	Fisheries and Oceans Canada **STANDARD OPERATING PROCEDURE** **SOP-OPA-ACC-01**
TITLE: Procedures for capture/pursuit and tagging of marine mammals	
EFFECTIVE DATE: APRIL 2013	**LAST REVISION DATE:** SEPT 2021
APPROVED BY: Ontario, Prairie & Arctic Animal Care Committee (OPA-ACC)	

1.0 PURPOSE

To provide instructions for the efficient and safe capture/pursuit and tagging of marine mammals

2.0 SCOPE

This procedure applies to all scientists, technicians, students, animal care and veterinary staff at the DFO Ontario & Prairie and Arctic Regions.

3.0 RESPONSIBILITIES

Ontario, Prairie and Arctic Animal Care Committee (OPA-ACC) is responsible for:

- Review and approval of animal use protocols and management procedures for animal use (OPA-ACC Chair: Michelle Wetton-Salo)
- Taking action if procedures are misused. (See Section 3.0, OPA-ACC Terms of Reference)

The OPA-ACC Veterinarian is responsible for:

- Support in the review process of animal use protocols.
- Advice on health and disease management for research fish.
- Provision of training and advice on use of anaesthetic drugs and prescriptions as required.
- Use of professional judgement in determining if research users of animals demonstrate competency to perform procedures; taking action to address unnecessary pain or distress of animals.

Division or Responsible Managers have overall responsibility for:

- Ensuring that personnel are aware of and understand the policy/procedure.

All personnel that plan to use this procedure are responsible for:

- Familiarizing themselves with this policy/procedure;
- Obtaining training for this procedure prior to conducting it unsupervised.

4.0 APPROVED PROCEDURE

CAPTURE/PURSUIT AND TAGGING PROCEDURES:
(By species)

BOWHEAD WHALES

Pursuit

Bowhead whales may be encountered as individuals, as cow/calf pairs, or in groups of 2-20 individuals. A variety of approach techniques are employed. In some cases, resting or slow moving individuals may be approached and tagged without pursuit, allowing the entire identification and tagging sequence to last less than 10 minutes. Individuals or groups of whales sighted within 100 m are initially approached slowly by the tagging boat as closely as possible, while support boats wait at distances of about 50 m or more. An individual whale is typically identified as a target whale if it surfaces or lies at the surface of the water within 30 m of the boat. A pursuit of the target whale is initiated if the whale moves away.

Dive times between subsequent surfacings of a moving whale typically last between 20 sec and 20 minutes. A pursuit is deemed continuous if the chase boats maintain approach over consecutive or non-consecutive surfacings of 10 minutes or less. If a whale surfaces twice at intervals of 10 minutes or more without successful approach to within 100 m by the tagging boat, the pursuit is deemed as non-continuous. To limit stress to whales, pursuits of target whales are limited to 30 minutes of continuous pursuit, or 60 minutes of non-continuous pursuit.

Tagging

The tag anchors are made of stainless steel and titanium. These parts are cleaned and sterilized thoroughly with Isopropyl alcohol or Betadine (or a mixture of 1 part bleach to 9 parts water, if isopropyl alcohol/betadine are unavailable in the field) prior to tagging. If a tagging attempt is unsuccessful and the tag comes into contact with the water or any potential source of contamination, the tag anchor is to be re-sterilized prior to the next tagging attempt. A minimum of two boats and a maximum of five are used during the search and pursuit and tagging of bowhead whales. These whales are not subject to capture or restraint. Individual target whales are tagged from a boat using a long tagging pole or a pressurized launcher – Aerial Rocket Tag System (ARTS). A visual assessment of the health of the animal should be conducted prior to tagging. Animals in poor health may be more susceptible to infection at the site of tag attachment (*eg*. fungal infection).

Whales will be approached slowly from a boat and tagging is completed with a final close approach to within 5 m (tagging pole) or 6 – 11 m (ARTS) and deployment of the tag. After deployment, the boat veers away, allowing the whale to escape. There is no realistic potential for mortality to individuals, as there is no restraint involved in tagging bowhead whales. When using the ARTS system, which is powered by a SCUBA tank, tags will be deployed at 9-11 bar pressure from a distance of 6-11 m (with lower pressures selected for shorter distances). Tags are targeted at the mid dorsal surface (widest area of the back) of the whale, with the body of the tag embedding into the blubber (a cap prevents the tag from completely embedding beneath the skin) and the antenna protruding from the skin surface.

NARWHAL AND BELUGA WHALES

Capture Tagging

Pursuit/Capture:

Turbidity of the water, tidal action, water depth, and bottom topography are the four primary determinants of the type of capture method used in a particular area. When the water is clear enough to follow belugas swimming below the surface and they can be herded to relatively rock free beach areas, a hoop net is used. When the water is shallow but too turbid to see whales under the surface, an encircling or seine net is used. If the water is deep, the shoreline steep, the bottom rocky or turbidity makes herding whales difficult, a stationary net attached to the shore is used.

A) Hoop net – beluga whales

A 12 mm X 305 cm length of 2 mm thick steel alloy tubing (electrical conduit) is formed into a 1.2 m diameter circle and the ends are welded together. A dense 2 cm thick foam tube, normally used to insulate water pipes, is placed around the hoop to provide cushioning and buoyancy. Duct tape is wrapped around the foam twice to fasten it to the hoop. The angle of wrapping is reversed for the second layer to help seal the foam from the water. Knotless netting with a stretched mesh size of 40 mm is normally used to form the purse. The netting is fitted to a width that encircles the hoop and then cut to a length of ~140 cm. One end of the netting is wrapped around the hoop and uncut knots are tied, using #10 tarred twine, where each of the meshes of the netting overlaps around the hoop. The other end and the cut side of the netting are sewn together using the same twine. A length of 7 mm twine ~1 m long is also threaded through the loose end of the net, tied at one end and formed into a loop at the other, to be used as a handle to control the netting while jumping.

Once a beluga is captured with a hoop net, a tail rope is used to assist in restraining the animal. The tail rope consists of a 2 m length of 12 mm polypropylene rope threaded through a 1 m length of 16 mm smooth rubber garden hose, such that the hose covers one end of the line. Both the garden hose end and the rope end are formed into knotless loops 15-20 cm in diameter and held in place with # 10 tarred twine and duct tape. To restrain a whale, the tail rope is wrapped around the caudal peduncle. The rope end is pushed through the loop at the hose end and drawn so as to cinch the hose-covered end around the whale just forward of the tail. The rubber hose helps to reduce abrasion of the whale's skin. The free end is either held in hand or secured to another longer rope leading to shore.

In order to use the hoop net effectively, a beluga must first be herded into water less than 1.5 m deep. In deeper water, whales have room to maneuver and are more likely to escape. In water deeper than 1.5 m it is also very difficult to get adequate footing to handle the whale, once members of the capture team enter the water. One or several boats are used to herd the whale slowly toward shore, staying 30-80 m behind it and preventing it from going into deeper water. Experienced individuals (usually whale hunters) from communities near the area where the whales are being live-captured, are well suited for this part of the capturing process. They are familiar with the behavior of these whales and although every drive is different, most times the initial phase of getting the whales into shallow areas is successful. If whales are not positioned properly after 20-30 minutes the drive is aborted.

An inflatable 4.5-5 m boat with a 25-35 hp outboard motor is used to provide the necessary maneuverability to herd the whales once in the shallow water. On some occasions, at the Churchill River for example, aluminum boats of the same length are used. The inflatable boat offers the advantage of portability to remote field locations and also safety for the whales, which are closely approached prior to capture. The capture team consists of one person operating the motor, another handling the hoop net in the bow of the boat and a third in the middle, with the tail rope. All members of the capture team wears either a dry or wet suit, which increases their buoyancy when they enter the water and helps keep them warm, in the cold waters where belugas are typically found. The person steering the boat positions it so that, once in shallow water, the whale is swimming alongside with its head near the bow. As the whale surfaces, the person in the bow attempts to place the hoop net around its head. Once the net is around the whale the person maintains a hold on the hoop while jumping from the boat. One person can usually control a whale in shallow water, but assistance from a second individual with a tail rope is needed to adequately restrain the animal or move it to a suitable tagging location.

Risks to the capture team include being struck by the boat and motor, jumping from the boat onto a rock, getting stuck in a soft bottom and twisting ankles or knees, and being struck by the whale's tail, which may be thrashing vigorously. Whales are occasionally struck by the boat or the motor and may get abrasions from rubbing on the bottom, the tail rope and netting around the hoop. To date, there have been no fatal injuries to either human or whale while using this technique.

Once a person is holding the hoop on each side of the whale and the tail rope is in place, the capture team has full control of the animal. The hoop portion of the net is used as a handhold to restrict the whale’s forward movement. The front netting can be pulled to either side to guide the whale in the desired direction. Normally the whale is brought toward the shore tail first until its back is sufficiently exposed to allow transmitter attachment and/or blood collection. The whale may have to be moved into deeper water as the tide recedes or into shallower water as it rises.

When employed in a suitable area, the hoop net is by far the most efficient of the three methods described here. Although whales are not caught during every attempt, hoop-netting is the most directed, safest (for human and whale), selective, and the least expensive means of capturing whales. It has been used to successfully capture more than 40 belugas at the Churchill River, three areas of Somerset Island, Coningham Bay on Prince of Wales Island, and Croker Bay on Devon Island. The whales at these locations are usually willing to go into shallow beach areas, and the water is clear enough to see them below the surface. We had only limited success with the hoop net in the Mackenzie Delta because the water there is very turbid, making it difficult to follow submerged whales.

B) Seine net – beluga whales

Seine or encircling nets have long been used to capture marine mammal species around the world. An adaptation of this technique has been used to capture belugas in the silt-laden channels of the Mackenzie River delta, since attempts at hoop netting had provided only limited success. A length of net with float and lead line is deployed from a fast-moving boat so that it surrounds the whale(s). The netting is usually 210/96 gauge green nylon twine with a stretched mesh size of 30 cm and is 14 meshes deep. A 17 mm foam

core float line and #30 lead line are used on the top and bottom of the netting. Although different lengths have been used, the optimal length appears to be 150 m. Attached to the net at both ends is a 4 m bridle and 15 m length of 17 mm polypropylene rope with a 30 cm inflatable buoy attached. The net is piled "accordion style" (folded forward then backward over itself) in a wooden box with the dimensions of 210 cm x 105 cm, with sides 25 cm tall. The stern side is hinged and the entire box is lined with a layer of 12 mm dense foam, to allow the net to spool out freely. The box is positioned at the stern of the boat and held overtop the outboard motor with a wooden bracket, braced to the gunnels of the boat. The lead line is positioned on the port side and the float line on the starboard side. The boat is a rigid hull constructed of aluminum or fiberglass and equipped with an outboard motor powerful enough to accelerate rapidly with the excess weight of the net.

Before deploying the net, the belugas must be herded into water ~2 m deep. The number of boats involved in herding has varied, but using five, with at least two people in each, seems to be most effective in the Mackenzie River delta. As the whales are being herded into shallow water the depth can be periodically tested with an oar or pole held vertically over the side of the boat. Once the water depth is shallow enough to set the net, the net boat moves to within 30 m of and parallel to the whale(s), matching their speed and keeping the whales along the port (lead line) side. When the driver is satisfied that the whales are moving in a consistent manner and in the proper position, he accelerates to full throttle. The hinged side of the box is let down to rest on top of the outboard motor and the first buoy is tossed into the water from the stern. The drag of the buoy in the water pulls out the net and, as it is discharged, the boat turns counter-clockwise, in front of the whales, keeping the lead line on the inside of the turn. Within a few seconds, the entire net is in the water and the other buoy is expelled. This marks the end of the net and should be very close to the first buoy, which is used as a target while the boat is completing the circle. While the net is being deployed, two or more small boats are driven in circles at high speed around the outside of the net, to distract the whales and reduce the likelihood of escape. A complete circle is not always formed. Therefore, it is important for the small boats to create a disturbance around the opening until the net can be pulled together or a whale hits the net and becomes entangled. Longer nets may allow larger complete circles to be set, but have the disadvantage of added weight and therefore slowing setting speeds, which may allow the animals to escape.

In most cases, if it does not escape under the net or through the gap between the beginning and end of the net, a beluga will quickly become entangled. In this respect, belugas are unlike some other cetaceans such as bottlenose dolphins and killer whales that either stay within the confines of the net or, with dolphins, occasionally attempt to jump over it. For this reason it is important that the support boats approach the whales quickly, and those that are entangled are brought to the surface promptly. It is also essential that the net not be set around more than 3 whales at once because it increases the difficulty in handling them, and may become too strenuous on the people in the 2 or 3 capture boats. Calves are particularly vulnerable. Young whales may have to be assisted to the surface if they are captured in a lower part of the net or entangled near another whale. If more than one whale is caught during a set, each whale is restrained and inspected for size and condition. Usually if there are more than two whales caught during the same set the least desirable animals are quickly released.

The hoop net and tail rope are placed on the whales as they are disentangled from the net. Once they are freed from the seine net they are carefully taken to shallow water. They might first be held against an inflatable boat and then that boat towed by another, until it is shallow enough for the capture team to get into the water and walk with them. Young-of-the-year whales are kept and held close to the adult they were captured beside. All 28 whales, including five calves, captured in the Mackenzie Delta, in 1993, 1995 and 1997 were successfully released.

There are some dangers associated with using the seine net. For example, boat collisions can occur while the net is being deployed and people can become entangled when working in the water. Nothing can be seen below the surface so parts of the net can easily become fouled around an ankle. Also, if the whale is not completely under control a person can be pulled under, especially if the whale is rolling in the net. In spite of these hazards, no serious injuries have occurred to date.

C) Stationary net – beluga whales and narwhal

Stationary nets are much like gill nets used to catch fish. The twine used to make the net is green or black in color and 210/96 or 210/180 gauge. Stretched mesh size ranges from 30-65 cm, and from 20 to 30 meshes deep. The top line is 12 mm nylon or polypropylene and the lead line is usually #51. The types of floats used are either 30-45 cm inflatable or 15 cm dense foam. Inflatable floats are spaced 4 m apart, occasionally attached to the net by 1 m rope, to reduce the possibility of catching pack ice moving with the wind and tide. Foam floats are placed 2 m apart and attached directly to the top line of the net. The nets are manufactured in 50 m lengths, and 2 or 3 lengths are used at a time. The shore end of the net is solidly anchored to rocks along the shoreline, above the high tide line. The sea end of the net is attached to a heavy anchor of rocks or metal in the water, by a 12-20 mm nylon rope. If the anchor is not heavy enough the tide and ice can cause it to shift position significantly.

Once the net is in position, one or more people constantly monitor it and scan the area for approaching animals. Boats are positioned close to the net, for quick and easy access, but not so they can be easily detected by approaching whales. This usually means having the inflatable boats on shore or with the larger boats, on the other side of a point or small island where the net may be set. When whales are seen moving close to the net, the capture team prepares to react in the event that one or more of the animals becomes entangled. Teams in two or more boats immediately approach any entangled beluga. If the whale is not at the surface when a boat arrives, it is immediately brought to the surface by pulling up the net at the nearest location where it can be grasped. A short struggle takes place as the whale is restrained with a hoop net or straps and a tail rope. The hoop net secures the head and, to a certain extent, the pectoral flippers. The tail rope secures the tail and is sometimes tied to one of the boats. Straps can be placed around the whale at the front flippers and near the tailstock and held by one or more persons in each inflatable boat. Shortly after being restrained belugas are usually calm. The netting holding the whale is quickly removed once other restraints are in place. As stated earlier, if more than two animals are caught at once the others are usually released.

Shorelines near deep water where stationary nets are used are often too rocky, slippery, or affected by strong tidal currents to be suitable sites for attaching transmitters to whales. Therefore, the whales are normally handled and instrumented at the site of capture. The capture boats are tied to a section of the net where the work is performed. Paddles or

stainless steel poles are used to keep the two boats apart, with the whale positioned between them. The whale must be lifted high enough out of the water for the area of transmitter attachment to be clear of the water.

The stationary net has also been used to successfully capture narwhal in Greenland and Canada's High Arctic. Narwhal prefer areas of deep water so seine nets are ineffective, because they can escape under the net. The tusks of male narwhals, as well as the difficulty in herding them into shallow areas, make the hoop net ineffective.

Tagging

Once the whale is situated, the satellite transmitter is attached with 2-3 10 mm nylon pins through the dorsal ridge. The nylon pins as well as all tools are cleaned and sterilized with Betadine antiseptic solution prior to use. Pins are pushed through the skin and blubber using a sterilized boring tool. This results in collection of skin and blubber sample and thus no other biopsies need to be collected. No anaesthetic is used in this process. Once the tag is fitted the tail rope is loosened, the whale is guided into deeper water and released. Upon release the whale typically rolls upside down and for this reason it is important to ensure they are in deep enough water to safely roll without injury.

Euthanasia (unlikely but if required)

If, in the unlikely event, a whale was injured in the capture phase, the method of choice is to apply a penetrating shot to the brain via 12 gauge shotgun with slug projectile. After death the body would be used by the local community as they see fit.

Cow / Calf Pairs

Pursuit of females with calves will be avoided for tagging activities; however, capture in stationary nets is possible. In this case the research team must consider release from any tagging activity if the veterinarian and / or researchers feel that the female or the calf exhibit signs of undue stress.

Remote Tagging

Pursuit:

As an alternative to capture tagging, in some situations, remote tagging will be employed. Animals will be approached in small vessels at low speed, parallel to the animal's direction of travel. The animal will not be "chased" as a tag needs to be positioned on the dorsal ridge of the animal and not from front or back side of the animal. As the vessel moves into position parallel to the direction of travel for the whales, the operator will landmark anywhere on the posterior back half of the animal to be tagged. Aiming for the back half of the animal is a necessary safety measure to avoid accidental contact with the blowhole and eyes. Only adult animals that appear healthy will be tagged. Adult whales will be assessed based on their colour (adult beluga whales are white, while young juveniles and calves are grey in colour, and adult narwhals are mottled with increasing white, while young juveniles and calves are grey in colour) and size. If an adult whale displays visible wounds, from hunting attempts or other injuries, or displays a concave dorsal ridge (which may indicate poor body condition) the animal will not be tagged. Tagging attempts will cease if the target animal displays active avoidance of the research vessel, or if a tag has not been equipped after 20 minutes of close approaching. If a tag strikes or completely misses an animal, further attempts may be made on the same day, provided the individual shows no evidence of changed/evasive behaviour (i.e., no flinch or other reaction).

Tagging:
Satellite transmitters will be affixed to whales through use of a cross-bow. Transmitters are thoroughly cleaned and sterilized to minimize risks of infection upon contact with the animal. Transmitters will be attached using 6cm metal barbs that penetrate dermal/blubber tissue. Metal barbs used to affix satellite tags will be sterilized using isopropyl alcohol or Betadine and then encased in plastic tubes for storage until deployment. Isopropyl alcohol or betadine (or a mixture of 1 part bleach to 9 parts water, if isopropyl alcohol/betadine are unavailable in the field), will also be on board the boat to re-sterilize any darts that come into contact with water. Transmitters attached using this method typically remain on the whale for 30-90 days, and re-sighted whales show no noticeable long-term impacts several months to years after tag deployment.

There is no realistic potential for mortality to individuals, as we will approach whales slowly from a boat and attempt to tag them from a distance of 10-20 meters. Possible injury during tag deployment includes unsuccessful tag attachment, in which the injury would be a superficial wound. Crossbow settings and small tag size are expected to limit tag penetration to just the skin and blubber layers (depth of 6 cm), so risk of injury to muscle and other tissue during our procedures is judged to be minimal. A visual assessment of the health of the animal will be conducted prior to tagging.

KILLER WHALES

Pursuit:
Once sighted, killer whale groups are observed from >1-2 km to assess their behavior. If they are not actively hunting, researchers will attempt to 'join' the group by slowly approaching the group at an angle to their direction of travel, eventually intersecting their path. At that point, killer whales generally display one of two responses: either swimming at slow speeds alongside the boat for periods of up to several hours, or avoiding the boat. In the latter case, avoidant behavior is clear, as killer whales will change their swim direction and/or submerge, and then surface some distance away. In this case, the approach process is repeated several times over a period of 1-2 hours and if it is too difficult to get within suitable distance to satellite tag the animals within that timeframe, plans will be adjusted either to attempt biopsying them (which can be successfully done from a greater distance, up to 20m) or photographing them/recording behaviors (both of which can be done from distances exceeding 50m).

Tagging:
Satellite transmitter tags: Whales will be slowly approached by boat to within a range of 5-10 m before transmitter deployment is attempted. Satellite transmitters will be deployed remotely using a crossbow. Satellite transmitters will be surface-mounted using 6 cm metal barbs that will penetrate dermal/blubber tissue of the dorsal fin or saddle patch area (just behind the dorsal fin). The metal barbs are sterilized using Betadine or isopropyl alcohol (or a mixture of 1 part bleach to 9 parts water, if Betadine or isopropyl alcohol are not available in the field), and then encased in plastic tubes for storage until deployment. The sterilization solution will also be on board the boat to re-sterilize any darts that come into contact with water. Transmitters attached using this method typically remain on the whale for 30-90 days, and re-sighted whales show no noticeable long-term impacts several months to years after tag deployment.

There is no realistic potential for mortality to individuals. Potential for injuries or strikes from the research vessel itself is minimal, as whales are always approached slowly to a minimum distance of 5-10 meters for tag deployment. Possible injury during tag deployment includes unsuccessful tag attachment, in which the injury would be a superficial wound. Crossbow settings and small tag size are expected to limit tag penetration to just the skin and blubber layers (depth of 6 cm), so risk of injury to muscle and other tissue during our procedures is judged to be minimal. A visual assessment of the health of the animal should be conducted prior to tagging. Animals in poor health may be more susceptible to infection at site of tag attachment (*eg*. fungal infection).

Multi-sensor tags: Whales will be approached by boat to within a 5-10 m range before tag deployment is attempted. A crossbow, Aerial Rocket Tag System (ARTS; see above section on Bowheads), or carbon-fiber pole will be used to deploy the tag just below and behind the dorsal fin. Tags will be attached via suction cups. The tags will stay on for approximately 6-12 hours and the location of the whale will be monitored either through a distant focal follow by boat and/or using the VHF transmitter on the tag. When the tag falls off, it will be retrieved in order for data to be downloaded. Injury due to the tag itself is not an issue, as the suction cup simply adheres to the surface of the skin, and any potential for injury otherwise is assessed to be minimal (see above).

WALRUS

Pursuit:

Walrus may be biopsied and tagged at terrestrial haulout sites, on ice, and in the water. All work on land is conducted in a way that minimizes disturbance and avoids causing animals to enter the water. After landing the boat some distance (i.e., several hundred meters or more), walruses at terrestrial haulout sites are approached slowly and downwind of their location. Biopsies can be deployed using airguns from up to 10m away to avoid disturbance, and when possible are retrieved using a long (8m) pole with a net attached. Tags are typically deployed (using crossbows) onto lone animals (see below) from a similar distance, to minimize chances of disturbance. Crossbow bolts are typically retrieved using a line retrieval system or net attached to a long pole.

When possible, to avoid issues with disturbing animals that are hauled out on land, biopsy and tagging attempts will be made on walrus on ice or in water. Animals hauled out on ice will be approached slowly by boat to distances required for biopsy and tag deployment. Walruses in water will also be slowly approached by boat to within distances required for biopsy and tag deployment (see above).

Tagging:

Options for tagging walrus involve 1) capture, restraint, and sedation to affix tags to the tusks and 2) remote deployment. However, given Inuit disapproval of methods involving anesthesia, all walrus tagging will be conducted remotely. Each satellite transmitter will be deployed dorsally into the shoulder/neck area of a walrus using a crossbow, and anchored using a single titanium dart measuring 4-cm. The dart penetrates the skin and blubber. Prior to deployment, the attachment darts are thoroughly disinfected using Betadine or Isopropyl alcohol (or a mixture of 1 part bleach to 9 parts water, if Betadine or isopropyl alcohol are not available in the field). Darts will be soaked in a vial of Betadine for approximately 10 minutes or isopropyl alcohol for approximately 1 minute. If using the bleach mixture, darts are disinfected in a freshly made mixture for about 10 minutes. If a tagging attempt is unsuccessful, tags are re-sterilized before making another

attempt. While no studies have documented tag expulsion in walrus, it is expected that the tag falls off the animal within several months (and as little as several days to a week) as tissue surrounding the attachment site expels the attachment dart (as has been documented for similar tag deployments in cetacean species).

On land, only lone or animals separated from the group are targeted. This reduces risk of inadvertently hitting another animal, causing undue stress, as well as risk of stampeding if the target animal reacts. Only a large part of the body (lower neck/shoulder area) is targeted from relatively short distances (less than 15m), making it unlikely the head is hit or any other crucial part of the body (eyes, nose, mouth). In the very unlikely event euthanasia is required, euthanasia will be accomplished by a rifle that delivers a life-ending shot to the back of the head.

SEALS

Capture/Restraint:

Gill nets (11" mesh) have been the most successful, which have a floatline and a leadline. Nets are set in a chosen area, and one of its ends anchored at the beach and the other at an appropriate distance from shore. Seals get entangled in this net and watches are performed to detect any entanglements. Once the seal is entangled in the net, the crew approaches the site by boat, and the following are carried out in order:

1. With the optional aid of net hooks, pull the net with the seal onto the boat.
2. Disentangle the seal from the net.
3. Place the seal into the restraint bag and close the zipper almost entirely (leave enough to let some air in). Bring the seal ashore.
4. Place the handle loops of restraint bag with seal inside over hook in the spring scale for hanging. Hang the spring scale onto (wooden) pole, and weigh the restraint net with the seal inside. With one person at each end of the pole, lift the pole until the restraint net does not touch the ground (Figure 1). Record the weight of the seal on field sheet.


Figure 1: Weighing the seal.

5. Place the seal over at ground, and in a ventrally recumbent position. A damp dark cloth will be placed over the seal's head up to the nostrils, making sure it can breathe but that its eyes are covered to reduce stress.
6. One person is designated to be in charge of restraining the seal at all times, checking its breathing pattern, and deployment of data-logger/transmitter. Watch out for prolonged apneas of > a few minutes due to stress-induced dive response, and for grey to blueish color in gums, tongue and conjunctiva due to anoxia (bright pinkish color is normal). Apply first aid techniques if any of these are detected. Another person should be designated to be in charge of periodically (approximately every 5 minutes) checking with the restrainer whether breathing pattern is normal.

A temperature gun should be used to monitor body temperature by consistently monitoring the unhandled hind flipper where sudden changes in either breathing or body temperature are indicators of stress or distress. The short handling time from capture to release (~30 minutes) minimizes potential for severe stress and hyperthermia.

Tagging:

Flipper Tags:
Flipper tags (e.g. SPOT tags) will be attached to the web of the right hind flipper. These tags have been used extensively by the Alaska Department of Fish and Game (see link - http://www.adfg.alaska.gov/index.cfm?adfg=marinemammalprogram.icesealmovements&tab=tagging-activities). Infection rates and healing of the flipper after tag attachment have been assessed and following the proper sterilization protocols, there is little evidence of infection (see https://onlinelibrary.wiley.com/doi/full/10.1111/j.1748-7692.2010.00400.x). A tarp on the shoreline will be kept as clean as possible for where the seal will be placed and sterile gloves will be worn throughout the tagging process.

First the flipper will be rinsed with water and dried with a towel and the tagging site will be prepared to decrease the risk of infection and minimize the risk of blood sample contamination. A veterinarian should administer an injectable lidocaine anesthetic (5% lidocaine) to the area while a punch template is positioned and allowed to take affect for 3min. A tagging template should be used to assist in avoiding major vessels in the flipper and for assisting in blood draws. This area will also be disinfected with betadine prior to the procedure. A 6mm biopsy punch will be used to create two holes through the skin of the hind flipper. 6mm biopsy punches are used for the flipper as that is the size of the tag bolts for attachment. Single use biopsy punches are purchased in pre-sterilized sealed pouches until needed and disposed of after use. The bottom portion of the tag will be inserted in the punch holes and secured to the top portion of the tag via two small plastic bolts that are already sealed in sterile bags. All tagging components that will touch the punch holes in the seal flipper, as well as the area on the seal flipper will be disinfected with betadine prior to attachment. After attachment, the entire area will be treated with over-the-counter Vetericyn Plus Antimicrobial wound care solution before the animal is released back in the water. Skin tissue from the biopsy punches of the hind flipper will be retained for analysis. Blood will be collected from the puncture sites (flipper and biopsy) into sterile plastic vials before wound care is applied, or a veterinarian will collect from the flipper vein. The instrumented seal will be released at the edge of the water. For the entire process, handling time is estimated to take approximately 30 minutes.

Back Mounted Tags:

Back mounted tags (e.g. SPLASH tags) are applied to the animals back between the shoulder blades with the antenna pointed towards the head so it will extend out of the water while the animal is at the surface. Tags will be attached with 5-minute epoxy glue and will remain fixed on the animal until shedding the following spring. We will use over the counter quick set epoxy glue (e.g. QuickCure5) which has been shown to not irritate or harm the skin and also has the lowest curing temperature compared to other epoxy glues. SPLASH tag application starts with cleaning and drying the fur with acetone. The satellite transmitter (300g in weight) is then glued to the fur mid-dorsally. Once the satellite transmitter is safely glued onto the fur, the seal will be released at the water's edge. For the entire process, handling time is approximately 30 minutes.

Prior to release, attach a jumbo rototag to the web of the right hind flipper, at 2.5 cm of the edge, between digits 3 and 4, using the special pliers. This is a plastic tag with an ID number to allow identification of the seal if it is found or harvested at a later date. Record the ID number of the flipper tag. Both sides of the tag and the tagging site will be sprayed with the antiseptic Betadine. The tag should be placed so as to have the pointy part facing the outside" of the flipper. Place the two parts (male and female) of the tag where they belong into the pliers; locate the spot on the web where to put the tag, avoiding major blood vessel; place the pliers around the web at the spot and with a good grip, press hard on the pliers to perforate the membrane and close the tag; with the same movement, pull the pliers back toward you to release the tag.

Sample collection:

While the seal is being restrained a skin/blubber biopsy sample should be taken (See ACC-SOP-02 for more details on biopsy collection from seals). Prior to taking the biopsy, an injectable anesthetic (5% lidocaine) or a local anaesthetic (xylocaine) may be applied to the area. After a minimum of 3 minutes the area will be wiped clear of debris

and the biopsy will be taken. A skin and blubber biopsy will be taken from the dorsal region using a biopsy punch – a 4 or 5 mm biopsy punch is a sufficient size to collect a small blubber and skin sample. Additional samples include hair clippings and a whisker. The whisker should be removed either by plucking or by cutting with scissors close to the base of the whisker.

Euthanasia (unlikely but if required):
Seal mortality is unlikely but if nets cannot be accessed due to weather (rough seas, safety issues for workers) or darkness, or if a seal goes unnoticed in the net for some unforeseen reason, the seal may not reach the surface to breathe and may drown. Seal carcasses are taken by the community (Inuit) members of the study team to their community for subsistence purposes (food for people, food for dogs, pelts for clothing or handicrafts).

If seals must be euthanized for some reason, a properly placed gun shot through the brain is the most practical and humane method. The goal is to penetrate and destroy brain tissue, and aim the shot to cause instant loss of consciousness. Field personnel will be carrying high power rifles or shotguns loaded with slugs which are adequate for the task. Care has to be taken since the projectiles will go right through the skull and out the other side, and only experienced gun handlers should attempt this. Those with little experience should be made aware of the safety concerns of making sure the bullet does not head toward other personnel or ricochet dangerously from a hard surface beyond the seal's head. For almost all Canadian pinnipeds, a 22 cal rim fire bullet is sufficient force if the bullet is well placed from a short distance. Aim either between the eyes or at the temple region, at an angle that will cause the bullet to pass through the main part of the brain. All this is easiest to accomplish with weapons equipped with open sites and at close range (to 4 ft away). If a rifle has telescopic sites aiming is difficult close up and the operator should place the rifle muzzle a few inches away from the aim point (and at the proper angle) to be sure to hit accurately (watch out for splatter).