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Analysis of Great Horned Owl Pellets with Rhinoceros Auklet Remains

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Compared to most avian predators, owls inflict minimal damage on bones regurgitated as pellets. Analysis of these bones is useful to ornithologists characterizing owl dietary habits (Dexter 1978, Kirkpatrick and Conway 1947, Stegeman 1957), to ecologists assessing compositions of small-mammal communities (Phillips 1951, Long and Kerfoot 1963), and to paleobiologists reconstructing ancient communities (Mayhew 1977, Dodson and Wexlar 1979, Hoffman 1988). The extent and nature of the damage inflicted on the bones may allow for identification of the type of owl forming the pellets (Dodson and Wexlar 1979, Hoffman 1988).

Great Horned Owls (*Bubo virginianus*) usually prey on a variety of small- to medium-sized mammals and birds, with mammals forming the bulk of their diets (Dexter 1978, Kirkpatrick and Conway 1947, Stegeman 1957). However, Great Horned Owls living on Protection Island, Jefferson Co., Washington, are noteworthy in that their regurgitated pellets contain bird remains exclusively. Here we characterize these unusual pellets and their contents.

Great Horned Owl pellets (87 in 1987; 42 in 1988) were collected at a roost site from June to August. The collection area, 25 m in diameter, was at the edge of a coniferous stand at the northeastern part of the island. Observations suggest that the pellets were produced by a single family of owls (two adults and three juveniles in 1987).

After softening each pellet in water, bones were extracted and identified by type and, when possible, source species. Each bone was characterized as complete or fragmented. A fragmented long bone was listed as retaining either the proximal or distal end, or only the midshaft; size was estimated to the nearest 25% of the original unbroken element (after Hoffman 1988).

To characterize whole pellets, lengths and widths of 30 pellets collected in 1988 (all those from which complete data could be obtained) were determined to the nearest millimeter. The pellets were dried to constant mass and the bones extracted. The extracted bones were then dried to constant mass and a bone/pellet mass ratio was determined for each pellet.

The pellets were cylindrical with rounded ends, with bones embedded in a matrix of feather material

(Fig. 1). Based on the sample of 30 pellets collected in 1988, mean pellet length ($\bar{x} \pm SD$) was 6.6 ± 1.4 cm, and mean pellet width was 3.2 ± 0.4 cm. The mean pellet dry mass was 9.8 ± 3.4 g, with an average of 30% of the dry mass attributable to bone.

Of the 129 pellets analyzed, 86.8% contained only bones of Rhinoceros Auklets (*Cerorhinca monocerata*), whereas another 6.2% contained bones of both Rhinoceros Auklets and other birds. Thus, 93% of the pellets contained auklet bones, while only 7% contained exclusively nonauklet skeletal material. No pellet contained mammal bones.

Nonauklet bones were not identified to species. However, some appeared to be from Pigeon Guillemots (*Cephus columba*) and juvenile Glaucous-winged Gulls (*Larus glaucescens*). At least two pellets contained bones of unidentified passerine birds.

Rhinoceros Auklet bones, either whole or fragmented, were found in 120 pellets. Ribs and vertebrae were found in almost all the pellets, while bones of the legs and feet were only modestly represented; bones of the head were uncommon (Fig. 2). No auklet wing bones were found in any pellet, although mature wing bones from small nonauklet birds were present in two pellets.

Tables 1 and 2 show the fragmentation patterns of the pelleted Rhinoceros Auklet bones. Tarsometatarsi, digits and coracoids were most frequently complete. Other bones of the appendicular skeleton—femora, tibiotarsi, fibulae, furculae and scapulae—were most frequently fragmented. This was particularly evident for furculae which were abundant in the pellets, but almost always fragmented. Among fragments of the tibiotarsi the proximal ends were most abundant, whereas the distal ends of scapulae were most common. Ribs often were fragmented, whereas vertebrae usually were complete. Keel and pelvic elements always were found as fragments.

Nonpelleted auklet remains were often scattered about the roost area. Especially common were wings and heads. Usually the wings had been severed from the body at the proximal ends of the humeri. Coracoids often remained attached to the humeri. Wings and heads of Rhinoceros Auklets often were found along roads traversing the island.

Owls were seen regularly at the roost site and at other locations on the island. Lawrence McCloskey (pers. comm.) watched an owl capture a Rhinoceros Auklet as it landed by its burrow at dusk several years ago on Protection Island. Another time he watched an owl swoop down and capture an auklet from the

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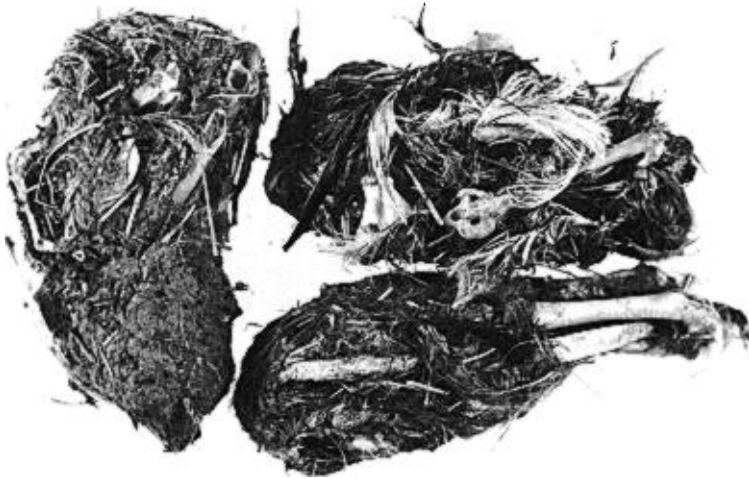


Fig. 1. Three Great Horned Owl pellets from Protection Island, Washington. Each pellet contains bones and feathers of Rhinoceros Auklets.

water's surface near Colville Island, 33 km north of Protection Island.

During the winter, Suzanne Sterling saw an adult owl feeding on a female Indian Peafowl (*Pavo cristatus*; pers. comm.). On a second occasion, she observed an owl feeding on a peacock draped over a tree limb. Until their recent removal by refuge management, Indian Peafowl were common feral residents of Protection Island.

Protection Island serves as a breeding ground for

several species of seabirds, including Double-crested Cormorants (*Phalacrocorax auritus*), Pelagic Cormorants (*P. pelagicus*), American Black Oystercatchers (*Haematopus bachmani*), Tufted Puffins (*Fratercula cirrhata*), Pigeon Guillemots, Glaucous-winged Gulls, and Rhinoceros Auklets (Thompson et al. 1985, Galusha et al. 1987). Of these species, Glaucous-winged Gulls and Rhinoceros Auklets are especially abundant, with over 11,000 and 34,000 individuals, respectively (Speich and Wahl 1989). By contrast, with the exception of shrews and an occasional chipmunk, few mammals reside on Protection Island.

Presumably, Great Horned Owls on Protection Island favor Rhinoceros Auklets as prey items because of their abundance, nocturnal activity, and size. The behavior of auklets returning to nesting areas also may attract hunting owls. On the moonlit night of 21 July 1991, we observed that once auklets with fish landed on the island, they remained stationary for up to several minutes, then rushed rodentlike to their burrows several meters away. We also observed groups of three to five birds engaged in social interactions which included "billing" and "freeze posturing" (Thoresen 1983).

We do not know if auklets are important prey at times other than summer. Anecdotal observations of owls feeding on Indian Peafowl during the fall may suggest seasonal dietary shifts when auklets do not frequent the island.

Given that few auklet head bones and no auklet wing bones were found in pellets and, given the occurrence of large numbers of auklet wings and heads scattered over the island, it is apparent that both heads and wings are torn from the auklets and discarded by the owls before the rest of the body is ingested. By contrast, Great Horned Owls feeding on mice in-

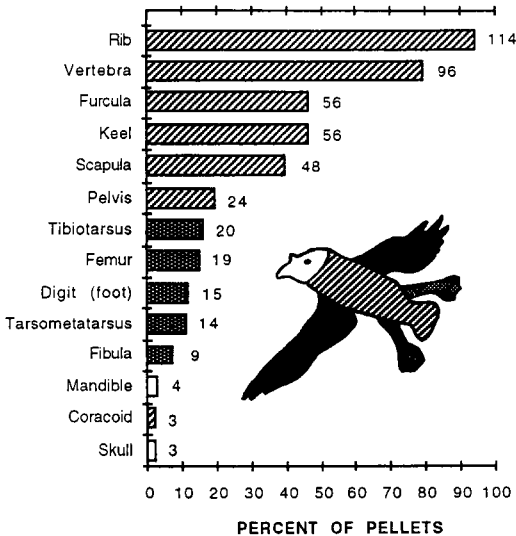


Fig. 2. Percentages of 120 Great Horned Owl pellets with each Rhinoceros Auklet bone type. Number of pellets shown at end of each bar.

TABLE 1. Numbers of Rhinoceros Auklet bones of appendicular skeleton recovered from 120 Great Horned Owl pellets. Fragmented bones are listed as retaining either proximal or distal end, or only the midshaft; size estimated to nearest 25% of original unbroken element.

Element	Complete 100%	Proximal			Midshaft			Distal		
		25%	50%	75%	25%	50%	75%	25%	50%	75%
Leg bones										
Femur	12	4	—	1	—	1	—	3	3	3
Tibiotarsus	4	10	—	2	—	1	—	1	1	6
Fibula	1	6	1	—	—	—	—	1	1	1
Tarsometatarsus	15	1	—	—	—	—	—	1	3	—
Digit	73	—	—	1	—	6	—	—	—	—
Other bones										
Coracoid	3	—	—	—	—	—	—	—	—	—
Furcula	4	71	14	2	28	8	—	59	28	4
Scapula	1	5	—	1	3	7	5	20	27	9

gest the entire bodies and the resultant pellets commonly contain skull-bone fragments and foreleg bones (Dodson and Wexlar 1979, Hoffman 1988). Early post-capture removal of auklet heads may prevent damage to the owls by the parrotlike beaks of the prey. Non- auklet wing bones found in two pellets indicated that removal of the wings is not always carried out on avian prey.

Members of different species of owls inflict distinctive fragmentation patterns on rodent bones (Dodson and Wexlar 1979, Hoffman 1988). These distinctive patterns serve as signatures characteristic of the types of owls responsible for accumulating the bones. This information is useful in paleoecological reconstruction. Whether such distinctive patterns occur with pelleted bird bones remains unknown.

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TABLE 2. Numbers of Rhinoceros Auklet bones of axial skeleton recovered from 120 Great Horned Owl pellets.

Element	Portion and condition	
	Complete	Fragment
Skull	1	6
Mandible	2	7
Keel	—	142
Rib	135	1,495
Pelvis	—	57
Vertebra	707	209

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