Grass Carp Advisory Committee (GCAC)

Annual Report 2021

GCAC Overview

The Grass Carp Advisory Committee (GCAC) is a technical committee reporting to the Council of Lake Committees. It coordinates regional efforts to seek eradication of Grass Carp in Lake Erie, if possible, while also maintaining surveillance where appropriate in other lakes to: 1) Coordinate actions that address specific Lake Erie Committee (LEC) Adaptive Response Plan priorities, 2) Develop coordinated approaches to address uncertainties identified by the LEC, 3) Provide recommendations about additional uncertainties that should be addressed, and 4) Coordinate surveillance throughout the Great Lakes.

GCAC updates

The GCAC terms of reference were established by the Council of Lake Committees in April 2021, and then reviewed and discussed during the initial committee meeting held December, 2021. During the 2021 meeting Eric Weimer (Ohio DNR) and Lucas Nathan (Michigan DNR) were selected as the Co-Chairs of the GCAC. Additionally, five GCAC task groups were established to coordinate various aspects of the GCAC activities, including Field Work, Data Management, Modeling, Telemetry, and Barriers. Task Group members were identified during the December meeting and they began coordinating efforts and developing charges during subsequent Task Group meetings.

Field Work

There were six response strategies used in 2021 to increase Grass Carp captures and address uncertainties related to population dynamics and removal effectiveness. The strategies included spawning, targeted, sustained, exploratory, real-time/non-detection, and bait/attractant (protocols available upon request). Targeted efforts (51%) made up the largest proportion of total effort (Fig. 1). The majority of efforts in 2021 (77%) were allocated to Lake Erie as it remains the top priority, in particular the Sandusky (54% of total effort) and Maumee (23% of total effort) rivers in Ohio.

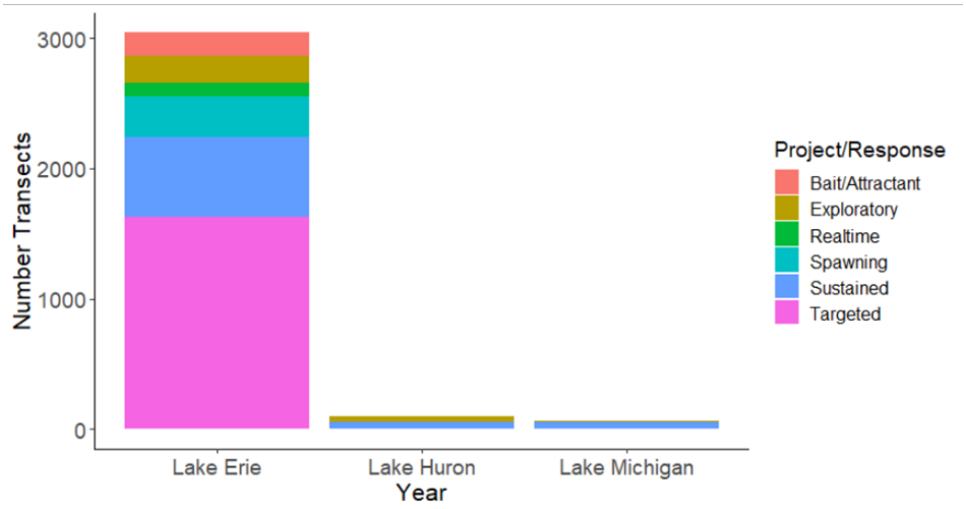

Figure 1. Grass Carp removal efforts (# transects) by Lake and Project/Response strategy in 2021.

A total of 185 Grass Carp were captured in the Western Basin of Lake Erie in 2021, with the majority of fish being collected in the Sandusky (n=110) and Maumee rivers (n=48). Other tributaries in Ohio contributed 27 total captures. Of all fish captured, 177 were removed, four tagged fish were released, and four fish were tagged and released (see telemetry updates). The Sandusky and Maumee rivers provided the majority (98%) of diploid fish. Additionally, a diploid was also captured in the Grand and Huron rivers (two total) in Lake Erie. There has been an increase in captures in Lake Erie in the last four years given increased numbers of field crews (nine total). In 2021, nine full time crews conducted a total of 2,976 efforts, equaling the combined efforts of 2018-2020. A total of 734 Grass Carp have been captured from 2012 to 2020, of which 372 (51%) tested diploid. Spawning response effort continues to produce the highest capture rates primarily in the Maumee and Sandusky rivers. The development of "Spawn Cast" by USGS was helpful for coordinating response efforts by forecasting physical conditions of the target rivers that are optimal for spawning.

Additional efforts by Canadian and U.S. field crews occurred across the Great Lakes. Efforts in Canadian waters were focused on Lake Erie, Lake Ontario, and the Huron-Erie Corridor using about 30 hours total of boat electrofishing, 141 trap nets, 15 hoop nets, 225 mini fykes, and a few gill nets. No Grass Carp captures occurred, and there were no confirmed sightings by commercial or recreational fishers. Reports from a bowfisher in Lake Michigan included three captures- one in the Galien River, a tributary just north of the Indiana-Michigan border; one in the St. Joseph River; and one in Muskegon Lake. Additionally, the USFWS-Green Bay FWCO led monthly efforts in Lake Michigan (focused on the St. Joseph River) that resulted in five captures. Of the eight Grass Carp captured in Lake Michigan waters, two tested diploid. As a result of these findings, a USFWS-Green Bay Grass Carp team will be developed for Lake Michigan in 2022.

In 2021 the University of Toledo grass carp egg crew surveyed the Maumee (8 dates), Cuyahoga (6 dates), Sandusky (4 dates), Tittabawassee (3 dates), Huron (OH) and St. Joseph rivers (one date each). A total of 617 samples were collected from neuston nets during these dates, including 58 tows on the Maumee, 46 on the Sandusky, 35 on the Cuyahoga, 14 on the Tittabawassee, 5 on the Huron (OH), and 5 on the St. Joseph rivers. Only one sample, collected during a discharge event greater than the 85th percentile on the Sandusky River in June, contained grass carp eggs.

Data Management

The data management task group was created to 1) Develop, publish, and maintain a Grass Carp collection form and database in Survey123 with the goal of standardizing data collection; 2) Align the Survey123 database with historical capture records; 3) Provide a forum for information sharing; and 4) Provide technical support services in Survey123. All Western Lake Erie Grass Carp crews (i.e., Michigan Department of Natural Resources, Ohio Department of Natural Resources, University of Toledo, U.S. Fish and Wildlife Service, and U.S. Geological Survey) enter data into Survey123. The data task group has reviewed, discussed, and modified the format of the Grass Carp collection form and structure of the Survey123 database to reduce errors and improve functionality for users. Partners requesting access to the shared database were granted permissions with restrictions to protect data integrity. Critical Survey123 updates were published based on task group decisions. Ongoing action items include cross checking previous years' data, integrated pre-2022 data into the Survey123 database, and developing a plan for streamlining lab processing data (I.e., ploidy results).

Modeling

Two ongoing projects have been focused on evaluating innovative methods to increase the efficiencies of removal efforts. First, a bait and attractant study led by USGS evaluated the ability of plant-based baits to attract and congregate Grass Carp in a desired area. Rapeseed, alfalfa, duckweed, soy, and a control bait were used. The goal was to maximize the number of fish and the time they spend in the arena. In the field, bait was deployed in the Sandusky River and Plum Creek on floating feeder rafts for rapeseed and algal pellet feeder. Hoop nets, targeted sampling, eDNA, ARIS acoustic surveys, and acoustic telemetry were utilized to detect fish near the feeding platforms. Bait or algae seems to do well at first, however in additional trials, the control provided similar numbers of fish. There could be a seasonal influence based on when fish are showing up to feed or not. The project will add additional sites upstream for 2022 with additional hoop nets near Fremont and above as well as include juvenile sampling. Second, tracking of "Judas fish" was used to actively track Grass Carp and also detect judas fish in conjunction with other protocols in the 2020-2021 seasons. Initial analysis is promising, showing higher probability of capturing Grass Carp after judas fish were detected. Judas fish are rarely recaptured, and crews are typically catching new fish.

An assessment of removal methods led by UT was developed to evaluate the use of trammel nets. Overall, the analysis suggested that combining trammel nets with electrofishing takes almost 3 times longer to catch a Grass Carp compared to electrofishing alone due to the time spent removing bycatch from the nets. Next steps include evaluating spatial information to predict capture probability and investigating how much each additional hour or minute of effort adds to the cumulative probability of catching a Grass Carp. With that information the optimal sampling time for a transect can be estimated.

Another UT-led study examined trends in catch and effort, and change in mortality since control began. Grass Carp mortality has increased with increasing effort, but has still not achieved the preliminary removal target of 390 fish per year. Annual mortality was initially calculated with catch curves for each year from 2014 to 2021. Diploid, triploid, and unknown ploidy fish were included in the model with many gear types used. Catch curve mortality estimates increased post removal, but with high uncertainty. Mortality estimates were refined by using a multilevel model which indicated more certainty that mortality is increasing, reaching a maximum level of ~14% in 2021, however it is not yet know if this increased level of mortality is enough to substantially lower the overall population.

Mortality estimates have a good linear relationship to removal numbers, however, the relationship is expected to level off at some point. While Grass Carp mortality has increase despite the short time span of control efforts and limited catch, it is recommended that current efforts continue.

Another iteration of the MSU population model was conducted using preliminary catchability and F were derived from abundance estimates and mark-recapture estimates (using two mark-recapture approaches) in the Sandusky River. Despite different methodologies, abundance estimates were in the same general ballpark from 2018-2020, ranging from 100-340 fish. Next steps include using values of F (likely from 2019) to evaluate relative impact of removal effort on Grass Carp abundance in population model. Other modifications to the model included redefining the spatial regions, survival, seasonal movement, abundance estimates at age, and uncertainty in high-quality reproduction events. Parameters that have not been updated since Dufour et al. 2021 include survival and abundance at age <5 years, stock-recruitment relationship, spawn-per-recruit, and age at maturity.

Telemetry

During 2021 there were confirmed to be 34 tagged Grass Carp at large whose transmitters had remaining battery life. Since the onset of Grass Carp tagging, 42 fish have survived the tagging process (e.g. 60-day post-tagging criteria outline in Harris et al. 2021 a,b) and 8 of fish have been harvested. Four new grass carp were implanted with acoustic telemetry tags during 2021. In addition to the existing GLATOS array in Lake Erie, the movement of tagged fish has been monitored by 71 receivers in Lake Erie nearshore habitat (<5m depth; <1km offshore) and 65 receivers from fine-scale positioning arrays within lotic habitats (Sandusky River and hot ponds).

Across all the receiver arrays, 2.7 million detections of Grass Carp were recorded in 2021 from 32 unique fish. Most of these detections were from the fine-scale receiver arrays with the Sandusky River. One novel movement of a Grass Carp into Lake Huron from 2019 was also discovered this year when a late upload of data to GLATOS occurred. These Lake Huron detections showed that a Grass Carp previously detected in southern Lake Huron during 2017 was detected further north around the tip of the Bruce Peninsula during late August of 2019. Other analyses of Grass Carp telemetry data are in various stages but include 1) quantifying timing of arrival at known spawning locations and overlap with other species in relation to the proposed seasonal barrier in the Sandusky River; 2) determining the effectiveness of bait and attractants to congregate Grass Carp around feeding stations; 3) Basin-wide seasonal movement patterns to inform location and timing of removal efforts. These telemetry data have and are being presented to removal crews to help field crews to maximize the efficacy of their efforts. Goals for 2022 tagging include an additional 8 Grass Carp with tags being distributed between fish captured in the Sandusky and Maumee Rivers, either evenly (4 from each river) or slight skewed towards the Sandusky River (5-Sand; 3-Mau).

Barriers

The Ohio DNR, in partnership with Michigan DNR and GLFC, had evaluated construction of seasonal barrier on the Sandusky River to interrupt Grass Carp spawning behavior. A feasibility study by the consulting firms AECOM and Kleinschmidt Group, Inc., was concluded in January 2021 and identified options for constructing both behavioral and physical-hydraulic barriers. resulting in some possibilities on a physical structure that would be velocity based that would disrupt behavior of Grass Carp to keep the fish away from upstream habitat and Brady's Island. Based on the options presented, Ohio DNR

decided proceed to the design phase of a behavioral barrier near Brady's Island. The partners are now working with the USACE through the GLFER program to further examine feasibility and design. An Action Plan request and funding request from GLRI have been submitted, and work on the design phase is anticipated to begin in 2022.