ARCTIC
VOL. 54, NO. 3 (SEPTEMBER 2001) P. 299–304

Capturing and Handling of White Whales (*Delphinapterus leucas*) in the Canadian Arctic for Instrumentation and Release

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(*Received 18 November 1999; accepted in revised form 24 October 2000*)

ABSTRACT. For many decades, humans have captured white whales (*Delphinapterus leucas*) for food, research, and public display, using a variety of techniques. The recent use of satellite-linked telemetry and pectoral flipper band tags to determine the movements and diving behaviour of these animals has required the live capture of a considerable number of belugas. Three principal techniques have been developed; their use depends on the clarity and depth of the water, tidal action, and bottom topography in the capture area. When the water is clear enough so that the whales can be seen swimming under the water and herded into shallow sandy areas, a hoop net is placed over the whale's head from an inflatable boat. When the water is murky and the belugas cannot easily be seen under the water, but can be herded into relatively shallow sandy areas, a seine net is deployed from a fast-moving boat to encircle them. If the whales are in deep water and cannot be herded into shallow water, a stationary net is set from shore to entangle them. Once captured, the whales have to be restrained in a way that allows them to breathe easily, have the tags attached, and be released as quickly as possible. The methods have proved to be safe, judging from the whales' rapid return to apparently normal behavioural patterns.

Key words: beluga, *Delphinapterus leucas*, capture, marine mammal, net, white whale

RÉSUMÉ. Durant de nombreuses décennies, l'homme s'est livré à la capture des baleines blanches (*Delphinapterus leucas*) à l'aide de diverses techniques, dans le but de se nourrir, de faire de la recherche et d'exposer publiquement ces animaux. L'utilisation récente de la télémesure en liaison avec un satellite et des rubans-sondes fixés sur les nageoires pectorales pour déterminer les déplacements et le comportement en plongée de ces animaux a nécessité la capture vivante d'un grand nombre de bélougas. On a recouru à trois techniques principales, dont l'utilisation dépend de la clarté et de la profondeur de l'eau, de l'action des marées et de la topographie du fond dans la zone de capture. Quand l'eau est assez claire pour qu'on voie les baleines nager sous la surface et qu'on puisse les rabattre dans des zones sableuses peu profondes, on place un verveux sur la tête de la baleine depuis un canot pneumatique. Quand l'eau est trouble et qu'on ne distingue pas bien les bélougas sous la surface tout en pouvant les rabattre vers des zones sableuses de profondeur relativement faible, on déploie une senne depuis un bateau qui se déplace à grande vitesse pour les encercler. Si les baleines sont en eau profonde et qu'on ne peut les rabattre dans de l'eau peu profonde, on installe un filet fixe depuis le rivage pour qu'elles s'y prennent. Une fois capturées, les baleines doivent être maîtrisées de telle façon que leur respiration n'est pas entravée; il faut ensuite fixer les sondes sur les animaux, qu'on doit relâcher le plus rapidement possible. Si l'on en juge par le retour rapide des baleines à des schémas de comportement normal, ces méthodes se révèlent sécuritaires.

Mots clés: bélouga, *Delphinapterus leucas*, capture, mammifère marin, filet, baleine blanche

Traduit pour la revue *Arctic* par Nésida Loyer.

INTRODUCTION

White whales or belugas (*Delphinapterus leucas*) have been captured alive for research and public exhibit for many decades. The earliest live-capture approaches were based on techniques developed to harvest the whales for meat, oil, and other products. Drive fisheries in the Churchill River and weir and net fisheries in the St. Lawrence River both presented opportunities to develop methods for later live captures. Belugas were collected for display in the late 1800s from the St. Lawrence River and as recently as 1994 from the Churchill River. At the Churchill and Seal Rivers in Manitoba, Sergeant and others drove animals into the shallows to apply tags and collect blood samples (Sergeant and Brodie, 1969). Since 1967, over 70 whales have been captured in the Churchill River for public display around the world (R. Moshenko, pers. comm. 1999).

Asper (1975) described various ways to catch cetaceans, including the hand-and-rope technique commonly used in the Churchill River. There, three or four men in each of two or three small boats herded whales toward shallow water. Once in the shallows, a man jumped from the front of a boat and attempted to secure a soft nylon rope (2 cm in diameter) around the whale's head when it surfaced. If

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he was successful, another man jumped into the water and secured the tail with a second rope. Other men in boats assisted as required (Fig. 1).

As efforts expanded to live-capture belugas for use in various studies by scientists from Britain, Denmark, and the United States, several developments were necessary, either to improve the customary technique or to address specific conditions that made this technique impractical (Smith and Martin, 1994; Richard et al., 1998). Here we present three methods that were developed specifically for the behaviour and habitat of belugas. Without them, the extensive recent literature on beluga movements and diving behaviour would not have been possible. Results of some of those studies are reported elsewhere in this volume (Martin et al., 2001; Richard et al., 2001a, b; Suydam et al., 2001).

FIG. 1. A whale is restrained using the original Churchill River capturing technique. (Photo by P. Hall.)

CAPTURE AND HANDLING METHODS

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

Hoop Net

A 12 mm × 305 cm length of 2 mm thick steel alloy tubing (electrical conduit) is formed into a circle 1.2 m in diameter, and the ends are welded together. A 2 cm thick tube of dense foam, normally used to insulate water pipes, is placed around the hoop to provide cushioning and buoyancy. Duct tape is wrapped twice around the foam 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 approximately 140 cm. One end of the netting is wrapped around the hoop and tied to it, using uncut knots of #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 (about 1 m) of 7 mm twine 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 (Fig. 2).

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 so 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 the hand or secured to another, longer rope leading to shore.

Before the hoop net can be used effectively, a beluga must be herded into water less than 1.5 m deep. In deeper water, whales have room to maneuver and are more likely to escape; it is also very difficult for members of the capture team to get adequate footing to handle the whale once they 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, as they are familiar with the behaviour of these whales. Although every drive is different, most times the initial phase of getting the whales into shallow areas is successful.

An inflatable 4.5–5 m boat with a 25–35 hp outboard motor (Fig. 2) provides the maneuverability necessary to herd the whales once they are 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 wear either a dry or a wet suit, which increases their buoyancy and helps keep them warm in the cold waters where belugas are typically found. The person steering the boat positions it

FIG. 2. A capture team member holding a hoop net and standing beside a commonly used inflatable boat, prior to a capture attempt at the Churchill River in 1992. (Photo by J.R. Orr.)

so that, once in shallow water, the whale is swimming alongside the boat 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, that person jumps from the boat, maintaining a hold on the hoop. One person can usually control a whale in shallow water, but assistance from a second individual with a tail rope is needed to restrain the animal adequately 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, or from the tail rope or the 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 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, the safest (for human and whale), the most selective, and the least expensive means of capturing whales. It has been used in the successful capture of 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.

Seine Net

Seine or encircling nets have long been used to capture marine mammal species around the world (Asper, 1975; Irvine et al., 1981). 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 a #30 lead line are used on the top and bottom of the netting. Although different lengths of net have been used, the optimal length appears to be 150 m. Attached to the net at both ends are a 4 m bridle and a 15 m length of 17 mm polypropylene rope joined to a 30 cm inflatable buoy. The net is piled "accordion style" (folded forward then backward over itself) in a wooden box (210 cm × 105 cm × 25 cm tall). The stern side of the box is hinged, and the entire box is lined with a 12 mm layer of dense foam to allow the net to spool out freely. The box is positioned at the stern of the boat and held above the outboard motor by 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 has a rigid hull constructed of aluminum or fiberglass and an outboard motor powerful enough to accelerate rapidly even with the excess weight of the net.

Before deploying the net, the team must herd the belugas into water about 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 tested periodically with an oar or pole held vertically over the side of the boat. Once the water depth is shallow enough for setting the net, the net boat moves to within 30 m of the whale(s), matching their speed and moving parallel to them, keeping the whales along the port (lead line) side. When the driver is satisfied that the whales are in the proper position and moving in a consistent manner, 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. As the net is discharged, the boat turns counterclockwise, 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 buoy marks the end of the net. It 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 circle the outside of the net at high speed to distract the whales and reduce the likelihood of escape. The net does not always form a complete circle. 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 (Fig. 3). Longer nets may allow larger complete circles to be set, but they have the disadvantage of added weight, which slows the setting speed and may allow the animals to escape.

In most cases, if a beluga does not escape under the net or through the gap between the beginning and end of the net, it will quickly become entangled. In this respect, belugas are unlike some other cetaceans, such as bottlenose dolphins (*Tursiops truncatus)* and killer whales (*Orcinus orca*), that either stay within the confines of the net or, in the case of dolphins, occasionally attempt to jump over it (Asper, 1975; R.S. Wells, pers. comm. 1999). For this reason it is important for the support boats to approach the whales quickly and bring those that are entangled to the surface promptly (Fig. 4). 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. It is also essential that the net not be set around more than three whales at once. A larger group is more difficult to handle, and the effort may become too strenuous for the people in the two or three capture boats. If more than one whale is caught during a set, each whale is restrained and inspected for size and condition. Usually if more than two whales are caught during the same set, the least desirable animals are quickly released.

The hoop net and the tail rope are placed on the whales as they are disentangled from the seine net. Then the whales are taken carefully to shallow water. They might first be held against an inflatable boat, which is towed by another boat, until the water is shallow enough for the capture team to get in and walk with the whales. 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.

Some dangers are 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.

Stationary Net

Stationary nets are much like the gill nets used to catch fish. The twine used to make the net is green or black in colour and 210/96 or 210/180 gauge. Stretched mesh size ranges from 30 to 65 cm, and the net is from 20 to 30

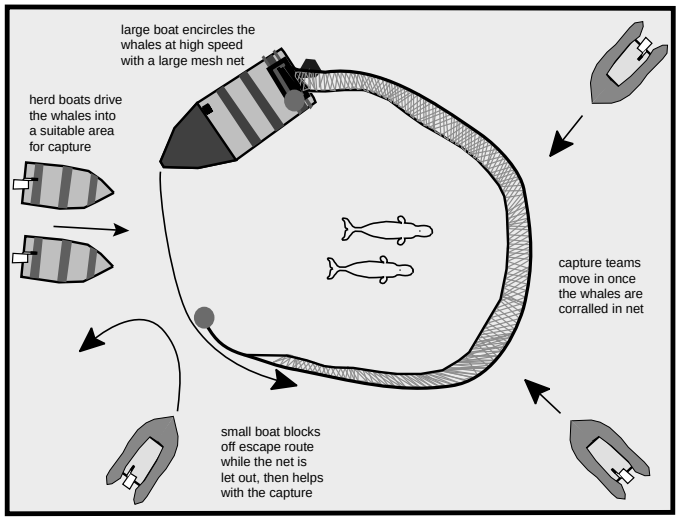

FIG. 3. How the seine net is deployed and where the support boats are positioned when using the encircling net to capture belugas.

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, spaced 4 m apart, are occasionally attached to the net by a 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, using a 12–20 mm nylon rope. If the anchor is not heavy enough, the tide and ice can cause it to shift position significantly (Fig. 5).

Once the net is in position, one or more people constantly monitor it and scan the area for approaching belugas. Boats are positioned close to the net, for quick and easy access, but where they cannot be detected easily by approaching whales. This usually means having the inflatable boats on shore or, if there are larger boats, on the other side of a point or small island where the net is 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 become 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. Belugas usually calm down shortly after being restrained. The netting holding the whale is quickly removed once other restraints are in place. As in the case

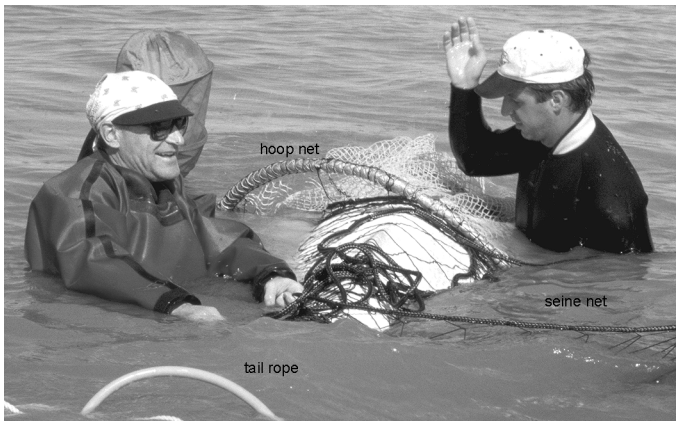

FIG. 4. A beluga, after being captured in a seine net, is restrained with a hoop net and tail rope. (Photo by D. Lonsdale.)

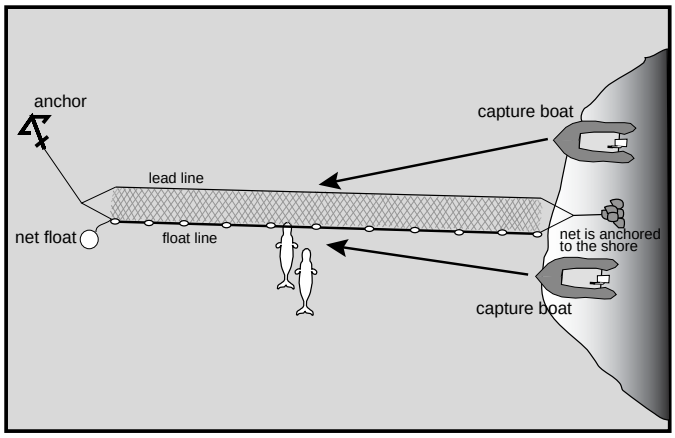

FIG. 5. The parts of a stationary net and how it looks once it is set.

of the seine net, 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.

Of the three approaches to capturing belugas described here, the use of a stationary net is probably the least preferred. A stationary net costs more than a hoop or seine net. Moreover, the technique is the most passive and potentially the most dangerous to both humans and whales. There is little control over the number of whales that may get entangled at the same time. Since the nets are quite deep, a whale caught near the bottom may have difficulty getting to the surface. If more than one whale is captured, they may become entangled in such a way that one or more of them is unable to reach the surface. Often the nets cause superficial cuts on the whale's flippers or tail. Since there is a capacious column of water for the whales to swim in, more time is often needed to secure and handle them. Of the 21 belugas caught using this method, 3 expired, 4 were released because they were too small to carry a transmitter, or because there were too many in the net to handle effectively at the time, and 14 have been successfully instrumented.

There are other drawbacks to the stationary net technique. Belugas can detect the net and simply avoid it. This method also may involve long periods of waiting between chance encounters with whales. The nets must be continually monitored, which is demanding when they are deployed 24 hours a day. People working around the net always run the risk of becoming entangled themselves, which could result in injury or even drowning. Working over the side of a boat on whales weighing more than 2 tons can result in muscle strain and back injury.

The stationary net has also been used successfully to capture narwhal (*Monodon monoceros)* in Greenland and Canada's High Arctic (Dietz et al., 2001). The narwhal's preference for deep water makes the seine net ineffective because the animals can escape under the net. The tusks of male narwhals, as well as the difficulty of herding them into shallow areas, make the hoop net equally ineffective.

CONCLUSIONS

Generally, belugas are not excessively aggressive toward humans during a capture. They attempt to escape when initially restrained, but seldom continue struggling for more than a few minutes. Usually they do not try to hurt members of the capture team deliberately. A few large male belugas, however, have rammed boats, charged at people, and even bitten people on the legs. No serious injuries have resulted. Injuries from being struck by a beluga's tail as it tries to escape are more the result of human carelessness than of beluga aggressiveness.

The description of methods presented here is intended to provide a general understanding of how white whales have been live-captured for scientific study. The thickness of ropes and twines, net sizes, and types of boats used may vary, depending on the area and the user; in this way, the methods have been adapted to suit the various physical characteristics of estuaries or locations along migration routes used by belugas in Canada. More than 100 belugas have been captured, tagged, and released since 1988 using these techniques, enabling the acquisition of highly valuable information on movements, habitat use, and other behaviour. Techniques similar to those described here have also been used in Alaska and Greenland.

ACKNOWLEDGEMENTS

The authors are indebted to their fellow capture team members, whose patience, dedication, cooperation, and capturing efficiency

made our tagging expeditions successful. Mads Peter Heide-Jørgensen, Anthony Martin, Pierre Richard, David St. Aubin, Tom Smith, and Randy Wells all made valuable contributions to the development of the three different capture techniques. Thanks also to Drs. Sylvain De Guise and Jeffery Boehm for their veterinary services and advice in the field. Peter Slezak and Ken Homewood of Leckies/Lakefish Net & Twine provided many valuable insights into the capacities of the various types of netting and ropes used in making the nets. Financial or logistical support or both were provided by the Department of Fisheries and Oceans, Eco Marine Corporation, the Fisheries Joint Management Committee, the Greenland Institute of Natural Resources, the National Environmental Research Institute, the Nunavut Implementation Fund, the Nunavut Wildlife Management Board, the Polar Continental Shelf Project, the Sea Research Foundation, the Sea Mammal Research Station, and the World Wildlife Fund. We also wish to acknowledge all the hunters and trappers' organizations in the Inuvialuit Settlement Region and Nunavut who supported the tagging programs near their communities. Pierre Richard, Randall Reeves, David St. Aubin, Sue Cosens, Randy Wells, and one anonymous reviewer provided valuable comments on early versions of this manuscript.

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