



State University of New York  
College of Environmental Science and Forestry  
Department of Environmental and Forest Biology

Stephen M. Schoenwiesner  
Licensing Manager  
New York Power Authority  
123 Main Street  
White Plains, NY 10601

9 March 2012

Dear Mr. Schoenwiesner,

We respectfully submit the enclosed pre-proposal titled "Ecology of Young-of-the-Year and Juvenile Muskellunge in Buffalo Harbor and the Upper Niagara River" to be considered for funding through the Fish and Wildlife Habitat Enhancement and Restoration Fund. Our pre-proposal describes four primary objectives, expected deliverables, and a budget estimate. We designed the proposed work to assess existing habitats used by muskellunge and their prey, and to collect information necessary for guiding habitat restoration efforts that will enhance populations of these native fishes. We are in preliminary discussions with the New York State Department of Environmental Conservation regarding additional cost-sharing opportunities. Please do not hesitate to contact us with any questions or concerns. We thank you for your time and consideration.

Sincerely,

A handwritten signature in black ink, appearing to read "Kevin L. Kapuscinski".

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# Ecology of Young-of-the-Year and Juvenile Muskellunge in Buffalo Harbor and the Upper Niagara River

## An Application for Funding Through the Fish and Wildlife Habitat Enhancement and Restoration Fund

Dr. Kevin L. Kapuscinski<sup>a</sup>, Derek P. Crane<sup>a</sup>, and Dr. John M. Farrell<sup>a</sup>

### Summary

The muskellunge (*Esox Masquinongy*) is ecologically important as the apex aquatic predator in Buffalo Harbor and the Niagara River, and has been economically and culturally important as a sport fish since at least the 1850s (1). Studying muskellunge ecology at sequential life stages (i.e., spawning/egg incubation, young-of-the-year, juvenile, adult) provides the most efficient means for identifying factors limiting recruitment and prioritizing efforts and resources for restoration. Despite ongoing and completed research efforts focused on muskellunge (2,3,4,5), there is a paucity of information on prey and habitat requirements of wild juvenile muskellunge, especially beyond their first five months of life (6). Growth, size, and condition influence survival of young-of-the-year (YOY) piscivorous fishes (7,8,9,10,11), and first-winter mortality is an important factor influencing recruitment of temperate species (12,13,14,15). Given the importance of this time period on recruitment, it is essential to understand how availability of prey and habitats affect muskellunge mortality. To our knowledge, no study has quantitatively described over-winter habitat use or mortality of wild YOY muskellunge, and few have investigated seasonal habitat use and biology of muskellunge from age-1 until maturity (16). Catches of wild juvenile ( $\geq$  age-1) muskellunge are uncommon compared to catches of YOY and adults for most bodies of water, yet surveys and visual observations in the upper Niagara River indicated that marinas and tributaries may be heavily used by juvenile muskellunge (17,18). However, the extent to which juvenile muskellunge use these habitats and the effects on their growth and survival are unknown. Knowledge pertaining to the juvenile phase of muskellunge life history is important for developing management and restoration strategies that will enhance recruitment in Buffalo Harbor and the upper Niagara River. Our proposed research will address several of the current information gaps in muskellunge life history, and build on previous research on muskellunge ecology.

### Objective 1

- a) Quantitatively describe over-winter habitat in the upper Niagara River
- b) Estimate mortality of YOY muskellunge in the upper Niagara River

We will investigate over-winter habitat use and mortality of YOY muskellunge by collecting fish from the upper Niagara River (Strawberry Island to northern tip of Grand Island), implanting them with radio transmitters, and actively tracking them during November-April. We will document the location (latitude-longitude), water depth, velocity, and habitat structure (via underwater video) upon relocation of a tagged fish. Mortality will be inferred by lack of movement of implanted fish and estimated. We will identify any patterns linking habitat use, mortality, and distance between summer rearing and winter habitats. Field work will be conducted during the winters of 2013-2014 and 2014-2015. We anticipate deliverables to include maps of winter habitat locations, quantitative data describing winter habitat, estimates of winter mortality, suggestions to improve winter habitat (if deemed necessary), and at least one publication in a scientific journal.

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## Objective 2

- a) Estimate growth, population density, size and age structure, and diet of juvenile muskellunge in marinas and tributaries, and make comparisons between habitat types
- b) Identify seasonal patterns of marina and tributary use by juvenile muskellunge and estimate mortality
- c) Quantify environmental factors (e.g., temperature, depth, turbidity, and velocity) in marinas and tributaries

To achieve objective 2a, we will sample muskellunge monthly from July 2013-June 2014 in Big Six Mile Creek Marina, River Oaks Marina, Spicer Creek, and Woods Creek (Figure 1). We will implant muskellunge with passive integrated transponder tags, record length and weight, and collect diet and scale samples. To achieve objective 2b, we will implant fish with radio transmitters and monitor their activity in 2014-2015. The timing of implantation and size structure of muskellunge implanted will be determined by results of 2013-2014 sampling. Implanted fish will be monitored via stationary receivers at tributary and marina mouths; fish that leave tributaries and marinas may also be actively tracked. Monitoring will be conducted to encompass an entire meteorological year. Results will provide information on the ecological costs and benefits of tributary and marina habitat use by juvenile muskellunge, and may help guide restoration of critical habitats.

## Objective 3

- Quantify prey fish caloric content and selection by YOY muskellunge

We will collect YOY muskellunge and prey fishes from the upper Niagara River by seining and transport them to a laboratory. Muskellunge will be held in individual tanks and presented with equal numbers of each prey species. The number and order of prey consumed by muskellunge will be analyzed to determine which species are selected. In addition, prey morphology (e.g., length, body depth, fin ray height, etc.) and caloric content will be quantified to determine which factors influence prey selection. This experiment will help determine if prey availability at particular sites is limiting muskellunge growth. Knowledge about prey fish-habitat relationships (see Objective 4) can be used to determine if habitat restoration at a site would improve fish assemblage structure, and ultimately, muskellunge growth.

## Objective 4

- Survey nearshore fish assemblages and habitat at muskellunge nursery sites

We will sample at least 10 sites (Figure 1) using a standardized seining and habitat survey protocol that began in 2007. Achieving this objective will provide nine years of YOY muskellunge catch rates at index sites. These catch rates serve as relative abundance estimates of YOY muskellunge and allow for site-specific comparisons and examination of trends through time. We will collect data necessary to quantify relations between fish assemblage structure and local habitat characteristics (e.g., depth, flow, substrate, vegetation, etc.). This work will also monitor the status of non-native species and native species of greatest conservation need (e.g., blackchin shiner *Notropis heterodon*).

## Budget and Timeline

Project costs are expected to total \$856,148 for work conducted during 1 June 2013 – 31 Dec 2015. Two post-doctoral associates (Kapuscinski and Crane) and a technician will be responsible for achieving Objectives 1, 2, and 4, whereas a graduate student (advised by Kapuscinski) will be responsible for Objective 3. We are seeking significant cost-share from the NYSDEC in addition to what will be provided by SUNY-ESF (\$266,242).

## References

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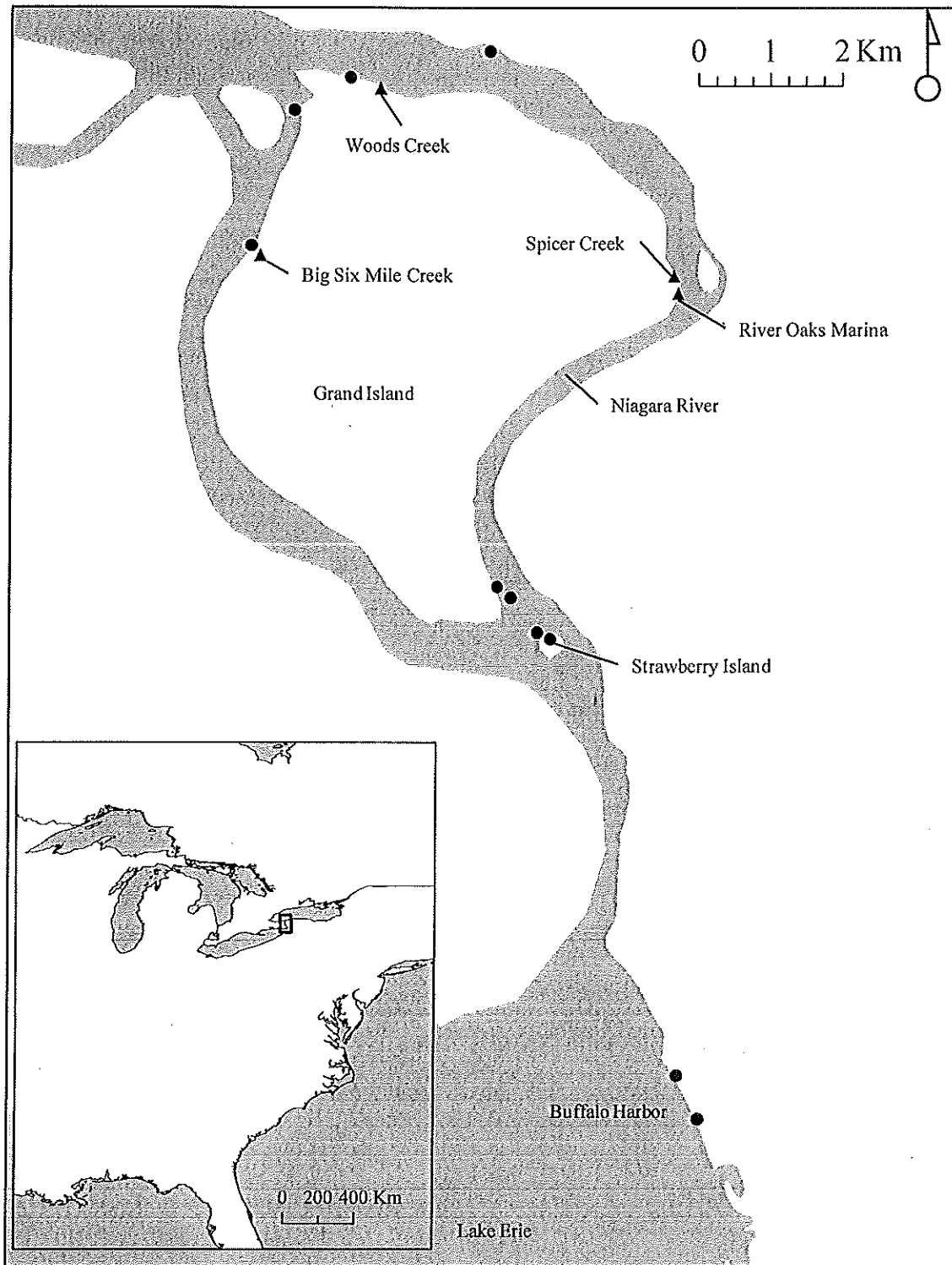


Figure 1. Map indicating sites to be included in a standardized seining survey (circles) and an examination of tributary and marina use by juvenile muskellunge (triangles).

**Fish and Wildlife Habitat Enhancement and Restoration Fund**  
**Conceptual Pre-Proposal**  
**Estimate of Project Cost and Funding Requested**

**Name of Proposed Project:** \_\_\_\_\_

	<b>Design/Build/Execute</b>	<b>Operate/Maintain</b>
<b>Total Project Cost:</b>	\$ 1,122,390	\$ N/A
<b>Cost Sharing:</b>	\$ 266,242	\$ N/A
<b>Funding Requested:</b> <i>(Total cost minus co-funding)</i>	\$ 856,148	\$ N/A