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Techniques for capturing, handling and marking harbour seals

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Effective methods for capturing, handling, and marking harbour seals were developed and tested during studies in British Columbia, Oregon, Washington, and California. Harbour seals were captured in water adjacent to haul-out sites using a 100–170 m-long net deployed and retrieved using two boats. Since 1978, 1100 harbour seals have been caught using these methods; as many as 87 individuals were caught in one capture attempt. Eight (0.73%) deaths occurred during handling, none involved drowning in the net. A variety of cattle ear tags were placed between the hind-flipper digits: Allflex double medium tags were superior for sighting purposes. During captive experiments, all roto tags remained attached, whereas only 28% of standard monel, 12% of rounded-post monel, and 0% of Allflex were retained. Radio-telemetry packages glued to the pelage remained attached for an average 208 days (max=288 days). Using the methods described in this paper, harbour seals could be captured, weighed, and marked with flipper and radio tags in an average of 20 min per individual.

Introduction

Effective methods for capturing, restraining, and marking individual pinnipeds have been developed for many species (Flyger *et al.*, 1965; Peterson, 1965; Stirling, 1966; Smith *et al.*, 1973; Gentry and Holt, 1982; Cornell, 1986). Partially because of their wary nature and use of haul-out sites inaccessible from land, harbour seals (*Phoca vitulina*) have not been the subject of large-scale tagging studies similar to those of other pinnipeds. As a result, no effective techniques were developed for capturing and tagging large numbers of seals.

In the process of studying harbour seal biology off the west coast of North America since 1978, we have developed and tested a set of techniques and equipment used for capturing, handling, and tagging this species.

Methods

Harbour seals were captured within bays off the coasts of British Columbia, Washington, Oregon, and California adjacent to haul-out sites. Haul-out sites typically were sandflats or mudflats exposed during low tides, where harbour seals had immediate access to deep channels. Harbour seals resting onshore were approached in two outboard-powered boats, the lead boat carrying the capture net on a platform set above the transom and outboard motor. The capture net was 120 to 170 m in length, formed of 5 to 7 panels, each 24 m in length and 8 m in depth. The netting was either 20- or 30-cm stretch mesh #36 nylon, dyed green. Paired floats (OSC-SC) were spaced every 1 m on the floatline, and the leadline contained 454 g of lead every 2 m.

The lead boat approached resting harbour seals slowly, eventually attaining maximum speed (approximately 20 knots) as the seals started to enter water. Within 20–30 m of the haul-out site and 10 m offshore, a 0.5-m diameter float attached to one end of the capture net was thrown towards shore, and the boat proceeded to make an arc in front of the haul-out site (Fig. 1). Careful stacking of the capture net allowed rapid deployment, the first boat landing ashore with approximately 7–10 m of net remaining on the platform. Persons in the second boat recovered the float, and pulled it to shore on the opposite side of the haul-out site. Both ends of the capture net were on shore in <2 min, which enclosed all harbour seals remaining in the water immediately adjacent to the haul-out site.

Each end of the net was then pulled along shore, keeping the leadline on the bottom, until the entire net with harbour seals was ashore. Harbour seals became entangled or enveloped by the capture net as it was brought to shore. A few seals occasionally escaped by crossing over the top of the floatline. Harbour seals were removed from the net by untangling individuals or by cutting the netting.

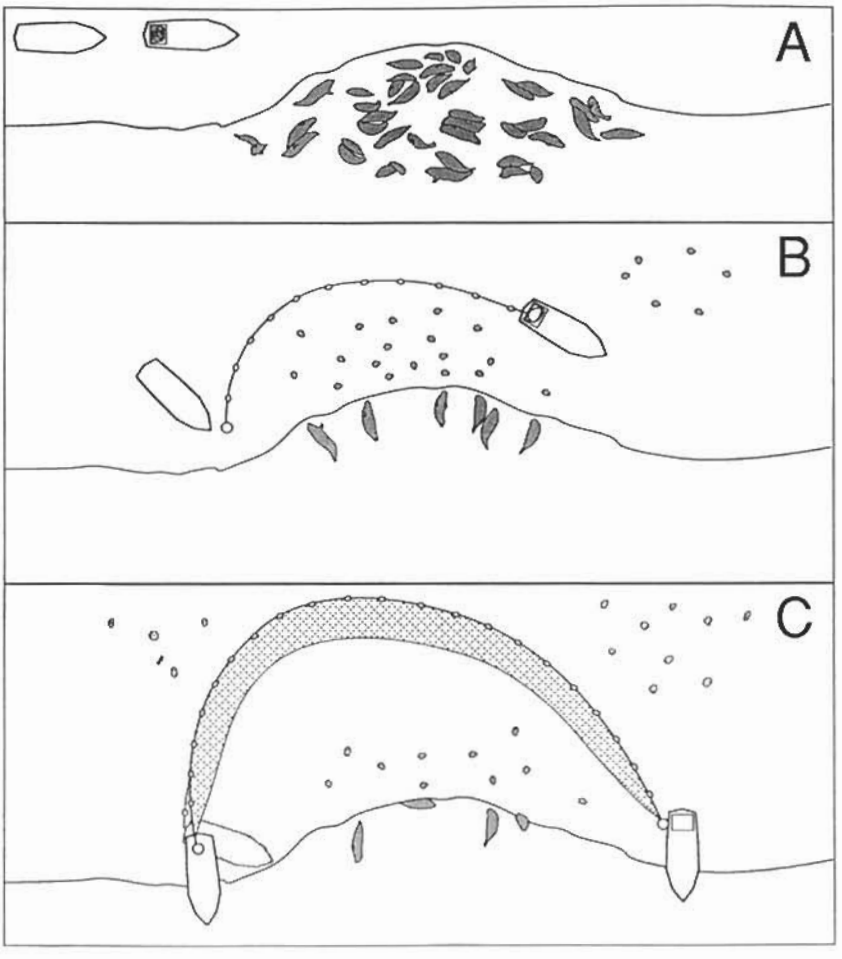

Figure 1. Method of net placement in front of harbour seal haul-out sites. The net is deployed rapidly from one boat, while the second boat retrieves a buoy at the other end of the net.

Once removed, each harbour seal was placed headfirst in a hoop net. Hoop nets consisted of a 5-cm diameter rubber hose formed into a 1-m diameter circle to which was attached a 2-m long bag formed of 2.5-cm stretch knotless nylon mesh. The nylon mesh was drawn together at the end to form a bag, but could be untied if we needed to release harbour seals through the closed end. Once removed from the capture net, harbour seals were physically restrained, and remained in the hoop nets until their release. The flexible hose of the hoop nets was bent backwards easily exposing the posterior portion of harbour seals for tagging.

With a team of 12 persons, we set and retrieved the capture net, removed animals from the net and placed them in hoop nets, and weighed, measured, tagged, and released harbour seals in approximately 15 to 20 min per seal.

Plastic cattle ear tags were placed in the webbing of each hind flipper between first and second digits. We used Jumbo rototags manufactured by Dalton and double medium tags manufactured by Allflex, both in various colours with black numerals. The sightability of rototags was improved by attaching a 2 by 20 cm orange vinyl streamer. We used various colours to designate sex or location of capture.

Durability and retention of different flipper tags were tested by placing various types of tags on 21 captive harbour seals at Point Defiance Zoo and Aquarium, Tacoma, WA. Between 1978 and 1981, 25 standard monel tags, 7 rounded-post monel tags, 2 Allflex tags, and 5 jumbo Roto tags were placed in the hind flippers. Thereafter, hind flippers of these harbour seals were observed periodically to determine the condition of the tags.

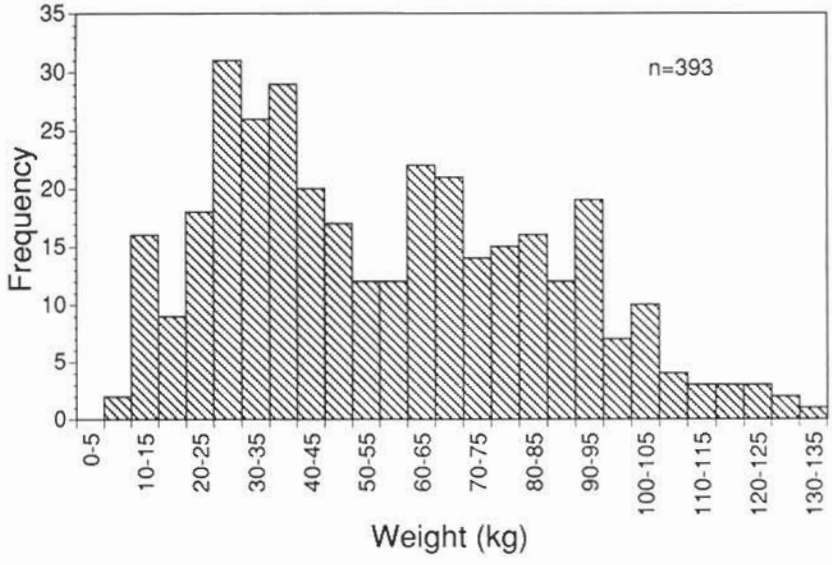

Figure 2. Weight frequency of 393 harbour seals captured in Washington, Oregon, and California from 1978 to 1990.

Radio tags were attached using either an anklet (Pitcher and McAllister, 1981) or an adhesive (Fedak *et al.*, 1983). Anklets consisted of a radio tag bolted to a plastic tie wrap inserted into surgical tubing. The plastic tie wrap was tightened until it barely rotated around the seal's ankle.

Other radio tags were glued to the pelage on the dorsum or top of the head of harbour seals using two methods. The pelage in the area of attachment was towel-dried, degreased with acetone, and blown dry with compressed air. Knotless nylon netting was stretched across a section of PVC plastic pipe 8 cm in diameter and 2 cm deep. Mesh was held in place with a stainless steel hoseclamp. PVC forms were cut halfway up the sides to facilitate removal. Forms with nylon mesh were placed on the seal's pelage and moved anteriorly, forcing hair up through the mesh openings. Approximately 30 cc of 5 minute epoxy (Devcon Corp.) were mixed and poured into the form, and radio tags were held firmly against the seal until the epoxy hardened around the tag and hairs. Forms were removed with tags secure within 5 to 15 minutes. Increased temperature and mechanical agitation of epoxy decreased the amount of time required for hardening. Any excessive mesh was removed, and orange paint was sprayed on the tag and epoxy.

In other cases, radio tags were glued and bolted to a 10-cm diameter piece of 0.5-cm thick neoprene. A thin layer of an industrial-grade cyanocrylite adhesive (Loctite 422) was spread under the neoprene, and the neoprene quickly held in place on the seals' pelage. Pressure was applied constantly until the tag was secure within 1 to 2 min. To compare these 2 methods using adhesives, transmitters were glued on 6 harbour seals using epoxy and 6 using Loctite in August 1984. Average duration of attachment for each method was compared using a Student's *t*-test.

Results

From 1978 to 1992, 1100 harbour seals were captured in British Columbia ($n=54$), Washington ($n=457$), Oregon ($n=290$), and California ($n=299$) using the encircling net. The greatest number of harbour seals caught during a net deployment was 87 near Point Reyes, California. Captured harbour seals weighed between 9 and 130 kg ($\bar{X}=53.7$ kg, Fig. 2). Eight harbour seals (0.73%) died during handling and tagging, no deaths occurred when animals were in the capture net. Three harbour seals that died had evidence of heartworm (probably *Skrjabinaria spirocauda*; Stroud and Dailey, 1978). Capture-related stress probably contributed to these deaths, with heartworms having exacerbated some situations. The cause of death for the remaining five is unknown.

Allflex tags were larger, and the numerals more easily distinguished from a distance than those on rototags. We could read numbers on Allflex tags attached to harbour seals in Alsea Bay, Oregon from a distance of 200 m using a 20–40 × spotting

scope (Harvey and Brown, unpubl. data). Both tag types were comparable for reading at distances less than 25 m.

In captive experiments, tags remained attached for a maximum of 9 years (monel tag). No roto tags were lost during the 3-year experiment, whereas 100% of Allflex tags, 28% of standard monel, and 12% of rounded-post monel tags were lost. Larger Allflex tags usually tore through the flipper webbing, whereas smaller tags that were lost either caused an enlargement of the post hole or failed to close properly during attachment.

Radio tags glued to seals using cyanocrylite remained functional an average of 206 days (SD=53.5), which was not significantly different from an average 210 days (SD=61.3) for tags applied using epoxy (t=0.05, P>0.05). One radio tag (glued on with epoxy) remained functional on a harbour seal for 288 days (Harvey, 1987). Because the Loctite 422 adhesive bonds more rapidly than epoxy, this adhesive often was used on large, aggressive males. Placement of radio tags on top of the head allowed tracking of individuals whenever they surfaced. Movements and duration of dive and surface interval were easily obtained whenever radio-tagged harbour seals were within 8 km (Harvey, 1987).

Discussion

The ability to capture and mark an organism allows repeated observations of an individual, and these data can be used to estimate population abundance, and describe individual movements and behaviours. Capturing pinnipeds, however, can be difficult because they spend most of their time in water. Otariids may be approached closely when they aggregate for long periods of time on rookeries (Gentry and Holt, 1982; Cornell, 1986). When they rest on ice, some polar phocids can be approached and immobilized easily by placing a sack over their heads (Stirling, 1966). Harbour seals are more difficult to capture because they often use intertidal sand and mud bars away from the mainland. Harbour seals also are wary, and immediately enter water when disturbed (Sullivan, 1979). Some researchers have caught limited numbers of harbour seals by crawling or swimming to haul-out sites and capturing individuals in hoop nets (Yochem *et al.*, 1987). The only other report of pinniped captures using nets was that by Smith *et al.* (1973); ringed seals (*Phoca hispida*) were caught in nets fixed in various configurations near shore.

Capturing harbour seals in estuaries was effective because channels near haul-out sites were free from obstructions that may have entangled the capture net. Capture nets may not work well near offshore haul-out sites, which have rocks and other obstacles. Maximum numbers of harbour seals were caught if the capture net was set rapidly without becoming entangled. Weights of captured harbour seals were similar to weights of seals collected by shooting in British Columbia (Bigg, 1969). Therefore, we assume net capture is not size selective, and randomly captures harbour seals on haul-out sites.

Mortalities during capture and tagging were few because the capture net was not secured to the bottom and was light enough that entangled harbour seals could surface to breathe. More than 66% of ringed seals caught by Smith *et al.* (1973) drowned in nets set at night, whereas 20% died during daytime. They suffered high rates of mortality because their nets were set in place for 21 days, only monitored during daytime, and not recovered immediately.

Mortality of harbour seals in our studies probably resulted from stress. Some physical condition (e.g. heartworm, lungworm, or pneumonia) may predispose an individual to stress-related deaths during tagging. We used physical restraint to hold harbour seals during tagging, which may be more stressful than using drugs. Deaths associated with inadvertent drug overdoses probably cause more deaths than physical restraint.

Pinnipeds have been captured and immobilized using drugs (Flyger *et al.*, 1965; Peterson, 1965; Ling *et al.*, 1967; Cline *et al.*, 1969). Although drugs may be effective on captive or sedentary pinniped species, most drugs do not cause immobilization soon enough to stop harbor seals from entering water (Flyger *et al.*, 1965). We preferred to use physical restraint during tagging, because harbour seals were generally small enough for 3 to 5 persons to restrain, and drugs may cause mortalities from hypo or hyperthermia and apnea (Flyger *et al.*, 1965; Ling *et al.*, 1967).

Because of their large size, Allflex tags were more easily read from a distance than other tags. Because of their large size, however, Allflex tags probably were lost more easily. Miller (1988) reported 50% of Allflex tags had fallen off harbour seals 5 months after attachment, whereas smaller Riese tags were attached after nearly 2 years. The choice of flipper tag depends partially on the reasons for tagging. Larger tags are best for identifying individual marks (e.g. reading specific numbers on tags), whereas smaller tags are best for long-term marking studies (Testa and Rothery 1992). The methods described have been used successfully in a number of studies of harbour seal biology on the west coast of the US (Brown and Mate, 1983; Harvey, 1987; Miller, 1988), and should prove useful in many studies of harbour seals elsewhere.

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