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Do Rhinoceros Auklet, *Cerorhinca monocerata*, Fledglings Fly to the Sea from Their Natal Burrows?

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The mode of departure of Rhinoceros Auklet fledglings from their nest burrows has remained uncertain. Both walk-down and fly-down hypotheses have been proposed. Here we use the unique geography of Protection Island, Washington, to evaluate the fly-down hypothesis. Some fledglings raised on Protection Island do appear to walk to the water, but our results suggest that many of the island's fledgling Rhinoceros Auklets fly to the sea.

Key Words: Rhinoceros Auklet, *Cerorhinca monocerata*, fledgling departure, Washington.

Rhinoceros Auklets (*Cerorhinca monocerata*) are the most abundant puffins in the waters of the Pacific Northwest. Unlike Tufted and Horned puffins (*Fratercula cirrhata* and *F. corniculata*, respectively), which also breed along western North America, members of most populations of Rhinoceros Auklets leave their nesting colonies before dawn to feed and return after sunset (Wilson and Manuwal 1986; but see Thoresen 1980). Consequently, some basic information on the behavior of these birds remains obscure, despite growing knowledge of their breeding biology (Richardson 1961; Scott et al. 1974; Leschner 1976; Summers and Drent 1979; Vermeer 1978, 1979, 1980; Thoresen 1980, 1983; Wilson and Manuwal 1986; Wilson 1993; Gaston and Duchesne 1996).

One elusive piece of information involves the mode of departure from nest sites by newly-fledged Rhinoceros Auklets. Young Atlantic Puffins (*F. arctica*) walk, flutter, or fly to the water from their burrows (Lockley 1934; Richardson 1961; Gaston and Jones 1998), whereas fledgling Cassin's Auklets (*Ptychoramphus aleuticus*) fly to the sea after making short "practice flights" (Manuwal 1974). Leschner (1976) found Rhinoceros Auklet fledglings that were too small to fly "crouched under rocks or crevices in the morning" on Destruction Island, Washington; this suggested to her "that fledglings walk or flutter to the water." Similarly, Wilson (1977) observed fledgling Rhinoceros Auklets on Protection Island, Washington, "walking down the grass covered slopes" to the sea. But Richardson, (1961) who also worked on Protection Island, wrote that "flight [capability] ... appears to develop precociously," and that like the "half-grown young" of murres, fledgling Rhinoceros Auklets "fly down to the water."

On Protection Island, hundreds of Rhinoceros Auklets nest along a sandy cliff that rises above Violet Point, a gravel spit that contains a large Glaucous-winged Gull (*Larus glaucescens*) colony. Each summer, scores of auklet fledglings are found dead within a relatively defined area of the gull colony, across an artificial channel and marina from the cliff. The distribution of dead fledglings and the unique semi-natural geography

of Protection Island allowed us to evaluate Richardson's fly-down hypothesis.

Methods

Protection Island, Jefferson County, Washington (48°08'N, 122°55'W), consists of a 35–76-m high plateau surrounded by steep, grass-covered, sandy cliffs ideally suited for Rhinoceros Auklet burrowing. The largest Rhinoceros Auklet colony in Washington is located here, with approximately 27 549 burrows (Wilson and Manuwal 1986). Violet Point, a gravel spit that extends 800 m east from the upper island, contained around 5 100 of Glaucous-winged Gull nests during this study (J. G. Galusha, personal communication).

In July and August 1992, 1993, and 1997 the location of each auklet fledgling found dead on Violet Point was plotted by measuring its north or south distance from a transect that measured its eastward distance from the base of the island's east-facing cliff. To estimate age at death, culmen and tarsal lengths, if still present, were measured in 1992 and 1993. The height of the highest (60 m) nesting burrows on the cliff in relation to the distribution of dead fledglings on Violet Point was used to approximate a range of presumed fledgling flight path angles trigonometrically.

Results

One hundred and twenty-one dead fledglings (43 in 1992, 11 in 1993, and 67 in 1997) were counted between 106 m east of the cliff base, at the western margin of the gull colony, and 398 m east of the cliff base, toward the center of the gull colony (Figure 1). The fledglings apparently died as a result of hitting the spit or being attacked by resident gulls. No dead fledglings were found beyond 398 m. The pooled mean (\pm SD here and below) distance of fledgling corpses from the base of the nest cliff was 303 ± 58.0 m ($n = 54$, range = 106–398 m). Mean culmen length was 24.4 ± 3.0 mm ($n = 35$), and mean tarsus length was 37.9 ± 1.6 mm ($n = 48$); Rhinoceros Auklets of this size are about 45 days old (Wilson and Manuwal 1986). During late July and early August, we occasionally found live

Rhinoceros Auklet fledglings hiding in grass between the nesting cliff and the channel/marina, and we regularly observed fledglings swimming in the water of the marina/channel.

Discussion

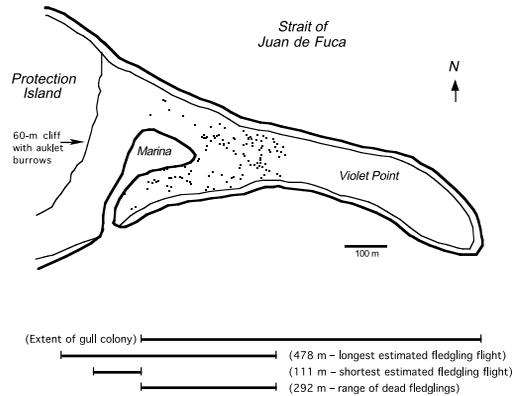
Large numbers of dead fledglings found in gull territories east of the marina/channel water and across from the nesting cliff support the hypothesis that these fledglings flew down and over the water from their natal burrows. Alternate means of reaching the east side of the marina/channel were highly unlikely: (1) walk/flutter down slope, enter the marina/channel water from the west shore, leave the water on the east shore, enter the gull colony, be killed; (2) walk/flutter down slope, enter the colony north of the marina/channel, walk/flutter through a gauntlet of gull territories to the east side of the water, be killed; (3) walk/flutter down slope, enter the colony north of the marina/channel, be killed, then be transported to distant points east of the water by gulls. With respect to (3), it should be noted that fledging Rhinoceros Auklets exhibit an average mass of 360 g (Wilson and Manuwal 1986), 34% of the average mass of 1051 g (Vermeer 1963) for adult Glaucous-winged Gulls in this region; thus it appears unlikely that auklet corpses could be moved very far from the place where they were killed.

Our data, with those of Richardson (1961), Leschner (1976), Wilson (1977), and Wilson and Manuwal (1986), support the following scenario for the departure of fledgling Rhinoceros Auklets from their nest burrows on Protection Island: In late July and early August, some fledgling auklets walk and flutter, but also many fly directly away from their natal burrows. Fledglings cannot sustain prolonged flight, however, and from the highest nests lose altitude at a rate of 13–32 m/100-m distance, with a slope of 7°–18° (Figure 1B); fledgling flights from lower burrows would exhibit progressively shallower angles. Fledglings from preferred nest sites located directly above the ocean (Richardson 1961) reach the water successfully. Fledglings that fly from nest sites along the cliff above Violet Point hit the gull colony where they are killed, unless they veer to the ocean or are fortunate enough to land in the marina/channel. Whether this scenario applies to fledgling departures at other Rhinoceros Auklet colonies remains unknown.

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A. Aerial view



B. Side view



FIGURE 1. A. Aerial view of Violet Point, Protection Island, Washington. Dots indicate locations of dead fledgling Rhinoceros Auklets found during July and August, 1992, 1993, and 1997. Lines below indicate approximate extent of the spit occupied by the gull colony, extent of fledgling auklet corpses, and estimated extents of fledgling auklet flight distances. B. Side view of Violet Point showing the estimated range of Rhinoceros Auklet fledgling flight paths, sloping from 7°–18° from the highest (60 m) natal burrows above the gull colony; fledgling flights from lower burrows would exhibit progressively shallower angles.

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