



**CLIMATE CHANGE:  
2021 and Beyond**

Preparing our communities for the future.



Great Lakes and St. Lawrence Cities Initiative Presents:

**Climate change potential impacts to fish, wildlife  
and the people who rely on these species**

**Dr. Len M. Hunt, Research Scientist, Ontario  
Ministry of Northern Development, Mines, Natural  
Resources, and Forestry**

# Organization

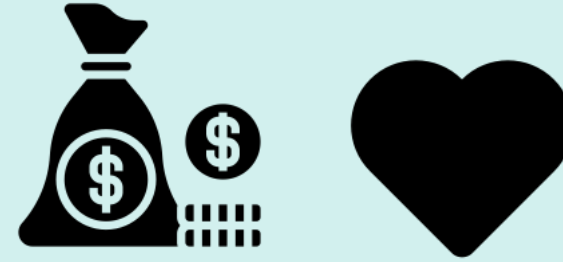
- What is the context for the presentation?
- Why should you care about climate change impacts to fish and wildlife?
- What are the likely impacts of climate change on fish?
- How might climate change impact benefits to people?
- What other factors should be considered?

# What is the context for the presentation?

- Expertise
- Climate change and uncertainty
- Models and projections
- Positive or normative



# Why should you care?



- Commercial and subsistence / tribal fisheries
- Great lakes / St. Lawrence recreational fishing:
  - \$2.2 billion USD 2016 spent by 1.8 million anglers in US<sup>1</sup>
  - Canadian totals are less certain but could be ~\$770 million CAD 2010<sup>2</sup>

<sup>1</sup> 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

<sup>2</sup> 2010 Recreational Fishing Survey of Canada

# Why should you care?



- Hunting

- 11.5 million hunters in US in 2016<sup>1</sup>
- 3 to 8% hunting participation rate near US Great Lakes states<sup>1</sup>

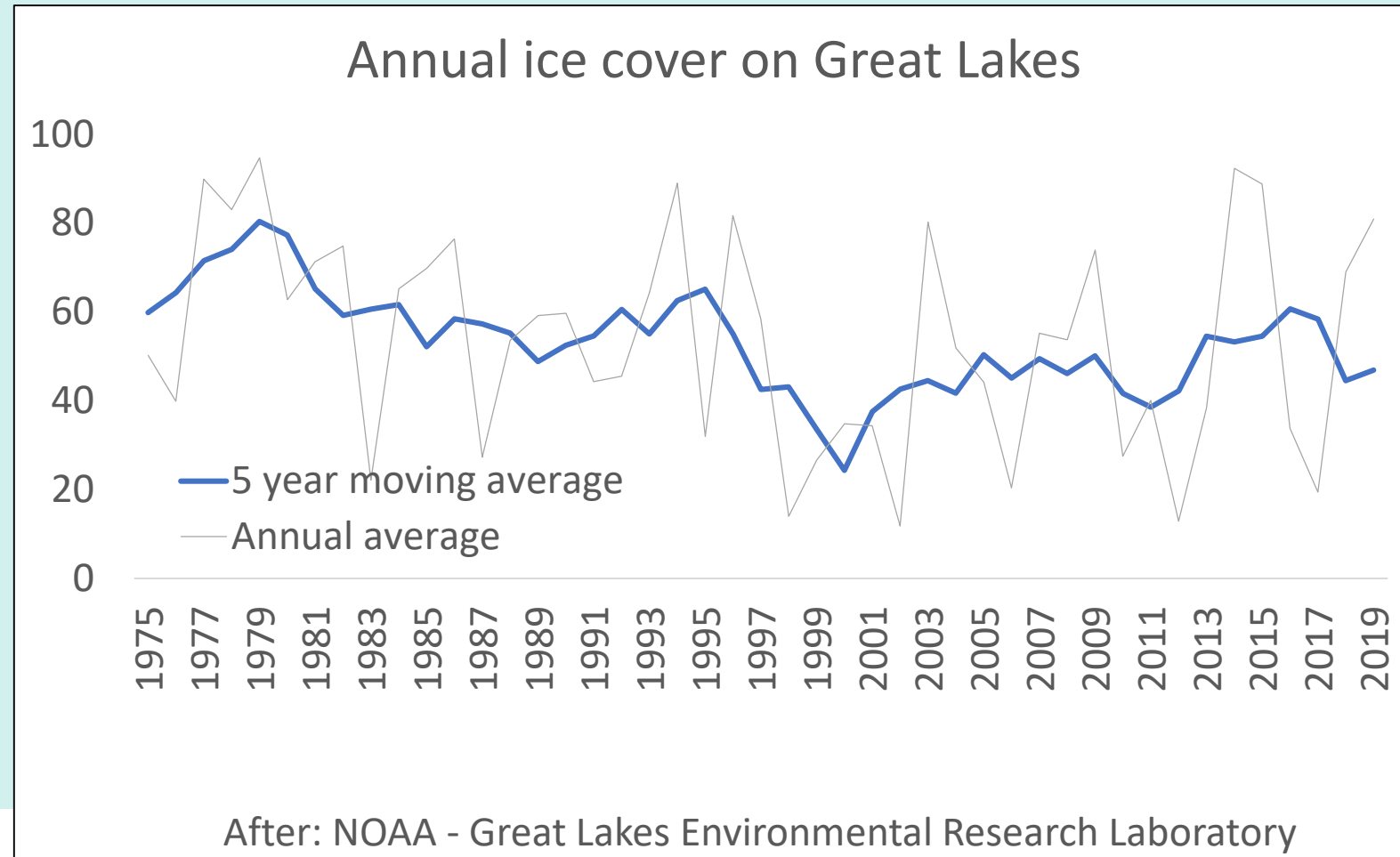
- Wildlife viewing

- 86.0 million wildlife watchers in US in 2016<sup>1</sup>
- 23.7 million people watch wildlife away from home<sup>1</sup>

<sup>1</sup> 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

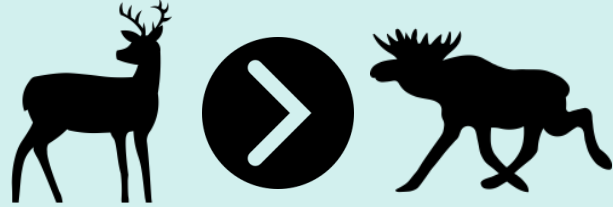
# What are climate change impacts?

- Air /water temp
- Precipitation
- Snow and ice cover
- Water quantity
- Water chemistry



# What are climate change impacts?

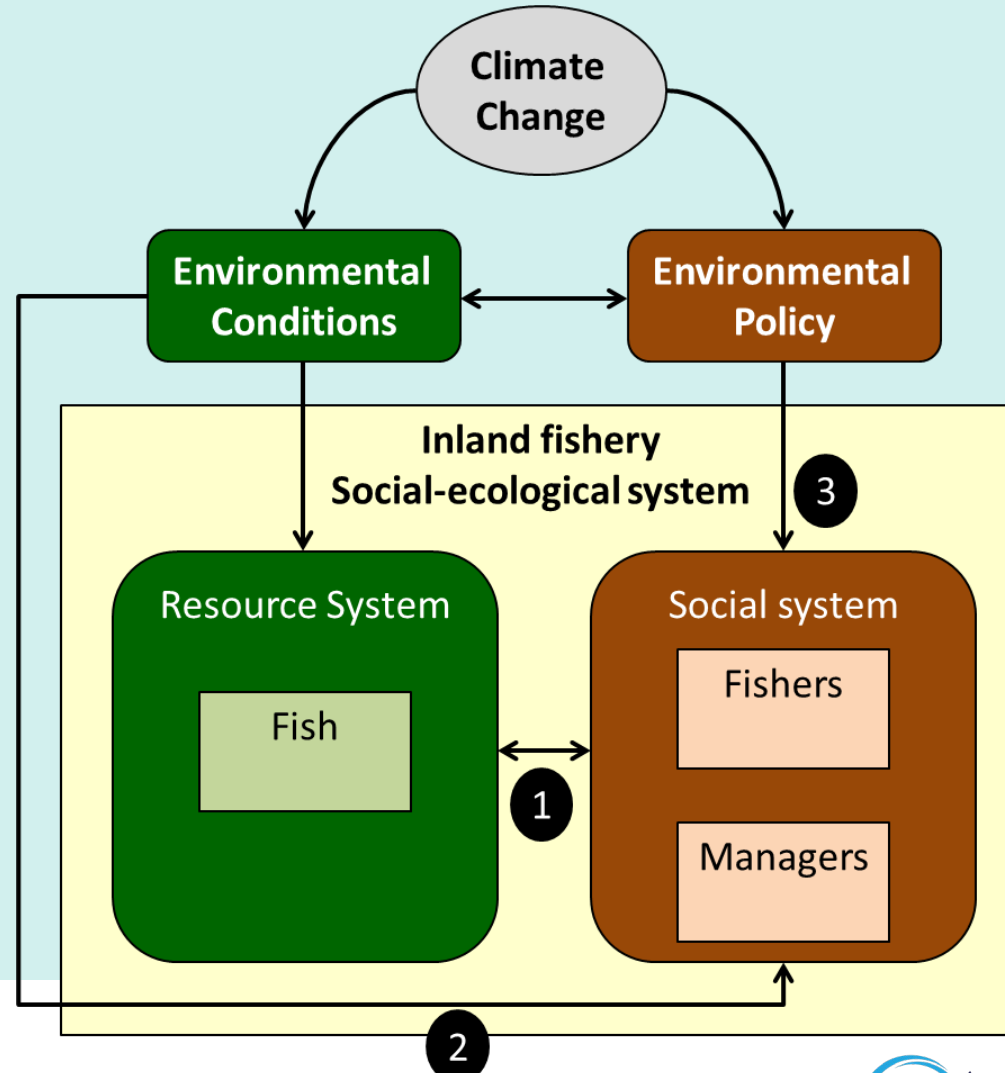
- Wildlife



- Fish

- Individuals (survival, growth, and reproduction)
- Populations (distribution and phenology)
- Communities or food webs (interactions)

# What about impacts to fisheries?



Source: Hunt et al. (2016)

# How might climate change affect fishing benefits?

- Scenario (transition from walleye to bass community)
- Ontario specific
- Estimate \$64 CAD loss in per trip value from the transition
- Crude translation to about \$16 million CAD loss in Ontario

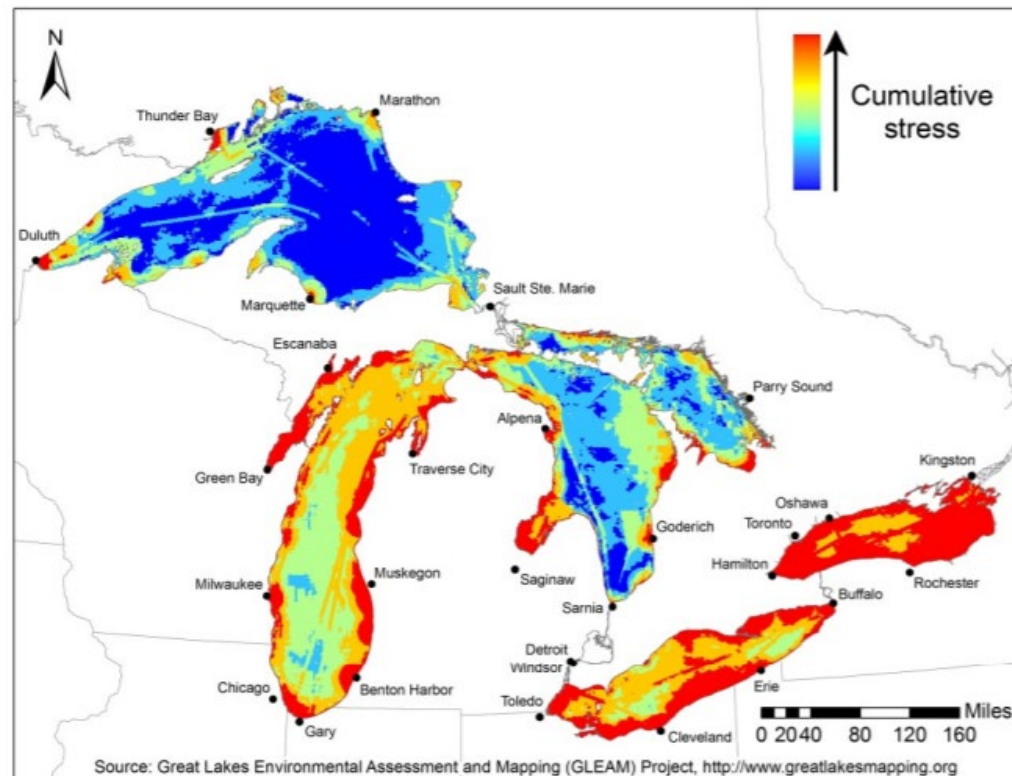
# What other factors should be considered?

## INVESTIGATORS

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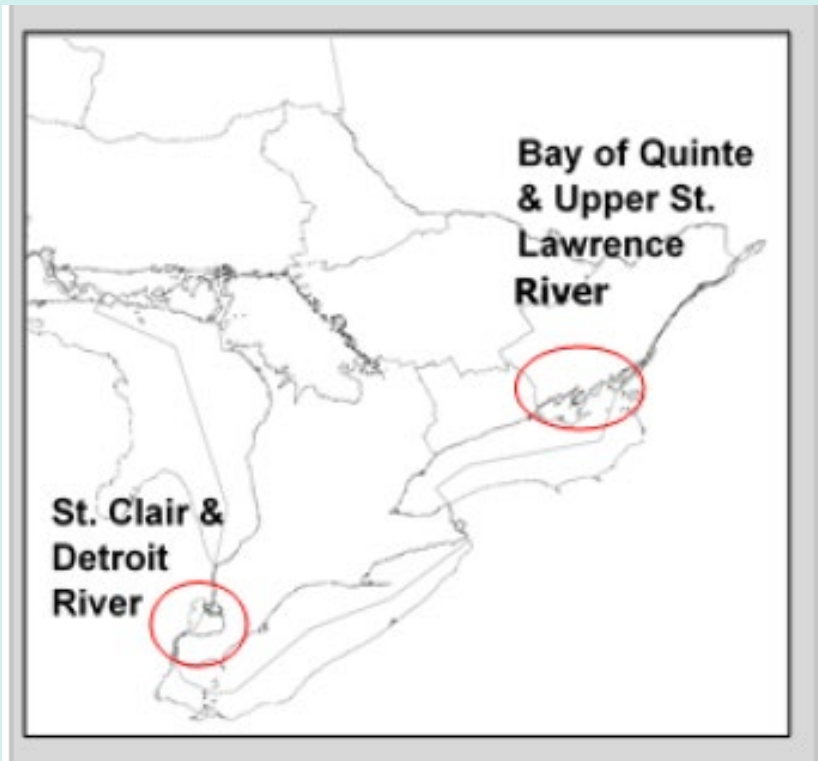
*Peter McIntyre, University of Wisconsin-Madison*



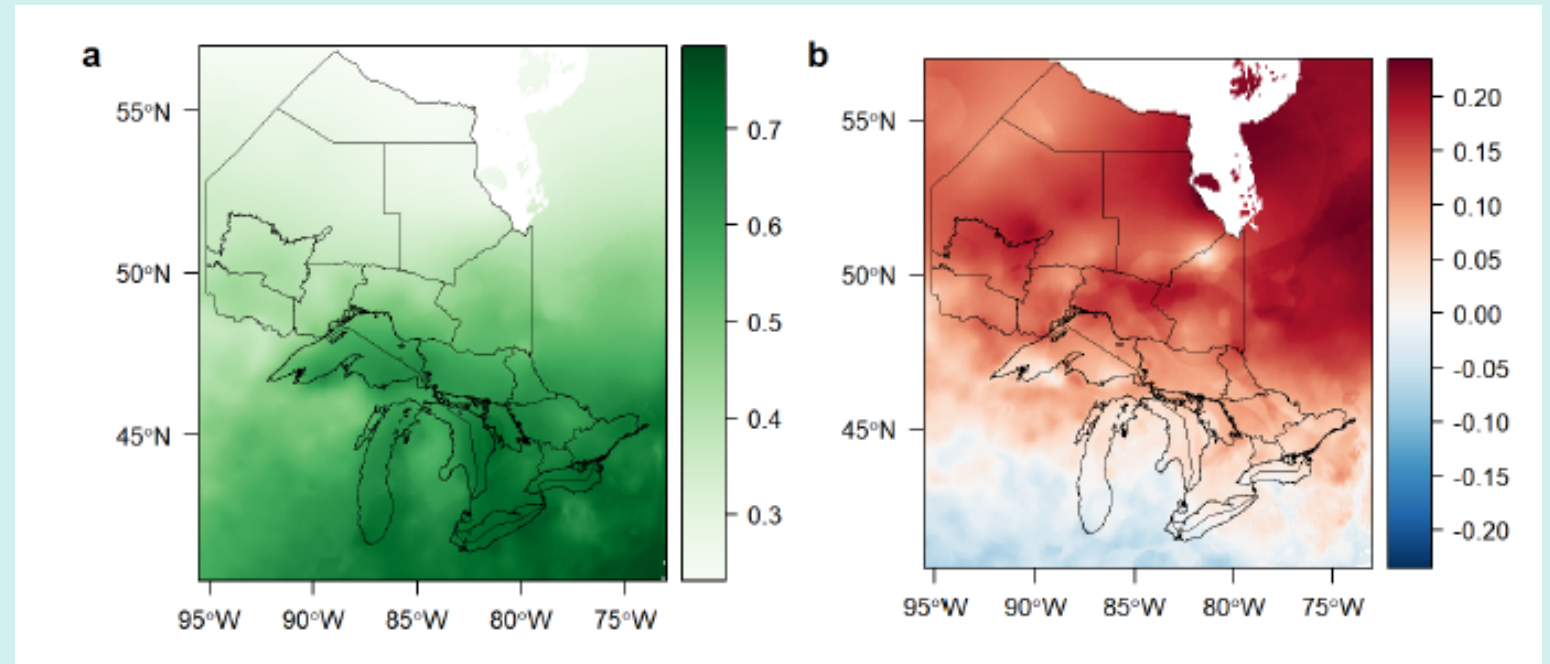
# What factors should be considered?

- Climate change
- Invasive species (~180 non-native species)
- Land use change (~2000 km<sup>2</sup> development increase in US, 1996-2010)
- Pollution
- Harvest
- **Elephant in the room: human population change**

# Combining climate and population change and invasive species in Ontario: warmwater invasive fish in GL wetlands



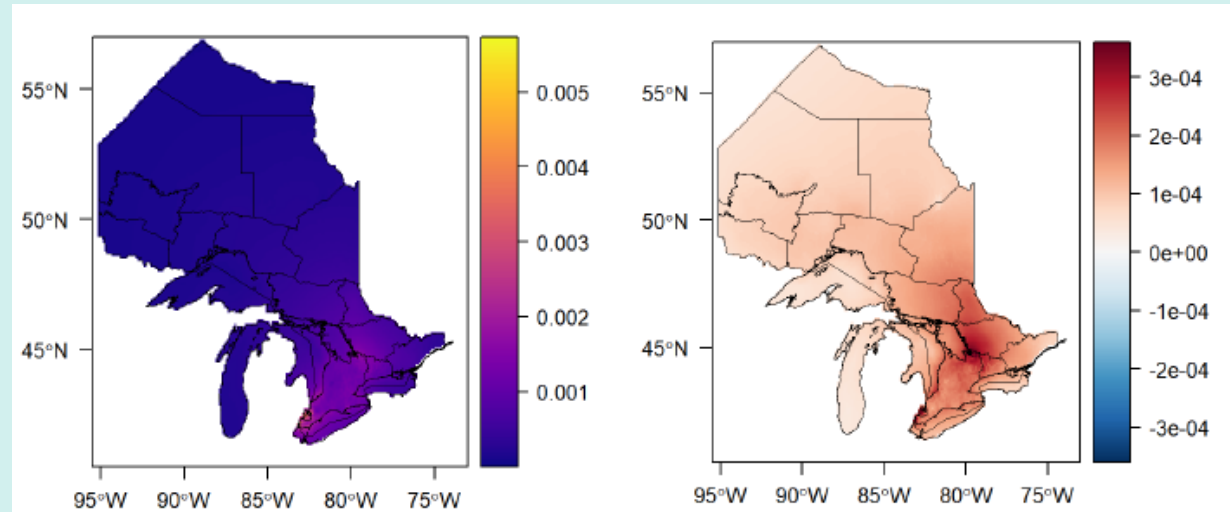
Initial sites for invasive fish



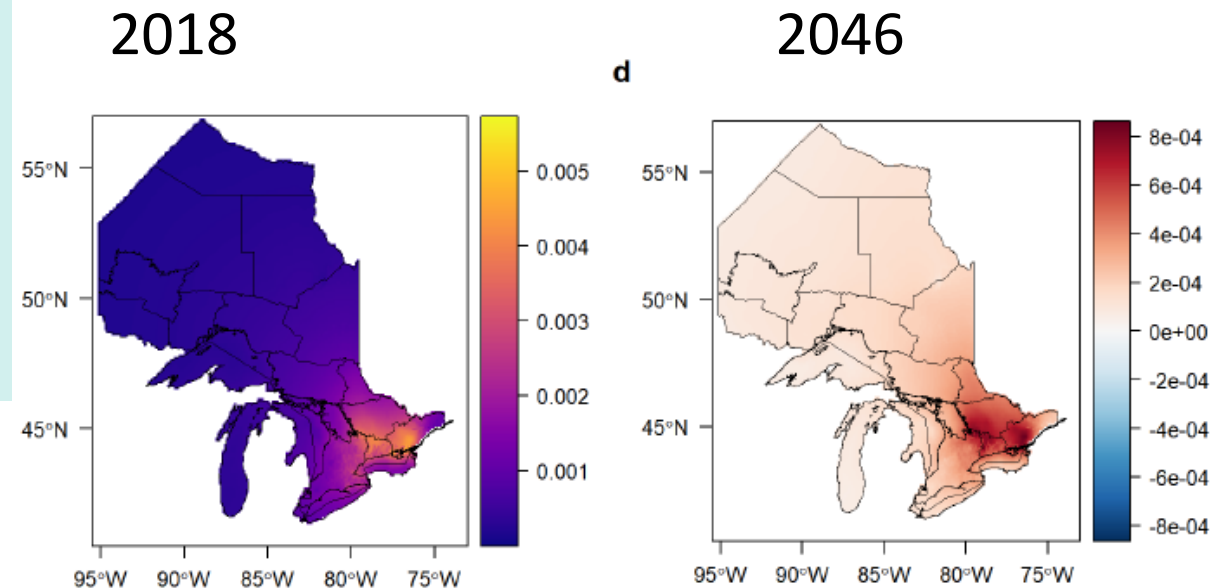
Climate habitat suitability  
(2018 and change to 2046)

# Combining climate and population change and invasive species in Ontario: warmwater invasive fish in GL wetlands

St. Clair (lake and river)  
and Detroit River



Bay of Quinte and upper  
St. Lawrence River



# What to take away?

- Fishing, hunting, and wildlife viewing activities are important
- Climate change can affect animals, populations, and communities
- Climate change impacts are complex and often rely on models
- Changing Walleye to Bass populations reduces value in Ontario
- Climate change is one important stressor of many stressors