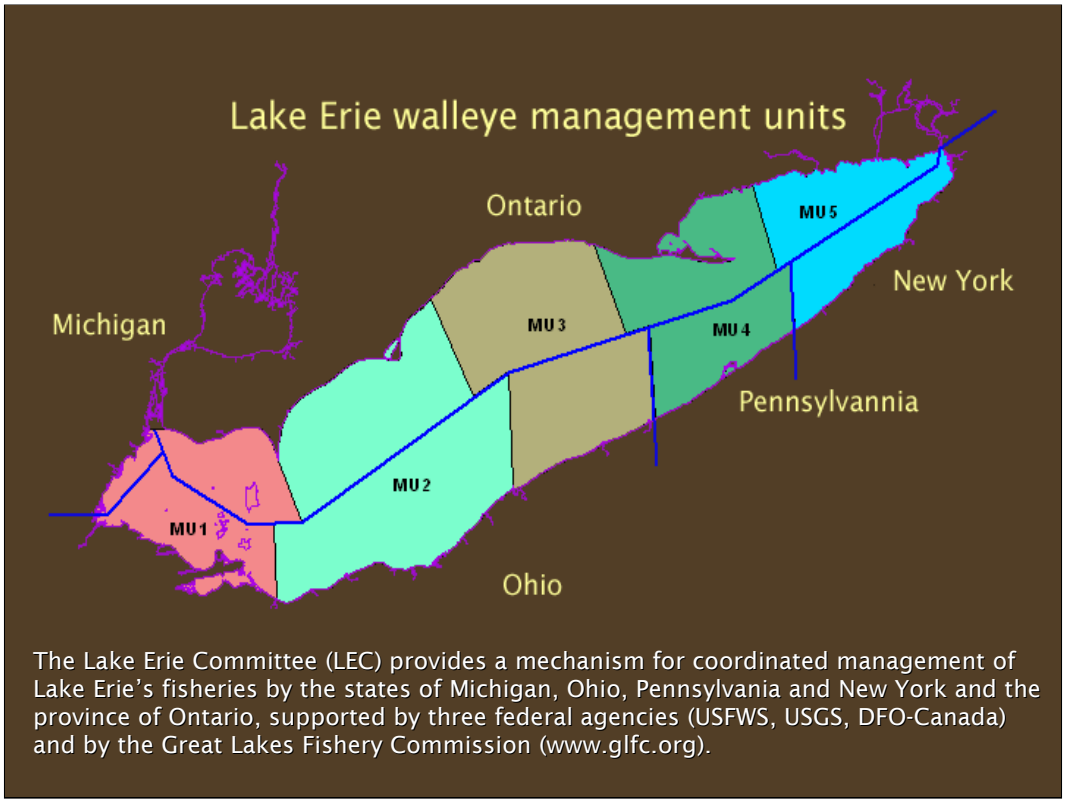
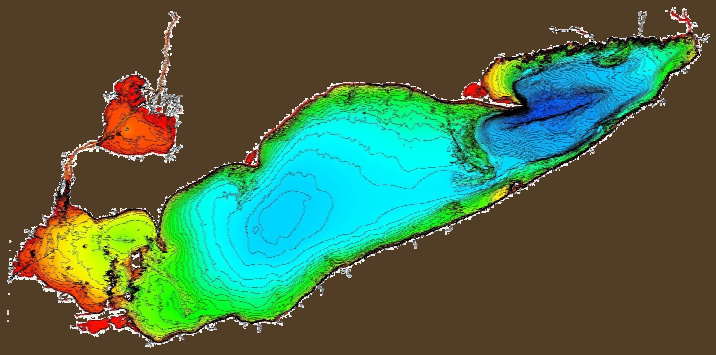
I am very pleased to have the opportunity to talk to you today about the fish community of Lake Erie



The Lake Erie Committee (LEC) provides a mechanism for coordinated management of Lake Erie's fisheries by the states of Michigan, Ohio, Pennsylvania and New York and the province of Ontario, supported by three federal agencies (USFWS, USGS, DFO-Canada) and by the Great Lakes Fishery Commission (www.glfc.org).

Five fishery management agencies (Michigan DNR, Ohio DNR, Pennsylvania Fish and Boat Commission, New York DEC, Ontario MNR and three federal agencies (USGS, USFWS, DFO Canada) collaborate through the Great Lakes Fisheries Commission to support annual population assessments for key species in Lake Erie, and to coordinate their management.

Goals established by Lake Erie Committee (LEC) for Lake Erie's fish communities



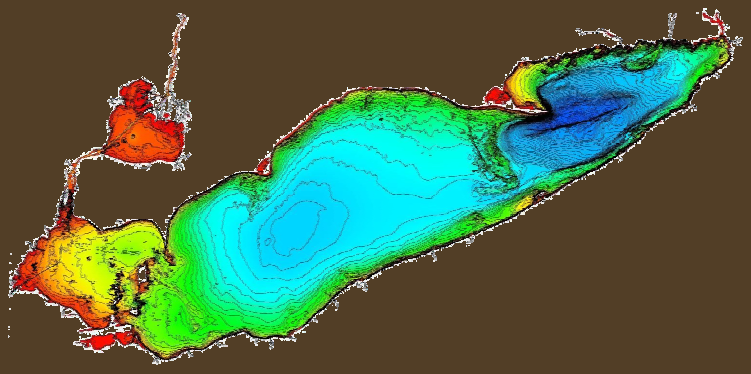
- Recognizes that 75% of the volume supports cool-water fish community
- To secure a balanced, predominantly cool-water fish community, with walleye as a key predator in the western basin, central basin, and nearshore waters of the eastern basin
- Community of self-sustaining indigenous and naturalized species occupy diverse habitats, provide valuable fisheries, reflects a healthy ecosystem

A map of lake bathymetry shows that the lake depths increase from west to east, while nutrient levels decline.

Most of the lake volume is classified as cool-water habitat (75% of volume). "Cool-water" fish have temperature preferenda between 20 and 28C.

LEC Goal for cool-water community:To secure a balanced, predominantly cool-water fish community, with walleye as a key predator in the western basin, central basin, and the near-shore waters of the eastern basin, characterized by self-sustaining indigenous and naturalized species that occupy diverse habitats, provide valuable fisheries, and reflect a healthy ecosystem

Goals established by LEC for Lake Erie's fish communities



· 25% of the volume supports coldwater species

· To secure a predominately cold-water fish community in the deep, offshore waters of the eastern basin with lake trout and burbot as key predators

•For the deeper waters of the eastern basin the LEC goal is:

•To secure a predominately cold-water fish community in the deep, offshore waters of the eastern basin with lake trout and burbot as key predators.

•Where coldwater fish have temperature preferenda < 20C. These preferenda are what these fish are metabolically adapted to live in, so this therma habitat supply really shapes the character of the fish community.

Time lines for assessment of status

- Historical reference to establish original species list(s) for lake/basins – native biodiversity
- 1970 – perhaps worst year for eutrophication and year of intensive study of Lake under Project Hypo
- "Post GLWQA" – 1980s, phosphorus loads reach targets set under Great Lakes Water Quality Agreement (GLWQA)
- 2004 – after zebra mussel colonization, and expansion of round gobies Lakewide

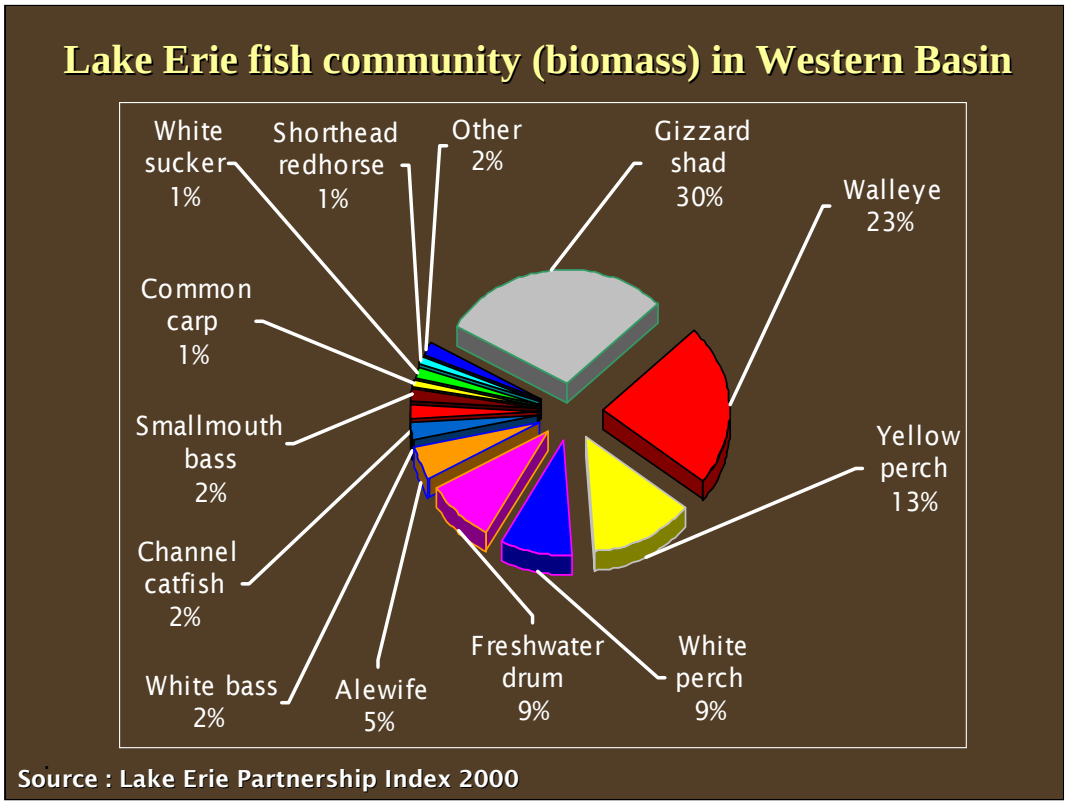
We will provide comments today, using three temporal reference points:

What was the native biodiversity of the lake or basins? We relay very strongly on work from surveys in 1928 and 1929.

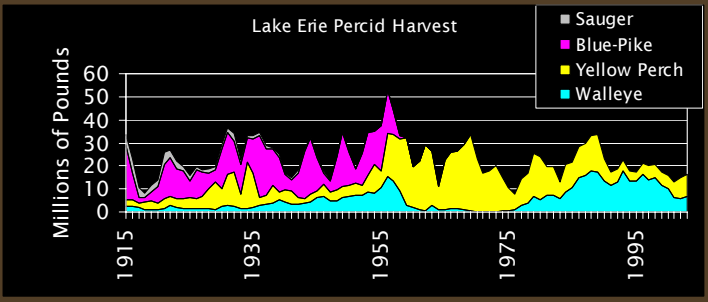
1970 – perhaps worst year for eutrophication and year of intensive study of lake under Project Hypo

"Post GLWQA" – 1980s, phosphorus loads reach targets set under Great Lakes Water Quality Agreement (GLWQA)

2004 – after zebra mussels colonization, and expansion of round gobies lakewide



- A standard survey of the fish community in western Lake Erie provides us with some indication of the biomass composition of the community
- The major species present are gizzard shad (NIS), walleye, yellow perch, white perch (NIS), freshwater drum and alewife (NIS)
- Although this is not true relative abundance, it is important to note that NIS species (shad, white perch and alewife) make up 44% of this biomass



Coolwater Community

Species	Historical Context	Post GLWQA	Status 2004	Comments
Blue Pike	extinct			
Sauger	"regionally extinct"			
Yellow Perch	more abundant	+++	Good	Natural variability
Walleye (SOLEC Indicator)	more abundant	+++	Poor	Improving
Lake Sturgeon	limited distribution	rare	Poor	Improving
Burrowing Mayflies (SOLEC Indicator)	limited distribution	+	Mixed	Natural variability
Community Status			**Mixed Improving**	

The graph indicates the composition of “percid” harvest, and when sauger harvest ended in the 1930s and when blue pike harvest ended in the early 1960s..

The cool-water community has lost significant biodiversity though the extinction of the blue pike (walleye subspecies), the regional extinction of sauger (walleye genus, separate species), and by the major decline in the abundance and distribution of lake sturgeon.

“Extinct” at a population or stock level

- Within North America, we have adaptation within a species, across its range (e.g., tolerance of largemouth bass to winter temperatures)
- Each Lake may have a “population” and further breakdown into “stocks” that use different spawning areas
- Extinction has a global meaning – the species no longer exists
- Loss of populations or stocks is a significant loss of genetic resources to both the species and the ecosystem
- In this usage we recognize the loss at a population level or lower at stock levels
- Blue pike is globally extinct, sauger is regionally extinct in Lake Erie

Within north America, we have adaption within a species, across its range eg tolerance of largemouth bass to winter temperatures

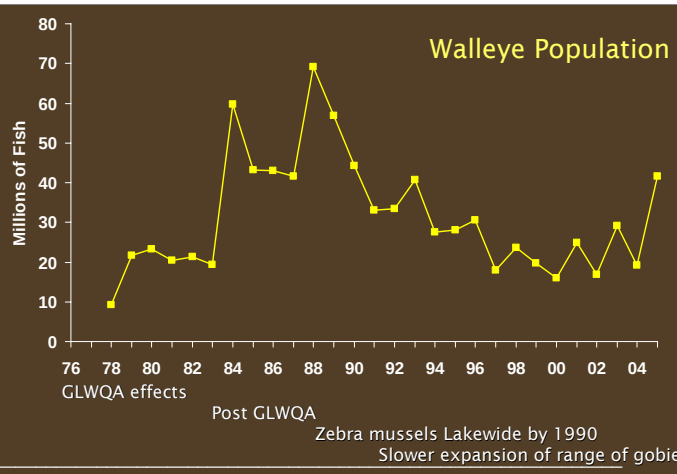
Each lake may have a “population” and further breakdown into “stocks” that use different spawning areas

Extinction has a global meaning – the species no longer exists. Blue Pike is globally extinct

We need to recognize that loss of populations or stocks, is a significant loss of genetic resources to the species, and loss to the ecosystem

Sauger is regionally extinct in Lake Erie. A well organized attempt to re-introduce the sauger, failed.

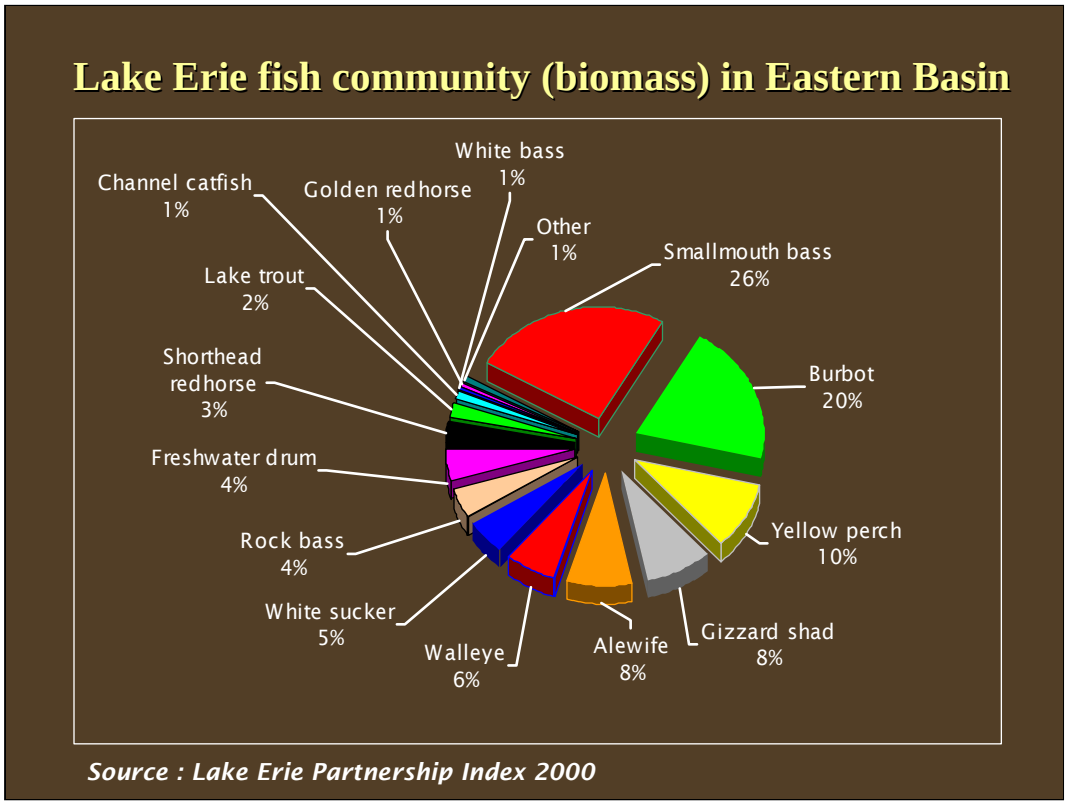
Coolwater species



Coolwater Community

Species	Historical Context	Post GLWQA	Status 2004	Comments
Blue Pike	extinct			
Sauger	"regionally extinct"			
Yellow Perch	more abundant	+++	Good	Natural variability
Walleye (SOLEC Indicator)	more abundant	+++	Poor	Improving
Lake Sturgeon	limited distribution	rare	Poor	Improving
Burrowing Mayflies (SOLEC Indicator)	limited distribution	+	Mixed	Natural variability
Community Status			**Mixed**	**Improving**

The pluses in this chart (0-4) are a subjective assessment of where a species was, relative to capacity of the lake to support it. Yellow perch are believed to be more abundant than historical record, and current status is good. Walleye is a SOLEC indicator species, that is believed to be more abundant than the historical record. This species made a strong recovery after the GLWQA implementation, but declined after zebra mussels colonized the lake. Strong international conservation actions (2000-2004) have set a stage for recovery. Its status is judged to be poor until the strong 2003 year class reaches maturity and in recognition of stock structure, discussed later. The status of Lake sturgeon is judged to be poor, due to apparent loss of many spawning groups or stocks and limited distribution in the lake. Burrowing mayflies are a SOLEC indicator, and have a “Mixed” status. Although they have increased abundance, they have not recovered across the historical range.



•A standard survey of the fish community in eastern Lake Erie provides us with some indication of the biomass composition of the community

•Includes shallow water as well as deep cold water, so more than “coldwater” community shown

•The major species present are smallmouth bass, burbot (cold water), yellow perch, gizzard shad (NIS), alewife (NIS), white perch (NIS), walleye, and white sucker. The burbot at 20% and lake trout at 2% of biomass are the cold water species present. Whitefish is less than 1%. NIS species make up 16% of this biomass (shad and alewife)

Coldwater species

Coldwater and associated species

Species	Historical Context	Post GLWQA	Status 2004	Comments
Long-jaw Cisco	"regionally extinct"			
Lake Herring	rare			
Slimy Sculpin	"regionally extinct"			
Spoonhead Sculpin	"regionally extinct"			
Lake Trout (SOLEC Indicator)	regionally extinct	pre-lamprey control	stocked	Improving
Diporeia hoyi (SOLEC Indicator)	"regionally extinct"	+++		
Mysis relicta	"rare"		Poor	Undetermined
Lake Whitefish	"common"	+	Mixed	Natural variability
Burbot	abundant	+	Good	Natural variability
Community Status			**Mixed**	

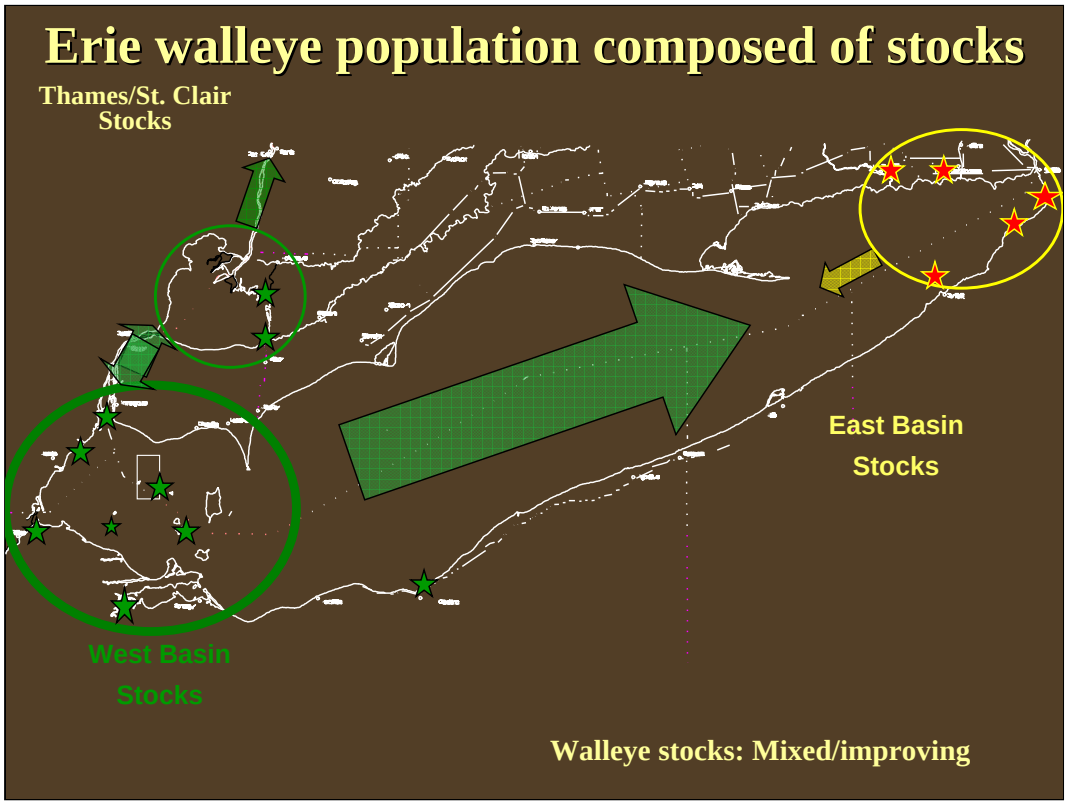
If we look down the list and see the number of regionally extinct or rare species, you can see that the coldwater community has experienced a catastrophic loss of native biodiversity. Long-jaw cisco, slimy sculpin and spoonhead sculpin have not been recorded in recent years. Lake herring is extremely rare. The former key invertebrate components of that food web (*Mysis relicta)*, oand (*Diporeia hoyi)* are used as food by all of the deepwater fish species for at least part of their life history, in north-temperate lakes (Scott and Crossman 1973).

On the positive side, a lake trout stocking program was initiated by NYDEC and USFWS (1970s), and survival of lake trout has improved with establishment of sea lamprey control in the 1980s. Similarly the native burbot have increased in abundance after sea lamprey control. The lake whitefish population increased substantially in the 1980s, and has remained at a higher level of abundance. We believe that there are more lake herring present but they continue to be rare.

The overall community status is judged to be mixed, without a defined trajectory.

You are looking at an alewife, frozen into surface ice after a winter die-off was recorded in February 2001. Smelt, gizzard shad and alewife are major prey items in Lake Erie, but winter conditions limit survival of alewife and shad, causing instability. All three species are NIS and can affect viability of salmonid eggs because of their thiaminase content. We would prefer to see lake herring recover as a prey species together with other native species.

Prey fish Community Status: Poor and unstable



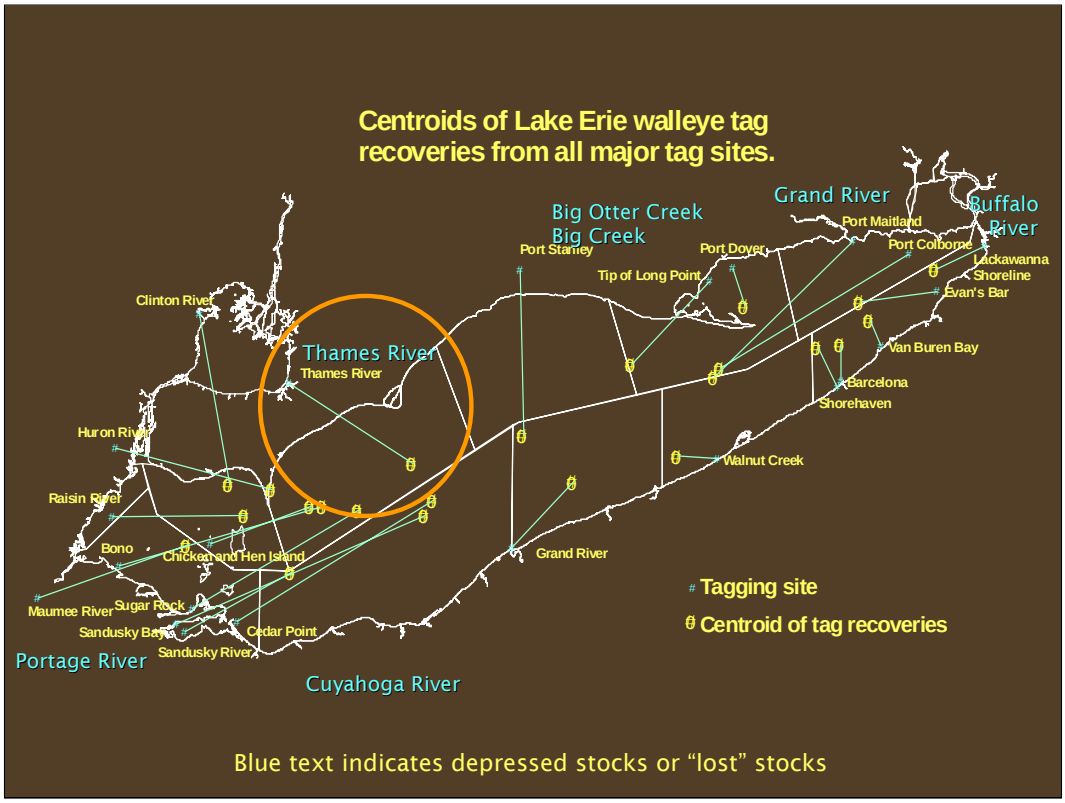
•The walleye population graph that you saw earlier is sum of the various stocks of walleye in the lake.

•The LEC has established that

•“Stocks (or populations) are the basic unit for conservation and management and should, where feasible, be identified, monitored, and appropriately managed. “

•In this graph you can see the spawning locations of known stocks and the predominant dispersal pattern

•Dr. Joe Koonce and colleagues noted in a historical perspective that “walleye stock diversity declined with the loss of tributary spawning stocks and lake spawning stocks became dominant”



Most of our knowledge about stocks comes from tagging studies, where adult walleye are tagged at spawning sites and tags are reported when fish are caught later. This map that shows fish tagging sites, and centroids show middle of distributions of recaptures.

Tag recoveries demonstrate how fisheries in particular areas depend on reproduction and

success of early life history in particular habitats (river-bay, shoal-lake complexes).

In my time on Lake Erie, we have seen a significant stock decline in the Thames River walleye stock (circle) which is depressed and no longer contributing to the fishery.

The status of walleye stocks is judged to be mixed, but improving.

Summary

- Aquatic communities have lost biodiversity
- Within that context:
  - Coolwater – mixed improving
  - Coldwater – mixed
  - Prey Species - poor
- Biological integrity requires maintenance of top predators to structure community
- Rehabilitation of walleye and lake trout stocks needed
- Top predators – mixed improving

Aquatic communities have lost biodiversity

Within that context:

Coolwater – mixed improving

Coldwater –mixed

Prey Species – poor

Biological integrity requires maintenance of top predators to structure community

Rehabilitation of walleye and lake trout stocks needed

Top predators – mixed improving