Manual of Fisheries Survey Methods II: with periodic updates

Chapter 29: Northern Pike Sampling Protocol

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Chapter 29: Northern Pike Sampling Protocol

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The Management Plan for Northern Pike in Michigan (Smith et al. 2016) identified as an action item adoption of a standard Northern Pike survey protocol for Michigan inland lakes. In September 2019, Fisheries Division Management Team charged the Esocid Committee with establishing a standardized sampling protocol for Northern Pike and establishing evaluation criteria for those surveys. Data collected using this protocol will provide guidance to evaluate adult Northern Pike populations to improve management recommendations with the ability to compare populations across regions. This protocol will also be used to build a robust database of targeted adult Northern Pike population assessments.

29.1 Survey Planning and Prioritization

Surveys designed to target Northern Pike are defined as the standard protocol for evaluating populations. Waterbodies selected for sampling Northern Pike populations are at the discretion of local management units. Northern Pike are typically not stocked by Fisheries Division, therefore, all populations are recognized as naturalized or wild. The following methods should be used when assessing Northern Pike populations.

29.2 Survey Procedures

29.2.1 Assessing Northern Pike Density (Population Estimate)

Objective: To conduct a population estimate for adult Northern Pike using a mark and recapture procedure to collect, mark, and recapture as many individuals as possible to estimate abundance.

29.2.1.1 Marking Phase

29.2.1.1.1 ***Timing*****-** The marking phase should be conducted starting at ice-out, with Northern Pike spawning typically taking place between 40 and 52°F (Scott and Crossman 1973). Ice conditions should be monitored closely, as spawning often takes place concurrent with ice-out. Sampling windows will vary across the state and from year-to-year because of latitudinal differences in climate, annual variability in spring warm-up, and differences in lake size. Surveys conducted during this period are important because spawning congregations allow for increased capture efficiency and sex can more easily be determined. The marking phase should cease on a biological trigger, such as when most females and some males are spent. The marking phase can also end when a daily recapture rate is greater than 30 percent. When the marking phase is stopped, cease marking and move to the protocol described in 29*.2.1.2 (Recapture Phase)*.

29.2.1.1.2 ***Gear*****-** The preferred gear types for the marking phase are large-mesh fyke and trap nets. Net standards and dimensions should meet those specified in the Michigan Department of Natural Resources (MDNR) Inland Lake Status and Trends Program Sampling Protocol (Wehrly et al. In Press). The number of nets used should be determined by the estimated amount of Northern Pike spawning habitat in the lake. Nets should be placed to sample the majority of the preferred

spawning habitat (Smith et al. 2016). For each individual net, record gear type (fyke or trap), date of set/lift, latitude and longitude, habitat type (i.e., substrate, vegetation, and structure), and water depth at net pot. If a net is added or moved, record the forementioned detail for each action.

29.2.1.1.3 ***Data Collection and Marking-*** For each net lift, record waterbody name, gear type, daily water temperature, weather conditions, length and mark data for each Northern Pike collected. For each Northern Pike collect and record (on envelope) all the following: sex determination (if identified), total length (tenths of inches), and presence of lesions and any abnormalities. Fish that cannot be classified (unknowns) should be recorded separately and data should be collected in addition to known sex fish for a total of five categories: F, M, F?, M?, UNK. **All** Northern Pike should be marked with a dorsal fin ray clip (for fish greater than 16 inches, this will also serve as aging structure). All fish should be released away from nets to validate capture, mark-recapture assumptions.

29.2.1.1.4 ***Aging Structure Collection-*** For Northern Pike ≥16 inches, clip the first few dorsal fin rays (2-3), cutting close to the body. For Northern Pike ≤15.9 inches, take scale samples from region under dorsal fin. Collect a maximum of 10 aging structures per inch group, unless instructed otherwise by local management unit. All structures should be placed in a sample envelope marked with date, waterbody name, species, length, and sex. Dry all envelopes at conclusion of each day.

29.2.1.2 Recapture Phase

29.2.1.2.1 ***Timing-*** The recapture effort begins immediately following the marking phase.

Alternatively, the recapture effort can be delayed until a Status and Trends survey can be conducted or when experimental gill nets can be used during the acceptable water temperature range (55–80°F) for conducting a Status and Trends survey (Wehrly et al. In Press).

The recapture phase using large-mesh fyke, trap, and experimental gill nets should be conducted until 30% of the marked fish have been recaptured. This level of recapture may not be achievable in all surveys, but 30% should be used as the target.

29.2.1.2.2 ***Gear-*** The preferred gear types for the recapture phase are large-mesh fyke and trap nets, with the addition of experimental gill nets. Field crews will continue to use the large-mesh fyke and trap nets already deployed for the marking phase. To increase capture probability across all size classes and improve sample size for the abundance estimate, experimental gill nets may be added to the recapture phase (Pierce 1997). Net dimensions should meet those specified in the MDNR Inland Lake Status and Trends Program Sampling Protocol (Wehrly et al. In Press). If conducting a full Status and Trends survey using Wehrly et al. (In Press), this should be the minimum amount of gear and effort used. Additional gear and effort can be added to strengthen estimate.

Using the same or similar locations sampled during the marking phase, large-mesh fyke and trap nets should remain in place. Experimental gill nets should be randomly deployed in the offshore or “deep-water” habitat areas of the lake. The number of experimental gill nets deployed should follow this standard used by Minnesota DNR: lakes less than 300 acres, up to 6 nets; 300 to 599 acres, up to 9 nets; 600 to 1,500 acres, up to 12 nets, and lakes 1,500 acres or greater, 15 nets or more can be used (Pierce 2010). Experimental gill nets should be run as short sets or temporary sets. The field crew should deploy experimental gill nets upon arrival at the lake, run all other large-mesh fyke and trap nets, then return to pull experimental gill nets. For each individual net, record gear type, date of set/lift, latitude and longitude, habitat type (i.e., substrate, vegetation,

and structure), and water depth at net pot (for experimental gill net, record water depths covered and GPS coordinates for net ends).

29.2.1.2.3 ***Data Collection and Marking-*** For each net lift, record waterbody name, gear type, daily water temperature, weather conditions, and length and mark data per Northern Pike collected. For each Northern Pike caught, collect and record (on envelope) all the following: sex determination (or unknown), total length (tenths of inches), and presence of lesions and any abnormalities. Fish that cannot be classified (unknowns) should be recorded separately and data should be collected in addition to known sex fish for a total of five categories: F, M, F?, M?, UNK. Any new Northern Pike should be marked with a dorsal fin ray clip (for fish greater than 16 inches, this will also serve as aging structure). All Northern Pike should be marked with a secondary mark (top caudal clip to distinguish recaptured fish). All fish should be released away from nets to validate capture, mark-recapture assumptions. All recaptured fish that are mortalities, should be included in the estimate. All unmarked fish mortalities should also be included in the estimate. Deceased fish may be held for a contaminant sample if requested by the Department of Environment, Great Lakes, and Energy (EGLE). Disposal of deceased fish should follow procedures outlined in EGLE Fish Waste Exemption.

29.2.1.2.4 ***Aging Structure Collection-*** For Northern Pike ≥16 inches, clip the first few dorsal fin rays (2-3), cutting close to the body. For Northern Pike ≤15.9 inches, take scale samples from region under dorsal fin. Continue collecting aging structures to meet the collection goal for the waterbody (collect a maximum of 10 aging structures per inch group, unless instructed otherwise by local management unit). All structures should be placed in a sample envelope marked with date, waterbody name, species, length, and sex. Dry all envelopes at conclusion of each day.

29.2.1.3 Data Analysis

Population estimates should be calculated using Chapman's modification of the Peterson estimator for a single recapture phase (equation below), and the modified Schnabel estimator for multiple recapture phases in closed systems (Hayes et al. 2007, Ricker 1975, Smith et al. 2016).

$$N = \frac{(M+1)(C+1)}{R+1}$$

where:

N = population estimate of adult Northern Pike in each length/sex strata;

M = number of adult Northern Pike caught, marked and released in initial marking phase;

C = total number of adult Northern Pike caught in recapture phase (unmarked + recaptures); and

R = number of adult Northern Pike recaptured in recapture phase.

29.2.2 Assessing Relative Abundance and Growth

Objective: To assess Northern Pike populations using catch per unit effort (CPUE) as a measure for relative abundance and to continue collecting aging structures to evaluate size structure, growth, and mortality.

29.2.2.1 ***Timing-*** The marking phase should be conducted starting at ice-out, with Northern Pike spawning typically taking place between 40 and 52°F (Scott and Crossman 1973). Ice conditions should be monitored closely, as spawning often takes place concurrent with ice-out. Sampling windows will vary across the state and from year-to-year because of latitudinal differences in climate, annual variability in spring warm-up, and differences in lake size. Surveys conducted during this period are important because spawning congregations allow for increased capture efficiency and sex can more easily be determined. If a spring Walleye population estimate is planned, additional netting gear can be added targeting Northern Pike spawning habitat.

29.2.2.2 ***Gear-*** Hanchin (2017) found a positive relationship between adult Northern Pike density and fyke and trap net spring CPUE in large lakes. The preferred gear types for early spring surveying are large-mesh fyke and trap nets. Net standards and dimensions should meet those specified in the MDNR Inland Lake Status and Trends Program Sampling Protocol (Wehrly et al. In Press). The number of nets used should be determined by the estimated amount of Northern Pike spawning habitat in the lake. Nets should be placed to sample the majority of the preferred spawning habitat (Smith et al. 2016). For each individual net, record gear type (fyke or trap), date of set (lift), latitude and longitude, habitat type (i.e., substrate, vegetation, and structure), and water depth at net pot. If a net is added or moved, record the forementioned detail for each action. If already conducting a Walleye population estimate, additional nets may be set targeting Northern Pike spawning habitat in the lake. The number of nets added should be relative to the amount of available Northern Pike spawning habitat in the lake. These nets should be labeled as targeted Northern Pike sets on the data sheet and in the notes when entering into Fish Collection System or the new Fisheries Information System (FISH).

29.2.2.3 ***Data and Aging Structure Collection-*** For each net lift, record waterbody name, gear type, daily water temperature, weather, and length data per Northern Pike collected. For each Northern Pike caught, perform and record (on envelope) all the following: sex determination (or unknown), measure total length (tenths of inches), and presence of lesions and any abnormalities. Fish that cannot be classified (unknowns) should be recorded separately and data should be collected in addition to known sex fish for a total of five categories: F, M, F?, M?, UNK. All fish should be released away from nets. For Northern Pike ≥16 inches, clip the first few dorsal fin rays (2–3), cutting close to the body. For Northern Pike ≤15.9 inches, take scale samples from region under dorsal fin. Continue collecting aging structures to meet the collection goal for the waterbody (collect a maximum of 10 aging structures per inch group, unless instructed otherwise by local management unit). All structures should be placed in a sample envelope marked with date, waterbody name, species, length, and sex. Dry all envelopes at conclusion of each day.

29.2.2.4 ***Data analysis-*** All large-mesh fyke and trap netting gear should be included in the CPUE comparisons when assessing the Northern Pike population. Catch per unit effort should be calculated as total number of fish captured divided by total number of net nights and kept separate by gear type and only compared to catch rates of the same gear. A total of 92 targeted Northern Pike surveys were conducted using entrapment gear statewide between 2000–2019 based on a survey of the management units. Catch per unit effort for these surveys is reported by management unit and gear type (Tables 1 and 2). The CPUE data have inherent limitations and biases since most surveys were conducted outside the preferred timing or temperature window for targeted pike surveys. The existing CPUE data should be used with caution due to these limitations that may introduce bias in the estimate. These data can, however, be useful as a starting point until a robust dataset of targeted survey catch rates is developed. Stratification of the current dataset by month, region, and lake size helps to minimize those biases and may make those comparisons more accurate.

29.2.3 Rivers

Sampling occurring in river habitats should follow protocols identified in the Stream Status and Trends Protocols specific to river size, wadeable or nonwadeable, and your survey goals and objectives (Wills et al. 2011).

29.3 Evaluation

Data collected from targeted Northern Pike surveys will be entered into Fish Collection System using guidance from the Status and Trends Protocol (Wehrly et al. In Press). The survey type should be listed as "Species Evaluation" and the notes should include the statement referencing the use of standard protocols. The new FISH system will have a checkbox/dropdown menu where you can specify the specific protocol used. All surveys that targeted Northern Pike using this protocol should be reported during annual requests issued by the Esocid Committee to document targeted surveys. The Esocid Committee will maintain a table of Northern Pike surveys to be used for creating updated evaluation criteria from surveys conducted according to the standardized protocol.

Evaluation criteria will ultimately be based upon targeted survey approaches discussed in this document, but the data presented in Tables 1 and 2 can serve as criteria in the meantime. Mean length-at-age can be compared to regional and statewide averages provided by Schneider et al. (2000) and by newly developed mean length-at-age averages from the Resource Inventory Team. The difference between the state average mean length for each age class and mean length-at-age from surveys should be used to calculate size differences for each age class. Age classes represented by a minimum of five fish are averaged to provide an index of fish growth (Schneider et al. 2000). Growth index scores between +1 and -1 are considered similar to the state average while scores less than -1 and greater than +1 are considered below or above the state average, respectively. Catch data, along with growth information, can be used to inform management decisions using Table 4 of the Management Plan for Northern Pike in Michigan (Smith et al. 2016). For additional analysis and comparisons, the Esocid Committee maintains more detailed, stratified datasets as described above in section *29.2.2.4*.

Table 1. Catch per unit effort (CPUE) from targeted Northern Pike surveys conducted by MDNR from 2000 through 2019 for large-mesh fyke nets (fish/net night), and trap nets (fish/net night).

Gear	Number of Surveys	Mean CPUE	25th Percentile	Median	75th Percentile
Trap Nets	49	4.42	0.83	1.94	6.63
Large-mesh Fyke Nets	43	4.3	0.69	1.64	4.46
Combined	92	4.36	0.71	1.83	4.86

Table 2. Mean large-mesh fyke and trap net CPUE (fish per net night) for targeted Northern Pike surveys conducted by management unit from 2000 through 2019.

Management Unit	Number of Large-mesh Fyke Net Surveys	Mean Large-mesh Fyke CPUE	Number of Trap Net Surveys	Mean Trap CPUE
Central Lake Michigan	3	0.4	4	1.1
Lake Erie	0	0	9	3.8
Eastern Lake Superior	9	4.2	6	5.7
Northern Lake Huron	2	3.4	3	5.4
Northern Lake Michigan	13	3.1	0	0
Southern Lake Huron	10	9.6	8	7.6
Southern Lake Michigan	6	0.5	19	3.5
Grand Total	43	4.3	49	4.4

29.4 References

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