

Botulism Workshop Highlights 2001-2003

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The Beginning

1998 Pennsylvania and Canadian coastline

- Warmest February and least amount of snowfall on record.
- July - Many dead channel catfish washed up on Presque Isle Beaches.
- August - Complaints of sick and dying gulls by local rehabilitator, Wendy Campbell.
- Dying birds reported along Canadian shoreline.

April to Early October 1999: The Mystery Begins

Erie Morning News Article by Jack Grazier, October 7, 1999

- April – Reports of thousands of dead alewives and gizzard shad along Pennsylvania eastern shores.
- June-July – Heavy beds of *Cladophora* algae washing up onshore.
- Wildlife Rehabilitator, Wendy Campbell, is brought more than a dozen gulls with symptoms of muscular weakness/paralysis.
- Pennsylvania Game Commission Officer, Larry Smith, reports dead gulls appearing all along Lake Erie Shoreline.
- Over 150 dead gulls picked up at Presque Isle State Park.

The Mystery Continues

Erie Morning News Article by Jack Grazier, October 22, 1999

- Pennsylvania Game Commission suspects poisoning as possible cause of gull deaths.
- Canadian Wildlife Service reports shorebirds, gulls and carp are washing ashore at Pelee National Park, Rondeau Provincial Park, and Long Point.
- Pennsylvania sends gulls to the National Wildlife Health Center in Madison, Wisconsin, for testing.

The Mystery Begins to be Unraveled

Erie Morning News Article by John Bartlett, November 2, 1999

- NWHC lab in Madison, confirms Type E Botulism as cause of death of gulls collected from Presque Isle.
- A major die-off of over 6,000 birds is reported (90% mergansers) between Rondeau Provincial Park and Point Pelee on Canadian shores.
 - Type E toxin is confirmed.

Botulism Moves East – 2000

- New York DEC Reports fish and mudpuppy die-offs from Pennsylvania state line to Dunkirk, New York.
- Alewives in March, smallmouth bass in April through June, and 8 sturgeon in August.

- Tests done in late November on carp, zebra mussel, and goby from the Dunkirk area, all were **negative** for Type E botulism.
- **Nov. 16, 2000** – First calls of dead water birds, Type E botulism toxin was cause of mortality.
- **Nov. 27-28, 2000** – Estimate of 5,400- 6,500 dead birds on shoreline.
- **Dec. 4, 2000** – 1,100 birds collected, scattered along the shoreline.

Avian Botulism in Lake Erie Workshop

January 24-25, 2001 – Erie, Pennsylvania

- Co-Sponsored by: New York and Pennsylvania Sea Grant
- Goal was to share information bi-nationally.
- Create a functioning network of government agency and university experts.
- Collaborate on research issues and develop a response plan for future outbreaks.

State and Provincial Updates for 2001

- Reports of extensive fish and mudpuppy kills (20 species affected). Freshwater drum, smallmouth, rock bass, sturgeon, carp, catfish and other benthic species.
- Soft-shell and map turtles dying in Presque Isle Bay. Botulism?
- Extensive *Cladophora* algal blooms wash ashore.
- Pennsylvania Fish and Boat Commission near-shore trawl data, gobies 70% of biomass.
- Freshwater drum 81% of dead fish on New York shoreline, 27 dead lake sturgeon collected.
- Lake Erie mortality 100 meter transect surveys 2,862 waterfowl of 18 species.
- Increased occurrences of round gobies in the die-off events of fish.
- Summary of Type E Botulism tests conducted from 1998-2001, and stomach contents from birds dying in botulism events. Round gobies and other fish were the main food identified in the stomach.
- Dead birds reported in Lake Ontario (unconfirmed).

Summary of First Workshop

- More than 60 researchers, fishery and wildlife biologists attend.
- Current knowledge and history of avian botulism outbreaks.
- Research and outreach priorities were discussed and developed. Botulism Taskforce was formed to improve communication.

Research:

- **Dr. Campbell** – Gull mortality summer to fall. Loon and merganser die-off in late fall. Die-offs seem to occur following changes in weather.
- **Dr. Baker** – Suggested to look for perturbations on the ecosystem, like significant change in wind or weather patterns.
- **Dr. Murphy** – Suggested that research is needed on the impacts of microcystines on fish and ducks.

February 28, 2002 – Buffalo, New York

- Co-Sponsored by: New York, Ohio and Pennsylvania Sea Grant
- Over 100 in attendance.

Presenters 2002

- **Dr. J. Michael Campbell** (Mercyhurst College) – Presented history of botulism Type E outbreaks in the Great Lakes and showed historical correlations with declining lake levels, invasive species (alewives) invasion, and association of kills with major storm events and internal seiche events.
- **John C. Lyons** (MD, FACS, MSME) – Presented facts about botulism in humans, particularly the bacterial genus *Clostridium*, and the interrelationship with avian botulism. The pathogenesis of *Clostridium*, clinical syndrome and treatments, and survival rates were discussed.
- **Dr. Rod Getchell** (Cornell University) – Discussed a project that will focus on the role of fish in the recent documented outbreaks of botulism in waterfowl and the suspect botulism in fish in the lower Great Lakes.

Four questions to be addressed in this study:

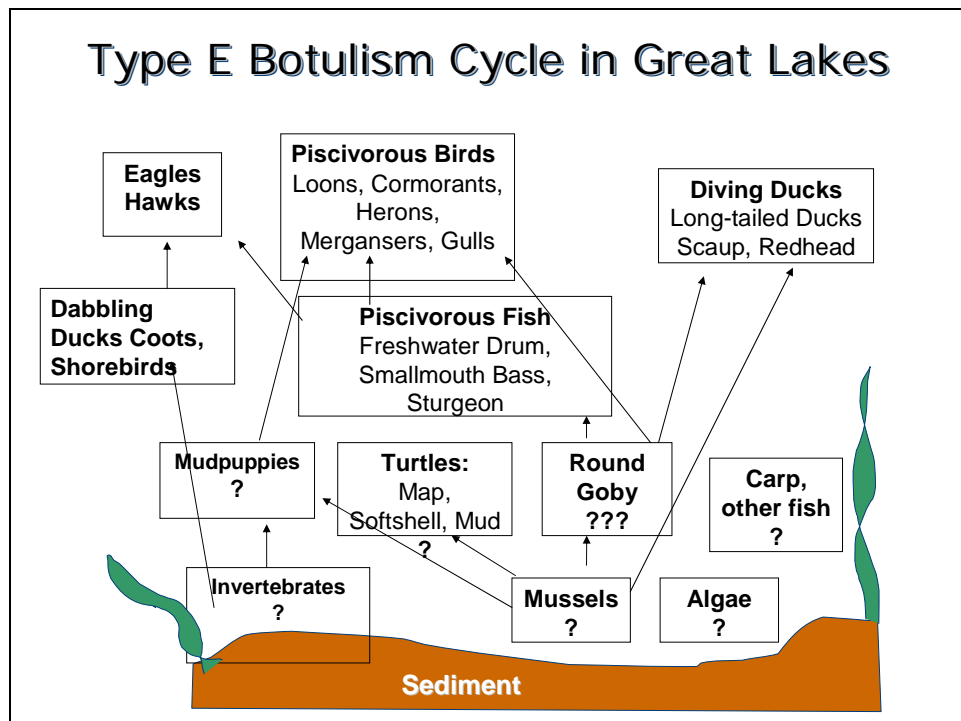
- Is *Clostridium botulinum* more likely to be present in the intestinal tract or tissues of healthy, moribund, or dead fish?
 - Is one species of fish more likely to carry *Clostridium botulinum* than another?
 - Does *Clostridium botulinum* toxin form in these fish ante- or post- mortem?
 - Are fish carrying *Clostridium botulinum* associated with waterfowl mortality events?
- **Dr. Grace McLaughlin** (USGS) – Discussed the National Wildlife Health Center's role and summarized the findings of Type E botulism in the Great Lakes.

Non-avian mortality

Algae

Environmental correlates

Population effects



Presenters 2002

- Ward Stone (NYDEC) – Presented overview of pathological work conducted in his lab in 2001.
- Type E botulism was first found in Lake Erie in 1999, NYSDEC first identified Type E in the fall of 2000.
- Long-tailed ducks (2001) tested positive for Type E and were feeding on quagga mussels.
- Type E was found in fish alimentary canals (gut content).
- Type E was found in freshwater drum gut and tissue samples.
- Type E was found in mudpuppies.
- Maggots (fly larvae) had Type E toxin.
- Mudpuppies and round gobies were found in the guts of gulls, mergansers and loons.

Update 2002 Pennsylvania

- March, May – dead alewives, turtles observed.
- June – dead gobies and mudpuppies.
- Less *Cladophora* algae than in past years.
- July – Dying smallmouth bass sent for analyses (-negative)
- Mortality probably due to rapid temperature drop 75°F to 50°F in 2 days.
- Large die off of common loons in October.
- **Ohio** – Report of dead gulls showing up on eastern beaches.

Update 2002 New York

- Fish kills observed similar to Pennsylvania.
 - March-April: alewives, gizzard shad – temperature stress
 - May-June: smelt – spawning, *Glugea*
 - June-July: smallmouth bass – spawning? upwelling?
 - June-August: warmwater species, upwelling
- Gobies forage fish composition
 - 2000 - declining in Western basin, increasing in the east.
 - 2001 - huge numbers in Eastern basin.
 - 2002 - decline in abundance.
- Ward Stone – 7,000 submissions for botulism testing.
- Round gobies and mudpuppies found in many birds.
- 1 opossum and 2 raccoons positive for Type E.
- Long-tailed ducks eating quagga mussels - source of Type E.
- Fed loon livers to gobies and induced mortality.
- Waterfowl positive for Type E in Lake Ontario.

Canada Update

- Several Erie events
 - June, July, August - gulls, terns, cormorants
 - September - gulls, cormorants
 - October - gulls
 - Late October and November - common loon, long-tailed duck, red-breasted merganser

- Huron - October
 - Grebes, mergansers, loons
 - Goderich and Port Elgin

April 3, 2003 – Buffalo, New York

Co-Sponsored by: New York, Ohio and Pennsylvania Sea Grant

Grace McLaughlin (USGS) Type E botulism Outbreaks in the Great Lakes

<u>Year</u>	<u>Lake</u>	<u>Number</u>	<u>1° Species</u>
1963-4	Michigan	>12,000	Gulls, Loons
1976-83	Michigan, Huron	>1800	Gulls, Loons
1998-2002	Huron, Michigan	~2500	Mergansers, Gulls, Loons
1999-2001	Erie	>25,000	Mergs, Gulls, Loons
2002	Erie	>25,000	Long-tailed ducks, Gulls Loons, Mergansers Cormorants

Research Update from the Lake Erie Botulism Conference of April 3, 2003

Research findings from:

Perez *et al.* – SUNY Fredonia

Bowser *et al.* – Cornell Univ.

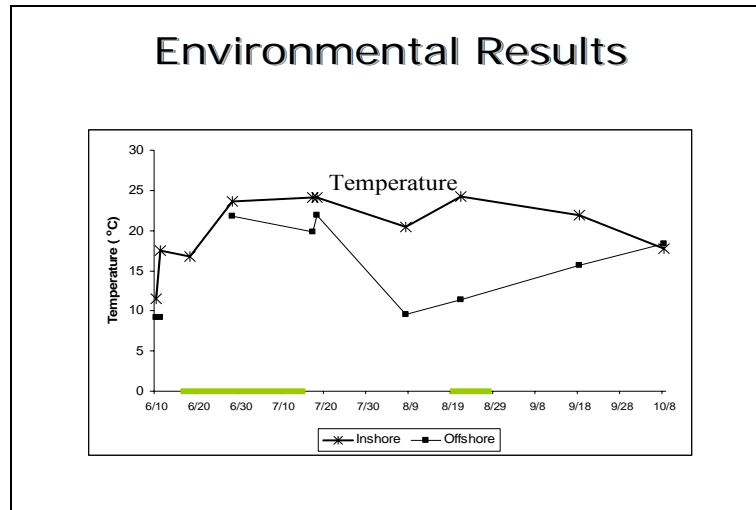
Robinson *et al.* – Ontario/Guelph

Physical-Chemical Parameters being studied by SUNY Fredonia researchers

- 0.5 m above sediment.
- Multiparameter Meter YSI 556:
 - Temperature
 - Dissolved Oxygen
 - Conductivity
 - Salinity
 - Total Dissolved Solids
 - pH
 - Redox Potential

Summary of Work by Perez *et al.*

- One large algal bloom in June was correlated with decreased visibility and fish mortalities.
- Temperature increased and Dissolved Oxygen and pH decreased during the two outbreak events (June/July, August).
- Weather events during the season 2002 that may explain mixing of the water column and changes in lake conditions.



Perez *et al.*

Research Plans for Cornell - Bowser *et al.*

- Make a greater effort to collect fish during botulism outbreaks, particularly round gobies and freshwater drum.
- Collect sediment and quagga mussels from outbreak areas to further analyze the food chain path that Type E Botulism is following.

Results from Cornell

- Measured significant numbers of *Clostridium botulinum* Type E in dead and dying freshwater drum during three die-offs in July of 2001 near Dunkirk and Barcelona Harbor on Lake Erie.
- Measured detectable levels of *Clostridium botulinum* Type E in one apparently healthy five fish pool of smallmouth bass from Dunkirk, New York.

Research in Canada - Robinson *et al.*

- Distribution of fish and bird mortality events (OMNR, CWS).
- Stomach examination of fish eating birds to determine food habits (OMNR, Canadian Cooperative Wildlife Health Centre).
- Loon population analysis for Ontario breeding lakes (CWS).
- Experimental dosing of fish with Type E toxin to:
 - evaluate toxic dose.
 - fish behavior relevant to consumption by fish-eating birds.
 - tissue distribution.
 (R.D. Moccia - University of Guelph).

Results from Moccia *et al.*

- **LOSS OF EQUILIBRIUM:** In a natural setting, fish showing equilibrium loss could represent “easy” prey for live-fish eating birds. Thus, such birds could be targeting intoxicated fish due to their abnormal behavior.
- **BREACHING BEHAVIOR:** In a natural setting, fish showing breaching behavior would present an “easy” target for predators and maximize botulism toxin ingestion.