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AVIAN CHOLERA IN OSPREYS: FIRST OCCURRENCE AND POSSIBLE MODE OF TRANSMISSION

LARRY J. HINDMAN
Maryland Department of Natural Resources
P.O. Box 68
Wye Mills, Maryland 21679 USA

WILLIAM F. HARVEY, IV
Maryland Department of Natural Resources
P.O. Box 68
Wye Mills, Maryland 21679 USA

GARY R. COSTANZO
Virginia Department of Game & Inland Fisheries
5806 Mooretown Road
Williamsburg, Virginia 23188 USA

KATHRYN A. CONVERSE
National Biological Service
National Wildlife Health Center
6006 Schroeder Road
Madison, Wisconsin 53711 USA

GEORGE STEIN, JR.
Maryland Department of Agriculture
P.O. Box J
Salisbury, Maryland 21801 USA

Abstract.—In 1994, six Ospreys (*Pandion haliaetus*) were recovered during the later stages of an epizootic of avian cholera (*Pasteurella multocida*) in diving ducks and seabirds on Chesapeake Bay in Maryland and Virginia. *Pasteurella multocida* was isolated from four Ospreys submitted for bacterial examination. This is believed to be the first report of avian cholera in Ospreys. The same isolate, serotype 3,4, was isolated from the Ospreys, diving ducks, and seabirds collected during the epizootic. Possible modes of transmission of avian cholera in Ospreys were either the ingestion of sick waterfowl or use of infected carcasses or bones as nest material.

COLERA AVICOLA EN *PANDION HALIAETUS*: PRIMERA INCIDENCIA Y POSIBLE METODO DE TRANSMISION

Sinopsis.—En 1994 se recuperaron seis individuos de *Pandion haliaetus* durante las últimas etapas de una epidemia de cólera avícola (*Pasteurella multocida*) en anátidos sumergibles y

en aves marinas en la Bahía de Chesapeake en Maryland y Virginia. Se aislo de cuatro de los individuos de *P. haliaetus* enviados para examen bacterial. Este se considera el primer registro de cólera avícola en esta especie. La misma cepa, serotipo 3, 4, se aisló de *P. haliaetus,* anátidos sumergibles y de aves marinas colectadas durante epidemia. Los métodos posibles de transmiston en *P. haliaetus* incluyen la ingestion de anátidos enfermos o el uso de cadáveres o huesos infectados como material para anidar.

Avian cholera (*Pasteurella multocida*) is a highly infectious bacterial disease that killed tens of thousands of diving ducks and seabirds on Chesapeake Bay in 1970 and 1978 (Locke et al. 1970, Montgomery et al. 1979). In late February–early April 1994, a third avian cholera epizootic on Chesapeake Bay killed more than 36,700 birds of 57 species, including 6 Ospreys (L. J. Hindman, unpubl. data). Although avian cholera commonly causes die-offs among waterfowl, it has been reported infrequently in raptors (Friend 1987). However, avian cholera has been reported in at least 15 species of raptors in North America, including eagles, falcons, kestrels, hawks, and owls (Brogden and Rhoades 1983, Hunter 1967, Rosen et al. 1973, Wilson et al. 1995). In all cases, the method of transmission suggested was ingestion of carcasses containing the etiologic agent (*P. multocida*). The purpose of this paper is to document the first reported occurrence of avian cholera in Ospreys and suggest the use of infected carcasses or bones as nest material as another possible mode of transmission.

METHODS

Between 21 Feb.–5 Apr. 1994, state and federal wildlife agency personnel and volunteers in Maryland, North Carolina, and Virginia recovered more than 36,700 dead birds killed by an epizootic of avian cholera in Chesapeake Bay. Control measures throughout the epizootic were limited to the collection and proper disposal of carcasses as described by Montgomery et al. (1979) and Friend (1987). Between 23 Mar.–3 Apr. 1994, six adult Ospreys were found dead and four were submitted for diagnostic evaluation; two carcasses were sent to the Maryland Department of Agriculture (MDA), Animal Health Laboratory, at Salisbury, and two to the National Biological Service, National Wildlife Health Center (NWHC), at Madison, Wisconsin, for diagnosis. Two carcasses were decomposed and unsuitable for diagnostic evaluation. The evaluations included a necropsy and collection of tissues for bacteriology, parasitology, and toxicology to rule out pesticide exposure and for microscopic examination of tissues (Rhodes et al. 1989). Any *P. multocida* isolates were serotyped (Heddleston et al 1972) by the NWHC and the National Veterinary Services Laboratory (NVSL), at Ames, Iowa.

We examined 29 over-water Osprey nests between 11 Apr.–5 May 1994 on the Chesapeake Bay in Maryland and Virginia and collected whole carcasses and skeletal remains of waterfowl and other birds. Two nests examined were at locations where dead Ospreys were found. All other nests were selected based on accessability. Carcasses and long bones from eight nests were double-bagged and sent to the NWHC for bacterial cul-

ture of *P. multocida* (Friend 1987, Rhodes et al. 1989). Remaining bird parts were sent to the Smithsonian Institution, Division of Birds (SIDB), Washington, D.C., for species identification by forensic techniques (Dove 1997, Laybourne and Dove 1994, Sabo and Laybourne 1994).

RESULTS AND DISCUSSION

One of the six Osprey carcasses recovered was found on an artificial nest structure (Edgewater, Maryland), a second on a pier beneath an artificial nest structure (Romancoke, Maryland), and a third fell from where it was perched in a tree (Easton, Maryland). The other three Osprey carcasses (from Cape St. Claire, Maryland; Pungoteague, Virginia; and Ophelia, Virginia) were found washed ashore during carcass collection surveys conducted during the 1994 epizootic.

The four Ospreys submitted for diagnosis were in good body condition with adequate body fat and good flight muscle development. The two Ospreys submitted to the MDA had no gross lesions of avian cholera. The only gross lesion found in one Osprey submitted to the NWHC was an enlarged spleen. However, microscopic examination of tissues revealed bacterial colonies throughout the spleen, liver, and kidney. The other Osprey had lesions consistent with avian cholera that included an enlarged spleen, hemorrhages on the surface of the heart and liver, and congestion of the esophagus and crop. *Pasteurella multocida* serotype 3,4 was isolated from the livers of all four Ospreys (Weaver et al. 1985). Although avian cholera has been documented from other raptors, this is believed to the first report of *P. multocida* in Ospreys.

Serotype 3,4 was also isolated from diving ducks and seabirds collected during the 1978 and 1994 epizootics on Chesapeake Bay (L. J. Hindman, unpubl. data; Montgomery et al. 1979). Three dead Ospreys were also recovered during the 1978 epizootic. However, *P. multocida* was not isolated from two specimens submitted for bacteriological examination (Montgomery et al. 1979).

The 29 Osprey nests examined were located between Occohannock Creek (37°33′N, 75°56′W) and Chesconessex Creek (37°52′N, 75°48′W), Virginia and between Kent Island (38°58′N, 76°20′W) and Barren Island (38°20′N, 76°13′W), Maryland, areas where bird carcasses were recovered during the 1994 epizootic (L. J. Hindman, unpubl. data). Remains from birds, other than Ospreys, were collected from 19 (66%) of the 29 Osprey nests. In 17 of 19 (90%) Osprey nests containing bird parts, remains of either whole carcasses, various skeletal remains (e.g., skulls, long bones, etc.), or feathers from waterfowl were found. Oldsquaw (*Clangula hyemalis*) parts were found in all but six of the nests containing waterfowl remains, including both nests where infected Ospreys were recovered. Osprey nests also contained remains of Bufflehead (*Bucephala albeola*), Canada Goose (*Branta canadensis*), Surf Scoter (*Melanitta perspicillata*), Ring-billed Gull (*Larus delawarensis*), and American Robin (*Turdus migratorius*) (Dove, pers. comm.). Coincidentally, Oldsquaw comprised 86%

of the 36,700 bird carcasses recovered during the 1994 epizootic (L. J. Hindman, unpubl. data).

It has been reported that *P. multocida* persists for several weeks to several months in bone marrow (Friend 1987). However, attempts to isolate *P. multocida* from the long bones of carcasses and skeletal remains collected from eight Osprey nests were unsuccessful (NWHC, Case Report 12695). The bones submitted to the NWHC had been in the nests for up to six weeks. They were completely desiccated and the only bone marrow present was barely moist or dry. *Pasteurella multocida* can be killed by exposure to ultraviolet light and drying. The presence of no other bacteria supports the finding that the bones were never or no longer infected.

Ospreys generally do not return to Chesapeake Bay until mid-March (Stewart and Robbins 1958), with nest building beginning within a few days of arrival. The arrival of breeding Ospreys occurred immediately after the peak in bird mortality (22 February–15 March during the 1994 epizootic (L. J. Hindman, unpubl. data). About 2000 breeding pairs of Ospreys nest along Chesapeake Bay shorelines and its tributaries on navigation markers, utility poles, nest platforms, hummocks, duckblinds, and dead trees (Reese 1991). Two-thirds of the breeding Ospreys nest offshore on artificial structures (Henny et al. 1974). Osprey mortality from avian cholera was either rare or occurred during the later stages of this disease outbreak, after intensive carcass collection ended. Each infected Osprey was reported by the public at sites receiving regular observation.

Ospreys have diets and nest-building behavior that may predispose them to exposure to avian cholera. Although Ospreys feed almost exclusively on live fish (Reese 1991, Vana-Miller 1987), there have been scattered reports of Ospreys taking non-fish species, including a few bird species (Wiley and Lohrer 1973). Reasons for taking prey other than live fish include scarcity of fish, murky water, inclement weather, lack of fishing skill in immature birds, and attraction of easily captured crippled, captive, or concentrated non-fish prey (Wiley and Lohrer 1973). Ospreys also regularly scavenge carcasses for nesting material (Poole 1989, Warham 1956). During the pre-laying period, Ospreys use sticks to build their nest base, then switch to flat, soft material for the lining that will support the eggs.

In this epizootic, whole carcasses and body parts of waterfowl were generally incorporated into the sticks comprising the main base of the Osprey nests. Ospreys gather most material within sight of the nest (Green 1976, Levenson 1979). Two of the four infected Ospreys were found at overwater nest sites on Chesapeake Bay where carcasses of infected waterfowl were common during the 1994 epizootic. The presence of the same *P. multocida* serotype in dead Ospreys, diving ducks, and sea birds provides circumstantial evidence that suggests the mode of transmission of avian cholera to Ospreys was by ingestion of sick waterfowl or by using carcasses of birds that may have died of avian cholera to line their nests.

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