

BOTULISM ON SEVERAL SASKATCHEWAN MARSHES, 1979

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Outbreaks of presumed avian botulism have been reported for several sites in southern Saskatchewan. However, positive diagnosis of botulism has been rare.

Avian botulism is caused by a toxin produced by the bacterium *Clostridium botulinum* type 'C'. This bacteria is a large, gram positive, rod-shaped anaerobe. It is a common soil bacteria which forms highly resistant spores. The toxin, which is extremely potent, is absorbed rapidly in the gastrointestinal system of the victim. Through the lymphatic system the toxin is transferred to the circulatory system where it travels to neurological junctions and interferes with impulse transmissions. The end result is increasing loss of motor control and paralysis.

There are two major theories regarding the methods of dissemination during an outbreak of the disease. The "sludge-bed" hypothesis suggests that a build-up of decomposing animal and plant matter induce anaerobic conditions providing an ideal situation for *C botulinum* to grow.¹ A suitable pH (7.5-8) and temperature (25°-30°C) are also contributing factors to these conditions.

The "micro-environment" concept suggests the bacteria finds a suitable growing medium in small organic particles such as dead invertebrates.¹ This concept suggests the toxin is ingested in the small

bodies rather than diffused in the water.

Whichever of the thesis is correct is not of major concern if one considers that they can both be caused by the same general environmental conditions.

During the 1979 field season we observed several outbreaks of what was presumed to be avian botulism. This report will describe our observations on some parameters and associated habitat conditions.

Observations

WOOD RIVER DELTA/OLD WIVES LAKE (N.E. 3-14-2 W3)

The Wood River Delta is located at the mouth of Wood River on the west end of Old Wives Lake. A dam and spillway (D.U. Project S 669) hold the water at a higher level and create a large riparian marsh upstream. On the downstream side of the dam a large, variable sized and very diverse marsh has developed. There is a salinity and vegetative gradient as the relatively fresh delta proceeds into the more saline Old Wives Lake.

The shorelines of the delta are very flat and, as summer evaporation lowers the water levels, large mudflats and shallow flooded areas appear. This site has experienced significant die-offs in the past. In 1970 E. M. Wright (former Provincial Biologist) estimated a toll of 24,000 birds primarily Pintail and Mallard.

On 12 August, 1979, Browne and Duffus made an inspection by canoe. On 17 August, we returned to obtain live samples for positive diagnosis of the disease. Due to the condition of the marsh and time constraints we only traversed a small area of the marsh. We saw about 250 to 300 dead and affected birds. During an aerial survey in the same week, we observed no build-up of carcasses which indicates the outbreak may have been limited. We estimated less than 2,000 birds affected at that time.

We removed several specimens for analysis: one adult female Green-winged Teal, one adult female Northern Shoveler, one adult female Pintail, one juvenile Pintail, one juvenile Shoveler, one Marbled Godwit, one American Avocet, one Stilt Sandpiper.

From this sample a mouse protection test, done by the Pathology Department, Western College of Veterinary Medicine, confirmed botulism intoxication as the disease (Dr. F. A. Leighton Final Report M 79-4434).

In addition, approximately 20 ducks in late stages of paralysis were dispatched. These were primarily Green-winged and Blue-winged Teal, Shoveler and Wigeon.

BIGSTICK LAKE EXTENSION (NE. 9-15-25 W3)

The Bigstick Lake Basin is large and saline and, due to low inflow, has not filled since the early 1950's. In 1974, Ducks Unlimited (Canada) built a restriction dam producing a 500-acre marsh on the west end. The conditions during 1979 resulted in the marsh being reduced to 250 acres.

The first report of dead birds came from D. Layton (D.U.). We believe this to be the first outbreak in the

restriction area. On the advice of Dr. W. I. Jensen (Bear River Research Station, Brigham City, Utah) we undertook to collect all the carcasses on the marsh and dispose of them by burning and burying.

During a four-day period with crews of four and five people, we collected all the carcasses by systematic exploration over the whole marsh. Sites were chosen on the nesting islands where trenches were dug for disposal. Using gasoline and diesel fuel, the birds were burned and the trenches filled.

Carcasses destroyed at the Bigstick Lake Extension, 23, 27, 28, and 29 August 1979: Green-winged Teal, 915 birds (44.2%); Blue-winged Teal, 216 (10.4%); Pintail, 189 (9.0%); Wigeon, 101 (4.9%); Shoveler, 90 (4.3%); Gadwall, 85 (4.1%); Mallard, 72 (3.5%); Dabbling Ducks, 1,668 (80.4%); Lesser Scaup, 13 (0.6%); Ruddy Duck, 7 (0.3%); Ring-necked Duck, 3 (0.1%); Redhead, 2 (0.1%); Canvasback, 1 (-); Bufflehead, 1 (-); Diving Ducks, 27 (1.3%); Canada Goose, 3 (0.1%); Coot, 42 (1.7%); Eared Grebe, 14 (0.7%); Sora, 3 (0.1%); Cormorant, 1 (-); Ring-billed and Franklin's Gulls, 13 (0.6%); American Avocet, 4 (0.2%); Lesser Yellowlegs 9 (0.4%); Pectoral Sandpiper, 1 (-); Long-billed Dowitcher, 1 (-); Wilson's Phalarope, 6 (0.3%); Northern Phalarope, 1 (-); Unidentified due to advanced decomposition, 280 (13.5%). Total, 2,071.

About 150 of these birds, alive when captured and deemed unlikely to recover, were dispatched. Unfortunately, no live samples were supplied to the Western College of Veterinary Medicine so we have no positive diagnosis. However, as Rosen pointed out, a presumptive diagnosis is unlikely to be confused with anything except acute lead poisoning and there was no

indication of toxic cyanophytic build-up.³

MIDDLE QUILL LAKE (21-34-16-W2)

Middle Quill Lake is a large, moderately saline basin created by a dam between Big and Little Quill Lakes. The area is an important staging and summer moulting site for the major prairie duck species.

Botulism was suspected during an inspection of the project on 13 August, 1979. Many dead birds were noticed in the outlet area between the structure and the lake proper. On closer examination, several birds symptomatic of waterfowl botulism were noticed. Seven of these were collected for analysis at the Western College of Veterinary Medicine in Saskatoon.

On 16 August, after receiving notification from Dr. Leighton that preliminary diagnosis indicated botulism, a thorough inspection of Middle Quill Lake was made by airboat. The disease appeared to be confined to the outlet area.

Approximately 300 carcasses were collected, burned, buried and covered by lime. Five scarecrows and two scare cannons were also set up in the outbreak area. (Periodic inspection of the site showed the cannons to be mechanically undependable.)

In response to a request by Dr. Leighton for additional information on the outbreak, another inspection was made on 6 September. This examination was intended to obtain an estimate of numbers, and species distribution of birds affected by the disease. A lack of time and manpower (two man-days) made accuracy difficult.

To obtain the requested data a quadrat (60 by 120 m) was

established along an arbitrarily selected portion of the outlet channel. Another (90 by 90 m) was located along the shore near the outlet. Both transects encompassed upland, open water and emergent vegetation. Roughly 80 percent of each was vegetated by *Scirpus paludosis* and some *Scirpus acutus*. The quadrats were searched on foot and an effort was made to comb the entire area; however, dense emergent cover and lack of manpower made accurate counts difficult.

Our findings were: Outlet channel quadrat, 104 ducks; Green-winged Teal, 48%; Blue-winged Teal, 20%; Mallard, 13%; Pintail, 6%; Unidentified, 13%. Lakeshore quadrat, 35 ducks; Green-winged Teal, 13%; Blue-winged Teal, 11%; Mallard, 14%; Pintail, 23%; Wigeon, 3%, Unidentified, 46%. In addition to the above, one Coot, one Sora, and one unidentified Sandpiper were found.

It should be noted that, on previous inspections, Shoveler and Pintail appeared to comprise a larger proportion of the affected birds than did Mallards.

Total ducks affected were estimated by extrapolating the quadrat information to cover the entire lengths of the channel and shoreline (approximately 180 m and 340 m, respectively). About 300 birds had been removed from the area previously, so these were added to the extrapolation.

Total mortality was estimated to be 725 birds. This estimate is undoubtedly conservative; however, it is not likely that the total number of birds lost would exceed 1,000.

Weather conditions, cool and overcast with some rain, relatively high waterlevels until late July, and



Mallard ducks.

Gary W. Seib

possibly the control measures, were instrumental in preventing a much larger mortality on this project.

Discussion

The presence of epizootic outbreaks of avian botulism on

breeding and moulting areas has significant implications. Although waterfowl populations are more dispersed on these areas, many of disease victims are captive subjects. Thus they may not be subject to one of the most inexpensive methods of

disease control, i.e., herding the birds from a particular area. Furthermore, other control methods that have been used on wintering grounds may become uneconomical on breeding areas. Dr. Jensen (pers. comm.) indicated cost per unit using a system of collection, hospitalization and injection was only \$2.00-\$3.00. To use that figure in a breeding/moulting marsh is probably inapplicable due to low concentrations of birds. Simply stated, we could not likely find enough birds in a small enough area to justify intensive care. However, if a die-off the size of the 1970 outbreak at Old Wives Lake occurred, a temporary treatment center could be attempted, if only to provide a cost-benefit analysis.

Under almost any circumstances, especially on Ducks Unlimited projects, habitat manipulation is the most inexpensive disease control method. Most authors feel that altered habitat conditions can be very effective in preventing or stopping an outbreak.^{3 4 2} They suggest the alteration of gradual sloping shorelines, 18-24" depth, permanent Full Supply Land maintenance, late reflooding (colder water temperature), and either flooding or drainage to alleviate the problem. At the Wood River Delta site there are presently no facilities for these types of manipulation. There the only possible control method would be to herd the birds into the lake proper. However, this involves the risk of moving the disease to different areas of the lake shore. At the Bigstick Lake Extension we do have some water level control, except during midsummer. In 1979, due to control gate problems, we received about 8"-12" of water from the Junction Reservoir irrigation system. We also have the option of dewatering the project, an operation

requiring about five days. The major drawback is that there are many flightless birds, some of which would have difficulty finding alternate water areas.

Our observations lead us to believe that the majority of the dead birds were adult moulters. The low numbers of diving ducks is probably attributable to their preference for moulting in deep, open water areas. One might suggest the disease, by the habitat conditions that encourage its occurrence, is somewhat selective. In fact, the published species composition in botulism outbreaks are fairly uniform. Green-winged Teal, Pintail, Shoveler and Mallard are usually among the largest numbers killed.

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¹BELL, J. F., G. W. SEIPLE and A. A. HUBERT. 1955. A micro environment concept of epizootology of avian botulism. *J. Wildl. Manage.* 19:352-357.

²HUNTER, B. F., W. CLARK, P. PERKINS, and P. COLEMAN. 1970. Applied botulism research including management recommendations. *Prog. Rept. Calif. Dept. Fish and Game, Sacramento.* 87 pp.

³ROSEN, M. N. 1971. Botulism. Pp. 100-117 *In: Infectious and Parasitic Diseases of Wild Birds.* I. W. Davies, R. C. Anderson, L. Karstad, and D. O. Trainer (ed). Iowa State Univ. Press, Ames, Iowa.

⁴WOBESOR, G. N. D. Botulism. Unpubl. Rept. 12 pp.