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A New Look at the "Point" of a Common Murre's Egg

"Egg-shaped" is an imprecise term. Which egg? The domestic hen's egg comes to mind first, with a shape shared by many other birds. But there is also the globe shape of many owls and woodpeckers, the sharply pointed eggs of many shorebirds, and the near-perfect ovals of many waterfowl, hawks, pigeons, and hummingbirds.

And what of the elongated, pear-shaped eggs of murres? British naturalist William Chapman Hewitson took note of the distinctive shape in 1833 in the second volume of his beautifully illustrated and pleonastically titled treatise *British Oology; Being Illustrations of the Eggs of British Birds, with Figures of Each Species, as Far as Practicable, Drawn and Coloured from Nature: Accompanied by Descriptions of the Materials and Situations of their Nests, Number of Eggs, &c.* He described the eggs as "readily known by their being much narrower and more pointed at the smaller end, and by their greater length [than the Razorbill]."

Ornithologists since then have wondered about the adaptive significance of the murre egg's unusual shape. The consensus has been a largely intuitive suggestion that the shape is an adaptation reducing the risk of an egg's rolling off a narrow cliff ledge where the murre lays and incubates its egg. The shape, it is assumed, would roll the egg in an arc or a circle to prevent it from rolling straight out over the ledge.

This is the pear-shaped egg of a **Common Murre** (or Guillemot, as the species is named in the U.K.) upon a cliff on Skomer Island, Wales. The shape has prompted new thoughts about how it might protect the egg on narrow ledges where nests are crowded closely to one another. *Photo by © Tim Birkhead.*

Science, as we know, perpetually moves beyond past beliefs, or it wouldn't be science. In this case, Tim R. Birkhead, Jamie E. Thompson, Duncan Jackson, and John D. Biggins at the University of Sheffield in England question the traditional belief.

Writing in 2017 in *Ibis* (tinyurl.com/guillemot-egg), they title their paper with a clever pun, "The point of a Guillemot's egg." (Guillemot is the British name of the Common Murre.) The authors suggest that the elongated pear-shaped structure may offer a different advantage. They state bluntly, "Contrary to popular belief, there is almost no evidence that the pyriform shape of guillemot eggs, and their resulting tendency to roll in an arc, is an adaptation to reduce the risk of their falling off cliff ledges."

Birkhead and his colleagues question the traditional assumption on four counts. First, the breeding ledges are often much narrower than the arc previously described for a rolling egg. Second, the murres typically incubate facing the cliff wall with the pointed end of their egg directed toward the cliff edge; thus, a dislodged egg would roll outward toward the edge and would be more likely to fall. Third, the murres' eggs vary considerably in shape, suggesting that there is little stabilizing selection on egg shape. Fourth, Thick-billed Murres' eggs are even less pear-shaped, yet this species nests on narrower ledges.

Two new explanations are suggested. Perhaps the pear shape may enable the eggs to withstand impacts from "the vigorous rough and tumble of a dense breeding colony." Mechanical analyses indicate that a combination of the shape and variations in thickness of the shell's regions confer stability, strength, and resistance against impacts. In addition, perhaps the shape may help to protect the blunt end of the egg from contamination by fecal material and other debris on the cliff where birds come into close contact. A variety of data and interpretations are offered to support these views.

The authors state that they are not making a case for either explanation and are simply offering these as testable hypotheses. The guillemot's pyriform egg, they suggest, "is likely to be a compromise between a number of different selection pressures."

The Elusive "Feathered Mouse" Is Harder and Harder to Find

Many birders share Arthur T. Wayne's frustration when trying to get a good look at a Black Rail. The father of South Carolina ornithology had this lament: "On October 17, 1891, I flushed one of these rails in a cornfield, but although I saw the exact spot where it alighted I was unable to flush it again."

Today's conscientious conservation-minded birders will not tramp across marshes trying to flush Black Rails. Even if they did, they might not succeed in seeing this tiny bird often described in ornithological literature as a feathered version of a scurrying mouse.

So-called targeted surveys—searches at locations long known to be important Black Rail habitats—have uncovered a bleak picture. Bryan D. Watts tells that sad story in a 2016 technical report published by the Center for Conservation Biology at the College of William and Mary (tinyurl.com/Black-Rail-decline). The findings are based on survey teams' extensive searches since 2014 throughout the eastern Black Rail's range along the Atlantic and Gulf coasts.

Especially disheartening examples of historical trends come from two locations where many birders have successfully sought the elusive rail in the past. The report describes these trends as a "catastrophic decline":

- Decadal high counts compiled for the population at Elliott Island, Maryland, include 100+ in the 1950s, 45 in the 1970s, 47 in the 1980s, 44 in the 1990s, 12 in the 2000s, and 2 in the 2010s. No Black Rails were detected there during the 2016 breeding season, a grim "milestone."
- Historical comparisons at Cedar Island, North Carolina, show a similar collapse: 80+ in the 1970s, 20 in the 1980s, 5 in the 1990s, and 1 in the 2000s. Only a single calling bird was reported from this site in 2016.

Estimates in New Jersey, Maryland, Delaware, Virginia, North Carolina, South Carolina, Georgia, Florida, and Texas broadly corroborate the Elliott Island and Cedar Island findings. The study areas in New Jersey, Delaware, Maryland, North Carolina, and South Carolina have documented an 89% decline in birds detected since surveys in the late 1980s. No satisfactory historical estimates were available to assess trends in areas south of South Carolina, but few were documented at potentially appropriate sites there.

The primary cause of the population crash is a familiar one known for birds with severely limited habitat preferences. The dominant habitats in this case are tidal marshes, and the rails' preferred high-marsh vegetation typically forms in a narrow band between the landward edge of low marsh plants and the uplands. There, the major concern is a rising sea level, where higher-than-normal flooding damages nests and drowns eggs.

Other habitats are used to lesser extents, but problems are frequent there as well. The report notes that drying occurs when wet hay meadows are drained for agriculture or when areas experience extended droughts. Oppositely, when nesting meadows receive too much rain, the sites may become unsuitable.

In all cases, according to the technical report, Black Rails seem "to walk a hydrology tightrope where they find required places for nest placement and foraging." The report also urges emergency management actions to prevent further population loss and begin restoration.

What hope is there? The Eastern Black Rail Conservation and Management Working Group, a consortium of biologists and agencies, is continuing its detailed habitat assessments. Only after those could a potentially effective conservation plan be devised. One thing is certain: Saving the feathered mouse will be a considerable challenge.

A **Black Rail** appearing suddenly and typically briefly from marsh vegetation is a sight savored by birders. Recent surveys in the species' prime eastern U.S. habitats show that this thrilling experience is much rarer, sometimes impossible, in virtually all of the traditional range. *Brazoria County, Texas; April 2008. Photo by © Brian E. Small.*

Some Breeding Birds Adjust to Local Climate Warming

Are birds adapting their breeding cycles to climate warming trends? Or are they failing to adapt? Many studies have involved small numbers of species, have covered relatively short time spans, or have focused primarily on negative impacts caused by climate change.

In addition, many researchers have not amassed sufficient long-term data to distinguish among climatic effects on year-round resident species, birds' various migration strategies, and different species' diverse diets. Most important, there has rarely been enough information to determine the ultimate and most crucial effect of breeding-season climate change: nesting productivity.

Scientists at the Powdermill Nature Reserve, a pioneering avian research center in southwestern Pennsylvania, have examined all of those factors in the most extensive long-term analysis of climate warming and breeding productivity yet undertaken for a diverse suite of breeding birds. Molly E. McDermott and Lucas W. DeGroote published their findings in a 2016 paper in the journal *Global Change Biology* (tinyurl.com/climate-impacts).

The most important feature of the study is its basis in a vast, consistently recorded array of data across an exceptionally long timespan: five decades of continuous banding operations that include 21 species breeding in the local vicinity. The information includes the timing of adults in breeding condition (judged by brood patch), the period of juveniles' first appearance (indicating the timing of nesting and fledging), and the ratio of juveniles to adults captured (as a suggestive index of nesting productivity). These breeding species are further analyzed among life-history categories such as nesting habitat, diet, and whether they are residents, short-distance migrants, or long-distance migrants.

Finally, the authors relate all of those factors to spring and summer temperatures and precipitation. Notably, the half-century time span is aimed at transcending

Fifty-six years of climate and banding data at the Powdermill Nature Reserve associate warmer spring temperatures with decreased breeding productivity of **Cedar Waxwings**. The correlation is not a prediction that climate warming will negatively affect this species' nesting success, but it disturbingly suggests the possibility. *Image courtesy of Powdermill Nature Reserve–Carnegie Museum of Natural History.*

The **Hooded Warbler** is one of five species whose nesting productivity has been lower in relatively warm springs during the past half-century, as measured by banding data at the Powdermill Nature Reserve. The pattern suggests a possible negative effect of climate warming. *Image courtesy of Powdermill Nature Reserve–Carnegie Museum of Natural History.*

The **Indigo Bunting** is among seven species whose productivity of young is greater in relatively warm springs, according to banding data at the Powdermill Nature Reserve. The positive correlation suggests that this species may be able to adapt to a warming climate. *Image courtesy of Powdermill Nature Reserve–Carnegie Museum of Natural History.*

irregular annual variations and, thus, interpreting long-term trends with higher confidence.

Birds analyzed were Ruby-throated Hummingbird, Eastern Phoebe, Red-eyed Vireo, Black-capped Chickadee, House Wren, Wood Thrush, American Robin, Gray Catbird, Cedar Waxwing, American Goldfinch, Ovenbird, Common Yellowthroat, Hooded Warbler, American Redstart, Yellow Warbler, Field Sparrow, Song Sparrow, Scarlet Tanager, Northern Cardinal, Rose-breasted Grosbeak, and Indigo Bunting.

Most species displayed sensitivity to changes in temperature and precipitation. The findings are too many to list here, but the following are three examples. Some might be expected, and some may be surprising:

- Pooling all species across the entire period, the average date of birds' breeding condition advanced 31 days earlier. Juvenile capture date advanced over time for 13 of the 21 species, and the advances averaged more than three days per decade for eight of those species.
- Increased productivity of young occurred in warmer springs for Eastern Phoebe, Red-eyed Vireo, Black-capped Chickadee, Gray Catbird, Northern Cardinal, Rose-breasted Grosbeak, and Indigo Bunting. In contrast, decreased productivity occurred in warmer springs for Cedar Waxwing, American Goldfinch, Ovenbird, Hooded Warbler, and American Redstart.
- Springs with more precipitation were associated with higher productivity for six species and lower productivity for five species, and had no effect on 10 species. Summers with more precipitation were associated with higher productivity for eight species and lower productivity for four species, and had no effect on nine species. Some species (for example, Hooded Warbler) that benefited from more precipitation in spring were hampered by more precipitation in summer, and vice versa.

Overall, the results indicate that many species are responding to climate change by breeding earlier, and that some are benefiting from warmer and wetter breeding seasons in production of young. Perhaps more food is available during warmer, wetter breeding seasons in southwestern Pennsylvania than during the start of the seasons when a "mismatch" in timing between maximum food abundance and the birds' requirements might occur.

McDermott and DeGroote summarize their findings this way: "Despite substantial yearly variation, the continuity and consistency of this large dataset show strong adaptive responses to climate. Specifically, our findings demonstrate that many bird species have phenological flexibility, advancing breeding as a response to increasing spring temperatures by at least 15 days over five decades."

Because the study also indicates that some species may not be adapting well, the authors emphasize a need for further long-term monitoring to assess which species are helped and which are harmed by current trends of climate change.

For researchers seeking that kind of information, the scale of Powdermill's database is a dream come true. Since the year-round banding program began 56 years ago, more than

740,000 birds have been captured (including original bandings plus recaptures).

The nature reserve in southwestern Pennsylvania spans 2,200 acres of woodlands, streams, fields, ponds, and thickets. It is located in the Ligonier Valley on the west side of the Allegheny Mountains. Powdermill was established in 1956 as a field station of Pittsburgh's Carnegie Museum of Natural History, thanks to leadership by M. Graham Netting, director of the museum.

Shepherded and promoted by Kenneth C. Parkes, the museum's eminent curator of birds, banding operations opened in 1961 under the direction of Robert C. Leberman. When Leberman "semi-retired" in 2004, Robert S. Mulvihill took over as bander-in-charge and has since moved on to a position as staff ornithologist at the National Aviary in Pittsburgh. The two were featured in "A *Birding* Interview with the Bobs" in the magazine's July/August 2013 issue (tinyurl.com/Birding-interview).

Lucas DeGroote, coauthor of the new paper, is the avian research coordinator at Powdermill, and chief author Molly McDermott is a postdoctoral candidate at

This pond and its environs at the Powdermill Nature Reserve in southwestern Pennsylvania are not only an idyllic landscape but also a center of important ornithological research. Nearby, strategically placed mist nets and a busy banding station provide a half-century of ornithological research enabling insights into the potential effects of climate change on bird species' breeding success. *Image courtesy of Powdermill Nature Reserve–Carnegie Museum of Natural History.*

Powdermill. The Avian Research Center's website (powdermillarc.org) offers an extensive history of its operations, many links to the center's scientific papers and other publications, photo galleries of birds in hand, and educational information on many facets of ornithology.

The Powdermill research calls to mind an extraordinary daily journal in which Henry David Thoreau recorded the first flowering dates of several hundred plant species in Concord, Massachusetts, between 1851 and 1854. Read his journal entry in March 1852, linking the phenology of plant life to birds' spring behavior:

> *The earth is perhaps two thirds bare* [of snow] *to-day. The mosses are now very handsome, like young grass pushing up. Heard the phoebe note of the chickadee to-day for the first time. I had at first heard their day-day-day ungratefully, – ah! you but carry my thoughts back to winter, – but anon I found that they too have become spring birds; they had changed their note. Even they feel the influence of spring.*

Thoreau's ecological link between plants' and birds' timing was a treasure of data that enabled researchers to demonstrate relationships between climate change and avian migrants' spring arrival and breeding phenology a century and a half later. That historic research is summarized in a "News and Notes" article in the May 2011 issue of *Birding*.