A Basin-wide Evaluation of Marsh Bird and Amphibian Indicators and an Evaluation of Wetland Indicator Metrics at Selected Coastal Wetlands in Lakes Erie and Huron

a research proposal to the

Great Lakes Commission

from

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1. Applicant Information:

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2. Applicant Background

Founded in 1960, Bird Studies Canada (formerly Long Point Bird Observatory) is a member-supported, non-profit research organization federally registered under Canada's Income Tax Act as Charitable Business No. 11902 4313 RR0001. The mission of BSC is to advance the understanding, appreciation and conservation of wild birds and their habitats, through studies that engage the skills, enthusiasm and support of its members, volunteers, staff and the interested public. BSC believes that thousands of volunteers working together, guided by a small group of professionals, can accomplish much more than could either of the two groups working independently. BSC has over 40 years of history working with volunteers to gather data for the study, understanding and monitoring of birds (and, more recently, amphibians).

BSC's headquarters office is located in Port Rowan, Ontario (located on the north shore of Lake Erie, and immediately adjacent to the internationally-recognized wetlands of Long Point). We also have satellite offices on the Pacific and Atlantic coasts. BSC is involved in conservation and research programs at the local, regional, national and international levels.

BSC's membership consists of about 12,000 amateur and professional naturalists, bird watchers, scientists, and conservationists across Canada and beyond. From the outset, BSC's programs have depended upon participation by volunteer members of the public: "Citizen Scientists." BSC makes a special commitment to involve Citizen Scientists in our work. Citizens learn by doing, contribute by doing, celebrate their achievements, and become engaged. Overall, BSC-founded projects presently engage over 25,000 volunteer participants throughout North America.

Over more than 40 years, BSC has developed many programs in partnership with many agencies:

> Since 1960, BSC's staff and volunteers have monitored population trends of birds on migration at Long Point, Ontario. This program continues today as one of the longest running bird monitoring initiatives in the Western Hemisphere. Based on our success at Long Point, BSC and the Canadian Wildlife Service recently developed the Canadian Migration Monitoring Network — a chain of 15 migration monitoring stations across the country. Each year, hundreds of volunteers receive intensive training in field research techniques at these research stations, and provide scientific data critical to bird conservation.
>
> The Marsh Monitoring Program (MMP) was launched across the Great Lakes basin in 1995, in partnership with Environment Canada and the U.S. Environmental Protection Agency, to assess

and monitor the health of aquatic habitats. Each year, about 500 volunteers participate in this program in Ontario and the adjacent Great Lakes states. The MMP is now serving as a model for the development of continental monitoring efforts focused on wetlands and wetland-dependent birds and amphibians.

The Important Bird Areas program is a worldwide initiative of BirdLife International to identify and protect the world's most important sites for birds. In Canada, the BirdLife partners are BSC and the Canadian Nature Federation. As the primary technical coordinator of this program in Canada, over 1000 sites across the country have been identified as Important Bird Areas by BSC.

The Canadian Lakes Loon Survey, founded by BSC in 1987, enables over 1000 cottagers across Canada to contribute to conservation science by keeping track of the reproductive success of loons on their lakes. In this collaborative program, the Common Loon is used as an indicator of lake health, particularly in relation to pH levels and concentrations of heavy metals.

Project FeederWatch, founded in 1976, encourages people with bird feeders to keep track of the numbers of each species visiting their feeder. In collaboration with the Cornell Lab of Ornithology, this project attracts over 2300 Citizen Scientists annually in Canada and about 13,000 more in the United States.

BSC coordinated the Great Lakes Beached Bird Survey — a three-year, bi-national program designed to provide quantitative baseline information on the extent of waterbird mortality throughout the coastal Great Lakes.

BSC also coordinates several regional programs, including: Ontario, British Columbia and Atlantic Canada Nocturnal Owl Surveys, the Ontario Red-shouldered Hawk and Spring Woodpecker Survey, the British Columbia Coastal Waterbird Survey, the Ontario Colonial Marsh Bird Survey; Ontario Heronry Inventory, and the Ontario Birds At Risk program; and is a primary driving force underpinning regional nest record schemes and breeding bird atlas projects across the country.

All of this research is overseen by a core of dedicated, professional staff who design the programs, coordinate the training and teaching, computerize the data, carry out data analyses, and prepare reports and scientific publications on the results. These results are used, in collaboration with partners, to develop and implement conservation action plans. Results from our programs are widely available to the scientific community, project sponsors and partners, project participants, and the public at large, through a variety of newsletters, a website, and formal data sharing arrangements.

BSC's programs are directed by a National Council, consisting of prominent scientists from across Canada. All programs are formally evaluated on an annual basis to ensure that they meet their goals and objectives. With an annual operating budget of $2.6 million, BSC has the capacity to administer large multi-year grants.

BSC's programs rely heavily upon effective partnerships at all levels — from individual volunteers, local naturalist clubs and community organizations, to regional, national and international conservation and research organizations, and every level of government. BSC has especially close ties with Environment Canada, which has a national responsibility for stewardship of migratory birds and their habitats. We are part of the tri-national North American Bird Conservation Initiative — a consortium of government and non-government agencies, as well as the equivalent national consortium (Partners In Flight-Canada). Together, these two consortiums provide an integrated framework for bird monitoring and conservation activities in North America. At the provincial level, we have very close ties with the Ontario Ministry of Natural Resources (OMNR). On its behalf, we coordinate several volunteer-based programs that help fulfil OMNR's mandate to monitor birds within the managed forests across Ontario.

We are also allied with numerous non-government organizations such as the Canadian Nature Federation, the Cornell Laboratory of Ornithology, Federation of Ontario Naturalists, and the National Audubon Society. Combining resources allows us to deliver research, monitoring and conservation programs more effectively and efficiently than any one agency could deliver alone.

3.0 Project Title: *A Basin-wide Evaluation of Marsh Bird and Amphibian Indicators and an Evaluation of Wetland Indicator Metrics at Selected Coastal Wetlands in Lakes Erie and Huron*

4.0 Project Narrative/Workplan

In collaboration with Environment Canada, the U.S. Environmental Protection Agency and Great Lakes United, Bird Studies Canada coordinates and delivers the Marsh Monitoring Program (MMP) — a long-term, binational program that engages several hundred volunteer naturalists annually to monitor trends in the occurrence and abundance of marsh birds and amphibians in coastal and inland marshes throughout the Great Lakes basin. Building upon this effort, there are four primary components of our research proposal to the Great Lakes Commission:

i) perform in-depth marsh bird and amphibian indicator evaluation (including the development of Indices of Biotic Integrity) using existing MMP data;
ii) coordinate the MMP protocol for use at all of the Consortium's pilot research sites, along with providing training materials and training opportunities, and providing access to experienced MMP field workers;
iii) oversee data management, analysis and reporting capacity for all bird and amphibian data collected at all Consortium research sites; and
iv) conduct intensive, site-specific indicator research at Long Point (Lake Erie) and provide assistance to similar research activities being proposed for other sites on the Ontario side of Lake Huron.

Overviews of each of the above components are presented in the following sections.

4.1 Marsh Bird and Amphibian Indicator Evaluation and Development of Indices of Biotic Integrity

MMP data previously collected from 1995 through 2001 will naturally complement additional data collected during pilot project research initiatives at Consortium targeted wetlands in 2002. Moreover, the existing and very extensive MMP database is immediately available for several kinds of in-depth analyses. Specifically, existing MMP bird, amphibian and habitat data from a seven-year period (1995-2001) will be used to conduct rigorous statistical analyses:

a) to determine sample sizes required to meet long-term marsh bird and amphibian monitoring objectives of coastal wetlands across the Great Lakes basin;
b) to determine whether variation in species population trends in coastal wetlands is reflective of wetlands (including those at inland areas) across the basin as a whole;
c) to test the variability of marsh bird and amphibian data collected within wetland classes;
d) to identify which marsh bird/amphibian species best characterize coastal wetland health;
e) to gauge the accuracy with which marsh condition can be predicted based on marsh bird and amphibian indicators; and
f) develop an Index of Biotic Integrity (IBI) protocol for marsh birds and amphibians.

An ultimate objective (IBI development) will enable us to select marsh bird and amphibian metrics based on their relative sensitivities to changes in wetland condition, derive scores for these indicators, and assign site-specific marsh bird and amphibian IBI scores to wetlands experiencing various degrees of stress. Ultimately, it should be possible to use marsh bird and amphibian IBI indices, in combination with similar scores derived for other biotic and abiotic wetland metrics, to assess and monitor the state of Great Lakes coastal wetlands as a whole and for each individual lake basin. One way this could potentially be achieved would be to use an additive scoring process across indicators, likely weighted for the relative importance of each indicator metric, the scores of which may in turn be weighted for confidence intervals of the supporting data.

4.2 *Providing Assistance to Consortium Researchers (MMP Protocol, Training and Access to MMP Volunteers*)

We propose that the MMP protocol be adopted by all Consortium proponents who plan to conduct marsh bird and amphibian indicator evaluation at selected project sites. To this end, BSC will provide and oversee necessary field training during pilot project indicator research in 2002. We expect that successful proponents will collaborate and coordinate with each other to standardize indicator research efforts among all sites. As such, in the event that a common training workshop is held among researchers who will be conducting pilot project research, BSC will provide training sessions and necessary instructions for field personnel to conduct marsh bird and amphibian indicator surveys at their sites. BSC will also provide training and instructional aids (e.g. marsh bird and amphibian call identification cassette tapes, audio playback tapes for eliciting secretive marsh bird calls, and standardized survey record forms).

As necessary, BSC also offers to help recruit assistance from local experienced MMP volunteers to aid proponents who are unable to incorporate marsh bird and amphibian indicator research at their sites, whether because of lack of experienced personnel, inability to accommodate MMP surveys in their scheduled timeline, their budget, or for other reasons. It is quite possible that some of these experienced people will have to be compensated for their time, and we urge other project proponents to build contingency costs into their budgets.

4.3 *Marsh Bird and Amphibian Data Management, Analyses and Reporting*

Bird Studies Canada has extensive experience in managing, statistically analysing and reporting on large databases, including those from the Marsh Monitoring Program. As such, BSC proposes to serve as the central repository responsible for managing, analysing and reporting on all marsh bird and amphibian data collected at pilot project sites during the 2002 field season.

4.4 *Site Specific Indicator Research at Long Point (Lake Erie) and Other Sites in Lake Huron*

Encompassing over 85 square kilometres of wetlands, the Long Point World Biosphere Reserve (and Ramsar site) is located on the north shore of Lake Erie. As the world's largest freshwater sandspit ecosystem, Long Point is an ideal Consortium project study area because of its very extensive and complex examples of both Open Lacustrine Wetlands and Protected Embayment Wetlands. Although much of the wetland area at Long Point is considered to be pristine, almost all of the area is subject to effects of natural temporal fluctuation in Lake Erie water levels. Various human disturbances (e.g. diking, channelization, water level manipulation, shoreline hardening, dredging, marina and resort

development) affect some of the wetlands that occur at the base of the point. Bird Studies Canada has an excellent working relationship with most of the major landowners, ensuring ready access to sample areas. In addition, we have been conducting a variety of kinds of wetland research in the local region since 1978, and have the logistical resources and site familiarity required to undertake in-depth research projects locally.

All of the above characteristics qualify Long Point as an excellent site for conducting wetland indicator research. Indeed, data collected at Long Point can be compared with those collected at other study sites in Lake Erie (and the other Great Lakes) to evaluate indicator metrics at sites considered stressed and those considered non-stressed. Selecting wetlands that represent a spectrum of stress levels at the outset of the Consortium's research will be especially important when it comes to determining how to set reasonable endpoints/attainment levels.

Consequently, Bird Studies Canada proposes to conduct site-specific indicator research at wetlands associated with Long Point. We also propose to work with Environment Canada to collect indicator data at several (as yet) unspecified wetland sites on Ontario's side of Lake Huron. To achieve this, BSC will collaborate with Environment Canada to evaluate indicator metrics at Long Point and Lake Huron sites, and we will coordinate our methodological approaches with several other research teams who specialize in assessing one or more of the other various indicator metrics to be evaluated.

Appropriate stratified sample designs (and sampling intensities) will be developed, based upon the areal extent, representativeness and complexity of community types at each wetland. Insofar as possible, each indicator type will be sampled at the same sample stations, so that cross-correlation of metrics is possible. All sample sites will be geo-referenced using a Global Positioning System. The Great Lakes Commission (and specific project partners) will be provided with electronic copies of the geo-referenced database.

Wetland indicator-specific research that will be conducted at Long Point (and to a slightly lesser degree at Lake Huron study areas) will consist of the following:

a) **4507** *marsh bird* and **4504** *amphibian community health*: One-hundred metre radius semicircular point count survey stations will be established in each major plant community, and at the same locations where the other floral/faunal sampling will occur. Occurrence and relative abundance of marsh birds and amphibians will be recorded at each survey station. Amphibians will be sampled entirely through audio detection; relative abundance of amphibians will be recorded using three levels of calling code intensities, which are based on estimated number of calling individuals for each species. Marsh bird abundance will be recorded through both visual and audio detection. Call playback recordings of marsh bird species that are otherwise difficult to detect will be broadcast with handheld tape recorders to elicit calls from these secretive species. Three sampling periods, spaced no less than 15 days apart between May 1 and June 30, will occur for amphibians in order to capture the height of calling for multiple species. Two sampling periods, spaced no less than 10 days apart between May 20 and July 5, will occur for marsh birds. Amphibian surveys will be conducted between one half hour past sunset and midnight, whereas marsh bird surveys will be done between 1800 hrs and sunset.

With some modifications, we will follow the procedures of Tom Burton and Don Uzarski for invertebrate and fish communities to select marsh bird- and amphibian-specific IBI metrics for assigning overall marsh bird and amphibian specific IBI site scores for stressed and non-stressed

sites in each wetland class. These site-specific scores can be combined with IBIs scores for other site-specific biotic indicators to develop multi-metric IBI site scores for both Open Lacustrine and Protected Embayment wetland types.

b) **4513** *plant community health*: BSC will collaborate with Environment Canada (Joel Ingram) to assess plant community health at Long Point and sites in Lake Huron. Floristic Quality Indices (FQI) will be assigned to each site following taxonomic identification of wetland plants that occur in representative plant communities. Currently, there are two different quantitative methods for sampling plant communities under consideration among the teams attempting to coordinate efforts for the Consortium's pilot project research — one method has been developed by Dennis Albert for Lake Michigan and Lake Huron; the other is being developed for Lake Erie by John Mack (Ohio EPA). Details pertaining to these sampling methodologies and how intensive floristic sampling will be conducted at Long Point and Lake Huron sites should be provided in Joel Ingram's proposal from Environment Canada. In any case, we will adopt whatever sampling protocol that is deemed to be the standard by the Consortium.

c) **4502** *fish community health*: As of yet, there are no collaborators firmly in place to sample fish communities at Long Point or on the Ontario side of Lake Huron. However, through the Ontario Ministry of Natural Resources' Fisheries Assessment Unit in Port Dover, Ontario, we will have access to current and historic fish sampling data from OMNR's electro-shocking program, as well as the local hoop-net and draw-seine commercial fishing industry in the Inner Bay of Long Point as sources of information.

d) **4501** *invertebrate community health*: Sampling and sub-sampling procedures for macro-invertebrates at Long Point and the Ontario side of Lake Huron will follow those of Tom Burton and Don Uzarski's team in Michigan, which should be described in greater detail in their proposal. Essentially, D-frame sweep nets will be used to collect invertebrate samples at all major emergent, shallow and submergent plant community zones during July and August. Sampling will coincide with sampling of plant communities, when plant communities are at their maximum biomass. Samples will be sent to Michigan State University for taxonomic identification and data analyses. Data analyses to determine which taxa provide the best indicator metrics for assessing wetland condition will follow those of Tom Burton and Don Uzarski for Lake Michigan and Lake Huron.

e) ***physical characteristic indicators;*** **4861** *water levels*, **4860** *P and total Nitrates*, and **4516** *sediment flow*: Wherever possible, we will draw upon existing information on chemical/physical parameters needed to assess biotic conditions and possible abiotic stressors. However, we anticipate the need to measure some abiotic parameters at the individual sample stations (e.g. water depth readings). Other potential measurements include soluble reactive phosphorus (SRP), nitrate-N, nitrite-N, ammonium-N, turbidity, alkalinity, temperature, DO, chlorophyll a, redox potential, and specific conductance. Analytical procedures will follow those being recommended by Tom Burton and Don Uzarski in their proposal for Lakes Michigan and Lake Huron.

f) ***landscape level indicator measures*** – (Environment Canada will be responsible for reporting on these measures for wetlands being sampled on the Ontario side of Lake Huron, while Bird Studies Canada will assume primary responsibility for the Long Point study area). In collaboration with Dr. Scott Petrie, the most recent available aerial photographs and data available (1999 vintage) from the Long Point Waterfowl and Wetlands Research Fund's wetland

studies at Long Point will be used to map all of the major emergent community types and determine their aerial extent. Dr. Petrie will also provide data on the extent of invasive plants (particularly *Phragmites*) at all Long Point study sites. Existing data from Dr. Petrie, the County of Norfolk and the Long Point Region Conservation Authority will be used to assess and quantify land-use classes adjacent to wetland sample sites. These data will be used in conjunction with limnological data and site-specific observations of dredging, point source pollution, and other factors to document the extent of possible stressors influencing each sample site and the Long Point wetlands as a whole.

4.5 *How Our Proposed Research Will Meet the Consortium's Feasibility Criteria*

Our final report will include sections on the feasibility of applying marsh bird and amphibian indicators in a monitoring strategy for Great Lakes coastal wetlands, including an analysis across the following six criteria:

a) Cost
b) Measurability
c) Basin-wide applicability of sampling by wetland type
d) Availability of complementary existing research or data
e) Indicator sensitivity to wetland condition changes
f) Ability to set endpoint or attainment levels

5.0 Project Team

5.1 *Bird Studies Canada's Project Team*

Members of the Bird Studies Canada project team and descriptions of how they will contribute toward research activities being proposed by BSC are given below.

Steve Timmermans, MSc., Aquatic Surveys Scientist, Bird Studies Canada
- Principle Investigator for BSC's research team; senior coordinator of the Marsh Monitoring Program;
- background specialization in waterbird and wetland ecology and management;
- responsible for completing Quality Assurance Project Plan for proposed research activities;
- responsible for analysing existing MMP data to develop practical biotic indices (e.g. IBIs) for marsh bird and amphibian indicators;
- co-responsible for liaising with other project teams;
- responsible for reporting results of marsh bird and amphibian indicator research.

Jon McCracken, Program Manager, Bird Studies Canada
- secondary contact for BSC's research team;
- over 20 years of field research experience related to marsh birds; co-designed and developed the Marsh Monitoring Program;
- manages all research and monitoring programs at Bird Studies Canada;
- ensures that proposed research activities are carried out in a timely and professional fashion, within budget, and coordinated with those of other Consortium research teams.

Dr. Charles Francis, Senior Scientist, Bird Studies Canada

- primary support scientist for BSC's research team;
- extensive professional experiencing in the design of large-scale monitoring programs and in advanced statistical applications and database management; adjunct professor at Queen's University;
- assists with preparing Quality Assurance Plan, research sampling design, power analyses, and statistical model design for analysis of marsh bird and amphibian indicator data.

Andrew Couturier, M.Sc., GIS Analyst, National Data Centre, Bird Studies Canada
- thoroughly familiar with all GIS applications and related analytical procedures;
- will provide or oversee all GIS work in connection to the Long Point study.

Dr. Scott Petrie, Scientific Director, Long Point Waterfowl and Wetlands Research Fund
- primary support for wetland classification, wetland mapping, and landscape measure indicator research at Long Point;
- background specialization in waterfowl and wetland ecology; adjunct professor at the University of Western Ontario;
- will provide matching funding and additional technical support by defining areal extent of wetlands by type (community mapping is required, in part, to construct the overall field-sampling framework), habitat adjacent to wetlands, land use classes adjacent to wetlands, invasive plants, and other landscape level indicator research at the Long Point study area.

5.2 *Collaborating Project Teams*

With the exception of the Ontario Ministry of Natural Resources, all research teams with whom we will be coordinating our efforts will also be submitting specific proposals to the Consortium. Main contacts for these teams, descriptions of their anticipated level of involvement with BSC's team, sites and lake basins at which they are proposing to conduct research, and the indicators that each of these teams will be coordinating with BSC to evaluate are as follows:

Joel Ingram (Environment Canada), Ontario
- direct collaborator with BSC in study design and data collection at Long Point;
- indicator research at 10 sites on the shore of Lake Ontario, Long Point (Lake Erie), and 10 as yet unspecified sites on Ontario's side of Lake Huron;
- will partner with BSC to collect data on marsh birds and amphibians, floristics, plant community health, macro invertebrates, and physical characteristics at Long Point wetlands;
- will collect marsh bird/amphibian data at sites on Ontario's side of Lake Ontario using the MMP protocol;
- will partner with BSC to collect data on marsh birds and amphibians, floristics, plant community health, macro-invertebrates, and physical characteristics on Ontario's side of Lake Huron.

Tom Burton (Michigan State University), Don Uzarski (Grand Valley State University), and Dennis Albert (Michigan Natural Features Inventory), Michigan
- indirect collaborator team with BSC and Environment Canada in study design and data collection procedures for macro-invertebrate, fish community and floristics sampling at Long Point wetlands;
- Tom Burton will be a direct collaborator in processing field samples of macro-invertebrates from Long Point and Lake Huron wetland sites;

- members of this team will conduct indicator research at several sites on the U.S. side of Lake Huron and Lake Michigan;
- willing to coordinate efforts to collect marsh bird and amphibian indicator data at sites described above (pending field personnel availability).

Ferenc DeSzalay (Kent State University), Ohio

- will coordinate efforts to collect data on macro-invertebrate communities, floristics and fish communities with those of Tom Burton's team and BSC's team;
- conducting indicator research at six wetland sites on Ohio's side of Lake Erie;
- willing to coordinate efforts to collect marsh bird and amphibian indicator data in Ohio (pending field personnel availability).

Doug Wilcox (USGS Great Lakes Science Centre, Michigan)

- conducting indicator research at one protected embayment wetland on Lake Michigan;
- will collaborate with BSC to collect data on marsh birds and amphibians at his study site.

Phil Ryan and Tom McDougall (Lake Erie Fisheries Assessment Unit, Ontario Ministry of Natural Resources), Ontario

- willing to provide existing fish data from Long Point commercial fisheries and OMNR fish-monitoring programs.

6. Project Schedule (January 2002 through November 2002)

Period	Tasks (excluding planning and networking required prior to January 2002)
January - February	-advertize for field research positions - assemble all background information on Long Point water chemistry, sedimentation, fisheries, etc.
	- Cross-train and meet with Consortium research team members to standardize sampling protocols and finalize "who does what"
	- acquire aerial photographs and/or Landsat images of study sites
	- begin work on Landscape measure indicator research and photo/image interpretation of selected sites
	- Develop study design for evaluating multiple indicators across study sites
	- Develop structure of GIS database for later data entry and analyses
	- Complete/refine biotic integrity indices for marsh bird and amphibian indicators using existing data
	- Develop and refine statistical methodology for evaluating marsh bird and amphibian indicator data
	- Seek volunteer support for MMP protocol indicator evaluation at other sites selected by the Consortium
	- provide quarterly update to the Consortium
March	- Acquire necessary equipment, permits and approvals for conducting field research
	- Interview, hire and train field researchers
	- Complete final logistics and prepare for field season
	- Establish and mark sampling stations for marsh bird, amphibian, invertebrate, and plant sampling at Long Point
	- Continue landscape indicator research across study sites
	- Continue seeking volunteer support for MMP surveys at other study sites
April - early July	- Conduct amphibian and marsh bird surveys at Long Point and Lake Huron study sites
	- Maintain correspondence with other research teams to coordinate research efforts
	- Compile and cross-check all marsh bird and amphibian data as it is received
	- Prepare for invertebrate, plant, and physical characteristic field research
	- provide semi-annual progress report to the Consortium
mid July -August	- Collect field data for invertebrate, plant, and physical characteristics at all sites
	- Identify/process floristic indicator samples as they are collected
	- Ship macro-invertebrate samples to Michigan State University (T. Burton) for identification/processing
	- Continue compiling marsh bird, fish, floristic, and physical data and prepare for analyses
	- provide quarterly update to the Consortium
September -November	- Analyze all marsh bird and amphibian indicator data and add to existing data base to refine biotic indices for these faunal indicators
	- Collaborate closely with other indicator specialists to ensure coordinated and standardized assessment of all indicators
	- Work with other research teams to develop IBIs for sites among both wetland types based on IBI metrics for multiple biotic indicators.
	- Work with other research teams to write, compile sections, and submit Final Report to the Consortium in conclusion of pilot project activities.