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RIGHT WHALE NECROPSY PROTOCOL

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Introduction

Large whale strandings present logistical problems in proportion to their mass. Often researchers, municipalities and State and Federal governments are stretched to the point of breaking as much as the lines that are used to tow the carcass ashore. Evidence is mounting that human induced mortality is the cause of a significant proportion of the whales that are stranding or found floating at sea (Moore *et al.* in press). For example, from 1970-1998, vessel strikes accounted for 35% (15 of 43) of documented right whale (*Eubalaena glacialis*) mortalities. This percentage increased to 47% (8 of 17%) for the years 1991-1998 (Knowlton and Kraus 2001). The US Marine Mammal Commission has stated that ship strikes now pose a serious threat to the recovery of northern right whales (Marine Mammal Commission 1999; see also Laist *et al.* 2001).

Large whale entanglements in fishing gear have also increased in recent years. This negative impact is considered such a serious threat to right whales that hundreds of volunteers have been trained and are participating in efforts to remove gear from swimming whales along the US and Canadian Atlantic coast. These efforts are now requiring many days, and the Herculean efforts, of these volunteers and yet the problem

still continues to grow. The Center for Coastal Studies (CCS Provincetown, MA) website, dedicated to documenting disentanglement efforts along the western Atlantic, has daily updates as to the status of entangled large whales (see <http://www.coastalstudies.org>). It must be stated that investigating a live entangled or stranded right whale must only be undertaken with the collaboration, cooperation, and supervision of experienced veterinarians, Federal and State government managers and field personnel. Do not at any time approach these situations by yourself or without discussions with just about everyone that you can think of.

Much of the information regarding ship strikes and entanglements has been generated from investigations of stranded or floating carcasses. For example, along the mid-Atlantic, stranding investigations lead to the determination that 30% (6 of 20) of stranded humpback whales (*Megaptera novaeangliae*) were killed by ship strikes between 1985-1992 (Wiley *et al.* 1994). A review of historical strandings databases led Laist *et al.* (2001) to suggest that that ship strikes “can significantly affect small populations of whales, such as the northern right whale in the western North Atlantic.” The key to determining cause of death in these investigations was conducting a thorough and systematic necropsy of the stranded whale.

The protocol that follows is an attempt to formalize the investigation of right whale strandings. A necropsy, by itself, is no different if conducted on a rodent or a right whale. The goal is to determine the cause of death. In addition, data can and should be collected on the health, age, reproductive status, and contaminant loads (among a multitude of other individual studies) of these rare and protected mammals. This protocol is a first attempt to bring together a number of separate researcher’s individual styles and experiences in handling the logistical problems of conducting a large whale necropsy. Any additional ideas, or just as important, ideas that did not work or proved dangerous, are welcome. This is a process that develops with each necropsy and with the level of data that is necessary and available to collect. In the end, it is the quality and consistency of the data collected by the necropsy team that will generate health and life history information and mortality determinations. These data will help provide managers with the evidence necessary to mitigate against ship strikes and fisheries interactions.

Valuable additional information on conducting marine mammal necropsies and necropsies in general is available by reviewing the following documents (complete references are included in the Literature Cited section):

Manual of Procedures for the Salvage and Necropsy of Carcasses of the West Indian Manatee (Trichechus manatus). Bonde *et al.* 1983.

Marine Mammals Ashore. Geraci & Lounsbury 1993.

Gross necropsy and specimen collection protocols. Rowles *et al.* 2001.

Veterinary Necropsy Protocol for Military Working Dogs and Pathology Specimen Submission Guidelines. Department of the Navy.

Marine Forensics Manual, Part 1 Marine Mammals. Galloway & Ahlquist ????

National Contingency Plan for Response to Unusual Marine Mammal Mortality Events. U.S. Department of Commerce.

Draft Contingency Plan for Hawaiian Monk Seal Mortality Events. Yochem, P.K.

Acknowledgments

This work was first developed as a way to standardize data collection during right whale necropsies - an all too common event. Amy Knowlton (NEAq) has assisted all who have been involved in right whale necropsies for the past decade and we thank her for her helpful attitude - under the circumstances. A small but dedicated team has been responding to large whale strandings for years on the US east coast including Susan Barco, Bob Bonde, Cindy Driscoll, Greg Early, Katie Touhey, Jim Mead, Mark Swingle, David St Aubin, Charley Potter, and Victoria Thayer. We have learned much from all of their contributions. Specific comments on this protocol were sought from Bob Bonde, Frances Gulland, Jim Mead, Mark Swingle and David St. Aubin. Steve Raverty provided an excellent comprehensive review and added significantly to the coverage of microbiology and infectious diseases. We thank them for their time and dedication to this tough problem. Development of this protocol was funded by the Office of Protected Resources, National Marine Fisheries Service. We all thank Teri Rowles for her tireless efforts towards research to conserve and protect marine mammals in all corners of the globe. The Peabody Essex Museum granted use of the copyrighted image on the cover. This protocol is dedicated to the memory of David St. Aubin, “keep your stick on the ice”.

Securing and Retrieving the Carcass

Most right whale carcasses are now initially reported as floating offshore. It is rare to have a right whale carcass actually strand without prior knowledge that it is floating near to far offshore. As it is the current policy to secure and tow all floating right whales to shore, the following steps, often undertaken concurrently, are necessary before the necropsy begins.

Generally, the carcass will be reported by a passing freighter, an offshore fishing vessel, the Coast Guard or Navy. In most cases the report will contain Lat/Long coordinates, but these will be hours to days old and the carcass will have to be re-located. This will need to be done before attempts are made to tow the whale to a suitable location for necropsy, and is generally best conducted from a fixed wing aircraft or Coast Guard helicopter (your regional stranding coordinator should take the lead on all of these negotiations). Be aware that current protocols for conducting offshore flights are under review and revision. It cannot be overstated that these types of flights are some of the most dangerous flying that can be done. The combination of changing weather conditions, uncertain flight tracks and times and the potential to use inexperienced pilots all combine to make these efforts non-risk averse. The relocation should also verify the species ID, size and general condition of the carcass. If possible, a VHF tag should be secured on the carcass to aid in the final recovery process.

The next step is to determine an appropriate landing site for the carcass, and prior permission must be obtained to land the carcass. The site would ideally have easy access to equipment and personnel, but also have the ability to be secured as the necropsy and clean up process could easily take two to three days to complete. In remote locations, the ability to get equipment to the site (but see below) will be weighted as the highest priority. This might require that the carcass will be towed for a significantly longer period than simply a straight line to shore. A list of additional site parameters also would include:

1. agreement with local municipality to land the whale and make sure they are aware of all of the possible odor and crowd problems.
2. minimal damage to wildlife and shore on the beach
3. availability of disposal site for soft and hard tissues: burial, landfill, towing back offshore

4. ability to get heavy equipment to the site and have enough area to maneuver during both low and high tides.
5. establish a perimeter around the whale that will keep the public safely away from cables, lines and tissues that can, and will, break with bone crushing force.
6. arrange for the local fire department to hose down the site with environmentally friendly detergents that will decrease the residual odors.

Once a necropsy site is secured the actual process of towing can begin. Taking a large whale under tow can prove extremely stressful on the vessel, captain and crew. Currents, winds, odor, all must be accounted for when maneuvering a carcass towards a beach. An adult right whale can weight up to 100,000kg, therefore the towing vessel should be generally larger than the whale being towed. Ideally it will have a towing post, but if not, care should be taken to secure the towing harness to the strongest attached piece of the vessel- do not tow it by cleats alone! Begin by passing a small line under the peduncle with a float attached to the end, or with a weight than can be retrieved with a boat hook on the opposite side of the peduncle. This line will then allow you to pass the heavy tow stap and secure tightly around the peduncle and against the leading edge of the flukes. At this point the whale can be safely taken under-tow. The whale should only be towed flukes-first. Post a watch to monitor the condition of the towing equipment and warn close approaching vessels to keep a safe distance.

If at all possible, arrange to land the whale on the beach at high tide. A large hydraulic backhoe or bulldozer with winch is sufficient to initially move the whale up the beach. If available equipment will be unable to move the whale up above the beach line then placing it high on the beach will allow at least 6-8 hours of work to be conducted during falling and rising tides. Right whale necropsies are often a race against tissue decomposition. As soon as the whale is secured on the beach a team of people should begin measuring and photographing the outside of the whale which will allow the internal examination to begin as soon as is possible.

To keep the beach as clean and organized as possible, and to lessen the confusion of multiple people wandering around, it is suggested that you set up work-stations around the whale. The public will be asking many questions- set up an outreach coordination

table and staff it with a person that can help get the message of endangered right whales out. The necropsy will be going on at two or three locations on the whale- set up a table where datasheets, film, cameras, notes, *etc.* can be organized. Parts and pieces of all types will be coming off the whale- set up a table with preservatives and histological equipment for easier processing, and set up a tarp on the beach where skeletal elements can be organized, described and photographed and then securely covered at night.

Beach Equipment Check List

Heavy Equipment and People

The ability to conduct a thorough necropsy of a large whale depends on the ability to deliver large equipment and a team of willing participants to the site. A minimum of a front-end/backhoe loader (if possible a loader with clam-shell/4-in-one front bucket) and a team of 5-10 people are needed to attempt such an undertaking. Larger equipment is sometimes helpful, but only if the operator is able to precisely finesse the equipment in very dangerous tight working quarters. An operator that is unable to communicate effectively with the necropsy team (and vice versa) is dangerously unacceptable. It is reasonably safe to have 2-3 teams of 3-4 people each dissecting and undertaking the necropsy, but at different ends of the animal! Great care should be taken to not have more knives cutting on the carcass than can be safely monitored. In each of these teams one person will be cutting, two will be assisting by pulling tissues and collecting samples and one will be recording data. Each member of each team should constantly identify and update an avenue of escape from the carcass should the tissue mass they are working on slip from the line, the line break, or a wave engulfs the whole carcass. It is the first author's worst necropsy nightmare to fall from the top of a large whale carcass onto a knife that is being used to dissect below.

Safety Equipment

Many large whale necropsies are conducted, by necessity, in extremely remote locations. While this makes logistics to and from the site challenging it also requires an honest appraisal of the potential risks to personnel conducting the necropsy. As a general rule you should be prepared to treat many small wounds on site and the potential for serious injury always exists in the slippery business of conducting a large whale necropsy. The authors have been involved with treating wounds from; small cuts and

abrasions to severe knife lacerations that required transport to a hospital for numerous stitches, to severe hypothermia, to potential concussions while conducting necropsies. We are aware of leg fractures and severe shoulder dislocations as well. It must be mentioned that there exists the possibility of transferring zoonotic agents (*Brucella*, etc.) from the live animal or fresh carcass to the investigative team. These risks can be reduced by the use of facemasks, thorough washing of hands and body, and by disinfecting instruments after the necropsy.

While we do not condone conducting necropsies in the dark, quite often you will find yourself out on the beach in the dark trying to secure the carcass, or collecting morphometrics, or cleaning up after the necropsy. In these cases it is useful to have a few commercially available headlamps to extend the day- though as mentioned above, it is extremely dangerous to work with heavy equipment in the dark. Along with the duties of conducting a thorough whale necropsy you must stay aware of what your assistants are doing, what the public is doing and how these actions may place them in harms way. With this caveat in mind we suggest the following safety equipment.

- First aid kit with multiple small and large bandages
- The addition of a “Severe Injury” kit is not unwise including large compression bandages, tourniquets, and shock treatments
- Eyewash canisters containing sterile solution
- In northern regions, space blankets
- Sharps containers

The following is a list of equipment that has been found to be useful in dealing with a right whale necropsy. More equipment is quite often helpful, although very thorough necropsies have been conducted with much less gear.

Necropsy Gear

- Hand-held GPS
- Digital camera (w/ disc space for at least 100 images) **OR** SLR camera w/ 28-70 lens, macro lens, 2x rolls of each; 50 Fujichrome, 64 Kodachrome, 200 Ektrachrome
- Hi 8 video camera and video tape for 8 hours
- Extra batteries for all above electronic equipment
- Photo ID board to insert in all photo images
- 2- metric tapes, 30 m long (note: check end to see where numbers start)
- 2-3 data clipboards (Rubbermaid makes a plastic rust-proof model)
- 30m of 2cm braided line (examine for any abrasions or weak spots and remove)

30m of 1cm line (examine for any abrasions or weak spots and remove)
 1 very heavy (10cm wide) nylon towing strap- e.g. used by large vessel travel lifts
 4-6 high quality knives w/ 12" blades and blade guard between blade and handle
 4-6 high quality knives w/ 8" blades
 4-6 high quality knives w/ 6" blades
 2- diamond "flat" steels
 2- "draw through" knife sharpeners
 2- ball shears or large boning shears
 4- 2' long metal meat hooks
 4- 8" long metal meat hooks
 4- scalpel handles and a box of blades (take care loading blades onto handles)
 4- large rat-tooth forceps
 4- small forceps
 2-4 15cm plastic rulers
 2- 30cm plastic rulers
 2- plastic "turkey basters" for collecting urine and fecal samples
 A meter long bow saw used for trimming tree branches
 A long pry bar used for carpentry
 Aerobic and Anaerobic culturettes
 100 tyvek tags for labeling
 Fine point and large indelible ink Sharpies
 Permanent ink pens
 #2 pencils for recording data onto datasheets and histo cassettes
 Several plastic 5 gallon buckets to store and wash gear
 2- rolls of duct-tape
 2 boxes of 2 gallon ziplock bags with-on label
 2 boxes of 1 gallon ziplock bags with-on label
 2 boxes of 1 liter ziplock bags with-on label
 large box of heavy garbage bags
 2- large plastic cutting boards for cutting and photographing tissues
 Set of sawhorses and 2' x 8' section of plywood to make workstation
 1- box each of large, medium, small latex gloves
 4- pairs of fish cutting gloves in each of above sizes
 Boots, coveralls and rain gear
 2 headlamps
 5- medium to large coolers

- 2 For dry equipment storage for transport
- 2 For tissue containment on site and transport (get 1/2 full w/ slush ice)
- 1 For food cooler for drinks, etc (do not mix w/ above)

 2- large plastic transport boxes

- 1 For transport of rain gear and boots
- 1 For plastic trash bags and Ziplocs

 4-5 scrub brushes for cleaning gear
 Dawn dishwashing soap
 Safety glasses for those "going deep" into the whale

Tissue and Fluid Collection

- 20L cube of 10% buffered formalin with pour spigot
- 2 gallons of 95% alcohol
- 6-8 plastic 1L jars w/ wide mouths
- 2-boxes of large Ziplocs
- 2-boxes of small Ziplocs
- 2- bread box size waterproof plastic boxes for gross tissue collection
- Histo cassettes
- 10 60cc plastic syringes
- 10 20cc plastic syringes
- 10 16-gauge needles

Blood, urine, swab, etc collection protocols are included under individual headings and should follow specific protocols of the requesting researcher.

Much of the dissection equipment above can be purchased from a quality meat packing supply business. Catalogues from Koch Industries, Kansas City, can be ordered by calling 1-800-456-5624. Other scientific equipment can be ordered from Baxter Scientific or Fisher Scientific among others. Forestry Suppliers (1-800-647-5364) have numerous items (clipboards, tyvek tags, “rite in the rain” notebooks) that are designed for the rigors of fieldwork.

To facilitate a convenient and safe transport system for dissection equipment, purchase one 8’ section of 6” PVC pipe and 6 end caps w/ screw on covers. Cut the pipe into 3’, 3’, and 2’ sections and mastic the ends onto the pipe. These will become safe means of transporting long knives and hooks to the site and can be filled w/ seawater and soap and “less clean” gear on the way back from the beach to wash the gear. They are nearly indestructible, and can be thrown in pickup truck beds or into boats for transport to and from the site. Also look for canvas “bucket buddies” (available through Forestry Suppliers) that fit over plastic spackling buckets. They allow a bucket to be filled w/ water to keep gear clean and store smaller items in the numerous pockets. This one item will drastically cut down the amount of equipment that is inevitably lost on sandy beaches during a large whale necropsy. There is nothing more dangerous than having large knives lying around on a beach.

Right Whale Necropsy Techniques And A Few Helpful Tips

Before you get started, take a few extra minutes to prepare yourself and your team for the necropsy. Gather all of the people that will be involved in the necropsy and conduct a pre-necropsy briefing to identify the procedures that will be conducted, the samples that will be collected and specific tasks individuals will accomplish. It is suggested that you set up individual teams with one prosector, one or more assistants, one recorder and one videographer per team, and as many teams operating as you feel are safe or needed. Take a moment to talk with the heavy equipment operators. Tell them that they will be working around small fragile people with their large equipment, but that the job needs to get done and more work that machinery can do, the less work for the people. It is also suggested that you conduct a post-necropsy de-briefing. Items covered should include; the physical requirements of the necropsy, did you have enough and the right kind of people; samples and data collected, do you need to alter protocols; and external logistics, was it a good place to conduct a necropsy and control the flow of people, products and press.

It is suggested that you wear good rubber boots and rain pants. Take a moment to duct-tape the folded rain pants onto the rubber boots just above the ankle when first putting them on. This will allow you to essentially wade into the necropsy and not allow “fluids” to drain back into your rubber boots, or up the inside of the rain pants. As inevitable splashes will occur, it is suggested those doing the internal exam wear goggles to reduce the potential of eye infections.

All data sheets should be filled out with either an indelible ink pen or when the weather is less enjoyable, a #2 pencil will still write on a wet data sheet. We have found it useful to have single-sided data sheets printed on Rite in the Rain paper, heavy bond cotton paper or mylar. Rite in the Rain is best. Cotton paper can be written on even completely soaked and will dry to a useable data sheet. Mylar is nearly indestructible, but special care must be taken to dry wet data sheets or they will fuse into one slippery mass on the drive home. With this in mind, set each day’s data sheets aside to dry and start new sheets on each day. These can be collated and transcribed during final report writing. If data sheets become splattered with biological fluids they can be sprayed with a mild formalin solution and dried for permanent storage.

All tags should be made of high quality mylar or heavy bond paper (if tag is not going to be immersed in fluids). As with data sheets above, tags should be labeled with indelible ink pens or Sharpies, but can be written on with #2 pencil even when drenched, though will smear if not handled carefully. Indelible Sharpies will survive normal chemicals (10% NBF, 70% ETOH) if allowed to dry before submersing. When collecting tissue samples in bags, place the sample in one bag, then place that bag within another bag with the tag between the two bags (for extra security place the tag in a small bag as well). This will keep the tag clean and legible indefinitely. We have recently added a commercial vacuum sealer to store all of our tissues after we return from the beach. These units are available with a wide variety of bag sizes and have kept frozen stored tissues in pristine condition for many months. Additionally, these vacuum-sealed tissues are much easier to ship through overnight shipments as they will not leak when properly sealed and packaged.

Set up a trash bag when first getting started. Deposit all gloves, used bags and trash in bag to keep beach site clean. When finished the necropsy and disposal of the carcass check the site for any remaining equipment. Set up sharps containers for disposal of glass, knives and scalpels. People will potentially be back walking on this site in bare feet soon after the necropsy so look extra hard for knives and scalpels. Fill in any pools of remaining fluid with sand to keep pets from rolling in the offal. If possible get the local fire department to hose the beach down with a mild environmentally friendly detergent. If the site is very public spread a few bottles of bleach over the necropsy site to help wash the beach and keep lingering odors down to a minimum.

Conducting a Right Whale Necropsy

The following is a step-down (or step-through the animal) procedure for conducting a right whale necropsy. The procedures are based on filling out data sheets that are included in the protocol.

Condition Code

The following is a review of the carcass condition codes from Geraci and Loundsbury (1993) and characteristics that identify each code. Condition code should be

noted when the animal is first observed and again when the necropsy begins. In the case of a whale being towed to shore for hours the condition of the carcass may deteriorate dramatically. It should be noted that large whales generally decompose faster than smaller cetaceans. Deep body tissues will be “pressure cooked” until they are unrecognizable, while more superficial areas that are exposed to cooling water (peduncle, dorsal head, appendages) will appear “fresh” for up to days after death.

Condition 1: Animal is alive when first reported/investigated.

Condition 2: Freshly Dead. Eyes still moist, skin not sunburned, little scavenger damage, no bloating, organs should be pristine, red blood flows from recent wounds. Carcass should be near normal mammalian temperatures (36-37° C).

Condition 3: Moderately decomposed. Bloating with tongue distended, epidermis sloughing, extensive sunburn, eyes sunken, organs are identifiable but friable, fluid/lipid pours from cuts to the blubber and muscle.

Condition 4: Severely decomposed. Carcass has collapsed due to organ decomposition, organs liquefied, blubber and muscle easily torn and falls from bone.

Condition 5: Mummified or skeletal remains. Carcass is a bag of bones wrapped in gas-filled blubber.

Large whales do not easily dissipate deep body heat after death, due to the large volume of tissue that is wrapped in insulative blubber, the thermal inertia of that tissue mass (Brodie and Pasche 1985, Innes 1986). Immediately after death blood stops transferring heat from deep tissues to the cooling radiators of the appendages and caudal peduncle. At this point the whale starts to literally cook from within. Collecting deep-body temperatures, especially from freshly dead animals, could be helpful in interpreting time of death. These temperatures should be collected by inserting a long puncture probe deep beneath the blubber to nearly the level of the vertebral column at a dorsal, mid-thoracic site.

Right Whale Human Interaction and External Observation Data Sheets

The investigation of human interactions with marine mammals is a recent development. While strandings of marine mammals have been investigated for decades (Fraser 1934) fisheries interactions with smaller marine mammals did not receive

attention until the late twentieth century (Hare and Mead, 1987, Kuiken, 1994). Large whale stranding response protocols were formalized in 1997 by the U.S. Southeast Regional Stranding Network (Blaylock *et al.* 1997). The U.S. Atlantic coast stranding network has been trained to investigate evidence of fishery interactions with small cetaceans (Read and Murray 2000) and has begun to report these findings in the scientific literature (e.g. Cox *et al.* 1998, Friedlaender *et al.* 2001). In small cetaceans, the quality and interpretation of data collected is directly related to the condition of the carcass (Cox *et al.* 1998). A fresh, non-frozen, carcass will yield the best interpretation of the potential for human interaction.

A thorough investigation of the external surfaces of the animal is required. An excellent review of the criteria used for diagnosing fisheries interactions in cetaceans is found in Kuiken (1994). In all necropsies, notes should be collected from observations of the leading edges of the appendages and other areas of where lines could become entangled on the whale. The baleen should be investigated for areas of fractures or abrasion that might indicate that the animal had been carrying line. In many instances the only evidence of entanglement will be found in abrasions of the epidermis along the leading edges and base of the appendages or fractures of the baleen. The entangling line will have come loose from the floating dead carcass or has been actively removed from the carcass by “concerned individuals”. While external examination of the lesions associated with fishery interactions might be difficult to impossible in severely decomposed carcasses, thorough investigation of all large whale strandings will aid in our understanding of the potential for human interactions.

Collisions between vessels and large whales have been shown to be a significant cause of mortality in right whales (Knowlton and S.D. Kraus, 2001; Kraus, 1990; Laist, *et al.* 2001). The investigation of possible ship-strike during a necropsy requires a significant allocation of time and the energies of a number of people and/or agencies. Cetaceans are wrapped in blubber, a lipid and connective tissue rich tissue, which acts as a cushion to most blunt trauma injuries. The external examination of a vessel strike carcass might show only mild abrasions of the epidermis, while dissection of the tissues deep to the blubber may show muscle tearing, hemorrhage and compound bone fractures. As a general rule, vessel strike as the cause of death in large whales cannot be ruled out

unless the whole carcass has been dissected down to the bone including the skull, ribs and vertebral column.

Documentation should be made of all evidence of human interaction using the Human Interaction and External Observation Data Sheets. Any skin lesions should be recorded on a separate External Observation Data Sheet and lesions sampled in 10% NBF. As a general rule when sampling for histopathology, tissues should be no more than 1cm in thickness but can be up to 2-3cm in width. This is to allow sufficient perfusion of fixative through the tissue, but to permit a view of both the lesion and normal surrounding tissues. Additionally, samples should be immersed into formalin at least 10x times the volume of the samples. Make specific notation if the lesion is fresh (as in a wound) or healed (as in a scar). Collect a genetic sample of a minced 1 x 3cm section of epidermis fixed in a super-saturated salt solution of 10% DMSO in water. Additional genetic samples can be collected from liver, heart muscle, pericardium and endometrium in DMSO if carcass condition warrants it. Recently, researchers have been requesting frozen epidermis samples in plastic to be used to determine hormone levels, contaminants and genetics. Collect a 10x10cm section of epidermis and freeze in a Ziploc bag and place on ice immediately and transfer to a -80°C freezer as soon as possible.

Photo and video documentation of the necropsy is of the utmost importance. Ensure that all evidence of human interactions are carefully and multiply documented. Take time to set-up clear photographs, including a label with the ID and notation of what tissue, to document any human interaction evidence, other lesions, etc. The importance of high quality photo and video documentation cannot be overstated.

Different species of cyamids may be found on different locations of a right whale. Cyamids should be collected from all locations from the carcass, kept separate, and the location on the whale recorded on a copy of the External Observation Data Sheet and in/on the sample (see specific cyamid collection protocol under **Current Tissue and Data Requests** section).

Right Whale Morphometric Data Sheet

The next step in the necropsy is to collect external length and girth measurements. A right whale specific morphometrics data sheet is provided as an appendix that can be

removed and used. All lengths should be made parallel to the long axis of the animal, unless otherwise noted on the data sheet. With a large whale, girth measurements are usually made on only ½ of the animal from the dorsal to ventral midline and multiplied by 2. We have discovered that this technique yields imprecise measurements of totals girth in small cetaceans (McLellan, unpublished data). We suggest making every effort to collect whole girth measurements by digging under the whale or dragging lines, and then the measuring tape, under the whale at the appropriate sites. Though, if ½ girth measurements are taken, record that clearly on the data sheet.

Right Whale Blubber Thickness Data Sheet

Blubber's condition (*e.g.* thickness, lipid content) can offer insights into the nutritional status and overall condition of cetaceans (*e.g.* Cox *et al.* 1998, Koopman *et al.* 2002, Koopman 1998, Lockyer *et al.* 1984, Struntz *et al.* 2004). Because blubber has differing functions and depth profiles at different positions along the body (Doidge 1990, Koopman *et al.* 2002, Pabst *et al.* 1999, Struntz *et al.* 2004) a comprehensive collection of blubber thicknesses across the entire body surface will provide the best description of a whale's nutritional status and body condition. To aid in collecting these systematic data, a right whale specific blubber data sheet has been developed.

The sheet identifies nine landmarks along the length of the whale where multiple blubber thicknesses, measured around the animal's girth, should be collected. Begin collecting data by determining which side of the animal has the most complete blubber and record the side examined. Locate the nuchal crest on top of the skull behind the blowholes, which will be the cranial-most landmark. Locate the following landmarks at the axilla, umbilicus, anus, and insertion of flukes. In an effort to collect blubber thickness at ca 1m intervals along the body (in adult right whales), regions between these landmarks should be subdivided into the intervals noted on the data sheet. These regions are consistent with those collected in small cetaceans (see Koopman 1998) and will provide valuable future comparisons among cetaceans. After the nine landmarks have been identified, make a longitudinal cut at the dorsal and ventral midlines. Then, at each landmark, make a transverse cut through the blubber (*i.e.* in a straight line perpendicular to the long axis of the body) from the dorsal midline to the ventral midline, cutting

completely through the blubber to the sub-dermal sheath. The cross-sectional cuts should then be subdivided into seven equidistant positions around the animal's girth from the dorsal to ventral midline and blubber thicknesses collected at those sites. The first location is on the dorsal midline, the fourth will be the lateral midline (transverse processes) and the seventh will be on the ventral midline, with 2 equidistant sites between each of these. Separate thicknesses should be recorded for epidermis (the dark pigmented external surface) and blubber (the white fiber and lipid rich hypodermis). Record thicknesses to the nearest mm.

Right Whale Gross Necropsy Report

The following is a gross necropsy report to be filled out while the necropsy is underway. Make notations of all findings during the necropsy. If there will be multiple teams collecting data during the necropsy the Necropsy Report can be taken apart and individual pages used as a rough division of labor. It is absolutely necessary to assign an individual as the data recorder for each team conducting the necropsy. This individual will allow the prosector to safely work while narrating observations to the recorder. An additional person with photographic skills is helpful and can be assigned the duty of taking stills and video of all findings.

The report is designed to prompt the team to make specific observations of all organ systems. If an organ/tissue appears normal, do not leave the data sheet blank, but note that there were no visible lesions (NVL). If an organ/tissue was not examined (N/E), note that on the data sheet as well and explain why (*e.g.* autolysis). If the tissue or body part was missing (*i.e.* flipper removed by propeller cut) mark it as not applicable (N/A) and note why. Fill in all fields with some type of notation. It will make the necropsy more valuable for future investigators if they can determine what you did during the necropsy. As a general statement, large whale morphology and health assessment characteristics are not well known. Specific observations on tissue morphology, fat distribution, and gross body condition, to name but a few, will prove valuable to the understanding of these rare events. Simply put, writing down more information is better! Fields are described below and an unused necropsy report that can be removed and copied is attached as an appendix. A review of the recent chapters by Rommel & Lowenstine (2001) on gross and

microscopic anatomy, and Rowles *et al.* (2001) on gross necropsy and specimen collection protocols is suggested as background before beginning the necropsy.

Before beginning the narrative label all of the pages of the necropsy report (and all additional pages of notes) with the Field Number.

LARGE WHALE NECROPSY REPORT

SPECIES _____ **FIELD NUMBER** _____

LOCATION _____ **LAT** _____ **/LONG** _____

DATE _____ **GENDER** _____ **TOTAL LENGTH** _____

HISTORY:

Give a description of the circumstances of the animal's appearance. Was the animal alive, found floating, or stranded? Who was involved in the investigation at various points during recovery, necropsy and disposal. What were the dates that the stranding events occurred and that the necropsy was performed? Provide a detailed description of where all of these events took place and include a map/chart as an appendix with the sites identified (a copy of a mariner's guide that you can draw locations onto works well). This segment of the report is a good place to list all of the people and institutions involved in the necropsy and contact information for each, for your own future reference or investigators following up on findings from the necropsy. Note: the Large Whale Necropsy Exam Report should have as the header the Field # to keep them associated in the future. The following text pages do not have the Field # as the header but the blank Large Whale Necropsy Exam Report is arranged that way. The blank sheets can be copied for use in all large whale necropsies.

EXTERNAL EXAM:

Much of the information that you would describe here comes for the **Human Interaction** and **External Observation Data Sheets**. Briefly, describe the condition of the carcass and all lesions noted. Note all lesions and evidence of human interaction (including prop wounds and line marks) on the Human Interaction Data Sheet and describe more fully here. Pay special attention to healed scars and new wounds. If a video or film was shot during the necropsy you can refer to specific segments or images to illustrate points. If genetic samples of epidermis can be collected, describe the site of collection, how the tissues were stored, and list on the **Specimen Collection Data Sheet**.

Flippers:

The proximal leading edge of the flipper and the axilla are common sites of entanglement with fishing gear or line. In some cases the entanglement is severe enough that the flipper has been literally “cut-off” by the sawing action of the line. In other cases the entanglement has restricted circulation enough to cause localized necrosis and/or loss of flipper tissues. The leading edge and axilla should be carefully investigated for evidence of abrasion or necrosis. Tissue samples should be collected from any suspected sight of entanglement to determine if pre- or postmortem. As multiple tissue samples may be collected from the flippers and flukes, make sure to separately label each sample so they may be correlated to corresponding lesions. In this case it is valuable to sketch the sites where samples are taken on an additional External Observation Data Sheet, and correlate the samples with the sites of lesions. Ensure that lesions are thoroughly photo and video documented. As the flipper is disarticulated from the scapula, examine the joint for roughened or abraded/missing articular cartilage.

Flukes:

As with the flippers, the leading edges of the flukes are very common sites of fishing gear or line entanglement. It is not uncommon in a vessel strike for the ship's propeller to remove a (small or large) portion of a fluke as the animal is attempting to dive. As noted above tissue samples should be collected from all trauma sites to fully interpret the extent of the entanglement or strike, and those areas should be fully documented.

INTERNAL EXAM:

After all of the external morphometrics, human interaction protocols, photographs and external tissues have been collected the internal exam can begin (but see below, point #3). After the blubber thicknesses have been measured the blubber can be stripped, or flensed, from the carcass. At the nuchal crest cut a round hole in the cranial most blubber strip that is big enough to get your hand through. Run a line through the hole and tie a loose bowline knot at the end of the line. Run a piece of 2”x 2”x 12” piece of through the hole to “toggle” the line. This toggle can easily be removed from the line and the line pulled through the blubber after it has been flensed from the carcass, and be easily placed

in the next strip of blubber. This toggle system distributes the pulling load, and should be done in place of tying a line around the blubber. Tying onto blubber should never be done, as a line can pull through the blubber at unpredictable points and will create a very dangerous situation.

A necropsy presents an endless string of observations and decisions of what is normal/abnormal and what should or should not be sampled. The following parameters are relevant:

1. Condition code 2 right whales are extremely rare. If one is encountered, sample it exhaustively and redundantly. In some cases there will be extreme differences in tissue condition from one side of the whale to the other, depending on how the whale was floating, and possible extent of trauma or scavenger damage. More autolyzed tissues are less valuable, but should be sampled whenever possible. In general, tissues should be collected and preserved in 10% NBF for histology and frozen for future diagnostics. Samples could prove valuable years or even decades after they were collected, for studies that have not even been designed yet.
2. Sample any obvious lesion, irrespective of condition. The tissues can always be discarded, but never collected after the fact.
3. Information on the reproductive tract is vital. As soon as the pertinent external measurements and photographs are collected begin the necropsy there.
4. All tissues must be labeled redundantly with Field #, date, species, location, and organ. Begin with the sample in a bag inside another bag with a Tyvek label in a separate bag between these two will protect the tag for future identification. Put a Tyvek tag inside of all wet fluid containers as well as writing the information on the top/side of the container.

BLUBBER:

Blubber thickness should be measured at multiple sites (see **Right Whale Blubber Thickness Data Sheet**) along one side of the animal. After the blubber has been measured and sampled it should be flensed to expose the subdermal connective tissue sheath and axial muscle. The blubber should be investigated for evidence of blunt force trauma including adipocyte fracture, bleeding, localized bruising, gross tearing and/or

necrosis. Blubber will act as a shock absorber that will limit signs of gross trauma, but that force will be transferred to the deeper tissues of the subdermal sheath and axial muscle. A mild external abrasion to the blubber may actually mask gross muscle trauma and massive internal bleeding when the blubber has been removed.

MUSCULOSKELETAL SYSTEM

Axial Muscle:

The axial muscles should be completely flensed from the vertebral column so that each skeletal element can be examined. The dorsal, epaxial muscles will be exposed after the blubber is flensed free of the carcass, and will, thus, be the first axial muscle to be investigated. The hypaxial muscles will not be exposed until the thoracic and abdominal cavities are opened and organs dissected free from the carcass. For both large axial muscle masses, areas of free-flowing blood, torn muscle fibers and/or necrosis should be recorded. A general ranking of muscle tissue decomposition along the vertebral column should be noted. To ensure that the muscle is fully investigated, serial transverse cuts should be made through the muscle every 1-2 m, and the cut surfaces of the muscle inspected. In all headings below, any suspected hemorrhage or edema should be described, photographed sampled in 10% NBF formalin for histological examination.

Axial Skeleton

By the end of the necropsy, the complete vertebral column should be flensed clean of tissue. In each of the following vertebral segments any bone fractures should be recorded and sampled. The articular surfaces of the vertebrae should be investigated and any lesions noted.

Thoracic Vertebrae:

Lumbar Vertebrae:

Caudal Vertebrae:

Ribs & Sternum:

All of the ribs should be removed, flensed clean and examined for old healed and new fractures. If working with heavy equipment the ribs can be removed in one complete section. To accomplish this, tie a line on three to four caudal ribs and pull lightly with the

equipment/winch. Disarticulate the ribs from the vertebrae working forward from the caudal to cranial ribs. If done in this way the ribcage can be laid out on the beach and video shot to document the location and extent of fractures. Care should be taken in the interpretation of fractured ribs. Large whales do not have the thoracic skeletal structure to support their mass when they strand on a beach. Rib fractures are an extremely common finding of large whale necropsies. Rib fractures just proximal to the site of articulation with the vertebrae (at the apex of the bend) are consistent with “green-stick” fractures of long bones. If the fracture opens away on the lateral aspect of the rib it was likely caused by the weight of the animal itself bending the “bow” of the rib cage when first grounded. Fractures that open into the body are more likely caused by external forces impacting the animal. Pre-mortem fractures are also usually associated with hemorrhage and edema.

Pelvics:

The paired pelvic rudiments are frequently lost while flensing the abdominal muscle. As the need to investigate the reproductive tract of right whales is an immediate concern, task a reliable person to remember to collect the pelvics. As right whales often have accessory hind limbs, completely flense, describe, photograph and collect the pelvic vestiges.

Cranium:

The skull should be completely flensed of tissue. Many large whale necropsies have had no significant findings until the skull was investigated. A minor strike to the head of a whale may render the animal temporarily unconscious. It must be noted that cetaceans are voluntary breathers - they have to be conscious to recognize when the blowhole has parted the ocean surface and only then will they breath. If a whale is rendered unconscious they will stop breathing and may never resume breathing again. In addition, any mandibular fracture of a baleen whale could be life threatening. The forces that act upon a whale mandible as the animal passes immense volumes of seawater through its mouth must be incredible. Even a relatively “small” fracture could render the whale unable to eat and while the immediate trauma may not cause the animals death a protracted period of starvation would still ultimate lead to the animal’s demise.

DIGESTIVE SYSTEM

Mouth:

The mouth should be investigated for evidence of vomited foodstuffs. Also check condition of skin surfaces around angle of mouth for line abrasions and the remaining oral cavity for evidence of traumatic bone fractures.

Baleen:

Look for fractured or missing baleen that would be consistent with carrying line in the mouth.

Tongue:

Look at dorsal and ventral surfaces for evidence of line abrasion.

Esophagus:

The esophagus may contain line or fishing gear that has become entangled around the epiglottis. Investigate the entire esophagus for foreign items.

Fore Stomach:

Investigate the entire stomach lining for ulcerations. If foodstuffs are present collect a sub-sample in a clean Ziploc bag. **Do not wash the foodstuffs with any water** because this may compromise future biotoxin analyses. Collect a clean sample of fluid from the stomach with a turkey baster and freeze.

Main Stomach:

Investigate lining for ulcerations and parasites. Collect sub-sample of foodstuffs.

Pyloric Chambers:

Investigate lining for ulcerations and parasites.

Duodenum:

Investigate lining for ulcerations and parasites.

Intestine:

If time is available, run the entire intestine. Note ulcerations and collect any parasites. Recent studies have found significant numbers of intestinal parasites that leads to severe diarrhea. Samples of feces should be collected and frozen.

Colon:

Examine and collect fecal samples if available. Be sure to note where sample was collected from (*e.g.* colon *vs.* anus).

Anus:

Examine and collect fecal samples if available. Be sure to note where sample was collected from (*e.g.* colon *vs.* anus).

Describe food-stuffs found in GI Tract:**Describe parasites found in GI Tract:****Describe samples collected for biotoxin analysis:**

In recent years biotoxins have been linked to numerous marine mammal mortalities. Samples of stomach and lower GI tract contents should be collected with a turkey baster and stored in sterile plastic tubes, or in large volumes in Ziploc bags for analysis.

Liver:

Inspect and record the surface features of the liver, including shape, color, visceral peritoneal condition, and note any irregularities and lesions. Note any adhesions, and describe sharpness of caudal margins. Make serial transverse or longitudinal cuts through the liver, inspect cut surfaces and describe tissue color, texture and presence of any obvious lesions and parasites. Investigate the common bile ducts for parasites.

Pancreas:

Inspect and record the surface features, including shape, color, visceral peritoneal condition, and note any irregularities and lesions. Note any adhesions. Make serial longitudinal cuts through the pancreas, inspect cut surfaces and describe tissue color, texture and presence of any obvious lesions and parasites. Note also condition of the associated lymph nodes.

Mesenteric lymph node:**CIRCULATORY SYSTEM****Heart:**

Before opening the heart, an attempt should be made to collect blood from either the heart or aorta. Blood can be drawn into a syringe and frozen for bacteriology and

serology. Inspect and note the general condition of the heart and valves, presence of any associated fat, and any lesions or abnormalities. Measure both left and right ventricular wall thickness and the thickness of the interventricular septum at midlevel of the heart. Collect interventricular septum, and papillary muscle, and epicardial coronary vessels in formalin to assess vascular injury.

Great Vessels:

Inspect and note general condition, presence of free-flowing blood or clots. Record intraluminal surface condition of large vessels.

Cranial Circulation:

Spinal Circulation:

The blood supply to the brain of cetaceans surrounds and runs adjacent to the spinal cord. Minor translations of the thoracic vertebrae and larger movements of the skull in relation to the vertebral column have the potential to occlude the brain circulation. Special care should be taken to investigate the deep circulation surrounding the spinal cord and describe any masses of loose blood or circulatory damage.

RESPIRATORY SYSTEM

Blowholes:

Inspect the blowholes for foreign debris, rocks, sand, etc.

Nares:

If possible inspect the internal nares for evidence of inflamed epithelium.

Larynx:

Inspect the larynx for any sign of dislocation from the internal nares.

Trachea:

Lungs:

Inspect and record condition of visceral pleura, note any irregularities in surface color and texture. Note any adhesions. Remove each lung by severing the primary bronchus. Note the color, consistency and volume of any fluid and collect an aseptic syringe full of fluid. Dissect down the bronchi, and note any contents, including froth, blood, parasites.

Make serial transverse cuts through the lung tissue and describe tissue color, texture and presence of any obvious lesions and parasites. Note also condition of the associated lymph nodes and collect histopath samples. Collect both lung and associated lymphatic tissues for histopathology (10% NBF) and for bacteriology (swabs) and molecular studies (frozen).

Bronchi:

Collect samples for histology from the cartilaginous rings and tissue just deep to the rings.

Alveoli:

Collect significant sections of lung tissue from the terminal airways, fixed in 10% NBF and frozen.

URINARY SYSTEM

Kidneys:

Inspect and record the surface features, including shape, color, parietal peritoneal condition, and note any irregularities and lesions. Dissect up the ureter to examine internal kidney structure, note any lesions and parasites. Make serial transverse cuts through the kidney and describe tissue color, and presence of any obvious lesions and parasites.

Ureters:

Bisect the ureter from the kidney to the bladder and note any irregularities and lesions.

Bladder:

Dissect the bladder free at its distal end. Note the presence of any urine and collect with a sterile syringe. If possible, singe the surface of the bladder with a heated piece of metal before inserting the syringe. Open the bladder and note any lesions.

Urethra:

REPRODUCTIVE SYSTEM

FEMALE

Ovaries:

Uterine Horns:

Uterus:

Cervix:

Vagina:

Mammarys:

MALE

Testes:

Epididymis:

Vas Deferens:

Prostate:

Seminal Vesicles:

Penis:

ENDOCRINE & HEMOLYMPHATIC SYSTEMS

Thymus:

Dissect free, inspect and sample.

Thyroid:

Dissect free, inspect and sample.

Parathyroid:

Dissect free, inspect and sample.

Adrenals:

Dissect free, inspect and sample.

Pituitary:

Collect after brain has been removed

Spleen:

Lymph Nodes:

CENTRAL NERVOUS SYSTEM

Brain:

The brain is generally too autolyzed to collect on large whales that have been dead for even a few hours. But, if an extremely fresh or euthanized specimen is presented, it is imperative that all efforts be focused on exposing the back of the skull and sawing through the calvarium. In this case, a large bow saw or reciprocating handsaw will be necessary. Start by cutting along the cranial-ventral margin of the occipital condyles. Continue dorsally beside the condyles for approximately 0.4 meters then join the two lateral cuts with a single straight dorsal cut. A pry bar and axe will be needed to “pop” the calvarium free. At this point the brain can be gently separated from the dura mater and completely removed. If this procedure does provide you with a whole brain, immediately place the brain on ice and contact your regional or the national stranding coordinator. Prepare a person to take the brain and immediately transfer it to a Fed Ex location for shipment. This will be your first priority. All other tissues can be collected and dealt with on site.

Spinal Cord:

Collect cross-section in 10% NBF

SENSORY ORGANS

Eyes:

Ears:

Bulla/Periotics:

Specific notations should be made of the tissues surrounding the ear structures. With care the intact bulla and periotic can be removed and should be collected for CT scanning.

CONCLUSIONS:

Concise review of lesions noted. Include notes of what important tissues were collected, where those tissues are being held, and who the contact is for those tissues. It is suggested that you remind yourself of who wanted information from this necropsy and who might contribute to the final version of the necropsy report.

CAUSE OF DEATH FROM FIELD DETERMINATION:

This report was generated by:

State your name, and the best address and contact information for you.

Remember, these necropsy reports might not become important until many years after the initial investigation. The more thorough and complete the necropsy report is during the initial observations, the more value it will have when finally analyzing the results of many separate necropsy investigations at some point in the future.

SPECIMEN COLLECTION DATASHEET

TISSUE	TEST CONDUCTED	SAMPLE SIZE	TYPE OF PRESERVATION	CHECK IF COLLECTED
Blubber	Toxicology	10x10cm through whole depth	Frozen in aluminum	
	Lipid analysis Thoracic	10x10cm through depth	Frozen in plastic	
	Lipid analysis Peduncle	10x10cm through depth	Frozen in plastic	
	Health Assessment	2x 10cm through depth	10%NBF	
	Any lesions	1 x 3cm	10% NBF	
	Histopath	1cm cubes	10% NBF	
	Trauma	x-section through wound	10% NBF	
Liver	Toxicology	100g- 2 sites collected	Frozen in plastic	
	Histopath	1cm cubes	10% NBF	
	Trauma	x-section through wound	10% NBF	
Kidney	Toxicology	100g- 2 sites collected	Frozen in plastic	
	Histopath	1cm cubes	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
	Trauma	x-section through wound	10% NBF	
Heart Right atrium Right ventricle Left Atrium Left ventricle	Histopath	2x2cm taken through depth	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
	Trauma	x-section through wound	10% NBF	
Lung	Morbillivirus	2x2cm cube	10%NBF	
	Morbillivirus	2x2cm cube	Frozen in plastic	
	Histopath	1cm cubes	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
	Trauma	x-section through wound	10% NBF	

Pancreas	Histopath	1cm cubes	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
	Trauma	x-section through wound	10% NBF	
Mammary	Histopath	1cm cubes	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
	Trauma	x-section through wound	10% NBF	
	Toxicology	100g	Frozen in plastic	
Muscle	Histopath	1cm cubes	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
	Trauma	x-section through wound	10% NBF	
	Health Assessment	Collect 3cm x-section of axial muscle	Frozen in plastic	
Lymphatics				
	PCR	Fresh	Frozen	
	Any lesions	1 x 3cm	10% NBF	
Blood	Bacteriology	Sterile syringe	Frozen	
	Serology	Sterile syringe	Frozen	
Urine	Toxicology	Sterile syringe	Sterile vial Frozen	
Uterus	Life History	Whole- minus sampling below	Frozen	
	Any lesions	1 x 3cm	10% NBF	
	<i>Brucella</i>	x-sections	Frozen	
Uterine Horn	Life History	2cm ring	10% NBF	
	<i>Brucella</i>	x-sections	Frozen	
Fetus	Reproduction	Whole	Frozen	
Ovaries & Assoc. Tissue Mesosalpynx	Life History	Whole	10% NBF	
	PCR	Fresh	Frozen	
Testes	Life History	2cm cube	10% NBF	
	PCR	Collect one testis whole	Frozen	

Bone	Trauma	x-section through fracture	10% NBF	
	Any lesions	1 x 3cm	10% NBF	
Stomach Contents	Life History	Sub-sample	70% ETOH	
	Biotoxin	Sub-sample	No water Frozen in plastic	
ADD OTHER SAMPLES BELOW				

Researcher Request Form

The following is a standardized form for specific tissues requests from right whales. Completed forms should be forwarded to the right whale necropsy coordinator.

RIGHT WHALE SAMPLE REQUEST: Specific tissue or data requested to be collected

REQUESTING AGENCY OR INDIVIDUAL: Give specific individual(s) making request.

CONTACT INFORMATION: Include email and phone numbers. Give specific details for necropsy personnel to contact the requesting individual including evening/home, cell phone, or pager phone numbers. Necropsies are often conducted at all hours in all conditions. Should questions arise about tissue collection or condition of the tissue the necropsy coordinator should be able to contact the requesting individual at any point.

AVAILABLE FOR PARTICIPATION IN NECROPSY? Give areas that the requester can respond to the right whale necropsy and collect data/tissues.

SAMPLE COLLECTION TECHNIQUE: Give a specific protocol for collecting the requested tissue/data. Protocol should include tissue type and amount, location and dissection approach.

MATERIALS NEEDED: If special fixation materials are needed they should be provided prior to the necropsy or make specific arrangements with the necropsy team leader prior to the necropsy.

SEND SAMPLES TO: Give address for tissues and general guidelines for when delivery is possible. Include a phone number to call to make arrangements for tissue delivery. In general, a Fed Ex # is helpful for sending tissues, and is very helpful to track tissues should they become lost during shipping.

Researchers Interested in Right Whales Tissues/Data

The Following is a list of current Right Whale Sample Requests.

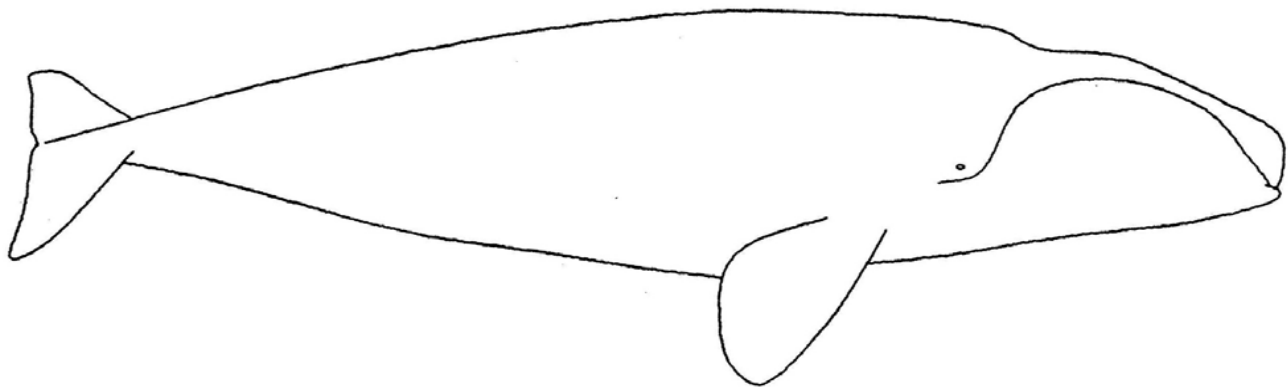
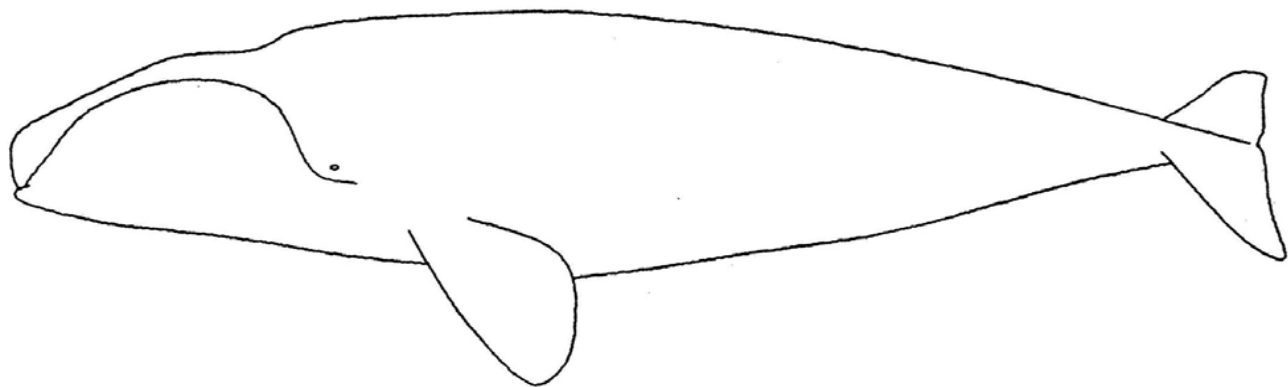
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Field # _____ Date _____ Observer _____



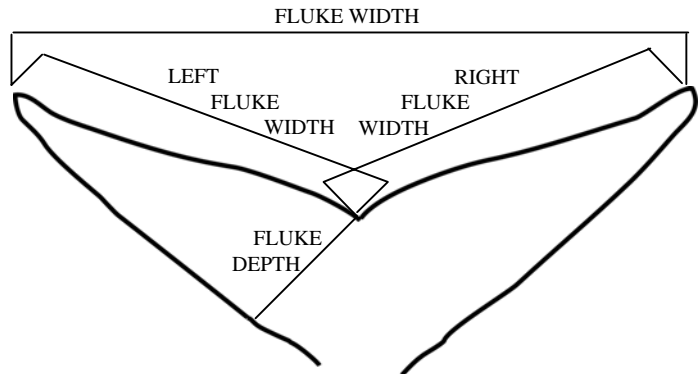
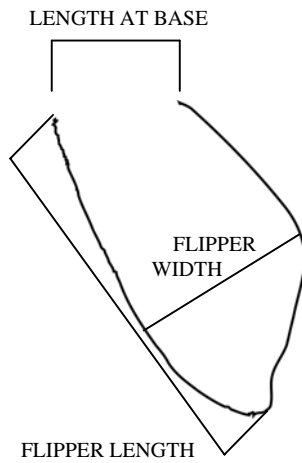
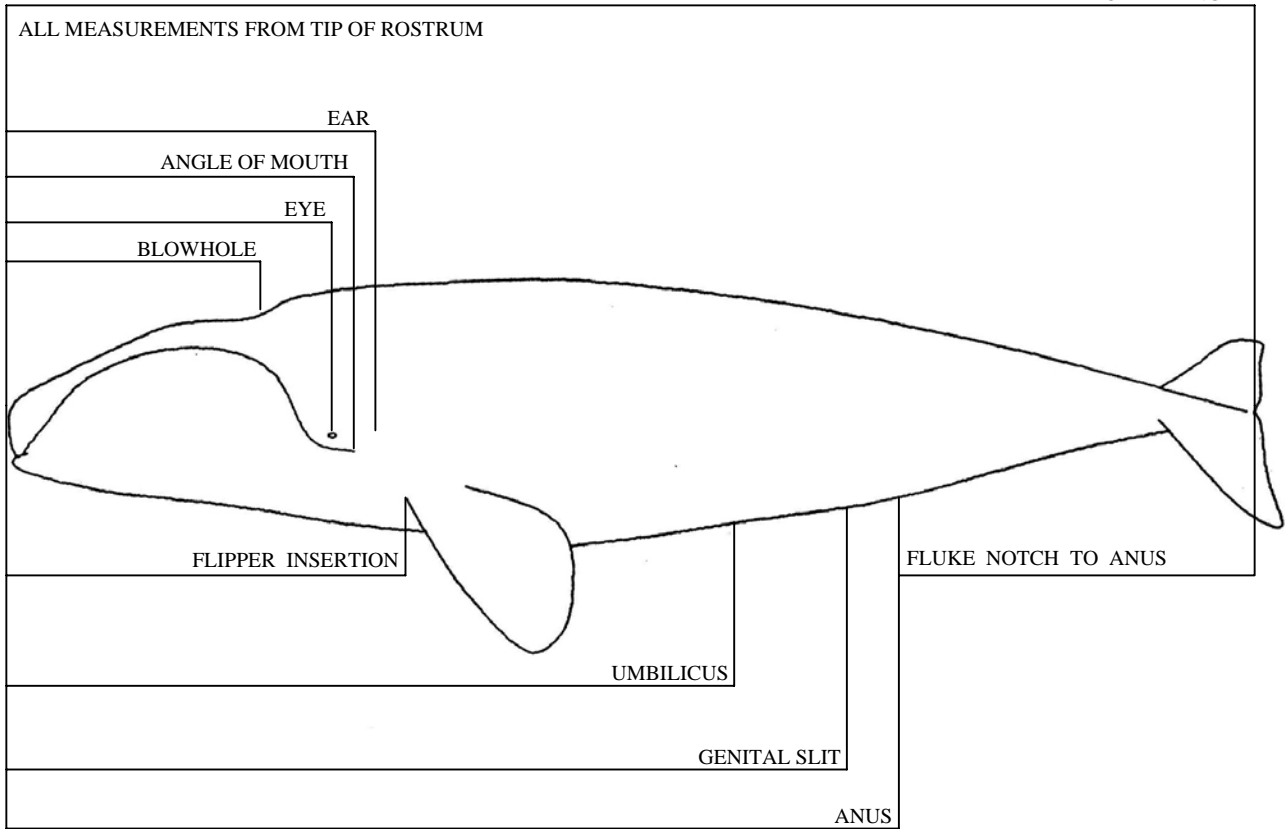
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Right Side Observations:

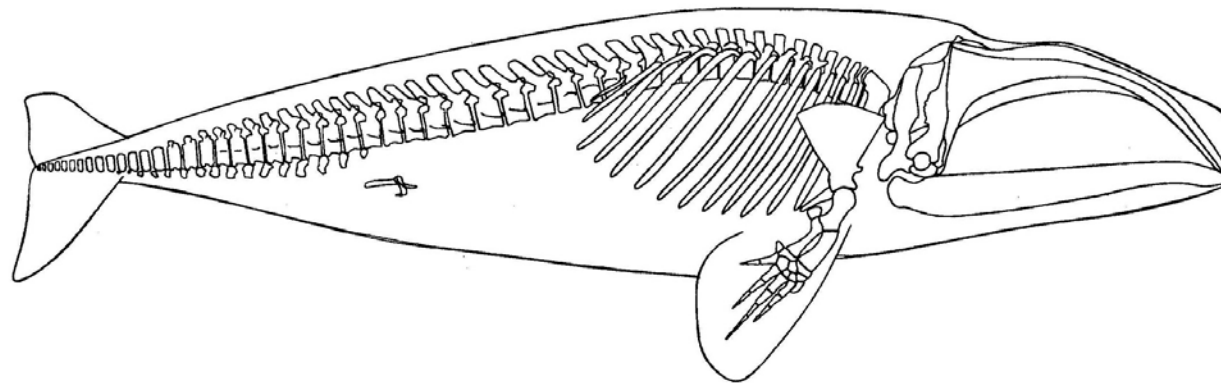
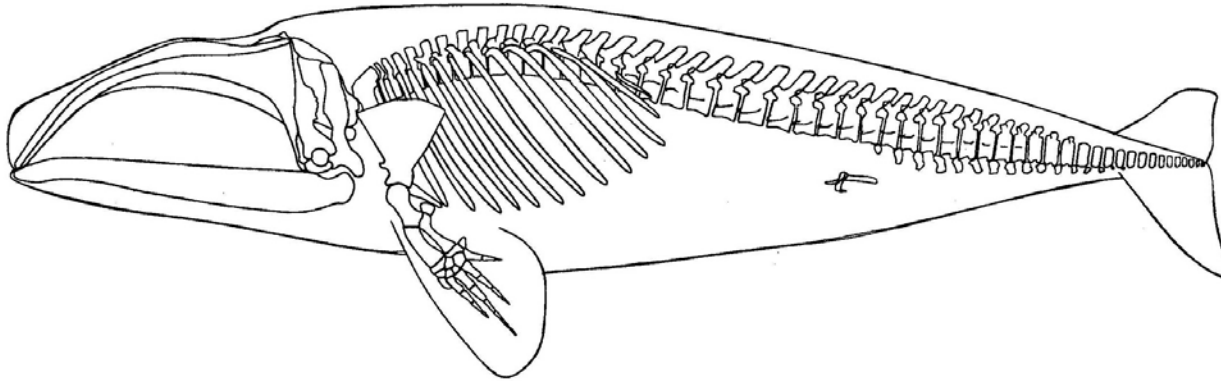
Right Whale External Morphometrics

WRITE MORPHOMETRICS ON LINES

TOTAL LENGTH



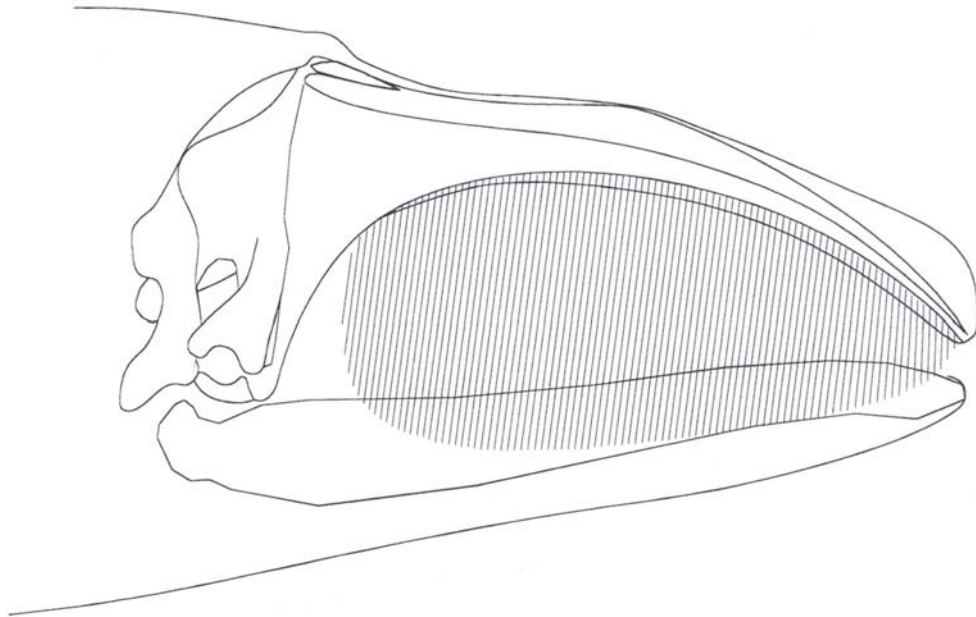
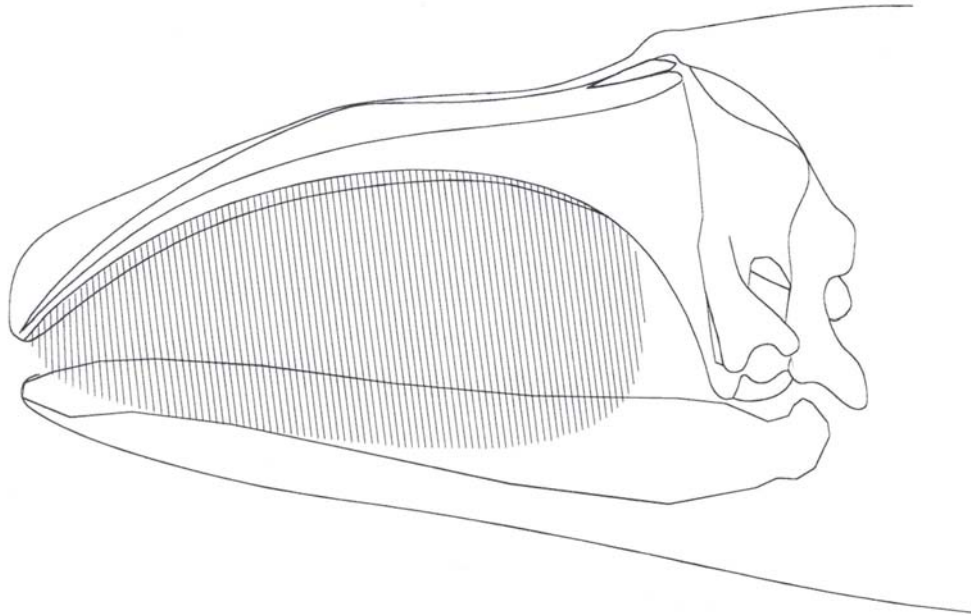
Field # _____ Date _____ Observer _____



Left Side Observations:

Right Side Observations:

Field # _____ Date _____ Observer _____



Left Side Observations:

Right Side Observations:

RIGHT WHALE NECROPSY REPORT

SPECIES _____ **FIELD NUMBER** _____

LOCATION _____ **LAT** _____ / **LONG** _____

DATE _____ **GENDER** _____ **TOTAL LENGTH** _____

HISTORY:

EXTERNAL EXAM:

INTERNAL EXAM:

Field Number _____

DIGESTIVE SYSTEM

Mouth:

Baleen:

Tongue:

Esophagus:

Fore Stomach:

Main Stomach:

Pyloric Chambers:

Duodenum:

Intestine:

Colon:

Anus:

Describe food-stuffs found in GI Tract:

Describe parasites found in GI Tract:

Liver:

Pancreas:

Mesenteric Lymph node:

Field Number _____

BLUBBER:

MUSCULOSKELETON

Axial Muscle:

Axial Skeleton

Thoracic Vertebrae:

Lumbar Vertebrae:

Caudal Vertebrae:

Ribs & Sternum:

Flippers:

Flukes:

Field Number _____

Cranium:

CIRCULATORY SYSTEM

Heart:

Great Vessels:

Cranial Circulation:

Spinal Circulation:

RESPIRATORY SYSTEM

Blowholes:

Nares:

Larynx:

Trachea:

Lungs:

Bronchi:

Alveoli:

Field Number _____

URINARY SYSTEM

Kidneys:

Ureters:

Bladder:

Urethra:

ENDOCRINE & HEMOLYMPHATIC SYSTEMS

Thymus:

Thyroid:

Parathyroid:

Adrenals:

Pituitary:

Spleen:

Lymph Nodes:

Field Number _____

REPRODUCTIVE SYSTEM

FEMALE

Ovaries:

Uterine Horns:

Uterus:

Cervix:

Vagina:

Mammarys:

MALE

Testes:

Epididymis:

Vas Deferens:

Prostate:

Seminal Vesicles:

Penis:

Field Number _____

CENRTRAL NERVOUS SYSTEM

Brain:

Spinal Cord:

SENSORY ORGANS

Eyes:

Ears:

CONCLUSIONS:

CAUSE OF DEATH FROM FIELD DETERMINATION:

This report was generated by:

ADDITIONAL OBSERVATIONS

Field Number _____

Evaluation of Human Interaction

Field Number _____

Species _____

Date _____

Location _____

Code 1 2 3 4 5

External Examination

A. Body Condition : Emaciated specimens often exhibit sunken epaxial musculature and neck
Emaciated _____ Not Emaciated _____ CBD _____ N/E _____

B. Net or Line Marks: Indicate Y/N/CBD/NE for each area and carefully describe net or line marks:
Head _____ D.Fin _____ L.Flipper _____ R.Flipper _____ Peduncle _____ Other _____

C. Fishing Gear Present on Animal (Yes) or (No)

D. Gear Retained (Yes) or (No)

E. Penetrating Wounds : Yes _____ No _____ CBD _____ N/E _____

F. Mutilations : Body Slit or Mutilated? Yes _____ No _____ CBD _____ N/E _____

G. Hemorrhaging / Bruising : Yes _____ No _____ CBD _____ N/E _____

Describe extent and area :

Internal Examination

A. Sub-Dermal Hemorrhaging : Yes _____ No _____ CBD _____ N/E _____

Describe extent and area :

B. Broken Bones : Yes _____ No _____ CBD _____ N/E _____

Describe :

D. Stomach Contents Retained : Yes _____ No _____

E. Histopathology Samples Retained : Yes _____ No _____

F. Gross Pathology : Yes _____ No _____ CBD _____ N/E _____

Describe :

*CBD - Can not be determined

*N/E - Not Examined

Histopathology Checklist

	Blubber/Epidermis		Lung		
	Trauma sites		Trachea		
	Abrasion sites		Left Atrium		
			Left Ventricle		
			Right Atrium		
			Right Ventricle		
			Aorta		
			Pulmonary Artery		
			Esophagus		
			Fore Stomach		
			Main Stomach		
			Pyloric Stomach		
			Duodenum		
			Intestine		
			Colon		
			Liver		
			Pancreas		
			Spleen		
			Kidney		
			Ureter		
			Bladder		
			Adrenal		
			Ovary		
			Uterine Horn		
			Testis		
			Epididymis		
			Prostate		
			Penis		
			Thoracic Spinal Cord		
			Lumbar Spinal Cord		
			Caudal Spinal Cord		
			Pre Scap Lymph		
			Mediastinal Lymph		
			Colonic Lymph		
			Thymus		
			Thyroid		
			Axial muscle		
			Nuchal fat		
			Pituitary		
			Brain		

RIGHT WHALE SAMPLE REQUEST:

REQUESTING AGENCY OR INDIVIDUAL:

CONTACT INFORMATION:

AVAILABLE FOR PARTICIPATION IN NECROPSY?

SAMPLE COLLECTION TECHNIQUE:

MATERIALS NEEDED:

SEND SAMPLES TO: