

MORTALITY OF SWANS DUE TO INGESTION OF LEAD SHOT, WHATCOM COUNTY, WASHINGTON, AND SUMAS PRAIRIE, BRITISH COLUMBIA

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INTRODUCTION

Poisoning of swans from the ingestion of lead pellets has long been known to affect populations wintering in the Pacific Northwest (Munro 1925, Eklund 1946, Cowen 1946, Kendall and Driver 1982, Blus *et al.* 1989, Lagerquist *et al.* 1994, Wilson *et al.* 1998). Recent mortalities of swans wintering in northwest Washington State and the Sumas Prairie of British Columbia have totaled at least 1,800 individuals, with over 1,100 of the mortalities being collected in Washington State. The first large scale die-off in this area was in the winter of 1991-92 and involved over 100 individuals. There were no reported mortalities between 1992 and 1998. Since 1999, there has been a large scale die-off in each subsequent year. Approximately 70 percent of mortalities have been attributed to lead poisoning. Mortalities occur in both Trumpeter and Tundra Swans, but over 92 percent have been Trumpeter Swans.

Swans arrive on the wintering grounds in this area near the end of October-early November. Mortalities generally increase sharply around the middle of December, peak around the first of January, and decline sharply in February. One-day counts performed each winter by Washington Department of Fish and Wildlife (WDFW) indicate the population has grown by approximately 15 percent each year since 1999, despite the mortalities.

In 2001, WDFW, Canadian Wildlife Service, the U.S. Fish and Wildlife Service and additional stakeholders from various government and non-government agencies began a joint initiative to locate the source(s) of the lead pellets. The Washington Cooperative Fish and Wildlife Research Unit (University of Washington) joined the effort in 2004. The study area is centered in Whatcom County, Washington, and the Sumas Prairie of British Columbia as that is where the majority of the

mortalities are occurring. The study area encompasses approximately 100 ha, 58 percent in the U.S. and 42 percent in Canada.

Ingested lead is broken down with the grinding action of the gizzard, enters the bloodstream, and paralyzes the internal organs (Shillinger *et al.* 1937; Bellrose 1975; Washington Department of Fish and Wildlife 2001). Waterfowl in general may succumb to lead poisoning within 21 days of ingesting as few as 2-3 pellets (USGS-National Wildlife Health Center, Madison, Wisconsin pers. comm.). There is some thought that as the number of pellets ingested increases, the time from ingestion to death decreases (Bellrose 1975, Pain 1990).

PACIFIC NORTHWEST UPDATE

In the Pacific Northwest, swans forage during daylight hours in agricultural fields (predominantly corn with a winter wheat or rye grass cover crop) and return to roost at a lake, flooded gravel pit or pond each evening. In addition, certain flooded agricultural fields may intermittently be used by swans as roosting habitat. As swans begin to suffer the symptoms of lead poisoning, they will typically remain at the roost site until death. Carcass collections at the roost sites as well as at agricultural fields and necropsies have been routinely performed since 1999. Carcasses recovered during the previous 6 years have averaged over 20 lead pellets each. The contents of a subset of over 900 gizzards were examined. Approximately 60 percent of these gizzards contained more than 10 lead pellets and nearly 75 percent of them contained fewer than 10 steel pellets. Pellets collected from over 300 gizzards were of sizes used in both upland game and waterfowl hunting. We have calculated "exposure windows" by back-dating carcass collection dates 28 days. This is a conservative estimate, in case swans survive slightly longer than other waterfowl. These

exposure windows indicate that swans are accessing pellets soon after arriving on the wintering grounds.

Between November 2001 and December 2004, 311 swans were captured with rocket nets. General body condition was assessed and a blood sample was collected and tested for blood lead content. Trumpeter Swans were marked with coded neck bands and vhf radio transmitters (245) or satellite transmitters (6); Tundra Swans were marked with coded neck bands (43) or Federal tarsus bands (17). Swans were monitored both day and night through ground-based and/or aerial telemetry. Population surveys were also conducted semi-weekly from November through December each year, but extended through January this past winter, to monitor population movements as well as validate our telemetry results.

To date, we have recovered 55 marked mortalities. Twenty of these were collar recoveries only where the carcasses were scavenged before located. Thirteen of the 55 had low blood lead levels at the time of capture and laboratory tests concluded lead poisoning as the cause of death. The cause of death of four of the 55 was not due to lead and 18 were lead exposed prior to capture, having high blood lead levels. Only one of the 55 was a Tundra Swan and that bird was exposed to lead prior to capture. Two of the satellite marked swans died shortly after capture in 2004-05; one was lead exposed prior to capture and the other suffered a severe wing injury. In addition, two of the remaining four satellite transmitters ceased operation soon after being fitted.

At the conclusion of the 2003-04 and 2004-05 field seasons, data from swans confirmed as being lead poisoned post capture were entered into kernel home range (ArcGIS 3.2) software to produce "activity centers" encompassing 50 percent and 90 percent of all detections of these swans. These activity centers were designated as "areas of interest" for the subsequent telemetry field season. These areas of interest were visited at least twice per day by telemetry personnel in 2003-04 to replicate swan locations as well as document individual foraging locations. Identification of the areas of interest has decreased the potential source area for lead pellets by more than 90 percent, from 100,000 ha to less than 10,000 ha.

Soil core sampling has occurred in both forage fields and roost sites identified as possible sources early in the study effort. To date, soil sampling work has not identified a point source of lead pellets and indicates greater lead shot densities in some forage fields than

at roost sites. We have found high variability in shot density within some forage fields, indicating a need for foraging observations (included in 2004-05 telemetry efforts). In addition, we have found shot throughout the core column in some locations which is indicative of historic deposition. Recovered shot has been of sizes used in both upland game and waterfowl hunting.

FUTURE PLANS

Future plans for the 2005-06 field season include the continuation of ground based telemetry surveys twice daily, coordinated by The Trumpeter Swan Society, in the areas of interest. Carcass collections will again be conducted at roost sites and forage fields as needed; necropsies will be conducted on at least the recovered carcasses of marked birds. Aerial surveys will be increased in frequency in an effort to increase the number of carcasses of marked birds recovered before scavenging occurs. In addition, soil sampling will be conducted in parts of the areas of interest. Sampling efforts will include investigation into the use of metal detectors as a means of identifying areas with high shot densities prior to coring.

LITERATURE CITED

- Bellrose, F. 1975. Impact of ingested lead pellets on waterfowl. Proceedings of the First International Waterfowl Symposium, Ducks Unlimited; St. Louis, Missouri. Pages 163-167.
- Blus, L. J., R. K. Stroud, B. Reisinger, and T. McEneaney. 1989. Lead poisoning and other mortality factors in Trumpeter Swans. Environmental Toxicology and Chemistry 8:263-271.
- Cowen, I. McT. 1946. Death of a Trumpeter Swan from multiple parasitism. Auk 63:248-249.
- Eklund, C. R. 1946. Mortality notes on the Trumpeter Swan. Auk 63:89-90.
- Kendall, R. J. and C. J. Driver. 1982. Lead poisoning in swans in Washington State. Journal of Wildlife Diseases 18:385-387.
- Lagerquist, J. E., M. Davison, and W. J. Foreyt. 1994. Lead poisoning and other causes of mortality in Trumpeter (*Cygnus buccinator*) and Tundra (*Cygnus columbianus*) Swans in western Washington. Journal of Wildlife Diseases 30:60-64.

- Munro, J. A. 1925. Lead poisoning in Trumpeter Swans. *Canadian Field-Naturalist* 39:160-162.
- Pain, D. J. 1990. Lead shot ingestion by waterbirds in the Camargue, France: An investigation of levels and interspecific differences. *Environmental Pollution* 66:273-285.
- Schillinger, J. E. and C. C. Cottom. 1937. The importance of lead poisoning in waterfowl. *Transactions of the North American Wildlife and Natural Resources Conference* 2:398-403
- Washington Department of Fish and Wildlife. 2001. Report to the Washington Fish and Wildlife Commission: The use of nontoxic shot for hunting in Washington. Washington Department of Fish and Wildlife Nontoxic Shot Working Group, Olympia, Washington, USA.
- Wilson, L. K., J. E. Elliot, K. M. Langelier, A. M. Scheuhammer, and V. Bowes. 1998. Lead poisoning of Trumpeter Swans, *Cygnus buccinator*, in British Columbia, 1976-1994. *Canadian Field-Naturalist* 112:204-211.