safety, people, information
- Firsthand experience with animals
- Risk assessment

Main themes:

- Safety
- Gaining information

Agenda details:

Tuesday, May 21, 2019, 09:00 – 13:00 Classroom

Background and objectives (.25 hr.)
Safety and authorization (.5 hr.)
Awareness and reporting (.25 hr.)
Risk assessment and documentation (.5 hr.)
Monitoring (.25 hr.)
Disentanglement/ stand-down; 1.5 hr.)
Debriefs and entanglement investigation (.25 hr.)
Preparedness and strategizing (.5 hr.)

Tuesday, May 21, 2019, 14:00 – 16:30 – Shoreside hands-on:

Grapple throws
Polework
Telemetry review
Overview of all tools/ review of cache of gear

Wednesday, May 22, 2019, 08:00 – 12:00 - Hands-on, on-water training:

Approaching animals (incl risk assessment) (support/ approach boats)
Grapple throws to establish a working line/ telemetry
Line handling (walking up and back, bending, clearing)
Adding "kegging" buoy
Nantucket sleighride
Attaching the flying cutter (simulated via the skiff hook)/ using the poles)
Use of cutting grapple for disentanglement
Communication
Documentation (use of DSLRs and sitecams)

Telemetry (setup, deployment and receiving)
Entanglement response safety (Clearing gear - cutting grapple, safety knives)
Data (support boat and on cruise)
Debrief

Thursday, May 23, 2019, 08:00 – 13:00 – Hands-on, on-water familiarization with animals

Locating whales (use of indicators)
Safe approach to whales
Monitoring a whale (for standby support and animal behavior)
Photo-documentation – positioning the vessel

** Hands-on response training simulates an entangled whale by having a boat pull gear (line and buoys) behind it. Approaches are made from appropriate boats (preferably ones that would be available in a response effort) and folks are proficient in. Exercises include establishing a control line, safely handing the line, kegging the animal (adding buoys), tagging an entangled whale, cutting it free via use of long poles, addressing "what if" scenarios, documenting the all aspects, gather data, and maintaining safety.*

Key messages:

1. Human safety is first/ primary. Do not put the whale's rescue before personal and team safety.
2. The primary goal of the response is **not** necessarily to free the animal, but to provide a safe and measured response that may gain additional information towards reducing the threat for the animals and ocean users (e.g. fishermen) alike.
3. Large whale entanglement response is covered under federal permit and requires authorization.
4. Imagery and messaging need to be approved prior to media use.
5. There is no obligation to respond. Standing down is a viable option. However, if we do respond under the Network's authority there are obligations/ requirements to be met.
6. Primary means of reducing risk during response is to minimize time and proximity to animal. Stay out of the danger zone.

Appendix I – Response Checklist

Response Mission Checklist

(See individual instructions and checklists for details)

☐ Receive initial report

☐ Contact primary observer if report is secondhand

* Use ***report form*** to obtain and document all pertinent information to determine whether to and how best to respond.

☐ Notify core team/vessel support (availability and time)

☐ Alert any nearby on-water resources (selective)

Primary assessment:

☐ Assess animal/entanglement
- Confirmed?
- Severity (Life threatening?)
- Animal condition
- Animal mobility

☐ Assess response conditions (use weather websites, charts, nav. software)
- Weather
- Time-of-day
- Distance offshore (safety and response time)
- Someone standing by

☐ Assess resources:

- Primary response platform and assoc. crew
- Responders (determine whether personnel resources are available)
  - Vessel crew
  - Level 3 and 4 responder(s)
  - Approach boat crew
  - Other required roles and responsibilities
- Support platforms (if not addressed above)
  - USCG (surface and/or aerial)
  - Aerial (e.g., Helicopters)
  - Researchers or other rapid responders that may already be on water

*** See *Personnel/Support Contact Matrix***

If response deemed appropriate/possible:

Pre-departure:

☐ Notify agency leads/approvals

☐ Establish communications person. Begin relaying information on report and preparations for response

☐ Establish ***float plan*** and shore-side contact (may be 1º communications person)

☐ Obtain shore-side gear (see ***gear checklist***)

☐ Ready response vessel/provide vessel safety orientation and mission brief prior to departure (per captain's instructions and ***vessel startup checklist***)

☐ Stow and secure all personal and shore-side gear

☐ Turn on GPS handheld or tracking software

☐ Prepare datalogger/report forms. Enter mission data and passenger manifest. Send floatplan.

☐ Perform GAR (mission/vessel ops risk assessment; proceed or abort)

☐ Establish roles:

______________________ Observer to assist captain while underway. May rotate into another role (e.g. documenter) once on site

______________________ Safety (likely stationed on bow during support ops and responsible for cutting grapple)

______________________ 1º Photographer

______________________ 1º Videographer

______________________ Gear person (know gear locations and assist with setups)

______________________ Communications (assist captain with relaying info/updates to shoreside POC. Capt. will do ship-to-ship

______________________ Data (Log all events and response steps. Use datalogger or data forms

______________________ 2º Photographer/videographer

Underway:

☐ Watch speed/have dedicated observers

☐ Prepare gear:

☐ Setup a polecam (GoPro on end of a pole)

☐ Setup a Boatcam (GoPro attached to vessel)

☐ Setup Helmetcams (helmets with GoPros)

☐ Setup a GoPro on inflatable instrument bar (if available)

☐ Setup telemetry and check for functionality. (Follow ***telemetry instructions***)

☐ Documentation familiarization and setup (see ***documentation checklist and instructions***)

☐ Setup two throwlines with buckets – one with medium grab grapple and the other with a cutting grapple. Know tool locations

☐ Inflatable setup (If warranted, begin inflation of approach vessel under direct instruction and supervision of captain)

☐ Communicate with any on-site resources (e.g. standby vessels)

**** On site/ Find animal (everyone should be looking)**

Secondary assessment:

☐ Assess animal/entanglement (get initial photo and video documentation)
Confirmed?
Severity (Life threatening?)
Animal condition
Animal mobility
Nature of entanglement (parts of body involved. type of gear, # wraps)

☐ Assess on-site response conditions
Weather
Time-of-day
Distance offshore (safety and medevac time)

☐ Assess resources (based on the additional information):
Responders (degree of experience on-site)
Support (Amount of support)
Equipment/ tools

☐ Establish preliminary action plan and review GAR (risk assessment)

☐ Update shore-side communications POC

Primary response:

**** Continue to monitor the animal**

☐ Pre-brief on action based on on-site and secondary assessment
Review action plan
Re-establish/confirm roles (see ***personnel matrix***)
Review safety protocols (see ***safety overview***)
Establish working channel and communication protocol

☐ Launch inflatable (**Do not launch until stopped and with captain's permission**.)

☐ Monitor response (e.g. conditions, animal behavior, personnel)

☐ Communicate between platforms

☐ Update shore-side communication

☐ Maintain safety

☐ Log actions (**use datalogger** or ***appropriate data forms***)

☐ Document (see ***documentation checklist***)

Post event (disentanglement efforts):

☐ Sampling (i.e. biopsy - see ***documentation checklist***)

☐ Documentation (continued – obtain images of freed animal)

☐ Update shore-side communication to notify core network members of outcome

☐ Deflate and stow inflatable for travel

☐ Stow gear

☐ Contact media coordinators and coordinate with public relations dept.

Underway for home:

☐ Watch speed and have dedicated observers

☐ Short de-brief

☐ Compile notes

☐ Update shore-side communication

☐ Assign roles for handling data and documentation (video, stills, tissue samples – see ***Documentation checklist*** for details)

Back at Harbor:

☐ Secure vessel

☐ Remove personal and shore-side gear

☐ Clean, inventory, and stow gear

☐ Stow and re-check telemetry gear (see ***telemetry instructions***).

☐ Wash down vessels and rinse engines

**** See vessel shutdown, post event, and media checklists ****

Follow-up:

☐ Complete data forms; enter data into database

☐ Update website (if applicable) and notify network

☐ Full debrief

☐ Prep vessel (fuel, oil)

☐ Prep gear (charge batteries, clear cards, re-stock, etc.)

☐ Thank you letters

☐ Reports

☐ Update effort lists

* Note anything that needs repair (e.g. outboard) or is low in supply (e.g. oil)

Revised June 21, 2020

TELEMETRY INSTRUCTIONS

For GPS/ Argos transmitter package
Juneau

The following set of instructions outlines basic information required to maintain, deploy, and retrieve data from a GPS/ Argos transmitter package used to monitor entangled whales.

The Telonics, Inc. GPS transmitter package is in fact three transmitters in one. It houses GPS, Argos PTT, and VHF transmitters. The advantages of the package are as follows:

- Greater accuracy and increased number of fixes through GPS technology.
- Argos PTT provides duplicity to and the means of obtaining the GPS data
- GPS and Argos-based systems provide broad-scale monitoring, while the VHF transmitter provides real-time tracking / re-location.

Maintenance

1) **Do not** store the tag near ferrous metals. The transmitter utilizes a magnetic reed switch, which may be compromised by surrounding metals.

2) Test the tag (and receivers) at least every 6 months. Allow tag to transmit for at least 2 hours. This will actually extend the tag's battery lifespan.

3) Remove or disconnect the batteries (9 volts) in the receiver (TR-4) and/or UHF tester (TSTR-4) until they are needed.

4) Store transmitter and receivers in an enclosed, dry location, preferably at constant room temperature. Cold temperatures will shorten battery lifespan and changes in temperature may cause condensation within electronics.

Operation

GPS fixes are obtained once every hour and stored on board. However, the system is equipped with the Argos PTT option and thus can relay data back to the user while the system is deployed. This is done by transmitting data to the "Argos Data Collection and Location System (DCLS)' carried aboard the polar-orbiting NOAA satellites. The satellites then forward this data to Argos-based ground stations. Fixes are then emailed to the Argos contract holder (Ed Lyman, Hawaiian Islands Humpback Whale National Marine Sanctuary) and the NMFS Regional Stranding Coordinators. One should expect delays between transmission and receiving the location data of as much as several hours. In addition, data is updated on the hour. The transmitter duty cycle is 24 hours.

Preparing the GPS/ Argos transmitter package for use is a bit more involved than just turning on the transmitter and deploying. For the GPS component of the tag to be functional it is essential that the tag obtain a GPS fix on its initial attempt. If the GPS transmitter is unsuccessful, it will not automatically attempt to reacquire a GPS fix, and you will need to shut the transmitter down and try again. For this reason, you should perform the system initialization well **BEFORE** deployment and monitor the process during initialization. During the period of time after initialization and before deployment, the GPS System should be stored outside with a clear view of the sky. This will reduce the amount of time and energy required to receive scheduled GPS position fixes. If stored inside, then each position fix attempt will consume the maximum amount of battery power. In addition, you may get position fixes prior to deployment that would also confirm the package's successful initialization.

It cannot be emphasized enough that the initialization procedure should be performed well BEFORE deploying the GPS transmitter package!

To monitor the GPS transmitter, and for that matter the VHF transmitter, you will use the VHF receiver tuned to the frequency of the onboard VHF transmitter. During the startup and initialization, the VHF transmitter will admit different series of pulses to inform you on the success or failure of GPS initialization.

VHF beacon monitoring pulses:

Very rapid pulses: The beacon utilizes these pulses to indicate special events.

4 pulses = system startup or system shutdown.
3 pulses = begin or end of GPS position acquisition. (*not* in Spread Spectrum systems)

Special Pulse Patterns: These are used to indicate system status.

2 pulses, pause, 2 pulses, pause – repeat = last GPS fix successfully acquired.
3 pulses, pause, 3 pulses, pause – repeat = last GPS fix not acquired
4 pulses, pause, 4 pulses, pause – repeat = system failure – call Ed Lyman
1 pulse, pause, 2 pulses, pause – repeat = main system battery pack exhausted.
1 pulse, pause, 3 pulses, pause – repeat = beacon's Real Time Clock not set.

The following ***MUST*** be performed in an area that allows the GPS System to have an unobstructed view of the sky. ***DO NOT*** attempt initialization inside a building, a boat cabin, or even a narrow fjord (for Alaska responders).

NOTE: NO OTHER RADIO DEVICES SHOULD BE ACTIVELY TRANSMITTING

Pre-deployment Checklist

☐ Note the frequency of the VHF tag and the platform number of the satellite GPS transmitter. Frequency and ID are written (and typically also engraved) on the side of the transmitter package. They are also noted below for your respective transmitter package:

VHF tag frequency:

151.820 (Channel 98 on TR-4 receiver)

Satellite tag platform ID:

108221

☐ Place the GPS system in an outdoor area where it will have clear access to satellites (no obstructions, including your body, above 10 degrees from the horizon). It is best to have the transmitter's antenna perpendicular to the horizon.

☐ Turn on the VHF receiver and tune to the VHF beacon frequency. You don't have to hook up the antenna, but should at least attach the coaxial cable. This will be enough of an antenna while you are testing the transmitters.

Note: TR-4 receivers are preprogrammed for 100 different discrete frequencies. The program sheet (found in the side pocket of the TR- 4 receiver's soft case) is used to determine which program number on the receiver corresponds to a given frequency.

TR-4 Receiver

☐ Remove the magnet and listen for the VHF beacon transmitter to begin, which should occur 7 seconds after pulling the magnet off. The beacon should pulse very rapidly 4 times, slowly a couple of times, very rapidly 3 times, and then go silent again. **Start your stopwatch now.** This sequence indicates that removal of the magnet has been sensed and that initialization has begun. VHF beacon transmissions are suspended during a position fix attempt to prevent interference with the GPS receiver. While the beacon is silent, the system is attempting to acquire its first GPS position. Use your stopwatch to measure the duration of the silence (the time the VHF beacon is *not* transmitting). This period typically lasts from 2 to 5 minutes. However, there may be cases where the silence could be as short as 20 seconds, or as long as 23 minutes.

☐ If the beacon is pulsing out a pattern of 2 beeps, pause, 2 beeps, pause, when it starts back up, then the initialization was successful and the GPS system has initialized properly. **However, if it took more than 9 minutes to acquire the position fix, it is recommended that you perform the initialization procedure again. Subsequent attempts to initialize should typically require only 2 to 5 minutes.** To do this, place the shutdown magnet on the system for at least 1 full minute, and then start the initialization procedure again at step 4.

If the beacon is pulsing out a pattern of 3 beeps, pause, 3 beeps, pause, then the last position fix attempt was unsuccessful, regardless of how long the attempt took. Shut down the GPS system by applying the magnet for at least 1 full minute. Verify that the system GPS antenna has clear view of the sky (no obstructions, including your body, above 10 degrees from the horizon). Reorient or relocate the system as required. It's possible that the system was unable to fix position due to poor satellite geometry (a temporary condition). If unsuccessful on the second attempt, wait 20 minutes before attempting to initialize the system again.

If the beacon is pulsing out a pattern of 4 beeps, pause, 4 beeps, pause, then the internal system failure has been detected. In this case, DO NOT DEPLOY THE SYSTEM. Call Humpback Whale Sanctuary/ Ed Lyman (808 – 264-8023).

These Special Pulse patterns will continue for a few minutes and then the VHF beacon should resume normal transmissions (single pulses every second).

NOTE: DO NOT DEPLOY THE SYSTEM UNLESS THE INITIAL GPS POSITION FIX HAS BEEN SUCCESSFULLY ATTAINED. IF THE GPS SYSTEM FAILS TO SUCCESSFULLY OBTAIN THE INITIAL FIX, IT WILL NOT ATTEMPT TO OBTAIN ANY FURTHER FIXES.

THE INITIAL GPS POSITION FIX ATTEMPT MUST BE SUCCESSFUL!

☐ If the GPS has successfully acquired its first fix and is now transmitting notify Ed Lyman of Hawaiian Islands Humpback Whale National Marine Sanctuary at (808) 264-8023, or email at Ed.lyman@noaa.gov, and/or contact the regional stranding coordinator. This will give them a heads up on the incoming data and allow them to provide you with fixes as soon as possible.

☐ By now you will know whether the VHF transmitter is working or not, but the transmitter still needs to be fine-tuned to account for any frequency drift, and maximize reception when it comes time to relocate the animal. Tune by turning the fine-tuning knob until you get the strongest, higher pitched return. Note this value for later.

☐ Attach the transmitter package to the rescue buoy by placing it in the buoy's center receptor (the snorkel) and securing it by use of a retaining bolt through the base of the snorkel and hole in the transmitter's tab located at the bottom of the unit.

☐ Attach a galvanic release, timed-release clip to the telemetry buoy via the swivel clip attached to the buoy's bail. The fixed side (smaller opening) should be attached to the buoy. The larger opening or side that opens should then be attached to the tether line (normally 70 – 80 feet in length). The timed-release will dissolve in approximately 10 - 14 days (depends on temperature and salinity) such that if no response is possible within that time frame, the galvanic release will dissolve, the clip will open, and allow the buoy to become detached, and thereby reducing additional impact to the animal. See time-release clip manual for additional details.

Timed-release clip

The length of the tether line may have to be adjusted, and the means of attachment to the entangled animal depends on the entanglement and how close you are able to get to the entangling gear (attachment point). Several options for attaching to the entangling gear (the whale) are: tying the buoy's tether or the buoy itself directly to existing gear, grappling the buoy into gear, and reaching out with the flying skiff hook and poles to attach the buoy to the gear.

The important thing to remember is, one, that the attachment of the telemetry buoy is done safely (for rescuers and whale). Two, that the attachment be reliable and functional, while minimizing the threat of increasing or complicating the existing entanglement.

Note: If a tag buoy is retrieved or tag set up, but not used, then remember to turn off transmitters by replacing the magnet back on the marked position on the top of the transmitter. Utilize the UHF and/or VHF receivers to determine whether tags are indeed turned off (see shutdown procedures below).

Users should note the exact time and location when a tag is deployed or recovered from a whale. The data from the tag will allow initial calculation of velocity and a complete picture of the animal's track.

Monitoring

VHF

There may be either a 2-element, (Nerf antenna) or a 3-element, fold up antenna, or perhaps both in your telemetry kit. **The 3-element antenna is the better antenna and should be used if conditions allow (see separate instructions in responder binder)**.

1) Assemble antenna (for 2-element antenna there may be a pair of shorter elements. If so, make sure they are screwed on forward; for the 3-element just fold out elements and tighten wingnuts) and attach to TR-4 receiver via coaxial cable.

2) Determine program number matching transmitter's frequency and enter that number into the TR-4 receiver. Set fine tune to value already determined during deployment. Initially set gain to point where you lose static. When you start picking up the transmitter's signal you may reduce gain even more. Lowering the gain will assist in directionalizing on the signal. Use headphones. There will either be basic headphones in the side pocket of the TR-4 receiver or a separate, higher quality, over-ear set in the kit.

2 – element Yagi antenna

Note: there is a front and back reception lobe to the antenna. You can pick up signals behind you as well as in front of you. Longer elements are to the rear.

3) Holding the antenna:

a. Always hold the antenna out and away from the body. Always use the handgrips that are provided. Stand behind the antenna, keeping your body at least arms length away from rear element. The rear element is always the longest element.

b. Holding the antenna higher is better. If possible, mount antenna to a pole (yard) to gain height.

RA-17, 3-element antenna

c. Whether hand-held or pole-mounted, keep coaxial cables, wires, other metal object, especially if wet, away from antenna. Do not bend elements (RA-17). If bent they can be straightened or replaced.

d. Hold the antenna vertically (antenna rays oriented vertically) until you get a hit. In this plane you typically get a more omni-directional reception lobe and greater range. When you get a hit turn the antenna horizontally to typically get better directionalizing capability.

e. Listen for differences in signal strengths as you rotate the antenna. You may notice that holding the antenna in one plane versus another may provide stronger signals. This has to do with the orientation or polarization of the two antennas (the transmitter's and receiver's).

f. To obtain a line of position (LOP) to the animal, you may have to estimate the midpoint of a sector in which you receive a signal and note the compass bearing. Since the tags only transmit at the surface and a surface interval may only last several seconds (several hits), you may have to work fast. This is one of your biggest hurdles. You may also have to deal with obstructions that block signals or cause secondary signals that have bounced off other objects (e.g. a mountain side). Be aware that VHF telemetry is only line-of-sight and depending on your platform height, you may only be able to pick up the transmitter from several miles (typically 4 - 7 nm) away.

Unless you have several stations picking up signals in order to triangulate compass bearings, you will have to keep refining your single bearing while you continue to move closer to the signal source.

Satellite

Hopefully once the GPS/ Argos transmitter has been turned on, then whenever an Argos satellite passes overhead Argos-based and GPS-based fixes on the buoy will be obtained. These will be sent to a ground station and processes. Fixes will be emailed to the Argos contract holder (Ed Lyman – Hawaiian Islands Humpback Whale National Marine Sanctuary, regional stranding coordinators, and the National Large Whale Entanglement Response Coordinator).

Shutdown

There is only a single control for starting up and shutting down the GPS System – the shutdown magnet. Should you need to shut it down again, use tape to secure the magnet back onto the top of the transmitter in the proper position (as indicated by a depression).

Thirty seconds after applying the magnet, the system will enter its shutdown mode, as indicated by the VHF beacon ceasing all transmissions.

If there are any questions please don't hesitate to contact Ed Lyman at (808) 264-8023.

Revised: October 2018

Timed-release clip for Large Whale Entanglement Response
(AKA Ross Clip)

Background and Justification: In authorized large whale entanglement response efforts, buoys meant to track an animal for later response, or to slow it down and keep it at or near the surface, are at times added to the gear entangling an animal. These buoys by their very nature and/ or purpose provide drag and buoyancy that can negatively impact the animal. As in any procedure, a risk assessment is performed to determine whether the use the buoy is warranted. This involves weighing the risks from the additional drag force and the impacts the added buoy may cause, to the benefits of re-locating and subsequently freeing an animal from a life-threatening entanglement. Typically risks and impacts to the animal(s) increase over time. The longer the buoy(s) is on the animal, the more sever the impact from drag forces associated with the buoy are likely to be. While low-drag telemetry buoys have been investigated (Ross, pers. comm.; Woodward, pers. comm.), they have yet to provide an adequate solution, and while any buoy is added with a short-term resolution in mind, sometimes for a variety of reasons (some aimed at reducing human risks), buoys are left on the animal for longer than anticipated. The use of the Ross timed-release clips, that incorporate easily-obtained and dependable galvanic releases, can mitigate the longer-term risks associated with added drag and buoyancy forces through dependable release of the added buoy(s) at a user-defined time.

Objectives on use: Use of galvanic releases incorporated in custom-made clips to safeguard against impacts caused by unanticipated long-term attachment of kegging and telemetry buoys to gear entangling large whales. In addition, the clips will likely decrease operational risks by allowing the use of telemetry in circumstances where timely response cannot be assured, such as tagging an animal during its migration, and/or feeling pressured to respond or recover a buoy at times and places a response should not be mounted. In cases of weighted gear coming off an animal, and at shallower depths (*i.e.* 1000 feet or less), the time-releases may allow the telemetry to be recovered once it returns to the surface and starts transmitting again.

Description: The Ross clip is essentially a modified (custom-made) Pelican hook that instead of the loop that holds the clip closed, incorporates a galvanic release to allow dependable, accurate, and user-defined temporal release. Different galvanic releases can be selected to accommodate different release times based on assessment of entanglement and animal, response parameters, and water chemistry affecting dissolution rates of the releases.

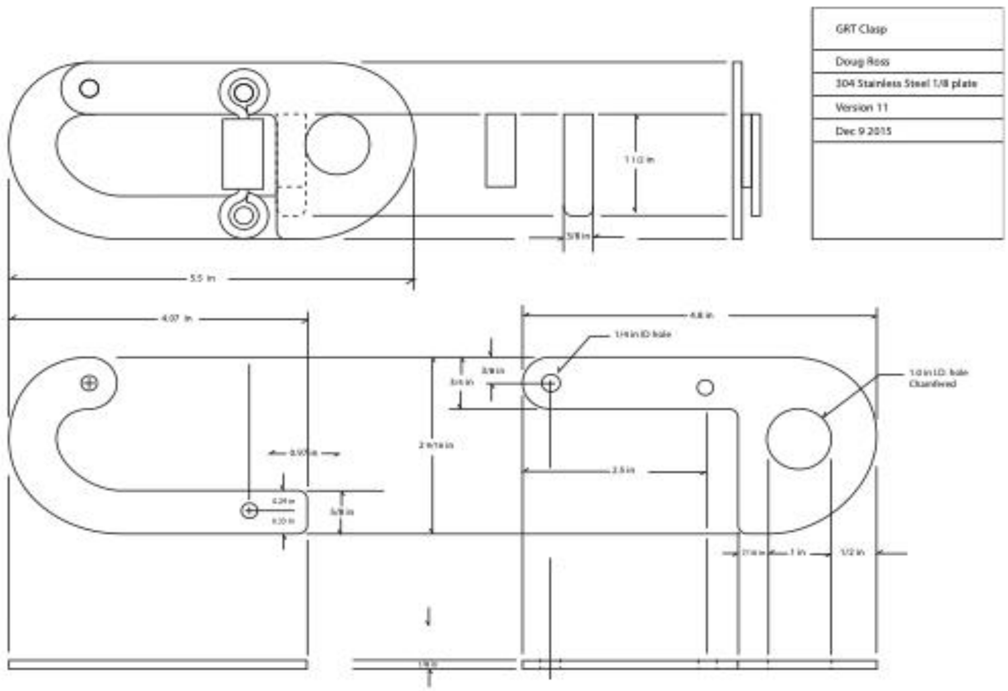


Figure 1: Schematic diagram of prototype Ross galvanic timed-release clip (D. Ross)

Future improvements: Many improvements have already been made. However, the use of round-stock, rather than plate stainless steel, are in the works.

Image of prototype galvanic timed-release

Instructions on use

Maintenance/ storage:

The clips themselves are stainless steel and fairly immune to effects of moisture; however, the galvanic releases are not and will start to dissolve if wet or even moist. **Clips must be stored in a dry location**.

If the galvanic releases have been used for more than 2 days (cumulatively) or are pitted (as opposed to smooth or burnished), then the galvanic release itself should be replaced. After removing the old galvanic release, keep all hardware; it will be used to mount the new release. If the release eyes do not match up (are not on the same plane), they can be slowly turned with a pair of pliers to line up. On securing to the clip, it is critical that the eyes, and thereby the galvanic release, be isolated from the rest of the clip by using either nylon or neoprene washers on either side of the eyes. Again, releases **need to be isolated from the rest of the clip to work properly**. Some models of the ROSS timed release have one eye floating in a socket (on release this allows the clasp side to be entirely free of any hardware and thus allow the tethered line to release cleanly), while others are secured on both side. If replacing an entirely spent galvanic release and working with the floating attachment model, you will need replacement hardware (10x24 ¾" SS) for attaching the one side of the galvanic release. Either way, the **hardware securing the galvanic release to the clip needs to be tight** or it might fail (see images).

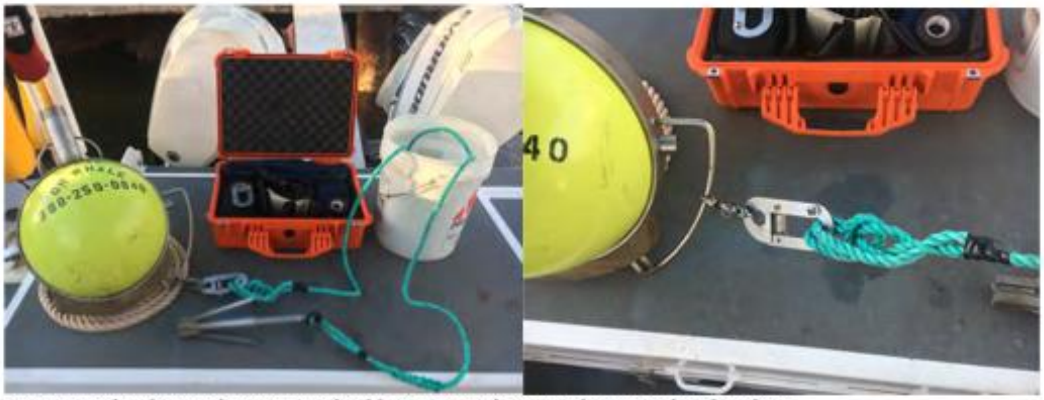
A new galvanic release isolated from the clip.

A burnished, un-isolated relase

Preparation:

The clips are attached at or near the buoys. For the telemetry buoy, the clip's smaller opening is secured to the existing clip attached to the buoy's bail. The tether line is attached to the larger opening either by using a knot (recommend a bowline with bitter end secured), or securing the clip on a spliced eye if it exists.

Make sure the galvanic release is fairly new (not pitted or smaller in diameter) and isolated, that the release hardware is secure/ tight, and that the tethering line and buoy are secure.



Ross timed-release shown attached between telemetry buoy and tether line.

Deployment:

The clip adds little complexity to the overall deployment and handling of the control line, thus maintaining minimal risk. Once the clip is secured to the telemetry buoy, deployment is really no different. It represents little threat of becoming caught in the entanglement or worse yet, catching a member of the team, since the clip resides right at the buoy. However, their use for kegging buoys may cause added risk as the user will have to work with the extra hardware and be aware of additional risks (snags and/or bangs). As always handle the gear with caution and make sure gear it is deployed on your terms (DO NOT let the animal take gear out of the boat).

A pitted galvanic release in need of replacement and a spent timed release in need of a new galvanic release. Not the missing hardware on the open clip side.

Appendix L – Risk Assessment GAR

Disentanglement Risk Assessment

OPERATIONAL DISENTANGLEMENT RISK ASSESSMENT

		Comments
Weather Conditions		
Max score = 5		
Responder Experience Level		
Max score = 5		
Complexity of Operation		
Max score = 5		
Animal Behavior		
Max score = 5		
Disentanglement Gear Condition		
Max score = 5		
Operating Area		
Max score = 5		
Resources Available		
Max score = 5		
Boat & Crew Fitness		
Max score = 5		
TOTAL RISK	0	
Max Total Score = 40		

WHALE RISK ASSESSMENT

		Comments
Age Class of Animal		
Max score = 5		
Number of Lines		
Max score = 5		
Number of Wraps		
Max score = 5		
Lines Cutting In		
Max score = 5		
Additional Weighting of Gear		
Max score = 5		
Degree of Cyamid Coverage		
Max score = 5		
Body Parts Involved		
Max score = 10		
TOTAL RISK	0	
Max Total Score = 40		

GREEN = 0 - 14 (Go, Low Risk)
AMBER = 15 - 28 (Use Extra Caution)
RED = 29 -40 (Stop, High Risk)

OPERATIONAL DISENTANGLEMENT RISK ASSESSMENT

Anticipated Weather Conditions and Forecast (Max score is 5)

Category	Score
Beaufort sea state 0	1
Beaufort sea state 1	2
Beaufort sea state 2	3
Beaufort sea state 3	4
Beaufort sea state 4 or greater	5

Responder Experience Level (Max score is 5)

Category	Score
Level 5 responder	1
Level 4 responder	2
Level 3 responder	3
Level 2 responder	4
Level 1 responder	5

Complexity of Operation (Max score is 5) * Use whale risk assessment score*

Category	Score
Whale Risk Score 6 - 12	1
Whale Risk Score 13 - 19	2
Whale Risk Score 20 - 26	3
Whale Risk Score 27 - 33	4
Whale Risk Score 33 - 40	5

Animal Behavior (Max score is 5)

Category	Score
Anchored animal	1
Free-swimming, highly approachable	2
Free-swimming, short time on surface	3
Free-swimming, highly evasive, terminating surfacings, short time on surface	4
Free-swimming, highly evasive, terminating surfacings, short time on surface, other animals present	5

Disentanglement Gear Condition (Max score is 5)

Category	Score
All gear needed is present, working, new condition	1
All gear needed is present, working, moderate cond	2
All gear present, working, bad condition	3
Minor gear missing, majority functioning	4
Moderate gear missing, majority functioning	5
Majority gear missing, majority non-functioning	

Operating Area (Max score is 5)

Category	Score
Within 5-10nm from shore	1
Within 11-15nm from shore	2
Within 16-20nm from shore	3
Within 21-25nm from shore	4
Within 26-30nm from shore	5
Greater than 30nm from shore	

Resources Available (Max score is 5)

Category	Score
Aircraft, addtl vessel, mother ship support	1
Addtl vessel, mother ship support	2
Small addtl vessel support	3
Only aircraft support	4
No additional resources available	5

Boat & Crew Fitness (Max score is 5)

Category	Score
Crew well rested, boat in great shape	1
Crew moderately rested, boat in good shape	2
Crew rested, boat in fair shape	3
Crew tired, boat in good shape	4
Crew exhausted, boat in poor shape	5

Anticipated Weather Conditions & Forecast:

Is the forecast and expected weather conditions conducive to conducting a disentanglemenmt operation? Is there enough daylight remaining to initiate a disentanglement operation, or is there adequate time to deploy a tag and regroup when conditions are better? What effects will changing weather conditions have on operations? Can adjustments be made quickly or operations terminated in the event that the weather deteriorates? Can any added equipment or drag to the animal safely be removed prior to leaving the animal at the end of the day?

Responder Experience Level:

Do the responders have the proper training, experience and authorization to conduct the disentanglement mission? How familiar are the crew with the entanglement configuration? How familiar are the responders with the operating platform? Do the responders have the equipment and experience to properly assess and obtain biopsy samples (also see Resources Available)? Do the responders feel comfortable in attempting to conduct a disentanglement operation, is this true for everyone on board the responding vessel?

Complexity of Operation:

These value is taken from the Whale Risk Assessment Component. It focuses on: What is the nature and configuration of the entanglement? Are the flippers involved? Is the mouth involved? Are there significant injuries associated with the entanglement that would limit any additional drag being applied to the animal? Is there any trailing line behind the animal, enough to motor up to and acquire? Has the animal been the focus of a disentanglement previously that might influence its current behavior? Is the animal's behavior uncooperative to attempt a disentanglement (also see Animal Behavior)? How much daylight is left for operations?

Animal Behavior:

How approachable is the animal? Is the animal traveling, if so, how fast and what is the surfacing times, is it adequate to make any attempts? Has the animal been the focus of a disentanglement previously that might influence its current behavior? Is there more than jus the entangled animal? Is it a mother/calf? Are the animals in a SAG?

Disentanglement Equipment Available:

Are the appropriate disentanglement tools available? Are there specialty tools needed to properly address the entanglement? Is there telemetry available to deploy to buy additional time to get the appropriate tools required? Are there multiple tools available in the event that a tool is lost overboard? Are there multiple cutting tools available depending upon severity of line constriction on animal?

Operating Area:

How far from shore is the animal (NOAA small boat policies)? What resources will be available in a remote area where USCG or medical services will not be easily accessible? Will boat traffic, floating debris or tidal/current changes have an impact on the operations?

Resources Available:

Are the appropriate reqources available onboard the responding vessel (i.e. cutting and attachment tools, telemetry tag and buoy, additional floatation, documentation equipment, etc)? Are there any additional resources readily available if needed (i.e. USCG vessel near-by, additional research vessels in vicinity, aircraft support, etc)? Do the responders have biopsy equipment? Is there a satellite phone available if VHF communication equipment doesn't work? Has a float plan been filed?

Boat & Crew Fitness:

Is the boat in good working order? Has it undergone all needed recent preventative maintenance? Are all of the communication equipment onboard functioning properly? Is the crew well rested or were they required to drive long distances to get there? Has the overall mission compromised health or added stress? Do any of the response crew have medical conditions that might prevent them from safely participating in the mission?

Appendix M – LWER Decision Matrix

Severity →

Likelihood ↑	A Negligible	B Minor	C Moderate	D Major	E Catastrophic
V. Very likely	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
IV. Likely	Minimal Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
III. Possible	Minimal Risk	Low Risk	Moderate Risk	High Risk	High Risk
II. Unlikely	Minimal Risk	Low Risk	Low Risk	Moderate Risk	High Risk
I. Very unlikely	Minimal Risk	Minimal Risk	Low Risk	Moderate Risk	Moderate Risk

Appendix N – Criteria for Determination Large Whale Entanglement Confirmation

In an effort to standardize the reporting and subsequent analytical use of large whale entanglement case numbers, we are instituting a nationally consistent, standardized definition of what constitutes a "confirmed" large whale entanglement case. The Regions provided the criteria that they currently use to determine if a reported entanglement case is considered to be a confirmed case (regardless whether it is a new case or a resight of a previously known case), versus an unconfirmed entanglement case, and a national standard was created based on this input.

Suggested National Criteria

Three different levels for entanglement case confirmation:

Entanglement- attached human-made materials (ropes, nets, line, debris, etc.), with or without associated materials (hooks, buoys, anchors, pots/traps, etc.)

1. Confirmed = criteria met on the affirmative that the animal was indeed entangled.
2. Unconfirmed = not enough information to successfully meet the criteria for confirmed; cannot be determined whether an animal is entangled or not.
3. Not Entangled = enough information provided to positively confirm that the animal was NOT entangled.

<u>Confirmed</u> = Large whales with attached human-made materials (may include rope, net, monofilament line, or debris), with or without associated materials (hooks, buoys, pots/traps, etc.). Relative severity of the entanglement (minor - life-threatening) does not matter for case confirmation. It is possible for a confirmed case to not have all of the details (exact species of whale, location, type of gear, etc.).

Reasons to deem a report "confirmed" can include:

- Photographic or video evidence (IDEAL);
- NOAA staff has direct visual observation;
- The report came from a trusted source (trained or professional observer);
- A follow-up interview of the reporting party was conducted by an experienced network member (Level 3+) or agency expert, using non-leading questions, and the network member/agency expert believes that the whale was entangled; or
- Corroborated, independent, and multiple sources of reports have been received with detailed descriptions of the animal and entanglement

<u>Unconfirmed</u> = Based on the information obtained from the reporting party, it cannot be confirmed if there are human-made materials attached to the animal.

Reasons to deem a report “unconfirmed” can include:

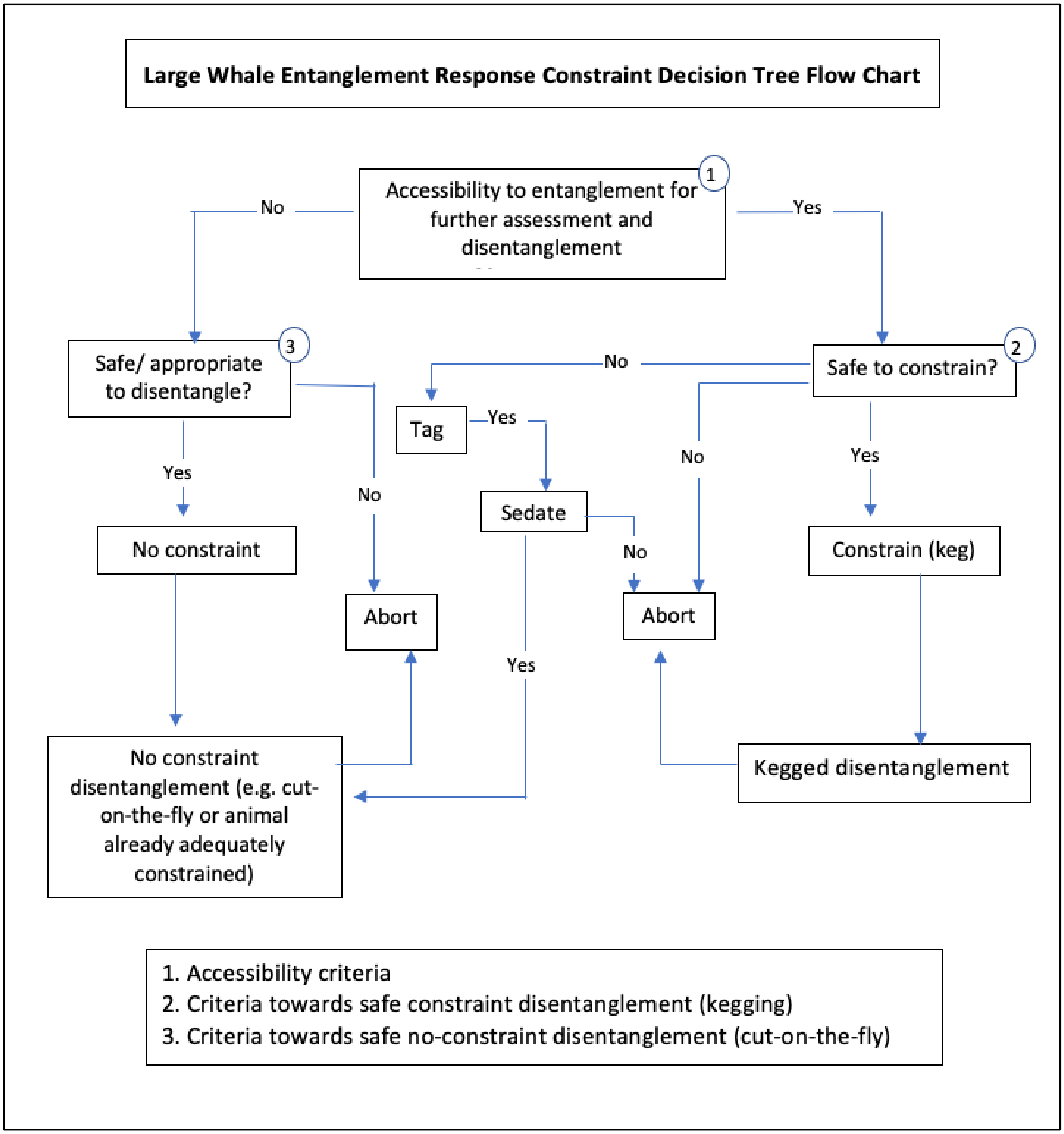
- No documentation/confirmation from photographic or video evidence (including only having photos of the whale that do not show any gear);
- Report from non-trusted source (untrained observer, general public);
- Information not able to be confirmed by follow-up interview or corroborated by subsequent reports
- Presence of gear in the vicinity, but unable to determine if attached to animal (whale logging near buoys, whale swimming/thrashing near fishing gear)
- Vague, uncertain, or limited descriptions
- 2^{nd} or 3^{rd} hand reports

Common incidents for this are they saw white on the animal (humpback flippers), there was a buoy next to the whale and it wasn't moving (potential logging), whale was thrashing about next to buoys. The report came from a non-trusted source (untrained observer, member of the public, etc.), the report is vague, the reporting party seems overly emotional or willing to say anything to provoke a response, or a limited/uncertain description, single sighting, or second or third-hand report.

Not Entangled = Documentation shows no gear attached to the animal. These may initially be considered “unconfirmed,” but we acquire additional information that confirms that the animal was not entangled. Either gear was not ever present (common incidents for this are scars or other newly documented entanglement trauma), or gear was present in the area or on the animal but was not attached to the animal (animals interacting with gear but the gear does not become attached to the animal).

In certain situations, a group assessment (independent blind evaluation of reports with subsequent comparison of results) may be used to make the final category determination.

Appendix O – Constraint Flowchart/Decision Chart



Appendix P – Heightened Consultation

Highlights the procedural and safety considerations on the following topics:

a. Case-by-case differences
b. Tool options - fixed knife, flying knife, cutting grapple
c. "Danger zone" and proximity to the whale, particularly near flukes
d. Qualifications for boat captain as far as experience and training in entanglement situations or large whale science studies
e. Stand down option at any point in the operation

Heightened consultation represents consultation with regional-specific leads (GAR/SER - David Morin; WCR - Justin Viezbicke, AK/PIR/WCR - Ed Lyman, any - Sarah Wilkin) with:

a. Detailed assessment of entanglement
b. Proposed course of action (can include telemetry buoy with future cutting)

If contact cannot be reached (out of cell service, unavailable):

Level 3s only authorized to document above water, no pole cams, tagging or cutting.

Level 4s authorized to document and apply tag, no cutting

Level 5s authorized to document, tag, cut anything on any species except right whales (which will be authorized on a case-by-case basis)

Appendix Q – Response Briefing/Incident Action Plan Sample

GENERAL BRIEFING	1. INCIDENT NAME	2. OPERATIONAL PERIOD	3. INCIDENT ID
	Pinos Mn crabtrap	First	2015May05Mn

4. INCIDENT SUMMARY **Nature of Distress or Injury**

Mn w/ obvious entanglment
BlueSteel around peduncle at fluke insert
trailing about 50' behind w/ 2 floats –
one white, one red-over-green

Looks freshly entanlged, but not likely to
shed on its own
Presently traveling with two other Mn

Responding Party (RP)/Vessel
Alsia Schulman-Janiger / Sea Wolf MBWW

RP Contact Information
Cell: 818 555-1234

Date and Time of First Sighting: 2015 May 05 / 14:30
Time Report Received: 15:15

Species (if known, otherwise a general description): humpback – Mn
Est. Size/Age Class: 30' subadult

General Locality
~ 5nm NNW of Pt. Pinos

Latitude: 36° 41.15'N
Longitude: 121° 58.11'W

confirm format
~~decimal degrees (nn.nnnn°)~~
decimal minutes (nn°nn.nn')
~~degrees min sec (nn°nn'nn")~~

Direction of Travel, Speed
SW 3kts

Weather/Sea State
partly cloudy, NW 5<10, swell 5'-7', <3' chop

5. COMMUNICATIONS PLAN

FUNCTION	MODE (Mobile Phone or VHF)	NUMBER OR CHANNEL DESCRIPTION	CHANNEL
COMMAND (TEAM — BASE)	Heather's mobile	415-555-2222	
TACTICAL (TEAM — TEAM)	M-VHF	USCG Ops	21A

TELEMETRY ARGOS Platform ID 834922 VHF Frequency 151.0700 RX Channel 92 GPS?

6. ACTION PLAN SUMMARY

MLS has WET telemetry, enroute to assess
Will report.
Fast Raft to stand by.
Stap, Marcos, & Ross on board.
Justin has been notified.

Photos or Video Taken?
stills & video, iPhone

Can RP stay with the animal? How long?
only 30 min (1600)

Hand-off Vessel(s)?
MLS Albin & Fast Raft

Response team ~ Folkens, Berger, Koontz, Shaw on standby for 2nd Ops Period
Also JD, Benson, Willis
Shaw, JD, Benson Rendezvous @ WET trailer/MLML SBO for gear
Team assembles @ CG Jetty (Fulmar) if a go @ 0800

CWR-ICS 100 MMHSRP 12/15	7. PREPARED BY	8. DATE PREPARED	9. TIME PREPARED
	Pieter Folkens	2015 May 05	1540

Appendix R – Large Whale Documentation Instructions and Hints (PIR)

Large Whale Response Documentation Instructions and Hints

Compiled November 2014
NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary
Documentation Instructions (for authorized responders):

1

Surface - still and video:

Always have support/documenting vessel maintain a safe distance and avoid getting in path of animal and effort. The best location is typically beside and slightly behind the animal and/or primary response vessel. If effort is underway, maintain at least 70 meters (75 yards) distance from animal and approach vessel.

Maintain communication with approach vessel. The approach vessel should be taking the lead here with response and safety being the priority; not obtaining the imagery.

If possible/safe, and while maintaining the above, work with support vessel helmsperson to have proper lighting and to have action more–or-less face you (people in approach vessel are facing you).

Try and get the following imagery depicting the broad nature of large whale entanglement response:

- Preparation*
  - Receiving initial report/assessment (*i.e.,* likely staged)
  - Authorization (*i.e.,* staged)
  - Gear preparation (assembly, programming, etc)
  - Training (*i.e.,* both classroom and on-water, hands-on)
  - Planning (action plan formulation)
  - Performing initial GARs
  - Alerting network and general communication
  - Loading support vessel with gear
  - Setting up telemetry

- Underway*
  - Getting underway (*e.g.,* response vessel from port/rescue inflatable from response vessel)
  - Vessel ops (*e.g.,* captaining, whale lookout while underway)
  - Vessel moving through water
  - Landmarks being passed
  - Searching
  - Preparation while underway (*e.g.,* setting up equipment)

- Animal
  - Identity (*e.g.,* species as well as individual – fluke, dorsal fin, scars)
  - Health (*e.g.,* emaciated? cyamids, blisters, color and texture of skin)
  - Wounds (*e.g.,* location, severity, identity of source)
  - Nature of distress (*e.g.,* entanglement, ship strike, stranding)
  - Behavior (*e.g.,* breaching, head rises, respirations, speed)

- Association with other animal(s)
    - Conspecifics
    - Other species (*e.g.,* dolphins)
    - Predation threat (*e.g.,* sharks)

- The entanglement
    - Identity of gear (*e.g.,* buoys, configuration of gear, close-ups of line)
    - How entangled (*e.g.,* origin, # of wraps, how tight)

- The response operation (get procedure, people, and whale in same shot)
    - Deploying inflatable
    - Initial approach
    - Assessment (*e.g.,* rescue team and whale, looking over side of boat)
    - Documenting (*e.g.,* shoot the other guy taking pictures)
    - Grapple (*e.g.,* try to have throw facing you)
    - Nantucket sleighride
    - Attaching telemetry
    - Kegging (*e.g.,* attaching as well as towing buoys)
    - Use of sea anchor
    - Cutting (*e.g.,* fixed knife and flying knife cuts)
    - Safety (*e.g.,* personnel with PFDs and helmets)

- People
    - Primary response team efforts (mostly covered above)
    - Network members/support team (*e.g.,* the team and other boats)
    - Interviews (ask personnel appropriate questions)
    - Pre and post briefs (*e.g.,* discussions, see planning)
    - Communication

- Post response*
    - Retrieval of gear
    - Breaking down inflatable and rescue tools
    - Returning to port (from vessel and from shore)
    - Unloading vessel
    - Communications and reports (*e.g.,* website)
    - Cleaning and stowing gear (next prep)
    - Gear investigation (*i.e.,* the science behind the response)
    - Obtaining telemetry fixes
    - Additional planning
    - Media

* Represents lower priority

Pick a good location on the vessel that allows flexibility, stability, personal safety, and avoids obstructions (*i.e.,* rigging). Always check/get permission from captain.

Helmsperson should always know you are shooting in these locations and maintain communication with helmsperson.

Watch yourselves. Don't get caught up so much with documenting the event that you put yourself at risk.

Additionally, as documenters you are in a role of assessing the overall operation. If you see someone doing something wrong/unsafe, or any risk, please point it out. What you document has value for assessment, training and media use. However, for media use certain criteria need to be met. For instance, personnel need to have PFDs on, and proper protocol needs to be displayed. Images will have to be reviewed prior to going out to the media.

Remember, certain lighting conditions, like glare off water, can fool a camera's automatic exposure settings. Sometimes it is best to use manual exposure settings and expose off neutral backgrounds or establish settings based on general lighting conditions. Generally, good surfaces/subjects to get exposure readings from are dark blue sky away from the sun, dark water on the shadowed side of boat (but not in the shadow), and a black Pelican case in the sun.

In low light conditions (dusk), set ASA higher. If conditions allow, ASA (ISO) should be set 400 or below. As it gets darker, ISOs (sensor light sensitivity) will have to be increased to maintain some shutter speed. Today's digital SLRs can accommodate high ISO settings, but be aware that at higher ISOs (> 3200) you may start to get grainy-looking images. You can also lower the shutter speed, but with a speed less than $1/500^{th}$ of a second (assuming you are using a 300 mm lens), you are likely to have soft-focused images.

Prioritize shutter speed. Typically shoot at shutter speeds greater than $1/1000^{th}$ of a second if possible. If there is a great deal of action or sea conditions are choppy, shoot at $1/1500^{th}$ of a second or faster. This will be no problem on a sunny day.

Use polarizing filters when possible during bright days but be aware that their use reduces the amount of light entering the camera by 1.5 – 2 F-stops.

Video cameras are generally more forgiving in regard to exposure and low light conditions, but still be aware of their limitation. Both will have difficulty auto focusing as light levels decrease. You may be able to use the video cameras in lower light situations than the digital still cameras.

Under certain conditions, like grey cloudy days, or calm seas, autofocus may not work well in the digital still cameras. Use manual focus.

Don't over zoom. Images and even video can be cropped afterwards. If you do zoom with the video, do so smoothly and hold for a short moment (*i.e.,* 1 - 2 seconds, and then zoom back out. If you zoom with the digital still cameras remember to shoot with a faster shutter speed. The rule of thumb is to shoot faster than the fractional value of the focal length of your lens considering any aspect ratio. For instance, with a Canon 7D, Mark II, which has an aspect ratio of 1.6 (the camera sensor is smaller than film, so it seems like you are zoomed in when compared to a full-frame camera), and using a 300 mm lens (which multiplying by the 1.6 gives you an apparent focal length of 480 mm), you'd want to shoot at least 1/500th of a second.

Change lenses if necessary. If the action is close there are typically different focal length lenses (*e.g.,* wide angle).

Use data forms or iPad dataloggers to log what you have shot. For video, it helps to verbally log while you are shooting. You may provide some conservative narration (don't overstep your knowledge base or over analyze a situation) and be aware that any conversations you might have are being recorded.

Watch batteries/storage for capacity. Don't wait until batteries are dead, or cards are full. You may miss an important shot. Look for a break in the action to make battery and card changes. When switching cards and tapes, take the time to make sure the removed media is safely stored and properly labeled.

Digital SLRs should be set to shoot in RAW format. Many cameras will also provide JPEGs. In addition, be aware that you will likely only be able to rapidly shoot eight frames or less at a time (due to processor, image quality, and card speed).

Watch that lenses and cameras are kept clean (*e.g.,* spray, whale breath, fingerprints). Just a drop of saltwater making its way into the interior of today's digital equipment can wreak havoc. Protect cameras from rain. Use appropriate paper or micro-fiber wipes to keep lenses clean.

If you see a dull spot on your images when viewing images on the camera's display, and your lens is clean inside and out, this may be dust on the sensor. You may need to have the camera professionally cleaned. Be careful when switching lens and do so when the camera is off. Don't leave a lens off the camera for an extended period of time, since this is when dust particles find their way to the sensor. Periodically clean the sensors if experienced and have the correct tools. If using one of the newer cameras, there is typically a sensor cleaning function when you turn the camera on or off. Try switching the camera off and then back on to see if that solves the problem.

When not in use, stow gear safely (don't leave on deck or cases setting open on benches).

GoPro/POV cameras

These are miniature digital cameras that shoot stills, as well as, very high resolution (*e.g.,* 4K) video. They are typically housed in waterproof cases good to 10 meters or more. Their small size, fast shutter, wide angle of view (170º), ease of use, and most importantly, their ability to be programmed, means they can be mounted on a variety of surfaces, including support and approach vessels, helmets, and poles and spars to continuously document the action from the air, surface and/or in the water (using a pole).

Though programmable, they will need some tending. Batteries and card storage typically last more than an hour. They can be easily turned on and off. The newer models can be controlled over WiFi and Bluetooth.

As is the case with any of camera, the priority is on personal safety and focusing on roles that reduce risk. As an example, if using a helmet-mounted camera, do not let the camera divert your attention.

Appendix S – Biological Samples During Large Whale Entanglement Response Activities

1) Only highly experienced and well-trained personnel may perform intrusive procedures (including but not limited to biopsy, blood sampling, and tagging). A veterinarian or their designee must be present if animals will be sedated or anesthetized.

2) Biological samples must be collected from live animals in a humane manner (i.e., that which involves the least possible degree of pain and suffering).

3) Sterile, disposable needles, biopsy punches, etc. must be used to the maximum extent possible (always use sterile or sterile disposable needles for blood sampling and injections of drugs or other approved substances).

4) When disposables are not available, all instruments (e.g., biopsy tips) must be cleaned and disinfected using non-toxic and non-irritating disinfectants between and prior to each use.

5) In order to avoid, minimize, or eliminate impacts on the affected species, non-target species, and the environment, mitigation measures described in Chapter 5 of the FEIS must be followed for the biological sampling activities authorized by this permit: http://www.nmfs.noaa.gov/pr/pdfs/health/eis_chapter5.pdf. These mitigation measures must also be followed with regard to ensuring human health and safety.

6) Authorized personnel working with marine mammals and marine mammal parts are encouraged to report to the Permit Holder any illness resulting from zoonotic disease transmission. This information should be included in the annual report.

7) Biological samples must be collected, maintained, and transferred in accordance with Appendix 9 of the NMFS research and enhancement permit No 18786-04 issued to the MMHSRP.

Appendix T – UAS Criteria Minimum Operational Requirements (Section 6.14 in NOAA UAS Handbook, initial release)

The following requirements must be met prior to any NOAA UAS flight operation commencing:

a. Flight Authorization Memorandum from Commanding Officer, Aircraft Operations Center.

b. For flights in the National Airspace Systems (NAS), an approved FAA airspace authorization.

c. For flights in Special Use Airspace (SUA), an approval from the controlling agency.

d. For flights in non-U.S. airspace, written approval from the foreign aviation regulatory agency, diplomatic clearance through the U.S. State Department, and compliance with all International Traffic in Arms Regulations and foreign export requirements.

e. Meet AOC PIC requirements.

f. Meet AOC airworthiness and maintenance requirements, as applicable.

g. AOC approved Operational Risk Management (ORM).

h. NTIA frequency clearances.

i. Ops plan (required for complex operations, see Section 6.6)

j. Meet all applicable environmental compliance requirements.

k. Approved checklist from Appendix I – Line Office Administrative Review of UAS Operations.

UAS Pre-Acquisition Approval Checklist

The Line Office shall certify that proposed UAS acquisition or Commercial Aircraft Service (CAS) meets Line Office requirements, NOAA, DOC, and other applicable federal policies by addressing each checklist item and completing all signatures prior to contract solicitation. Completion of this checklist applies to the processing of all UAS acquisitions, regardless of dollar value or previous AOC UAS airworthiness determinations. The applicability of each checklist item for acquisitions of UAS and/or CAS is indicated.

Reference: NOAA UAS Handbook, Appendix H – UAS Pre-Acquisition Guidance.
Federal Policy Checklist

____ Inherently Governmental Functions Determination (CAS)

For services, determination that none of the functions being performed are inherently governmental (FAR 7.503[e] and CAR 1307.503).

__ Statement of Work Requirements (CAS)

This statement of work includes specific tasks to be performed and the deliverables to be provided.

For a service contract, the UAS operational tasks and a surveillance plan must be provided. These documents must be submitted with the purchase requisition and requisition package submission to AGO.

____ Liability Insurance Requirements (CAS)

This statement of work includes liability insurance requirements.

Contracted UAS operations expose NOAA to additional liability risk. Line Offices shall include liability insurance requirements for inclusion in solicitations for services.

____ NOAA UAS Privacy Policy (CAS)

This statement of work addresses NOAA's UAS Privacy Policy and does not change or remove any existing obligation of law or policy regarding privacy.

NOAA's UAS Privacy Policy outlines the collection, use, retention, and dissemination of information obtained by UAS operation and use to ensure that, in carrying out NOAA's mission, any UAS operation by NOAA, on behalf of NOAA (*e.g.*, by contractors), or with NOAA sponsorship (*e.g.*, by grantees), will not violate the privacy rights of the of the individuals whose Personally Identifiable Information (PII) may be collected or observed through NOAA's UAS activities.

__ Federal Cyber Policy (UAS Acquisitions and CAS)

This statement of work addresses Federal Cyber Security and Information Technology Policies.

This includes, but is not limited to Sec. 205 of the Cyber Security Information Sharing Act of 2015, OMB Circular A-130, NIST SP 800-37, and NAO 212-13 NOAA Information Technology Security Policy.

____ Environmental Compliance (UAS Acquisitions and CAS)

The Line Office has completed all applicable environmental compliance reviews, consultations, and permitting requirements, including, but not limited to, the National Environmental Policy Act, 42 U.S.C. § 4321 et. seq; NOAA Administrative Order 216-6A; Endangered Species Act, 16 U.S.C. § 1531 et seq., and Marine Mammal Protection Act, 16 U.S.C. § 1361 et seq. If applicable, the statement of work addresses any required mitigation measures, best management practices, monitoring, terms and conditions, or other environmental compliance requirements.

Approval

____UASPO Director (Acquisitions and CAS)

UASPO has been consulted regarding this pre-solicitation. (sign and date)

____OMAO UAS Advisor (CAS)

OMAO has reviewed the pre-solicitation specifications provided to ensure they include NOAA and FAA operational requirements. (sign and date)

OMAO-assigned clearance number.

____AOC UAS Section Chief (UAS acquisition)

The AOC UAS Section has reviewed the pre-solicitation specifications provided to ensure the UAS acquired will meet NOAA airworthiness and operational requirements. (sign and date)

____Line Office Executive Level Approval (sign and date)

The____________________(Line Office) has reviewed this pre-solicitation form and supporting documents. Approval to proceed with this acquisition is granted.

Appendix U – Free-swimming Whale Sedation Datasheet (IFAW)

Marine Mammal Rescue and Research
Free-swimming Whale Sedation Datasheet

ifaw

Whale ID: ____________________ IFAW#: ____________________
Date: ____________________ Location: ____________________________________

DARTING/SEDATION DATA		
Est. Weight (kg):	**Dart Dosing Weight (kg):**	**Actual Weight (kg):**
Projector: MK24C Daninject JM	**Dart Type:** Paxarms Daninject	**Marksman:**
Needle Length: 6" 9" 12"	**Darting Attempted?** N Y	**Darting Time:**
Darting Distance (m):	**Dart Pressure Setting:** 130 PSI	**Wind Dir & Speed:**
Contact? N CBD Y: location on animal:		**Est Needle Depth/Angle:**
Post-Darting Behavior: dive delayed dive stayed at surface other:		
Dart Discharged? N CBD Y	**Est. % Discharged:**	***If darted, fill out disent and recovery data**
Midazolam (50mg/ml) **Target Dose (mg/kg):**________ **Actual mg:**________ **Vol (mls):**__________ **Actual Dose (mg/kg):**___________		
Butorphanol (50 mg/ml) **Target Dose (mg/kg):**_______ **Actual mg:**_______ **Vol (mls):**________ **Actual Dose (mg/kg):**___________		
Time to First Evidence of Sedation: ___________ **(describe in notes)**		
Overall Level of Sedation: none mild moderate/ideal deep		
Add'l sedatives needed? N Y: (*note drug(s), volume, route, inj site if not noted in Capture Data Box*)		
Notes:		

Marine Mammal Rescue and Research
Free-swimming Whale Sedation Datasheet

ifaw

Whale ID: ______________________ IFAW#: ______________________
Date: ______________________ Location: ____

RECOVERY DATA		
Flumazenil (0.1mg/ml)	**Volume (mls):_______ Route/Site:_________ Time:_______**	
Naltrexone (50 mg/ml)	**Volume (mls):_______ Route/Site:_________ Time:_______**	
Time of initial behavior change:	**Describe behavior:**	
Time to RR/depth normal:	**Time to swim speed normal:**	**Time to full recovery:**
Time backed off animal:	**Behavior:**	
Monitoring vessel:	**Behavior in the water:**	
End vessel monitoring time:	**Behavior at time of departure:**	
Recovery Assessment: Smooth / Rough Fast / Average / Prolonged		
Recovery Notes:		

DRUG LOG (list all drugs drawn up today)				
Drug	**Bottle #**	**Volume (mL)**	**Used**	**Not Used**

Other Comments:

Appendix V – Large Whale Dosage Charts

Large Whale Sedation Dosage Chart (Midazolam and Butorphanol)

	0.1mg/kg dose of each	50 mg/ml concentration
Animal Weight (kg)	**Dose (mg)**	**Dose (mls) of each drug**
5,000	500	**10**
6,000	600	**12**
7,000	700	**14**
8,000	800	**16**
9,000	900	**18**
10,000	1,000	**20**
12,000	1,200	**24**
15,000	1,500	**30**
20,000	2,000	**40**
25,000	2,500	**50**
30,000	3,000	**60**
35,000	3,500	**70**
40,000	4,000	**80**
45,000	4,5000	**90**
50,000	5,000	**100**

Large Whale REVERSAL Dosage Chart: NALTREXONE

Naltrexone syringe(s) with Flumazenil (normal dose 0.01 mg/kg, concentration 0.1mg/kg = 1000mL dose for 10,000kg whale= not possible)

	0.1mg/kg dose Naltrexone	50 mg/ml concentration
Animal Weight (kg)	**Dose (mg)**	**Dose (mls) of each drug**
5,000	500	**10**
6,000	600	**12**
7,000	700	**14**
8,000	800	**16**
9,000	900	**18**
10,000	1,000	**20**
12,000	1,200	**24**
15,000	1,500	**30**
20,000	2,000	**40**
25,000	2,500	**50**
30,000	3,000	**60**
35,000	3,500	**70**
40,000	4,000	**80**
45,000	4,5000	**90**
50,000	5,000	**100**

Large Whale CEFTIOFUR Dosing Chart

(based on Gulland et al. 2008 & Meegan et al. 2013)

		Ceftiofur Dose 6.6mg/kg MbW	200 mg/ml concentration
Actual Weight (kg)	**Metabolic Weight (MbW) = W(kg)^0.75**	**Dose (mg)**	**Dose (mls)**
5,000	595	3,927	**20**
6,000	681	4,495	**23**
7,000	765	5,049	**25**
8,000	846	5,584	**28**
9,000	924	6,098	**31**
10,000	1000	6,600	**33**
12,000	1147	7,570	**38**
15,000	1355	8,943	**45**
20,000	1682	11,101	**56**
25,000	1988	13,120	**66**
30,000	2280	15,048	**75**
35,000	2559	16,889	**85**
40,000	2,828	18,665	**93**
45,000	3,090	20,394	**102**
50,000	3,344	22,068	**110**

Appendix W – Sample Debrief Report (Hawaii 3/8/2013)

Response Debrief
3/8 – 3/11, 2013

Entangled subadult humpback whale off Maui

Event background:

On March 8, 2013 at 10:25 HST, tour vessel, Man-o-War, and a U.S. Coast Guard (USCG) helicopter located and reported a subadult humpback whale entangled off Lahaina, Maui. The animal had a single wrap of line around its tailstock and across its fluke blades, and a wrap of line just around the left fluke blade. A yellow toggle buoy rested right at the trailing edge of the flukes and a round (9" diameter), orange (faded red) buoy trailed about 5 feet behind the flukes. The entangling line, made up mostly of 3/8", 3-strand Blue Steel line, trailed about 30 feet behind. The animal was in good condition and not emaciated. The one wrap around the left blade was cutting in several inches into the leading edge of the fluke blade. The entanglement was assessed and considered life threatening.

Entangled humpback whale showing the wraps of gear around tail region (NOAA HIHWNMS/MMHSRP permit # 932-1905)

Operational synopsis:

A full complement of appropriate personal with all roles filled was utilized during both days of operation. All personnel had participated in entanglement response training at least once. On the first day's effort, 7 (of 9) personnel had firsthand experience in large whale disentanglement, and 3 personnel had hands-on experience. On the second day's effort, 6 (of 8) personnel had participated in previous large whale disentanglement efforts, and 4 personnel had hands-on experience. All response personnel were trained, prepared, and qualified for the roles they played. The Co-investigator (CI) under the NOAA Fisheries' Marine Mammal Health and Stranding Response Program (MMHSRP) enhancement permit for both efforts was Ed Lyman (level 5 responder from the Hawaiian Islands Humpback Whale National Marine Sanctuary), who also acted as the efforts' Incident Commander (IC). On the second day's effort Justin Viezbicke (level 4) was a member of the approach team. Justin had participated in 5 large whale disentanglements and was a valuable addition to the team.

Authorized approach team pulling up towards whale (NOAA HIHWNMS/MMHSRP permit # 932-1905)

The Sanctuary's 36-foot rigid-hulled inflatable, the Koholā, was the primary response vessel on both days. The entire cache of entanglement response equipment was already onboard and aided in rapid response capability. Additional (secondary) support vessels were used on the first day's effort in order to help maintain contact (visual) with the highly mobile animal, establish a perimeter in the higher traffic near shore environment, and provide increased safety. The secondary support boats were the U.S. Coast Guard's 45-foot patrol boat out of Maalaea Harbor and the Aloha Kai, a 22-foot catamaran, provided by a trained responder and operator of Ultimate Whale Watch. All boats were appropriate for conditions and response to the animal, and captained by appropriate personnel. The Sanctuary's

15-foot, soft-bottom response inflatable was used during both responses and crewed by appropriate personnel. Conditions were excellent for the first half of the first day's response and deteriorated as the day progressed, but remained well within working limits. The conditions during the second day's effort were optimum towards safety and productivity, a result of tracking the animal and waiting for the appropriate day.

Objectives:

The primary objective of entanglement response is not necessarily to free the whale, but to document the entanglement and its overall impact to the animal (at an individual, population, and species level) through recovery of gear, documentation of the entangling gear and animal, through scar study analysis, and tissue sampling; and maintain safety at all times. The information garnered, along with the documentation of aggregations of debris found floating free, will help answer such questions as where the gear is coming from, the type of gear, how was it set or lost, when and how might the animal have come in contact with it, and allow us to better quantify the degree of threat different gear types/ marine debris; and practices pose to whales and other marine animals. Again, if the entanglement is assessed as likely life threatening, and if resources and conditions allow, a response towards cutting the animal free may be mounted. In those cases where disentanglement effort is carried out, every precaution is to be taken to have **no harm** come to the responders and minimal harm to the animals being disentangled.

Outcome:

Responses mounted on March 8 and 11, 2013 involved the Hawaiian Islands Humpback Whale National Marine Sanctuary, the NOAA Corps, NOAA Fisheries Pacific Islands Regional Office, Kaho'olawe Island Reserve Commission, West Maui Rapid Response team (Ultimate Whale Watch and Hawaii Marine Education and Research), U.S. Coast Guard (station Maui and Air Station-Barbers Point), and MacGillivray Freeman Films (MFF- IMAX team), primarily through helicopter support.

On the first day's effort, the authorized response team was able to assess and document the entanglement, and remove approximately 75ft of trailing line. The initial response effort was halted due to diminishing daylight and the animal was tagged with a tethered transmitter buoy with the intent of resuming operations when weather and resources allowed. Three days later on March 11, those conditions were met and the response team re-located the animal using the tag package. On the second day's effort the response team was able to make several cuts using a fixed knife on the end of a pole to free the animal of over 125 ft of remaining gear. It is believed the animal will likely expel a small piece of line, which was left in one wound, over time. The wounds themselves, while around 4 inches and 1 inch deep along the leading edge of the left fluke blade, will very likely heal. Post mitigation assessment of the animal, which had over 200 feet of line removed, is that it will very likely survive its ordeal thanks to the collaborative efforts of the community working together.

Analysis/ post response risk assessment:

Vessels (including aerial platforms):

What worked well:

- *All vessels functioned well. Vessel operations themselves were seamless.*
- *Response and support vessels were equipped and fully staffed. Support vessels included sanctuary vessel, Koholā, West Maui first responder team's vessel, Aloha Kai, and the U.S. Coast Guard's 45-footer out of station Maui.*
- *The Koholā was the primary response vessel and is customized and outfitted specifically for the task of large whale response, providing turnkey and safe operations.*
- *Aerial support provided by MFF's chartered helicopter was critical to the success of the mission, since the crew provided valuable information on the entanglement and helped re-locate the entangled animal several times. The animal would have been certainly lost without this assistance.*

U.S. Coast Guard provides safety support towards large whale rescue operations

Improvements:

- *While the entire bow of the approach inflatable has been cleared of lifelines, D-rings and some handles, a grapple on the working line did catch a handle on the vessel's starboard quarter temporarily before breaking free. Additional catch points on the approach inflatable still need to be cleared.*

Note: Prior to repackaging the response inflatable, additional potential catch points, such as the remaining lifelines along the sides of the vessel, and some D-rings forward and amidships were entirely removed from the inflatable's spontsons.

Personnel:

What worked well:

- *All necessary roles (e.g. helm, documentation, note taker, gear person, 1º disentangler, support/ safety, communications) were covered during both day's efforts.*
- *Both response and support personnel had received training and were qualified for their roles. Decision process on who took what role was based on experience, amount of training, present condition of person, level designation, and nature of operations, including the animal's behavior and the complexity of the entanglement (Part of action plan/ ICS protocol).*
- *For their experience level, team did very well and worked well together.*
- *Safety remained priority throughout the operation.*
- *Two additional network personnel - NOAA Corps Officer LTJG Joseph Carrier and Lee James (West Maui first response), got valuable firsthand, hands-on, on-water experience working near an entangled whale. Both had participated in several trainings and did extremely well as 1º disentanglers in the approach vessel.*
- *Considering the behavior of the animal during the initial response (fast paced/ not cooperative, having the added experience of Justin Viezbicke (level 4) during the second effort was prudent and much appreciated.*
- *Grant Thompson, who had participated in many trainings, including a scenario-driven, "what if" training, provided much greater overall safety during the second effort.*

Improvements:

- *Considering the difficulties surrounding the animal on the first day's effort, would have been nice to have had more experience/ depth towards the effort. Would have provided greater safety (though all primary roles were appropriately filled), and allowed for possible rotation of some roles to better manage fatigue and provide additional training opportunities. Unfortunately,*

we did not have that depth on the initial response, but addressed this on the second effort.
• Keep working towards, when opportunities present themselves, and appropriate, getting appropriate network responders additional hands-on experience. Immediate candidates who participated in these efforts, but did not get opportunities are: Nicole Davis, Grant Thompson, Cheryl King, Mark Deakos, and Jason Moore.

Approach team during first day's effort (NOAA HIHWNMS/MMHSRP permit # 932-1905)

Equipment:

What worked well:

• A full complement of equipment was available.
• Backup equipment was supplied through first responder caches provided by the West Maui first response team and the U.S. Coast Guard – station Maui, who were part of the effort.

Improvements:

• The angle of attack (angle of blade relative to pole) is critical and needs to be better addressed. On the initial attempts to make the cuts to lines encircling the fluke blades, the hooked knife fixed to the end of the pole would just bounce over the lines. On replacing the knife and bending the protective tip tab down

(towards the animal and thus line), the knife readily slipped under the wraps and made the necessary cuts.
• Remove additional catch points on approach inflatable (see above).
• Handheld VHFs for comms between inflatable and support vessels had issues. They may need to be replaced sooner than latter.
• Establish chargers and someone to maintain charge of electronics. We went through 3 cell phones trying to maintain comms with the IMAX helicopter.
• Make sure Koholā vessel inverter is functional.
• Utilize the boat hook when possible to grab trailing line (However, much of the time it the trailing line was too deep and in fact, we lost a boat hook due to the gear being too deep).

Fixed knife at end of pole. Notice that knife is held with blade parallel to animal's body until time to engage entangling line (NOAA HIHWNMS/MMHSRP permit # 932-1905)

Assessment/ documentation:

What worked well:

• The team obtained excellent above water and underwater documentation of the animal, the gear and the operation, including still and video.
• Utilized a wide variety of cameras, including DSLRs, handycams, helmetcams, boatcams, polecams, and housed DSLRs.

• *The second day's effort included a professional photographer, Jason Moore, who has participated in several trainings and could have filled in at other roles.*
• *Excellent documentation of entanglement, shedding light on impact, gear identity, how entanglement might have occurred. Documentation also drove much of the media, which is an important part of our outreach and awareness towards the threat. We continue to lead in this regard.*

Final cuts. Images obtained by professional photographer, Jason Moore. (NOAA HIHWNMS/MMHSRP permit # 932-1905)

Improvements:

• *Could have had support vessel be better prepared to obtain post mitigation documentation and biopsy sampling on final cuts, since, in hindsight, the animal provided no other opportunities once it was cut free.*
• *Could have utilized additional sitecams (helmet cams, polecams, boatcams) at times. However, the decision to not use cameras in some cases, and at some times, was based on the difficult nature of the effort.*
• *Have support vessel be closer on first day's effort as to obtain better documentation (this is also listed under protocol and safety as these are the priority).*
• *Used a professional photographer on the first day's effort.*
• *Obtained interview footage and video footage of setup and breakdown.*

Note: The GoPro camera attached above the knife on the pole needs to be done in such a way as not to impede the cut or the cutter's view of the lines he or she is targeting. It is recommended that the camera be placed at least 1.5 feet above the knife and oriented at least 90º from the blade. In our case we removed the pole camera to expedite the final cuts. ***Cameras should be used only when they don't interfere or jeopardize operations and safety.***

Imagery captured by GoPro camera attached pole above skiffhook deployment to establish a clean working line (NOAA HIHWNMS/MMHSRP permit # 932-1905)

Animal:

What worked well:

• *Excellent documentation towards identifying the animal. While skin samples towards DNA were not obtained, dorsal fin and fluke images were.*

Improvements:

• *Obtain skin samples*
• *Investigate means to reduce impact of kegging, especially as it affects wounds.*

Entanglement:

What worked well:

- *Excellent documentation of gear and how it was wrapped on the animal both from surface and underwater.*
- *Gear investigation/ effort has provided the identity of the gear.*

Response team investigates gear to determine identity and how animal may have become entangled (NOAA HIHWNMS/MMHSRP permit # 932-1905)

Improvements:

- *Become better educated on various types of gear, especially local gear. Invest in or establish gear people to meet these goals.*

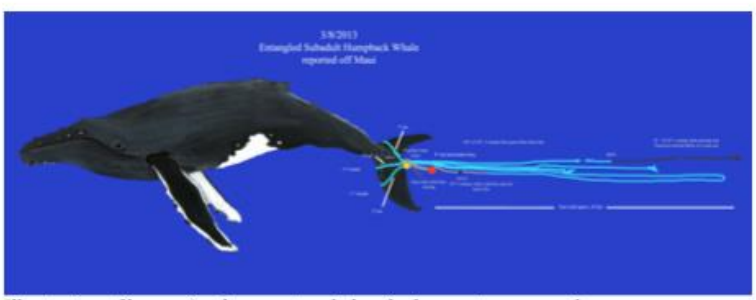


Illustration of how animal was entangled and where cuts were made

Conditions:

What worked well:

- *Conditions on both response days were excellent, especially considering the location of operations. However, conditions, including sea state and wind, were continuously evaluated and action plans throughout operations were based on conditions.*

Note: The first day's efforts were terminated in part not just due to an assessment of the disentanglement operation, but also on the assessment of risk associated with contact with a humpback whale on the transit back to port in failing light. In fact, we should have terminated earlier.

Note: For the second day's effort, the animal was monitored until conditions were conducive towards a response.

Improvements:

- *Avoid as much as possible transit in darkness. We did slow the boat to less than 10 kts.*

Protocols:

What worked well:

- *An action plan was established based on existing assessment and adhered to closely.*
- *The entire response, the animal, and the gear were well documented.*
- *Excellent communications (between boats, boats and shore, and boats and air)*
- *We were able to grapple/ attach to the entangling gear 5 times during the first day's effort. Considering the animal's mobility this was quite a feat.*
- *Re-located animal using telemetry. Excellent opportunity for several folks to become familiar with VHF telemetry.*
- *Attempted to maintain gear in front of approach vessel (e.g. attached a clean working line at one point, removed sea anchor)*

Improvements:

- *Maintain support vessels at appropriate distances. Stay alert to approach team as well as the entangled animal (see safety)*
- *Be aware of anything that is or is likely to be attached to the animal. This especially applies to tools, like clips and grapples. In general try and keep these at least several feet in front of you.*

- *One of the reasons we had to attach to the animal 5 different times on the first day, was in part that we likely loaded up the working line too fast, which resulted in the light gauge line either parting from load or stress from the grapple.*
- *Would have been nice to have obtained a skin sample*
- *The support boat's cutting grapple role in case the approach boat or someone in it should get caught in entangling gear was not assigned.*

Safety:

What worked well:

- *Safety protocols were adhered to (e.g. safety gear, handling line, wearing of PPEs, personnel and roles, communication, etc.)*
- *Safety maintained throughout operation; no injuries to response personnel (other than minor rope burns).*
- *Responsiveness of response team to emerging situations (i.e. whale suddenly diving deep, buoys coming up from behind, gear snagged on support vessel)*
- *Performed pre-briefs and post-briefs (after action plans – in process).*
- *Performed GAR-based risk assessment incorporating rescue mission (Initial GARS for 3/8 and 3/11 were 34 and 27 respectively)*

Improvements:

- *Positioning of support boats. At times, especially on the first day's effort, the primary support boat was too far away from the approach vessel. Part of the reason for this was the high speed and unpredictable nature of the animal and thus the effort. In fact, at one point the entangled animal doubled back and the entangling gear got caught on the engines of the secondary support vessel and the vessel had to be cut free. However, a higher degree of attention would of allowed closer proximity between approach and support vessels and thus increase in safety, and at the same time decreased the likelihood of interfering with the effort.*
- *Tools (grapples and clips) pose a risk of attaching to personnel and boats. The approach boat crew must work carefully around them and in general kept them in front, rather than behind, the approach vessel. On one instance, the approach crew allowed two grapples attached to the working line to get beside the vessel and one of the grapples did snag temporarily on a handle on the starboard quarter of the vessel.*
- *The support boat's cutting grapple role in case the approach boat or someone in it should get caught in entangling gear was not assigned.*

Main recommendations:

- **Better address angle of attack of knives.** This is critical towards success of getting hold of and thus subsequently cutting lines, especially those that are wrapped tight around the animal.
- Positioning of support vessels such that they are close enough to lend assistance should it be needed, but far enough not to complicate (i.e. affect the animal's behavior) or compromise the effort (I.e. get caught in trailing gear). **Be aware of your overall environment.**
- Be better prepared to collect biopsy or post mitigation documentation upon last cuts.
- Remain aware of amount of kegging relative to the animal's behavior. Kegging to quickly or too much may result in premature parting of entangling gear or working line and may also impact the animal through its impact in wounds.
- Maintain, as much as possible, gear attached to the animal in front of you.
- Fill contingency roles as well as known roles
- Use best person for the role. Includes professional photographers for documentation

Highlights:

Network participation: Several trained network members obtained additional firsthand and hands-on experience in large whale entanglement response.

Maintained safety: Held to proper protocols and prioritized safety. Operation carried out to level of experience on board.

Communications: Excellent communications adhered to on board, between vessels, and to shore side contacts.

Rapid response: Response team on site within 1 hour.

Persistence: Our ability to tag the animal 5 times during the first day's effort.

Teamwork: Everyone worked well together. Having the three support boats and the IMAX helicopter was key to maintaining contact with our animal.

Patience: We waited for the right conditions and built upon our personnel resources.

Innovation: Switching knives, modifying the knife, removing the polecam, and handling of line all contributed towards success of those final cuts.

Time line narrative:

3/8/2013

10:25 Initial report of entangled humpback whale received from the tour vessel, Man-of-War, and a USCG helicopter on patrol as part of Operation Koholā Guardian for an entangled whale reported the previous day. Animal was located just off Lahaina Shores (east end of Lahaina, Maui), in the company of one other whale, and moving rapidly off to NNW. Entanglement described as multiple wraps around the tailstock and trailing line with red and yellow buoys attached. Based on initial report, entanglement determined to possibly be life-threatening and response initiated. The reporting vessel stood by and monitored the animal until response teams arrived on scene. Considering the speed of the animal and peak season (number of other whales in area), decision made to have rapid response team out of Mala Wharf and USCG- station Maui deploy surface assets to get to the animal as soon as possible and take over standby support. Both teams could initiate assessment and documentation, and were equipped and trained to attach a telemetry buoy.

10:45 Sanctuary response teams depart for vessel.

11:00 Lee James and Mark Deakos with West Maui Rapid Response Team depart Mala Wharf with vessel, Aloha Kai, provided by Ultimate Whale Watch. They arrive on scene shortly and relieve Man-of-War of monitoring the animal.

11:20 Authorized and trained response team made up of Ed Lyman, Matt Dixon, Ka'au Abraham, and Rachel Finn of HIHWNMS, Joe Carrier of NOAA Corps, Nicole Davis of NOAA Fisheries Pacific Islands Regional Office, and trained responder Kate Eifler depart Maalaea Harbor on vessel Koholā. Inflatable is prepared while vessel is underway.

12:25 Koholā arrives at location of entangled animal where Aloha Kai has been standing by. A second whale is with the animal. The entangled animal has a single wrap of likely 1/2" Blue Steel line around the tailstock and a single wrap of the same line around the left fluke blade. A yellow toggle buoy trails right at the trailing edge of the flukes and a round (9" diameter) orange (faded red) buoy trails about 5 feet behind the flukes. The entangling line trails about another 30 feet behind. Decision is made to have James board the Koholā in preparation for Carrier and Lyman to be in the inflatable.

12:30 Helicopter carrying MacGillivray Freeman Film crew (filming a humpback whale film for IMAX) arrives and lends aerial support.

12:40 Teams begin to assess animal and document entanglement. Entanglement thought to likely be life-threatening upon further assessment.

12:51 Grapple is thrown from the Koholā and a transmitter package is attached to the entangling gear; it trails another 70 feet behind to a green, hard plastic buoy.

13:10 Inflatable (approach vessel) is launched carrying Lyman and Carrier. James is at the helm of the support vessel, Koholā.

13:20 A second buoy, polyball, is attached to the established control line.

13:32 Another polyball is added.

13:34 Another polyball is added. All of the added gear comes off of the animal along with approximately 75ft of the entangling gear.

13:45 The companion animal is no longer present.

13:49 The transmitter package is re-attached.

13:54 A polyball is re-attached.

14:30 A polyball is removed and a sea anchor is attached.

14:44 The sea anchor is removed due to difficulties in handling the working line and a polyball re-attached.

15:01 Another polyball is attached.

15:28 Entangled animal swims directly under support vessel, Aloha Kai, resulting in the added gear to catch on the vessel's outboards. As a precautionary measure, all but one buoy of the added gear is removed from the animal in order to free the vessel.

15:35 Telemetry buoy re-attached.

15:40 Additional kegging buoys re-attached.

15:44 Established control line parts with all attached buoys.

16:00 Animal lost in competitive group and choppier seas.

16:28 IMAX helicopter able to relocate animal, which is now in company of another whale, several miles off to the NW in middle of Pailolo Channel.

16:44 Response team catches up and now on site again with animal.

16:50 The transmitter package is attached for the fourth time of the day.

17:08 Two polyballs and a sea anchor are attached.

17:15 All added gear comes off animal yet again.

17:32 The transmitter package is attached for the fifth time.

17:57 Approach team of Lyman and Carrier make one more attempt to pull up within range of a cut. While close, attempt is unsuccessful.

18:19 Teams cease disentanglement effort due to diminishing daylight and depart for harbors. Animal left at position 21° 04.964'N / 156° 43.909' W

20:41 Koholā arrives back at Maalaea Harbor.

22:30 Argos telemetry shows whale in the middle of Pailolo Channel, heading westward. Weather forecast for next two days not optimal for response and plan is to stand-down until conditions are appropriate.

3/9/2013

04:17 Satellite fixes show the animal off the north shore of Lanai, perhaps taking advantage of a lee from gusty south winds.

14:00 Animal is off of the East shore of Lanai and is moving approximately 2.5kts. Tour vessel, Cross Winds, sights animal as it heads around Lanai's eastern shore

22:00 Animal is off of the west side of Kaho'olawe.

3/10/2013

04:17 Animal is off Keawikapu, Maui. Winds light right now, but forecasted to be 15 kts again from the south, which will make response difficult. Weather Monday, 3/11/2013, is still looking favorable with light NE winds.

21:00 Animal has continued to move WSW over last 10 hrs and is now approximately 18 nm from Maalaea or 5 nm NW of western-most point of Kaho'olawe.

3/11/2013

07:30 Justin Viezbicke, another Level 4-trained responder with HIHWNMS, arrives on Maui to assist with response effort. Decision was made to fly Justin over given the difficult nature of the response effort on 3/8/13.

08:10 Authorized and trained response team made up of Ed Lyman, Justin Viezbicke, and Rachel Finn of HIHWNMS, Joe Carrier of NOAA Corps, Grant Thompson of Kaho'olawe Island Reserve Commission, Nicole Davis of NOAA Fisheries Pacific Islands Regional Office, Lee James with West Maui Rapid Response Team, and trained responders Cheryl King and Jason Moore depart Maalaea Harbor on vessel Koholā. Inflatable is carried on aft deck.

08:40 Koholā is in the vicinity of last known satellite fix for animal provided by telemetry. VHF is used to locate animal's exact position.

10:20 Animal is located with telemetry package attached. Location: 20° 37.731'N / 156° 45.214' W

10:32 Inflatable launched. Decision is made to have Lyman and Viezbicke in the response vessel initially due to their advanced training levels and extensive experience.

10:45 First polyball is attached.

10:48 Decision made to have third person aboard inflatable to assist team in pulling up closer to animal and in positioning vessel for cuts. Thompson, who had been through additional training, elects to stay onboard Koholā to handle cutting grapple should it be needed and be gear person. James is selected as third person in inflatable. Davis provides long-lens images and Finn wide-angle and notes. King provides HD video. Moore in charge of documentation. Carrier is captain of Koholā.

10:54 Another polyball is attached.

11:15 A clean working line is established beyond grapples.

11:30 First cut is made to the line around the flukes using a fixed knife on 19 feet of pole. Cut is documented using helmetcams and polecam.

11:35 Animal is still able to dive and takes all gear under.

12:02 Two more cuts are made to the lines on the flukes and the animal is freed of over 125 ft of gear. A small piece of line is left in a wound, which will likely be expelled over time. All gear was recovered. Attempt to get post imagery and/ or tissue samples not successful. Animal is last seen at: 20º 41.507'N / 156º 44.069' W.

12:10 Inflatable brought onboard Koholā.

12:37 Team departs for harbor.

13:42 Koholā arrives back at Maalaea Harbor.

Other tour companies (e.g. Maui Nui, Cross Winds II, Wiki Wahine, and Trilogy Excursions) and charter vessels (e.g. Lucky Strike II) called in reports or helped monitor the animal.

Participants (training and experience level in parentheses):

3/8/13:

- Ed Lyman (on-site IC and CI, 1º disentangler, level 5)
- LTJG Joseph Carrier (Captain of sanctuary's support vessel, 1º disentangle, level 3)
- Nicole Davis (Documentor/ Communications, level 3)
- Rachel Finn (Documentor, level 3)
- Lee James (2º support, safety, level 3)
- Mark Deakos (2º support, level 3)
- Matt Dixon (Note taker/ gear, level 2)
- Ka'au Abrahams (Documentor/ note taker, level 2)
- Kate Eifler (Communications, level 2)

3/11/13:

- Ed Lyman (on-site IC and CI, 1º disentangler, level 5)
- LTJG Joseph Carrier (Captain of sanctuary's support vessel, safety, level 3)
- Nicole Davis (Documentor/ Communications, level 3)
- Grant Thompson (Gear, safety, level 3)
- Rachel Finn (Documentor, Note taker, level 3)
- Lee James (2º support, safety, level 3)
- Justin Viezbicke (IC, 1º Disentangler, level 4)
- Cheryl King (Documentor, level 3)
- Jason Moore (Documentor, level 3)

Shoreside:

David Schofield, NOAA Fisheries, off-site IC coordinator and POC (4)

Nancy Daschbach, Sanctuary, POC for Koholā float plan.

Support:

U.S. Coast Guard – station Maui and Air Station Barbers Point

Aloha Kai (Ultimate Whale Watch)

First Responders/ Sightings (tour and charter operations):

Man of War

Wiki Wahine

Maui Nui

Cross Winds II

Lucky Strike II

Appendix X – Large Whale Entanglement Questions and Answers

Q: What do marine mammals get entangled in?

A: Marine animals, like whales, dolphins, seals, and sea lions, can become entangled in fishing gear that is being used to fish either commercially or recreationally, lost or abandoned gear, and other types of rope/line and trash, including plastic bags, that find their way into their natural environment.

Q: How does entanglement harm marine mammals?

A: Entanglement of marine life is a global problem that results in the death of hundreds of thousands of marine mammals worldwide every year (Read *et al.* 2006). Entangled marine mammals may drown or starve because they are restricted by the entangling gear, or they may suffer physical trauma and infections from the gear cutting into their flesh over a long period of time. Entangled marine mammals may also be more susceptible to other threats, like vessel strikes, which may increase due to the animal's inability to avoid vessels like they normally would.

Smaller marine mammals, like seals, porpoises, dolphins, and smaller whales, may drown immediately if the gear is large or heavy. Large whales over time face risks from exhaustion, infection, starvation, and injury from the entanglement cutting into the body. The threat of entanglement to large whales is typically not immediately life-threatening, and there is time for qualified experts to respond to and assess an entangled large whale, and possibly cut the animal free. Entanglement is considered a primary cause of human-caused serious injury and mortality in many large whale species, especially right whales, humpback whales, and gray whales.

Q: What is a life-threatening entanglement?

A: The threat of entanglement to large whales is typically not immediately life-threatening, and there is time for qualified experts to respond to and assess an entangled large whale, and possibly cut the animal free. However, a life-threatening entanglement includes any material that impacts the ability of the whale to swim, breath, or feed, or that may cause severe internal injury (*e.g.*, swallowed hooks still connected to line and/or lure protruding from the mouth; *e.g.*, see pp 34-35 NMFS Serious Injury Procedure (Anderson *et al.* 2008) for details).

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

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

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

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

Regional Entanglement Hotlines	
Maine through Virginia	1-866-755-6622
North Carolina through Texas	1-877-942-5343
California, Oregon, and Washington	1-877-SOS-WHALe (1-877-767-9425)
Alaska	1-877-925-7773
Hawaii	1-888-256-9840
United States Coast Guard (nationwide)	VHF Channel #16

Here are the steps to follow:

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

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

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

Only responders who have been authorized by NOAA Fisheries and who have the training, experience, equipment, and support needed should attempt to disentangle marine animals. Entanglement response efforts also rely on the support of many state and federal agencies (including law enforcement agencies and the United States Coast Guard), non-governmental organizations, and others working together to respond to, and ultimately prevent, entanglements. Many members of the on-water community act as first responders by appropriately reporting, documenting and assessing entangled large whales.

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

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

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

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

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

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

Q: What type of gear is used for disentanglement?

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

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

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

Q: What is NOAA Fisheries doing to prevent future entanglements?

A: NOAA Fisheries is engaged in multiple initiatives to help understand and reduce future whale entanglements. For example, NOAA Fisheries is participating in the California Dungeness Crab Fishing Gear Working Group convened by the State of California, which consists of state government officials, commercial and recreational fishermen, non-governmental organizations, and other fishing gear and marine mammal experts.

On the East Coast, NOAA Fisheries has been working with stakeholders to reduce entanglements through the Atlantic Large Whale Take Reduction Team as well as engaging with the fishing community to develop and test ropeless fishing gear. NOAA Fisheries is also working with stakeholders to investigate how gear may be modified to allow whales to more easily self-release from gear, through the use of knots, knot-less gear, or weak links.

NOAA Fisheries is working to improve the scientific understanding of the risk factors that may contribute to whale entanglements, such as whale distribution and fishing effort in overlapping time and space. Each disentanglement effort provides information to guide gear modifications and management strategies to further reduce threats. A better understanding of the risk factors can also help guide fisheries management.

Q: Why does NOAA Fisheries track and document large whale entanglement incidents?

A: It's important for NOAA Fisheries and our partners to track, document, and respond to as many of these incidents as possible, as entanglements represent an anthropogenic (man-made) threat to large whale populations, some of which are critically endangered (*e.g.*, North Atlantic right whales). Entanglement data are used by scientists and managers to better understand the threat and the broad-based risks it poses as to mitigate the threat - the ultimate goal.

Q: Is all the fishing gear found on large whales only from the U.S. Fisheries?

A: No, some of these entanglements have originated in waters outside the United States since large whales travel long distances between their feeding and breeding grounds, and as a result cross international boundaries and oceans. NOAA Fisheries collects and tries to identify entangling gear from each response in order to work with fishing communities domestically and abroad to reduce future entanglements. However, definitive identification is not always possible.

Q: What can people do to help prevent entanglement of marine animals?

A: When fishing or boating, do not leave fishing gear or trash behind. Also, consider participating in community clean-up efforts. Whether at the beach, river, or local park, trash can often find its way into the ocean and present an entanglement risk. And always remember to “lose the loop” - cut any loop before properly discarding it in the trash so that it does not become an entanglement hazard.

Q: Why is standing by a whale while an authorized response is getting underway so important and how can I do it safely?

A: If a boat does not stay with an entangled whale, it typically will not be found by rescuers on the same day. Considering the vastness of the ocean and the mobility of a whale, it is no easy task to find a specific whale. An entangled whale ends up being a large needle in an even larger haystack - the world’s oceans. Therefore, a network or reporting vessel is often asked to “stand by” or monitor the animal within a safe (and depending on the responder, a legal) distance from the whale. Without standing by, rescuers may have to wait until the whale is opportunistically found again. Reporting, the initial assessment and monitoring the animal are considered foundational for a successful disentanglement.

If a response is possible, authorities may ask that you stand by and watch the animal from a safe and legal distance (greater than 100 yards and not directly behind the animal). However, it’s not safe to approach closer than that - boats have been capsized and individuals have been killed when in close proximity to whales. Also be aware of any trailing gear because there may be hundreds of feet of rope behind the whale that could be an entangling risk for your vessel or motor.

Standing by a whale is not necessarily easy. Depending upon the species and its behavior at the moment, whales may stay on a dive for 2-30 minutes (or much more) at a time, covering significant distances. If a whale is in an aggregation, following that particular whale can be challenging. Identifying the whale as an individual, using scars or the shape of the dorsal fin is helpful in this instance (entangling lines may not be easy to see or may even be invisible from above the waterline). Through educational campaigns, boaters are encouraged to wait by the entangled whale from a safe distance and call the United States Coast Guard (VHF Channel 16) immediately. The United States Coast Guard will notify the disentanglement network and may request that the reporting vessel contact other vessels nearby to make a relay where a new vessel takes on a turn of standing by while the previous vessel retires.

Q: Why should a person never get in the water and attempt to cut the whale free?

A: Swimming after a whale entangled in gear is impractical and dangerous. Like most wild animals, whales do not want to be approached closely by people. When threatened, their options include swimming away quickly, diving, or even breaching for protection (swimmers in the water near a whale have been injured or killed by the whale’s movements).

One of the most dangerous aspects being anywhere near an entangled whale is the gear itself. Line and net have an incredible propensity for entangling anything that touches it. Becoming entangled in the fishing gear attached to a whale would be disastrous, especially if the whale dove. Other practical problems include the water temperature and the water clarity of whales' preferred habitats.

Q: Cutting something must be better than nothing?

A: This is one of the most dangerous misconceptions facing an entangled whale. There is a distinct difference between cutting gear or lines and disentangling the whale. People have reported cutting line from anchored whales, then watching them swim away. This very well-intentioned act often does more harm than good. By cutting the lines that anchor a whale or cutting only the lines that are most visible or accessible, a person may be releasing an animal with the most lethal part of the entanglement still present. Days or months later, and likely many miles away, the United States Large Whale Entanglement Response Network may get a report of the whale with a little amount of entangling gear left around the body, flipper, or in the mount, and will face the challenges of trying to subdue and disentangle a free-swimming animal with very little opportunity to use traditional rescue techniques. After being freed from anchoring gear, the lines left on the animal may hinder movement, feeding, cause severe infection through abrasion, and/or become embedded within the animal. Though it is difficult and feels worrisome to wait for trained responders, it offers the best possible chance of survival for the whale through the best likelihood of removing all of the gear off the animal.

Q: Why haven't you gone out yet to save that whale? Isn't the whale about to die?

A: If a whale is able to make it to the surface to breathe, it is likely going to live over the short term. NOAA Fisheries Entanglement Responders often receive reports of entangled whales late in the day, without a vessel standing by, in poor weather, or hours or even days after the fact, making an immediate effective response unlikely. Many whale species may spend part of their year fasting and can survive for some time without feeding. In some cases, whales may be assessed as having a non-lethal entanglement and will likely shed the gear on their own. The United States Large Whale Entanglement Response Network and Stranding Network members will only intervene with whales that have a life-threatening entanglement or are likely to become so. To monitor entangled animals, the United States Large Whale Entanglement Response Network depends on documented, opportunistic sightings from the on-water community such as fishermen, whale watch vessels, or research cruises. These are the network's first responders.

If a whale is deemed to have a serious entanglement, one of the first steps taken during a rescue is to attach a VHF/satellite buoy to the gear entangling the animal. If the whale is lost, the weather turns bad, or more resources are needed, the animal may then be tracked through data obtained from the buoy on the animals' location for additional rescue attempts. Our experience indicates that this buoy creates minimal further harm to the animal and may actually pull the gear free with the added drag. Without the option of tagging, it could be many months before re-sighting the whale (or never).

Q: Do the marine animals know that you are trying to help them?

A: Certainly, they are aware of a rescue team's presence but just what they think of response activities is unclear. As with any wild animal, they may be very dangerous when injured and under stress. While working closely with a marine mammal, rescue teams make every effort to keep themselves safe. Animals may react with fight or flight responses and may use their heads, flukes, or flippers to defend themselves.

Q: What is a success? Why do we sometimes leave gear on a whale?

A: Safely (for responders and whales) removing life-threatening gear from a whale is the main objective of any disentanglement operation. An additional important objective is the full documentation of the entanglement.

This does not necessarily mean that every inch of line will be removed from a whale. Research has shown that a large number of whales become entangled every year, but some shed the gear on their own (it is impossible to say how many entanglements end in fatality, as not all whales are observed after they die before stranding or sinking). During some rescue operations, some gear may be left on the whale due to safety and/or logistical challenges in removing all of the gear, or with the understanding that the whale may shed the remaining gear on its own. Line may be left in the mouth with the ends shortened, with the possibility it will be cast-off naturally over time. If the line is embedded within the whale, the line may be shortened, allowing the wound to reject the foreign body at its own pace (like a splinter from a body).

Q: Why is documentation of large whale entanglements important?

A: Without documentation, little can be learned about entanglements and how to prevent them. By understanding how, where, when, and which whales get entangled, we may be able to make better decisions regarding prevention, which is the ultimate solution to the problem. The primary focus of entanglements should be in prevention and it is difficult to prevent the problem if we do not fully understand it - the science behind the response effort. Documentation helps quantify entanglement incidence and prevalence, which helps us understand the overall impact on whale populations. When we know the main sources of entanglement, we can prioritize the best methods to solve the problem. For whales entangled in active fishing gear, we need to find effective deterrents to reduce interactions. For whales entangled in marine debris and lost and abandoned fishing gear, we need to provide more outreach and education while encouraging prevention. With the Stranding Network documenting each entanglement fully, for example, we have found that many whales become entangled while feeding and are more likely to become entangled in any gear floating or suspended in the water column (as opposed to lying flat on the seafloor). Documentation also can help show if the disentanglement has been successful or not and creates an understanding of the healing process.

Q: How do we know that whales are becoming entangled and at what current rate?

A: A variety of means is used including the reports received as well as scar analysis. The latter involves the photo-documentation of a region of the body that often gets entangled and is also easily visible from the surface. By documenting each entanglement, researchers have been able to monitor evidence of previous entanglements on different populations of whales. Many entanglements involve the tailstock of whales (where the flukes meet the body), leaving scars that may persist for years. By photographing tailstocks of humpback whales within the Gulf of Maine, for example, a rate of entanglement is measured and compared between years. Evaluating documented entanglements and the whales over time may be the only way to measure the success or failure of management initiatives geared towards reducing and eliminating entanglements.

Q: Do you analyze the gear collected from a disentanglement?

A: When disentangling, a secondary goal is to document and recover the entangling gear. Any entangling gear recovered is sent to be investigated for identifying type of material, including a specific fishery, the origin (source of entanglement), and configuration (the part of the gear), as NOAA only has gear experts on the East Coast. It may be provided to the NOAA Office of Law Enforcement if the gear is considered non-compliant with regional or seasonal fishery restrictions.

Gear removed from stranded and entangled large whales may provide NOAA Fisheries with the only consistent proof whether fishing gear modifications implemented to protect large whales are working or not.

Appendix Y - Glossary of Acronyms and Abbreviations

AED	Automated external defibrillator
AGL	Above Ground Level
ALDFG	Abandoned, Lost, or otherwise Discarded Fishing Gear
ALWDN	Atlantic Large Whale Disentanglement Network
AOC	Aircraft Operation Center
ARO	Alaska Regional Office (NMFS)
BWRI	Blue World Research Institute
CCS	Center for Coastal Studies
CI	Co-investigator
CWR	California Whale Rescue
CWRT	Campobello Whale Rescue Team
DEA	Drug Enforcement Administration
DFO	Division of Fisheries and Oceans (Canada)
DSLR	Digital single lens reflex (camera)
DVM	Doctor of Veterinary Medicine
ESA	Endangered Species Act
FAA	Federal Aviation Administration
GAR	Green-Amber-Red model/checklist
GARFO	Greater Atlantic Regional Field Office (NMFS)
GPS	Global Positioning System
GWERN	Global Whale Entanglement Response Network
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
IAP	Incident Action Plan
ICS	Incident Command System
IC	Incident Commander
IFAW	International Fund for Animal Welfare
IWC	International Whale Commission
LWER	Large Whale Entanglement Response
LWERC	Large Whale Entanglement Response Coordinator
MC	Mission Commander
MMPA	Marine Mammal Protection Act
MMHSC	Marine Mammal Health and Stranding Coordinator
MMHSRP	Marine Mammal Health and Stranding Response Program
MPA	Marine protected area
NARW	North Atlantic right whale
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPLWERN	North Pacific Large Whale Entanglement Response Network
NTIF	Notice of Intent to Fly
OEM	Original Equipment Manufacturer
OMAO	Office of Marine and Aviation Operations
OPR	Office of Protected Resources
ORM	Operational Risk Assessment
OO	Operations Officer
PI	Principal Investigator
PIC	Pilot in Command
PMMC	Petersburg Marine Mammal Center

PPE	Personal Protective Equipment
PFD	Personal floatation device
POV	Point of view
PTT	Platform Transmitter Terminal
RABEN	Red de Asistencia a Ballena Enmalladas (Mexico's Large Whale Disentanglement Network)
RHIB	Rigged-hull Inflatable boat
RSC	Regional Stranding Coordinator
ROV	Remotely Operated Vehicle
SAR	Stock Assessment Report
SAWDN	South Africa Whale Disentanglement Network
SOP	Standard Operating Procedure
TRT	Take Reduction Team
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
USCG	United States Coast Guard
VFR	Visual Flight Rules
VO	Visual Observer
VTOL	Vertical Takeoff and Landing
WET	Whale Entanglement Team
WCO	West Coast Office (NMFS)