by Paul Hess

Forest Birds Face Risk of Mercury

Think about toxic mercury in avian food chains. What species come to mind? Surely Common Loon, probably Bald Eagle and Osprey, and possibly marsh birds and kingfishers. All specialize on a diet of fish, which provide a well-known pathway for bioaccumulation of mercury. But Bicknell's Thrush? An insectivorous and strictly terrestrial songbird with no orientation to aquatic habitat? Yes, it joined the list in 2005 when Christopher C. Rimmer and six coauthors announced that they had found mercury contamination in Bicknell's Thrushes on both their breeding and their wintering grounds (*Ecotoxicology* 14:223–240). As the first comprehensive study of mercury in a terrestrial passerine, the report inevitably aroused concern about possible contamination of other songbird species. In fact, Rimmer and his colleagues also found mercury in Yellow-rumped Warblers, Blackpoll Warblers, and White-throated Sparrows on Mt. Mansfield, Vermont, although the samples from this single site were too few for confident interpretation of the results.

Findings of mercury contamination in birds were associated heretofore with species that feed on aquatic prey. A new study shows that strictly terrestrial, insectivorous songbirds such as **Bicknell's Thrush** are also susceptible to ingestion of this toxic chemical. *Jefferson, New Hampshire; June 2005. © Garth McElroy.*

Overall, Bicknell's Thrushes were sampled at 21 locations in Maine, New Hampshire, New York, Vermont, New Brunswick, Nova Scotia, and Québec, representing most of the Bicknell's breeding range in northeastern montane forests. Mercury concentrations in the thrush were relatively low compared to those documented in birds at the top of aquatic food chains, but the results pointed to an analogous pathway for bioaccumulation in the montane forest ecosystem. Evidently, atmospheric mercury is windborne northeastward from power plants and industrial sources, deposited on foliage and leaf litter by rain and snow, then ingested by herbivorous insects, which in turn are consumed by insectivorous birds. At some point in the process, inorganic mercury in the atmosphere is converted by bacteria into its biochemically toxic form, methylmercury, but exactly how this occurs in montane environments without standing water is not yet understood.

Mercury levels in Bicknell's Thrushes sampled at seven wintering sites in Cuba and on Hispaniola were unexpectedly high: two to three times greater than in those sampled at the breeding sites. Significant industrial sources of mercury are unknown in the winter range, which suggests that increasing levels of mercury in the global atmosphere may be a factor in the contamination. The authors emphasized that chronic, year-round exposure to mercury heightens concern about potentially damaging effects on Bicknell's Thrushes.

Because of its small population (estimated at only 40,000), its geographically limited breeding and winter ranges, and its threatened boreal and tropical habitats, Bicknell's Thrush is ranked by Partners in Flight in the highest-priority category for conservation action. Rimmer and his colleagues called for further studies to learn how mercury contamination may affect the demographics and reproductive success of this and other insectivorous passerines. By early 2006, the Rimmer team had analyzed more than 400 Bicknell's Thrush samples from the breeding grounds and nearly 100 from the wintering grounds. For their next steps, the researchers plan to obtain lifetime demographic data on mercury exposure in individual birds of known identity, to investigate the pathways by which mercury bioaccumulates in the montane forest food chain, and to expand their studies of mercury exposure on Hispaniola.

Chandler S. Robbins: Sixty Visionary Years

It was 27 December 2005—three days until Chandler S. Robbins would retire at age 87 from an epic career of government service to our birds. Robbins joined the U. S. Fish & Wildlife Service as a "junior biologist" in 1945 and retired as an internationally esteemed Research Wildlife Biologist for the Service. In his office at the Patuxent Wildlife Research Center in Maryland, reflecting upon sixty years as a bird conservationist, he needed no time to mull the inevitable cliché: Which of his countless efforts brought him the most satisfaction? Organizing the North American

Breeding Bird Survey (now 3,000 routes) to quantify avian population trends on an unprecedented scale? Publishing *Birds of North America: A Guide to Field Identification* (nearly six million copies sold), which still gives many birders their first look at sonograms? Driving the phrase "conservation of Neotropical migrants" deep into our collective conscience?

All were enormously important, but another achievement stands atop his list. "Most satisfying to me," Robbins says, "has been the protection of forest habitats in Maryland." His research team was completing seminal studies of habitat requirements of forest-interior birds in 1983 just as the state was beginning to plan environmental protection of Chesapeake Bay. Regulations adopted in the Chesapeake Bay Critical Area Act of 1984 to minimize forest loss by development within 1,000 feet of tidewater were later extended to contiguous forests countywide. The method was gratifying: "The state used our definition of forest fragmentation. Developers had to conserve forests larger than 100 acres, replace them with an equivalent amount of forest, or pay the state to do it." The victory was only a beginning. Maryland's Forest Conservation Act of 1991 went even further, by regulating statewide the development of any area larger than one acre. "It was the toughest protection of any state," he says with pride.

Chandler S. Robbins is the father of the North American Breeding Bird Survey, the coauthor of a multi-million-selling field guide to birds, and a conservationist whose research has spanned much of the Western Hemisphere. He has retired after a sixty-year career with the U. S. Fish & Wildlife Service. *© U. S. Geological Survey, Patuxent Wildlife Research Center.*

Robbins treasures that research because its environmental results were quickly tangible, but larger-scale projects such as the Breeding Bird Survey have been his hallmark. People told him that birders would never accept the rigorous procedures. "I had confidence that people *could* do it. The only question was, *would* they? To many, it wasn't fun, but to a lot of people it was, and they made it successful," he says. Legions of amateur observers have been the key to that success, and Robbins has urged young birders to join the ranks: "Young people have such tremendous advantages in their wonderful vision and excellent hearing. They need to realize that they can make a great impact on the Breeding Bird Survey and other important projects, too." Robbins is an exceptional role model for one such project, the Christmas Bird Count. Since his first count at age 16 in Belmont, Massachusetts, he has participated in more CBCs than anyone else past or present: an amazing 351 through the 2005–2006 season.

Matching his intensity as a conservation scientist, Robbins has been an intensely active birder. Long before the ABA was born, he asked readers of *Maryland Birdlife* in 1947, "Do you keep a bird list?" He invited them to send their lists for publication. A quarter-century later he would chair the committee that compiled and published the first ABA Checklist. "Hopefully, this list will require a minimum of future changes," he told ABA members in his committee report (*Birding*, July/August 1975). Hopefully, indeed. After thirty years of continual and much-more-than-minimal changes, does anything in the current list trouble him particularly? "Yes. The waterfowl at the front. I like things stable, not changing all the time." Is he a lister? "I do keep a world list, but it is never up-to-date, simply because it is not a high-enough priority. The only list I keep currently up-to-date is for our two-and-a-half-acre property in Laurel [Maryland], where the total since 1950 is 201 species."

His colleagues at Patuxent have created an inspiring web site in his honor, which will be maintained until December 2006 as a special gesture to ABA members: <www.pwrc.usgs.gov/whatsnew/events/robbins>.

Relationships in the Paridae

The familiar plumage pattern of our seven North American chickadee species is mirrored in many European, Asian, and African species of tits. Long-standing taxonomy formerly placed all of these look-alike birds in one large genus, *Parus*. But the morphological similarities hide more molecular divergence than a single genus should accommodate, in the view of Frank B. Gill, Beth Slikas, and Frederick H. Sheldon. Prominent investigators of the family Paridae for many years, they recently examined phylogenetic relationships among 40 parids including the New World chickadees and titmice and the Old World tits. The study, reported in 2005 (*Auk* 122:121–143), was the most comprehensive molecular analysis of parids yet published.

Comparing nucleotide sequences in the mitochondrial cytochrome-*b* gene, the authors recommended that *Parus* be split into six genera.

The large genus *Poecile* would include all North American chickadees, five Eurasian gray tits, and the distinctive Varied Tit of the Far East. *Baeolophus*, the genus of North American titmice, was already recognized along with *Poecile* in the American Ornithologists' Union *Check-list* in 1998. *Lophophanes* would be restricted to Crested Tit and Gray-crested Tit of the Old World. *Periparus* would include Coal Tit of Eurasia and five additional tits in Asia and the Philippines. *Parus* would remain a large genus but now limited to Great Tit of Eurasia and eleven Asian and African tits. *Cyanistes* would consist of Eurasia's Blue Tit and Azure Tit.

Chickadees, titmice, and Old World tits were long combined in a single genus, *Parus*, but a recent genetic analysis suggests that dividing them into six genera would be more appropriate. Among numerous results, the study links **Chestnut-backed Chickadee** and Boreal Chickadee as each other's closest relative. *Vancouver, British Columbia; February 2006. © Bob Steele.*

Among North American parids, the new research confirmed findings of previous studies in which Gill and others had used different analytical methods. For example:

- Black-capped Chickadee is more closely related to Mountain Chickadee than to Carolina Chickadee, even though Black-capped and Carolina interbreed regularly.
- Chestnut-backed Chickadee and Boreal Chickadee, the two brown-hued North American endemics, are each other's closest relative. That pair in turn is most closely related to Gray-headed Chickadee, which lacks brown and has a predominantly Eurasian distribution. Interestingly, the authors suggested that the Gray-headed Chickadee's immediate ancestor colonized Eurasia from North America. If so, then today's small Gray-headed population in Alaska represents either a remnant of the ancestral species or a subsequent recolonization of North America.
- Bridled Titmouse, though its prominent facial pattern matches that of the Old World Crested Tit, is more closely related to the plain-faced New World titmice. The authors suggested that the similarity may reflect a conserved ancestral trait.
- Mexican Chickadee, whose relationships with other species have never been clear, persists in an uncertain phylogenetic position. One interpretation of the new data links it to Black-capped and Mountain Chickadee; another interpretation associates it with Carolina Chickadee.
- Within species, substantial genetic divergence exists between two subspecies of Carolina Chickadee, *extimus* in the east and nominate *carolinensis* (sometimes called the "Cajun Chickadee") in Louisiana, which have subtle size and plumage differences. Substantial genetic divergence also appears between two Mountain Chickadee populations, *gambeli* sampled in Arizona and *baileyi* sampled in California, whose plumage features differ recognizably.

Parids' phylogenetic history is surprising. The extreme similarities in plumage patterns among tits worldwide would seem to indicate a recently evolved group. Instead, Gill, Slikas, and Sheldon suggest that the cytochrome-*b* sequence divergence points much further into the past. They hypothesize that an initial parid radiation in the Old World during the mid-Tertiary Period occurred at least six million years ago. Then came a two-stage late-Tertiary colonization of the New World, by the ancestor of our modern titmice approximately four million years ago and by the precursor of all North American chickadees perhaps half a million years later. Thus, parids' classic plumage patterns represent remarkably prolonged morphological stasis across millions of generations of genetic diversification. These patterns are, in the authors' words, "the surface hallmark of the Paridae".

Bill Adaptations in Marsh Sparrows

Sparrows living in tidal marshes tend to have larger bills than those of their taxonomically close relatives inland. Russell Greenberg and several colleagues have studied the phenomenon extensively in Swamp Sparrows. He and Sam Droege reported in 1990 that bill volumes in the "Coastal Plain" subspecies (*nigrescens*) of Chesapeake and Delaware bays averaged significantly larger than those in the inland races *georgiana* and *ericrypta* (*Condor* 92:393–404). Other researchers had found similar contrasts between tidal-marsh and inland subspecies of Savannah Sparrow, Sharp-tailed

Ecologically based variations in morphology can be strong drivers of evolutionary divergence. Such might be the case for sparrows of tidal marshes, whose bills are typically larger than bills of their close genetic relatives inland. For example, bills of **Seaside Sparrow** average longer than those of Le Conte's Sparrow. *Chambers County, Texas; December 2004. © Alan Murphy.*

Sparrow (at that time a single species), and Song Sparrow. Greenberg and Droege suggested that the appearance of this same pattern among various species might reflect an advantage related to feeding in tidal mud. Greenberg, Pedro J. Cordero, Droege, and Robert C. Fleischer reported in 1998 that the difference in bill size was evident even between Swamp Sparrow populations that differed very little genetically (*Auk* 115: 706–712). The authors commented that selection for larger bills must have been intense if it occurred without long-term genetic isolation from the inland birds.

J. Letitia Grenier and Greenberg advanced the research in 2005 by examining whether tidal-marsh dwellers show a consistent tendency toward larger bills across a wide range of sparrow taxa (*Evolution* 59:1588–1595). In the genera *Passerculus*, *Ammodramus*, and *Melospiza*, the authors compared ten pairings of endemic tidal-marsh species and subspecies with those thought to be their closest genetic relatives in non-tidal habitats. Eight comparisons were between subspecies pairs within Savannah Sparrow, Nelson's Sharp-tailed Sparrow, Song Sparrow, and Swamp Sparrow. The other two pairings compared Seaside Sparrow and Saltmarsh Sharp-tailed Sparrow with Le Conte's Sparrow. In every pairing, bills in the tidal-marsh sample averaged significantly longer—proportionately longer even when the comparison controlled for covarying increases in body mass and bill depth. Turning to the question of adaptive value, Grenier and Greenberg noted that studies of various passerine families have associated longer, thinner bills with diets in which seeds are relatively unimportant. This is the case for tidal-marsh sparrows, which depend heavily on marine invertebrates living in mud and crevices. Is selection favoring longer bills for more efficient foraging in tidal mud? The authors noted that the apparent advantage has yet to be demonstrated as an inherited adaptation.

Grenier and Greenberg wondered whether tidal marshes might be settings for ecological speciation in sparrows. By this process, divergent selection on ecologically based traits such as adaptive bill morphology would lead to assortative mating and ultimately to reproductive isolation from birds in non-tidal populations. Tidal and non-tidal wetland habitats are distinct but often adjacent, especially where rivers flow into coastal estuaries. Across these sharp environmental gradients, populations of other closely-related taxa (e.g., King Rails and Clapper Rails) show little genetic divergence and sometimes interbreed—yet they maintain sufficiently distinct morphology to be classified as separate species. Which leads to another question: Are larger bill size, darker plumage (also a typical feature of tidal-marsh taxa), and other characters pushing sparrows in tidal marshes toward speciation from their inland and upland counterparts? For an answer, further studies must measure the rates of gene flow and assortative mating between adjacent populations.