Great Lakes Coastal Wetland Communities: Vulnerabilities to Climate Change and Response to Adaptation Strategies

CCAF Wetlands Study

Investigators:

Susan Doka — Fisheries & Oceans, Great Lakes Lab for Fisheries & Aquatic Sciences, Burlington, ON

Joel Ingram — Environment Canada, Canadian Wildlife Service, Downsview, ON

Linda Mortsch — Environment Canada & University of Waterloo, Atmospheric Impacts Research Group, Waterloo, ON

Partners:

Nick Mandrak — DFO, Burlington, ON

IJC Lake Ontario – St. Lawrence Study Partners

CCAF Fish Community Project Overview

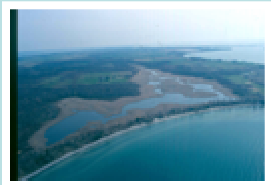
Climate Change Effects

Temperature & Water Level Predictions

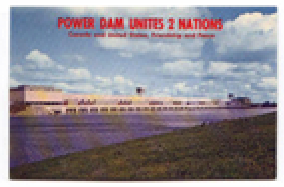
Habitat Mapping & Modelling

Adaptation Strategies

Marsh Dyking & Barriers



Water Level Regulation



Assessment Objectives

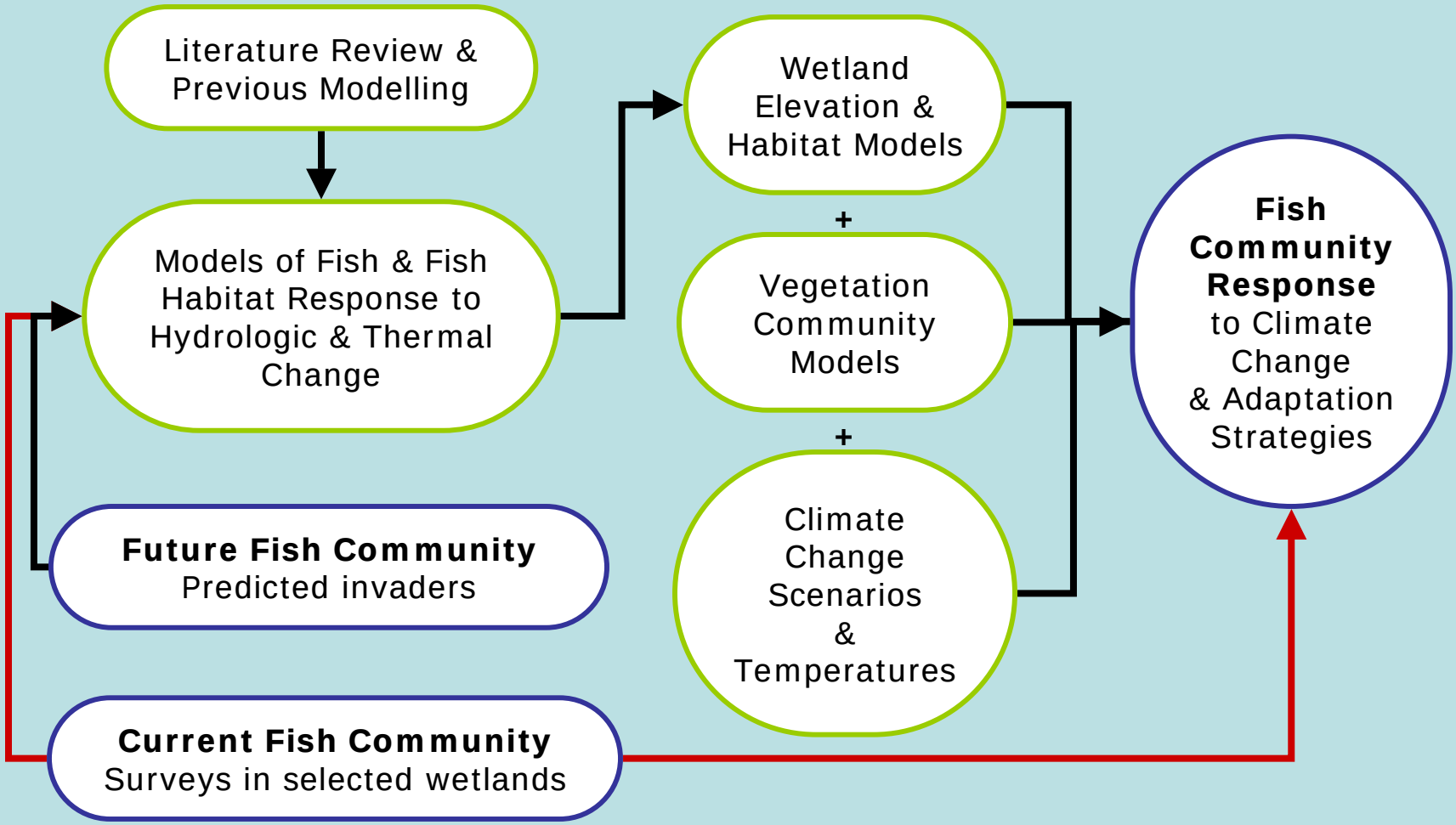
1. To assess the vulnerability of Great Lakes coastal wetlands to water level fluctuations due to climatic change
2. To assess vulnerability of wetland fish & bird communities to projected vegetation, thermal & water level changes in the lower Great Lakes

Fish & Bird Habitat Supply & Effects

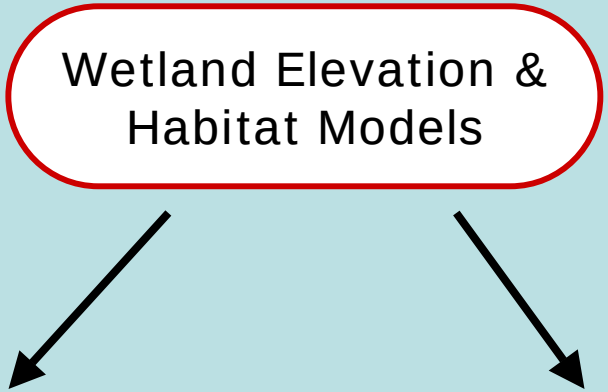
Evaluation Objectives

1. Evaluate the effects on coastal wetlands of modifications to water regulation on Lake Ontario as an adaptation strategy
2. Evaluate the effects of wetland dyking on Lakes the lower Great Lakes as an adaptation strategy

CCAF Fish Sub-Project Overview



CCAF Habitat Field Surveys
Dyked/Closed - Open Wetland Comparisons



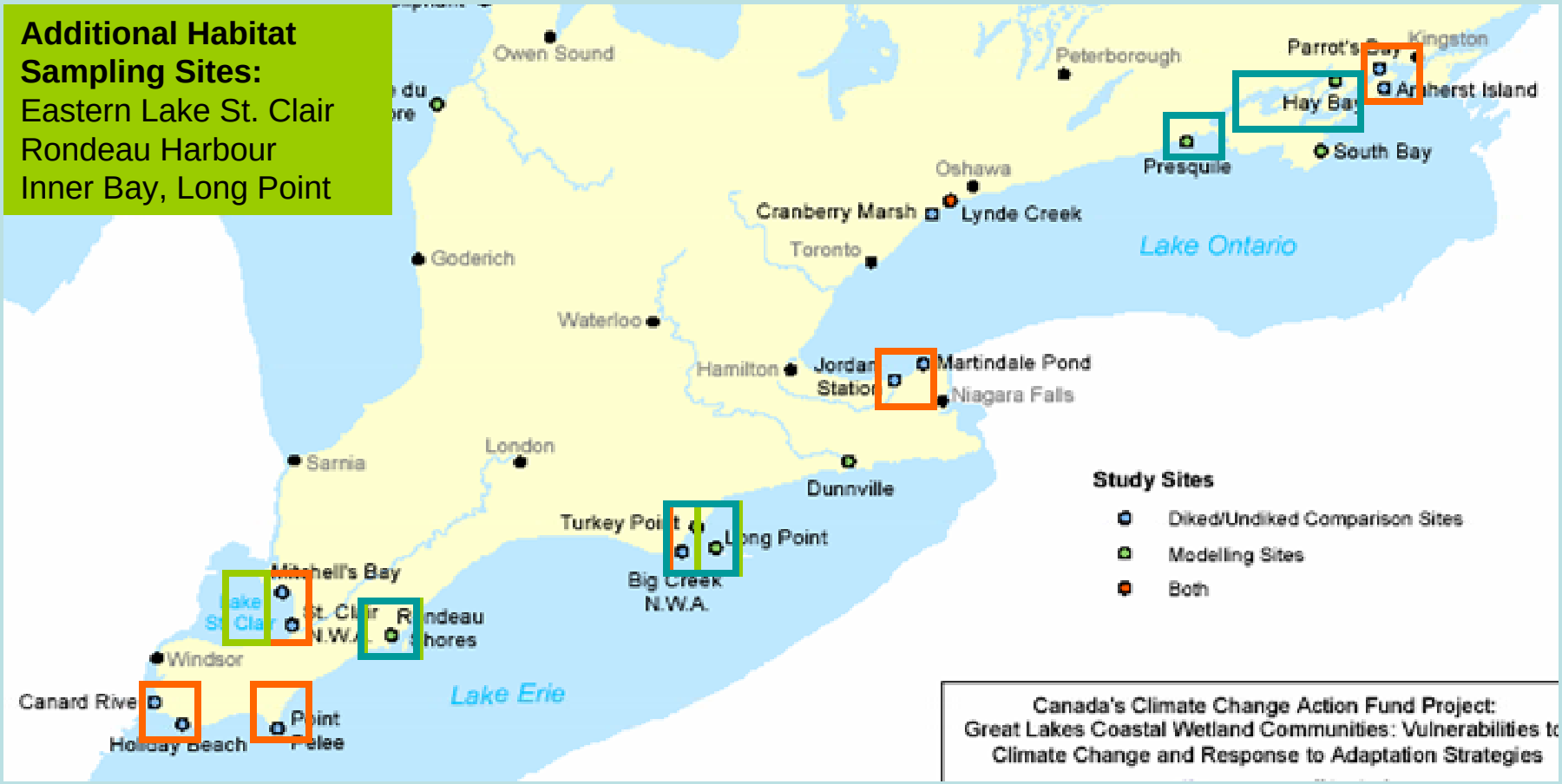
CWS Surveys
Emergent Vegetation
Hi-Res Elevations
Water Level Loggers
Bird Community

DFO Surveys
Submergent Vegetation
Substrate Type
Water Depth
Temperature Loggers
Physicochemical Variables
Fish Community

Habitat Assessment includes: existing GIS layers, air photo interpretation, satellite imagery, field data (long-term point and sporadic spatial)

CCAF Wetland Locations

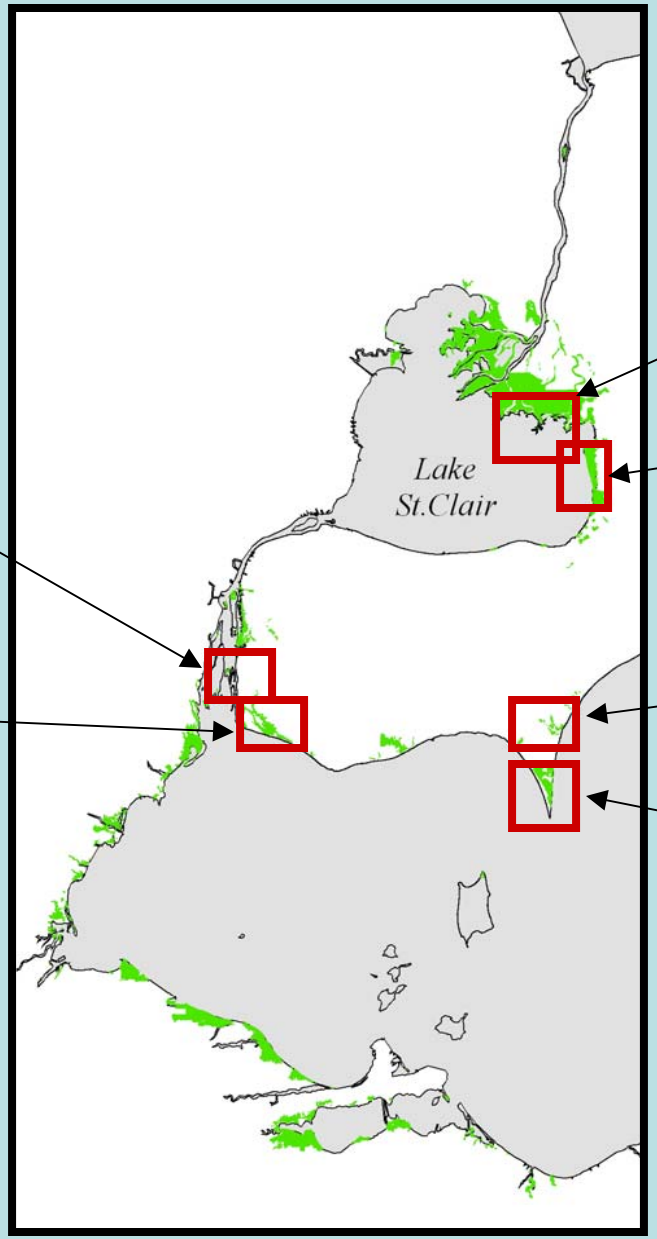
Additional Habitat Sampling Sites:
Eastern Lake St. Clair
Rondeau Harbour
Inner Bay, Long Point



Fish & Habitat Sampling Sites: Mitchell's Bay, St. Clair NWA, Canard River, Holiday Beach, Point Pelee, Hillman Marsh, Big Creek NWA, Inner Bay Long Point, Jordan Station, Martindale Pond, Parrott's Bay, Amherst Island

CCAF Fish Modelling Sites: Rondeau, Long Point, Presqu'ile, Bay of Quinte, etc.

Huron-Erie Corridor Wetland Locations



Mitchell's Bay + Adjacent Site

St Clair National Wildlife Area

Canard River

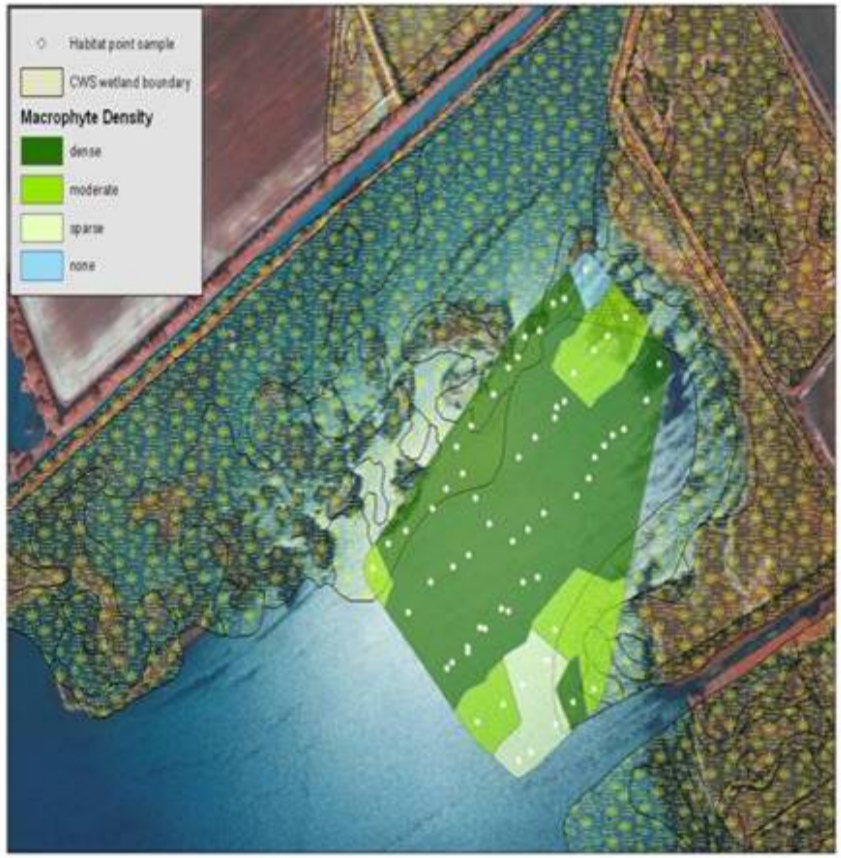
Holiday Beach

Hillman Marsh

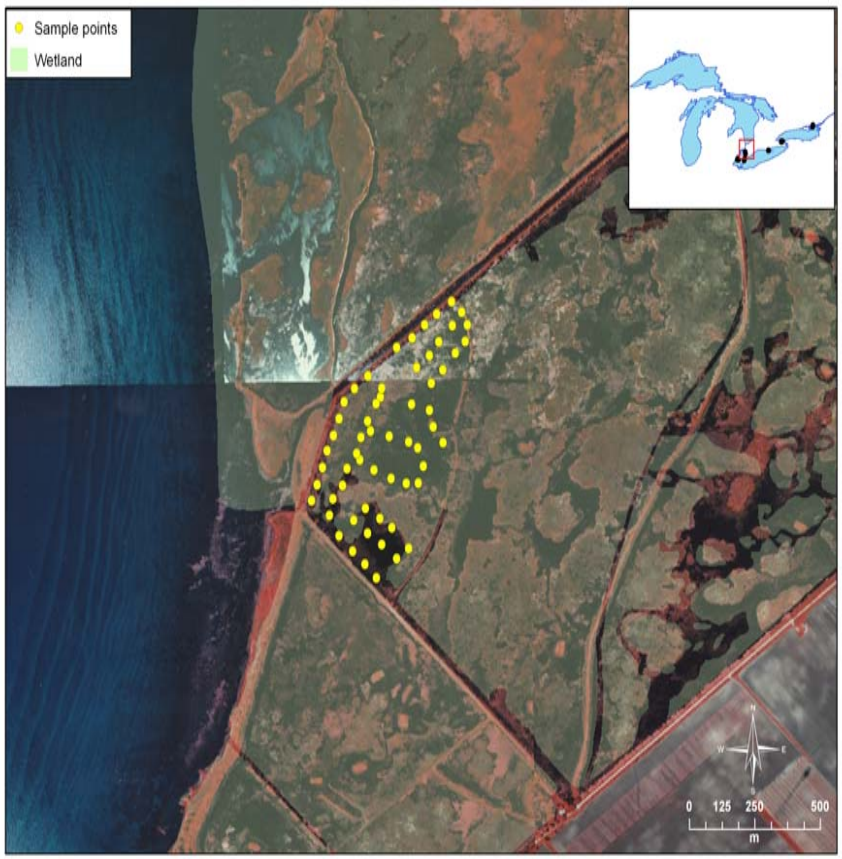
Point Pelee

Habitat Surveys in Submergent Vegetation
Lake St. Clair

Mitchell's Bay (open wetland)

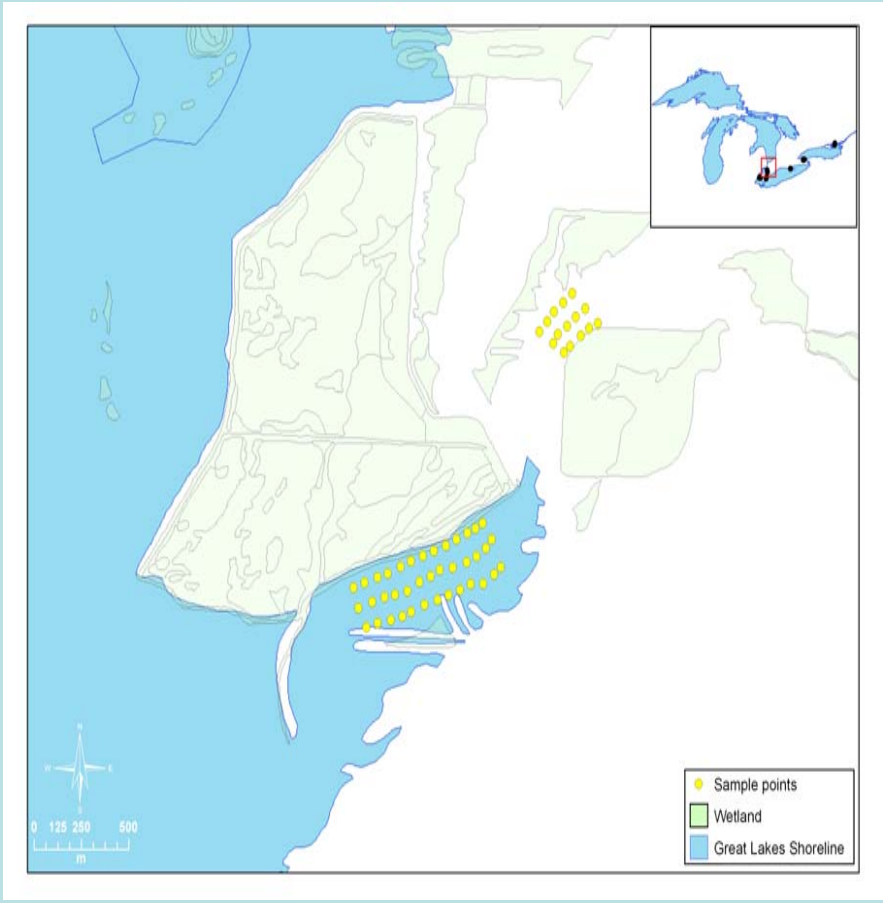


St. Clair National Wildlife Area (dyked)

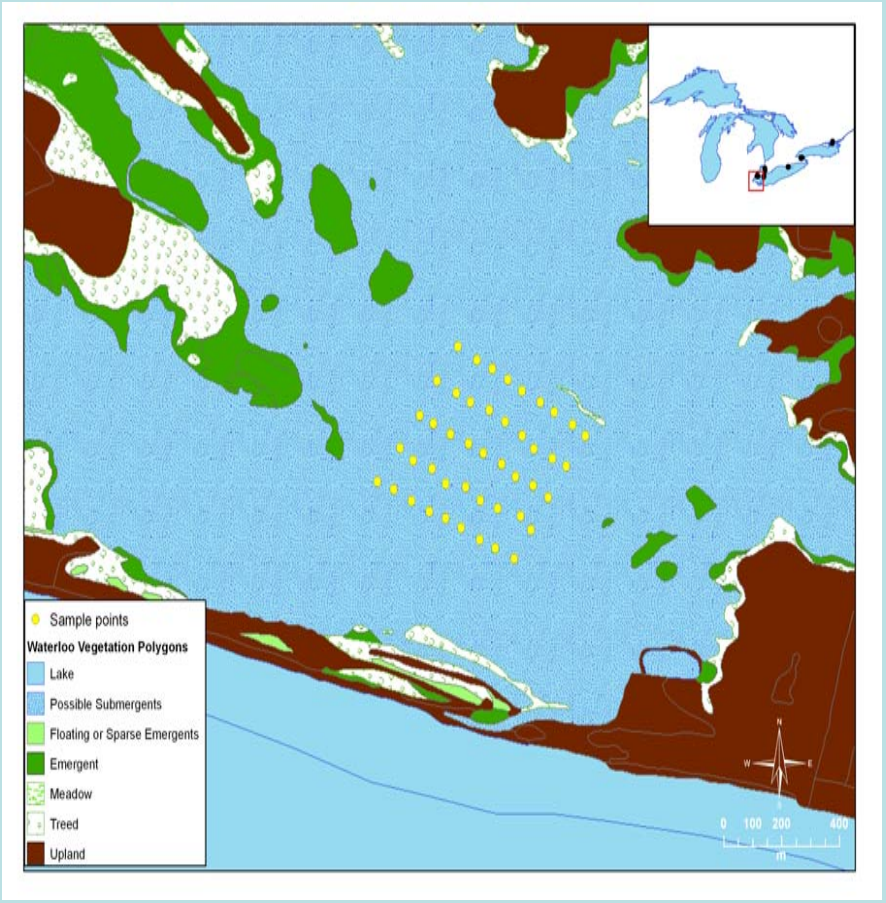


Habitat Surveys in Submergent Vegetation
Detroit River-Erie

Canard River (open wetland)

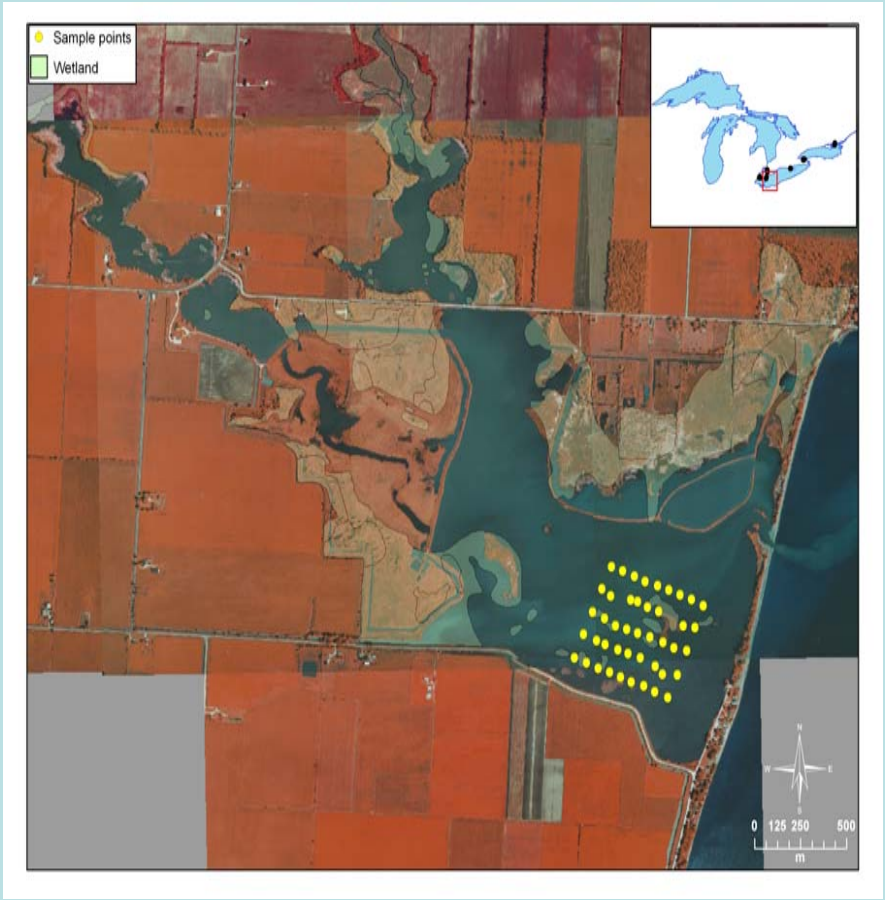


Holiday Beach (dyked wetland)

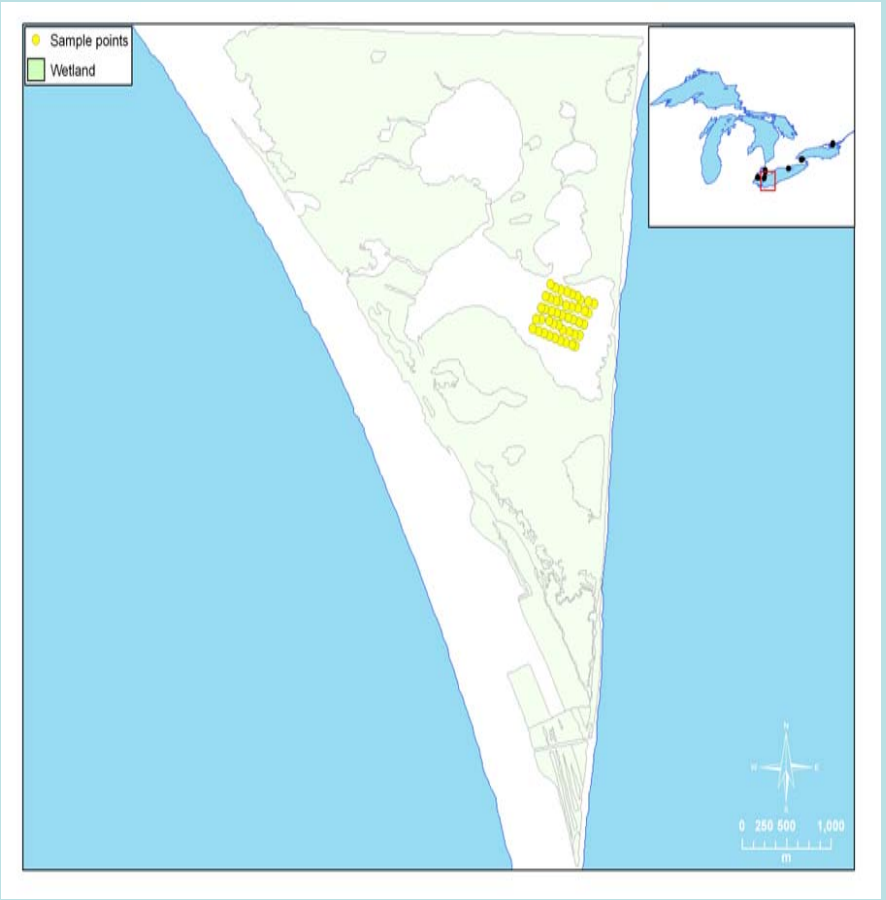


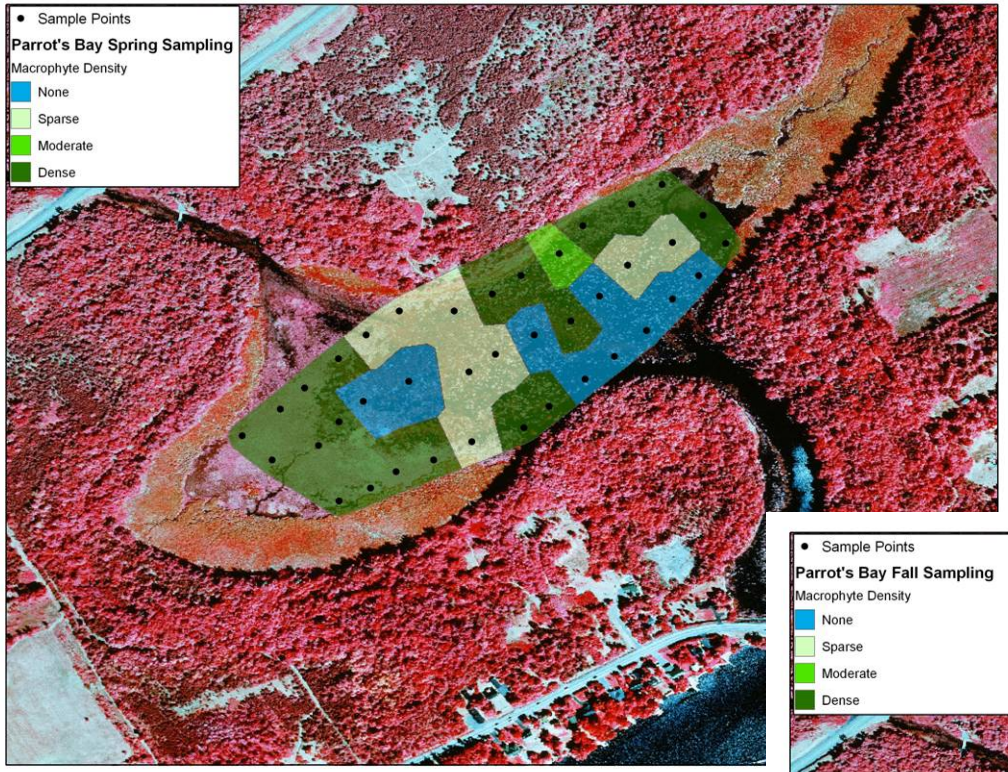
Habitat Surveys in Submergent Vegetation Western Lake Erie

Hillman Marsh (open wetland)

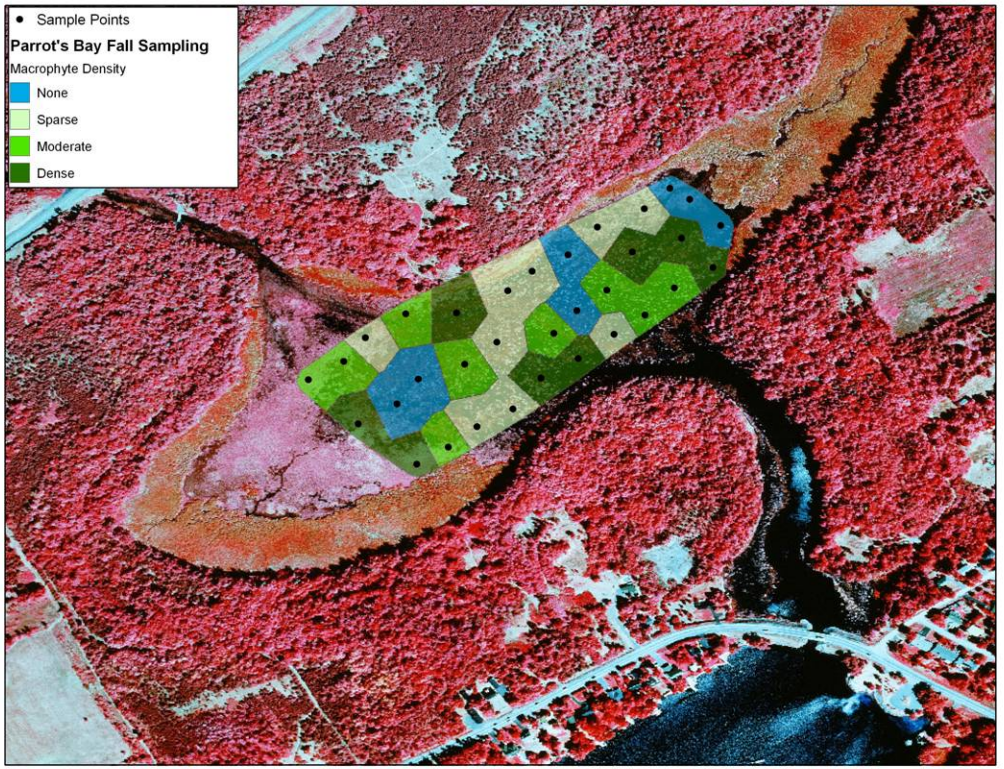


Point Pelee (closed wetland)





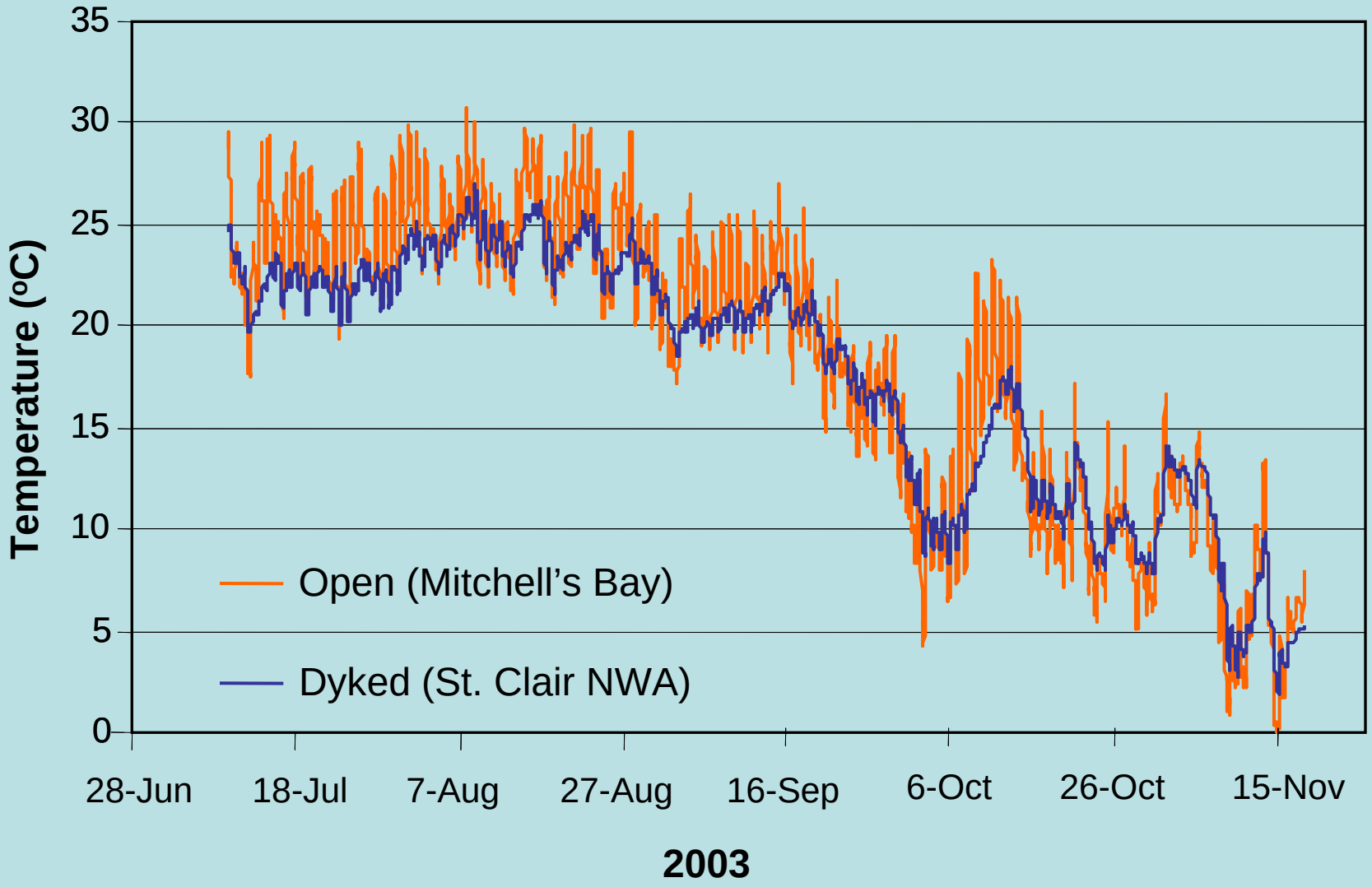
Temporal Habitat Surveys in Submergent Vegetation for Assessing Fish Habitat Availability (Merged with IR Imagery of Emergent Vegetation)

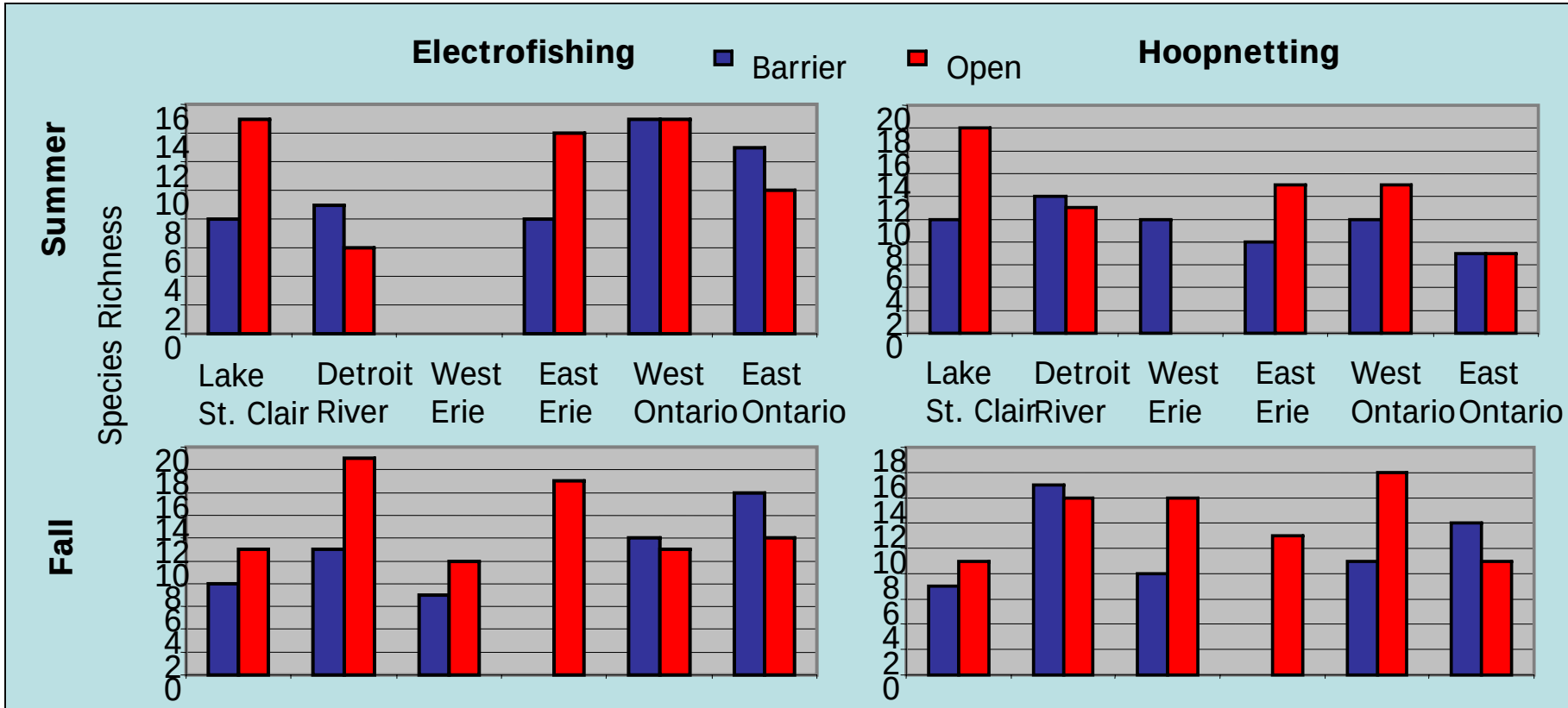


Spring and Fall Submergent Vegetation

Parrott's Bay, Lake Ontario

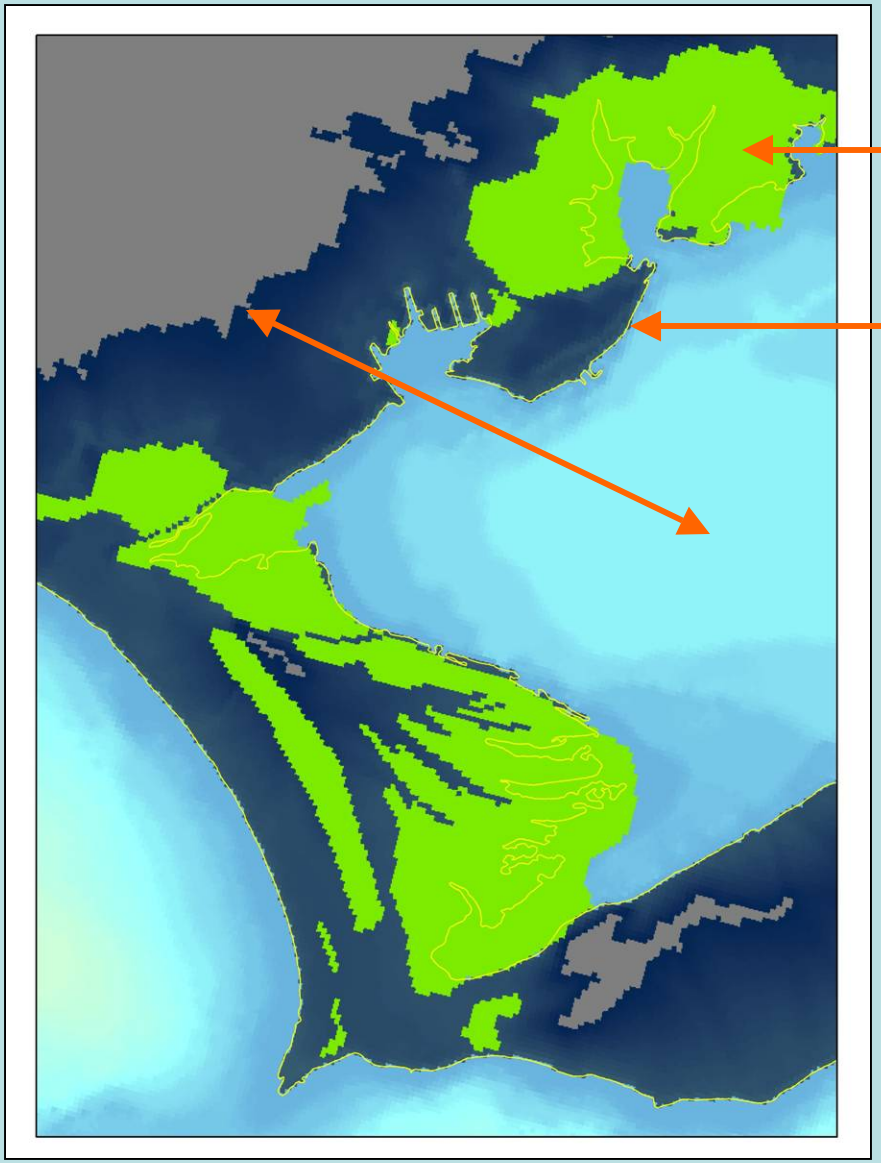
Lake St. Clair Wetland Temperatures





	Cold	Cool	Warm
Non-Piscivore (N)	troutperch	white sucker, banded killifish, brook silverside, greater redhorse, shorthead redhorse, round goby, golden shiner, pugnose shiner, emerald shiner, blackchin shiner, spottail shiner, yellow perch, logperch	rock bass, black bullhead, yellow bullhead, brown bullhead, freshwater drum, goldfish, spotfin shiner, common carp, gizzard shad, channel catfish, bigmouth buffalo, green sunfish, pumpkinseed, warmouth, orangespotted sunfish, bluegill, pugnose minnow, white perch, mimic shiner, tadpole madtom, white crappie, bluntnose minnow, fathead minnow, black crappie, central mudminnow
Piscivore (P)	chinook salmon, brown trout	longnose gar, northern pike, spotted gar, walleye	bowfin, smallmouth bass, largemouth bass, white bass

Fish Habitat Layers – Presqu'ile Bay, Lake Ontario



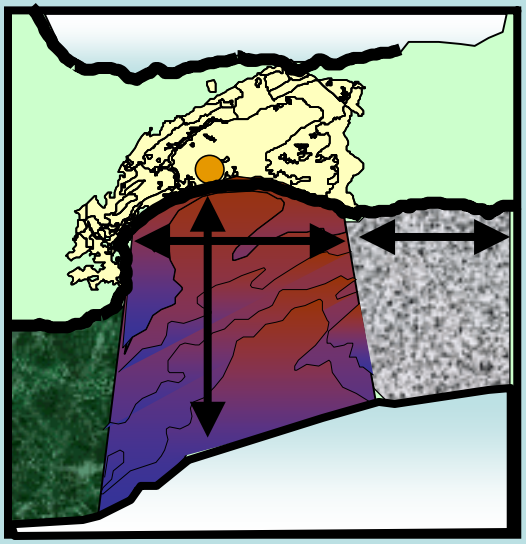
Wetland polygons or grids
(define emergent vegetation)

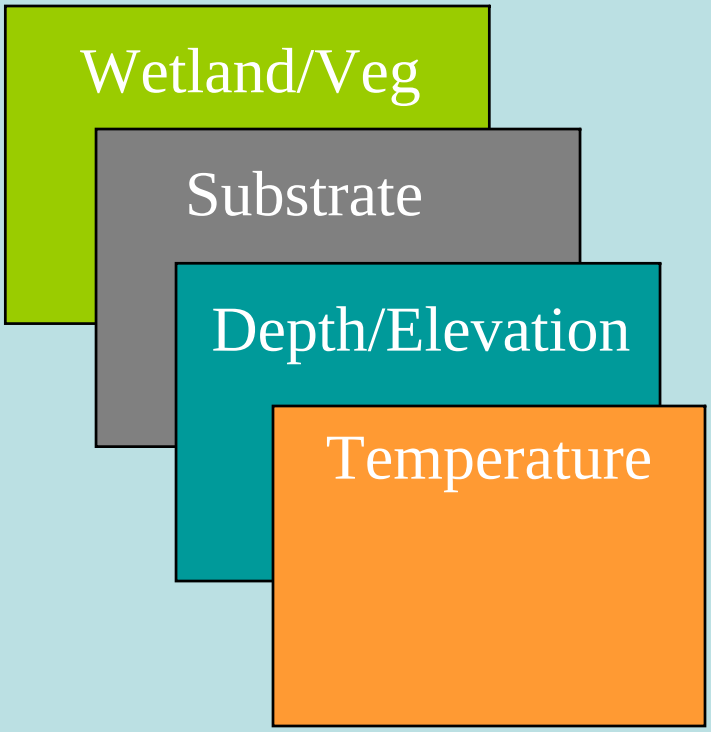
Substrate Type
(habitat surveys or assigned by shoreline characteristics)

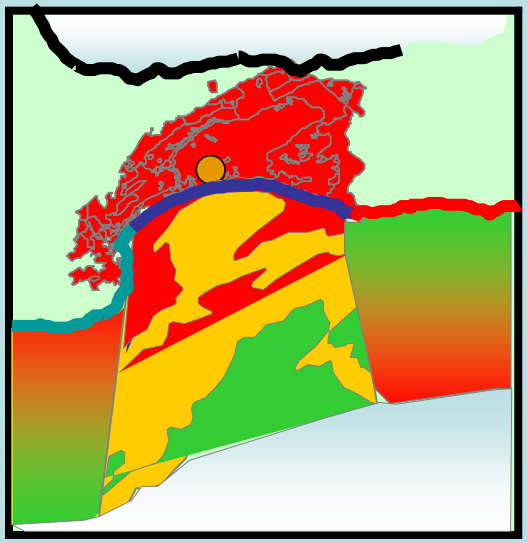
Elevation (80-52m)

Submergent Vegetation
(habitat surveys or models; not shown)

Habitat Suitability Modelling

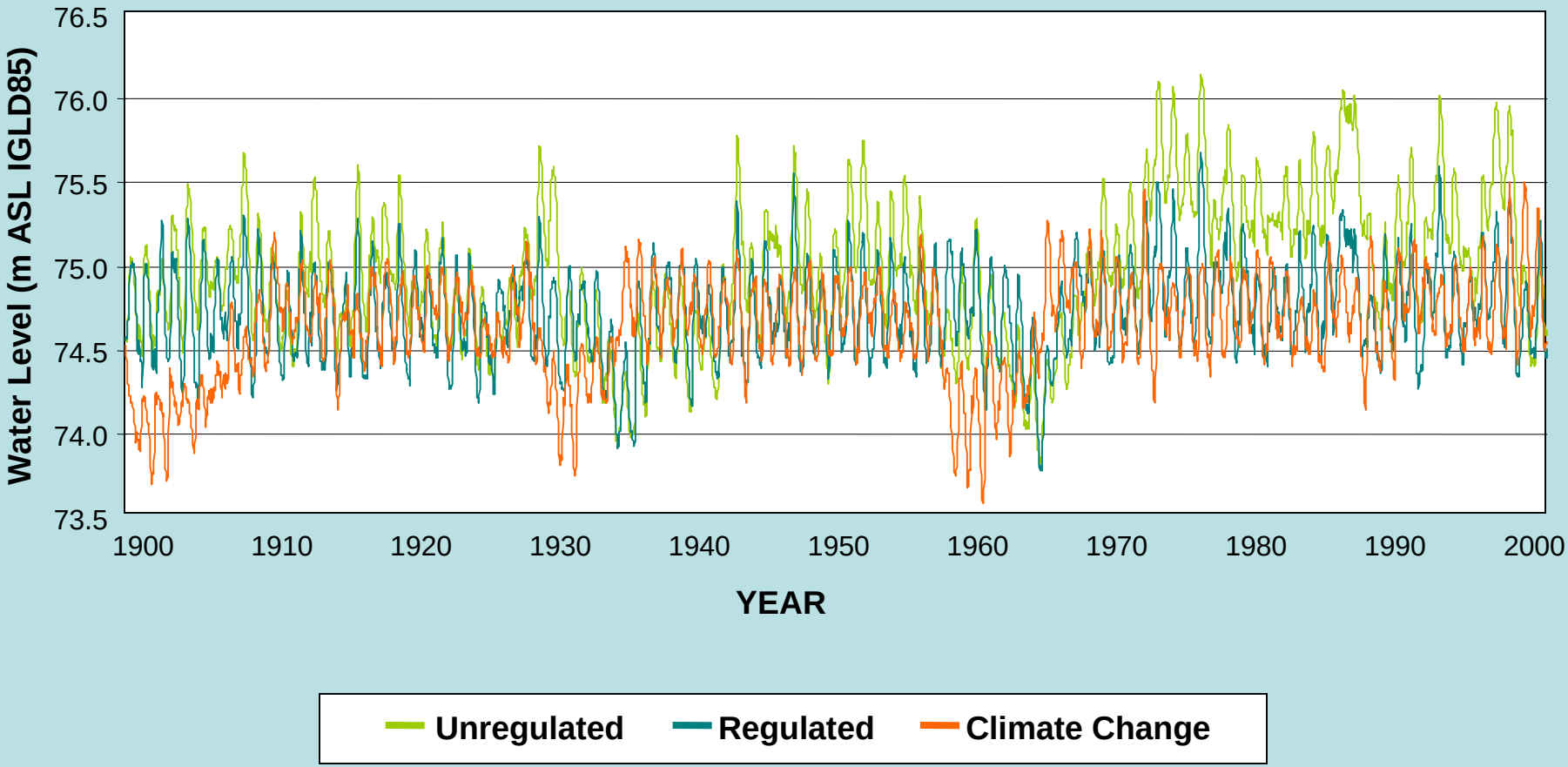






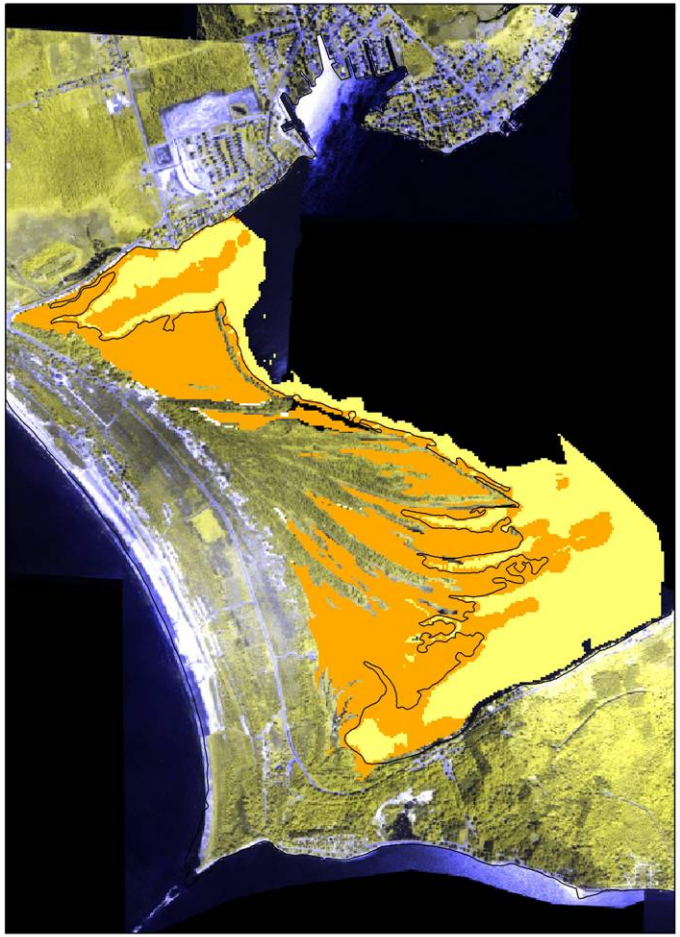
Buffer shoreline types to depth contour → Map habitat combinations → Model suitabilities for different life stages, species & guilds

Lake Ontario Simulated Historical Water Levels

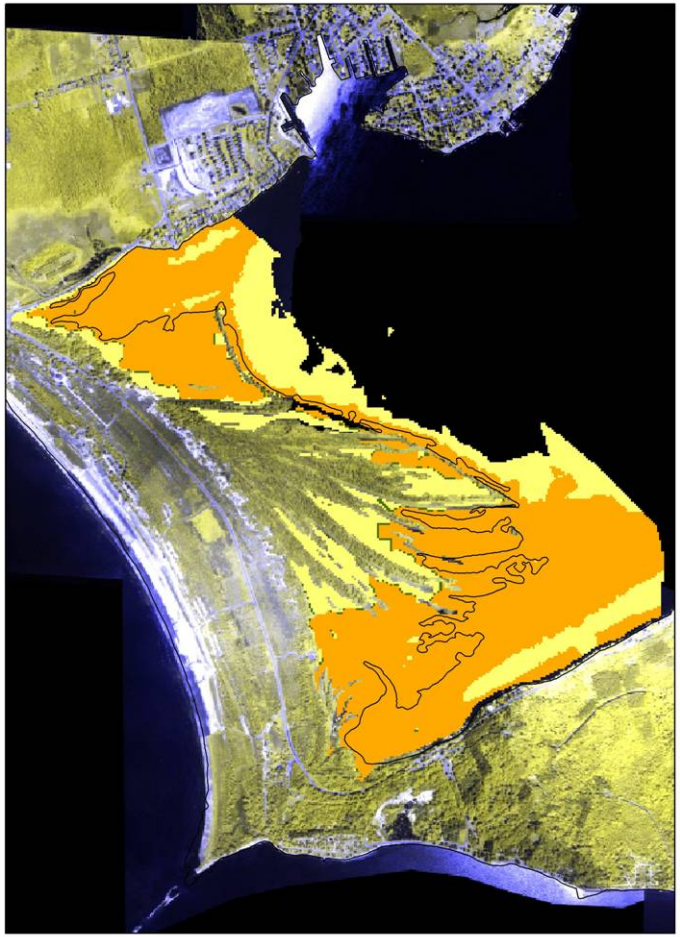


Presqu'ile Bay – Lake Ontario North Shore

1986 Pike YOY Suitability



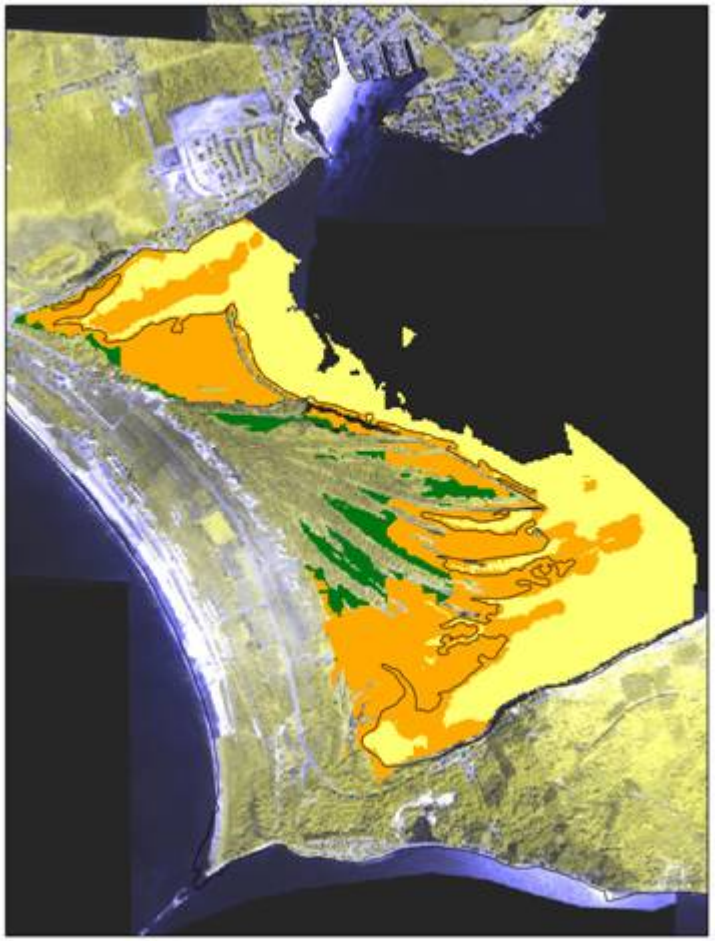
CC 1986 Pike YOY Suitability



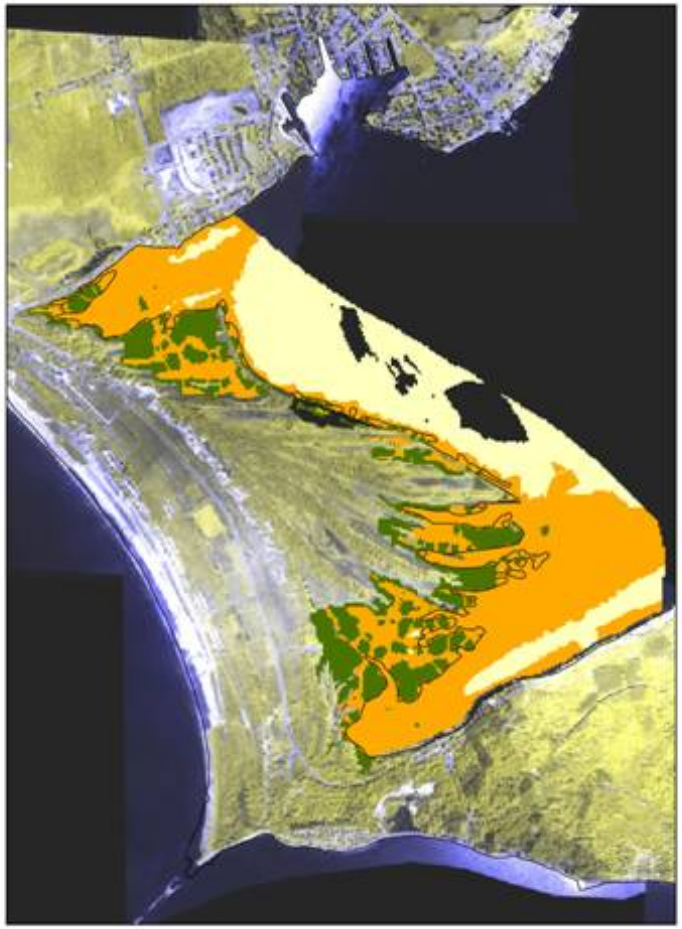
Low Med High

Presqu'ile Bay – Lake Ontario North Shore

1999 Pike YOY Suitability



CC 1999 Pike YOY Suitability



Low Med High

Framework for Huron-Erie Corridor

1. *Current* habitat information needed at the correct resolution, especially bathymetry/elevation and turbidity, if possible

2. Habitat supply models needed to assess fish community effects due to multiple stressors

3. Must be life stage based assessment, which requires knowledge of habitat requirements

4. Evaluate the habitat supply of potential future fish community based on invasion due to climate change.

Acknowledgements

GIS Support:

Carolyn Bakelaar, Charlene Rae

Field & Lab Support:

Lynn Bouvier, Jason Barnucz, Matt Stuart, Kathy Seifried, Cindy Chu, Kris VandeSompel

Modelling Support

Jim Moore, JEMSys

Charles K. Minns, DFO