# First Successful Radio-Telemetry Study of Kittlitz's Murrelet—Problems and Potential

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**Abstract.** Using the night-lighting technique, we captured 20 Kittlitz's Murrelets (*Brachyramphus brevirostris*) in Glacier Bay, Alaska, during May 2004. Following capture, each bird was weighed, measured and photographed, had a blood sample taken and had a radio-transmitter attached with a glue adhesive. Our capture effort was confined to the West Arm of Glacier Bay, where birds generally were found offshore and in deep water at night. Birds were relocated from fixed-wing aircraft and motorized vessels. All 20 birds were relocated at least once during the study. Overall relocation success (total relocations/possible relocations) was 64 percent. Aerial-based relocation success (73 percent) was greater than boat-based relocation success (59 percent). Retention time of the transmitters was short ($\bar{x}$ =10.3), we determined that using the subcutaneous anchor technique (or a method with equal or greater retention time) may be the best method for affixing transmitters to Kittlitz's Murrelets in future studies.

## Introduction

Radio-tagging is a valuable tool for collecting useful information on species that are either rare or elusive (Kenward, 2001). Advances in technology, including increased battery life and transmission range coupled with decreased tag size and mass, allow radio-telemetry to be used increasingly on various small avian species. Recent telemetry-based work on small alcid species, including the Xantus' Murrelet (*Synthliboramphus hypoleucus*) and Cassin's Auklet (*Ptychoramphus aleuticus*) has enhanced our knowledge of these enigmatic species. Telemetry studies of the Marbled Murrelet (*Brachyramphus marmoratus*) have filled many gaps in the understanding of the basic biology of this species, including selection of nesting habitat, foraging behavior, and productivity. The congeneric Kittlitz's Murrelet (*Brachyramphus brevirostris*) is one of the rarest seabirds in North America, and most aspects of its biology remain obscure. Available evidence from pelagic surveys indicates that the species is declining at an alarming rate across their core geographic range (69 FR 24875 24904). Preliminary analyses of surveys conducted in Glacier Bay in 1991 and 1999/2000 (Federal Register 2004, Robards and others, U.S. Geological Survey, written commun. 2003) suggests that Kittlitz's Murrelets have declined by more than 80 percent during that period.

Conservation and management of Kittlitz's Murrelet has been hampered by the lack of specific information on the breeding biology and habitat needs (both aquatic and terrestrial) of this species. In 2004, we conducted a pilot study with two objectives: (1) determine if radio-telemetry could be used to study Kittlitz's' Murrelet in Glacier Bay, and, if so, (2) collect data on the early season distribution and movement of the species in Glacier Bay.

## Methods

Twenty Kittlitz's Murrelets were captured in Glacier Bay National Park (fig. 1) using the night-lighting technique, in which birds are located on the water at night with a powerful handheld spotlight and then, while disoriented from the light, captured in a long-handled dipnet (Whitworth and others, 1997). Following capture, all birds were weighed, measured, photographed, bled, and affixed with a radio-transmitter. Body measurements taken from each bird included length of tarsus, flattened wing chord, and culmen. Each bird was inspected to determine the presence and development of a brood patch. Blood was drawn for genetic analysis (MacKinnon, Queens University, written commun. 2005), and measuring stress hormone levels. All birds were captured between May 6 and May 14, 2004. Radio-transmitters (model A4360, Advanced Telemetry Systems Inc., Isanti, Minn.) were attached dorsally with commercial-grade adhesive (Slo-Zap cyanoacrylate, Pacer Technology, Rancho Cucamonga, Calif.). Transmitters weighed approximately 4.5 g, which equals less than 2 percent of the mean body mass of the birds captured in this study (mean body mass 238±4 g, N=20).

Surveys were conducted from small boats and fixed wing aircraft (once every two days depending on weather conditions) to relocate radio-tagged birds. For boat-based surveys the radio receiver was connected to a hand-held three-element yagi antenna. Aerial telemetry surveys were conducted with a Cessna 206 equipped with two wing strut-mounted, four element yagi antennas with the radio receiver connected to the antennas through a switch box (Kenward, 2001).

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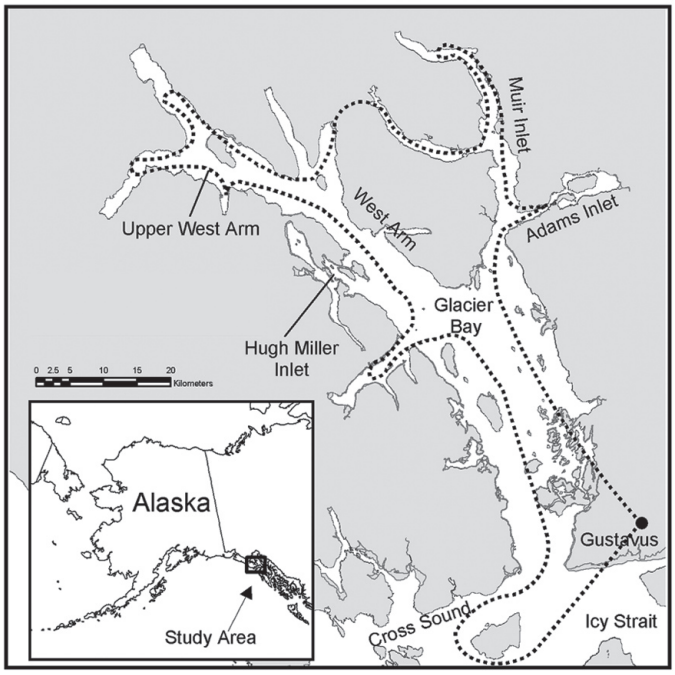


**Figure 1.** Study area with general path of aerial telemetry survey transect in Glacier Bay National Park (dotted line), May 2004.

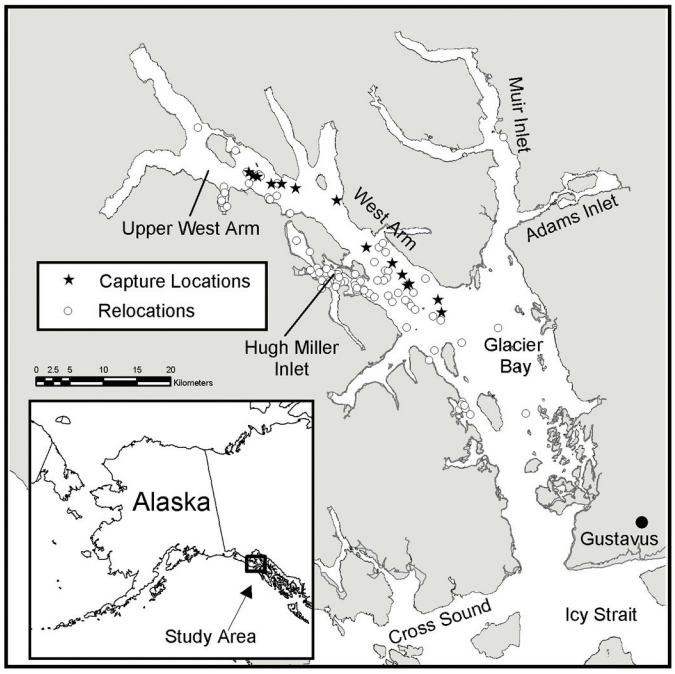


**Figure 2.** Capture locations and telemetry relocations of Kittlitz's Murrelets in Glacier Bay National Park, May 2004.

## Results

Capture of Kittlitz's Murrelets in Glacier Bay was attempted on six nights between May 6 and May 14, 2004. Twenty birds were captured during 26 hours of effort for an average of 0.9 birds captured per hour. Kittlitz's Murrelets observed on the water at night generally were found in groups of two. We were able to capture both members of six pairs of murrelets (12 birds). The eight additional birds captured in the sample were all originally sighted on the water in a group of two, but in each case we were only able to capture one member of the pair. The birds generally were captured offshore and in deep water. At the point of capture, mean distance from shore was 2.18 km (±0.89 SD; range=0.85-3.86 km; fig. 2). All birds were captured in water deeper than 100 m.

Birds captured in this study showed a wide range of plumage development. Three birds (15 percent) were found mostly in winter (basic) plumage at the time of capture, showing only slight development of breeding plumage, evidenced by some dark feathers erupting on the face, behind and below the eye. Three other birds (15 percent) were molting into breeding plumage at the time of capture, but still showed clear remnants of winter plumage. The remaining 14 birds (70 percent) were in breeding plumage at the time of capture. Of the 20 birds captured in this study only seven (35 percent) showed evidence of brood patch development. Of these seven, five (71 percent) exhibited a loss of down and contour feathers, and the remaining two (29 percent) exhibited an almost complete loss of down in the brood patch area and vascularization of the patch.

All birds captured were relocated at least once during the study. All relocations were within Glacier Bay with the majority confined to the West Arm of the Bay (fig. 2). Maximum detection distance for boat-based surveys was 4 km and in excess of 10 km for aerial surveys. Relocation success was defined as the total number of frequencies detected in a single survey/the number of frequencies still active at the time of the survey. Our relocation success for all surveys combined was 64 percent. We recorded 96 relocations out of a possible 149 relocations. Relocation success for boat-based surveys was 59 percent (55 relocations out of 93 possible relocations) and relocation success for aerial surveys was 73 percent (41 relocations out of 56 possible relocations).

Mean tracking time of birds tagged in this study was 10.5 days (±5.2 SD) (table 1). Individual tracking time ranged from 1 to 18 days. Sample sizes for individual birds (number of locations for an individual) were too small to adequately construct home range estimates for any of the birds.

## Discussion and Conclusions

To our knowledge, this is the first study to successfully capture Kittlitz's Murrelets using the night-lighting technique and the only study to track multiple birds using radio-telemetry. Previous radio-telemetry studies of Marbled Murrelets in Alaska and British Columbia captured birds in at-sea habitats similar to those found in Glacier Bay National Park (Whitworth and others, 2000; Nadine Parker, oral commun.). Marbled Murrelets in these previous studies occurred in relatively high densities (Whitworth and others,

**Table 1.** Comparison of mean tracking time of small, radio-tagged alcids, from four studies using different attachment methods.

| Data source | Species | Location | Attachment method | Tracking time |
|---|---|---|---|---|
| This study | Kittlitz's Murrelet | Glacier Bay National Park | Glue | 10.5 days |
| Adams and others, 2004 | Cassin's Auklet | Channel Islands National Park | Subcutaneous Anchor | 30.0 days |
| Newman and others, 1999 | Marbled Murrelet | Año Nuevo Bay, California | Subcutaneous Anchor | 45.1 days |
| Whitworth and others, 2000 | Marbled Murrelet | Auke Bay, AK | Subcutaneous Anchor | 67.0 days |

2000; Nadine Parker, oral commun.) and a concern prior to attempting this study was whether Kittlitz's Murrelets occurred in high enough densities in Glacier Bay to enable capture of an adequate sample for a radio-telemetry study. Our capture per unit effort (0.9 captures/hour) was greater than expected and we believe that this capture technique is an efficient and cost-effective method of capturing Kittlitz's Murrelets in this study area.

Although all birds marked in the study were relocated at least once, overall relocation success for the study (64 percent) was lower than expected, and boat-based relocation success was particularly low. The 4 km maximum detection range of the boat-based surveys may have affected relocation success, particularly in the lower portions of Glacier Bay where the bay is wider and there are more islands to block potential radio signals. In addition, several areas of Glacier Bay are designated non-motorized zones and we were not able to access these areas during our boat-based surveys. Non-motorized zones were accessible for aerial surveys however, and this increase in survey area, coupled with greater maximum detection range, could account for the greater relocation success of aerial surveys. The main benefit of the boat-based survey is that it allows researchers to observe radio-marked individuals to assess behavior (e.g. reaction to radio, foraging behavior, disturbance by vessels, etc.).

The mean tracking time of Kittlitz's Murrelets in this study was much less compared to radio-telemetry studies of other small alcids (table 1). Several factors can influence the tracking time of a radio-telemetry study including transmitter failure, individuals leaving the study site, and transmitter loss. It is unlikely that transmitter failure is responsible for the low mean tracking time of our study. The ATS model A4360 radio-transmitter has been used in several studies including an intensive multi-year study of Marbled Murrelets in British Columbia (over 500 birds radio-marked). The researchers conducting this study found no evidence of widespread transmitter failure (Nadine Parker and Russell Bradley oral commun.). While it is possible that radio-marked Kittlitz's Murrelets left the Glacier Bay study area after being captured, aerial telemetry surveys were flown outside of Glacier Bay in Icy Strait and Cross Sound and no frequencies were detected.

For a radio telemetry study to be successful, the method of transmitter attachment must provide adequate transmitter retention time without adversely affecting the behavior of the animal (Newman and others, 1999; Kenward, 2001). Currently, the most common method of attaching radio-transmitters to small alcids is the subcutaneous anchor technique (Newman and others, 1999; Whitworth and others, 2000; Adams and others, 2004). This technique was developed specifically to improve tracking time of radio-marked birds. Previous studies indicated that adhesive-only attachments are not as durable as the anchor technique (Quinlan and Hughes, 1992; Newman and others, 1999). Mean tracking time of small alcids with transmitters attached using the subcutaneous anchor method are three to six times greater than the tracking time of Kittlitz's Murrelets with glued-on transmitters in our study (table 1).

If radio telemetry is to be used as a tool to study Kittlitz's Murrelet then tracking time of individual birds should be greater than that in our study. Generally, home range estimation for individual animals requires a minimum sample size of 30 position locations (Millspaugh and Marzluff, 2001). Our sample size of position locations for any of the marked birds was not large enough (range=1–11 position locations) to estimate home range or make inferences about habitat use and individual movements. Tracking time from this study would need to be increased by a factor of three to obtain enough data to characterize habitat use and home range.

## Management Implications

On May 4, 2004, the U.S. Fish and Wildlife Service added Kittlitz's Murrelet to the list of candidate species for listing as threatened or endangered species (69 FR 24875 24904). Among the likely causes for the recent "significant population declines" in the core range of the species are "habitat loss or degradation, increased adult and juvenile mortality, and low recruitment…" (69 FR 24875 24904). Investigation of these and other potential causes for decline would directly benefit from data collected using radio-telemetry methods. Habitat use and nesting requirements are important needs that will also be essential if a future determination of critical habitat for the species is justified.

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## Suggested Citation

Romano, M.D., Piatt, J.F., and Carter, H.R., 2007, First successfult radio-telemetry study of Kittlitz's Murrelet—Problems and potential, *in* Piatt, J.F., and Gende, S.M., eds., Proceedings of the Fourth Glacier Bay Science Symposium, October 26–28, 2004: U.S. Geological Survey Scientific Investigations Report 2007-5047, p. 120-123.

A Bald Eagle rests atop a small iceberg. (Photograph by Brenda Ballachey, U.S. Geological Survey.)