The Wilson Journal of Ornithology 118(3):420–422, 2006

Likely Predation of Adult Glossy Ibis by Great Black-backed Gulls

Christina E. Donehower[1]

ABSTRACT.—Great Black-backed Gulls (*Larus marinus*) are known to prey upon a wide range of bird species, particularly adults, young, and eggs of seabirds and waterfowl. Here, I provide the first account of Great Black-backed Gulls pursuing and attacking, in flight, a medium-sized wading bird, the Glossy Ibis (*Plegadis falcinellus*). I recorded two observations at Stratton Island, Maine, the northernmost breeding site for the Glossy Ibis in North America. *Received 12 September 2005, accepted 21 March 2006.*

Great Black-backed Gulls (*Larus marinus*) are well-known predators of colonial waterbirds. Many studies have attributed heavy losses of seabird and waterfowl eggs and young to this species (Hatch 1970, Mendenhall and Milne 1985, Mawhinney and Diamond 1999, Whittam and Leonard 1999, Massaro et al. 2000), particularly following human disturbance (Johnson 1938, Kury and Gochfeld 1975, Åhlund and Götmark 1989, Mikola et al. 1994). Great Black-backed Gulls have also been observed attacking and killing adult waterfowl (reviewed in Ryan 1990), seabirds (Robinson 1930; Snyder 1960; Harris 1965, 1980; Pierotti 1983; Russell and Montevecchi 1996; reviewed in Good 1998), migrating passerines (reviewed in Macdonald and Mason 1973), and even other gulls (Corkhill 1971; reviewed in Good 1998). Large birds may be seized or struck on the wing (Snyder 1960, Harris 1980, Burger and Gochfeld 1984, Ryan 1990), harassed and pursued on the water (Addy 1945, Sobkowiak 1986, Ryan 1990), or surprised on land (Robinson 1930, Snyder 1960). Here, I describe the first observation of Great Black-backed Gulls (length 71–79 cm, wingspan 152–167 cm, mass 1,300–2,000 g; Good 1998) attacking adult Glossy Ibis (*Plegadis falcinellus*), a medium-sized wading bird (length 48–66 cm, wingspan 92 cm, mass 500–800 g; Davis and Kricher 2000).

On 15 June 2005, I observed two aerial chases in which Great Black-backed Gulls pursued and struck Glossy Ibis in flight. Both events were recorded on a handheld camcorder (*Sony Handycam Vision* with 200× digital zoom) and later reviewed. All video was taken from a 6-m-high observation tower on Stratton Island (43° 31′ N, 70° 19′ W), a 12-ha National Audubon Society waterbird sanctuary located 2.4 km south of Prout's Neck, Saco Bay, Maine (see Kress 1998 and Chase 1994 for a detailed site description and history). The island supports approximately 100 breeding pairs of Glossy Ibis (C. S. Hall pers. comm.) and represents the northernmost nesting colony for this species in North America (Davis and Kricher 2000). Although gulls do not breed on Stratton Island (National Audubon Society gull control measures include nest destruction and shooting of gulls seen entering the island's tern colony), more than 400 Herring (*L. argentatus*) and Great Black-backed gulls reside on Stratton and nearby Bluff Island—an active, unmanaged gull colony less than 400 m away (CED unpubl. data).

Event 1.—At 15:30 EDT, I observed a Great Black-backed Gull adult in breeding plumage chasing an adult Glossy Ibis above the tree line of the wading bird colony. The ibis flew erratically, climbing high and then low, banking and trying to elude the gull. The aerial chase continued for about 1 min, at which point a second Great Black-backed Gull adult in breeding plumage joined in the pursuit. At 15:32, the latter gull struck the ibis with its bill, hitting it with such force that the ibis plummeted to the ground and out of view. I was unable to determine whether one or both gulls further pursued the ibis.

Event 2.—At 16:01, I again saw an adult Great Black-backed Gull pursuing an ibis in flight. At 16:06, a second adult Great Black-backed Gull again joined in the chase and

[1] Dept. of Natural Resource Sciences, Macdonald Campus, McGill Univ., 21111 Lakeshore Rd., Ste-Anne-de-Bellevue, QC H9X 3V9, Canada; e-mail: christina.donehower@mail.mcgill.ca

struck the ibis 10–15 sec later, hitting it on the back near the rump and tearing off a small section of skin and feathers with its bill. The ibis tumbled out of the air and fell into the vegetation. The latter gull immediately followed the ibis into the vegetation. Although my view was partially obscured by the vegetation, it was clear that for the next 2–3 min, the gull was trying to gain control of the struggling ibis. At one point, the gull could be seen grasping the ibis' neck in its bill. At 16:07, the gull flew away, abandoning the ibis in the vegetation.

Following the gull's departure, Audubon staff and I retrieved and inspected the ibis. It was alive but appeared exhausted, with drooping wings and little reaction to approaching humans. There were no visible injuries other than the small surface wound inflicted during the chase. We placed the bird in a box and released it several hours later.

While this is the first account of Great Black-backed Gulls attacking adult Glossy Ibis, such attacks may be fairly common at this site but seldom observed. I have observed gulls feeding on fresh ibis carcasses on several occasions but never witnessed the kill. Additionally, during an annual wading bird and seabird census in late May, I found remains of 24 adult ibis. All carcasses had been cleaned of flesh and viscera, but they retained wings and sometimes the head/neck or legs, indicating gull predation (there are no mammalian predators on Stratton, and raptors seldom visit the site). Perhaps aerial pursuit is not the usual means of capture, and/or the events are easily missed due to the dense vegetation and trees favored by nesting ibis. Audubon personnel have also seen gulls occasionally take ibis fledglings from the air and noticed fledgling remains in the wading bird colony, but they have never conducted systematic observations to quantify predation rates (C. S. Hall pers. comm., S. Sanborn pers. comm.).

In contrast, Great Black-backed Gull depredation of other species nesting on Stratton (e.g., adult and duckling Common Eiders [*Somateria mollissima*] and tern [*Sterna* spp.] eggs and chicks) is frequently observed (CED unpubl. data). In the breeding seasons of 2004–2005, few (if any) ducklings survived to fledging as a result of opportunistic, group attacks by gulls (CED unpubl. data). Some attacks involved more than 20 gulls simultaneously descending on a crèche, fighting and plunge-diving to consume ducklings. Existing gull control practices to enhance tern restoration (nest destruction and shooting of tern predators) seem to have little benefit for eiders (and perhaps ibis), as predatory gulls continue to congregate in large numbers around crèching and nesting areas.

For a small ibis colony of 100 breeding pairs, the presumed number of Great Black-backed Gull kills reported here seems considerable and warrants further investigation. In a recent review, Davis and Kricher (2000) found no reports of predation on adult Glossy Ibis, though they described the Glossy Ibis as ''an understudied species'' and suggested that Peregrine Falcons (*Falco peregrinus*) likely take adults at some colonies. It appears, then, that this level of adult mortality is unprecedented and, if continued, could lead to colony extinction. Additional study is needed to determine whether a few ''specialist'' gulls prey on ibis at Stratton Island, and, if so, whether they prey on weak, sick, or otherwise unfit individuals.

ACKNOWLEDGMENTS

I thank D. M. Bird, S. W. Kress, C. S. Hall, and R. D. Titman for supporting my graduate work. Staff and volunteers of the National Audubon Society's Seabird Restoration Program provided assistance, field camp facilities, and logistical support on Stratton Island. This observation was recorded during a gull predation study funded by the Cornell Lab of Ornithology, the Garden Club of America (Frances M. Peacock Scholarship for Native Bird Habitat), and the Avian Science and Conservation Centre of McGill University. M. A. Gahbauer, M. A. Hudson, and three anonymous reviewers provided helpful comments on earlier drafts of this manuscript.

LITERATURE CITED

ADDY, C. E. 1945. Great Black-backed Gull kills adult Black Duck. Auk 62:142–143.

ÅHLUND, M. AND F. GÖTMARK. 1989. Gull predation on eider ducklings *Somateria mollissima*: effects of human disturbance. Biological Conservation 48: 115–127.

BURGER, J. AND M. GOCHFELD. 1984. Great Black-backed Gull predation on kittiwake fledglings in Norway. Bird Study 31:149–151.

CHASE, G. P. 1994. Stratton's islands of Saco Bay: an interwoven history. Mendocino Lithographers, Fort Bragg, California.

CORKHILL, P. 1971. Cannibalistic Great Black-backed Gulls. British Birds 64:30–32.

DAVIS, W. E., JR., AND J. KRICHER. 2000. Glossy Ibis (*Plegadis falcinellus*). The Birds of North America, no. 545.

GOOD, T. P. 1998. Great Black-backed Gull (*Larus marinus*). The Birds of North America, no. 330.

HARRIS, M. P. 1965. The food of some *Larus* gulls. Ibis 107:43–53.

HARRIS, M. P. 1980. Breeding performance of puffins *Fratercula arctica* in relation to nest density, laying date and year. Ibis 122:193–209.

HATCH, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87:244–254.

JOHNSON, R. A. 1938. Predation of gulls in murre colonies. Wilson Bulletin 185:161–170.

KRESS, S. W. 1998. Applying research for effective management: case studies in seabird restoration. Pages 141–154 *in* Avian conservation: research and management (J. M. Marzluff and R. Sallabanks, Eds.). Island Press, Washington, D.C.

KURY, C. R. AND M. GOCHFELD. 1975. Human interference and gull predation in cormorant colonies. Biological Conservation 8:23–34.

MACDONALD, S. M. AND C. F. MASON. 1973. Predation of migrant birds by gulls. British Birds 66:361–363.

MASSARO, M., J. W. CHARDINE, I. L. JONES, AND G. J. ROBERTSON. 2000. Delayed capelin (*Mallotus villosus*) availability influences predatory behaviour of large gulls on Black-legged Kittiwakes (*Rissa tridactyla*), causing a reduction in kittiwake breeding success. Canadian Journal of Zoology 78: 1588–1596.

MAWHINNEY, K. AND A. W. DIAMOND. 1999. Using radio-transmitters to improve estimates of gull predation on Common Eider ducklings. Condor 101: 824–831.

MENDENHALL, V. M. AND H. MILNE. 1985. Factors affecting duckling survival of eiders *Somateria mollissima* in northeast Scotland. Ibis 127:148–158.

MIKOLA, J., M. MIETTINEN, E. LEHIKOINEN, AND K. LEHTILÄ. 1994. The effects of disturbance caused by boating on survival and behaviour of Velvet Scoter *Melanitta fusca* ducklings. Biological Conservation 67:119–124.

PIEROTTI, R. 1983. Gull-puffin interactions on Great Island, Newfoundland. Biological Conservation 26:1–14.

ROBINSON, H. W. 1930. Departure and landing of Manx Shearwaters. British Birds 23:224–225.

RUSSELL, J. AND W. A. MONTEVECCHI. 1996. Predation on adult puffins *Fratercula arctica* by Great Black-backed Gulls *Larus marinus* at a Newfoundland colony. Ibis 138:791–794.

RYAN, R. A. 1990. Predation by Great Black-backed Gulls on banded waterfowl. North American Bird Bander 15:10–12.

SNYDER, F. 1960. Great Black-backed Gulls killing Dovekies. Auk 77:476–477.

SOBKOWIAK, S. 1986. Greater Black-backed Gull and Bald Eagle predation on American Coots. M.Sc. thesis, McGill University, Montreal, Quebec.

WHITTAM, R. M. AND M. L. LEONARD. 1999. Predation and breeding success in Roseate Terns (*Sterna dougallii*). Canadian Journal of Zoology 77:851–856.

The Wilson Journal of Ornithology 118(3):422–423, 2006

Tailless Whipscorpion (*Phrynus longipes*) Feeds on Antillean Crested Hummingbird (*Orthorhyncus cristatus*)

Jennifer L. Owen[1,3] and James C. Cokendolpher[2]

ABSTRACT.—A tailless whipscorpion (*Phrynus longipes*) was observed feeding on an Antillean Crested Hummingbird (*Orthorhyncus cristatus*) atop a large boulder on the island of Virgin Gorda in the British Virgin Islands. This is the first record of any avian species serving as prey for an amblypygid. *Received 13 June 2005, accepted 21 March 2006.*

[1] Dept. of Range, Wildlife, and Fisheries Management, Texas Tech Univ., Box 42125, Lubbock, TX 79409-2125, USA; and Texas Parks and Wildlife, Bentsen Rio Grande Valley State Park, World Birding Center, 2800 South Bentsen Palm Dr., Mission, TX 78572, USA.

[2] Invertebrates, Natural Science Research Lab., Museum of Texas Tech Univ., Lubbock, TX 79409, USA.

[3] Corresponding author; e-mail: jennifer.owen@tpwd.state.tx.us

Whip spiders (tailless whipscorpions), or amblypygids, are members of the class Arachnida, order Amblypygi. *Phrynus longipes* is the largest amblypygid on many Caribbean islands, including the U.S. and British Virgin Islands (Lazell 2005). The average body length of *P. longipes is* ~35 mm and the an-

tenniform legs can reach an additional 34 mm (Quintero 1981). Amblypygids have no venom glands; instead, they use their sharp raptoral pedipalps (first pair of appendages) to capture prey. They are generally nocturnal and are considered mostly ''sit and wait'' predators, feeding on prey items found around their home territory in the caves and crevices between and under large rocks, and on trees (Weygoldt 2000). Although the diet of *P. longipes* consists primarily of arthropods, especially insects, it has been recorded to prey upon vertebrates, such as *Anolis* lizards (Weygoldt 2000) and *Eleuthrodactylus* frogs (Reagan and Waide 1996). There are no previous records of avian species serving as prey for any amblypygid.

Antillean Crested Hummingbirds (*Orthorhyncus cristatus*) are diurnal and inhabit the Lesser Antilles, including the British Virgin Islands (Lazell 2005). The main cause of mortality for hummingbirds is predation of their eggs and nestlings; predation on adult hummingbirds is relatively rare (Miller and Glass 1985). Thirteen cases of adult hummingbird predation have been documented worldwide, with only two events involving an invertebrate predator; the Chinese praying mantis (*Tenodera aridifolia*) was the predator in both cases (Miller and Glass 1985). Like amblypygids, the Chinese praying mantis is a ''sit and wait'' predator.

At 22:00 EST on 20 October 2004, J. Egelhoff observed an adult *P. longipes* (body ~30 mm long) feeding on an adult Antillean Crested Hummingbird (~80 mm long), 1 m above ground, atop a large boulder behind the Little Secrets Nature Gallery in Spanish Town, Virgin Gorda, British Virgin Islands (18° 26.68′ N, 64° 26.38′ W). The *P. longipes* was holding the hummingbird with its raptoral pedipalps and was feeding on the hummingbird's body; it continued to feed for 2 hr. At the time of observation, the hummingbird was no longer alive, and due to the mutilation caused by the feeding amblypygid, we were unable to obtain information on the hummingbird's weight, sex, or breeding status. The amblypygid is now part of the living exhibit at the Little Secrets Nature Gallery.

Although it is unknown how the *P. longipes* acquired its avian prey, our observation is the first record of an amblypygid feeding on a hummingbird, or any other avian species.

ACKNOWLEDGMENTS

We thank Jim Egelhoff and the Little Secrets Nature Gallery on Virgin Gorda, British Virgin Islands, for locating and photographing the predation incident, and to Dr. J. Lazell, The Conservation Agency, and the Falconwood Foundation for supporting research in the British Virgin Islands. We also thank Texas Tech University for financial support. This is manuscript T-9-1054 of the College of Agricultural Sciences and Natural Resources, Texas Tech University. We thank J. M. Wunderle and two anonymous reviewers for the helpful comments that improved this manuscript.

LITERATURE CITED

LAZELL, J. 2005. Island: fact and theory in nature. University of California Press, Berkeley.

MILLER, R. S. AND C. L. GLASS. 1985. Survivorship in hummingbirds: is predation important? Auk 102: 175–178.

QUINTERO, D. 1981. The amblypygid genus *Phrynus* in the Americas. Journal of Arachnology 9:117–166.

REAGAN, D. P. AND R. B. WAIDE (Eds.). 1996. The food web of a tropical rainforest. University of Chicago Press, Chicago, Illinois.

WEYGOLDT, P. 2000. Whip spiders (Chelicerata: Amblypygi): their biology, morphology and systematics. Apollo Books, Stenstrup, Denmark.

The Wilson Journal of Ornithology 118(3):424–426, 2006

Polydactyly in a Vaux's Swift

Walter H. Sakai[1]

ABSTRACT.—I report on polydactyly in a Vaux's Swift (*Chaetura vauxi*). An extra, asymmetrically located toe was found on each foot of one swift. A check of 329 swifts from several museums produced no other examples of polydactyly in this species. A review of the literature and a query over the Internet, however, produced 10 other examples of polydactyly in wild birds. *Received 5 August 2005, accepted 27 February 2006.*

Polydactyly is a relatively common malformation phenomenon in vertebrates. It has been well documented in humans and domestic animals such as cats, dogs, mice, and chickens (Clark et al. 2000); however, it is an uncommon phenomenon and rarely reported in wild birds. A group of eight Vaux's Swifts (*Chaetura vauxi*, family Apodidae) was brought to me from the California Wildlife Center, an animal rehabilitation center in the Santa Monica Mountains in Malibu, California. On 29 April 2002, the swifts were found dead along Cross Creek Road (34° 02′ 35″ N, 118° 41′ 02″ W) near Malibu Creek, Malibu, Los Angeles County, California.

As I was preparing the birds as study skins and examining the swifts' pamprodactyl-type feet (Proctor and Lynch 1993), I found that seven of the birds were normal and one had an extra, asymmetrically located toe on each foot. On both feet, digit one (the hallux) was located 11 mm below the joint of the tibiotarsus and tarsometatarsus. The tarsometatarsi were 13.5 mm long. On the left foot, the extra digit was located on the tarsometatarsus 6 mm from the joint of the tibiotarsus and tarsometatarsus (Fig. 1A) and was 6 mm long. In addition, digit one and the extra toe of the left foot were joined by a webbing of tissue; thus, the nails touched. The extra digit on the right foot was located at the joint of the tibiotarsus and the tarsometatarsus (Fig. 1B) and was 10 mm long.

A survey of the literature and a query to museum bird curators and collection managers via the ''AVECOL'' listserve produced reports of 10 birds with polydactyly. Extra toes were reported for Mallard (*Anas platyrhynchos*; Napier 1963), Common (currently Wilson's)

[1] Life Sciences Dept., Santa Monica College, 1900 Pico Blvd., Santa Monica, CA 90405-1628, USA; e-mail: sakai_walter@smc.edu

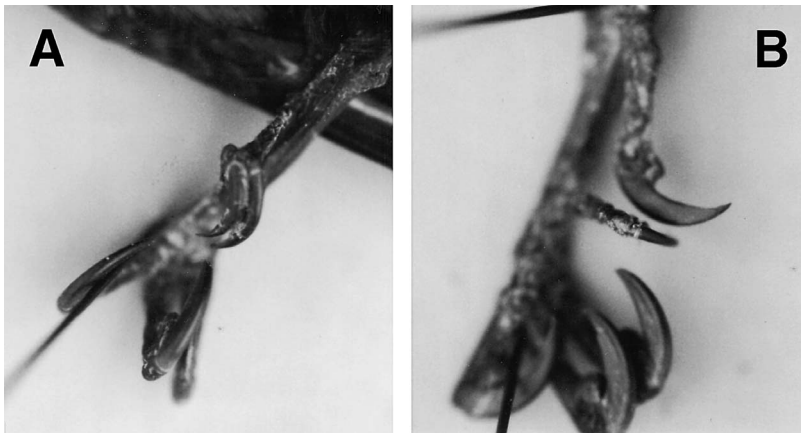

FIG. 1. Left (A) and right (B) feet with extra toe of a Vaux's Swift (*Chaetura vauxi*) collected 29 April 2002 along Cross Creek Road near Malibu Creek, Malibu, Los Angeles County, California.

Snipe (*Capella gallinago* [currently *Gallinago delicata*]; Fogarty 1969), Sooty Tern (*Sterna fuscata*; Austin 1969), Long-billed Curlew (*Numenius americanus*; Forsythe 1972), Ring-billed Gull (*Larus delawarensis*; Ryder and Chamberlain 1972), Common Nighthawk (*Chordeiles minor*; Chandler 1992), Common Loon (*Gavia immer*; R. Y. McGowan pers. comm.), Common Swift (*Apus apus*; Gory 1992), Common (currently Eurasian) Kestrel (*Falco tinnunculus*; Trinkaus et al. 1999), and Eastern Screech-Owl (*Otus* [currently *Megascops*] *asio*; Albers et al. 2001). An unconfirmed case of polydactyly in Anna's Hummingbird (*Calypte anna*) was reported from the San Francisco Bay Area, California (W. H. Baltosser pers. comm.)

I also checked Vaux's Swifts in the collections of two nearby museums: 75 specimens at the Los Angeles County Museum of Natural History (LACMNH), Los Angeles, California, and 157 specimens at the Western Foundation of Vertebrate Zoology (WFVZ), Camarillo, California, all of which were normal. The 73 Vaux's and Chimney Swifts (*Chaetura pelagica*) in the collection at Delaware Museum of Natural History, Wilmington, Delaware, also were reported as normal (J. L. Woods pers. comm.). C. M. Dardia (pers. comm.) reported that all 24 Vaux's Swifts in the collection at Cornell Museum of Vertebrates, Ithaca, New York, were normal.

The causes of polydactyly among vertebrate groups have included UV-B radiation (Blaustein et al. 1997), parasites (Johnson et al. 2001), parasites and pesticides in amphibians (Kiesecker 2002), nuclear radiation in humans (Lazjuk et al. 1998), and congenital defects in humans (Castilla et al. 1996). Extensive teratological studies have been conducted on Domestic Chicken (*Gallus domesticus*), and several breeds normally have five toes (Warren 1941, 1944). Unfortunately, the life history of the Vaux's Swift with polydactyly is unknown. The individual in question appeared healthy and its weight (12.8 g) did not differ from that of the other seven individuals (mean = 12.67 ± 0.62; *Z*-test, $P = 0.71$) found with it, although it was lower than the mean (17.1 ± 1.3 SD, $n = 72$) weight of birds reported by Dunning (1984).

The Vaux's Swift specimen with polydactyly (Santa Monica College [SMC] SMC 1100) was prepared as a wet specimen, and the other seven specimens (SMC 1049, 1051, 1052, 1053, 1056, 1057, and 1058) were prepared as study skins. All eight specimens were then transferred to the LACMNH's Ornithology Collection (wet specimen: LACM 113615; skins: 112233, 112234, 112230, 11232, 11231, 11229, and 11228).

ACKNOWLEDGMENTS

I thank the various museum ornithology curators and collection managers who responded with both positive and negative reports, and for suggesting possible specimens. Thanks to L. Matsui, who brought the specimens to me from the California Wildlife Center where she volunteers. Thanks to R. A. Cobb and K. L. Garrett for suggestions on preservation of the specimen. Thanks to K. L. Garrett and R. Corado for access to the swifts at the LACMNH and the WFVZ, respectively. J. L. Woods provided information on swifts at the Delaware Museum of Natural History, and C. M. Dardia provided information on Vaux's Swifts at the Cornell Museum of Vertebrates. L. S. Hall provided useful comments. Photographs were taken by J. Smargis. I would like to thank E. L. Bull and two anonymous reviewers for their useful and helpful comments on this paper.

LITERATURE CITED

ALBERS, P. H., D. J. HOFFMAN, AND I. L. BRISBIN, JR. 2001. Unusual leg malformations in screech owls from a South Carolina superfund site. Journal of Toxicology and Environmental Health, Part A 63: 89–99.

AUSTIN, O. L., JR. 1969. Extra toes on a Sooty Tern chick. Auk 86:352.

BLAUSTEIN, A. R., J. M. KIESECKER, D. P. CHIVERS, AND R. G. ANTHONY. 1997. Ambient UV-B radiation causes deformities in amphibian embryos. Proceedings of the National Academy of Sciences USA 94:13735–13737.

CASTILLA, E. E., R. L. DA FONSECA, M. DA G. DUTRA, E. BERMEJO, L. CUEVAS, AND M. MARTINEZ-FRIAS. 1996. Epidemiological analysis of rare polydactylies. American Journal of Medical Genetics 65: 295–303.

CHANDLER, R. M. 1992. Polydactyly in a Common Nighthawk. Kansas Ornithological Society Bulletin 43:17.

CLARK, R. M., P. C. MARKER, AND D. M. KINGSLEY. 2000. A novel candidate gene for mouse and human preaxial polydactyly with altered expression in limbs of hemimelic extra-toes mutant mice. Genomics 67:19–27.

DUNNING, J. B., JR. 1984. Body weight of 686 species of North American birds. Western Bird Banding Association Monograph, no. 1.

FOGARTY, M. J. 1969. Extra toes on the halluces of a Common Snipe. Auk 86:132.

FORSYTHE, D. M. 1972. Long-billed Curlew with supernumerary hallux. Auk 89:457.

GORY, G. 1992. Un cas de monstruousité chez le Martinet Noir (*Apus apus* L.). Bulletin de la Société d'étude des Sciences Naturelles de Nîmes et du Gard 59:139. [In French]

JOHNSON, P. T. J., K. B. LUNDE, R. W. HAIGHT, J. BOWERMAN, AND A. R. BLAUSTEIN. 2001. *Ribeiroia ondatrae* (Trematoda: Digenea) infection induces severe limb malformations in western toads (*Bufo boreas*). Canadian Journal of Zoology 79:370–379.

KIESECKER, J. M. 2002. Synergism between trematode infection and pesticide exposure magnifies amphibian limb deformities in nature. Proceedings of the National Academy of Sciences USA 99:9900–9904.

LAZJUK, G., Y. SATOW, D. NIKOLAEV, AND I. NOVIKOVA. 1998. Genetic consequences of the Chernobyl accident for Belarus Republic. Gijutsu-to-Ningen 283:26–32.

NAPIER, A. 1963. Congenital malformations of the feet in Mallard ducklings. Wildlife Trust Annual Report 14:170–171.

PROCTOR, N. S. AND P. J. LYNCH. 1993. Manual of ornithology: avian structure and function. Yale University Press, New Haven, Connecticut.

RYDER, J. P. AND D. J. CHAMBERLAIN. 1972. Congenital foot abnormality in the Ring-billed Gull. Wilson Bulletin 84:342–344.

TRINKAUS, VON K., F. MUELLER, AND E. F. KALETA. 1999. Polydactyly in a kestrel (*Falco tinnunculus tinnunculus* Linne, 1758): a case study. Zeitschrift für Jagdwissenschaft 45:66–72.

WARREN, D. C. 1941. A new type of polydactyly in the fowl. Journal of Heredity 32:1–5.

WARREN, D. C. 1944. Inheritance of polydactylism in the fowl. Genetics 29:217–231.