Type E Botulism in Michigan
An Overview

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Presentation Overview

- Botulism basics
- Die-off along Northern Lake Michigan
  - Quick History - 1960s/70s
  - 2006: limited to Sleeping Bear Dunes
  - 2007: scattered along 100’s miles Northern Lake Michigan
- Basin-wide information from 2007 (via USGS)
- Coordination issues in Michigan
- Next Steps
Botulism basics – part 1

- *Clostridium botulinum* is a natural bacteria in the Great Lakes region.
- These rod-shaped organisms form spores that persist until good growth conditions form.
  - spores can remain in the ecosystem for extended periods of time (years) and are quite resistant to temperature extremes and drying.
Botulism basics – part 2

- The **Toxin** produced by the bacteria is one of nature’s most potent – it seizes up nerve receptors.

  Botulism toxin structure→

  BoTox treatments!

- Botulism is a **neuro-muscular disease**...
Botulism basics – part 3

- **Botulism causes a paralysis**
  - All 7 types of botulism are paralytic to some degree, due to the nature of the neurotoxins produced by the bacteria.

- **Type A or B** – associated with bad canning and toxins are used in facial BoTox treatments!

- **Type C & E** – migrating waterfowl/avian mortalities (and lesser degree fish kills)
  - Type C – marshes/wetlands typically West of Mississippi – documented since early 1900s
  - **Type E** – more prevalent in Great Lakes but has been found in California
Type E Botulism Cycle in the Great Lakes

Sediment
Type E Botulism in Michigan, 1963
1963

- The first waterfowl die-off attributed to Type E botulism toxin occurred in 1963.
- Prior to this die-off Type E botulism was not known to exist in wild birds in North America.
- The 1963 die-off extended from the Indiana border to Leelanau County, nearly the entire Lake Michigan shoreline of the Lower Peninsula.
- **The estimated mortality was 7720 birds** (3300 loons, 4290 gulls, and 130 miscellaneous birds).
1964

- The 1964 die-off occurred along the northern end of Lake Michigan from St. Ignace to Wisconsin.
- **The estimated mortality was 4920 birds** (3570 loons, 820 gulls, 200 grebes, 240 ducks, and 30 miscellaneous birds).
- The die-off occurred between August and October.
  - Gulls in early August in Delta County (Upper Peninsula), and Benzie, Oceana, and north and south Manitou Islands (Lower Peninsula).
Type E Botulism in Michigan, 1965
Type E Botulism in Michigan, 1976

~600 Loons
1983 – Loon Type E Dieoff
* Est. 593 dead loons
* Pre Zebra/Quagga/Goby

1983 to 2005: None Reported
Approximately 1400 Grebes
650 Cormorants
550 Gulls
200 Loons
100 Mergansers
Approximate Area of Summer and Fall 2007 Botulism mortalities Lake MI 3000-7500 birds? Estimate...
Bird species confirmed in 2007 by MDNR Wildlife Lab - from type E botulism in MI

- Common loon
- Long-tailed duck (Oldsquaw)
- Grebes (horned, red-necked)
- White Winged scoter
- Gulls (Herring and Ring Billed)
- 1 Bald Eagle (Benzie Co. Rush Lake)
- 4 Piping Plovers (Benzie Co.)
- Double Crested Cormorant
- Mergansers
Four Endangered Piping Plovers died of Type E Botulism in summer 2007
Most monitored shoreline (NPS personnel and volunteers)
At Sleeping Bear Dunes National Lakeshore

1135 total dead birds 2007 (possibly not all from type E)
Preliminary 2007 Great Lakes Carcass Count = 8319

**Lake Michigan** (June – Dec 2007)
- 3238 reported
- 13 (WI DNR)
- 1135 (Hyde et al)
- 2090 (Common Coast)

**Lake Huron** (Sep – Nov 2007)
- 44 reported (CCWHC)

**Lake Erie** (July – Dec 2007)
- 3237 reported
- 17 (CCWHC)
- ~220 (Presque Isle State Park)
- 3000 (NY DEC; waiting on final NY counts)

**Lake Ontario** (June – Dec 2007)
- 1787 reported so far
- 332 Jefferson County transects
- 1399 Little Galloo Island (Aug–Sep)
- Waiting on NY DEC for final NY counts
- 56 (CCWHC)

- avian mortality reported
Top 5 Species collected by Great Lake

Lake Michigan (3238)
- Common loon (1103)
  - BOT E confirmed by NWHC
- Long-tailed duck (1049)
- Ring-billed gull (355)
- Double-crested cormorant (325)
- White-winged scoter (441)

Lake Huron (57)
- Common loon (34)
  - BOT E confirmed by CCWHC
- Red-necked grebe (10)
  - BOT E confirmed by CCWHC

Lake Erie (3237)
- Gulls (3000)
- Common loon (235)
  - BOT E confirmed by NWHC
- Horned grebe (1)
- Surf scoter (1)

Lake Ontario (1787 so far)
- Ring-billed gull (923)
- Caspian tern (309)
- Double-crested cormorant (153)
- Long-tailed duck (128)
  - BOT E confirmed by NWHC
- Common loon (101)
  - BOT E confirmed by CCWHC
NPS divers est. 10-20 gobies / sq. meter
Gobies dying of Type E?
Notice Pigment Color
Fish eating birds eating dying / paralyzed gobies....and mortalities by the 100’s
Coordination Issues

• Sea Grant held botulism education / coordination meeting February 2008
  - Citizen groups / NGOs / Lakeshore riparians
  - State Agencies
    • MDNR (Wildlife, Law, Fisheries, State Parks)
    • MDEQ Office of Great Lakes
    • Michigan Dept. of Community Health
  - Federal Agencies
    • USGS, USFWS, USDA Forest Service, US National Park Service
  - Tribal Groups
  - Academic / Educational

• What to do with carcasses? Type E Botulism mouse bioassay sampling / confirmation... Counts

• Need research on Ecology of Type E Botulism within Dressenid Mussel Beds to understand linkages
Coordination Issues

- Lengthy shoreline to cover.
- Data collection and preservation.
  # of species for testing, confirmation of cause.
- Identify by species, by county, township/section?
- “Fresh” carcasses must be put in freezer, transported to lab for testing.
- Consistency in message to the public regarding safe/approved techniques. Also, when should people report a suspected die-off, and to whom?
- Volunteers must work under agency permit. Also endangered species, and banding issues, i.e. need to know how to handle.
- State-approved disposal methods. Burying? Bagging?
Counts by Township & Section Number
Along the shore (GPS Coordinates If possible)
General Comments:

• Remind the public that humans will NOT get botulism by swimming in the lake
  – Bacteria killed when meats are cooked – don’t eat raw fish
  – Some concern for dogs / coyotes who might eat dead carcasses but this is quite rare

• Expect another seasonal episode in 2008 – the summer die off and fall die offs
  – Bird / Fish samples must be “fresh” to confirm type E Botulism

• US EPA GLNPO & GL Regional Collaboration is actively tracking this issue and is calling a researcher meeting in June 2008.
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