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The Occurrence of *Theromyzon rude* (Annelida: Hirudinea) in Association with Mortality of Trumpeter Swan Cygnets (*Cygnus buccinator*)

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Parasitism by nasal leeches has been reported in a variety of species of waterfowl in North America (Trauger and Bartonek, 1977, *Wildfowl* 28: 143–152). *Theromyzon*, also known as the duck leech, is the only glossiphoniid leech that feeds while attached directly to the mucosal lining of the nasal passages and/or beneath the nictitating membrane of the eyes of its avian hosts. *Theromyzon rude* (Baird) is the species reported most frequently from North American waterfowl (Trauger and Bartonek, 1977, op. cit.; Davies and Wilkialis, 1980, *Can. J. Zool.* 58: 913–916; Davies, 1984, *Can. J. Zool.* 62: 589–593). Klemm (1982, U.S. Environmental Protection Agency Report No. 600/3-82-025, Cincinnati, Ohio, 177 pp.) has reported *Theromyzon biannulatum* and *T. tessulatum* from lakes and ponds in the United States and Canada.

Theromyzon feeds on blood and because of its large size (up to 35 mm when blood engorged) and nasal feeding site, it creates some unique problems for its host while feeding. Large numbers of engorged leeches can physically obstruct the nasal passages, pharynx, and trachea, eventually leading to suffocation, particularly in cygnets and ducklings. Secondary bacterial infections may also occur in association with severe infestations.

Seven trumpeter swan cygnets found dead at Yellowstone National Park in 1979 and 1980 were frozen and sent to the National Wildlife Health Laboratory for ne-

croscopy. Blood engorged leeches, identified as *T. rude*, were found in the nares, pharynx and trachea of all birds. Four of seven cygnets were suspected to have suffocated as a result of their leech infestations. The mean intensity in these swans was 36 (± 13.2) (range 22–57) and the leeches ranged in size from 12 to 26 mm. Twenty-eight blood-engorged leeches were removed from the nares and trachea of one 4-wk-old female cygnet weighing approximately 475 g. Three of these four cygnets had systemic bacterial infections with *Pseudomonas* sp. in conjunction with their sizable infestations (> 22). *Pseudomonas* is a ubiquitous facultative microbe in aquatic and terrestrial environments, and the infections were probably introduced by the leeches' feeding technique.

The other three cygnets did not have respiratory obstructions associated with their leech infestations, two died from trauma and the cause of death of one was not determined. These birds also had fewer leeches; mean intensity for this group was 10.7 (± 6.6) (range 2–18). Intestinal helminths were not associated with the diagnosed cause of death. Virological tests were negative. Representative specimens of *T. rude* were deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, USA (Accession No. 365637).

Although the significance of infestations of nasal leeches as a mortality factor in populations of waterfowl is uncertain, Meyer and Moore (1954, *Wasmann J. Biol.* 12: 1–15), Smith et al. (1966, *In Waterfowl Tomorrow*, Linduska (ed.), U.S. Bur.

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Sport Fish. Wildl., Washington, D.C., pp. 39–50), Moore (1966, Nat. Mus. Canada, Nat. Hist. Papers 32: 1–11), and Bartonek and Trauger (1975, Can. Field-Nat. 89: 234–243) have documented leech parasitism as a cause of or contributing factor in the death of various species of waterfowl, particularly young birds. Davies and Wilkialis (1981, Can. J. Zool. 59: 1196–1199) experimentally showed that young ducklings were physiologically stressed when exposed to short term feeding of *T. rude*. Banko (1960, N. Am. Fauna No. 63, 214 pp.) suggested that infestations of nasal leeches may have contributed to mortality in trumpeter swan cygnets at Red Rock Lakes National Wildlife Refuge (NWR). McDonald (pers. comm.) found that *Theromyzon* caused mortality in trumpeter swans from Red Rock Lakes NWR examined during 1958–1965. Eight of 14 swans of various ages had unusually high intensities of nasal leeches (from 15 to 72 parasites per bird), and the death of the parasitized swans was attributed to suffocation.

Trumpeter swan cygnets in the intermountain regions of Montana, Idaho, and Wyoming have a low survival rate during their first 8 wk. Field studies conducted at Red Rock Lakes NWR and Yellowstone National Park have shown that young cygnets were extremely weak and retarded in their development, thus less likely to survive the first weeks post-hatching (Page, 1974, The ecology of the trumpeter swans on Red Rock Lakes National Wild-

life Refuge, Montana, Ph.D. Thesis, Univ. of Montana, Missoula, 143 pp.; Shea, 1979, The ecology of trumpeter swans in Yellowstone National Park and vicinity, M.S. Thesis, Univ. of Montana, Missoula, 132 pp.). Page (1974, op. cit.) reported that mortality of cygnets at Red Rocks Lakes NWR was 73% during 1971–1973 and noted that food availability was not a factor. Shea (1979, op. cit.) reported that the cygnet mortality rate at Yellowstone National Park was 76% in both 1977 and 1978. In contrast, mortality of trumpeter swan cygnets on breeding grounds in Alaska was only 15–20% from 1965 to 1968 during their first 8 wk (Hansen et al., 1971 Wildl. Monogr. No. 26, 83 pp.).

It is possible that unusually high intensities of *T. rude* significantly contribute to the high mortality rate observed in trumpeter swan cygnets of the intermountain regions of the United States. The obstructive effects of these intermittent parasites on the respiratory system were evident in the dead swans examined from Yellowstone Park. Secondary bacterial infections, such as *Pseudomonas* in this case, in association with severe infestations of leeches must also be considered of significant importance.

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