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VOCALIZATIONS OF THE KITTLITZ'S MURRELET[1]

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Abstract. We present the first documentation of Kittlitz's Murrelet (*Brachyramphus brevirostris*) vocalizations, based on recordings made in Glacier Bay, Alaska, in 1994. We identified two apparently related types of calls: groan and quack. The Kittlitz's Murrelet calls were markedly different from the most common calls of the congeneric Marbled Murrelet (*Brachyramphus marmoratus*), but shared characteristics with the Marbled Murrelet's less common "groan" call. Phylogeny, breeding biology, and habitat characteristics may explain relationships between the congeneric vocalizations. More complete knowledge of the Kittlitz's Murrelet vocal repertoire is needed before vocalizations can be either used or discarded in the design of effective programs to monitor this rare and poorly-known species.

Key words: Alaska, Alcidae, Brachyramphus brevirostris, *calls, communication, Kittlitz's Murrelet.*

The Kittlitz's Murrelet (*Brachyramphus brevirostris*) is a rare North Pacific alcid whose breeding biology and behavior remain obscure. Limited data suggest a world population of only about 20,000 birds (van Vliet 1993). Federal listing of the Kittlitz's Murrelet as a species of special concern in Alaska highlights the vulnerability of this species to oil pollution, gill-netting, and trophic changes (van Vliet and McAllister 1994). Because the Kittlitz's Murrelet has cryptic breeding plumage and breeds solitarily in remote alpine habitats (Day et al. 1983), it is an exceptionally difficult species to monitor or manage.

Unlike its congener the Marbled Murrelet (*Brachyramphus marmoratus*), whose conspicuous vocal activity and extensive repertoire have been reasonably well described (Nelson and Hamer 1995, Nelson 1996), the vocal repertoire of the Kittlitz's Murrelet is virtually unknown; indeed, it is one of the last species within the North American avifauna whose voice has remained unrecorded. Webster (1950) gave the only known description of the Kittlitz's Murrelet call, referring to it briefly as "a hoarse, long-drawn-out squawk." Here we provide a more thorough description of the voice of the Kittlitz's Murrelet based on the first known audio recordings obtained for the species.

METHODS

We recorded alternate-plumaged Kittlitz's Murrelets at sea on the morning of 4 August 1994 from a 6-m vessel in Johns Hopkins Inlet (58°54′N, 137°02′W), Glacier Bay National Park, Alaska. We used a Sony TCD-D7 DAT recorder and a Sennheiser ME-88 shotgun microphone with a K3U power supply. Sonograms were produced on a Macintosh computer using Canary bioacoustics software, version 1.2.1 (Cornell Laboratory of Ornithology, Ithaca, New York). Vocalizations have been archived at the Library of Natural Sounds, Cornell Laboratory of Ornithology.

We drifted among small numbers (<10) of foraging Kittlitz's Murrelets for about 5 hr, and heard only a few vocalizations. Calling birds did not open their bills when vocalizing, but occasionally could be identified by distention of the gular region.

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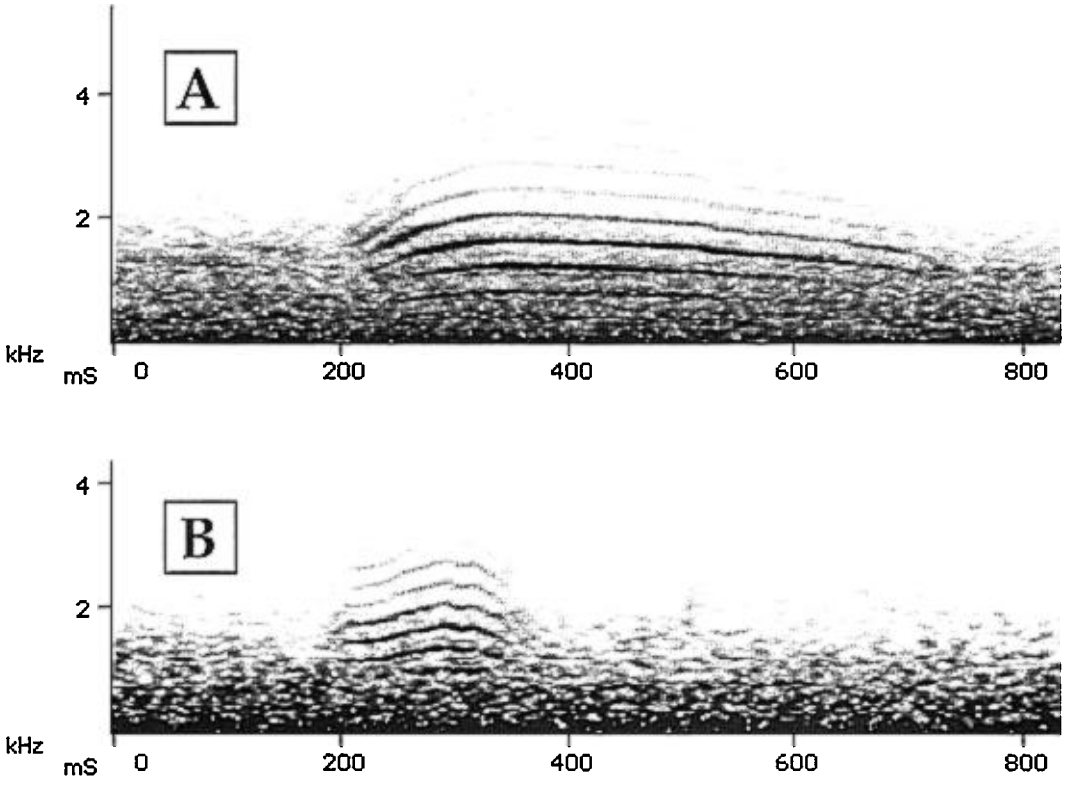

FIGURE 1. Spectrograms of the two types of Kittlitz's Murrelet calls recorded in Johns Hopkins Inlet, Glacier Bay National Park, Alaska on 4 August 1994. Panel A: "Groan" call; B: "Quack" call. Sound digitized at 22,050 Hz with 16 bit sample size. Spectrogram specifications: Hamming window function; clipping level −128 dB; overlap 99.22%, FFT size 256 points, frame length 256 points.

Low signal-to-noise ratios due to boat and water noise obscure the lower frequency component of the calls. The extremely quiet nature of the calls further reduced the quality of our recordings, but as first examples of this species' vocalizations they reveal much information and should serve as a useful starting point for further investigations of the enigmatic vocal behavior of the Kittlitz's Murrelet.

RESULTS

We discerned two types of calls, similar in tonal quality and in fundamental frequency, frequency range, and harmonic pattern. Differences were mainly in duration and frequency modulation. We were unable to record sufficient calls to investigate differences among individual Kittlitz's Murrelets. We therefore emphasize that we are not presenting definitive call types for this species; the calls named here may in fact represent individual variation or plasticity related to behavior.

The basic call was the "groan" call (Fig. 1A; pronounced as "*aaahhrr*" or "*urrrhhn*"), a broadband call with an emphasized frequency (*f*) of 1.7–1.9 kHz, with harmonic tones ranging from 0.8 to 4.2 kHz. The duration ranged between 0.3 and 0.6 sec. This was the call most frequently given, usually between members of a pair or a small group. It appeared to be a contact call, and was given with particular emphasis by a member of a pair whose partner had dived. Variations of this call also were given immediately after individuals had taken flight. These variants generally had a more rapid frequency peak and slightly higher frequencies, with *f* of 1.95, but were otherwise similar to the basic call. One exceptional flight variant had a lower *f* of 1.52 kHz and was frequency modulated to result in a distinct rapid quaver.

The "quack" (Fig. 1B; pronounced as "*urgh*") was heard infrequently from birds on the water. Again, this was a broadband call, with *f* of 1.74 kHz and harmonics ranging from 0.95 to 3.10 kHz. However, at 0.15 sec this call had a much shorter duration than the groan or quaver calls. This may simply be a compressed version of the groan call.

DISCUSSION

Kittlitz's Murrelets are a relatively reticent species, but are not silent as is sometimes presumed. The vocalizations described here are very subtle, so it is not surprising that they rarely have been noted by persons familiar with the species. Most of the calls we heard were audible only after cutting the boat's engines, and

with concentrated, patient effort. Many calls would not have been audible without the aid of a directional microphone. In contrast, the strident calls of Marbled Murrelets can be easily heard at sea, even from large ships traveling at speed. It is therefore difficult to conclude whether the Kittlitz's Murrelet is mostly nonvocal at sea, or whether its vocalizations simply go unheard.

There also appears to be a lack of inland vocal activity associated with known Kittlitz's Murrelet nesting areas. There are no reports of aural detections of Kittlitz's Murrelets over land. Indeed, several attempts to record Kittlitz's Murrelet vocalizations at a known alpine nesting area (Piatt et al., in press) failed, even as Marbled Murrelets were frequently heard calling from the valley below (Naslund et al., unpubl. data). This secretive behavior may be part of the suite of antipredator habits (e.g., cryptic adult and nestling plumage, nest structure, and behavior at the nest) that the Kittlitz's Murrelet has evolved to facilitate solitary nesting on open ground (Naslund et al., unpubl. data). However, considering how little we know about the species' nesting behavior, that they nest only in very sparsely populated regions, and that almost no dedicated effort has been directed toward land-based listening for their vocalizations, the role of overland vocalizations in their behavior remains undetermined.

If Kittlitz's Murrelets do vocalize over land, an understanding of their repertoire could be useful for inland censusing, or at least for identifying potential nesting areas. Detections of Marbled Murrelets over land have been routinely used to assess presence and identify potential nesting habitat (Ralph et al. 1995). In practice, most Marbled Murrelets are heard and not seen (Paton 1995), and vocalizations have consequently formed the basis of our knowledge of Marbled Murrelet ecology and abundance in nesting areas (Naslund 1993, Naslund and O'Donnell 1995). Surveys at sea have allowed researchers to delimit the breeding range of the Kittlitz's Murrelet (Piatt et al., in press) and to estimate population sizes, but inland breeding bird surveys have not been attempted. If further research confirms that the Kittlitz's Murrelet is non-vocal over land, then alternate inland survey methods would need to be pursued in order to learn more about this enigmatic species.

Marbled and Kittlitz's Murrelets are phenotypically and genetically similar species (Pitocchelli et al. 1995, Friesen et al. 1996a, 1996b) and could therefore be expected to have similar vocalizations. However, the typical "keer" call of the Marbled Murrelet (Nelson 1996) is a pure-sounding whistle, and is unlike any of the known Kittlitz's Murrelet calls. On the other hand, the uncommon (ca. 1% of Alaskan detections; K. Kuletz, unpubl. data) "groan" call of the Marbled Murrelet (Nelson 1996) is spectrographically similar to the groan of the Kittlitz's Murrelet. As the structure of bird sounds is often linked to habitat (Wiley and Richards 1982), differences in vocalizations among *Brachyramphus* murrelets may reflect evolution in different breeding habitats, i.e., alpine talus vs. old-growth forest. Vocalizations common to both species may reflect either ancient habitat overlap or modern convergence.

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EVIDENCE OF MALE-BIAS IN CAPTURE SAMPLES OF MARBLED MURRELETS FROM GENETIC STUDIES IN BRITISH COLUMBIA[1]

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Abstract. We report a significant male-bias (1.8:1) in Marbled Murrelets (*Brachyramphus marmoratus*) captured with floating mist nets during the breeding season over four years (1994–1997) at Theodosia Inlet, Desolation Sound, British Columbia. There was little evidence for marked annual or diurnal variation in male-bias, or for variation due to flight direction of birds when they contacted the net (inland vs. out to sea). In contrast, samples of adult and juvenile Marbled Murrelets captured using a night-lighting technique at Desolation Sound in 1997 were not male-biased. We believe that the most likely explanation for our results is that there are sex-specific differences in behavior of Marbled Murrelets during the breeding period, such that more males than females are flying between marine foraging and inland nesting areas.

Key words: Brachyramphus marmoratus, *male-bias, Marbled Murrelet.*

Marbled Murrelets (*Brachyramphus marmoratus*) are atypical among Alcidae and other seabirds in that they nest predominantly in large trees found in old-growth coniferous forests (Nelson 1997). In recent years, population declines have been observed for Marbled Murrelets over much of their range (Nelson 1997) including parts of British Columbia where the Marbled Murrelet is classified as a "threatened" species (Rodway 1990). Current demographic information is limited to adult:juvenile ratios derived from marine and aerial surveys (Nelson 1997), but interpretation of survey data are difficult if one lacks basic information on population or subpopulation sex ratio and age structure.

In this paper, we report the sex of Marbled Murrelets captured during the breeding season using floating mist-nets and a night-lighting technique. We used a recently developed molecular technique (Griffiths et al. 1996) to sex birds because Marbled Murrelets are sexually monomorphic. This is the largest known-sex sample of Marbled Murrelets ever examined, and these data may have important implications for the conservation and management of this species.

METHODS

FIELDWORK AND CAPTURE OF BIRDS

A floating mist-net system (Kaiser et al. 1995) was used to capture Marbled Murrelets from late May to

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