

Birds as Prey for Praying Mantises

Observations from Around the World

Praying mantises, or mantids, (approximately 2,000 species of the order Mantodea and family Mantidae) are recognized as voracious predators that feed predominantly on arthropods, principally, spiders and such insects as butterflies, moths, flies, and honeybees.

On occasion, praying mantises have

been reported, anecdotally, to catch and devour vertebrates—amphibians (frogs and salamanders), reptiles (snakes, lizards, and soft-shelled turtles), and small mammals (shrews, mice, and bats). Some mantises have been known to prey on birds. Most accounts of predation of birds have been from the United States, follow-

ing releases in North America through the 1900s of several non-native species of large mantids from Europe and Asia as biological control agents for insect pests. Both native and established, nonindigenous mantids are now recognized as potential threats to small birds, especially hummingbirds, throughout the North American continent.

Most reports of mantid predation on birds are unpublished and from diverse sources. I became increasingly aware of the phenomenon when I unexpectedly uncovered accounts of it while searching the literature for reports of spider predation on small vertebrates (including birds). To conduct a more focused study of reports of mantid predation on birds, I collaborated with Michael Maxwell, a behavioral ecologist at National University in San Diego, CA, who studies praying mantises, and J. V. Remsen, Jr., an ornithologist at Louisiana State University in Baton Rouge.

Our research team uncovered 147 accounts of mantid predation on birds—less than one-third (45) published—after an extensive bibliographic search using Thomson-Reuters and Scopus databases, SORA (Searchable Ornithological Research Archive), Google Scholar and Google Books, ProQuest Dissertations and Theses, and social media. The earliest reports were prior to 1920, and two-thirds of all records were from 2000–2015. Most accounts were on organizational or scientific institutional sites such as Hummingbird Society (www.hummingbirdsociety.org), Audubon Society (www.audubon.org), and National Geographic Society (www.nationalgeographic.com), or blogs and other social media sites (e.g., www.youtube.com). We compiled and synthesized these records—and from photos, identified



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Stagmomantis limbata (bordered mantis) eating an Anna's hummingbird (*Calypte anna*) stuck on barbed wire in the Sierra foothills, California. Visible on the mantis is the spine (brown) on the front leg used to help secure the prey.



TODD KLEIN

Female *Tenodera sinensis* (Chinese mantis) clutching and feeding on an immature male ruby-throated hummingbird (*Archilochus colubris*) in Clermont, New Jersey. A courting male mantis (light brown) is positioned on the back of the female.

mantids (M. Maxwell) and birds (J. V. Remsen, Jr.)—to provide a detailed, comprehensive summary of this remarkable behavior exhibited by one of the world's most charismatic group of insects.

Twelve mantid species, representing nine genera (*Coptopteryx*, *Hierodula*, *Mantis*, *Miomantis*, *Polyspilota*, *Sphodromantis*, *Stagmatoptera*, *Stagmomantis*, and *Tenodera*), were identified as predators of birds. In turn, birds of 24 species, representing 13 families—Acanthizidae (gerygones and thornbills), Acrocephalidae (reed warblers), Certhiidae (treecreepers), Estrildidae (waxbills), Maluridae (fairywrens), Meliphagidae (honeyeaters), Muscicapidae (chats and flycatchers), Nectariniidae (sunbirds), Parulidae (wood warblers), Phyl-

loscopidae (Old World leaf warblers), Scotocercidae (bush warblers), Tyrannidae (tyrant-flycatchers), and Vireonidae (vireos)—in the order Passeriformes and the hummingbird family, Trochilidae, in the order Apodiformes, were captured by mantids in 13 countries and on all continents except Antarctica, mostly in warm climates (<41° latitude).

Most reports (77 percent, or 113 total) are from the United States, and nearly all of these (110) occur when hummingbirds are attracted to feeders or flowers; i. e., in gardens and yards, nature centers, bird sanctuaries, and state parks. In addition, hummingbirds were the victims of four of the five additional cases of mantids eating birds elsewhere in the Western Hemisphere, one in Canada, two in

Central America, and one in Trinidad. The fifth account was of an event recorded by Hermann Burmeister in 1864, that of a white-crested tyrannulet (*Serpophaga subcristata*) being eaten by a mantid in Argentina.

We uncovered records of eight predation events for Australia and one for India, all involving passerine birds. Four accounts were found for Africa, all describing predation by large mantids (*Polyspilota aeruginosa*, *Miomantis* sp., and *Sphodromantis* spp.) on small passerine birds. All 16 records for Europe were for Spain, where large, presumably gravid mantids (*Mantis religiosa*) attacked and fed on birds—all passerines—caught in mist nets. David Bigas, of the Parc Natural del Delta d'Ebre in Delta Ebre, Spain, and colleagues reported

in 2006 that in this circumstance, a mantis typically would approach a bird hanging upside-down in the mist net while it was still alive and enter

species assume a predatory posture, with their front legs folded (“praying”) beneath the head. When a bird comes within reach—typically 5–10

consuming brain tissue, as described earlier for mantises preying on birds caught in mist nets.

In most cases (115 of 147 total) in which birds were attacked, they were captured and consumed, at least in part. Only three captured birds escaped on their own after vigorous wing beating; 26 others were rescued by humans who detected their wing noise or distress calls. Praying mantises are strictly predatory, so most reported incidents of them feeding on birds probably reflect predation events. However, in one case of apparent scavenging in California, a female *Stagmomantis limbata* (bordered mantis) was observed feeding on the carcass of an Anna’s hummingbird (*Calypte anna*) impaled on barbed wire, although it is likely that the bird was still moving when the mantis encountered it.

So, what attributes are shared by the 12 species of mantids that prey on small birds? Perhaps most important, and not surprising, is their comparatively large size. Most exceed 6 cm in body length. *Hierodula werneri* and *Tenodera sinensis*, two of the largest species, can achieve body masses of up to 7 grams (g) when well fed. Eleven of the 24 bird species reported as prey have body masses less than this. This suggests that mantids that capture and consume small birds and other vertebrates often outweigh their prey. Curiously, all mantids reported to have preyed on birds were females, and two of these females were mating with males while feeding on a bird.

Does small size make birds particularly susceptible to predation by mantids? The answer is a qualified “yes.” As suggested earlier, most of the birds captured by mantids were hummingbirds. They presumably are doomed from the outset by their comparatively small size (3–6 g), and it is likely that hummingbirds of all species are at risk wherever there are large mantids. Still, mantids capture birds larger than 6 g. In Europe, such larger bird species as the European



Mantis religiosa (European mantis) eating a black-chinned hummingbird (*Archilochus alexandri*) at a feeder in Millwood, Colorado.

the bird’s cranium through one of the eyes and feed on its brain tissue.

Anatomically, praying mantises are well adapted for carnivory, being large and equipped with an elongated, flexible *prothorax* (neck) that permits 180° swiveling of a triangular head endowed with two large compound eyes for perception and three simple eyes (*ocelli*) that detect light. Many species are ambush predators, including those in four genera—*Mantis*, *Sphodromantis*, *Stagmomantis*, and *Tenodera*—for which we uncovered records of predation on birds. These

centimeters (cm)—the mantis strikes out with its two front legs to snare the prey and hold it. The mantis then uses its other four legs to cling to its perch, using a sharp, hook-shaped spine housed in a groove on the underside of each leg, while it feeds on its prey, often while it is still alive (although birds may die within a few minutes after being captured). Approximately two-thirds of the predatory accounts we uncovered indicated that mantises bit their bird prey in the neck, head, or throat, in some cases chewing a hole in the head and extracting and

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robin (*Erithacus rubecula*) and European pied flycatcher (*Ficedula hypoleuca*) have been taken when caught in mist nets, which obviously reduces significantly a bird's ability to escape and defend itself. One account from the U.S. describes a mantid seizing a blue-headed vireo (*Vireo solitarius*) with an estimated mass of 14–19 g without the aid of a mist net.

Why are there more accounts of predation on birds by praying mantises for North America—especially the U.S.—than elsewhere? This is most likely attributable to three factors. First, North America has hummingbirds, some of the world's smallest birds. They are particularly susceptible to larger mantids, such as those in the genera *Mantis*, *Tenodera*, and *Stagmomantis*. Second, hummingbird feeders and gardens with plants that produce flowers rich in nectar are common in this part of the world, bringing birds close to humans where predation on them by mantids can be documented more easily. Finally, the large non-native mantids, *Mantis religiosa*, *Tenodera augustipennis*, and *T. sinensis*, released across the continent in the 1900s to control pests, presumably reached the eastern U.S. on garden nursery stock and became established and abundant in this part of the continent where hummingbirds are plentiful. In 1950 Ashley Gurney, of the U.S. Department of Agriculture, noted that *T. sinensis* (the Chinese mantis) was accidentally introduced into the U.S. and was first noticed in Philadelphia in 1896. This mantis was recognized in 2006 as an invasive species by William Snyder, an entomologist at Washington State University, and Edward Evans, then at Utah State University.

So, is bird predation on U.S. birds by praying mantises attributable largely to the introduction and establishment of large non-native mantids? Our analysis of 43 photographs from throughout the U.S. of bird captures by mantids shows that

58 percent (25) of the birds were snared by alien species, specifically *M. religiosa* (the European mantis) and *T. sinensis*. And although this is a disturbing statistic, bird predation by native mantids is not insignificant; the remaining 42 percent (18) were captured by native *Stagmomantis* spp. Also, observations of bird predation by mantids in the U.S. precede the twentieth-century introduction of alien species to the continent. Nevertheless, in the eastern U.S. most incidents of bird predation involved introduced mantid species, while those in the western states usually involved native mantids.

Despite the above treatise about praying mantises preying on birds, the consumptive relationship between these two taxa is not one-sided. Birds also eat large mantises, although the predators in this circumstance are not hummingbirds but rather birds with body masses of more than 50 g. For example, Kuang-Ying Huang, of National Taiwan University, and colleagues in 2004 listed *Hierodula patellifera* as a prey item delivered by besra sparrowhawks (*Accipiter virgatus*) in Taiwan to their nestlings. And Saida Tergou, of the Agronomic National School Superior of El Harrach, Algeria, and associates reported in 2014 the presence of large mantises (e. g., *Sphodromantis viridis* and *Mantis religiosa*) in regurgitated pellets of the tawny owl (*Strix aluco*) in Algeria.

What is the ecological significance of predation on birds by praying mantises, particularly in the U.S. where such events are reported more frequently and large mantids have been introduced and become established (and for at least one species, recognized as invasive)? Generally, mantids are not major threats to most bird populations. Bird mortality from predation is largely attributable to raptors and cats. Predation on hummingbirds is generally assumed to be rare, although Theodore Zenzal, Jr., of the

University of Southern Mississippi, and colleagues described in 2013 two accounts of migrating ruby-throated hummingbirds being taken by raptors. A variety of other vertebrate predators—frogs, lizards, and snakes—have been reported to feed occasionally on hummingbirds, but such accounts are mostly anecdotal. Notably, in 2012, Daniel Brooks, Curator of Vertebrate Zoology at the Houston Museum of Natural Science in Texas, documented 69 captures of birds by large orb-weaving spiders (e. g., those in the genera *Nephila* and *Argiope*), with hummingbirds (particularly the ruby-throated hummingbird) captured more frequently than birds of other species. So, on a large geographic scale, it appears that most avian victims of predation—even hummingbirds—are taken by animals other than praying mantises. However, in suburban and urban areas, where hummingbird feeders and gardens are plentiful and concentrated, the release of mantis oothecae (egg cases) as a strategy to control insect pests might ultimately threaten hummingbirds. What's more, in such environs, mantises can have negative effects on other beneficial life forms. For example, mantis predation and feeding on insect pollinators such as honeybees are well documented. Considering this and the risk to small birds, any release of mantids, especially non-native species, in such surroundings could have unwelcome consequences.

Source: Nyffeler, M., M. R. Maxwell, and J. V. Remsen, Jr. 2017. "Bird predation by praying mantises: a global perspective." *The Wilson Journal of Ornithology* 129(2):331–344.

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