Maryland Birdlife 68(1):38–45

Bald Eagle (*Haliaeetus leucocephalus*) Mortalities in Maryland, 1988–2017

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Abstract: Bald Eagle (*Haliaeetus leucocephalus*) mortalities reported to the Maryland Department of Natural Resources were entered into a database over a 30-year period. A total of 591 Bald Eagle mortalities were reported during the period from 1988 through 2017. The probable causes of death were determined for 438 mortalities. The most common cause of death was trauma, accounting for 63% of the mortalities for which the cause of death was known. Other causes of death were electrocutions (15%), poisonings (15%), disease (3%), drownings (2%), and death by entanglement (1%). Carbamate poisoning resulted in multiple eagle deaths due to a few single events. Comparisons with other studies, both national and local, are discussed.

In 1988, sixteen Bald Eagles (*Haliaeetus leucocephalus*) were found dead in Maryland as a result of poisonings. As the eagle biologist for the Maryland Department of Natural Resources (MDNR), I started tracking the occurrences of all Bald Eagles found dead in Maryland and reported to the MDNR. That year, I created a database to track all reported eagle mortalities. I encouraged agency staff, other government agencies, wildlife rehabilitators, and the Maryland Natural Resources Police to send reports of any dead eagles to my office. Over time, a cooperative network of contributors reported eagle mortality events (Driscoll et al. 2004).

METHODS

The following information was recorded in the database for each dead eagle found or those injured ones that subsequently died: species, age, date, location, county, cause of death, band number (if banded), and comments. For most eagle mortality events, all the fields of data were reported and entered into the database with the exception of band number since most birds were not banded. However, some information was not reported or known for many of the mortalities.

For all entries, it was assumed the biologist, wildlife technician, or law enforcement officer reporting the mortality had the ability to externally examine the carcass, investigate the circumstances, and report the probable cause of death. Some carcasses were submitted to the USGS National Wildlife Health Center in Madison, Wisconsin or the U.S. Fish and Wildlife Service Forensics Laboratory in Ashland, Oregon for examination. Necropsies were also performed by the Toxicology Directorate of the Army Public Health Center, Aberdeen Proving Ground, Maryland. Many were examined by local wildlife rehabilitators and veterinarians. Probable causes of death were based on field investigations, clinical examinations, radiographs and blood tests. In most cases, full necropsies were not performed. If no necropsy was conducted and no samples collected, determining infectious diseases was not possible.

Injured Bald Eagles that were taken to veterinarians or wildlife rehabilitators and subsequently died or were euthanized, because of the severity of their injuries, were included in the mortality database. The cause of death was attributed to the cause of the injury, not the act of euthanasia. Many of these birds had their blood tested and were radiographed for shot. Necropsies were performed on many of the eagles taken to wildlife rehabilitators.

RESULTS

During the 30-year period from 1988 through 2017, there were 591 Bald Eagle mortalities reported and entered into the database. Of these, 168 were adults, 362 were immature, and ages were not reported for 61. There were also 9 dead Golden Eagles (*Aquila chrysaetos*) found in Maryland during the same time period, mostly immature birds.

The number of dead Bald Eagles found in any given year ranged from 4 to 38 (Figure 1). The general trend in the number of eagles found dead increased over the 30-year period. This was to be expected since the Bald Eagle population in Maryland had increased since the late 1970s (Therres 2005). The spike in numbers of dead eagles in 1988 and 2017 were due, in part, to several eagles dying from poisonings. The spikes in 1997 and 2003 did not have any significant poisoning events during those years. The reason for those spikes in dead eagles is unknown.

At least one dead Bald Eagle was found in every county in Maryland during the 30-year period (Table 1). Harford County had the highest number of reported dead eagles (n = 117), most of which were found on Aberdeen Proving Ground (n = 96). Aberdeen Proving Ground is a United States Army facility at the head of the Chesapeake Bay and a major concentration area for wintering Bald Eagles (Buehler et al. 1991; MDNR, unpublished data). The military base also had an active Bald Eagle monitoring program and reported all dead eagles found to my

office and the U.S. Fish and Wildlife Service (USFWS). It supported a high number of nesting pairs (Watts et al. 2014). Dorchester County had the second highest number of dead eagles (n = 62). That county had the highest breeding population of Bald Eagles in Maryland (Therres 2005) and a large number of wintering eagles at Blackwater National Wildlife Refuge (USFWS, unpublished data). The vast majority of Bald Eagle mortality events occurred in the Coastal Plain counties which correspond to where most of the Bald Eagles occur in Maryland.

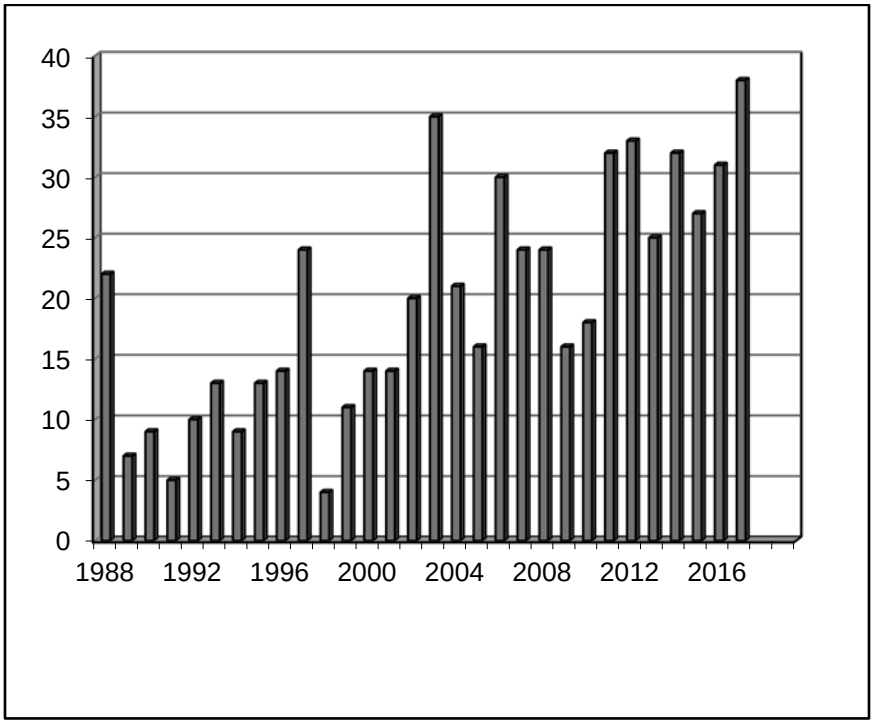

Figure 1. Number of known Bald Eagle mortalities in Maryland reported by year during the period 1988 through 2017.

The probable cause of death was determined for 74% (n = 438) of the Bald Eagle mortalities (Table 2). For the 153 deaths for which the cause of death was unknown, the carcass was either too decomposed to determine the cause or the eagle was not taken to a wildlife rehabilitator, veterinarian or lab.

Table 1. Reported eagle mortalities in Maryland by county of occurrence during the period 1988 through 2017.

County	Bald Eagles	Golden Eagles
Allegany	2	0
Anne Arundel	21	1
Baltimore	10	0
Calvert	21	0
Caroline	29	0
Carroll	1	0
Cecil	32	0
Charles	54	0
Dorchester	62	4
Frederick	2	0
Garrett	1	0
Harford	117	0
Howard	1	0
Kent	44	0
Montgomery	11	0
Prince George's	9	0
Queen Anne's	29	0
St. Mary's	30	0
Somerset	18	1
Talbot	44	0
Washington	4	0
Wicomico	14	0
Worcester	25	0
Not reported	10	3
Total	**591**	**9**

Table 2. Causes of Bald Eagle deaths reported to the Maryland Department of Natural Resources during the period 1988 through 2017.

Cause of Death	Number of Mortalities of Known Causes	Percentage of Mortalities of Known Causes
Disease/Infection	13	3
Drowning	10	2
Electrocution	66	15
Entanglement	6	1
Poisoning	66	15
Trauma	277	63
Total known causes	**438**	**100**

Cause of Death	Number of Mortalities	Percentage of Mortalities
Known causes	438	74
Unknown causes	153	26
Total	**591**	**100**

Of the Bald Eagle mortalities for which probable cause of death was determined, trauma was the major cause accounting for 63% (n = 277) of these mortalities. Included in the trauma-killed eagles were 45 (10% of all known causes) that were killed by colliding with suspended electric or telephone wires, 59 (13% of all known causes) killed by vehicles (including two by trains and three by airplanes), and 21 (5% of all known causes) that were shot. Of those that were shot, the majority (n = 13) were adult eagles.

Poisonings accounted for 15% (n = 66) of the Bald Eagle mortalities for which the cause of death was determined. The two primary types of poisonings were from lead and from carbamate pesticides such as carbofuran. Forty-one Bald Eagles were killed by carbamates, as were 7 Golden Eagles. Another 12 Bald Eagles were poisoned by other chemicals. Carbamate poisoning events usually involved several eagles. The largest mortality from a single poisoning event was 13 Bald Eagles found dead in a field on 20 February 2016 in Caroline County. In all of the carbamate poisoning events, the eagles appeared perfectly healthy but dead. In some cases, the eagle appeared to have died in mid-flight and was found dead in the middle of a field. Other eagles were found along the edges of fields presumably after falling out of trees.

Twenty Bald Eagle deaths were attributed to lead poisoning, of which 14 were adults. Death by lead poisoning is a slow process and usually only single dead eagles were recovered as a result. Eagles usually ingest lead by feeding on prey or carcasses of animals shot with lead pellets from shotguns or dead deer killed by lead bullets from rifles. The type of lead ingested was not determined or reported. Seventeen of the lead poisoned eagles died during the fall and winter. Only 3 eagles died during the spring and summer months.

Because most of the eagles were not necropsied or sampled for diseases, only 3% (n = 13) of the Bald Eagle mortalities for which probable cause of death was reported died of natural causes (i.e., disease/infection). If drownings (n = 10) were the result of catching a fish too big and subsequently being pulled under water, then 5% (n = 23) of known mortalities could have been natural. If eagle deaths resulting from fights with other eagles or ospreys are considered natural, then up to 10% of the mortalities were the result of natural causes. The remaining mortalities of Bald Eagles for which the cause of death was determined were the result of human actions.

DISCUSSION

The causes of mortality reported in this paper may not entirely represent those that affect the Bald Eagle population throughout Maryland. Not all dead eagles found in Maryland were reported to MDNR. Of the eagles found and reported to MDNR, most were from human-frequented areas. Eagles that died in remote

locations such as marshes and forests had a lower chance of being found. Perhaps those Bald Eagles were more likely to die of natural causes, and the proportion of human-caused mortalities for Maryland eagles as a whole is less than indicated by the data presented in this paper.

Trauma as the most common cause for Bald Eagle deaths documented during this study is not unusual. Many studies of Bald Eagle mortality have documented trauma as the major cause of death in various parts of the country (e.g., Deem et al. 1998, Harris and Sleeman 2007, Russell and Franson 2014). During the period 1975 to 2013, trauma accounted for a third of the 2,980 dead Bald Eagles from throughout the country examined at the National Wildlife Health Center (Russell and Franson 2014). Bald Eagle mortalities in Virginia were similar in the percentage of trauma-caused deaths in Maryland, accounting for 70% of the Bald Eagles examined by the Wildlife Center of Virginia in Waynesboro, Virginia (Harris and Sleeman 2007).

Collisions with overhead wires accounted for 16% (n = 44) of the trauma-caused mortalities in Maryland. Adding the number of electrocuted eagles (15% [n = 66]) to that results in 31% (n = 110) of the dead Bald Eagles dying because of overhead wires and the poles that support them. The percentage of eagles killed by electrocution in Maryland was similar to the national percentage (12.5%) reported by Russell and Franson (2014) and the percentage in western Canada (11.5%) reported by Wayland et al. (2003). The location that accounted for many of the electrical line mortalities in Maryland was Aberdeen Proving Ground. Mojica et al. (2009) attributed the high incidence of collisions and electrocution at Aberdeen to the location of the electrical lines relative to both vegetation and the shoreline and to the placement of the lines relative to the major flight lines used by the eagles on the Army facility; however, at least one electrocution could have been by a lightning strike (Mark S. Johnson [Aberdeen Proving Ground], in litt.). The Army has worked to remediate the electrical line problems at Aberdeen Proving Ground with a number of successful techniques. Fortunately, only 5% of Bald Eagle mortalities in Maryland during this study were the direct result of shootings. Several other eagles had shot in their bodies as determined through radiographs, but died of other causes. During the early 1960s, shooting was the major cause of death (62%) of Bald Eagles examined at Patuxent Wildlife Research Center that came from various parts of the country (Coon et al. 1970). Since shootings most likely occur in areas less frequented by humans, the low percentage documented in this study may underrepresent the true percentage of eagle mortalities in Maryland due to shooting. However, that number is likely nowhere near the percentage documented in the 1960s. Russell and Franson (2014) attributed death by shooting to 10% of the Bald Eagles examined by the National Wildlife Health Center. Shooting deaths in Maryland are more likely close to the national percentage than the 5% documented in this study.

Poisonings may have the greatest potential for impacting Bald Eagle populations. The effects of organochlorine pesticides resulted in dramatic population declines in the 1950s and 1960s (Buehler 2000). Mortalities as a result of poisonings in Maryland were below the national level of 26% (Russell and Franson 2014). They were similar to the percentage of eagles killed in western Canada by lead and pesticide poisoning (Wayland et al. 2003). The percentage of eagles killed by lead poisoning (n = 20) in Maryland (30% of poisoned Bald Eagles) was well below the national level reported by Russell and Franson (2014). They found 62% of eagles killed by poisoning were the result of lead poisoning. Franson and Russell (2014) reported the odds of lead poisoning were greater for females versus males, adults versus juveniles, and in the central U.S. compared to the Atlantic flyway. In Maryland, the ratio of lead poisoned Bald Eagles was nearly three adults for every one immature bird. Nationally, carcasses were found at greater frequency in late autumn and winter than spring and summer (Franson and Russell 2014). In Maryland, the vast majority of eagles that died of lead poisoning were also found during the fall and winter months. Franson and Russell (2014) found no evidence that lead exposure predisposed eagles to other causes of mortality.

The increase in the number of reported Bald Eagle mortalities in Maryland is to be expected due to the increase in the eagle population within the state (Therres 2005). The more eagles there are in the wild, the more likely it is that dead eagles will be found. Viewed from a population perspective, that is not cause for concern.

ACKNOWLEDGMENTS

Thanks are extended to all those who reported eagle mortality events to MDNR over the 30-year period. Special thanks go to Erica Miller, Sallie Welte, and Andrea Howey-Newcomb of Tri-State Bird Rescue & Research (Newark, Delaware); Amy Burgess and Lynda Hartzell of Aberdeen Proving Ground; Cindy Driscoll (State Fish & Wildlife Veterinarian for MDNR); and licensed wildlife rehabilitators for their numerous reports provided. Thanks are extended to Gwen Brewer (MDNR), Cindy Driscoll, and three anonymous reviewers for reviewing a previous draft of the manuscript and providing helpful comments for improving the paper.

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