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The RAM-packs came back: a method for attaching and recovering pinniped data recorders

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Abstract

A means of attaching and recovering pinniped data recorders was developed and tested on harbour seals (*Phoca vitulina*). A buoyant pack containing a VHF-transmitter and a data recorder, was glued to the pelt. The moult acted as the release mechanism. The detached RAM-packs, whether floating at sea or washed ashore, were later located by aircraft, boat, or on foot using the radio transmitter. In a trial program, RAM-packs were applied to six harbour seals off the coast of British Columbia. The results show the packs do not cause undue stress to the animal and are useful for recovering data from pinnipeds that are difficult to recapture.

Introduction

Data recorders are miniature computers that can be attached to seals and other animals to gather information on such factors as time, location, diving depth, heart rate, body temperature, and water temperature. They have provided valuable information on pinniped diving and have been used on many species including harbour seals (*Phoca vitulina*; Stewart *et al.*, 1989), elephant seals (*Mirounga angustirostris*; Le Boeuf *et al.*, 1988), northern fur seals (*Callorhinus ursinus*; Gentry *et al.*, 1986, Goebel *et al.*, 1991), gray seals (*Halichoerus grypus*; Thompson *et al.*, 1991) and Weddell seals (*Leptonychotes weddellii*, Kooyman, 1975, 1981).

Data recorders are easy to apply. Depending on the species, seals can be caught in nets and nooses on land or in the water, or through breathing holes in the ice (Stirling, 1966; Smith *et al.*, 1973; Cornell, 1986; Jeffries *et al.*, 1992). The data recorder can be glued to the pelt or harnessed to the animal. Recovering the recorder, however, is not always easy. For some species, such as elephant or fur seals, the animal can usually be recaptured on the rookeries or haulouts. For others, such as gray or harbour seals, the options are to shoot the animal or intermittently relay data via satellite or VHF transmitter.

The goal of our study was to develop a means of attaching and recovering data recorders placed on harbour seals, without causing unnecessary duress to the animal. The basic concept was to build a buoyant pack, glue it to the pelt, and use the moult as the release mechanism. The 'RAM-pack' had to be made of a non-compressive material that would float if it detached under water, and needed to incorporate a radio-transmitter for re-locating it at sea or on shore. It also had to include a conductivity sensor that would detect when the seal was hauled out and when the pack had moulted off.

The following describes the method used to build the RAM-packs and the results of applying them to six harbour seals in British Columbia during a trial program.

Methods

RAM-pack construction

Micro balloon glass bubbles were added to cold-cure epoxy in a 2-to-1 ratio. The composite was stirred slowly and thoroughly to avoid trapping air bubbles, and poured into a 22-oz paper cup. After setting for 24 hours, the cast was removed from the paper cup and turned on a lathe (see Fig. 1 for dimensions). Holes were drilled for the transmitter and data recorder before cutting the cast in two on a band saw and sanding the edges smooth.

A strip of HS-900 Ethafoam©, with one side bevelled on a 45° angle, was glued to the top section of the cast to increase buoyancy (Fig. 1) and a paper label (10 × 5 cm) reading:

SCIENTIFIC INSTRUMENT—REWARD IF RECOVERED

THIS DEVICE CONTAINS IMPORTANT DATA ON THE DIVING BEHAVIOUR OF HARBOUR SEALS. TAMPERING WITH OR ATTEMPTING TO OPEN THE DEVICE WILL DESTROY ITS CONTENTS. IF FOUND, PLEASE RETRIEVE AND NOTIFY:

was glued to the bottom half with 5-minute epoxy. The entire cast (including label and ethafoam, but excluding the flat back side) was then coated with cold-cure epoxy.

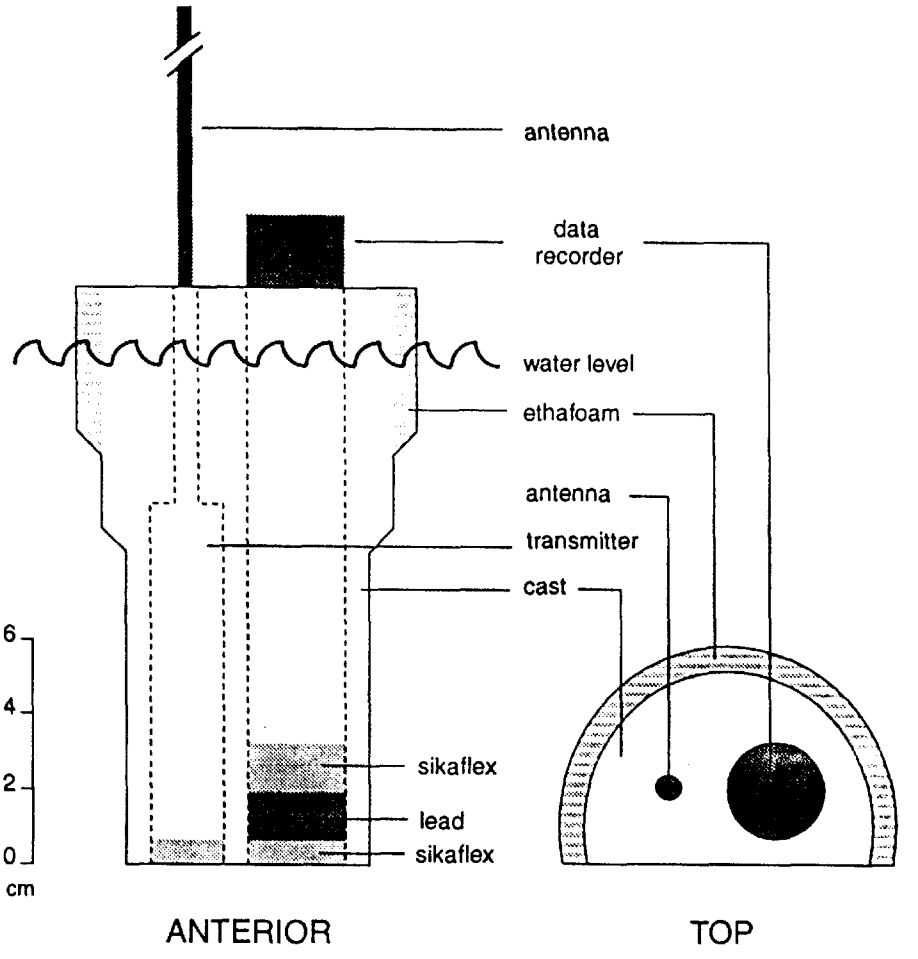

Figure 1. Top and anterior views of the RAM-pack. Note that the transmitter antenna extends 26 cm. See text for further explanation.

The aluminium casing for the data recorder was glued into the largest hole in the cast with Sikaflex 241© (a polyurethane sealant/adhesive). The casing protruded 2 cm from the top to facilitate inserting the computer (time-depth-recorder, Wildlife Computers, Seattle, WA) and capping the unit with the conductivity sensor (Fig. 1). A 65-g lead disk machined to the same diameter as the data recorder was sandwiched in layers of Sikaflex© against the recorder, keeping it as close to the end of the hole as possible (see Fig. 1). The lead acted as ballast to keep the antenna floating upright. A VHF radio tag (Advanced Telemetry Systems model 5B) with a 400 day battery life was coated in Sikaflex© and inserted into the smaller hole from the bottom. Both holes were filled flush with the bottom of the cast with Sikaflex©.

Finally the unit was sandpapered and painted a fluorescent colour on all sides except the anterior attachment surface.

Seal capture and RAM-pack deployment

Six harbour seals were caught in monofilament gillnets in the Strait of Georgia, off Vancouver Island, British Columbia. Using a 14-foot outboard powered skiff, a single section of gillnet (50 m long × 30 meshes deep, mesh size 25 cm) with a light lead line was set near seal haulouts. Unwary seals became entangled while swimming to and from their haulouts.

Seals that entangled in the netting were pulled into the boat and restrained on a 'cradle' board with five car seat belts. Netting was then cut away from the seal and a pack-sized patch of fur cleaned with methyl hydrate. Next the RAM-pack, with antenna pointing posteriously, was glued with 50 cc of 5-minute epoxy high on the seal's back away from the spine where it would not impede the animal's movement (Fig. 2). Both hind flippers were tagged with Rotoriese #2 tags. Finally, the seals were weighed by suspending the restraining board from a spring scale. In all, less than 45 minutes elapsed between capture and release.

Results and Discussion

The six seals used in this study were captured between July 30 and August 8, 1990 and weighed an average of 55.9 kg (Table 1). Their packs moulted off

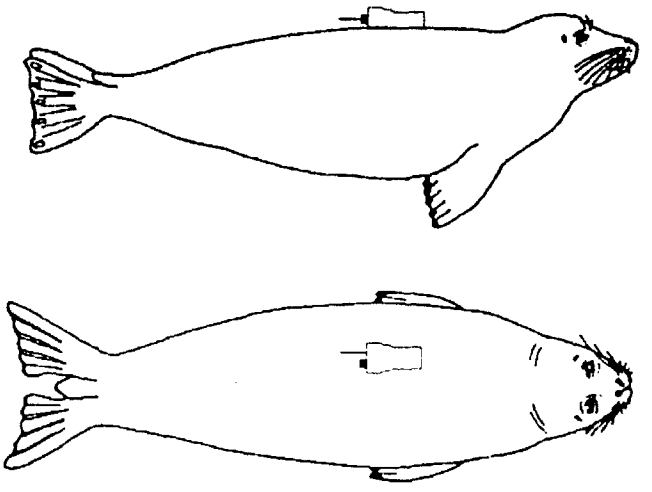

Figure 2. Placement of a RAM-pack on a harbour seal. Note that, to reduce fouling and not impede the seal's movement, the pack is placed to the side of the spine with the antenna pointing posteriorly.

an average of 27 days after being deployed, and were found an average of 10 days later. Three of the packs were turned in by individuals who found them on the shore (nos. 2,3, and 4), whereas two others were tracked down by telemetry (nos. 1 and 6). Only pack no. 5 was not recovered. Our efforts to locate it were thwarted by interference from a pager service that was broadcasting at the same frequency as our transmitter.

The conductivity sensor on the top of the RAM-pack indicated August 28 was the mean moulting date for seals numbered 1,2,4 and 6 (range: August 16–September 8). Harbour seals in this region of British Columbia moult as early as June and as late as October (Stutz, 1967; Bigg, 1969) and take about 5 weeks to finish (Scheffer & Slipp, 1944). Peak moulting occurs in August and September (Stutz, 1967). Differences in the timing of moult may be related to the seal's age or reproductive status (Thompson & Rothery, 1987). Note, however, that the bulk of the RAM-packs may accellerate hair detachment at the point of attachment and may have biased estimated date of moult.

Inspection of the moulted hairs stuck to the back of the recovered packs showed no signs that the glue had negatively affected the seal's pelt. However, most of the hairs on pack no. 3 were broken and had not moulted. We believe this animal had finished moulting when captured because her pelt was short compared with other seals. This being the case, the growing hairs probably lifted the glued pack away from the body, enabling the pack to move and eventually pull away. Hair growth, therefore, needs to be considered if maximum data is to be obtained from the device by deploying it shortly after moulting.

The RAM-packs were recovered within a mean distance of 10 km from where they were deployed. The short distance is partly explained by the oceanographic events (ocean currents and prevailing winds) in the study area, which helped to contain the device after the seal had moulted, as well as the fact that harbour seals appear to have small home ranges. These two conditions were carefully contemplated before deploying our RAM-packs, and should be considered by other researchers wishing to apply similar devices in other areas or to other species. A third consideration is accessibility of the public to the shoreline in the study area, which in our case increased the likelihood of someone finding our pack and returning it.

Each RAM-pack weighed 450 g (including the transmitter and data recorder), and was designed to be balanced and have near neutral buoyancy so it did not hamper the seal's diving. The pack undoubtedly caused some drag during swimming, which could be reduced by building a smaller pack. When free of the seal, the device had to float in an upright position with the antenna above the water, so a piece of lead was inserted into the bottom of the back. Similarly, since the device had to re-float if lost at depth, we did not use foam or neoprene which would have compressed under water pressure, but used a combination of epoxy and glass bubbles instead. This combination has a compressive strength of about 12,000 psi and should withstand dives deeper than the maximum 186 m dive recorded during our tests.

We can not overemphasize the importance of carefully mixing the cast. Should too many air bubbles get into the mix, the cast may act as a sponge, filling with water through interconnected air bubbles. In addition, air bubbles might compress at depth whch could prevent the pack from re-floating if it came off at depth. It is therefore imperative that each RAM-pack be tested for adequate buoyancy before deployment.

We believe glueing RAM-packs to the pelage and using the moult for recovery is an effective means of deploying data recorders on harbour seals that does not cause undue stress to the animal. The packs are relatively inexpensive to build, are reusable, and are a potentially useful means for recovering data from other pinnipeds that are difficult to recapture.

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Table 1. Results of applying RAM-packs to six harbour seals captured in the Gulf Islands in 1990. Shown are the dates of capture, moulting and pack recovery, as well as the number of days between tagging and moulting, and between moulting and recovery of the pack. The table also contains the mass and sex of the captured seal, the frequency of the VHF-transmitter and the distance between where the seal was captured and where the pack was recovered.

Seal			Date			Days			
no.	mass (kg)	sex	seal capture	moult	pack recovery	attached	adrift	Distance (km)	Radio freq. (kHz)
1	56.7	m	Jul 30	Aug 16	Sep 5	17	20	6.5	161.25
2	68.0	f	Aug 1	Sep 6	Sep 6	37	0	3.0	159.50
3	43.1	f	Aug 3	Oct 1*	Nov 22	58*	53	8.7	159.00
4	54.4	f	Aug 7	Aug 21	Aug 31	21	10	3.0	159.25
5	54.0	f	Aug 7	—	—	—	—	—	162.25
6	59.4	f	Aug 8	Sep 8	Sep 17	31	9	27.8	160.20

*hairs on back of pack appeared broken, not moulted

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