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POST-FLEDGING BEHAVIOR OF A RADIO-TAGGED JUVENILE MARBLED MURRELET

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Abstract.—We used telemetry to follow a Marbled Murrelet (*Brachyramphus marmoratus*) for 2 wk after it fledged in Prince William Sound, Alaska. Between 12 (fledging date) and 26 Aug. 1994 we made 12 relocations on 9 days. The chick fledged after 0100 h and was first located at 1020 h of the same morning, 12 km from the nest. Subsequent movements were within a 12 km^2 area, primarily along 4 km of shoreline. Average distance between consecutive relocations was 3.2 km (SD = 3.3), or 1.7 km (SD = 1.5) not including the first relocation. The juvenile was usually <100 m from shore in water <30 m deep or <200 m from shore in water 50–210 m deep. Its movements often corresponded to tidal flux.

CONDUCTA DE UN JUVENIL DE *BRACHYRAMPHUS MARMORATUS*, MONITOREADO CON UN RADIOTRANSMISOR, LUEGO DE ESTE DEJAR EL NIDO

Sinopsis.—Utilizamos radiotelemetría para seguir por dos semanas, luego de su nacimiento, a pichones de *Brachyramphus marmoratus.* El estudio se llevó a cabo en Prince William Sound, Alaska. Entre el 12 de agosto (día de su nacimiento) y el 26 de agosto, hicimos 12 relocalizaciones en 9 dias. El pichón voló luego de 0100 h y se localizó por primera vez a las 0920 h de la misma mañana, a 12 km del nido. Los movimientos subsiguientes fueron dentro del área de 12 km2, primeramente a lo largo de los 4 km de playa. La distancia promedio entre áreas de relocalización fue de 3.2 km (DE = 3.3), o 1.7 km (DE = 1.5) sin incluir la primera relocalización. Generalmente, el juvenil se encontró a menos de 100 m de la orilla, a menos de 30 m de profundidad o a menos de 200 m de la playa en aguas de 50–210 m de profundidad. Sus movimientos muchas veces correspondieron al influjo de la marea.

The Marbled Murrelet (*Brachyramphus marmoratus*) is listed as threatened from California to British Columbia and is a species of concern in Alaska. Because it is difficult to find murrelet nests, researchers are developing a productivity index based on counts of juveniles at sea (Kuletz et al. 1995, Ralph and Long 1995, Strong et al. 1995). The design of juvenile surveys will depend partly on the behavior of fledglings, for which there is little data. Therefore, we report on the movements of a radio-tagged Marbled Murrelet chick.

STUDY AREA AND METHODS

The study area was Port Nellie Juan (PNJ), a mainland fjord 35-km long (60°33′N, 148°18′W) in Prince William Sound, Alaska. The area has mountains to 1700-m, glaciers, and forests along shorelines and lower valleys. Most of PNJ is >200 m deep, with maximum depths of 750-m. Tidal range is 5-m. The murrelet nest, located on 28 Jun. 1994, was in Kings Bay (Fig. 1) on a ledge 7-m up a vertical rock face and 5-m from mean high tide.

On 11 August at 2200 h, the chick weighed 118 g, and because it was

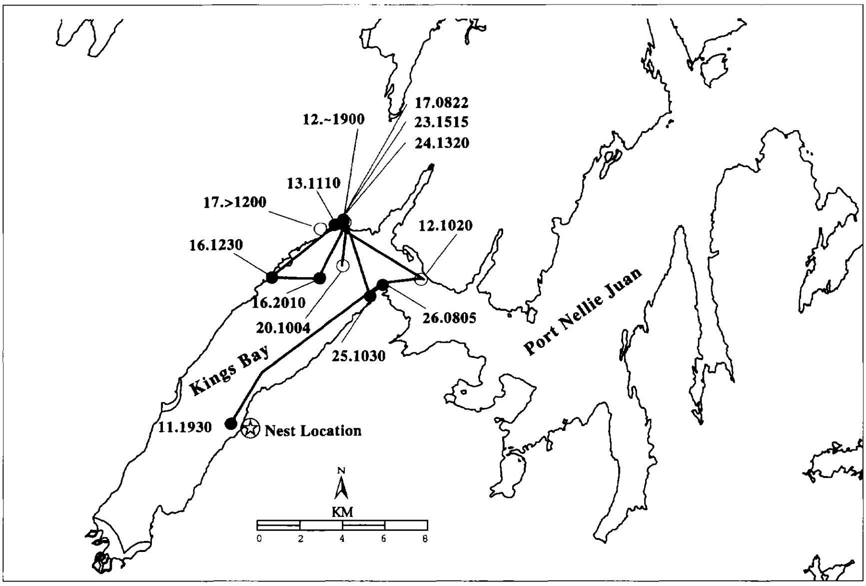

FIGURE 1. Telemetry detections of a juvenile Marbled Murrelet radio-tagged at its nest in Port Nellie Juan, Alaska, on 11 August 1994. All detections were in August and each is labeled with day.time. Solid circles = pinpointed locations, open circles = approximated locations.

in full juvenal plumage, would fledge within 48 h (Nelson and Hamer 1995). Based on activity of the radio-tagged parent, the chick was estimated to be 28–35-d old. We used marine epoxy to glue a transmitter to feather shafts in the middle of the bird's back. The transmitter (model BD-2G, Holohil Systems Ltd., Ontario, Canada) was 1.5 g, 20-mm long, had a 15.6-cm antenna at a 30° angle, and a battery life of 6 wk.

We used Telonics TR-2 and ATS receivers and Yagi antennae to track the murrelet by air and by boat. We flew on 17 August, 5 September, and 9 September, for approximately 1 h each. During aerial tracking, at maximum altitude (1700 m) signals could be detected at 13 km. When the signal was detected (n = 1), the plane circled lower and we alternated reception from 2 antennae to locate it. We conducted telemetry searches from 8-m whalers on 14 d between 12 August and 7 September (n = 19 searches, 29.3 h with receiver on). Birds on the water could be detected up to 2 km away. Signal detections from the boat (n = 11) required visual contact to pinpoint. Without visual contact, the boat's location at maximum signal reception was used to plot the coordinates in a geographic information system (GIS, Atlas GIS 1992). The GIS measured distances between points and the minimum area polygon. We recorded the pattern and strength of the signal or attempted visual contact to determine if the bird was resting, diving or flying. We spent 10.7 h observing the juvenile. Time of day was recorded in Alaska Standard Time (AST).

RESULTS

The chick remained in the nest after being tagged until at least 0100 h on 12 August, but was not in its nest at 0920 h. At 1020 h the signal was located but not pinpointed, near shore, 12 km from the nest (Fig. 1). At approximately 1900 h the chick was pinpointed 60 m offshore, still 12 km from its nest but approximately 5 km from the first relocation. The chick was found in this general area on four other dates until 26 August. For 2 wk the juvenile remained near the mouth of Kings Bay in an area approximately 12 km^2 (Fig. 1).

The juvenile moved at least 5 km between 1020 h and 1900 h on 12 August, 2.2 km between 1230 h and 2010 h on 16 August, and 1.5 km between 0822 h and afternoon on 17 August. Among dates, the mean distance between relocations was 3.2 km (SD = 3.3), or 1.7 km (SD = 1.5) if the first day's movement from the nest was not included. The juvenile was not relocated after 26 August despite aerial surveys. The signal lasted 15 d, approximately the same as the adult mean of 14 d (n = 47 birds; Kuletz et al. 1995).

When we observed the juvenile (n = 4 d), it appeared healthy and was diving. It did not preen or appear bothered by the transmitter. The longest the juvenile rested was 30 min, and it appeared to drift with the tide when not foraging. We never observed the juvenile flying. On 13 August the juvenile was in the vicinity of four adult murrelets, but was solitary on the other dates. The juvenile was usually next to shore in water <30-m deep, or within 200-m of shore in water 50–210 m deep. Twice we observed the juvenile chasing forage fish near the water surface, causing fish to jump out of the water.

DISCUSSION

The evening before fledging, the chick was 58% of mean adult mass obtained from adults captured in 1994 (n = 51, $\bar{x}$ = 204 g; Kuletz et al. 1995). The chick was 28–39 g lighter than chicks summarized in Nelson and Hamer (1995), which were 63–70% of adults, averaging 222 g. Although the fledging mass was low, the chick did not display abnormal behavior.

The chick fledged between 0100 h and 0920 h, when sunrise was 0555 h, whereas other Marbled Murrelet chicks (n = 8) have fledged at dusk, between 2020 h to >2200 h (Nelson and Hamer 1995). High tide was at 0522 h, so that during the approximate time the chick left the nest and when it was located 12 km to the northeast, the tide was flowing out and may have facilitated the juvenile's movement out of Kings Bay. The juvenile's movement back into King's Bay corresponded with the flood tide that afternoon. Likewise, relocations made on the morning and afternoon of the same day on 16 and 17 August, suggest that tidal or surface water flow facilitated the bird's movements.

The nest was 5 m from saltwater, thus the chick did not have to fly far to water. We could not determine whether the chick flew 12 km to its first relocation, or if it had traveled on water. We had no indication that the chick flew during these 2 wk, although some juveniles can fly (Sealy 1975). A radio-tagged chick in Washington flew 41 km from its inland tree nest (Hamer and Cummins 1991). On the second day, the Washington fledgling was 5 km from its first at-sea location, a distance slightly greater than the consecutive sightings of the Kings Bay fledgling.

Juveniles are often found closer to shore than adults (Sealy 1975), and this juvenile appeared to favor the shoreline. The area used by the juvenile was generally protected from strong winds, and although the fjord is deep, a shelf <100-m deep extends 150-m from shore, with coves <10-m deep. Murrelet density in central PNJ was high, suggesting good foraging conditions; mean murrelet density in July and August 1994 (n = 12 d) was 20.8 birds/km^2, with an average of 6.4% juveniles/d (Kuletz et al. 1995). The juvenile's feeding activity suggested that prey were available near the surface. The majority of juveniles encountered in 1995 surveys were, like the tagged juvenile, solitary foragers.

The juvenile remained in central PNJ, primarily along 4 km of shoreline, for a minimum of 15 d after fledging. Afterward, we could not determine if the chick lost the transmitter, left the area, or died. Our search for the juvenile extended beyond PNJ, but it is possible that the juvenile remained in the study area after we lost its signal.

Although the juvenile traveled 12 km from its nest initially, subsequent movements during its first two weeks at sea were more limited. The range of this juvenile would easily be encompassed within a 40–50 km section of shoreline, which has been suggested as a practical survey unit for a Marbled Murrelet productivity index (Kuletz et al. 1995, Ralph and Long 1995, Strong et al. 1995). Our results suggest that replicate juvenile surveys could include the same individuals, and in this location, juveniles could originate from nesting habitat nearby. More juveniles need to be studied to determine if these results are typical.

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