LEAD SHOT POISONING IN SWANS: SOURCES OF PELLETS WITHIN WHATCOM COUNTY, WA, USA, AND SUMAS PRAIRIE, BC, CANADA

MICHAEL C. SMITH[1], MICHAEL A. DAVISON[2], CINDY M. SCHEXNIDER[3], LAURIE WILSON[4], JENNIFER BOHANNON[2], JAMES M. GRASSLEY[1], DONALD K. KRAEGE[2], W. SEAN BOYD[4], BARRY D. SMITH[4], MARTHA JORDAN[5], AND CHRISTIAN GRUE[1]

[1]*University of Washington, Washington Cooperative Fish and Wildlife Research Unit, School of Aquatic and Fishery Sciences, P.O. Box 355020, Seattle, WA 98195-5020, USA.* E-mail: mcsmith@u.washington.edu

[2]*Washington Department of Fish and Wildlife, 16018 Mill Creek Blvd., Mill Creek, WA 98012, USA.*

[3]*US Fish and Wildlife Service, 510 Desmond Dr. SE #102, Lacey, WA 98503, USA.*

[4]*Environment Canada, Pacific Wildlife Research Centre, 5421 Robertson Rd., RR#1 Delta, BC, V4K 3N2, Canada.*

[5]*The Trumpeter Swan Society, County Road 9 – Suite 100, Plymouth, MN 55441, USA.*

EXTENDED ABSTRACT.—Over the past nine years (1999–2008), swan populations in northwest Washington State and on Sumas Prairie, British Columbia (Figure 1) have declined by over 1,500 birds due to lead poisoning caused by ingestion of lead pellets. The large majority of mortalities involved Trumpeter Swans (*Cygnus buccinator*) and most have occurred in Whatcom County, Washington State. Swan mortalities in Skagit and Snohomish Counties (Figure 2) of Washington State have also been included in the study total as these individuals may have ingested lead pellets in Whatcom County and Sumas Prairie prior to moving south.

Lead shot use for waterfowl hunting has been banned in northwest Washington State since 1989 (WDFW 2001) and in the Sumas Prairie area of British Columbia since 1990 (Wilson et al. 1998). Lead shot is still permitted for upland bird hunting and target shooting in most of both areas. Swans are at risk from lead poisoning because of their method of feeding (Blus et al. 1989). Large amounts of plant and sediment material are consumed whole, along with small pebbles (grit) to aid in the grinding of food in the birds' gizzards. Because of their size, lead pellets may be unintentionally ingested when birds eat grit or seeds. The grinding action and acidic environment of the gizzard break down the pellets, allowing lead to enter the bloodstream (Shillinger et al. 1937, Bellrose 1975, WDFW 2001). Symptoms of lead poisoning in waterfowl (e.g., lethargy, muscular weakness) can appear as early as four days after ingestion of as few as two or three pellets, with death occurring in 17–21 days (USGS-NWHC, pers. comm.). If more pellets are ingested, less time may be required before mortality occurs (Bellrose 1975, Pain 1990).

In 2001, an international effort was initiated to locate the source(s) of the lead. Participants included the Washington Department of Fish and Wildlife, US Fish and Wildlife Service, Environment Can-

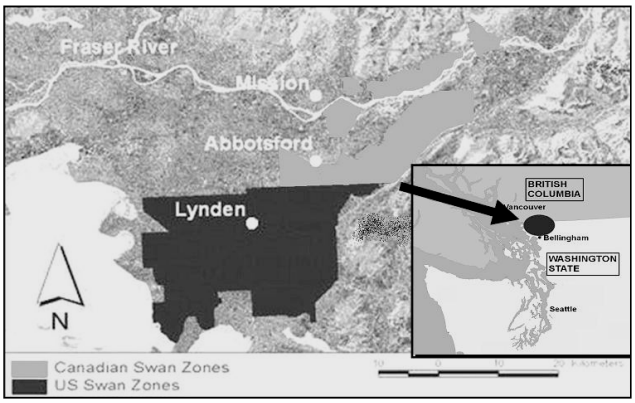

Figure 1. A map of the study area encompassing the lead related swan mortalities in Whatcom County, Washington State, and Sumas Prairie, British Columbia. The study area is ~100,000 ha, 58% in the United States and 42% in Canada.

Figure 2. A schematic of county boundaries in northwestern Washington State.

ada, The Trumpeter Swan Society, and the University of Washington (Washington Cooperative Fish and Wildlife Research Unit). Rocket propelled nets were used to capture a total of 249 Trumpeter and 42 Tundra Swans between 2001 and 2005. A blood sample was collected from each captured swan and analyzed for blood lead content (BC Ministry of Agriculture and Lands, Animal Health Centre, Abbotsford, BC.). Trumpeter Swans were fitted with either a VHF (n=243) or satellite (n=6) transmitter attached to a coded neck collar. Tundra Swans were fitted with a coded neck collar. Sick and dead swans were collected throughout the winter, and carcasses examined to determine cause of death, measure liver lead residues, and recover shot from gizzards. Results suggest that swans arrive on the wintering grounds with low blood lead levels, but some birds subsequently become exposed to lead after ingesting lead shot.

During the winter months (October-February) of 2001–2006, telemetry surveys were conducted each day and night to document locations of marked individuals. Population surveys were also conducted semi-weekly from November to January to obtain additional detail on population movements and to validate telemetry data. The locations of collared swans were used to identify forage areas and roost sites. Telemetry data for swans that died from lead poisoning after radio-collaring were used to identify and prioritize areas for lead shot density assessment (shot collected from soil/sediment sampling).

Lead shot has been found in fields and water bodies where hunting and target shooting have occurred. Relatively high densities of lead shot were found on the US side of Judson Lake, a ~100 acre lake spanning the US/Canada border. Waterfowl hunting still occurs on the US side of Judson Lake, but this activity has not occurred on the Canadian side for at least 30 years because of a landowner ban.

An adaptive management approach was initiated in October 2006 to test the hypothesis that Judson Lake is a primary source of lead shot. Swans were discouraged from using Judson Lake by both passive (windsocks, effigies) and active (noise makers, laser light, airboat) deterrent methods. Hazing activities ceased in late January 2007 and swans were allowed on the lake as the water depth at that time was believed to be sufficient to preclude swans from accessing sediments. The number of lead poisoned swans in 2006–2007 decreased by >50% compared to the average of the five previous years. However, population surveys showed that fewer swans foraged in an agricultural area near Judson Lake. Heavy snow and freezing temperatures forced most swans to leave the study area for up to two weeks during the predicted lead exposure period. Therefore, it was unclear if the decreased lead mortality was due to the exclusion of swans

from Judson Lake, reduced use of the nearby agricultural area, or because swans departed the area during adverse weather.

Hazing at Judson Lake was repeated from October 2007 to January 2008. Preliminary results from visual inspections (liver lead tests to confirm cause of death are pending) indicate that swan lead mortality again decreased by >50% compared to the average of the five years previous to the hazing activity. During the winter of 2007–2008, there were no weather events forcing swans to depart the study area. However, as in 2006–2007, population surveys showed that fewer swans foraged in the agricultural area near Judson Lake. Lead shot density assessment of these fields is currently underway.

Lead related swan mortalities in Skagit and Snohomish Counties of Washington State have been included in this study. During years prior to hazing Judson Lake, nearly 78% of the lead mortalities have occurred in Whatcom County/Sumas Prairie. In both 2006–2007 and 2007–2008 there was a southward shift in mortalities with over 50% of the estimated lead mortalities occurring in Skagit and Snohomish counties. It is unclear if these individuals ingested lead pellets in Whatcom County and Sumas Prairie prior to moving south or accessed new source(s) in either Skagit or Snohomish County.

At this time conclusions are preliminary. Because mortalities have declined by 50% during the two years of hazing, we conclude that Judson Lake is a source of lead shot but it clearly is not the only source. Cooperators are continuing to analyze data to clarify the relative contribution of Judson Lake versus other possible sites in northwest Washington State and Sumas Prairie, British Columbia. Following this analysis, cooperators will determine the best course of action to reduce the availability of lead shot to swans during 2008–2009 and subsequent wintering periods. *Received 31 May 2008, accepted 28 July 2008.*

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Key words: Lead poisoning, lead shot, lead shot sampling, swan, waterfowl, waterfowl hazing.

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