An Attempt to Determine the Prey of the Great Auk
(Pinguinus impennis)

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The flightless Great Auk (Pinguinus impennis), the largest of all Recent Alcidae, was exterminated in
1844 (Greenway 1958), and no one who can properly be called a naturalist ever encountered the bird in
life. As a consequence, virtually no details are known of its behavior or ecology. One of the principal
nesting grounds of the Great Auk was on Funk Island, off the northeast coast of Newfoundland. Several
expeditions have been made to Funk Island for the purpose of obtaining remains of these birds, the best
documented of these being the visit of the schooner Grampus in 1887, in which F. A. Lucas was a
participant. Lucas (1890) published a report on this expedition, including a brief history of the Great
Auk and observations on its osteology.

Most of the Great Auk bones from Funk Island were accumulated as a result of the birds being
slaughtered for oil, the carcasses being rendered on the island and discarded there. Presumably the
contents of the digestive tract were discarded with the carcasses, and it therefore seemed likely that hard
parts of prey might be preserved in the soil along with Great Auk bones. While there is no reason to
doubt that the Great Auk ate mainly fish, as do most other North Atlantic alcids, it would be of interest
to determine the sizes and specific identity of its prey, as this might lead to a better understanding of the
ecological requirements of the bird.

Until recently there was a venerable wooden crate, stored in the basement of the National Museum
of Natural History, that contained the unsorted bones of Great Auks, still in the peaty soil from which
they were exhumed on Funk Island by the Grampus expedition. This material was evidently in excess
of that needed by Lucas for his studies and had never been processed. There is now no way of knowing
if this sample represents a collection from a single site or a composite from several sites. From this
material we recovered the following long bones of Pinguinus impennis: 156 carpometacarpi, 148 ulnae,
99 humeri, 126 coracoids, 124 femora, 123 tibiotarsi, and 150 tarsometatarsi, as well as many cranial
elements and an abundance of all the lesser parts of the skeleton. Only six bones of birds other than
Great Auk were found; these belong to at least two murres (Uria sp.). Thus, any prey remains from this
sample would almost certainly have come from Pinguinus.

After the removal of the large bones, there remained about 25,000 cc of matrix, which was subjected
to several washings and then screened through fine mesh. The resulting concentrate was examined and
sorted under magnification. In the process, hundreds of sclerotic plates and seven stapedes of Great Auk
were retrieved. Probably because of the acidic nature of the soil, no otoliths of fish were preserved. Other
fish remains were sparse but nevertheless prove of interest. The identity of these specimens is as follows.

Menhaden, Brevoortia cf. tyrannus (Clupeidae).—Seventy-nine scales and scale fragments to about
11 mm in diameter. These scales are from fish about 140-190 mm standard length (SL).

Shad, Alosa sp. (Clupeidae).—Two scales from a fish about 120 mm SL. Only American shad
(A. sapidissima) and alewife (A. pseudoharengus) occur north to Labrador today.

Capelin, Mallotus villosus (Osmeridae).—Seven small vertebrae, 1.4-1.6 mm long. These are from
fish 80-100 mm SL that would have been 1–2 yr old.

Indeterminable Gadidae.—Three anterior vertebræ, 1 mm long and 3 mm wide, from fish 120–150
mm SL; 1 right fifth pharyngobranchial, 7.1 mm long, from a fish about 250 mm SL; 6 fragmentary
vertebræ.

Three-spined stickleback, Gasterosteus aculeatus (Gasterosteidae).—One right pectoral spine, 6.2 mm
long, slightly worn; 1 dorsal spine pterygiophore, 4 mm long in midline. These elements represent a fish
100–120 mm SL, which is equal to or exceeds the hitherto known maximum size of the species.

Morone cf. saxatilis (Percichthyidae).—One complete (6.1 × 7.1 mm) and 2 fragmentary scales. These
could possibly be from the white perch, M. americanus. They represent a fish 280–320 mm SL, near or
about the maximum for white perch, but the size of a 2- or 3-yr-old striped bass, M. saxatilis.

Flatfish, cf. Pleuronectidae.—One left supracleithrum, 6.1 mm long. This bone is from a fish 80–100
mm SL.

Indeterminable Teleostei.—Seven vertebræ, 1.5–2 mm long; 1 glossohyal (?); 1 exoccipital facet for
reception of atlas vertebra; 1 half fin ray; 6 bone fragments.
The following ecological and distributional information on these fishes is summarized from Bigelow and Schroeder (1953, 1964), Leim and Scott (1966) and Scott and Grossman (1973). South of Funk Island in the Gulf of Maine, Atlantic menhaden appear inshore between May and June, when temperatures reach about 50°F (10°C), and are gone by October or early November. They do not enter brackish water in the north and in some years have failed to appear north of Cape Cod. Before about 1850, menhaden occurred periodically as far north as the Bay of Fundy. The scales from Funk Island provide evidence of the species about 800 km northeast of its known historic range, suggesting that its distribution has become more southerly. American shad and alewife remain offshore most of the year; north of Cape Cod they enter freshwater streams to breed between late April and early July. Adult capelin move inshore to spawn in June or July at water temperatures of 40-47°F (4-8°C), while large numbers of juveniles remain just offshore. Spawning occurs from Newfoundland northward, after which the adults return to deep water. Stickleback primarily inhabit freshwater, estuaries, and the nearshore environment, but it is not uncommon to encounter individuals in floating masses of seaweed offshore. Striped bass are inshore fish rarely taken more than 7 or 8 km from the coast from May to October. The remainder of the year they occur in freshwater rivers.

In the area from Cape Cod to the mouth of the St. Lawrence River, the species of fish recorded here are available in shallow marine waters only during five or six warm months (May to October). Only Gasterosteus would be available in the shore zone in winter, because Brevoortia departs southward, Morone invades freshwater, and Mallotus and Alosa move into deeper water. The remains could thus have been accumulated at Funk Island only coincident with the breeding season of the Great Auk.

All prey species in the sample could be obtained in the water column from near the bottom to near the surface, except for the one flatfish, which is benthic. The remains suggest that the birds fed in water less than about 18 m deep and within 2 km of shore. The combination of Brevoortia and Morone would probably not occur in shallow water today, but as noted, the range of Brevoortia has evidently been shifting southward in historic times. Such factors of fish distribution as the former overlap of Brevoortia and Mallotus may have played an important role in the location of breeding colonies of the Great Auk.

The size of the fishes indicates juveniles (1–2 yr old) of Brevoortia, Alosa, Mallotus, and most Gadidae; subadults of Morone and one of the Gadidae; and an adult Gasterosteus. Almost all the specimens would have ranged from 70–190 mm SL, thus being of an appropriate size for prey of Pinguinus. The specimens of Morone and one specimen of Gadidae were 240–320 mm SL and may have been near the maximum size that a Great Auk could manage.

The overall taxonomic composition of the fish remains from Funk Island corresponds closely with that reported for the prey of the larger extant species of Atlantic alcids (see references in Swennen and Duiven 1977). In alcids, prey may apparently be determined not only by availability but also by selection of species with higher caloric value (Harris and Hislop 1978), thus perhaps explaining the predominance of Brevoortia and Mallotus in our sample, both of these fishes being relatively oily.

Because there is extensive overlap in the prey species taken by the larger North Atlantic alcids, it is believed that ecological segregation of these birds is facilitated by their taking prey of different sizes (Harris 1970). Swennen and Duiven (1977) found in experiments with captives of three species of Atlantic alcids that prey diameter rather than length was the principal factor affecting the size of prey selected. Common Murres (Uria aalge) took larger (deeper-bodied) fish than did the smaller Razorbill (Alca torda) or the Common Puffin (Fratercula arctica). All three species preferred prey smaller than the maximum size manageable.

In this regard it is of considerable interest that the specimens of Brevoortia in our Funk Island sample come from individuals with a minimum body depth of about 42–57 mm and a maximum body depth of approximately 49–66 mm. Common Murres can take prey up to 44 mm maximum depth, but only very reluctantly consume fish of more than 40 mm depth and prefer those about 23 mm (Swennen and Duiven 1977). Therefore, the Funk Island remains of Brevoortia are in accord with the expected dimensions for the prey of an alcid the size of the Great Auk.

Any conclusions from this study are necessarily based on very slender evidence. We would anticipate, however, that the collection of larger and more carefully controlled samples from Funk Island could result in statistically meaningful data on the prey of Pinguinus, thus filling in our knowledge of food habits in Recent North Atlantic alcids. If nothing else, we hope we have demonstrated the feasibility of such a study.

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