

Attachment of radio-transmitters to sandpipers: review and methods

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Radiotransmitters were attached to 33 Dunlin *Calidris alpina* and 63 Western Sandpiper *Calidris mauri* over a period of three years. Methods for attachment are described, and other studies of radiotransmitter use with shorebirds are presented in a brief bibliography.

Introduction

Remote sensing techniques such as radiotelemetry have been utilized in the study of animal movements for the past three decades (Kenward 1987), yet these techniques have only recently become widely used in studies of shorebirds. Over the past several years a reduction in the dimensions of radio transmitters and improved attachment techniques (Sykes *et al.* 1990, Williams 1990, Rappole & Tipton 1991) have made the use of this technology practicable for the collection of data on even the smallest shorebirds. In this paper we present a brief bibliography of studies in which radio transmitters (hereafter referred to as radios) were placed on shorebirds. Next we describe a method of radio attachment we have used successfully on two species of calidrine sandpipers, the Dunlin *Calidris alpina* and Western Sandpiper *Calidris mauri*.

The first shorebird studies to utilize radiotelemetry techniques for data collection were published in the 1980s. In 1981 Dugan published accounts of nocturnal foraging by two Grey Plovers *Pluvialis squatarola* fitted with radios. In 1986 Redmond and Jenni published results of their investigation of chick movements and mortality in radio-tagged Long-Billed Curlew *Numenius americanus*, and Wood published results of a study of diurnal and nocturnal territoriality by radio-tagged Grey Plover. Other studies have since followed (Table 1).

As the size of radios decreased it became feasible to place radios on small shorebird species and chicks. Iverson *et al.*

(1991) used radio telemetry to trace the spring migration of 31 Western Sandpiper. Yalden (1991) tracked the movements of four Golden Plover chicks *Pluvialis apricaria* with 1 g radios.

Over the past three years we have placed radios on 33 Dunlin and 63 Western Sandpiper caught on their wintering grounds in California. The radios used (Holohil Systems Ltd., R.R. #2, Woodlawn, Ontario, Canada KOA 3M0) weighed from 1.1–1.4 g, and were found to have a battery life of 28–37 days. We were able to receive radio signals at maximum distances of 2.5 km on flat ground and 9 km from a 30 m hill under optimal conditions. The radios were colored dark brown to blend with the back feathers of the bird, and the antenna was colored a flat black.

Initially we glued radios to the feathers of the interscapular region of the bird using cyanoacrylate glue (Superglue®) (following Raim 1978). However, we felt this placement interfered with the natural stroke of the birds' wings (as noted by Hill & Talent 1990). Also, retention time was short; in some cases radios fell off within days.

After experimenting with several techniques we derived an effective method for attaching the radios using an epoxy developed for use on seabirds (Titan Corporation, 5629 208th St. S.W., Lynnwood, Washington, USA 98036). The radio was glued to an area of clipped feathers on the lower back of the sandpipers. Movement of the wings was unrestricted and retention time was at least seven weeks. The birds preened the radio in among the back feathers, and the antenna into the tail feathers. The radio was not visible to

Table 1. Published accounts of radiotelemetry studies of shorebirds (American Woodcock *Scolopax minor* excluded).

Species	N	Radio weight (g)	Method	Source
Grey Plover <i>Pluvialis squatarola</i>	2	3.5	harness	Dugan 1981
Long-billed Curlew <i>Numenius americanus</i>	39	?	?	Redmond & Jenni 1986
Grey Plover <i>Pluvialis squatarola</i>	15	?	harness	Wood 1986
Green Sandpiper <i>Tringa ochropus</i>	?	?	?	Smith 1987
Wilson's Phalarope <i>Phalaropus tricolor</i>	28	3.5	glue	Colwell & Oring 1988
Purple Sandpiper <i>Calidris maritima</i>	3	2.0	glue	Cresswell/Summers 1988
Snowy Plover <i>Charadrius alexandrinus</i>	18	2.0–2.6	glue	Hill & Talent 1990
Bristle-thighed Curlew <i>Numenius tahitiensis</i>	7	?	harness	Gill <i>et al.</i> 1991
Western Sandpiper <i>Calidris mauri</i>	31	0.9	glue	Iverson <i>et al.</i> 1991
Dunlin <i>Calidris alpina</i>	14	1.1	glue	Warnock 1991
Golden Plover <i>Charadrius apricaria</i>	4	1.0	glue	Yalden 1991



observers using spotting scopes. Radio-tagged birds were regularly observed roosting and foraging normally among flocks of untagged birds. Subsequent to the study at least two of the birds have been resighted behaving normally and without their radios.

To attach the radio, one person held the bird in the left hand, with the head between the second and third fingers, and the wings between the first and second fingers and the third and fourth fingers, leaving the right hand free for clipping. Using penknife scissors, a 10 mm length of the posterior element of the dorsal feather tract was clipped, about 5 mm above the uropygial gland (Figure 1). Blowing gently under the feathers helped to locate the tract, and a few drops of water helped to keep surrounding feathers clear of the attachment site. While the feathers were being clipped, a second person mixed the epoxy for 1.5 minutes, and then spread a thin layer of epoxy on the clipped area, working the glue up around the feather stubs with a flat toothpick. A layer of epoxy was also spread on the radio, which had first been scored with sandpaper. The radio was then pressed into place over the clipped feathers and held firmly until the bond was set, about one minute.

After practice, we were able to attach a radio in four minutes. Because the entire process could be completed at the banding site, under the best circumstances a bird could be caught, radio-tagged, and released within 15 minutes.

Potential Problems

Infrequently (6% of Western Sandpiper, 9% of Dunlin) birds were not able to fly with the radio. This occurred especially with low-weight birds and birds kept too long in captivity (i.e. 3–4 hours). We found that radios could be removed from problem birds by carefully cutting the radio from the feather stubs with a sharp razor and applying a few drops of liquid band-aid (Nexiband®). Following removal of the radio these birds flew well.

Clipping of feathers at the site of radio attachment may create a thermal window at the attachment site through which heat could be rapidly conducted in hot weather or lost during cold weather creating extra physiological stress for radio-tagged birds. This did not appear to be a problem in California.

Birds appeared to acclimate to the radio after the first three days, but it was during this period that most predation events occurred. In 1991 and 1992, 29 Dunlin were radio-tagged, and six of the seven Dunlin known to have been predated were taken within three days of release. Of the 60 Western Sandpipers radio-tagged, five were predated within the first two days, and none during the remainder of the study.

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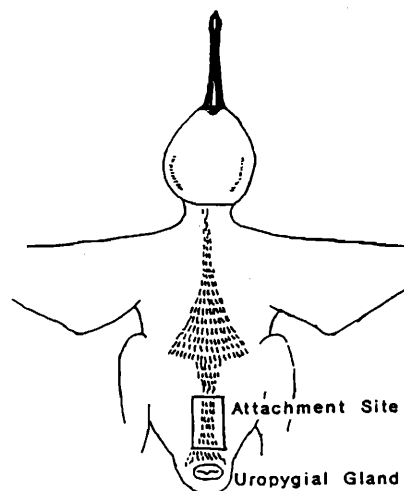


Figure 1. Dorsal view of *Calidris* sandpiper showing attachment site for radio-transmitters.

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