PROPOSAL TO THE GREAT LAKES COMMISSION
GREAT LAKES COASTAL WETLANDS CONSORTIUM

Applicant Information

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Applicant Background

The Great Lakes Science Center is a federal research center within the Biological Resources Division of the U.S. Geological Survey. The mission of the Center is to conduct studies that describe the status, interrelationships, and environmental interactions of Great Lakes resources in support of natural resource and environmental management efforts. The Principal Investigator serves as Branch Chief of the Coastal and Wetland Ecology branch, which investigates the extent to which human activities affect the productivity of Great Lakes living resources across the entire basin by altering the amount, diversity, and quality of habitat in the nearshore zone available to support those resources.

Project Title

Wetland Indicator and Methods Evaluation at Arcadia Lake, a Protected Embayment of Lake Michigan

Project Narrative/Workplan

At the selected study site where we collected some similar data in 1995, the project team proposes to study wetland indicators and methods of data collection to cover all relevant metrics for Flora and Fauna, Physical Characteristics, and Landscape Measures categories, as directed by the Project Management Team in its deliberations and as described in the Request for Proposals. The information obtained will be reported and delivered to the Consortium to be used in development of the final protocols for the wetland monitoring program.

Study Site

Arcadia Lake is a protected embayment near Lake Michigan at the city of Arcadia, Michigan, which is approximately 18 km south of Frankfort. The lake is separated from Lake Michigan by

dunes but is hydrologically connected by a channel. The hydrology of Arcadia Lake and its wetlands is determined by Lake Michigan water levels. The 170-ha wetland lies in a broad basin in the upstream portion of Arcadia Lake and downstream from the confluence of Bowens, Tondu, and Lucker creeks. The adjacent land is used for agriculture; the upstream watershed is agricultural, about 40% forested, and extends inland about 8 km. The wetland is separated from Arcadia Lake by a 1.0-km-long road crossing with two large culverts that restricts flow during high flow periods. The shallow open water adjacent to the crossing is sometimes slightly turbid. Surface sediments in the aquatic zone are largely decomposed peat, with some sand and silt. Numerous ditches were constructed through much of the wetland in an unsuccessful attempt to drain it for agriculture, and cattle are currently grazed in sedge/grass portions of the wetland.

Flora and Fauna Indicators

Invertebrate Community Health. To reduce effort in sorting specimens from sediments and detritus, invertebrate communities will be sampled using funnel traps in daily sets. Paired clear plastic funnels attached to collection vessels will be mounted in vertical and horizontal positions from rods anchored in the sediments. Each of four pairs of traps will be set, moved, and sampled in July in association with one of four fyke nets set for fish sampling, which will generally be placed in submersed aquatic beds, short emergent marsh, and tall emergent marsh vegetation types in standing water. After a 24-h period, invertebrates will be removed, placed in labeled jars with preservative, and returned to the laboratory for identification and enumeration. Funnel traps are most effective, however, in collecting zooplankton rather than macroinvertebrates. Therefore, we will conduct additional sampling with standard D-frame dip nets with 0.5-mm mesh. In each major vegetation type with standing water, triplicate net sweeps will be made through the water at the surface, in the middle of the water column, and above the sediment surface. Samples will be placed in a white enamel pan and representative subsamples of 150 individuals collected, including both large and small, motile and non-motile, and sessile species. This sampling will be conducted in May and repeated in July and September. Identification of invertebrates from funnel traps and dip nets should be taken to the lowest practicable taxonomic level. In addition, adult caddisflies (Trichoptera) will be sampled using ultraviolet blacklight traps placed in overnight sets at each site for two nights, again in May, July, and September. The traps consist of an Eveready 9450 flashlight containing an F6T5-BLB blacklight tube and a small plastic pan partially filled with 85% ethanol. Because of the low luminosity of the bulb and placement of the lights in locations with limited long-distance visibility, the traps draw insects from only a limited area within a wetland and generally will not draw insects from other habitats. Caddisflies from each collection will be placed in jars, picked, sorted, and identified to species level.

Fish Community Health. Fyke nets are very effective in sampling fish within wetland plant communities ranging from submersed and floating-leaf vegetation to short and tall emergent vegetation. Use of two frame sizes is necessary to allow nets to be placed in a variety of water depths. Use of two mesh sizes is necessary to enhance the ability to capture both large and small fish. In mid-summer, we will use four fyke nets placed in the morning and retrieved the following morning. The nets will be fished for two consecutive days then moved to a different location for two additional days. Nets with 91-cm x 91-cm frames and both 0.48-cm and 1.27-cm standard knotted mesh will be placed facing the shore in water 1 m deep or greater with 6- to

15-m leads perpendicular to and reaching shore and 3-m wings extending to each side. Nets with 45-cm x 45-cm frames of both mesh sizes will be placed similarly in water less than 1 m deep. After collection, all fish will be anesthesized with MS-222, identified, counted, measured for length, and released. Occurrence of DELTs (deformities, eroded fins, lesions, and tumors) will be noted also. Electrofishing will also be attempted using standardized methods if water depth is sufficient to make it worthwhile.

Amphibian Diversity. The Marsh Monitoring Program operated by Bird Studies Canada (Port Rowan, Ontario) will be used to conduct surveys for both wetland amphibian and bird communities. The protocols are based on the point-count method that incorporates fixed survey stations along a travel route. Weather- and temperature-sensitive amphibian data will be collected by surveying calling species from fixed stations three times during the spring and early summer, with at least 15 days between surveys. A lengthened sampling season from April to early July enables nearly all of the 13 species of frogs and toads potentially present to be detected coincident with their breeding season. The surveys will generally begin one-half hour after sunset and end before midnight. During 3-minute survey periods, all species heard within a semi-circle in front of the observer will be mapped, and the intensity of calling activity will be categorized as 1) individuals can be counted, calls not simultaneous; 2) calls distinguishable; some simultaneous calling; or 3) full chorus; calls continuous and overlapping.

Bird Diversity and Abundance. Date- and time-sensitive bird data will be collected by visual or auditory observation at fixed stations twice during the year between 20 May and 5 July, with at least ten days between surveys. During 10-minute survey periods, 30-second recordings of calls for Virginia Rail (*Rallus limicola* Vieillot), Sora (*Porzana carolina* L.), Least Bittern (*Ixobrychus exilis* Gmelin), Pied-billed Grebe (*Podilymbus podiceps* L.), and a combination of Common Moorhen (*Gallinula chloropus* L.) / American Coot (*Fulica americana* Gmelin) will be broadcast with 30 seconds of silence between calls. Five minutes of calling will be followed by five additional minutes of observation. Each bird observed will be assigned to one of three categories: adults observed in contact with the sample area (not in flight), aerial foragers, and outside/fly-throughs.

Plant Community Health. Color infrared aerial photographs at a scale of 1:5000 will be contracted for collection in July, with early return of the film. Major vegetation types clearly definable on the photographs, including submersed aquatic plant communities, will be mapped in the field with photographs in hand. Intergrading, minor, and all invasive vegetation types will be delineated also. These data will be compared to our 1995 data to track changes in areal extent of vegetation types, especially invasive types, through time. In late July or early August, after mapping and ground-truthing are completed, we will sample twenty 1-m x 1-m quadrats in the dominant emergent vegetation type and the SAV or SAV/floating-leaf vegetation type according to a random or stratified random design (additional vegetation types may be added, if appropriate). All taxa in each quadrat will be identified to species, if possible, and estimates of percent cover will be assigned to each taxa in the quadrats. All taxa identified during quadrat sampling will be used to generate a species list, and they will be evaluated for characteristics such as turbidity tolerance and invasiveness. We will also collect data regarding attributes of physical habitat to assist in ecological interpretation of data; water depth at each

quadrat location is most essential. A general floristic survey of all vegetation types, including any elevation gradients within the wetland, will also be conducted to assist in developing a more complete species list for use in FQI calculations.

Physical Characteristics

Many aspects of degradation to Great Lakes wetlands that affect biotic communities are related to alterations of physical conditions. Therefore, physical indicators should also be evaluated. Data on *Water-Level Fluctuations* will be obtained from the U.S. Army Corps of Engineers at http://huron.lre.usace.army.mil/hmpghh.html . *Sediment Flow* will be assessed using Onset continuous recording light meters to detect changes in turbidity that can affect biota. Given the location and setting of the study wetland, indicators such as *Sediment Available for Coastal Nourishment* and *Storms and Ice* are not applicable.

Landscape Measures

Data for some of these indicators can be derived from aerial photographs; others will require field data collection by methods not yet determined. Aerial photographs will be used to determine *Areal Extent of Wetland by Type*, *Habitat Adjacent to Wetland, Land-Use Classes Adjacent to Wetland, Land-Use Classes in Watershed, Extent of Upstream Channelization, Proximity to Navigable Channels,* and *Proximity to Recreational Boating Activity.*

Project Team

Dr. Douglas A. Wilcox, wetland ecologist, USGS B Great Lakes Science Center: Principal Investigator, Plant Community Health, Physical Characteristics

Mr. Patrick L. Hudson, invertebrate biologist, USGS B Great Lakes Science Center: Invertebrate Community Health

Mr. Kurt P. Kowalski, geographer, USGS B Great Lakes Science Center: Landscape Measures

Mr. M. Glen Black, fishery biologist, USGS B Great Lakes Science Center: Fish Community Health

Dr. James E. Meeker, ecology professor, Northland College: Plant Community Health

Dr. Brian J. Armitage, invertebrate biologist, Ohio Biological Survey: Invertebrate Community Health (adult caddisflies)

Mr. Steve Timmermans, biologist, Bird Studies Canada: Amphibian Diversity and Bird Diversity and Abundance

Project Schedule/Timeline

January 2002: Awarding of subcontracts
February 2002: Quarterly update
March 2002: Project team coordination meeting
May 2002: Start of field data collection, semi-annual progress report
August 2002: Quarterly update
September 2002: Completion of field data collection
November 2002: Final report