



NORTHERN LAKE MICHIGAN BOTULISM NETWORK

BEACH RANGER MANUAL ***2008***

**The Watershed Center- Grand Traverse Bay
13272 West Bay Shore Drive
Traverse City, MI 49684
231.935.1514
www.gtbay.org**

TABLE OF CONTENTS

Introduction to the Northern Lake Michigan Botulism Network

Communications

- a. Contacting the Northern Lake Michigan Botulism Network
- b. Botulism Hotline Response Card

Beach Ranger Responsibilities

- Community Outreach
- Bird Sampling
- Bird Disposal
- Beach Monitoring

The Botulism Response Tool Kit

Botulism Basics

- What can I do to help?
- How are humans and pets affected by Botulism?
- What is Botulism?

Resources

- Great Lakes Watershed Contacts
- References

Bird Identification Guides

INTRODUCTION

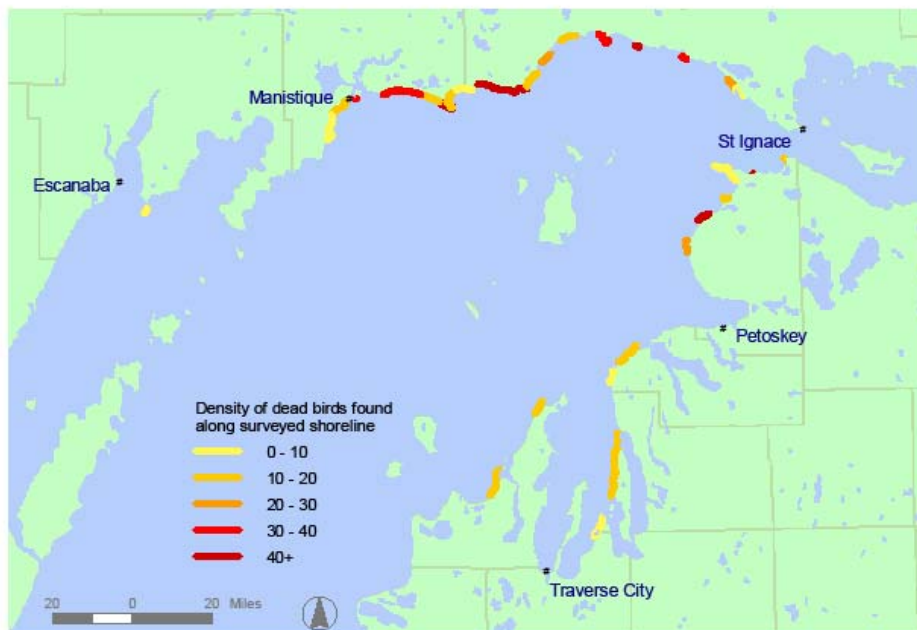
NORTHERN LAKE MICHIGAN BOTULISM NETWORK

WHO WE ARE... We are a group of concerned citizens who care about the Great Lakes and are concerned about the significant die-offs of waterbirds associated with Botulism E outbreaks.

WHAT WE DO... We monitor beaches along Northern Lake Michigan and respond to avian botulism outbreaks. The data we collect will help to quantify the scale of waterbird die-offs and will be used to support efforts to understand the dynamics of botulism events.

WHERE WE WORK... We are working to protect the beaches and near shore habitats of Northern Lake Michigan.

Autumn 2007 bird mortalities in northern Lake Michigan
Shoreline survey effort by Common Coast Research & Conservation – DRAFT



HOW THE NETWORK OPERATES...When people observe bird die-offs on the beach, they should call The Watershed Center in Traverse City, Michigan.

The Botulism Hotline number is **(231.935.1514)**.

The Watershed Center will contact the County Coordinator, who will call the nearest Beach Ranger.

The Beach Ranger will return the phone call and follow-up as needed. In addition we are conducting surveys to identify beached birds along established transects.

COMMUNICATIONS

HOW YOU CAN REACH US... We operate from Traverse City, Michigan.

THE WATERSHED CENTER- GRAND TRAVERSE BAY

Andy Knott, Executive Director
13272 West Bay Shore Drive
Traverse City, MI 49684

Phone: 231.935.1514

Fax: 231/935.3829

Email: info@gtbay.org

Website: www.gtbay.org

GRAND TRAVERSE BAY REGION

Project Coordinator: Peg Comfort
Phone: 231.676.0566

White Pine Associates
Email: whitepine@torchlake.com

LITTLE TRAVERSE BAY REGION

Project Coordinator: Kevin Cronk
Phone: 231.347.1181

Tip of the Mitt Watershed Council
Email: kevin@watershedcouncil.org

UPPER PENINSULA REGION

Project Coordinator: Joe Kaplan
Phone: 906.487.9060

Common Coast Research & Conservation
Email: commoncoast@gmail.com

Northern Lake Michigan Botulism Network- Partner Organizations

The Watershed Center: Grand Traverse Bay- Andy Knott

Michigan Sea Grant- Mark Brederland

Sleeping Bear Dunes National Lakeshore- Ken Hyde

Common Coast Research and Conservation- Joe Kaplan

Inland Seas Education Association- Christine Diana

Michigan Loon Preservation Association- Ross Powers

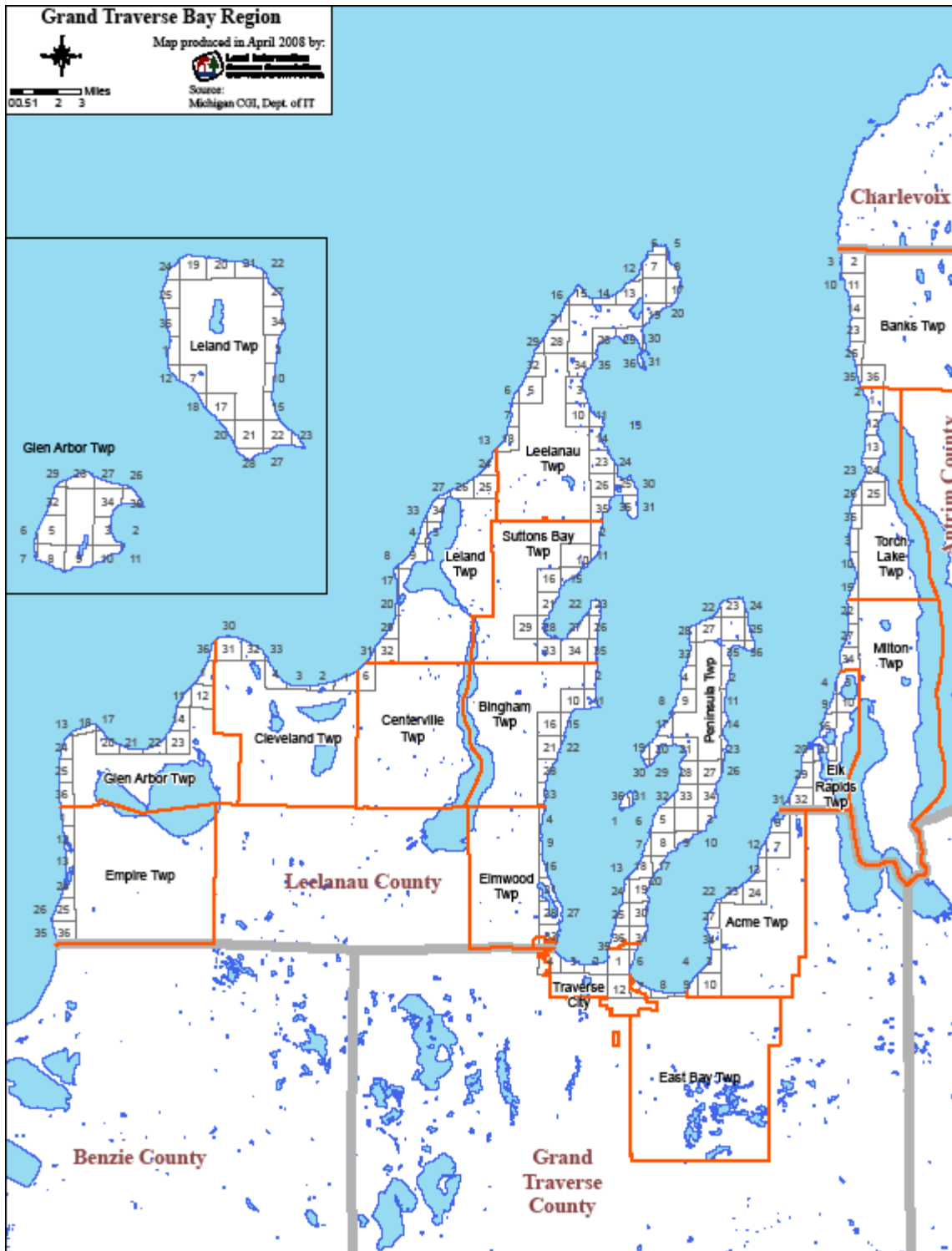
Tip of the Mitt Watershed Council- Kevin Cronk

White Pine Associates- Peg Comfort

NORTHERN LAKE MICHIGAN

BOTULISM NETWORK

COUNTY	COUNTY COORDINATOR	PHONE	EMAIL
Alpena	Kevin Cronk	231.347.1181x109	kevin@watershedcouncil.org
Antrim	Peg Comfort	231.676.0566	whitepine@torchlake.com
Benzie	Mark Breederland	231.922.4628	breederl@msu.edu
Charlevoix	Kevin Cronk	231.347.1181x109	kevin@watershedcouncil.org
Cheboygan	Kevin Cronk	231.347.1181x109	kevin@watershedcouncil.org
Delta	Joe Kaplan	906.487.9060	commoncoast@gmail.com
Emmet	Kevin Cronk	231.347.1181x109	kevin@watershedcouncil.org
Grand Traverse	John Nelson	231.935.1514	baykeeper@gtbay.org
Leelanau	Christine Crissman	231.271.3077	crrissman@schoolship.org
Leelanau-Sleeping Bear Dunes National Lakeshore	Ken Hyde	231.326.5134 X422	Ken_Hyde@nps.gov
Mackinac	Joe Kaplan	906.487.9060	commoncoast@gmail.com
Manistee	Mark Breederland	231.922.4628	breederl@msu.edu
Menominee	Joe Kaplan	906.487.9060	commoncoast@gmail.com
Presque Isle	Kevin Cronk	231.347.1181x109	kevin@watershedcouncil.org
Schoolcraft	Joe Kaplan	906.487.9060	commoncoast@gmail.com



BOTULISM HOTLINE
PHONE: 231.935.1514
EMAIL: aknott@gtbay.org

RESPONSE INSTRUCTIONS

1. Receive phone call from concerned citizen.
2. Record contact information on spreadsheet:
 - a. name
 - b. address
 - c. phone number
 - d. email
 - e. county
 - f. location on Transect Map
3. Record observations on spreadsheet:
 - a. number of dead birds observed
 - b. species of dead birds observed
 - c. loons observed- yes/no
 - d. banded birds observed- yes/no
4. Ask caller to take pictures and send to: aknott@gtbay.org
5. If the observed birds are loons/banded birds:
 - a. Then contact the appropriate County Coordinator.
 - b. The County Coordinator will make arrangements with the caller to visit the site.
6. If the observed birds are not loons/banded birds, then tell the caller:
 - a. If the birds are not located on your property, then leave the birds alone.
 - b. If the birds are located on your property, then wear plastic gloves and do one of two things:
 - 1) Place bird in plastic bag and dispose of bird in household trash.
(Do not compost.)
 - 2) Bury bird in sand away from shoreline at least 2 feet deep.
7. Give Safety Instructions:
 1. Wear plastic gloves.
 2. Dispose of gloves and plastic bags in household trash.
 3. Wash any tools used such as shovels.
 4. Wash hands after handling.
8. Thank the caller for reporting to the Botulism Hotline.
9. Tell the caller, "This information will be helpful in determining where die-offs are occurring and which species of birds are affected."
10. Call or Send Email to the County Coordinator.

BEACH RANGER RESPONSIBILITIES

Beach Rangers are responsible for:

- 1) Becoming familiar with accurate, up-to-date information about botulism and its impact on the Great Lakes Ecosystem
- 2) Clearly communicating accurate information to the public through *Community Outreach*
- 3) Participating in *Beach Monitoring* activities
- 4) Following recommended protocols for *Beach Monitoring* developed by Common Coast Research and Conservation, Inc.
- 5) Following recommended protocols for *Bird Sampling*
- 6) Following recommended protocols for *Bird Disposal*.

The protocols were developed by the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Michigan Department of Community Health and Michigan Sea Grant.

Community Outreach

1. After The Watershed Center (TWC) contacts you, please return the phone call promptly. They will give you the contact number and address of the concerned citizen who called TWC.
2. Complete the top half of the *Sampling Form* with the name, address and contact information of the person who called.
3. Call the person and set up a time to visit the site.
4. Make sure your Tool Kit is complete.
5. Visit the site and assess the situation.

Bird Sampling

1. Complete the bottom half of the *Sampling Form*.
2. Complete a *Sampling Form* for each bird
3. Be sure to wear rubber, plastic or disposable gloves!
4. Any bird collected for submission for a necropsy or botulism testing must be freshly dead. Presence of a bad smell or maggots is evidence that the bird has been dead longer than 24 hours and is not acceptable for testing.
5. Tag no more than 2 carcasses of each species of the other Migratory Birds. Submission of birds for examination and testing is *limited to two individuals per species per county*. Once the disease is confirmed in a county, no additional testing will be needed on that species. Please use MDNR Necropsy Specimen Tags and print information using a Sharpie Extra-fine Point Permanent Marker.

**NOTE: This limit does not apply to loons.
Please collect ALL banded birds and ALL juvenile loons.**

MDNR NECROPSY SPECIMEN TAG

1. NECROPSY NUMBER: (to be completed by MDNR) SPECIES:
2. SEX: (if known) AGE: (adult/juvenile)
3. COUNTY: COLLECTED: (number of this species)
4. Township: Range: Section:
5. COLLECTOR'S NAME & ADDRESS:
6. DNR EMPLOYEE NAME & WORKSTATION
 Rich Earle, Traverse City Field Office
7. HISTORY
 Date Collected:
 Numbers and Species involved in die-off:

6. Tag Banded Loons or Juvenile Loons:

COMMON COAST

Date:

County:

Township: Range: Section:

Collector's Name:

Collector's Address:

7. Take a picture of each bird before bagging.

8. Put birds on ice as soon as possible.

9. Contact your County Coordinator and then take birds to the nearest MDNR Office:

ATT: Rich Earl
MDNR Traverse City Field Office
970 Emerson Road
Traverse City, MI 49686
(231.922.5280)

10. MDNR field personnel will forward specimens to the MDNR Wildlife Disease Lab in Lansing for botulism testing and necropsy.

11. Mail your completed *Sampling Forms* to The Watershed Center.

NORTHERN LAKE MICHIGAN BOTULISM NETWORK

SAMPLING FORM

DATE: _____ **OBSERVER:** _____
Month-Day-Year

LOCATION

COUNTY: ___ Antrim ___ Benzie ___ Grand Traverse ___ Leelanau

PROPERTY OWNER'S NAME: _____

PHONE: _____ EMAIL: _____

STREET ADDRESS: _____

NEAREST CROSSROADS: _____

NEAREST TOWN: _____ ZIP CODE: _____

TOWNSHIP: _____ SECTION: _____

SAMPLE

SPECIES: _____

AGE: ___ Adult ___ Sub Adult ___ Juvenile

BANDING: ___ Yes ___ No

BANDS: Colors _____ Numbers _____

CONDITION: ___ Newly dead ___ Partially decomposed ___ Totally decomposed

TAGGED: ___ MDNR ___ Common Coast Research

SUBMITTED MDNR Sick or Dead Bird and Mammal Observation Report: ___ Yes ___ No

OBSERVER INFORMATION

NAME: _____ PHONE: _____

BOTULISM NETWORK RANGER: ___ Yes ___ No

MICHIGAN AUDUBON MEMBER: ___ Yes ___ No

LICENSED REHABILITATOR/VETERINARIAN: ___ Yes ___ No

Bird Disposal

- 1. DO NOT HANDLE BIRDS WITH YOUR BARE HANDS!**
2. Wear gloves or use a garbage bag over your hand to collect bird carcasses.
3. Place birds in garbage bags. The number of birds per bag will depend on the size of the birds and the quality of the garbage bags.
4. Dispose of carcasses by placing the garbage bag in your household trash or by burying them. Do not place them in a compost pile.
5. You can bury animal carcasses on your property only, unless you receive permission from other property owners to remove carcasses from their land.
6. If you bury carcasses, then dig a hole at least two (2) feet deep away from the shoreline. Burying them to this depth will discourage other animals from unearthing them.
7. Remove the carcasses from the garbage bag(s) and then bury them.
8. Once you finish handling the carcasses, you should dispose of your gloves in a garbage bag and put them in the trash that is going to a landfill.
9. Sanitize your hands and any tools you used.

Beach Monitoring

Before you begin the Beach Monitoring:

1. Make sure your Tool Kit is complete.
2. Complete the top portion of the ***Monitoring Form***.
3. Use a separate form for each transect you conduct.
4. Set the datum on your GPS to UTM NAD83.

Conducting the Beach Monitoring:

1. At the beginning of the transect, mark the GPS location (GPS start) and add this location to a *route* on your GPS.
2. Mark the starting point with a wooden stake that you will be able to identify during future surveys. Make a GPS coordinate and make note of an easy to find location like a road end.
3. You may want to add waypoints along your route where the shoreline deviates from a straight line.
4. Carefully look for birds between the water and the high water mark. Birds are often deposited far from the water during storm activity or carried up the beach by scavengers.
5. Use the identification keys to identify unknown birds.
6. If you can not identify the bird to species, enter it as “Unidentified” and photograph the bird. Please do not guess at the identity of the bird.
7. Please note that there are categories for Unidentified Mergansers, Unidentified Waterbirds and Unidentified Gulls.
8. Tally all dead and sick birds encountered by species on the ***Monitoring Form***.
9. Inspect every bird carcass for USFWS leg bands or colored bands.
Bands are located above the feet and can be found on either or both legs.

10. If a banded bird is found:
 - a. Photograph the bird in place.
 - b. Tag the carcass: with an MDNR Necropsy Specimen Tag.
 - c. Wear plastic gloves and collect the entire carcass in a garbage bag.
 - d. Record the GPS location.
11. Mark each bird using athletic field spray paint/nail polish on the bill and toe nails to avoid recounting.
12. Record observations/comments on the *Monitoring Form*.

Finishing the Beach Monitoring:

1. When your route has reached one (1) mile, then stop the Survey. You may do transects that are longer than one mile, but please record birds in each one mile segment.
2. Mark the GPS location of the end of your transect (GPS end).
3. Mark the location with a wooden stake. Leave the stake for the duration of the Survey period.
4. You may report birds that you observe beyond the transect but record them on a separate data sheet marked, "Casual Observations."
5. Mail completed *Monitoring Forms* to:

The Watershed Center
13272 West Bay Shore Drive
Traverse City, Mi 49684

NORTHERN LAKE MICHIGAN BOTULISM NETWORK

MONITORING FORM

Date: _____
(mm/dd/yyyy)

Observer: _____

GPS start: _____ / _____
(UTM NAD83)

GPS end: _____ / _____
(UTM NAD83)

Location: _____
(use landmarks or roads to describe start and end points)

County: _____ **Township/Range:** ___N ___W **Section:** _____

Species	Number dead	Number sick	Comments
White-winged Scoter			
Long-tailed Duck			
Bufflehead			
Common Goldeneye			
Common Merganser			
Red-breasted Merganser			
Unidentified Merganser			
Common Loon			
Horned Grebe			
Red-necked Grebe			
Double-crested Cormorant			
Unidentified Waterbird			
Ring-billed Gull			
Herring Gull			
Unidentified Gull			
Comments:			

THE BOTULISM TOOL KIT

Remember to check your Tool Kit and make sure it is complete before going to the beach! Plastic bins work great for keeping everything together. A sled really helps if you have to haul large birds any distance.

TOOLS

1. GPS
2. camera
3. binoculars
4. surveyor tape
5. trifold shovel
6. plastic sled
7. large cooler with ice packs

SUPPLIES

1. batteries
2. plastic gloves
3. force flex plastic bags
4. athletic field marking spray paint/nail polish
5. masking tape
6. MDNR Necropsy Specimen Tags with wire
7. Sharpie marker- fine point
8. pencils with small sharpener
9. Sampling Forms
10. Monitoring Forms
11. Maps (County Road Map, Regional Map showing township, range and sections)
12. Hand sanitizer

IDENTIFICATION GUIDES

1. Beached Bird Guide for Northern Lake Michigan
2. A Guide to Aging Common Loons
3. Birds of the Great Lakes
4. Guide to Birds and Fish of Lake Michigan's Shore

BOTULISM BASICS

Frequently Asked Questions

Botulism is a neuromuscular disease caused by the bacterium *Clostridium botulinum*. Botulism poisoning of fish and wildlife has recently increased in the Great Lakes Basin. Researchers, state and federal agencies and a variety of non-government organizations are monitoring the occurrences of botulism and investigating the possible causes behind these outbreaks.

This information provided is designed to answer questions that occur when there is a botulism outbreak in a specific area of the Great Lakes and to explain the associated ecological implications.

Recent botulism outbreaks have primarily impacted bird populations, although some species of bottom-dwelling fish have suffered localized die-offs. The threat to human health is minimal, and the only documented cases of human sickness resulting from Type E botulism were caused by consumption of cold smoked, vacuum packed fish during the 1960s.

This information is provided so that hunters, recreational anglers, coastal residents and interested citizens can take simple, common sense precautions to reduce or eliminate any risk from handling or consuming waterfowl or fish that have been exposed to botulism toxin. *Source: Michigan Department of Environmental Quality, 2007 and Michigan Sea Grant, 2007.*

Topics:

What can I do to help?

How does Botulism affect Human & Pet Health?

What is Botulism?

What can I do to help?

- What steps can I take to help stop the spread of botulism?*
- How should I notify authorities of a potential botulism related fish or bird kill?*
- How can people who want to help clean up the beach after a bird kill best protect themselves?*
- What is the best way to dispose of dead fish/birds in my area, especially after a botulism outbreak?*
- Is rehabilitation of sick birds possible? If so, how, and who should I contact about it?*

What steps can I take to help stop the spread of botulism?

Identifying possible cases of avian botulism at the early stages is the key to effective control. Public awareness of the conditions that lead to avian botulism and prompt corrective action can greatly reduce the epidemics which now claim hundreds of thousands of birds each year. Sick and dead birds in areas of avian botulism epidemics should be reported immediately. (v)

Contact The Watershed Center- Grand Traverse Bay (231.935.1514) to aid in their efforts to monitor outbreaks, and they can provide you with answers to additional questions regarding disposal of dead birds to help prevent the spread of botulism, as the bacteria in the carcasses can serve as the source of outbreaks for months.

How should I notify authorities of a potential botulism related fish or bird die-offs?

In case of a die-off, contact The Watershed Center- Grand Traverse Bay (231.935.1514). They will send a Beach Ranger to your beach. The Beach Ranger will record the location, type of birds or fish, and number of carcasses found. (ix)

By reporting accurate information about botulism, you will assist natural resources managers and research scientists.

How can people who want to help clean up the beach after a bird kill best protect themselves?

Always report die-off before disposing of dead birds!

People who handle dead wildlife should wear protective gear, such as disposable rubber gloves or an inverted plastic bag over their hands. In cases where a diseased or dead bird is handled without gloves, hands should be thoroughly washed with hot, soapy water or an anti-bacterial cleaner.

- ***What is the best way to dispose of dead fish/birds in my area, especially after a botulism outbreak?***

Be sure to follow the recommended protocols explained in this manual. (ix)
They have been developed by the Michigan Department of Natural Resources,
Michigan Department of Environmental Quality, Michigan Department of Community
Health and Michigan Sea Grant.

- ***Is rehabilitation of sick birds possible? If so, how, and who should I contact about it?***

Rehabilitation is unusual, but may be possible in cases where birds did not ingest a large amount of the toxin. Recovery can be aided by providing these birds with rest, fresh water and shade. They should be protected from predators during this process.

A botulism antitoxin is available, but it requires special handling and must be given early on. Surviving an outbreak will NOT give birds immunity to botulism. (x)

Please remember that extreme caution should be practiced when handling wildlife. Contact the MDNR Traverse City Field Office (231.022.5280).

Human & Pet Health

- *Is it safe to eat fish/waterfowl?*
- *Can I get botulism?*
- *Can I swim in the water?*
- *Is it safe to walk dogs on the beach after a bird kill?*
- *Will my dog get sick if it eats a dead bird?*
- *Do I have to wash my hands after I touch a dead bird?*
- *What steps should I take when preparing healthy fish or birds for consumption to ensure maximum safety?*

- ***Is it safe to eat fish/waterfowl?***

When fishing or hunting on the Great Lakes, you should only harvest fish and waterfowl that act and look healthy. Don't take any fish or game that show signs of illness, and follow good sanitary practices when preparing them. (viii)

It is especially important to stay away from the gut area when cleaning fish; filleting is recommended. Similarly, when preparing waterfowl, the gut should be immediately removed and care should be taken to not disturb the gut contents. (See also: *What steps should I take when preparing healthy fish or birds for consumption to ensure maximum safety?*)

□ ***Can I get botulism?***

Yes. Botulism in humans is usually caused by the consumption of improperly home-canned foods and is most often a result of the Type A or Type B botulinum toxin. A few cases of Type E botulism in humans have been reported in North America as the result of eating improperly smoked or cooked fish, but these cases are very rare.

Thorough cooking is necessary to destroy the bacteria and bacterial toxins. The U.S. Food and Drug Administration recommends cooking food for 10 minutes or longer at 176°F/80°C to destroy the toxin.

As a precaution, any fish or waterfowl that are sick or act abnormally should not be harvested or eaten because cooking may not destroy the botulism Type E toxin.

More information on botulism from a human health and food safety standpoint can be obtained through the USDA Food Safety Research Information Office's Clostridium botulinum resource list at:

http://fsrio.nal.usda.gov/document_reslist.php?product_id=137).

(See also: What steps should I take when preparing healthy fish or birds for consumption to ensure maximum safety?)

□ ***Can I swim in the water?***

Yes. You are not at risk for botulism poisoning by swimming in Great Lakes waters. Botulism is only contracted by ingesting fish or birds contaminated with the toxin.

If you have concerns about water quality, contact your local health department, The Watershed Center- Grand Traverse Bay or swim in a regulated beach area.

Remember that beaches sometimes close for other reasons such as fecal contamination.

(More information regarding beach advisories can be found through the U.S. EPA's Beaches website at, www.epa.gov/beaches.)

□ ***Is it safe to walk dogs on the beach after a bird kill?***

Yes. If you bring pets to the shore, keep them away from dead animals on the beach.

□ ***Will my dog get sick if it eats a dead bird?***

Dead wildlife may contain potentially harmful bacteria or toxins. In cases where you think your pet may have ingested a contaminated carcass, monitor for signs of sickness and contact a veterinarian if you suspect they are falling ill.

□ ***Do I have to wash my hands after I touch a dead bird?***

Yes, you should always wash your hands after handling any wildlife. Ideally, you should always wear gloves to handle any dead animal.

□ ***What steps should I take when preparing healthy fish or birds for consumption to ensure maximum safety?***

1. Wear rubber or plastic protective gloves while filleting, field dressing, skinning or butchering.
2. Remove the intestines of birds soon after harvest, don't eat the intestines and avoid direct contact with intestinal contents.
3. Fish should be filleted, and contact with any gut material should be avoided.
4. Hands, utensils and work surfaces should be washed before and after handling any raw food, including fish and game meat.
5. Please remember that proper and thorough cooking is necessary to destroy disease-causing organisms that occur naturally or that can be introduced during handling, storage, or preparation.
6. Contact your local health agency for more detailed information on other possible health and fish consumption advisories.

Information on Clostridium botulinum is available in the Bad Bug Book through the U.S. Food and Drug Administration:
(<http://vm.cfsan.fda.gov/~mow/chp2.html>).

Information on Great Lakes fish consumption advisories is available through the Great Lakes Information Network (GLIN) website:
(<http://www.great-lakes.net/envt/florafauna/wildlife/fishadv.html>).

General information on food preparation is also available through the Food Safety Research Information Office of the USDA, Department of Agriculture:
(http://fsrio.nal.usda.gov/document_reslist.php?product_id=130).

What is Botulism?

- What is botulism?*
- What species are affected by Type E botulism? Type C botulism?*
- Is Type E botulism responsible for the recent bird and fish kills?*
- Where does botulism come from?*
- How do birds end up dying as a result of the botulism toxin?*
- Why are we so concerned about avian botulism outbreaks?*
- Has botulism always been in the Great Lakes?*
- Why are botulism outbreaks occurring now?*
- Is there a link between botulism outbreaks and fluctuating water levels?*
- What are some possible symptoms that an animal with botulism could display?*
- Why is it difficult for scientists to positively determine that birds have died from Type E botulism?*
- Do the recent algal blooms of the macroalgae Cladophora play any role in the botulism outbreaks?*
- Are inland lakes susceptible to Type E botulism outbreaks?*

What is botulism?

Botulism is a serious neuromuscular illness caused by a toxin that is produced by the bacterium *Clostridium botulinum*. Avian botulism has been recognized as a major cause of mortality in migratory birds since the 1900s. Human botulism is typically caused by eating improperly canned or stored foods. The bacterium is classified into 7 types (A-G) by characteristics of the neurotoxins that are produced. Four of these types (A, B, E and rarely F) cause human botulism, while types C, D and E cause illness in mammals, birds and fish. All types of botulism are paralytic to some degree, due to the nature of the neurotoxins produced by the bacteria.

The following are the four most common types of botulism:

- *Type A or Type B botulism* is most commonly caused by the consumption of bacteria in improperly home-canned foods. Diluted and purified forms of the type A and B toxins are also used in certain facial aesthetic products.
- *Type C botulism* and *Type E botulism* are responsible for extensive waterfowl and some fish kills. They are both brought on by the consumption of these particular types of the botulinum toxin through food web interactions. Type C botulism mostly impacts waterfowl (especially ducks) and is typically restricted to marshes and wetlands in prairie regions, primarily found west of the Mississippi River. Type E botulism is more prevalent in the Great Lakes, but has also been documented in California.

□ ***What species are affected by Type E botulism? Type C botulism?***

A large number of bird and fish species are susceptible to the Type E botulinum toxin, as are some amphibians, like mudpuppies, and most mammals. A few cases of Type E botulism in humans have been reported in North America and were the result of eating improperly smoked or cooked fish, but these types of cases in humans are rare.

Loons, mergansers, long tail ducks, grebes, scaup, cormorants and gulls in particular are the bird species affected by Type E botulism.

Commonly affected fish species include, Freshwater Drum (Sheepshead), Smallmouth Bass, Rock Bass, Stonecats, Round Gobies, Channel Catfish and Sturgeon. (i)

Type C botulism outbreaks on prairie wetlands have mainly affected ducks, coots, grebes, gulls and other shorebirds. (ii)

□ ***Is Type E botulism responsible for the recent bird and fish kills?***

Yes. Pathology conducted on victims of the recent die-offs points to Type E botulism as the cause. Type E Botulism is contracted by ingesting invertebrates, fish or birds contaminated with the toxin (*Clostridium botulinum*).

□ ***Where does botulism come from?***

Botulism spores (the resting stage of the bacteria) are abundant in anaerobic habitats, such as soils, and aquatic sediments of many lakes and can be readily found in the gills and digestive tracts of fish living in those lakes. The spores can remain in the ecosystem for extended periods of time, even years, and are quite resistant to temperature changes and drying. These spores, themselves, are harmless until the correct environmental factors and anaerobic conditions prompt them to germinate and begin vegetative growth of the toxin-producing bacterial cells.

The active bacteria that cause botulism only grow in a nutrient-rich substrate, such as areas with large amounts of decaying plant growth, which are free of oxygen (anaerobic). Fish that die for any reason and that contain the bacterial spores in their tissues are also suitable substrates for growth and toxin production by the bacteria. (ii)

□ ***How do birds end up dying as a result of the botulism toxin?***

Fish-eating birds that died of Type E botulism were poisoned by eating fish that contained the toxin. However, it is not clear exactly how this happens. Birds, such as loons and mergansers, normally capture and eat only live fish. Yet, *Clostridium botulinum* Type E should not grow and produce the actual toxin in living fish. (ii) (See also: *Where does botulism come from?*).

It is possible there are circumstances that can cause toxin production in the tissues and digestive tracts of live, perhaps dying, fish. Alternatively, it may be that the fish captured alive and eaten by the birds had themselves fed on a source of Type E toxin. In these cases, it would be the toxin in the digestive tracts of the live fish that was the source of toxin for the birds in these outbreaks. (ii)

It is also possible that the live fish captured by the birds were already partially paralyzed by the Type E toxin and were therefore particularly easy prey for the birds. This might account for preferential feeding on toxin-containing fish by the affected birds.

Scientists also think that ingestion of maggots from the carcass of an infected animal can continue the spread of botulism, which may be responsible for large kills of shorebirds.

□ ***Why are we so concerned about avian botulism outbreaks?***

Natural resource managers, environmental organizations and others are concerned about the thousands of migrating birds that have died, including loons, and other species. According to estimates compiled from the USGS, National Wildlife Health Center's databases, about 52,140 avian deaths were attributed to Type E botulism from 2002 to 2006 on the Great Lakes. (iii)

Recent reports from the Sleeping Bear Dunes National Lakeshore also estimate that an additional 3,000 avian botulism-related mortalities occurred in 2006 on Lake Michigan. (iv)

Some fish species, such as Lake Sturgeon, that have been listed as threatened, endangered or of special concern, are also now at an increased risk because of botulism.

Additionally, dead wildlife may contain toxin levels that could harm other animals, including pets.

□ ***Has botulism always been in the Great Lakes?***

While Botulism has been around for a long time, records of it did not appear on the Great Lakes until recently. Type C botulism was first identified in the Great Lakes in 1936 on Lake Michigan, v and Type E botulism in the Great Lakes was first documented on Lake Michigan in 1964 regarding a 1963 outbreak.

Significant die-offs of birds and fish have occurred regularly in Lake Erie since 1999 and Lake Ontario since 2003. Avian mortalities attributed to Type E botulism from 1999-2006 in Lake Erie and lake Ontario are estimated at 61,630. (Mortality figures from databases maintained by the USGS - National Wildlife Health Center.)

Different types of avian botulism have had destructive effects on birds throughout the U.S. for a considerable time, and probably predate written records. One of the earliest major reported die-offs of a large number of waterfowl was encountered in the Great Salt Lake area of the United States in the early 1900s. Since early observations occurred on alkaline lakes in areas of western North America, the phenomenon was suspected of being a form of alkali poisoning and became known as Western Duck Sickness. It wasn't until a quarter of a century later that the cause of these die-offs was determined to be Type C botulism poisoning. (vii)

□ ***Why are botulism outbreaks occurring now?***

Many scientists believe that there are outbreaks of Type E botulism only when a variety of particular ecological factors occur simultaneously, such as warmer water temperatures, anoxic (oxygen deprived) conditions, and adequate levels of bacterial substrate. As average air and water temperatures have been rising on a global scale, warmer temperatures and anoxic conditions are occurring more frequently.

Once these factors lead to the production of the toxin in food material eaten by fish, the toxin can be passed up the food chain as birds consume the infected fish or eat maggots from the decaying carcasses of infected individuals. (ii)

Invasive species may also play a role. Current hypotheses under study suggest that zebra and quagga mussel beds may create additional habitat for the bacterium that causes botulism. Many scientists believe that mussels also have the potential for filtering the bacteria and passing it up the food chain when the mussels are eaten by fish such as the round goby.

Invasive mussels may also be responsible for the increase in growth of the algae *Cladophora* (which is also potentially tied to botulism outbreaks), since the mussel's filtration of the water makes it clearer, therefore prompting increased algal growth. This increase in algal growth and the subsequent decay of the algae can increase the oxygen demand in the ecosystem leading to possible anaerobic conditions necessary for botulism toxin production.

□ *Is there a link between botulism outbreaks and fluctuating water levels?*

There is some evidence that outbreaks correspond to low water level events. Historically, larger bird die-offs as a result of Type E botulism have occurred during periods of low or rapidly declining water levels, and water level fluctuations and draw down events in wetlands have also correlated with Type C botulism outbreaks. The mechanism behind this possible link still needs to be researched but is likely to be related to warmer water and sediment temperatures during low water events.

□ *What are some possible symptoms that an animal with botulism could display?*

As Type E botulism results in paralysis, infected species begin to exhibit unusual behavior. Water birds may not be able to hold their head up and as a result, often drown. Gulls can often walk, but not fly. Other birds may drag one or both wings (poor posture) while standing.

Once infected with Type E botulism, fish may flounder or swim erratically near the surface of the water. Their equilibrium may be affected, and they may have trouble staying right-side up. “Breaching” may also occur, during which a fish will float with its head near the surface and tail end lowered below. Infected fish usually die quickly and are most likely to be seen washed up on shore. (viii)

Note: **DO NOT HARVEST OR EAT any fish or waterfowl that seem sick.**

□ *Why is it difficult for scientists to positively determine that birds have died from Type E botulism?*

Both Type C and Type E botulism, as well as a few other types of poisoning, can produce similar symptoms in affected wildlife. Definitive diagnosis of Type E botulism requires that the Type E botulinum toxin be found in the blood of a live, sick bird OR a fresh, dead bird.

Although finding the toxin in a recently dead bird may be evidence that the bird died of botulism, it is also possible that the toxin detected was produced after death, during putrefaction, and may not have been the cause of the bird’s death. (ii)

□ *Do the recent algal blooms of the macro algae Cladophora play any role in the botulism outbreaks?*

The recent increases in the growth of *Cladophora* ultimately result in increased decaying plant matter in some areas of the Great Lakes. This decomposition can create an oxygen-deprived environment that is suitable to the bacterium that produces the Type E botulism toxin. (See also: *Why are Botulism outbreaks occurring now?*)

□ *Are inland lakes susceptible to Type E botulism outbreaks?*

The Michigan Department of Natural Resources has cited rare reports of Type E botulism on the state's inland lakes. Scientists believe that there is a minimal threat of botulism outbreak transfer from the Great Lakes to inland lakes, since the disease itself is not transferable from a transportation standpoint. The likelihood of an infected animal getting from the Great Lakes to an inland lake is small, since it will probably be too incapacitated by the toxin to travel.

With botulism spores already existing everywhere, the most likely way an outbreak would occur in a new location is if the optimal environmental factors exist that allow the bacteria to enter a vegetative state and produce the toxin. (See also: *Why are botulism outbreaks occurring now?*)

RESOURCES: GREAT LAKES WATERSHED

Contact Information

Canada

If you recognize sickness or death in Canadian wildlife, report this to local wildlife officials or make a report directly to the Canadian Cooperative Wildlife Health Center (CCWHC):

Call the Ontario/Nunavut Region office (Toll-Free in Ontario only): 1-866-673-4781
(Long Distance Charge 1-519-824-4120 Ext. 54662)

Email: ccwhc@ovc.uoguelph.ca

-or-

Call the National Toll-Free number (across Canada) to be routed to the Ontario/Nunavut office: 1-800-567-2033

Email: ccwhc@usask.ca

You can also call Ducks Unlimited Canada for other questions about botulism, or to report Canadian bird mortalities

Toll free: 1-800-665-DUCK

Illinois and Indiana

For botulism-related questions in Illinois or Indiana:

Elizabeth Hinchey Malloy, Illinois-Indiana Sea Grant

Email: hinchey.elizabeth@epa.gov

Phone: (312) 886-3451

Website: <http://www.iisgcp.org/>

Michigan

For questions about botulism (or any wildlife diseases), or to report a suspected Botulism outbreak in Michigan:

Dr. Tom Cooley, Michigan Department of Natural Resources (MDNR), Wildlife Disease Laboratory

Lab email: cooleytm@michigan.gov

Phone: (517) 336-5034

For other botulism-related questions in Michigan:

Mark Breederland, Michigan Sea Grant

Email: breederl@msu.edu

Phone: (231) 922-4628

Website: www.miseagrant.umich.edu

New York

For questions about Fish and Wildlife, or to report a suspected botulism outbreak in New York:

New York State Department of Environmental Conservation

Buffalo: (716) 851-7010; Avon: (585) 226-2466; Syracuse: (315) 426-7400; Cortland: (607) 753-3095; Watertown: (315) 785-2261; Cape Vincent Research Fisheries Station: (315) 654-2147; Lake Erie Fisheries Research Unit: (716) 366-0228

For other botulism-related questions in New York:

Helen Domske, New York Sea Grant

E-mail: hmd4@cornell.edu

Phone: (716) 645-3610

Website: <http://www.seagrant.sunysb.edu/botulism/default.htm>

Ohio

For botulism-related questions in Ohio:

Frank Lichtkoppler, Ohio Sea Grant

E-mail: Frank.Lichtkoppler@lakecountyohio.gov

Phone: (440) 350-2267

Websites: <http://www.seagrant.sunysb.edu/botulism/default.htm> or <http://www.sg.ohiostate.edu/>

For other fish or wildlife-related questions in Ohio:

Ohio Department of Natural Resources, Division of Wildlife

Email: wildinfo@dnr.state.oh.us

Phone: 1-800-WILDLIFE (1-800-945-3543)

Website: <http://www.dnr.ohio.gov/wildlife/default.htm>

Pennsylvania

To report dead or dying birds in Pennsylvania call:

- PA Game Commission at: (877) 877-0299
- Presque Isle State Park: (814) 833-7424
- Erie County Health Department: (814) 451-6700

For botulism-related questions in Pennsylvania:

Eric Obert, Pennsylvania Sea Grant

E-mail: eco1@email.psu.edu

Phone: (814) 217-9018

Websites: <http://www.pserie.psu.edu/seagrant/publications/botulism.htm> or <http://www.seagrant.sunysb.edu/botulism/>

United States (general)

For additional information on botulism or any other federal wildlife health issue in the U.S.:

USGS, National Wildlife Health Center

Phone: (608) 270-2400

Website: <http://www.nwhc.usgs.gov/>

Wisconsin

For botulism-related questions in Wisconsin:

Victoria Harris, Wisconsin Sea Grant

Email: harrisv@aqua.wisc.edu

Phone: (920) 465-2795

Website: <http://www.seagrant.wisc.edu/>

For general fish and wildlife questions in Wisconsin:

Wisconsin Department of Natural Resources, Bureau of Wildlife Management

Website: <http://dnr.wi.gov/org/land/wildlife/>

For rehabilitation of sick birds in the Green Bay area of Wisconsin:

Bay Beach Wildlife Sanctuary, rehabilitation center

Phone: (920) 391-3685

Website: www.baybeachwildlife.com

RESOURCES: REFERENCES

The following references were cited in the section entitled Botulism Basics, which includes answers to frequently asked questions. This information was compiled by Michigan Sea Grant and is posted on the MDNR website.

i.) Pennsylvania Sea Grant factsheet on botulism:

http://www.pserie.psu.edu/seagrant/publications/fs/Botulism_12-2003.pdf

Citation:

Pennsylvania Sea Grant and Penn State Erie. 2003. Botulism Factsheet:
http://www.pserie.psu.edu/seagrant/publications/fs/Botulism_12-2003.pdf.

ii.) Canadian Cooperative Wildlife Health Centre website on botulism:

http://wildlife1.usask.ca/wildlife_health_topics/botulism/botulisme.php

Citation:

Leighton, F.A. *Wildlife Health Topics, "Botulism"*. Canadian Cooperative Wildlife Health Centre (CCWHC), March 2000,
http://wildlife1.usask.ca/wildlife_health_topics/botulism/botulism.php
(accessed December 2006).

iii.) Mortality figures from internal databases maintained by the USGS - National Wildlife Health Center. Estimate totals compiled in February, 2007.

iv.) Sleeping Bear Dunes mortality estimates supplied via personal communication with Ken Hyde, Sleeping Bear Dunes National Lakeshore, 1 March 2007.

<http://www.nps.gov/slbe/>

v.) Michigan DEQ website on botulism: http://www.michigan.gov/dnr/0,1607,7-153-10370_12150_12220-26493--,00.html

Citation:

Michigan State Department of Natural Resources. *Michigan Wildlife Disease Manual, "Botulism"*. State of Michigan, 2001-2006,
http://www.michigan.gov/dnr/0,1607,7-153-10370_12150_12220-26493--,00.html (accessed December 2006).

vi.) Kaufmann, O.W. and L.D. Fay. 1964. *Clostridium botulinum* type E toxin in tissues of dead loons and gulls. *Michigan State University Agricultural Experiment Station Quarterly Bulletin*. 47(2):236-242.

vii.) Environment Canada, Prairie and Northern Region website's page on Type C avian botulism: <http://www.pnrrpn.ec.gc.ca/nature/migratorybirds/avianb/dc22s00.en.html>

Citation:

Avian Botulism Task Force. *Avian Botulism*. Environment Canada, Prairie and Northern Region, 27 November 2006, <http://www.pnrrpn.ec.gc.ca/nature/migratorybirds/avianb/dc22s00.en.html> (accessed December 2006).

viii.) NY DEC website's botulism FAQ:
<http://www.dec.state.ny.us/website/dfwmr/faqbotu.html>

Citation:

New York State Department of Environmental Conservation. *Type E Botulism in Lakes Erie and Ontario - Q & A*, <http://www.dec.state.ny.us/website/dfwmr/faqbotu.html> (accessed December 2006).

ix.) NY-PA-OH Sea Grant website on botulism:
<http://www.seagrant.sunysb.edu/botulism/default.htm>

Citation:

New York, Pennsylvania and Ohio Sea Grant. *NY/PA/OH Sea Grant: Botulism in Lakes Erie, Ontario*, 30 November 2006, <http://www.seagrant.sunysb.edu/botulism/default.htm> (accessed December 2006).

x.) USGS National Wildlife Health Center website on avian botulism:
http://www.nwhc.usgs.gov/disease_information/avian_botulism/index.jsp

Citation:

USGS National Wildlife Health Center. *Disease Information, "Avian Botulism,"* 7 November 2006, http://www.nwhc.usgs.gov/disease_information/avian_botulism/index.jsp (accessed December 2006).

xi.) Michigan Sea Grant web page on avian botulism:
<http://www.miseagrant.umich.edu/habitat/avian.html>

Citation:

Michigan Sea Grant. *Avian Botulism*, 30 January 2007, <http://www.miseagrant.umich.edu/habitat/avian.html> (accessed February 2007).