

From Monitoring to Final Disposition: Collaborative Response to the First Live Sperm Whale (*Physeter macrocephalus*) Stranding in Alabama, USA

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Large whale stranding responses present unique logistical challenges, particularly when the whale strands alive. Few case reports exist that share successful approaches to the many phases of response. For live large whale strandings, response efforts need to consider animal welfare, human safety, and the ability to collect, archive, and share meaningful diagnostic information. Rapidly collected biological samples from these strandings are vital to understand causes of death, build knowledge of basic biology and ecology, and support conservation and management for these protected species. Published, peer-reviewed case reports of large whale strandings primarily focus on euthanasia (e.g., Daoust & Ortenburger, 2001; Kolesnikovas et al., 2012; Harms et al., 2014), providing few details on live-animal monitoring, postmortem transport, necropsy, or disposal (e.g., Heyning & Heyning, 2001; Neto et al., 2008). According to Boys et al. (2021), however, even publications describing marine mammal euthanasia rarely include details on methods (provided in 3.1% of publications) and time to death (provided in 0.5% of publications). Additionally, most case examples focus on Mysticetes, and only one report of a response to a live sperm whale (*Physeter macrocephalus*) is available (Peterson & Hoggard, 1996; for review, see Boys et al., 2021). Because large whale strandings are rare in most regions, published reports are extremely valuable to inform the efficiency and success of future response efforts.

Sperm whales are the largest Odontocete species and are globally distributed in deep marine waters (Rice, 1989; Whitehead, 2002). They are listed as “Vulnerable” by the International Union for Conservation of Nature’s (IUCN) *Red List* (Taylor et al., 2019), and in the United States, they are protected under the Marine Mammal

Protection Act of 1972 and the Endangered Species Act of 1973. In the Gulf of Mexico (GOM), sperm whales are widely distributed along the continental slope and in oceanic waters. The most recent stock assessments estimate that there are ~1,180 individuals in this region, and these represent a genetically distinct population (Engelhaupt et al., 2009; Garrison et al., 2020). While information on GOM sperm whales is increasingly available, the population remains logistically difficult to study, and there have only been 16 sperm whale strandings on the GOM coast of the U.S. since 1 January 2011 according to the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) National Marine Mammal Health and Stranding Response Program (MMHSRP) database (<https://mmhsrp.nmfs.noaa.gov/mmhsrp>). Hence, sperm whale strandings, especially live-animal strandings, provide unique opportunities to collect valuable data on this population in the GOM.

Local marine mammal stranding networks in the U.S. are authorized by NOAA NMFS to respond to live- and dead-stranded marine mammals. The Alabama Marine Mammal Stranding Network (ALMMSN) at the Dauphin Island Sea Lab (DISL) is the only entity authorized to respond to stranded marine mammals in the state. This paper details the ALMMSN response, from initial report to final disposition, for the first documented live sperm whale stranding in Alabama. The animal stranded out of habitat inside Mobile Bay, which is >100 km from the nearest known sperm whale habitat (Garrison et al., 2020). We highlight the challenges and successful aspects of the response, including multi-day live-animal monitoring, in-water sedation and euthanasia, transport, field necropsy, personnel safety, and the

importance of interagency collaboration throughout the process. For the sedation and euthanasia phase of response, we provide detailed doses and times of drug delivery, animal response, and time to death. Our findings will benefit other stranding networks by informing best practices for coordinating large whale stranding response, particularly in areas where these strandings are rare and resources may be limited.

Initial Report and Monitoring

Day 1—The live-stranded, out of habitat sperm whale was reported by a member of the public to ALMMSN at 1455 h on 19 November 2020. Personnel from the Alabama Department of Conservation and Natural Resources (ADCNR) were first on scene at 1613 h and provided on-water support throughout the response. The whale was stranded in 1 to 2 m of water near Weeks Bay on the eastern shore of Mobile Bay (Figure 1, Location A). The animal's respiratory rate was ~3.4 breaths per 5 min, and it was occasionally exhaling underwater. The animal was also moving unpredictably, including moving its flukes and pectoral fins, arching and turning its body, and listing to its left side (Table 1). Due to safety concerns (e.g., animal behavior, water depth, waning daylight), a response crew was designated to monitor the animal by boat from ~30 m away to maintain visual contact but avoid stress to the animal and potential human safety hazards. The crew lost sight of the whale after dark on a rising tide, and efforts to find it with spotlights were unsuccessful.

Day 2—On 20 November 2020, ADCNR and ALMMSN staff searched for the whale by boat, starting at the animal's last known location. At ~0900 h, the whale was reported by the public to ALMMSN as re-stranded in 1 to 2 m of water in Navy Cove, ~19 km southwest from the original stranding location (Figure 1, Location B). The on-water search crew was able to rapidly deploy to the re-stranding location and begin monitoring by 0915 h. Representatives from ALMMSN, ADCNR, and stranding network partners from Mississippi (the Institute for Marine Mammal Studies [IMMS] and Mississippi State University, College of Veterinary Medicine [MSU-CVM]) monitored the animal from boats throughout the day.

Two responders, one a veterinarian, approached the whale on foot in the water to perform a basic veterinary assessment. The animal was in poor body condition, the skin cranial to the dorsal fin was moderately blistered and peeling from sun exposure, and the animal's respiratory rate was 2 breaths per 5 min (Table 1). Responders covered the exposed skin with wet sheets to prevent further sun damage. The whale was alert and responsive to movement in the water. Vocalizations (clicks) from the animal

were heard and felt by responders in the water and heard from the response boat ~10 m away.

Due to the animal's poor condition and prognosis, euthanasia was considered the most humane option. Estimated weight and length measurements were necessary to allow veterinarians on-site to determine doses needed for sedation and euthanasia drugs. Using a tape measure, in-water responders estimated the straight length of the whale as 1,097 cm, and this length was applied to estimate weight at 13,507 kg using the *WhaleScale* app (Harms, 2019). Due to the unusual nature of a large whale stranding in the area, sufficient drug doses were not on hand. Coordinated efforts with southeastern and west coast partners, including IMMS, MSU-CVM, NOAA, and The Marine Mammal Center in California, ensured adequate doses of sedation drugs were available the following day.

Day 3—The whale moved out of sight of boat-based monitoring crews overnight, and search efforts to relocate the whale resumed early on 21 November 2020. Due to the potential for active movement by the animal and distance between previous stranding locations, ALMMSN requested aerial support to increase search capacity. On-water and aerial search efforts, aided by ADCNR and the U.S. Coast Guard (USCG), were unsuccessful in locating the whale.



Figure 1. Map of the stranding locations (referenced in the text and in Table 1) of the sperm whale (*Physeter macrocephalus*) in Mobile Bay, Alabama

Day 4—The whale was resighted at ~1100 h on 22 November 2020 near Daphne, Alabama, a residential area ~37 km north of the previous stranding location on the eastern shore of Mobile Bay (Figure 1, Location C). ALMMSN staff arrived on scene at 1211 h. The whale was in 1 to 2 m of water adjacent to a publicly accessible waterfront park. The high visibility and accessibility of the area enabled members of the public to approach the whale by kayak, on foot, and with a recreational drone. Local media also arrived on scene and were broadcasting live. NOAA Office of Law Enforcement and Alabama Law Enforcement Agency representatives provided critical crowd control, and ADCNR provided additional boat resources and support personnel from the Marine Resources and Wildlife and Freshwater Fisheries Divisions. The whale's respiratory rate was ~9.2 breaths per 5 min, and it was occasionally exhaling underwater and rocking from sternal to lateral recumbency (Table 1). For safety, the stranding team monitored the animal from boats ~40 m away. After dark, monitoring became more difficult, and the whale, which became more mobile with the rising tide, struck the monitoring boat unexpectedly. Due to human safety concerns, vessel monitoring efforts were halted for the night.

Days 5 & 6—On-water and aerial search efforts by ADCNR and USCG personnel were unsuccessful on 23 November 2020. During these efforts, ALMMSN maintained communication with the public, community collaborators, and stranding network partners. The whale was resighted by a member of the public at 1054 h on 24 November 2020 ~25 km southwest of the Day 4 stranding location on the western shore of Mobile Bay near Fowl River (Figure 1, Location D). ALMMSN staff arrived on scene at 1154 h. High winds and rolling waves made the water functionally deeper than previous beachings (~1.5 to 2 m). The whale was rocking from sternal to lateral recumbency with the surf and lifting its flukes, making approach for sedation and euthanasia impossible. Its respiratory rate had decreased to ~1.8 breaths per 5 min (Table 1). Personnel from ALMMSN, IMMS, and MSU-CVM monitored the animal with support from the Mobile Police Department and ADCNR until sunset.

Day 7—At 0609 h on 25 November 2020, an on-site ADCNR officer confirmed that the whale was in the same location as the previous day. The water depth was ~1.5 m, and the animal remained in sternal recumbency and was less mobile than on previous days. The animal was alert, and some vocalizations (clicks) were occasionally audible. Its respiratory rate was ~4 breaths per 5 min, and the breaths were weak (Table 1). A crew of two veterinarians and two biologists from ALMMSN, IMMS, and MSU-CVM was deployed on a

floating mat to assess the whale's condition and prepare for possible euthanasia. The mat was connected by a line to the response boat for safety with a designated support staff person monitoring the line (Figure 2a). The animal was not responsive to stimuli (gentle prodding with a paddle). It was deemed safe and appropriate to proceed with sedation and euthanasia under approval of the NOAA NMFS MMHSRP Southeast Regional Coordinator.

Sedation and Euthanasia

Sedation and euthanasia protocols for this specific stranding were drafted with input from colleagues at NOAA, North Carolina State University Center for Marine Sciences and Technology (NCSU CMAST), University of North Carolina Wilmington (UNCW), and Woods Hole Oceanographic Institution (WHOI). Successful sedation and intracardiac (IC) euthanasia were performed by ALMMSN, IMMS, and MSU-CVM using combined resources and established methods that were modified for deeper water (Harms et al., 2014).

Support staff on the boat recorded the animal's behavior and respirations, as well as estimated dosage and timing of administered sedation and euthanasia drugs. Sedation was accomplished starting at 1012 h, with a combination of intramuscular (IM) midazolam (675 mg; 0.05 mg/kg), acepromazine (2,701 mg; 0.2 mg/kg), and xylazine (47,275 mg; 3.5 mg/kg) administered in the epaxial muscle, allowing 10 to 15 min between drugs (1012 h, 1026 h, and 1039 h, respectively; Figure 2b). The whale's respiratory rate continued to be ~4 breaths per 5 min during this time. Respirations continued to be weak, and the animal was occasionally exhaling underwater (Table 1).

Additional IM midazolam (150 mg; 0.01 mg/kg) was administered at 1055 h to determine if deep sedation would lead to euthanasia. The whale lifted its flukes out of the water at 1059 and 1106 h. The animal did not expire after deep sedation; however, it listed slightly to its right side with the water current at 1125 h and remained in that position. Only two breaths were taken from 1101 to 1132 h, after which the blowhole remained open. With consultation of NOAA, UNCW, and WHOI partners, the decision was made to proceed with IC potassium chloride (KCl) for euthanasia.

At 1152 h, an ~7 cm incision was made through the blubber ~22 cm dorsal to the caudal aspect of the left pectoral fin insertion. A lidocaine block was not performed due to water depth and the improbability of relocating the block site after administration. A custom-made, 1-m long needle designed for large whale euthanasia (Harms et al., 2014) was inserted through the incision into the

Table 1. Daily monitoring log for the sperm whale (*Physeter macrocephalus*) stranded in Mobile Bay, Alabama, including stranding location, water depth, average respiratory rate, animal behavior, and hazards to personnel

Day	Location (depth, m)	Respiratory rate/5 min	Animal behavior	Hazards
1	A (1.0-2.0)	3.4	<ul style="list-style-type: none"> • Exhaling underwater • Flukes and pectoral fins moving, arching, turning whole body, listing to left side 	<ul style="list-style-type: none"> • Deep water • Large and unpredictable movements of whale • Waning daylight
2	B (1.0-2.0)	2.0	<ul style="list-style-type: none"> • Skin blistering and peeling from sun exposure • Clicking and moving head in response to people in water 	<ul style="list-style-type: none"> • Deep water • Response personnel near whale for veterinary assessment
4	C (1.0-2.0)	9.2	<ul style="list-style-type: none"> • Exhaling underwater • Rocking from sternal to lateral recumbency 	<ul style="list-style-type: none"> • Deep water • Public approaching animal by foot, kayak, and drone • Waning daylight • Animal struck boat after dark
6	D (1.5-2.0)	1.8	<ul style="list-style-type: none"> • Rocking from sternal to lateral recumbency • Lifting flukes 	<ul style="list-style-type: none"> • Deep water • High wind with rolling waves • Waning daylight
7	D (1.5)	4.0 (pre- and during sedation)	<ul style="list-style-type: none"> • Clicking • Weak breaths • Exhaling underwater post-sedation • Lifting flukes post-sedation 	<ul style="list-style-type: none"> • Deep water • Response personnel near whale for sedation and euthanasia

heart (entry into the left atrium confirmed during necropsy), and 4.8 L of saturated KCl solution (~300 mg/ml) was administered at 1156 h (Figure 2c). The animal lifted its flukes once at 1157 h and rolled into right lateral recumbency, after which no further movement was noted. No heartbeat, palpebral or corneal reflexes, or respirations were detectable at 1206 h. Total time to death from initial sedation was 1 h 54 min. Blood for diagnostics was drawn from the ventral fluke vein at 1219 h (Nollens et al., 2018).

Postmortem Transport and Necropsy

Postmortem transport and necropsy were complicated by the animal's large size. Professional partners trained in rigging, towing, and heavy equipment operation were instrumental in successful recovery of the euthanized animal for necropsy. Because of proactive planning among ALMMSN, NOAA NMFS MMHSRP, the U.S. Army Corps of Engineers, and a local tow boat company, transport commenced within 1.5 h of euthanasia. Two orange ring buoys were attached to the animal to aid visibility on the water prior to towing (Figure 2d). The animal was towed by boat (8.5 m in length with twin 150 hp engines) from the euthanasia location to a shipping dock (~14 km at 3.4 kts; total time ~2.5 h) using an ~11-m long, 1.6-cm diameter blue synthetic tow line attached to a 6-m long yellow endless synthetic sling (~3,800 kg capacity)

girth-hitched around the peduncle. Although the animal was negatively buoyant, it was kept at the water surface when underway by forward movement of the tow boat and was identifiable by a round yellow buoy attached to the tow line. An ADCNR enforcement boat escorted the towing vessel as an additional safety measure.

Once at the dock, crews from a local construction company helped attach the synthetic sling to the whipline of a crane (Liebherr LR 1280; overall capacity 300 tons; Liebherr, Bulle, Switzerland), suspending the whale vertically in the water with flukes at the surface. The round yellow buoy was attached to the peduncle to identify the whale in case it sank. A second line (14-m long blue endless synthetic sling with ~9,000 kg capacity) was basket-hitched around the peduncle cranial to the first line, and a 10-kg steel bow shackle was used to sink the line along the animal's body. The second line was attached to the forks of a Caterpillar TH407C Telehandler (~3,700 kg capacity; Caterpillar, Deerfield, IL, USA) that was maneuvered to position the line around the axilla, elevating the animal sternal in the water. A third line, identical to the second line, was weighted and basket-hitched around the maxilla. The whale's weight was distributed as evenly as possible among the lines, and all three lines were secured to the crane. The animal was lifted from the water and lowered to ~1 m above ground level for photographs (Figure 2e)

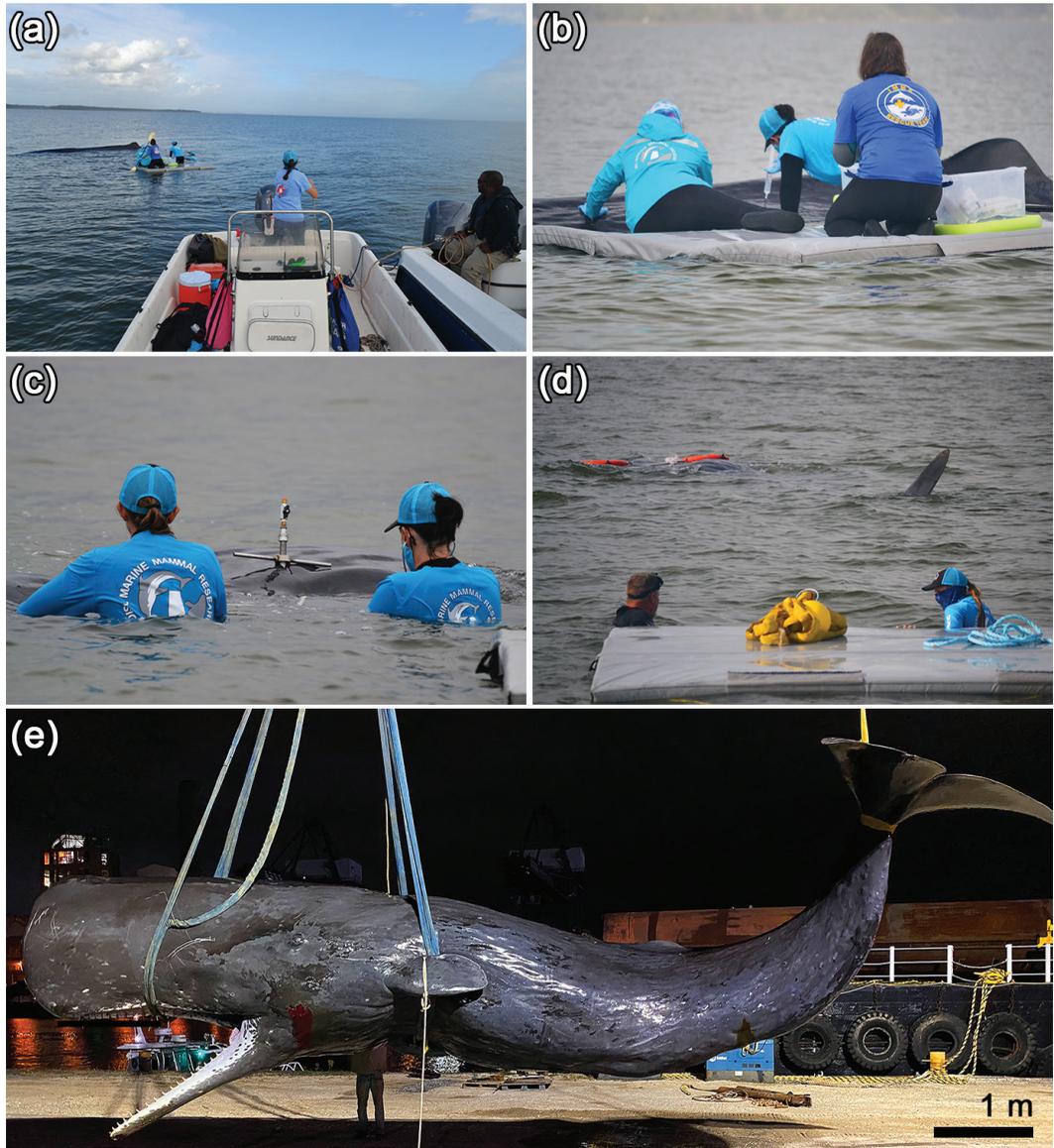


Figure 2. Assessment, euthanasia, and transport of the sperm whale stranded in Alabama: (a) Initial assessment from a floating mat connected by a line to a response boat on day of euthanasia; (b) intramuscular sedation; (c) placement of large whale euthanasia needle, shown immediately post-euthanasia; (d) preparation for postmortem transport showing the sling (yellow) and line (blue) used for towing; two orange ring buoys demarcate the whale, and the fluke is visible above the water; and (e) postmortem view of the whale showing placement of sling and lines to lift the animal from the water using a crane.

before being lifted into a semi-end dump trailer for transport (~0.25 km) to a privately owned location for necropsy.

During transportation of the whale, ALMMSN personnel began preparation for a large-scale, field-based necropsy. Preparation included packing and transporting necessary supplies and equipment, recruiting personnel and assigning roles, preparing

sample collection checklists and protocols in coordination with NOAA NMFS MMHSRP (including requests from researchers across the U.S.), and coordinating logistical operations with property owners at the necropsy location. The necropsy was performed during the following 2 d, which included the U.S. holiday of Thanksgiving Day. ALMMSN was assisted by personnel from regional stranding

network partners (DISL, IMMS, MSU-CVM, Gulf World Marine Institute, and Emerald Coast Wildlife Refuge) and a local small animal emergency hospital, which facilitated some time-sensitive sample analyses.

The necropsy field site was set up with eight stations (Figure 3), with personnel assigned to each station to efficiently perform tasks. Each day started with a safety briefing and clear assignment of roles and responsibilities, and there was always a trained Emergency Medical Technician on scene for human safety. Prior to entering the site, personnel were required to outfit themselves at the Personal Protective Equipment (PPE) station (1) as appropriate for their assigned task. To avoid carrying sharp or contaminated tools throughout the site, a Tools station (2) that included a cleaning and sharpening area was situated adjacent to the Necropsy trailer (3) where the whale was located. A notetaker was stationed at the Necropsy trailer. Tissues removed from the carcass were examined and transferred to Subsampling (4) and Collection (5) stations for initial processing and storage for diagnostic analyses, respectively. Supplies were transported and stored in an enclosed trailer with a generator (6; Honda EU3000iS 3,000 watt, 120V inverter generator; Honda, Hamamatsu, Shizuoka, Japan) for powering equipment. Photographers (two) moved among stations as needed.

Clean areas were accessible by crossing through a Decontamination station (7), clearly designated with foam mats, where personnel discarded or cleaned and removed PPE and washed exposed skin before crossing the biosecurity line. The First Aid/Rest station (8) included an area for photography equipment and datasheets and an area with first aid supplies, seating, food, and drinks available. A facility with running water, restrooms, and showers was accessible within walking distance of the necropsy field site.

The necropsy was completed with the whale in right lateral recumbency inside the dump trailer, allowing for easy carcass disposal but limiting the necropsy examination and sampling to the animal's left side. Additionally, the number of personnel inside the truck was limited to four to five people at a time due to safety concerns and space constraints. Additional safety measures were implemented and clearly communicated with all necropsy team members to ensure safe movement of personnel and equipment, via manually stabilized ladders, in and out of the Necropsy trailer. During necropsy, the actual straight length of the animal was measured as 1,020 cm. Successful placement of the euthanasia needle in the left atrium of the heart was confirmed. After necropsy, the carcass was transported inside the dump trailer to a remote property for burial. The truck

was weighed at a weigh station before and after carcass removal to obtain an estimated carcass weight of 15,585 kg.

Photos of the whale's flukes taken during necropsy were matched to a sperm whale photographed by NOAA NMFS with approximately seven other sperm whales on 1 August 2012 along the Florida Escarpment (25.722°, -84.670°; ~800 m water depth), ~600 km from the entrance to Mobile Bay (L. Aichinger Dias, UM-CIMAS/NMFS SEFSC, pers. comm., 26 January 2021).

Challenges and Successes

This unprecedented case underscores the importance of interagency collaboration to facilitate success at all levels of stranding response, including monitoring, sedation and euthanasia, postmortem transport, necropsy and sample handling, and carcass disposal. In total, more than 20 agencies from multiple states provided on-water, aerial, and logistical support. A Unified Command approach under the Incident Command System (ICS), modified for the number of available personnel and complexity of this event, was instituted to organize and coordinate this multiagency response effort (Geraci & Lounsbury, 2005). The ICS, a component of the National Incident Management System in the U.S., is designed to provide a hierarchy of command and organization to an incident response (e.g., Wilkin et al., 2017). Use of the ICS in large whale stranding response is recommended to help define clear roles and responsibilities (Geraci & Lounsbury, 2005). Multiple ALMMSN staff members had up-to-date ICS training, including advanced trainings at the 300 and 400 levels. Basic ICS trainings are provided online and free of charge through the Federal Emergency Management Agency (FEMA) at <https://training.fema.gov/nims>.

Planning—Proactive and collaborative planning was essential to smoothly and efficiently accomplish all parts of the response. The rapidly changing status of the animal's location and condition required adaptability and flexibility in response efforts. ALMMSN, NOAA, and other partners remained in constant communication to plan for multiple possible stranding scenarios and response options. For example, early in the response when euthanasia was determined as the most humane outcome for the stranded animal, planning commenced on logistics for towing, necropsy, and carcass disposal. Though euthanasia was not undertaken for several more days, proactive planning allowed for development of primary and alternative plans that could be quickly implemented when needed. This approach also helped to identify resources, such as local professionals and heavy equipment, that would prove invaluable

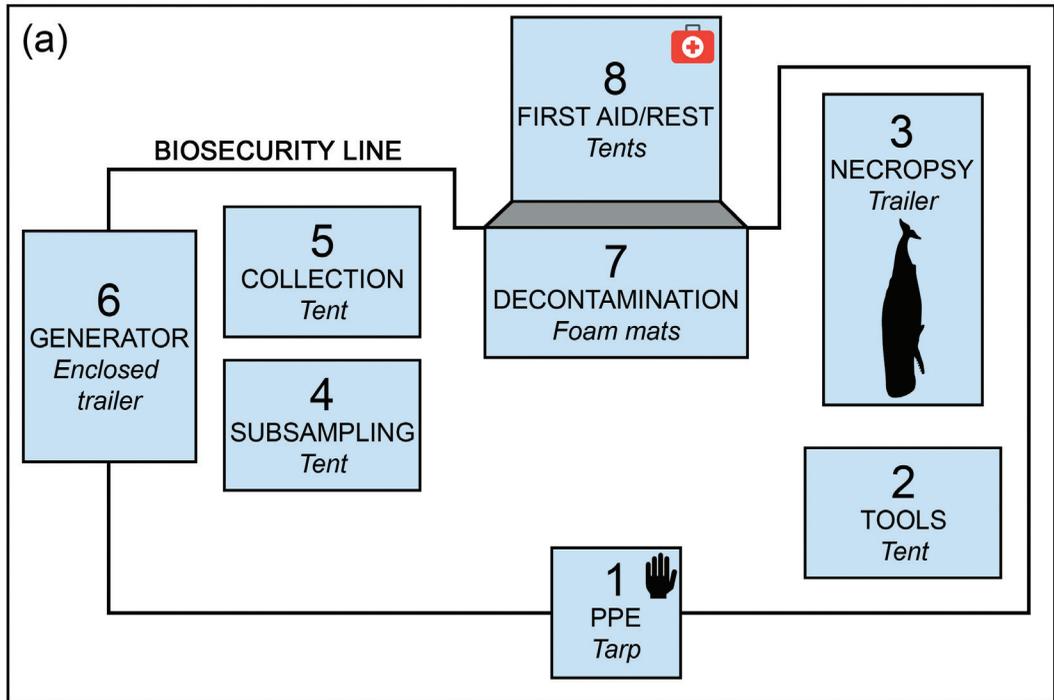


Figure 3. Necropsy field site: (a) Schematic of workstation layout. The biosecurity line demarcates the “contaminated” zone (inside the line where personal protective equipment [PPE; glove icon] was required) and the “clean” zone (outside the line). The dark gray shaded area represents the transition area from the contaminated to the First Aid/Rest station (first aid kit icon); and (b) photo of field site setup prior to beginning the necropsy. Numbers correspond to the stations in (a), which are described in the text. The PPE (1) and Tools (2) stations were not yet set up at the time this photograph was taken.

at later stages of the response. Of note, these efforts specifically facilitated timely collection and processing of some samples over a holiday when most analytical facilities were not accepting shipments or running diagnostics. Collaborative planning among various groups allowed use of collective resources and expertise and ultimately improved the success of the response efforts and the quality of data collected.

Safety—Safety was of paramount concern throughout the response effort. Concerns included the inherent risks of working with a large whale, adverse weather and water conditions, responder fatigue caused by long hours working outside, and biohazard safety and decontamination, among others. A Safety Officer was appointed early in the response to oversee safety protocols. Participant roles were discussed daily, and a debrief was held nightly, with assignments changing as needed. An effort was made to limit monitoring crews to two observers for no more than 8 h to limit personnel fatigue. Experienced captains, trained in marine mammal approach and with familiarity to local waters, supported all on-water activities, and ADCNR provided a boat captain for most overnight shifts. First aid and trauma kits and USCG-required safety equipment were always present on vessels, in vehicles, and at the field site, and all staff, including partners outside ALMMSN, were informed of the locations of these resources. ALMMSN staff are trained in cardiopulmonary resuscitation (CPR), automated external defibrillator (AED) use, and bleeding control response, and ALMMSN has an Emergency Action Plan for worst-case scenarios. Core ALMMSN staff also have 24-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training (developed by the Occupational Safety and Health Administration [OSHA], U.S. Department of Labor), which informed layout of the necropsy field site, particularly organization and use of the PPE, Decontamination, and First Aid stations. ALMMSN's previously developed safety protocols, training, and availability of the necessary safety equipment provided a solid basis for additional safety measures that proved important during this unique response.

Communications—Communication was a critical component of this high-profile response. A Public Information Officer from ALMMSN was designated to speak with the media so that veterinarians and stranding staff could focus on response efforts. A member of the on-water stranding team was assigned as a Communications Officer to share timely updates with the Public Information Officer. Regular media updates, including facts about sperm whales, status of search efforts, and contact information for the ALMMSN stranding

hotline, were used to increase public awareness and likelihood of reporting sightings, which were vital to rapid response. Ultimately, the story was shared broadly on social media and picked up by local, regional, national, and international media outlets. Information shared with the public was vetted through the DISL and NOAA Communications offices. We found daily updates were efficient and effective, with initial posts made through social media and then added to a cumulative news story on the DISL website so that anyone following the story could see all daily updates in one location. We additionally included a Frequently Asked Questions section on the website. This approach allowed us to refer stakeholders quickly and easily to key information and to maintain consistency in public messaging throughout the response without duplicating efforts.

Communication with and participation by community partners such as law enforcement officers was critical to animal welfare as well as public and responder safety. The whale stranded in four locations across Mobile Bay, moving nearly the full length of the bay and stranding on both shorelines adjacent to residential areas over the course of 7 d (Figure 1). This wide area and extended time period garnered a great deal of public attention, making crowd control and public relations vital to ensure safe conditions throughout the response. To aid these efforts, ALMMSN communicated with ADCNR personnel as part of daily briefings and notified the USCG daily of the whale's last known location to inform safety alerts (also known as a "BOLO") for vessels in the area. Law enforcement officers were also instrumental in preventing public access to the animal in shallow waters and grounding a drone that was flying low and creating noise near the animal. Keeping community partners updated on public relations also helped to maintain consistent messaging so that these agencies and their public relations specialists could refer questions back to vetted information. Our established relationships and communications with community partners (e.g., ongoing outreach and education activities and regular training for first responders, law enforcement, municipal authorities, and other officials), which are part of regular stranding network operations, facilitated these interactions and vastly improved the response to this unprecedented event.

Conclusion

This case report contributes to the sparse literature on large whale stranding response by providing novel details on all phases of response—from monitoring and euthanasia to carcass transport, necropsy, and disposal of the first documented

live-stranded sperm whale in Alabama. Stranding response and euthanasia of large whales is logistically challenging, requiring large doses of drugs, specialized equipment, and heightened safety and communications considerations due to the animal's large size. This unprecedented case highlights the need for stranding networks to have ready access to a large whale euthanasia kit and large volumes of sedation and euthanasia drugs, either on hand or via agency partnerships, even in locations where large whale strandings are uncommon. It also underscores the importance of training opportunities, such as advanced life support, bleeding control, ICS, and HAZWOPER, for stranding network members and funding to invest in these opportunities. Proactive planning, education and outreach, and protocol development that is part of regular stranding network operations can prove invaluable as a framework for unique and challenging stranding events such as the case presented herein. During ALMMSN's response to the first live large whale stranding in Alabama waters, preparedness, collaboration, and communication among local, state, federal, and private agencies were key to success.

Acknowledgments

We would like to thank all organizations involved in the response effort; ALMMSN staff and volunteers; B. Mase and the NOAA NMFS MMHSRP for help coordinating this response; and C. Harms at NCSU CMAST, W. McLellan at UNCW, and M. Moore at WHOI for their input on the sedation and euthanasia protocol. We thank the following participating agencies (in alphabetical order) for sharing personnel and resources to support the response: ADCNR, Alabama Law Enforcement Agency, Emerald Coast Wildlife Refuge (B. Dolan and D. Siesriez), Esfeller Construction, Gulf World Marine Institute (L. Albrittain), IMMS, MedVet Mobile, Mobile Police Department, MSU-CVM (S. Hughes, K. McNulty, and T. Morgan), NOAA Office of Law Enforcement (Officer G. Kornegay), NOAA Communications, The Marine Mammal Center, TowBoatUS Mobile/Blue Diving & Salvage, LLC, U.S. Army Corps of Engineers, and U.S. Coast Guard Air Station New Orleans, Aviation Training Center – Mobile, Sector Mobile, and Station Dauphin Island. Stranding response was conducted under the Stranding Agreement between DISL and NOAA/NMFS and NMFS MMHSRP Permit #18786. Response was funded by NOAA NMFS and *Deepwater Horizon* natural resource damage settlement funds provided by the Alabama Trustee Implementation Group with funding support and participation of ADCNR.

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