

# Lake Erie Grass Carp Adaptive Response Strategy 2019-2023



Photo source: J. Francis, Michigan Department of Natural Resources

**Lake Erie Committee**  
**Great Lakes Fishery Commission**  
**December 2018**

# Lake Erie Grass Carp Adaptive Response Strategy, 2019-2023

Lake Erie Committee, Great Lakes Fishery Commission

December 2018

## Executive Summary

Fisheries management within the Lake Erie basin is coordinated under the auspices of the Great Lakes Fishery Commission's (GLFC) Lake Erie Committee (LEC). The LEC is comprised of senior fisheries managers from Michigan, New York, Ohio, the Province of Ontario, and Pennsylvania. This document offers strategic guidance to coordinate inter-jurisdictional fisheries management and research for reducing the likelihood that an established Grass Carp (*Ctenopharyngodon idella*) population will expand and threaten vegetated habitats, associated fish communities, and fisheries of Lake Erie.

Foraging from abundant Grass Carp could impact the vegetated habitats and associated ecosystem functions, fish communities, and fisheries of Lake Erie.

**Our intent is to prevent Grass Carp from attaining densities that cause adverse impacts, by using a science-based, adaptive management approach to guide effective decision-making by fisheries management agencies.**

### Current status of Grass Carp in Lake Erie:

- ✓ Individual fish have been captured since the 1980s but are becoming more apparent in fishery catches and agency assessments since 2015.
- ✓ Most (85%) fish from recent collections are diploid (fertile), which are illegal to possess in all jurisdictions of the Lake Erie basin.
- ✓ Three states (Ohio, Pennsylvania, New York) permit regulated possession of triploid (sterile) Grass Carp for vegetation control in their lakes and ponds, excluding Lake Erie.
- ✓ Reproduction is occurring in the Lake Erie basin, particularly in the Sandusky River (Ohio).
- ✓ Abundance remains below a threshold of causing detectable levels of adverse impacts.

### Key management considerations:

- ✓ Likely sources of natural reproduction and pathways of additional introductions of Grass Carp
- ✓ Accuracy of Grass Carp abundance estimates in Lake Erie
- ✓ Efficiency and effectiveness of agency Grass Carp removal efforts

### Objectives:

- ✓ Improve the collective understanding of Grass Carp population dynamics, behavior, and impacts in Lake Erie to inform effective management actions.
- ✓ Implement controls to minimize population expansion, by removing fish and/or blocking access to preferred habitats
- ✓ Minimize the likelihood of introduction and establishment of new breeding populations of Grass Carp in the tributaries and nearshore areas of Lake Erie and Lake St. Clair.

Implementation:

- ✓ This strategy will be implemented during 2019-2023 by federal and state agencies, working in partnership via the Great Lakes Fishery Commission's Lake Erie Committee.
- ✓ Future revisions to the strategy will be informed by changes in Grass Carp population status in the Lake Erie basin, in the sources and pathways for new introductions, and in the availability of new science, tools, and resources for detection, monitoring, and control.

## Introduction

Fisheries management within the Lake Erie basin is coordinated under the auspices of the Great Lakes Fishery Commission's (GLFC) Lake Erie Committee (LEC). The LEC is comprised of senior fisheries managers from Michigan, New York, Ohio, the Province of Ontario, and Pennsylvania. This document offers strategic guidance to coordinate inter-jurisdictional fisheries management and research for reducing the likelihood that a reproducing Grass Carp (*Ctenopharyngodon idella*) population will expand and threaten vegetated habitats, associated fish communities, and fisheries of Lake Erie. As selective herbivores, Grass Carp in sufficient densities could reduce the biomass and diversity of vegetation in wetlands, bays, and other nearshore areas to levels that affect ecosystem functions (van der Lee et al. 2017), such as nutrient cycling, turbidity control, and habitats for aquatic organisms, including many fish species. Only 10% of Lake Erie's original coastal marshes remain today (Herdendorf 1987), increasing their ecological importance and need for protection against further threats. Although Grass Carp have already invaded Lake Erie and reproduction has been documented, Cudmore et al. (2017) do not consider the population to be established. A coordinated interagency response to Grass Carp, through a strategic and adaptive approach to reduce or eradicate local populations, can minimize their potential impacts in Lake Erie.

## The Strategy

The purpose of this adaptive response strategy is to guide interagency efforts of the Lake Erie Committee (LEC) and its partner agencies and attain the following goal:

***Prevent Grass Carp from attaining densities capable of adversely affecting vegetated habitats, ecosystem functions, and associated fish communities in Lake Erie.***

### **Guiding Principles:**

- Eradication of existing Grass Carp in Lake Erie is unattainable using existing tools and technologies, but the establishment of a large Grass Carp population is unacceptable to the LEC and should be prevented to the extent possible.
- A site specific, adaptive response approach is warranted for population control of existing Grass Carp in Lake Erie, given the large size and complexity of the system, limited control capabilities and resources, uncertainties in risk assessment, and challenges in detecting and monitoring fish of low abundance. Attention will be directed at specific areas (tributaries, river mouths, bays, harbors) where control actions can be maximized. Positive results from actions within specific areas should accrue to reduce population-level impacts on fish communities throughout the basin. Evaluation of actions and outcomes will be an essential component of the approach.
- Each LEC member agency will determine which actions will be employed within its jurisdiction, as well as criteria used to determine when an action is warranted. Current research should guide agency efforts to maximize effectiveness.
- The strategy must accommodate both diploid and triploid Grass Carp, based on differences in their risk of ecological impacts, sources and pathways of entry, and the regulated use of triploid fish in three states.

- The strategy is a living document, to be reviewed and revised in accordance with any changes in the status and trends of Grass Carp in the Lake Erie basin during 2019-2023.

**Objectives:**

**1. Improve the collective understanding of Grass Carp population dynamics, behavior, and impacts in Lake Erie to inform effective management actions.**

- a) Determine preferred habitats, movement, and behavior in Lake Erie and connecting waters
- b) Determine densities of adult Grass Carp in specific areas of Lake Erie and major tributaries
- c) Determine colonization (within area) and expansion (across area) rates of populations
- d) Identify factors that promote aggregation and collection of Grass Carp
- e) Determine levels of reproduction and factors affecting recruitment in Lake Erie
- f) Determine expected outcomes from management options using simulation models
- g) Determine baseline conditions for wetlands and/or associated fish communities in Lake Erie to support scientific evaluation of impacts from Grass Carp

**2. Implement control to minimize expansion of Grass Carp in Lake Erie**

- a) Remove Grass Carp from the Lake Erie basin, particularly in identified spawning locations; actions to be determined by LEC member agencies and may include
  - i. Opportunistic removals, such as
    - fisheries (commercial, angling/bowfishing)
    - by-catch during monitoring or research projects of any agency or other group
  - ii. Routine project removals
    - planned sampling for Grass Carp assessment and research projects (see Obj. 1).  
*Example: a single- or multi-agency standardized sampling event using trammel nets and electrofishing to assess population status and provide data for simulation modeling.*
  - iii. Targeted project removals
    - targeting specific conditions and locations where Grass Carp are likely to be concentrated (see Obj. 1)
    - may involve several vessels, mobilized with relatively short notice.  
*Example: a high discharge event in the Sandusky River, with multiple electrofishing boats working in the Fremont-area spawning location.*
  - iv. Planned multi-agency project removals
    - large event, organized by agency with jurisdiction
    - potential to remove greater numbers of Grass Carp; not driven by a high-risk incident (e.g. known release of live Grass Carp in a location)
    - typically uses an Incident Command System
    - widely-distributed invitations to partner agencies (including, but not limited to, participants in the Great Lakes St. Lawrence Governors and Premiers Mutual Aid Agreement, as well as federal partners (e.g. U.S. Fish and Wildlife Service, Fisheries and Oceans Canada, U.S. Geological Survey))

- projects should be scheduled well in advance, would have a defined set of objectives (in addition to removal), and would require operational flexibility to meet variable environmental or other conditions.

*Examples: 2014, 2017, and 2018 Planned Actions in Michigan and Ohio.*

v. Incident response removals

- large-scale response to a high-risk incident
- may engage participants under the Mutual Aid Agreement
- would likely utilize the Incident Command System structure
- would be used in a circumstance with a moderate-to-high likelihood of success (as determined by the host/requesting agency)

*Examples: robust removal effort in response to a documented release of live adult Grass Carp into a tributary by a fish hauler; identification of an aggregation within a constrained area like a canal or inland waterway.*

b) Conduct applied research to develop and employ innovative capture and control tools and technologies targeting Grass Carp, such as

- identifying baits that attract Grass Carp for passive capture (nets, trotlines) or concentrate Grass Carp for traditional active sampling (trammel nets and electrofishing)
- development of poison baits targeting Grass Carp
- determine feasibility of using hydrological barriers to facilitate removal of Grass Carp in Lake Erie tributaries

**3. Minimize the likelihood of introduction and establishment of new breeding populations of Grass Carp in the tributaries and nearshore areas of Lake Erie and Lake St. Clair.**

a) Maintain or improve federal, provincial, and state laws and enforcement to prevent entry of diploid Grass Carp into the Lake Erie watersheds

- monitor triploid supply chain for ploidy compliance
- ensure that current Grass Carp regulations are being enforced
- increase awareness of bait harvesters and anglers about the threats of Grass Carp

b) If feasible, use hydrological barriers to block movements of Grass Carp to potential spawning areas and/or new habitats

c) Monitor the frequency and trends of reported Grass Carp in Lake Huron, particularly near Saginaw Bay and the St. Clair River in the main basin, as potential sources of fish

**Implementation:**

Progress toward the goal will accrue over time through implementation of the three objectives. This strategy is intended to coordinate actions to be undertaken by state, provincial and federal partners during the first 5-year period, 2019-2023. An evaluation of these actions will occur at the end of the 5-year period, with a focus on progress toward the objectives. Lessons learned during this period will be used to inform future Grass Carp strategy documents. Actions during subsequent periods will be informed by changes in the status and trends of extant Grass Carp in the basin, in the sources and pathways for new introductions, and in the availability of new science, tools, and resources for detection, monitoring, and control.

## **Background**

The first documented Grass Carp from Lake Erie was caught and reported by an Ohio commercial fisher in 1985, and additional captures of adult fish have occurred intermittently to the present. Over the decades, agency fisheries managers believed that these Grass Carp were escapees from triploid (sterile) stockings in private lakes within the Lake Erie watershed and of minimal threat to the ecosystem. In 2012, four sub-adult (age-1+) Grass Carp were captured in a commercial seine from the Sandusky River (Ohio) and two were determined to be diploid (fertile). Based on ploidy status and an analysis of otolith microchemistry, all four juveniles were likely produced in the Sandusky River during 2011 (Chapman et al. 2013), constituting the first evidence of natural reproduction by Grass Carp in the Lake Erie, and Great Lakes, Basin. These results triggered focused efforts with various gears by fisheries agencies to capture additional Grass Carp in Lake Erie, determine their ploidy, and seek additional evidence of natural reproduction. Between 2015 and 2017, ninety Grass Carp were collected, mostly from Lake Erie's western basin and its tributaries. For fish whose ploidy could be determined, about 85% were diploid, indicating a potential for additional reproduction in Lake Erie. Moreover, chemical signatures of the otoliths from the diploid Grass Carp indicated that some fish were originating from areas other than the Sandusky River. In June 2017, Grass Carp eggs were collected in the Maumee River by researchers at the University of Toledo (Dr. Christine Mayer, personal communication). Although focused sampling has provided increased catches of Grass Carp and evidence of reproduction in the Lake Erie Basin, other information (public sightings/reporting, agency fisheries assessments) has not indicated population expansion and establishment throughout the basin. As well, adverse grazing impacts have not been documented in vegetated areas of the lake.

Given our current levels of understanding, we believe that the threat of Grass Carp impacts to vegetated habitats and fish communities in Lake Erie can be mitigated through the strategic application of adaptive, science-based management actions. Important considerations in developing this response strategy include:

- Recognition of the limitations of current tools and technologies to eradicate the existing Lake Erie population of Grass Carp, or to maintain or alter population abundance, biology, or behavior of Grass Carp that are already present in the Lake Erie basin;
- Addressing the most likely sources and pathways of additional introductions into the Lake Erie basin, including escapees from inland waterbodies into tributaries of Lake Erie/Lake St. Clair, movements of fish from Lake Huron, human-mediated releases into Lake Erie/Lake St. Clair or tributaries via bait buckets, commercial fish haulers, or other means;
- Projections of ecological impacts (Cudmore et al. 2017), where foraging on submerged aquatic vegetation is expected to increase commensurate with Grass Carp abundance throughout the vegetated areas of the Lake Erie basin, affecting wetland-dependent native species the most severely;

- Accommodating various socio-economic factors, including
  - the regulated use of triploid (only) Grass Carp in three (New York, Ohio, Pennsylvania) of the LEC's five management jurisdictions on Lake Erie and in the upper Maumee River watershed of Indiana,
  - societal concerns about trade-offs or collateral damage that limit control options for managers,
  - complexities of having different laws and enforcement capabilities among the LEC's jurisdictions,
  - limitations on agency resources (costs, staff, time) that emphasize a need for efficient decision-making and effective actions;
  
- Recognizing the importance of inter-jurisdictional regulatory complexity and promoting consistency with
  - policies/plans involving Grass Carp of all LEC agencies,
  - roles and commitments among management agencies of the LEC and with other signatory management and science agencies, as expressed under *A Joint Strategic Plan for the Management of Great Lakes Fisheries*, <http://www.glfc.org/pubs/misc/jsp97.pdf>.
  - Grass Carp related position statements issued by the GLFC's Council of Lake Committees (CLC) and the LEC, and with the CLC's environmental principles for sustainable fisheries,
  - the Canadian Asian Carp Response Plan, <https://asiancarp.ca/SURVEILLANCE-PREVENTION-AND-RESPONSE/Asian-Carp-Response-Plan>, as it pertains to Grass Carp
  - the U.S. Asian Carp Management Plan (Conover 2007) and efforts of the Asian Carp Regional Coordination Committee, <http://asiancarp.us>,
  - efforts of the Great Lakes St. Lawrence Governors and Premiers, including implementation of a Mutual Aid Agreement, <http://www.gsgp.org/media/1564/ais-mutual-aid-agreement-3-26-15.pdf>, to respond to serious threats from aquatic invasive species and to encourage continued cooperative actions by the states and provinces to combat aquatic invasive species, and
  - a binational strategy to address aquatic invasive species under Annex 6 of the 2012 Great Lakes Water Quality Agreement;
  
- Addressing knowledge gaps to bolster effective decision-making and actions, with a focus on
  - estimating Grass Carp abundance in Lake Erie and removal targets for control of population growth and spread,
  - understanding habitat preferences associated with spawning and aggregating behaviors of Grass Carp to inform collection programs in Lake Erie,
  - assessing wetlands and habitat use by Grass Carp (and other species potentially affected by Grass Carp), to understand changes in habitat suitability and to identify areas for monitoring Grass Carp populations
  - detection/monitoring of Grass Carp, to accurately assess changes in Grass Carp abundance and reproduction to inform management decisions

- Incorporation of results from a formal Structured Decision Making exercise (e.g., Runge et al. 2013) to evaluate options for controlling Grass Carp in Lake Erie at socially and environmentally acceptable levels. This work is expected to continue and provides useful information for implementing any LEC response strategies
  - This exercise consisted of three workshops, hosted and facilitated by the Quantitative Fisheries Center (Michigan State University) during 2017
  - Included participants from provincial and state management agencies, federal agencies, academic institutions, and subject matter experts.
  - Fundamental management objectives were to fulfill public trust and responsibilities, minimize management costs, minimize collateral damage, and maximizing knowledge gained through implementation.
  - Management options were determined and explored with a simulation model (modified from Jones et al. 2017), providing insights into:
    - targeted Grass Carp numbers for removal,
    - sampling and removal methods,
    - use of barriers in selected areas, and
    - Critical uncertainties (abundance and gear efficiency).
  
- Incorporation of knowledge gained from coordinated inter-jurisdictional efforts conducted in Michigan and Ohio waters of western Lake Erie, including the Maumee and Sandusky Rivers.

### References

- Chapman, D.C. J.J. Davis, J.A. Jenkins, P.M. Kocovsky, J.G. Miner, J. Farver, and P.R. Jackson. 2013. First evidence of grass carp recruitment in the Great Lakes Basin, *Journal of Great Lakes Research* 39(4):547-554
- Conover, G., R. Simmonds, and M. Whalen, editors. 2007. Management and control plan for bighead, black, grass, and silver carps in the United States. Asian Carp Working Group, Aquatic Nuisance Species Task Force, Washington, D.C. 223 pp.
- Cudmore, B., Jones, L.A., Mandrak, N.E., Dettmers, J.M., Chapman, D.C., Kolar, C.S, and Conover, G. 2017. Ecological Risk Assessment of Grass Carp (*Ctenopharyngodon idella*) for the Great Lakes Basin. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/118. 115 p.
- Herdendorf, C.E. 1987. The ecology of the coastal marshes of western Lake Erie: A Community Profile. U.S. Fish and Wildlife Service Biological Report 85(7.9) Washington, D.C. 171 p. + appendices
- Jones, L. A., Drake, D. A. R., Mandrak, N. E., Jerde, C. L., Wittmann, M., E., Lodge, D. M., vander Lee, A. S., Johnson, T. B., and Koops, M. A. 2017. Modelling survival and establishment of Grass Carp,

*Ctenopharyngodon idella*, in the Great Lakes Basin. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/101. 52 p.

Runge, M. C., J. B. Grand, and M. S. Michell. 2013. Structured decision making. Pages 51–72 in P. R. Krausman and J. W. Cain, editors. Wildlife management and conservation: Contemporary principles and practices. Johns Hopkins University Press.

van der Lee, A. S., Johnson, T. B., and Koops, M. A. 2017. Bioenergetics modeling of grass carp: estimated individual consumption and population impacts in Great Lakes wetlands. *Journal of Great Lakes Research*, 43: 308-318.