

Re-emergence of Type E Botulism: Issues and Implications for Great Lakes Shoreline Communities

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Botulism in the Great Lakes

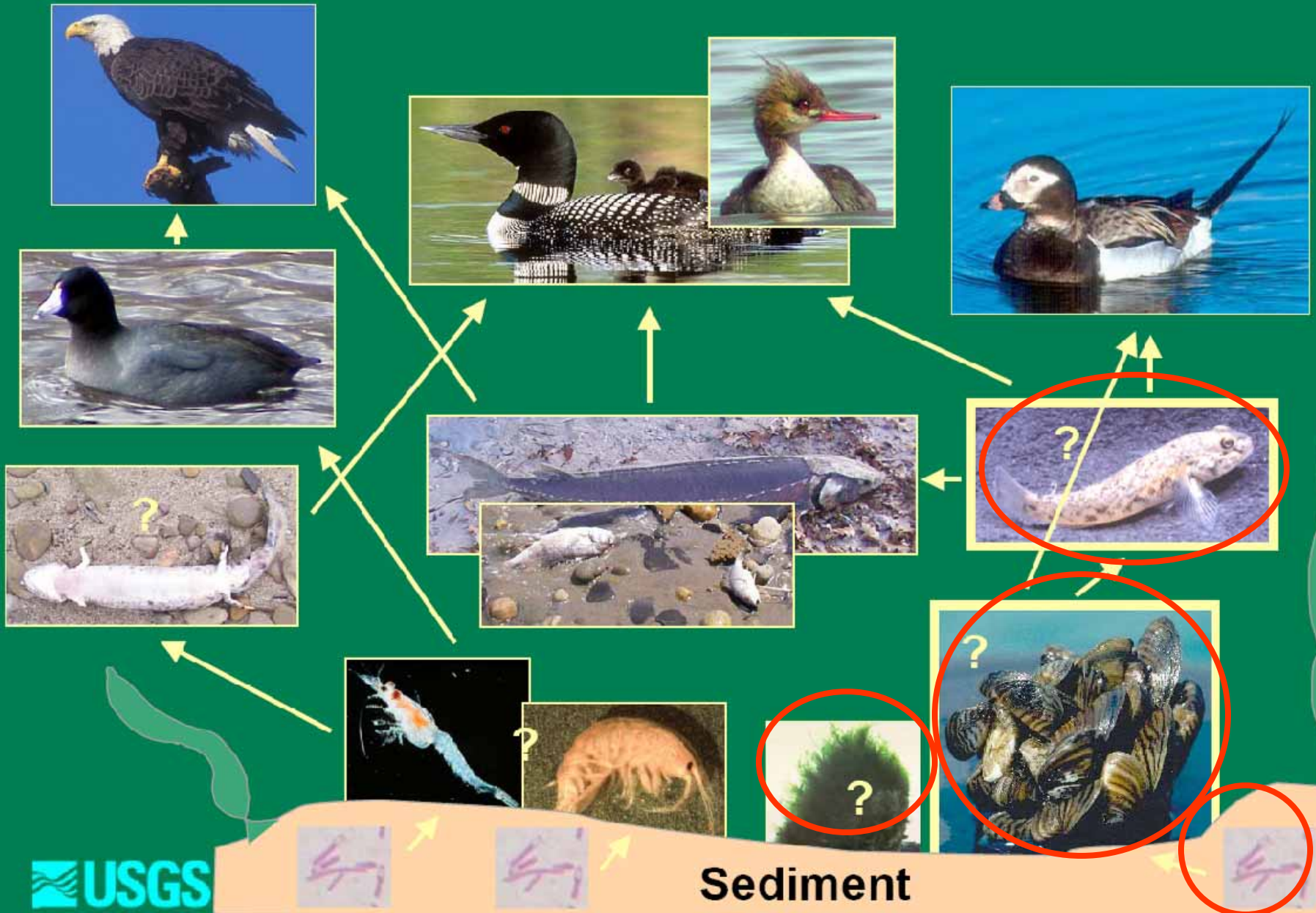
- **Avian botulism, a disease caused by *Clostridium botulinum*, has been recognized as a major cause of mortality in migratory birds since the 1900s. Although type C has caused the die-off of thousands of waterfowl (especially ducks) across the western United States, type E has been mainly restricted to fish-eating birds in the Great Lakes.**
- **We have seen a re-emergence of type E botulism across the Great Lakes Basin in the last 8 years.**



What are the Mechanisms?

- Botulism Spores
 - Naturally Occurring
- Zebra and Quagga mussels
 - Abundant Across the Great Lakes
 - Dramatically Increased the Photic Zone
 - Provide Source of Soluble Phosphorus Due to Filtering
- Round Goby
 - Dense Populations
 - Cladophora Fields and Mussel Beds Provide the Necessary Habitat
 - Mussels are a Source of Food
- Cladophora Algae
 - Naturally Occurring
 - Increase Abundance Due to Increased Light Penetration
 - Sloughed Cladophora Mats Create Environment for Toxin Production

Type E Botulism Cycle in the Great Lakes



- Pre Zebra/Quagga



Post Zebra/Quagga



Study Site: Northern Lake Michigan

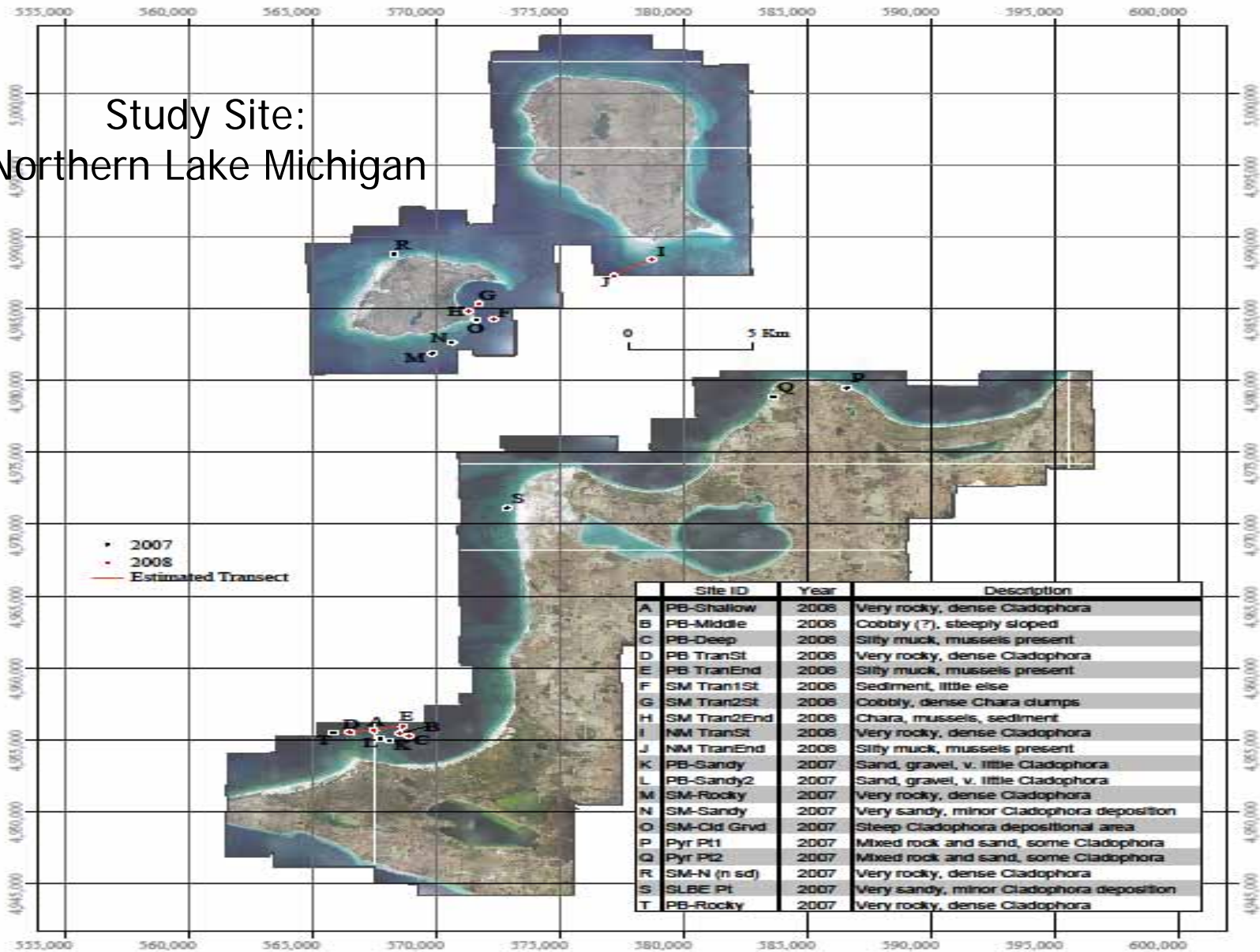


Image: Brenda Moraska Lafrancois, PhD
NPS St. Croix Watershed Research Station

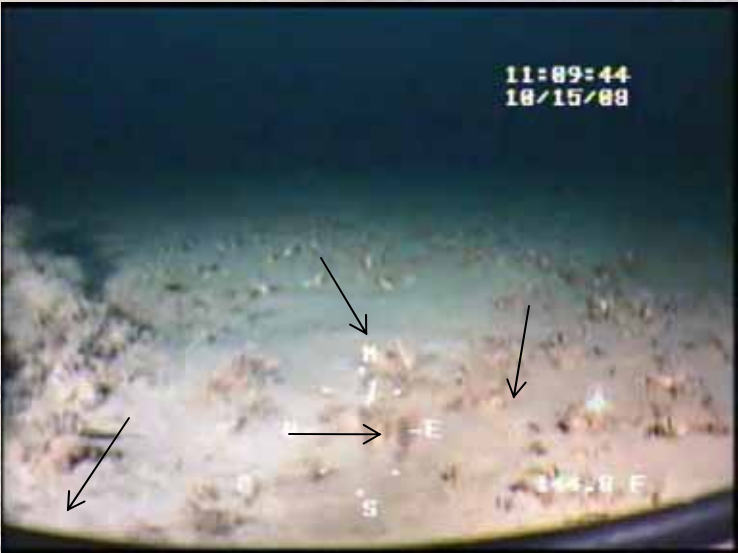
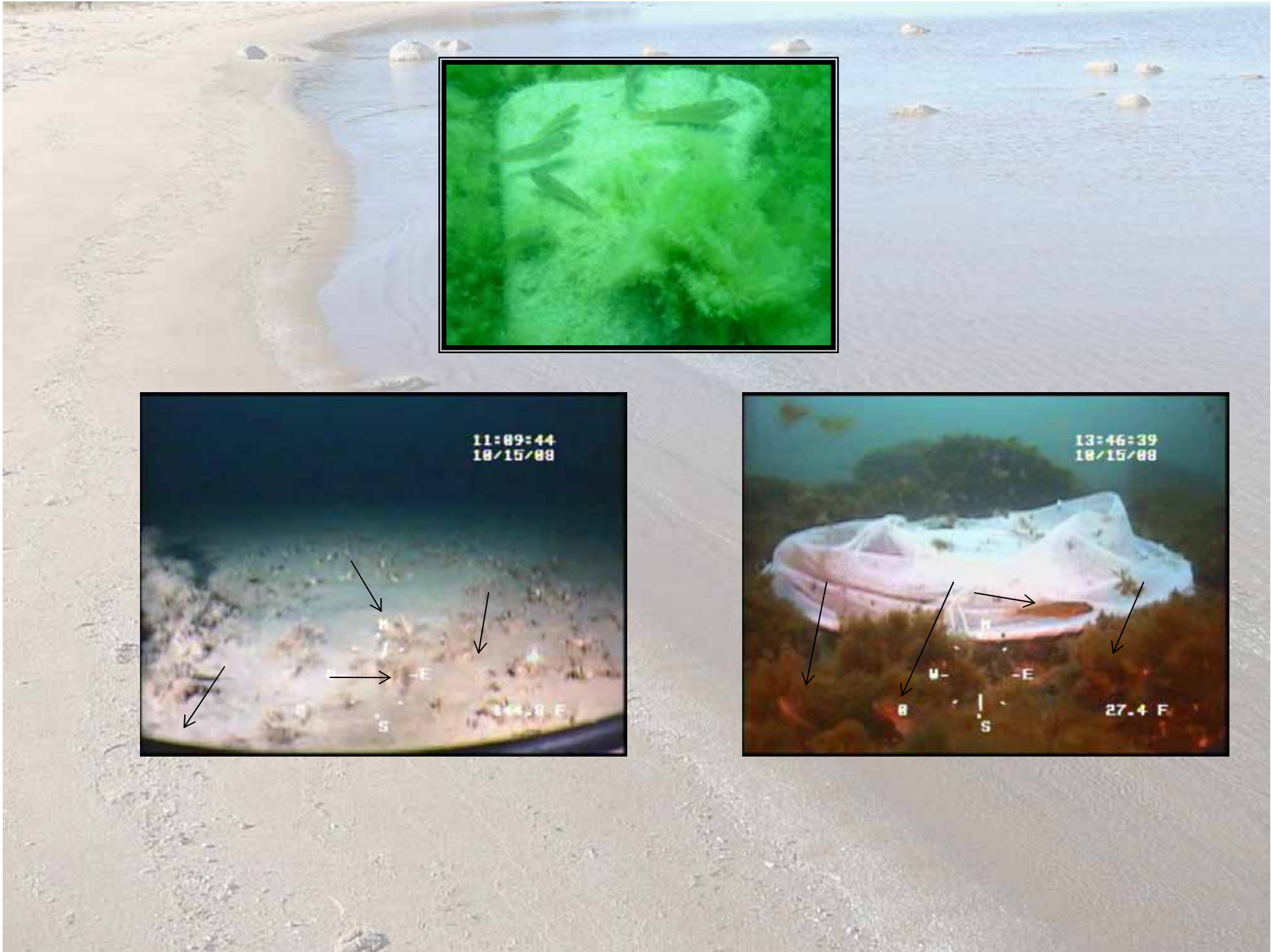


"Goby Arch"



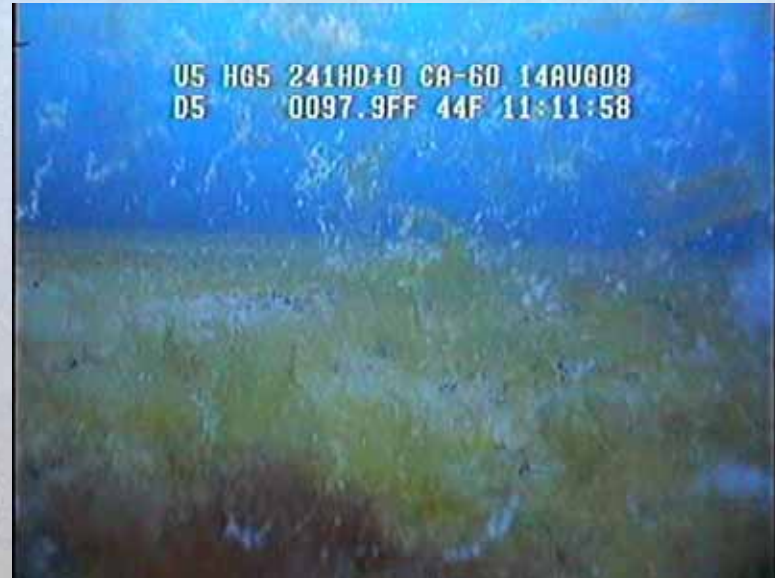
October 2008, Cloudy, High Sea State

August 2008, Sunny, Low Sea State





Two Growing Cycles



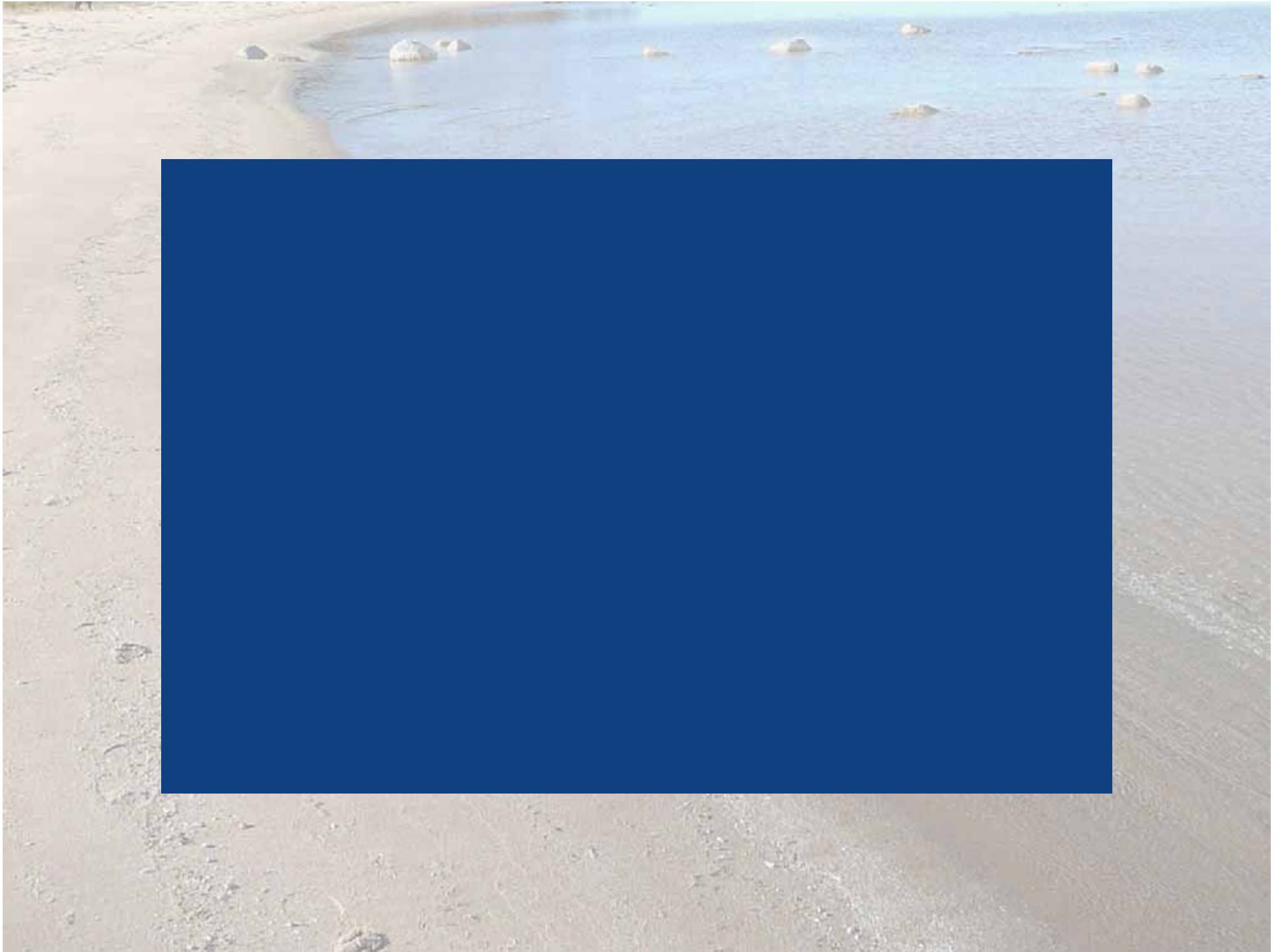
Deeper Growing Depths



Cladophora Covered Rocks



Detached Cladophora







Cladophora Algae

- Washing ashore



**Round gobies and dreissend mussels
have been implicated in the transfer of
botulism**



Type E Botulism Cycle in the Great Lakes

*“The Times They Are a-
Changin’ ”*

Bob Dylan

The Times Have Changed

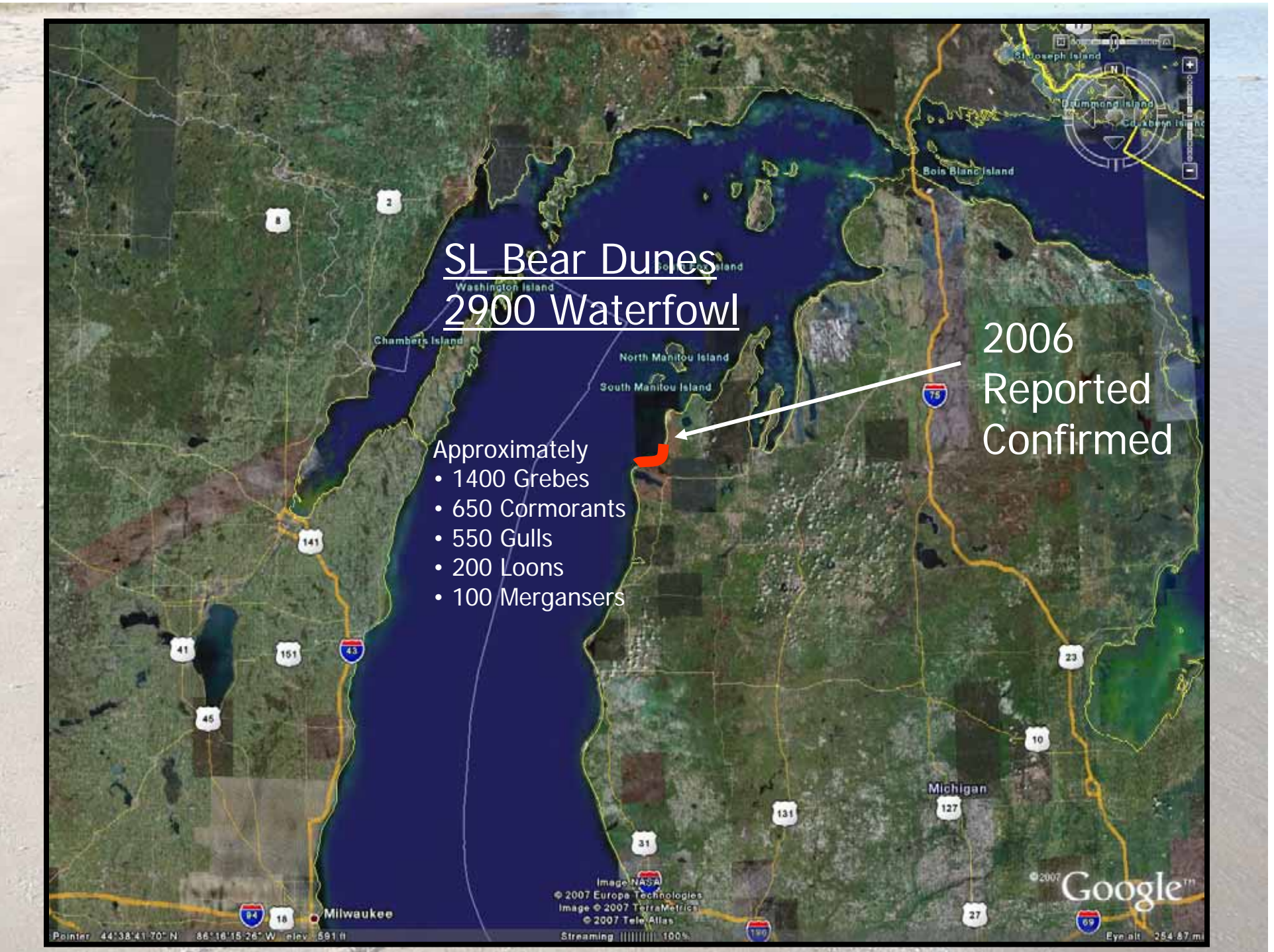
 USGS

 Sediment

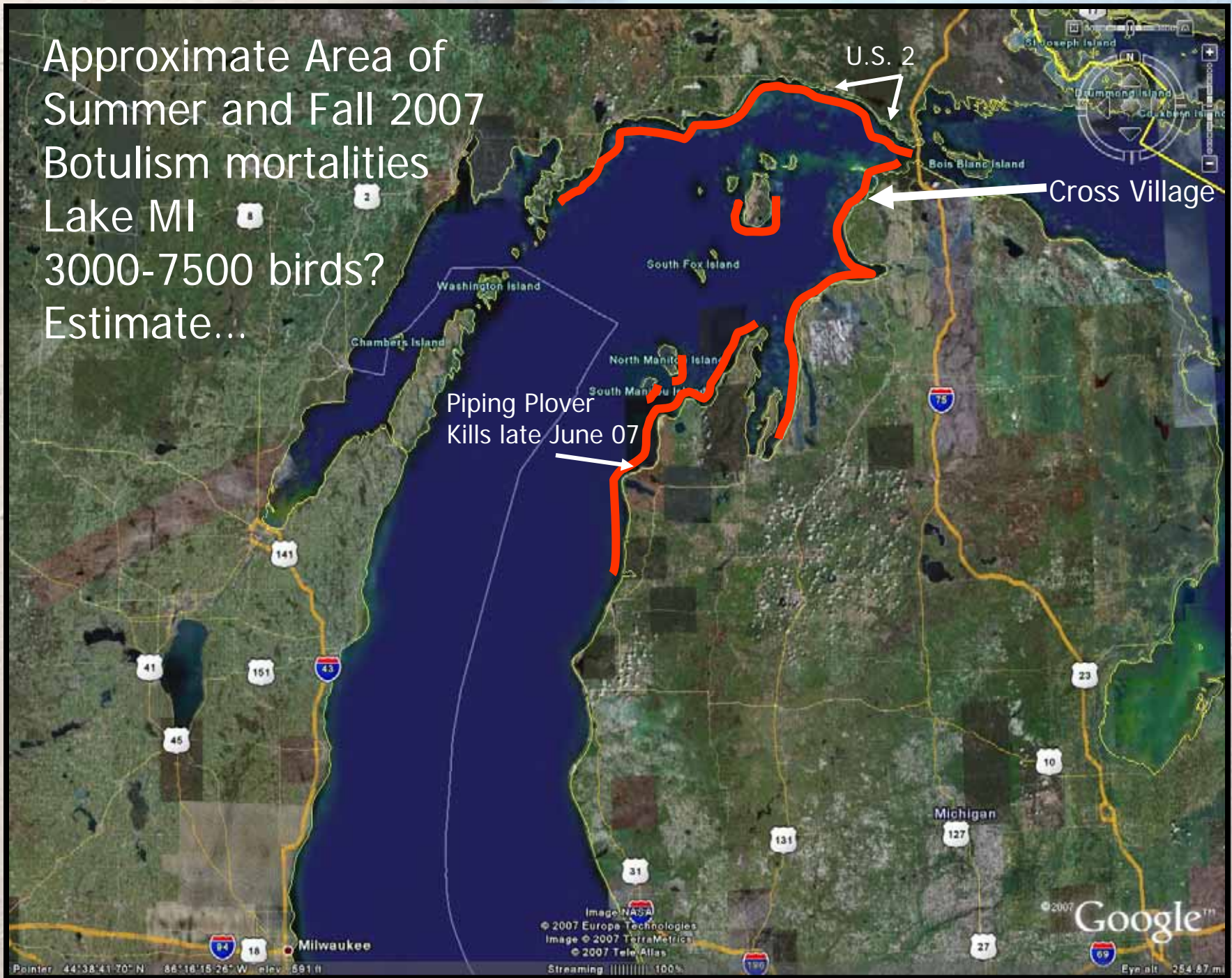
SL Bear Dunes
2900 Waterfowl

2006
Reported
Confirmed

- 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...



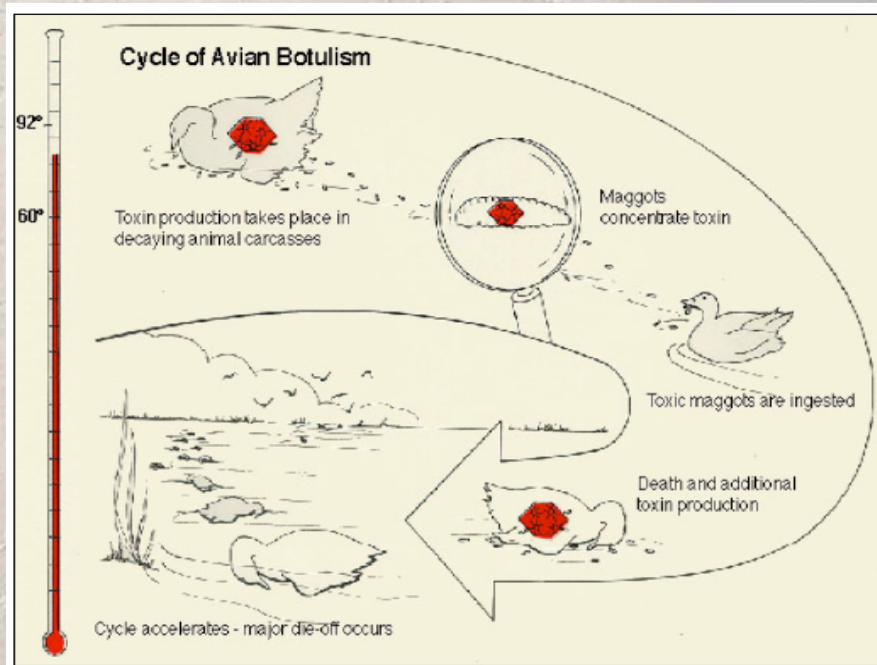


Piping Plovers – Endangered sp. 63 breeding pairs in 2007

4 piping plovers lost to
Type E Botulism in
Benzie County,
Late June, 2007

GOOD NEWS
Apparently no
BotE impacts in
2008!

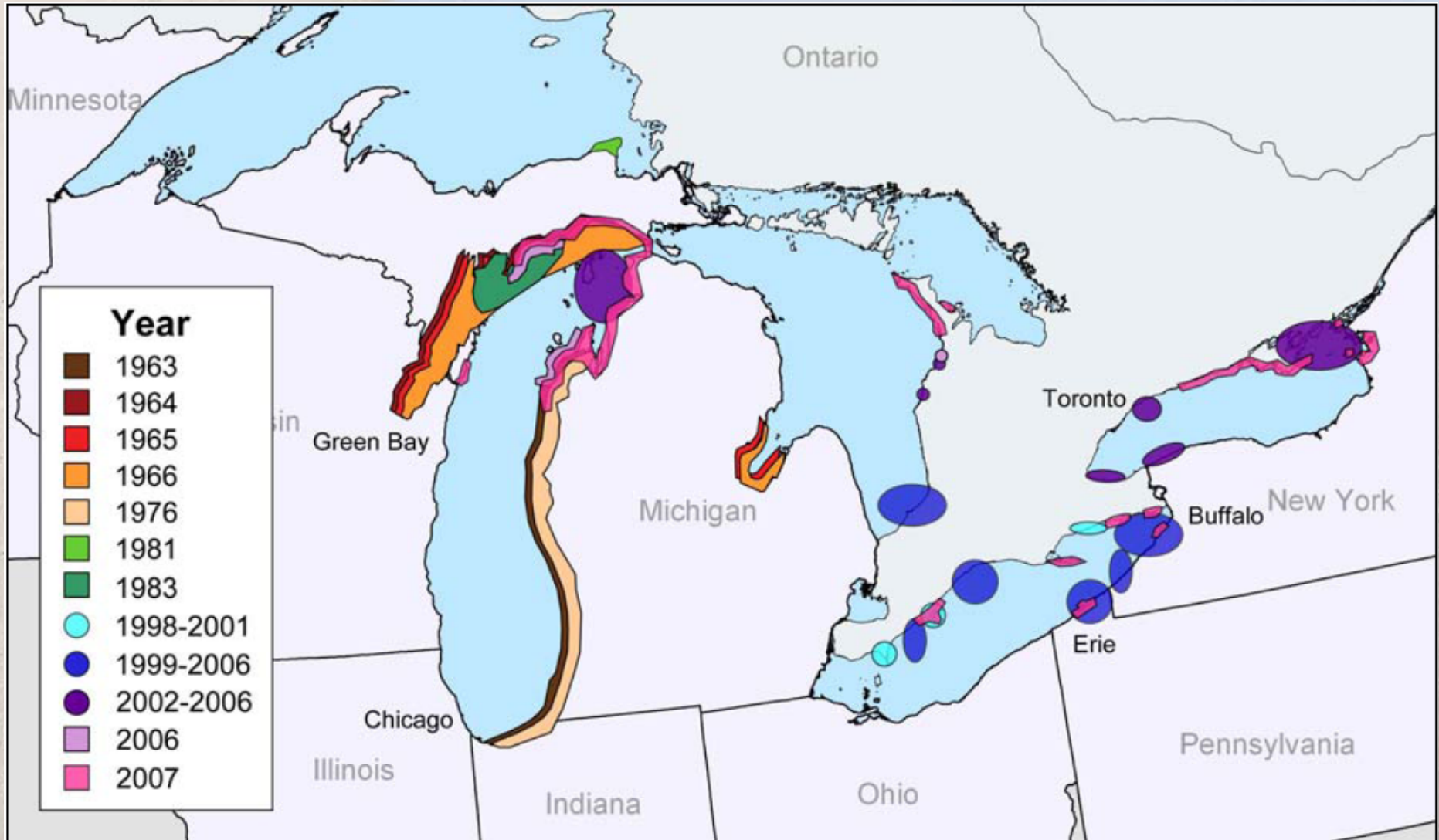
Photos: VanZoren



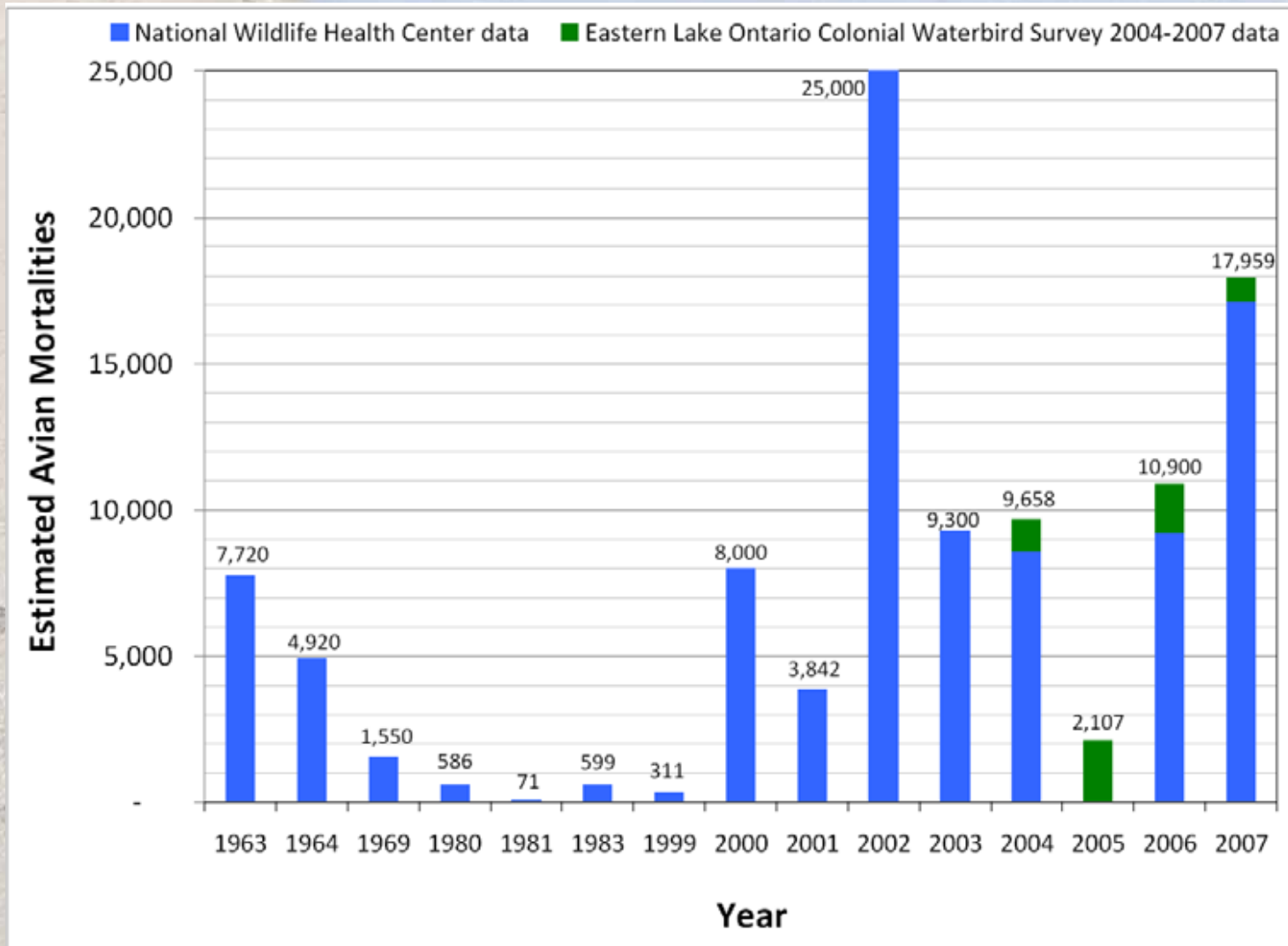
Preliminary 2007 Great Lakes Carcass Count = 8319



Historic and Current Geographic Extent of Type E Botulism



Estimated Total Avian Mortalities



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 Erie (3237)

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

Lake Huron (57)

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

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

Gobies dying of Type E?

Notice pigment color





Key Items

- Humans will NOT get botulism by swimming in the Great Lakes
 - Bacteria & toxin killed/neutralized 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 annual summer die offs and fall die offs
 - Summer – gulls/cormorants
 - Fall – migratory species like loons, long-tailed ducks



Changing Definition of “Nearshore Waters”

Coastal Margin and Nearshore Areas

- Coastal Margin area
 - shallow water depths < 3 m
- Nearshore area

Old:

- water depths > 3 m and < 15 m

New:

- > 3 m and $< ???$ m





Special Thanks for Info:

- Chiara Zuccarino-Crowe, US EPA GLNPO
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- Ken Hyde, Biologist
National Park Service
Sleeping Bear Dunes National Lakeshore