Climate Indicators and Fish Management on the Grand Portage Reservation

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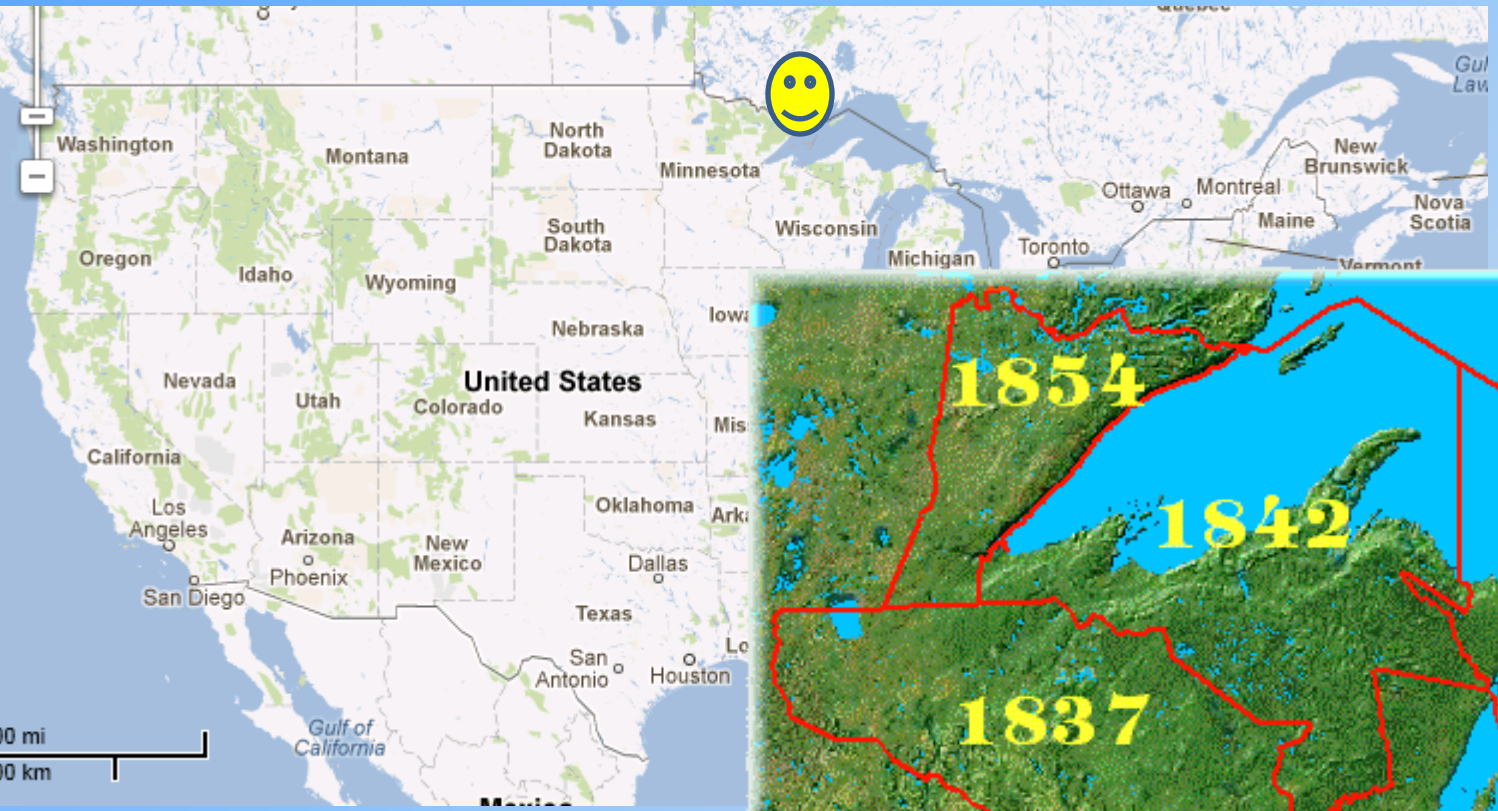
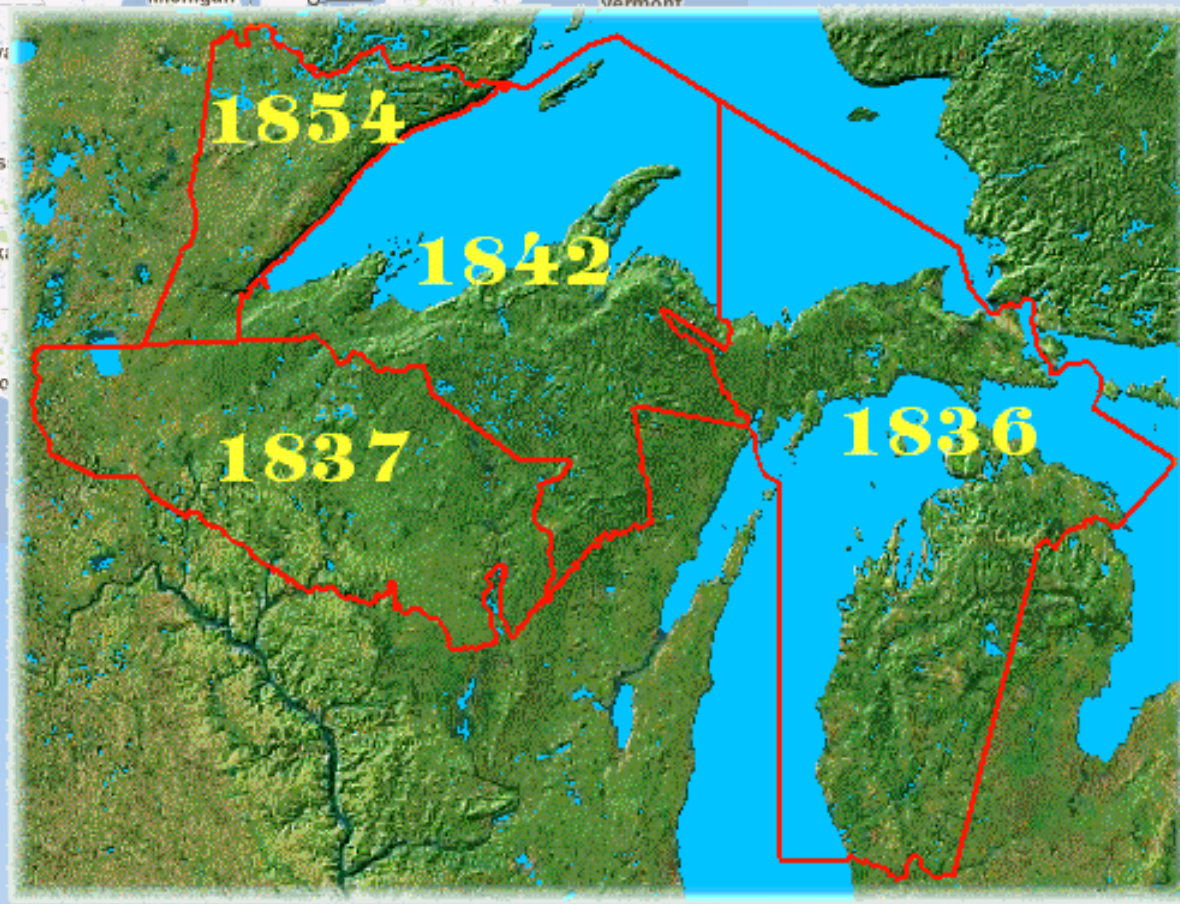
Where is Grand Portage?





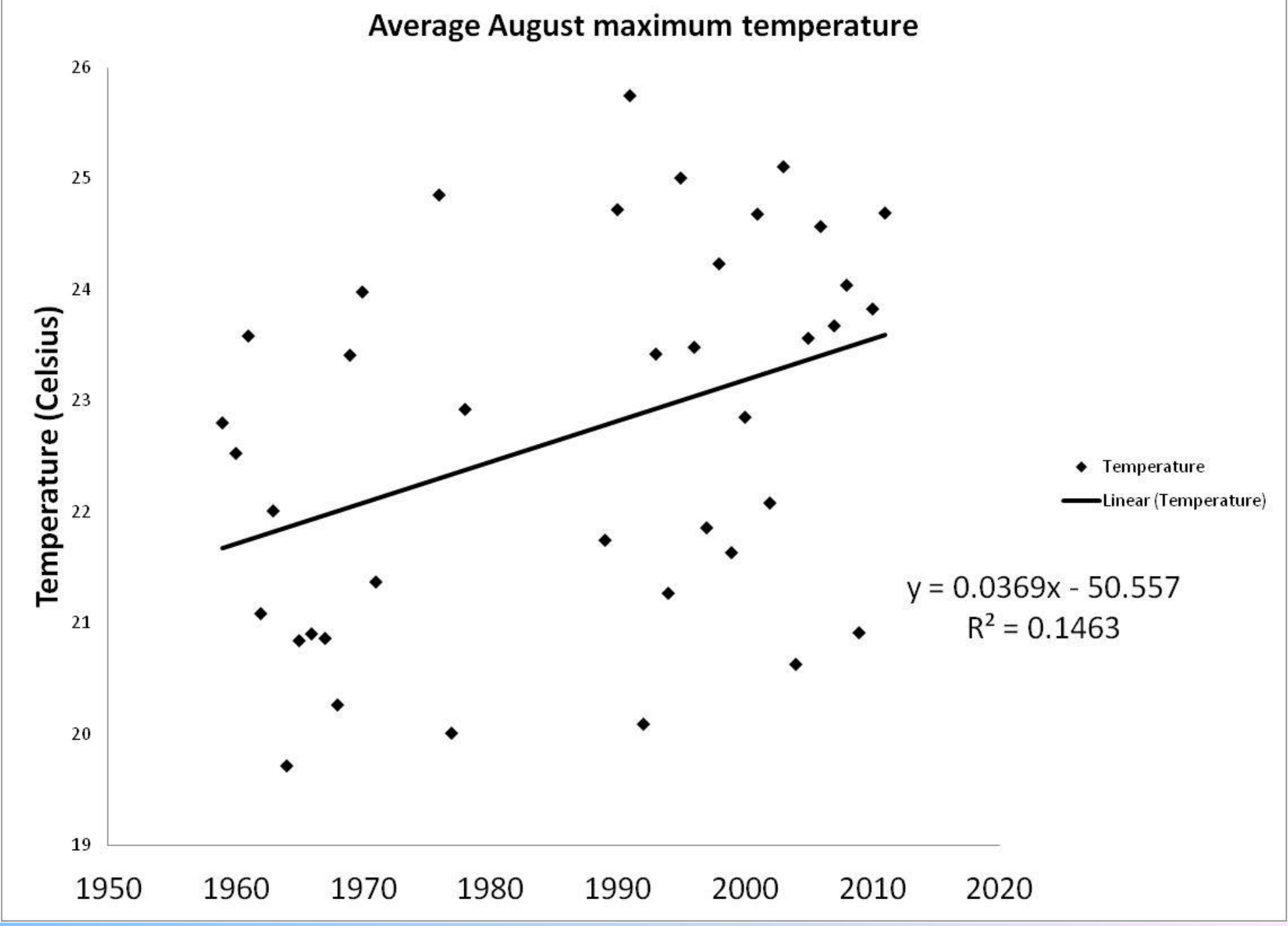

Pigeon River
593
Wauswaugoning Bay
Francis Island
Little Susi
Long Isla
61
Grand Portage
Grand Portage Island
Co Rd 17

What defines Grand Portage?

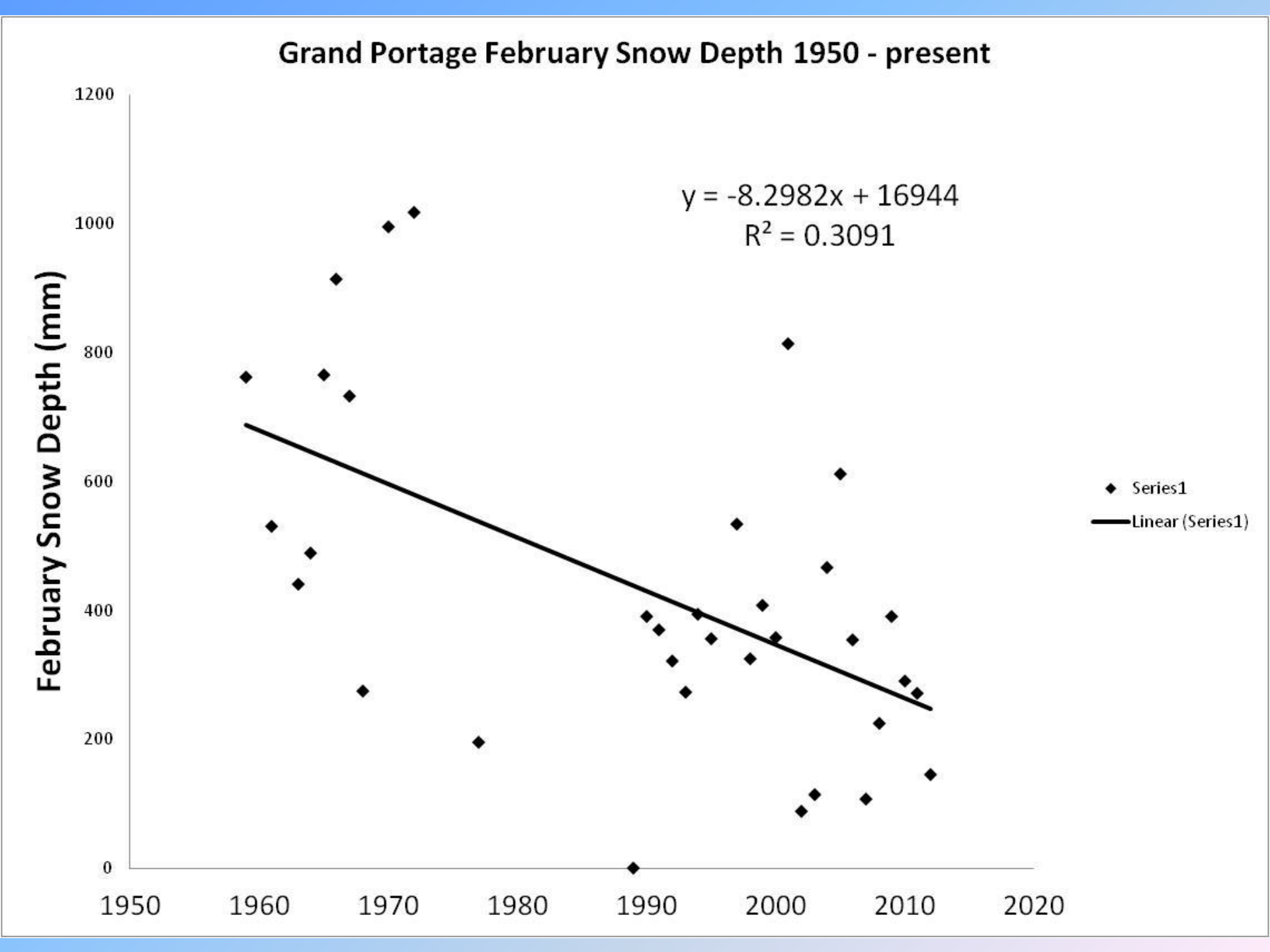

MOORE


PACIFIC TRAIL

Is climate change happening in Grand Portage?



Data from Grand Portage Weather station, provided by NOAA


Grand Portage February Snow Depth 1950 - present
y = -8.2982x + 16944
R² = 0.3091
February Snow Depth (mm)
1200
1000
800
600
400
200
0
1950
1960
1970
1980
1990
2000
2010
2020
Series1
Linear (Series1)

Climate change

+

Invasive species

=

Fish community shifts

COMMENTARY

Temperature changes?

Fish-killing variances more complex

By Robert Boros

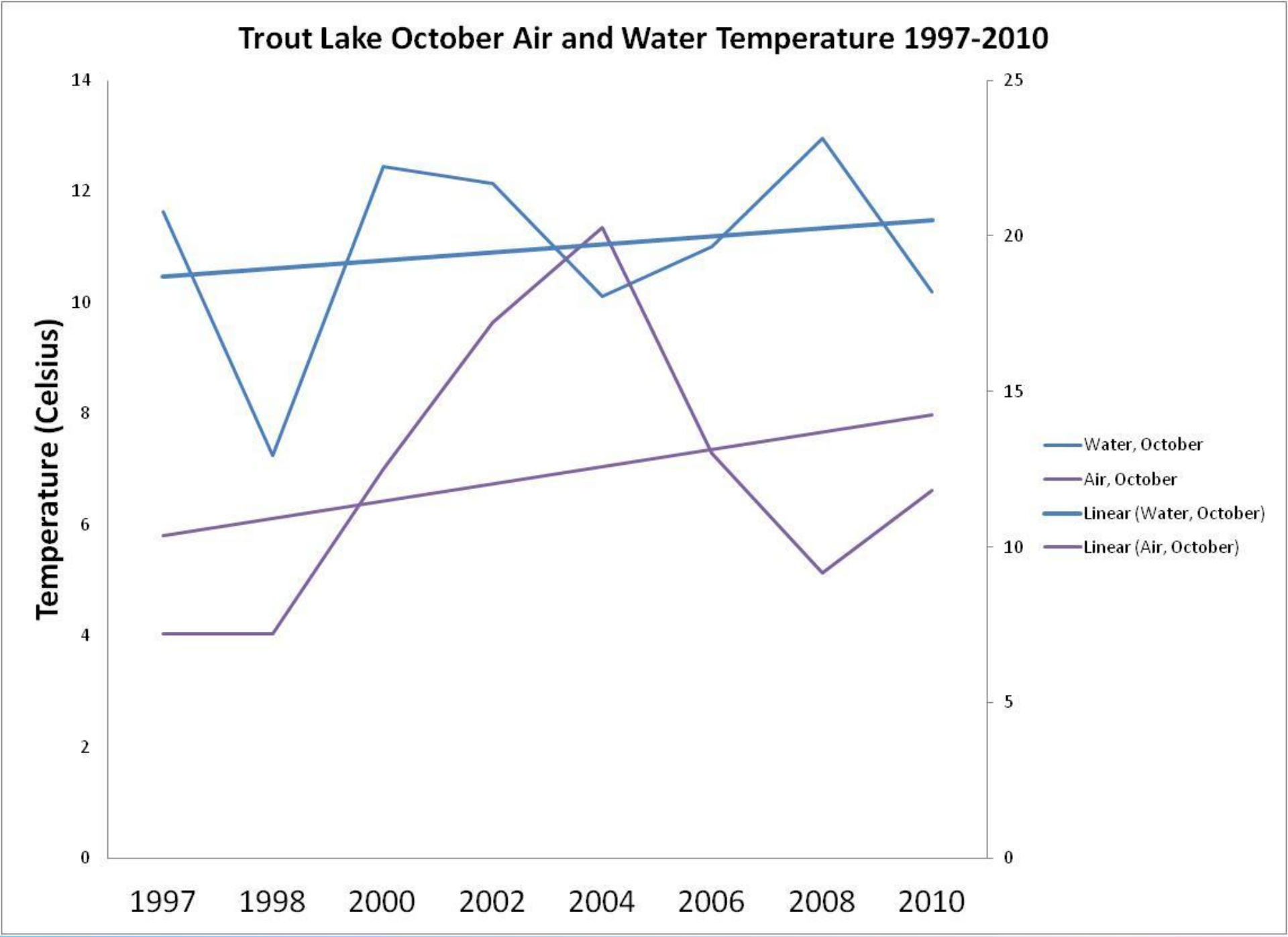
I first started getting calls about large numbers of dead fish on the Detroit River late in November. There were several reports of a large number of dead fish on the lower branches of Rouge Creek around Council Point Park.

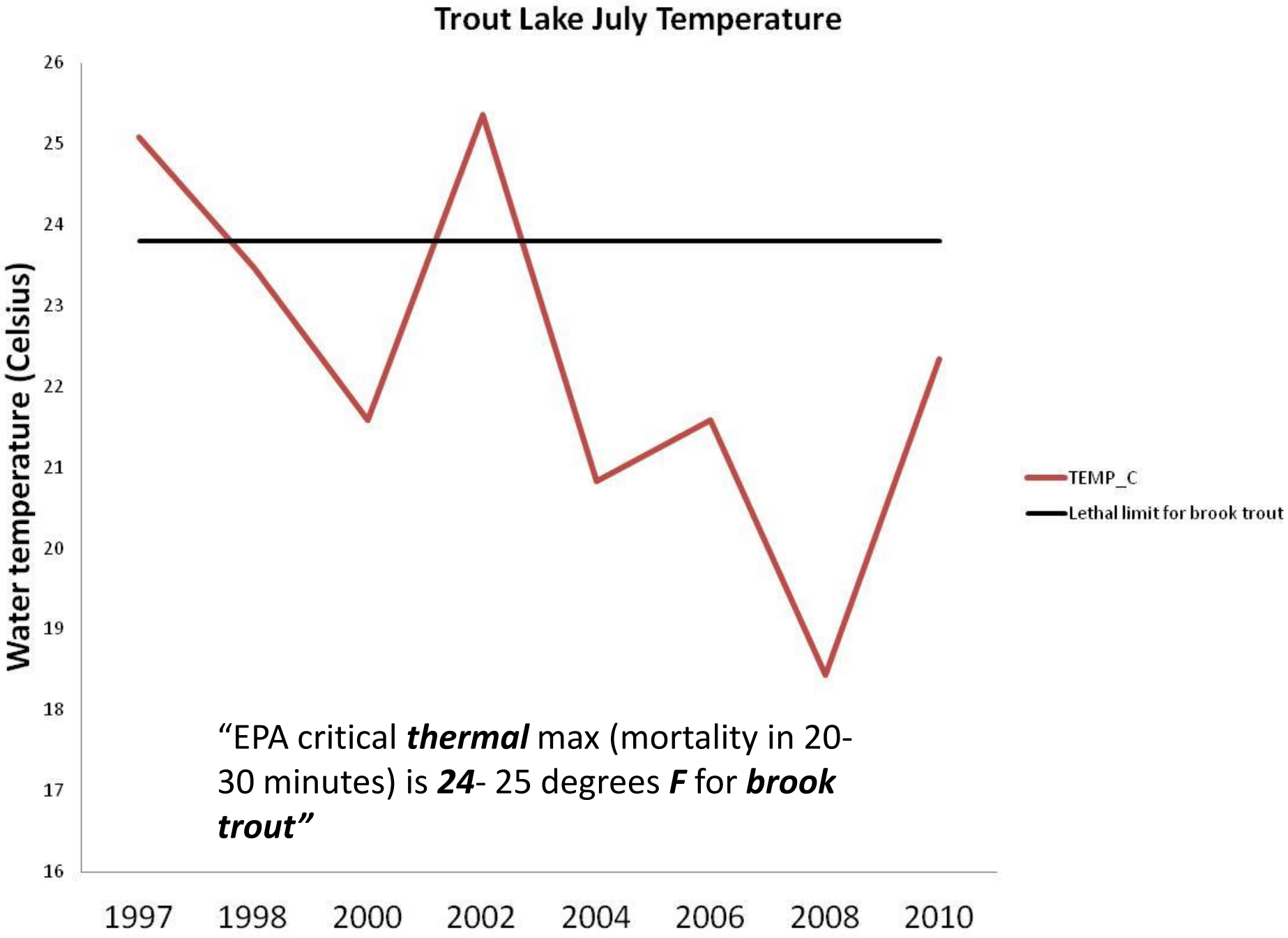
When I arrived at the park to take a closer look, I was surprised to see tens of thousands of dead gizzard shad covering a large section of both the lower north and south branches. The dead fish were heavily concentrated around the La Plaisance Tract as well, which enters into the creek

over the past few months. Shad have a tendency to migrate to areas of warmer water. Many times they can be found in large numbers around warm water discharges and flowing storm water outfalls.

It is hard to argue with some officials when looking at the huge fish kill that occurred last September and not relate it to temperature change. We had a lot of very cold rain during that period, and it caused a considerable amount of cold storm water to enter the very shallow waters of the Rouge Creek.

Naturally, as an area


Trout Lake October Air and Water Temperature 1997-2010
Temperature (Celsius)
14
12
10
8
6
4
2
0
25
20
15
10
5
0
1997
1998
2000
2002
2004
2006
2008
2010
Water, October
Air, October
Linear (Water, October)
Linear (Air, October)


Trout Lake July Temperature
Water temperature (Celsius)
26
25
24
23
22
21
20
19
18
17
16
1997
1998
2000
2002
2004
2006
2008
2010
TEMP_C
Lethal limit for brook trout
"EPA critical ***thermal*** max (mortality in 20-30 minutes) is ***24***- 25 degrees ***F*** for ***brook trout"***

“Water Temperature Monitoring

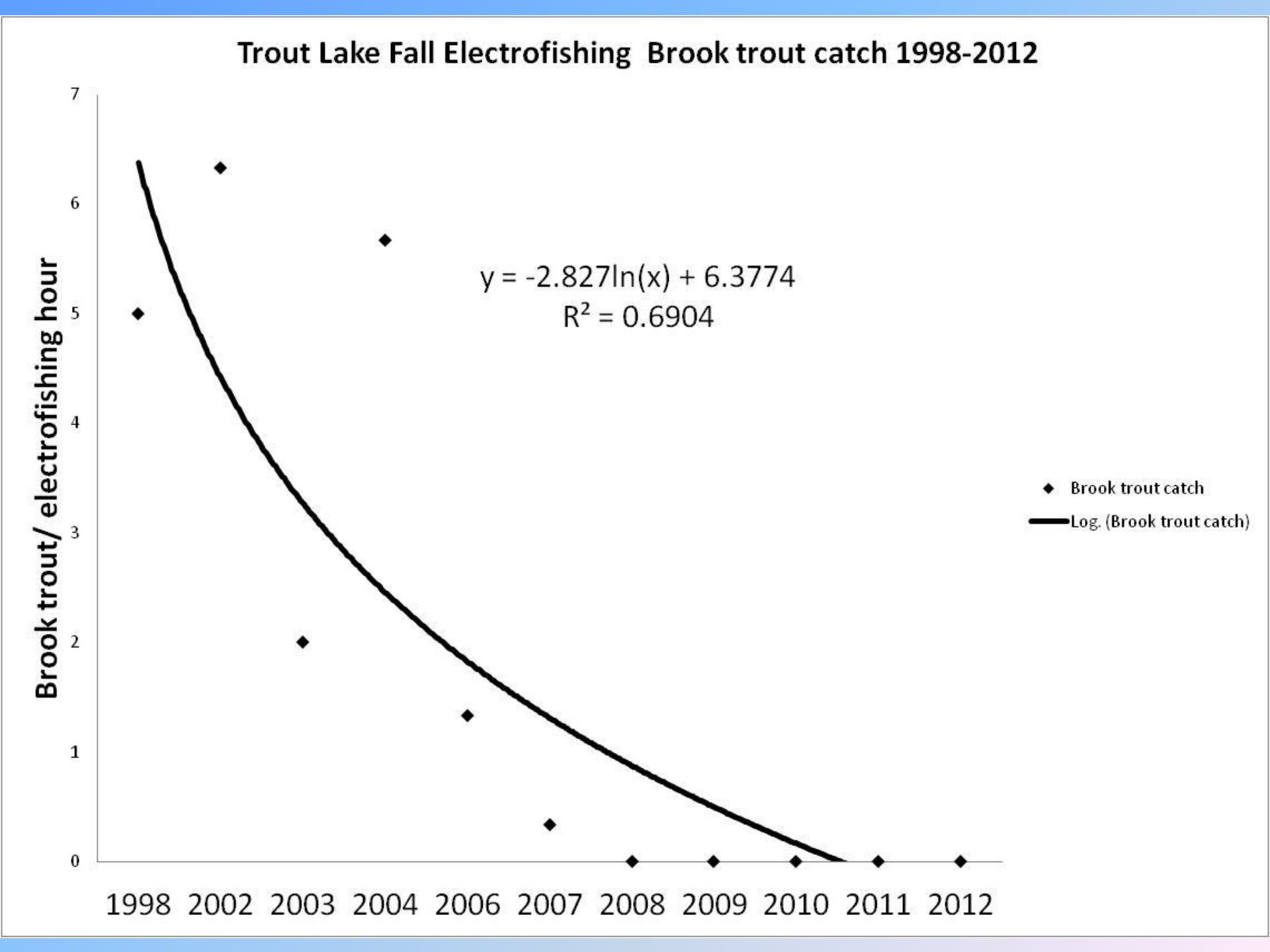
With declines in ice cover and increasing water temperatures, we feel the need to closely monitor water temperatures in Grand Portage. Brook trout inhabit many waters in Grand Portage, and have/are reaching their thermal maximum in many. Enhanced monitoring of surface waters and the hypolimnion during summer stratification periods are needed to evaluate the sustainability of the water body to support its current fish community.”

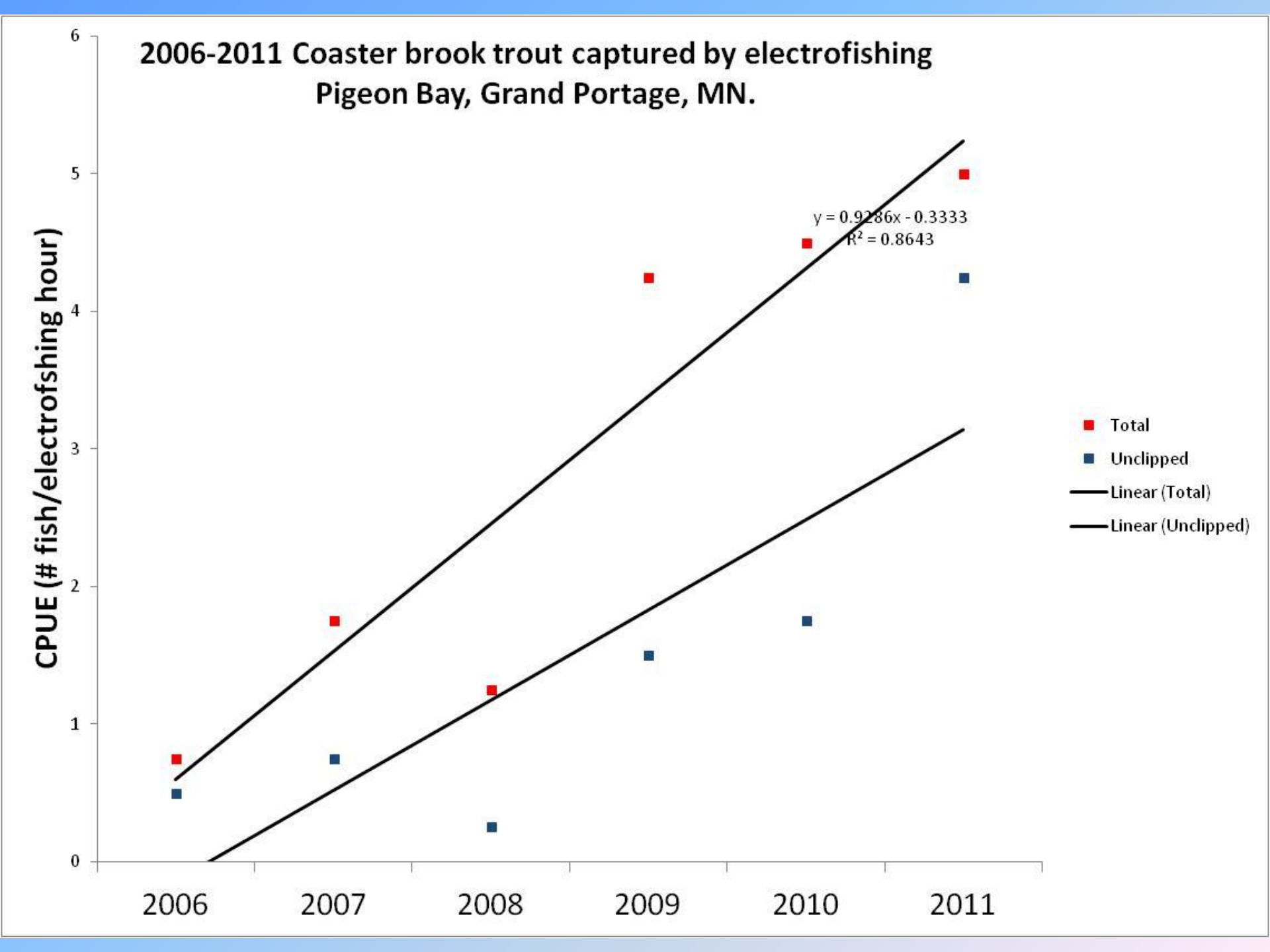
- Grand Portage Strategic Plan to Adapt to Climate Change

What are climate change impacts to subsistence lifestyles and traditional practices?

Are there impacts to access to nutritional foods?

Are we seeing effects of extreme weather conditions?


Trout Lake Fall Electrofishing Brook trout catch 1998-2012
Brook trout/ electrofishing hour
7
6
5
4
3
2
1
0
y = -2.827ln(x) + 6.3774
R² = 0.6904
Brook trout catch
Log. (Brook trout catch)
1998
2002
2003
2004
2006
2007
2008
2009
2010
2011
2012


2006-2011 Coaster brook trout captured by electrofishing
Pigeon Bay, Grand Portage, MN.
CPUE (# fish/electrofshing hour)
0
1
2
3
4
5
6
2006
2007
2008
2009
2010
2011
y = 0.9286x - 0.3333
R² = 0.8643
Total
Unclipped
Linear (Total)
Linear (Unclipped)

Warm temps + Extreme Weather + Invasive species = Loss of native species


+

+

=



+

+


=


Loss of coldwater fisheries

Altered habitats

Changed fish assemblages

Grand Portage
History of the climate change plan

- Began in 2008
- Request of Trust Lands Administrator to create a white paper on climate change
- Set up a team
- Monthly meetings for a year
- Interview elders
- Air quality, water quality, forestry, fisheries and wildlife, solid waste, food and energy sustainability
- One chairperson

Structure of our plan

- Executive summary

Chapter 1 - White paper on climate change

- Guiding Principles
- History
  - Native Cultures Worldwide
  - Grand Portage Band
- Evidence of climate change

  - Global

  - Local

  - Recommendation for adaptation

Chapter 2 Strategic planning for resource management

- Air
- Water
- Forestry
- Fisheries
- Wildlife
- Food Sustainability
- Alternative energy

Components of our plan

Guiding principles

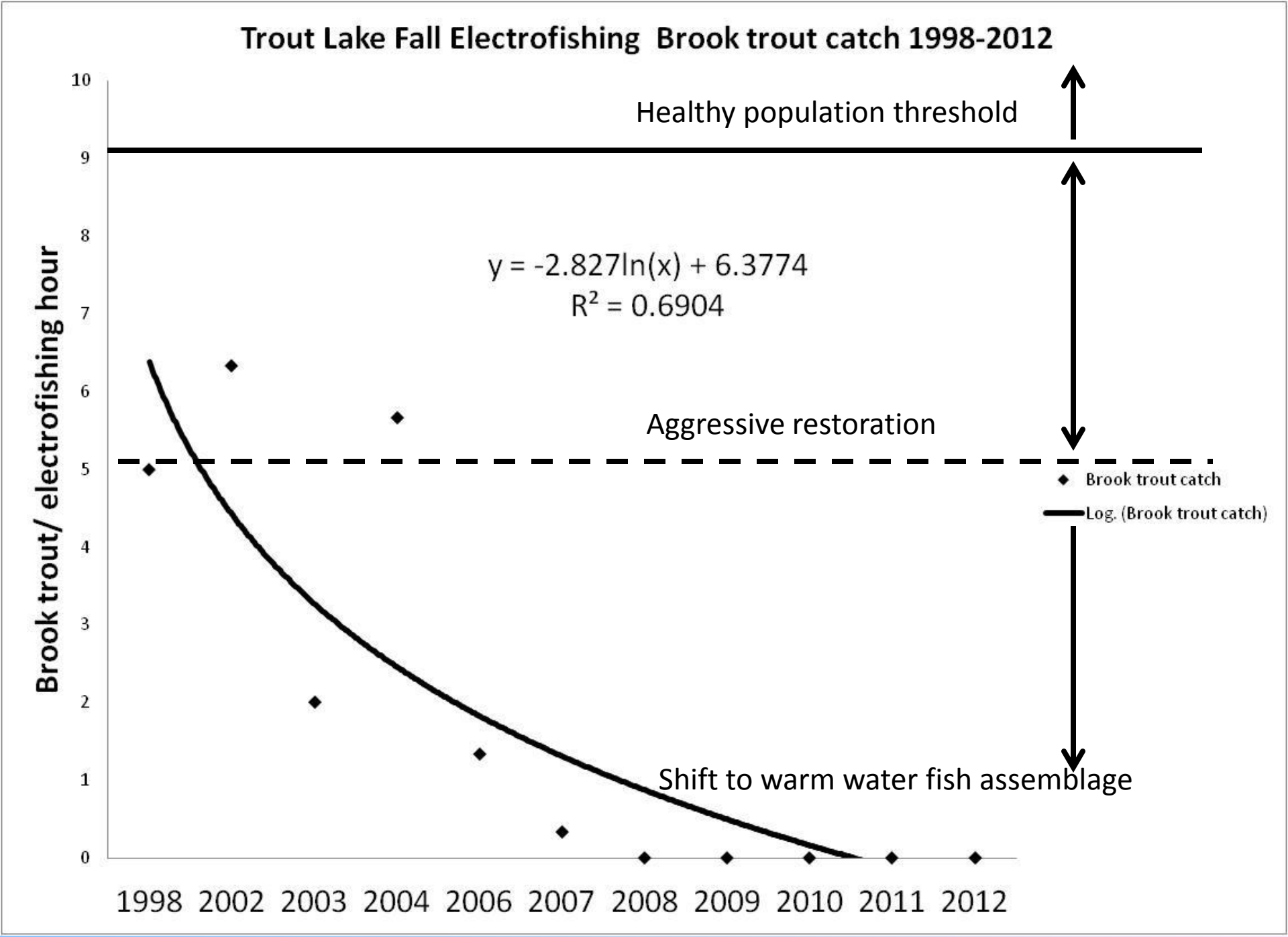
1. Look Seven Generations Ahead
2. Incorporate Ojibwe Worldview
3. Protect Existing Resources
4. Restore on the Basis of Sound Science
   - Improve and Protect Impacted Resources
   - Plan for Future Change
   - Establish Rigorous, Long-Term Monitoring Programs
   - Critically Evaluate Management and Regulation of Natural Resources
   - Coordinated Research to Fill Critical Gaps in Knowledge
   -Include a Long-Term Integrated Strategic Plan for Restoration, informed by the best science and management practice

Examples of trigger points

- Acute
- Paradigm shift
- A few examples

Acute trigger points – Trout Lake Fishery

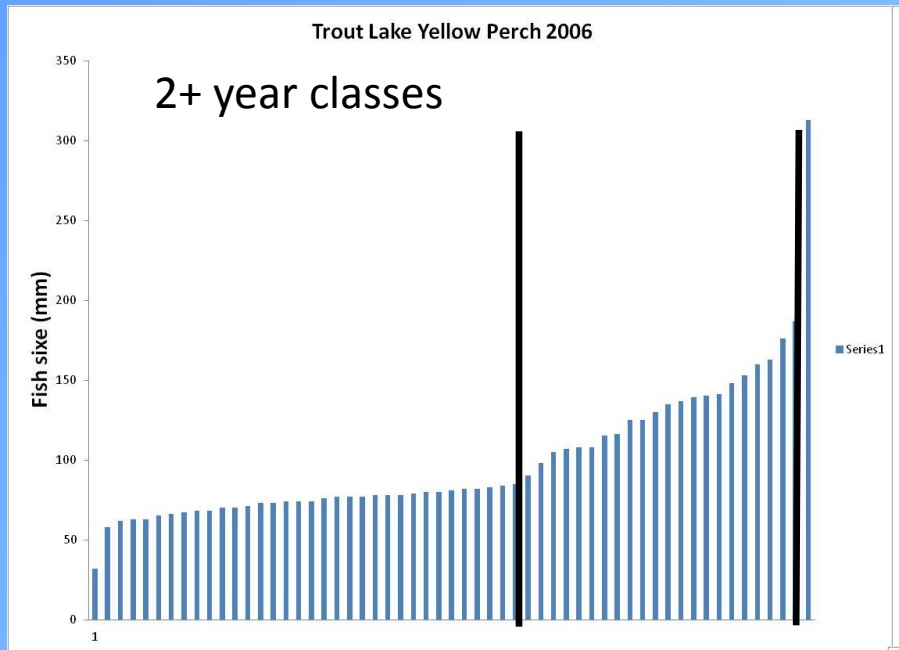
- When brook trout population exceeds Catch Per Unit Effort (CPUE) of 10 fish/electrofishing hour - do nothing
- When brook trout population falls between 5-10/e-fishing hour – aggressive restoration – supplemental stocking, limit harvests
- When brook trout CPUE falls to 0-5 for three years, shift to warm water fish assemblage

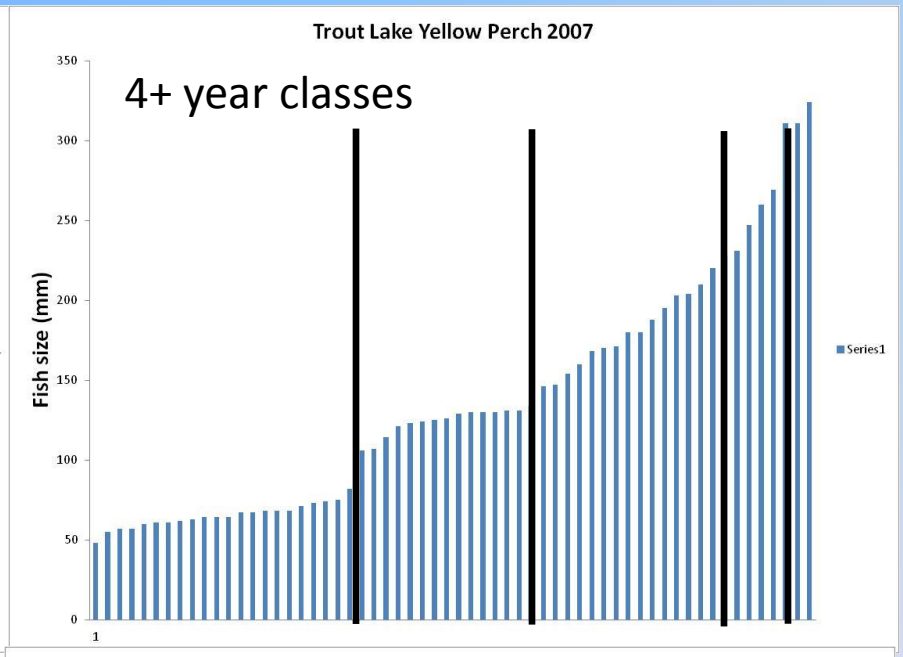

Trout Lake Fall Electrofishing Brook trout catch 1998-2012
Brook trout/ electrofishing hour
10
9
8
7
6
5
4
3
2
1
0
1998
2002
2003
2004
2006
2007
2008
2009
2010
2011
2012
Healthy population threshold
y = -2.827ln(x) + 6.3774
R² = 0.6904
Aggressive restoration
Shift to warm water fish assemblage
Brook trout catch
Log. (Brook trout catch)

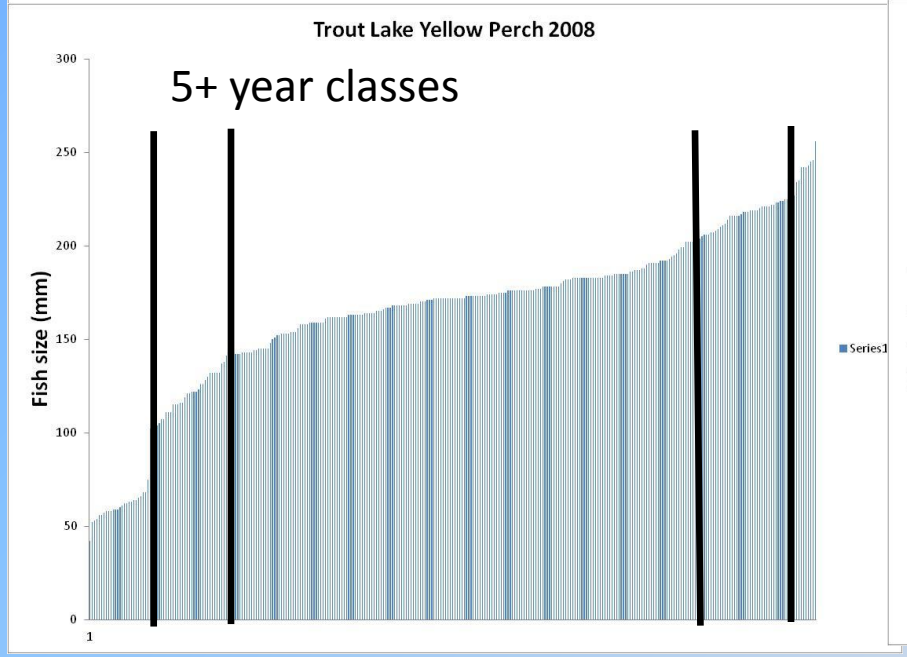
Case study, Trout Lake

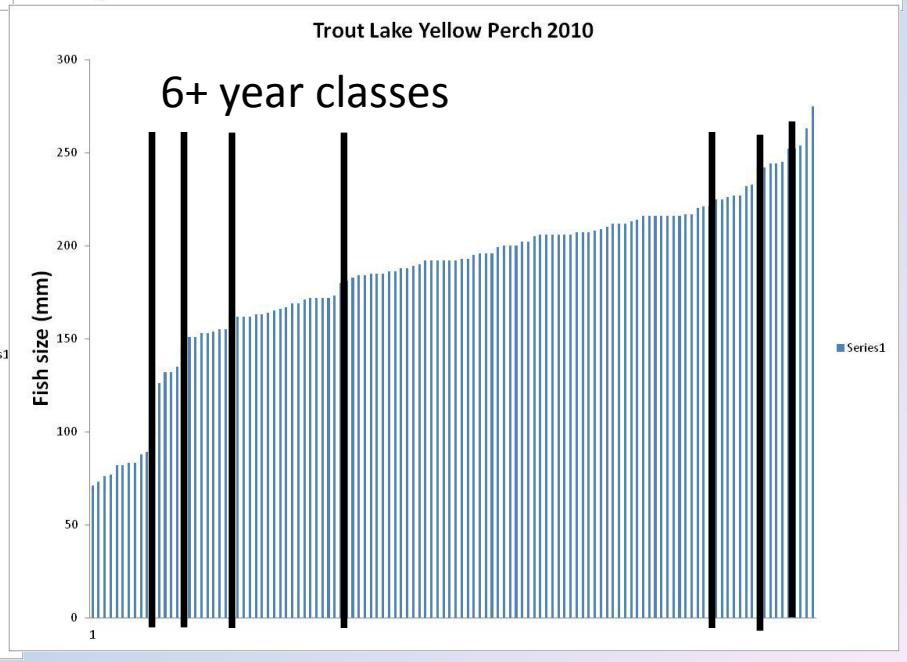
- Historically a brook trout lake
- Populations diminished
- Supplemental stocking
- Decision to shift to warm water fish assemblage
- Yellow perch 2004
- Walleye 2006
- Last brook trout 2007
- Presently self sustaining perch/walleye

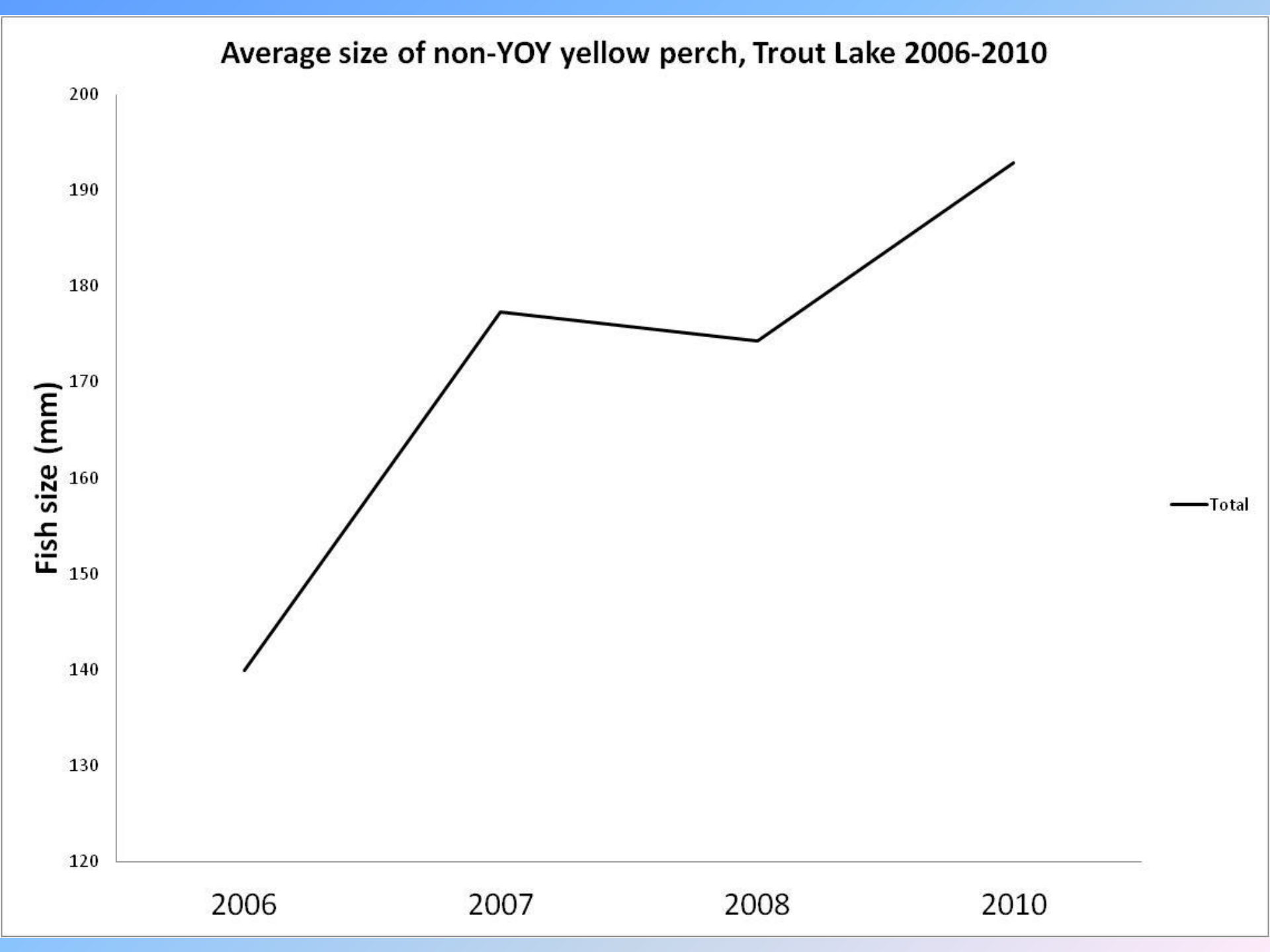
Trout Lake Yellow Perch 2006-2010










Average size of non-YOY yellow perch, Trout Lake 2006-2010
Fish size (mm)
200
190
180
170
160
150
140
130
120
2006
2007
2008
2010
Total

Fisheries Paradigm shifts..

Fish Community

Increased water temperatures may force a shift in fisheries management from cold-cool water species to cool-warm water species.

Aquatic Invasive Species (AIS)

Warming water temperatures will enhance or expand habitats for invasive species particularly in nearshore areas, and increase the potential for new invasive species to establish a population. Increased AIS surveys are necessary to monitor and detect AIS, which typically outcompete and displace native species.

Water Temperature Monitoring

Declines in ice cover and increasing water temperatures will affect biota. It is necessary to closely monitor water temperatures in Grand Portage. Enhanced monitoring of surface waters and the hypolimnion during and extreme weather events or summer stratification periods are needed to evaluate the sustainability of the water body to support its current fish community.

Fish Health

Bodily functions of a fish (i.e., metabolism, respiration, digestion) increase with temperature. This requires a fish to consume more food resources to maintain its body condition. As a result, contaminants in prey items are ingested more frequently (i.e., mercury, PCBs) and bio-accumulate faster, yielding higher levels of contaminants for the same aged fish than historically measured.

We must increasing fish health monitoring for contaminants like mercury, and test a suite of fish species and sizes to help create baseline information about current contaminant levels.

Large Scale Fisheries Management and Coordination

We intend to increase our involvement in the political arena and government to government communication and consultation relative to climate change and fisheries.

We will continue :

- work with the Great Lakes Fisheries Commission
- participate on Lake Superior Committee and the Technical Committee
- to conduct coordinated research
- work with the U.S. Environmental Protection Agency (Great Lakes National Program Office) and Environment Canada
- take part in the Lake Superior Binational Program
- be active on the Lake Superior Work Group and Aquatics Community Committee.

Where are we now?

- Initial Draft of Plan now complete
- Must be vetted/edited
- Present to council
- Will request resolution to adopt plan