2023 COOPERATIVE SCIENCE AND MONITORING INITIATIVE (CSMI) LAKE ONTARIO

Field Year Prospectus

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2023 Cooperative Science and Monitoring Initiative (CSMI) Lake Ontario Field Year Prospectus

Background

The Cooperative Science and Monitoring Initiative (CSMI) is a binational effort to coordinate enhanced monitoring and research activities across the Great Lakes to address specific science priorities for each lake, which are established by the Lake Partnerships under the Lakewide Management Annex of the 2012 Great Lakes Water Quality Agreement (GLWQA). For CSMI field years, the Lake Partnerships identify priority areas where additional science and monitoring efforts are needed to provide the best information for managers to make lake-wide management decisions. The Lake Ontario Partnership identified four priority areas for the 2023 Lake Ontario CSMI: chemical contaminants, nutrient and bacterial pollution, habitat and species, and invasive species. Each priority area is further described through specific research topics and needs (see Appendix 1).

CSMI field year planning, implementation, and reporting activities are coordinated by the GLWQA Science Annex CSMI Task Team. The planning team for 2023 Lake Ontario CSMI used the four priority areas to categorize research efforts, which range from investigations of nutrient dynamics and chemical contaminants to studies of native fish species populations. In all, over 50 binational projects are planned for 2023 fieldwork in Lake Ontario. Some of these projects represent established baseline monitoring programs that provide data on an ongoing basis, others are unique collaborations among agencies that enhance binational monitoring activities, and others are targeted CSMI field year projects that leverage additional resources.

The foundation of the CSMI process is built upon binational and domestic collaboration that would not be possible without a dialog amongst many partners working together to plan and execute projects that address CSMI priorities. Leveraging existing long term monitoring programs provides access to sampling locations, equipment, research vessels, and scientific experts, that maximizes the integration, reach and scope of the CSMI sampling process. This Prospectus highlights a subset of the extensive binational collaborative muti-agency efforts occurring throughout 2023, specifically the: lower food web sampling, water quality and nutrients monitoring efforts, coordinated glider deployments, chemical contaminants monitoring, and fish population assessments. An overview of select one-year targeted projects and program enhancements that address science priorities are also summarized, including projects funded through the US Great Lakes Restoration Initiative (GLRI). Additionally, the Great Lakes Research Consortium (GLRC) Small Grants Program put out a call for proposals to address CSMI 2023 priorities and funded three projects led by academic institutions. Due to the large scope of work planned in Lake Ontario for 2023, not all activities occurring during the field year are included within the main text of this prospectus; a comprehensive list of the projects identified by the CSMI Task Team for the 2023 field year is included in Appendix 2 for reference. A table of agency and partner abbreviations/acronyms used throughout the text can be found in Appendix 3.

Overview of Planned Work

Lower food web surveys

Several annual monitoring programs that assess the lower food web will continue in 2023, including EPA GLPNO spring and summer surveys, DFO and ECCC coordinated spring and summer surveys, the Lake Ontario biomonitoring program implemented by Cornell University, and MECP surveys of index stations along the northern shore of Lake Ontario. Some supplemental work to address CSMI priorities will occur during these surveys, including nearshore sampling for phytoplankton on EPA GLNPO surveys led by UMD NRRI. In addition, multiple partners (EPA GLNPO, EPA ORD, DFO, Cornell University) are coordinating binationally to implement the Lake Ontario Lower Food Web Assessment (LOLA), which is based on a lake-wide transect design that has been sampled on a 5-year basis since 2003.

For this effort, EPA vessels will sample five north-south transects across Lake Ontario in the months of May, July, and September to assess water quality, zooplankton communities, and mysid populations. Sampling of phytoplankton and microbial communities will also be completed at select sites and focus on nearshore-offshore comparisons.

Sampling efforts will combine broad spatial coverage while targeting specific transects to conduct fine-scale sampling to assess the vertical distributions of zooplankton communities during both day and night, using a combination of stratified net tows and laser optical plankton counter (LOPC) technology. In addition to these surveys, DFO will conduct bi- weekly surveys of the westernmost transect and measure additional parameters, including primary production. Coordinated analysis of samples collected from across the lake by multiple groups will be used to estimate secondary production of zooplankton and mysid populations. In addition to these LOLA surveys, MECP will conduct an intensive sampling effort to assess patterns in nearshore nutrient, water quality, and lower food web components in the western basin of Lake Ontario. The surveys are intended to identify spatial and temporal patterns in mixing of waters originating from both land runoff and onshore circulation from the open lake basin over gradients of depth, shoreline configuration and proximity to points of discharge over the study area. The Lake Ontario benthic community will be sampled during a lake-wide survey in September, coordinated by the US EPA GLNPO with SUNY Buffalo State University and partners at NOAA GLERL, who will conduct a targeted assessment of Dreissenid mussel condition and reproduction at a subset of locations.

Water quality and nutrients monitoring

Binational efforts to address and understand water quality concerns in Lake Ontario will feature enhanced monitoring to enable calculation of tributary nutrient loads to the lake, including the load from Lake Erie via the Niagara River. Projects will assess the roles of storm sewer inputs and coastal wetlands in loading of nutrients and contaminants to the Lake Ontario nearshore. The nearshore areas in western, southern, and northern Lake Ontario will be extensively sampled as part of high-resolution spatial water quality mapping and binational coordinated monitoring of benthic algae and adjacent water quality.

CSMI efforts will compliment long term monitoring of the open waters of the lake, which will be sampled by a collaborative of federal, provincial, and state agencies to ensure enhanced spatial and temporal coverage of

water quality conditions over the entire lake. In addition, the Lake Ontario Nearshore Nutrients Study (LONNS), led by USGS in coordination with several partners (Appendix 2) builds on previous efforts during CSMI years since 2008 to characterize the connection between tributary nutrient inputs and nearshore water quality. The LONSS includes a total of 25 sites, including 16 nearshore/shoreside sites, 10 embayment sites, and 9 tributary sites. Samples will be collected approximately monthly during April to September and will be coordinated with the CSMI Lake Ontario Lower Food Web Assessment (LOLA) sampling efforts to the extent possible. In addition to water quality variables sampled in previous LONNS efforts, the 2023 effort will include chlorophyll, trace metals, and harmful algal bloom related variables (algal identification and enumeration and cyanotoxins). Additionally, USGS is leading a project to continuously monitor water at the entrance to Irondequoit and Sodus Bays. These data will provide highly resolved data that can fill temporal gaps and enhance understanding of ecosystem processes.

Enhanced coordination of technology-based approaches

Multiple efforts during the CSMI year include increased coordination of technology-based approaches to enhance research and monitoring programs. There are now several agencies in Canada and the US which have autonomous Teledyne Slocum Gliders available for deployment in the Great Lakes (EPA, NOAA, CIGLR, USGS, Large Lakes Laboratory, DFO, RAEON), each which have different sensor payloads capable of measuring specific water quality parameters that will supplement on-station sampling by research ships. For the 2023 Lake Ontario CSMI, plans are underway to coordinate the timing and location of glider deployment to answer questions related to: differences between nearshore and offshore conditions, conditions tied to different depths within the lake such as: temperature, deep chlorophyll layers, zooplankton diel migration, and lake-wide fish distribution. In addition, several partners including EPA GLNPO, EPA ORD, Cornell University, DFO, and ECCC are working to coordinate efforts to deploy Fluoroprobe instruments, which measure different algal pigments through the water column, and assess how these pigment data compare to phytoplankton community taxonomic data. These efforts will improve our ability to interpret fluoroprobe data and compare data across programs to better understand the phytoplankton community in Lake Ontario. Partners involved in Lake Trout monitoring projects (see *Fish Population Assessments* for details) are also coordinating extensively to provide training on tagging fish and extend the scope of population assessments using acoustic telemetry.

Chemical contaminants

Several projects to further our understanding of chemical contaminant distribution in Lake Ontario are scheduled for the 2023 CSMI field year, with contributions from U.S. and Canadian partners including: USGS, EPA, UMD NRRI, Clarkson University, NYSDEC, ECCC, ECCC-CWS, MECP, TRCA, Upstate Freshwater Institute, and SUNY College of Environmental Science and Forestry. US-led efforts will evaluate mercury cycling and bioaccumulation in the food web, as well as characterize contaminants of mutual concern (CMCs) and contaminants of emerging concern (CECs) in water, sediment, and fish tissues. Projects will focus on water and sediment sampling in the tributaries, nearshore, and embayment areas with some whole lake sampling designed to better understand mercury cycling and to support lake-wide contaminant surveillance. Enhancements to the LONNS (see *Water Quality and Nutrients Monitoring*) this year will measure organic compounds (PCBs, dioxin, and pesticides, including mirex) and contaminants of emerging concern (PFAS, PFOA, personal care products, and hormones) alongside water quality and nutrient assessments. Other contaminant projects will include assessment of contaminant levels in fish tissue and evaluation of waterfowl consumption advisories based on chemical contaminant levels in bird tissue. A project led by the SUNY ESF researchers will also specifically assess contaminants in the invasive Round Goby.

Canadian-led efforts are primarily comprised of long-term monitoring programs focused on 1)

contaminants of emerging and mutual concern in water, sediment and biota on a lake-wide scale and 2) monitoring of contaminants and microplastics at regional and local scales. In addition to this microplastics monitoring by TRCA, which is focused on urban areas, researchers at SUNY ESF are characterizing microplastics and associated organic micropollutants from embayments and nearshore zones.

Fish population assessments

The spring prey fish and fall benthic prey fish Lake Ontario bottom trawl surveys are part of the ongoing binational effort to assess important prey fish species such as Alewife, Deepwater Sculpin, Round Goby, and Rainbow Smelt, among others. They are conducted annually with collaboration among USGS, NYS DEC, and MNRF. Data collected from these surveys are used to inform fishery management decisions related to predator- prey balance in the lake. In the spring survey, over 230 trawls will be completed using large research vessels in the main lake and embayments, at depths ranging from 5-219 m. Hydroacoustic fish abundance data, which are collected along transects in open-water pelagic habitats that are not sampled with the bottom trawl, are also collected during the spring survey. During the fall benthic prey fish survey, approximately 170 bottom trawl tows will occur across the main lake and embayments at depths from 6-226 m.

During the 2023 CSMI field year, several projects will focus on Lake Trout and Lake Trout habitat as it relates to spawning. This year will mark the beginning of a 10 year-long study of Lake Trout movements using acoustic telemetry. By tagging many Lake Trout (target number is 360) with acoustic transmitters, researchers will be able to track these tagged fish as they undergo spawning migrations, allowing identification of areas currently being used for spawning. Spawning habitat will be assessed and characterized with drop-cameras to inform future habitat improvement projects. Additionally, a project led by researchers at SUNY University at Buffalo will employ epigenetics to determine whether hatchery-rearing leads to heritable genetic changes in Lake Trout used in restoration stocking efforts.

Appendix 1. Lake Ontario CSMI Summary: 2023 Field Year Priorities

Lake Ontario CSMI Summary: 2023 Field Year Priorities

In addition to the below priorities, the Lake Ontario Partnership identified the priority for the 2023 CSMI projects to be inclusive of indigenous communities and Traditional Ecological Knowledge. Indigenous Nations, traditional knowledge holders, and the indigenous science community are encouraged to identify projects according to traditional teachings and cultural views of the Lake Ontario basin and connecting channels, and in surrounding indigenous territories to protect water quality, indigenous cultural species, and ecosystem sustainability in Lake Ontario.

Chemical Contaminants

1. Characterize critical and emerging pollutants, with a focus on chemicals with potential for trophic transfer in nearshore and offshore.
2. How do shifts in the Lake Ontario food web and invasive species affect contaminant transfer?
3. What are the impacts of climate change on contaminant bioavailability, cycling and movement?
4. What is the abundance and distribution of microplastics in Lake Ontario and are microplastics significant vectors for inter/intra basin transport of chemical contaminants and bioaccumulation?

Nutrient and Bacterial Pollution

1. Improve whole-lake phosphorus load and productivity estimates.
2. Better characterize and increase understanding of spatial and temporal patterns of microbial, heterotrophic, and primary production.
3. Establish a coupled hydrodynamic ecosystem model that includes phosphorus inputs, transport, fate, and effects in the Lake.
4. Integrate new innovative approaches and technologies for measuring/monitoring primary production (including the benthic alga Cladophora).

Habitat and Species

1. Increase understanding of the physical drivers of fish habitat and impacts on fish recruitment and production.
2. Survey and map lake bottom substrates in targeted locations in Lake Ontario.
3. What are the impacts of lake level fluctuations on habitat and wetland health and ecology?
4. Improve and enhance winter limnology research and increase understanding of the impacts of a changing winter season (due to climate change) on Lake and wetland ecosystems.
5. Understand changing species dynamics, food web structure and energy transfer in Lake Ontario, including benthos, zooplankton, and fish populations.

Invasive Species

1. Dreissenid mussel population dynamics (including fecundity/recruitment and predation by Round Goby) and ecosystem impacts.
2. Impacts of invasive species on wetlands, especially invasive plant species and the question of whether road salt is driving increases in invasive aquatic plan

Appendix 2. Lake Ontario 2023 CSMI Prospectus project inventory. Project number does not denote importance or ranking; projects are sorted by CSMI priority (CC= chemical contaminants; HS= habitat and species; IS= invasive species; NB= nutrients and bacteria) (updated April 2023).

#*	Project Title	Lead Agency/ies	Contact Name (Email)	Priority/ies
1	Eastern Basin Warmwater Fisheries Assessment	DEC	J. Goretzke (jessica.goretzke@dec.ny.gov)	CC
2	Fish contaminants (supplemental lab work)	DEC	Wayne Richter (wayne.richter@dec.ny.gov)	CC
3	Update New York and Pennsylvania Waterfowl Consumption Advisories	DEC	Wayne Richter (wayne.richter@dec.ny.gov)	CC
4	Contaminant monitoring in biota	ECCC-WQMSD	Tana McDaniel (Tana.Mcdaniel@ec.gc.ca)	CC
5	Lake wide surveillance for CMCs, CECs, nutrients, water quality	ECCC-WQMSD	Vi Richardson (violeta.richardson@ec.gc.ca)	CC
6	Integrated Atmospheric Deposition Network	EPA GLNPO	Derek Ager (ager.derek@epa.gov)	CC
7	Evaluation of legacy and emerging contaminants - nearshore & offshore invasive benthic prey	SUNY College of Environmental Science and Forestry	Roxanne Razavi (razavi@esf.edu)	CC
8	Microplastics and CMCs in urban areas	TRCA	Krista Chomicki (kchomicki@trca.on.ca)	CC
9	Characterization of microplastics and organic micropollutants from embayments and nearshore	Upstate Freshwater Institute, Syracuse NY	David Matthews (damatthews@upstatefreshwater.org)	CC
10	Adult Lake Trout Assessment (USGS, NYSDEC)	USGS	Brian O'Malley (bomalley@usgs.gov)	CC
11	Great Lakes Sediment Surveillance Program	EPA GLNPO	Brian Lennell (lenell.brian@epa.gov)	CC; HS
12	Great Lakes Fish Monitoring and Surveillance program	EPA GLNPO	Brian Lennell (lenell.brian@epa.gov)	CC; HS
13	Food web-influenced contaminant model including PFAS	EPA ORD	Ryan Lepak (lepak.ryan@epa.gov)	CC; HS
14	Lake level monitoring & inundation maps (coordination w/ NYSDEC)	USGS	Chris Gazoorian (cgazoori@usgs.gov)	CC; HS
15	Lakewide benthic preyfish surveys (NYSDEC, MNRF) – collaborative effort	USGS	Brian O'Malley (bomalley@usgs.gov)	CC; HS
16	Mercury cycling and bioaccumulation in the Lake Ontario foodweb	USGS Mercury Research Laboratory, USGS Upper Midwest Water Science Center, with USEPA ORD, GLNPO	Sarah Janssen (sjanssen@usgs.gov)	CC; HS
17	Nearshore Index Station Monitoring (sediment, water, benthic invertebrates, phytoplankton, & zooplankton	MECP	Nadine Benoit (Nadine.benoit@ontario.ca)	CC; HS; NB
18	Joint Nearshore Sentinel Site monitoring (cladophora/mussels/WQ)	ECCC-WQMSD-MECP	Megan McCusker (Megan.McCusker@ec.gc.ca); Mary Thorburn (mary.thorburn@ontario.ca)	CC; HS; IS; NB
19	Lower Food Web Biomonitoring Program (NYSDEC, Cornell, USGS)	DEC	M. Connerton (michael.connerton@dec.ny.gov)	CC; NB
20	Mooring deployments, hydrodynamic and water quality modelling, and in-lake microplastics	ECCC	Reza Valipour (reza.valipour@ec.gc.ca)	CC; NB
21	Connecting Channels Water Quality Monitoring (also see Tributary Water Quality Monitoring)	ECCC-WQMSD	Matt Graham (Matt.Graham@ec.gc.ca)	CC; NB
22	Provincial Water Quality Monitoring Network (PWGMN)	MECP	Georgina Kaltenecker (PWQMN@ontario.ca)	CC; NB
23	Evaluation of benthic cyanobacteria in shoreline habitats of the Lake Ontario watershed	SUNY College of Environmental Science and Forestry	Roxanne Razavi (razavi@esf.edu)	CC; NB
24	Lake Ontario Nearshore Nutrient and Contaminant Study (LONNS 2023)	USGS	Jess Trevino (jtrevino@usgs.gov)	CC; NB
25	Tributary load monitoring: Oswego, Genessee, Niagara, St. Lawrence	USGS	Guy Foster (gfoster@usgs.gov)	CC; NB
26	Sources of bioavailable mercury along the southern shoreline and nearshore of Lake Ontario	New York State Water Resources Institute (NYSWRI)	Evie Brahmstedt (esb279@cornell.edu)	CC;NB
27	Indexing young of the year salmonine and alewife abundance	DEC	M. Connerton (michael.connerton@dec.ny.gov)	HS
28	Winter limnology sampling (Winter grab)	DFO	Warren Currie (Warren.Currie@dfo-mpo.gc.ca)	HS
29	Fish telemetry & walleye recruitment	DFO	Jon Midwood (Jon.Midwood@dfo-mpo.gc.ca)	HS
30	Ice mapping algorithm (work completed; see manuscript)	DFO	Jon Midwood (Jon.Midwood@dfo-mpo.gc.ca)	HS
31	Herring Gull and Cormorant Egg Monitoring	ECCC-CWS	Shane deSolla (Shane.Desolla@ec.gc.ca)	HS
32	Lakewide Benthic Survey & Dreissenid mussel assessment	EPA GLNPO (EPA, NOAA, Buffalo State)	Annie Scofield (scofield.anne@epa.gov)	HS
33	Lake Ontario Lower Food Web Assessment (LOLA)	EPA GLNPO, EPA ORD, DFO	Annie Scofield (scofield.anne@epa.gov)	HS
34	Assessing algal blooms and toxins and benthic condition in the St. Lawrence River	EPA R2	Antony Tseng (tseng.antony@epa.gov)	HS
35	Nearshore Fish Community Surveys	MNRF	E. Brown (erin.n.brown@ontario.ca)	HS
36	Migratory Trout and Salmon Assessment	MNRF	M. Yuille (michael.yuille@ontario.ca)	HS

* Project number reflects entry based on alphabetical sorting by priority and agency; this number reflects no other rank, order, or priority.

Appendix 2 continued. Lake Ontario 2023 CSMI Prospectus project inventory. Project number does not denote importance or ranking; projects are sorted by CSMI priority (CC= chemical contaminants; HS= habitat and species; IS= invasive species; NB= nutrients and bacteria) (updated April 2023).

#*	Project Title	Lead Agency/ies	Contact Name (Email)	Priority/ies
37	Fish Community Index and Binational Prey fish surveys	MNRF	E. Brown (erin.n.brown@ontario.ca)	HS
38	Recreation Fisheries and Harvest Surveys	MNRF	M. Yuille (michael.yuille@ontario.ca)	HS
39	Commercial Fishing Harvest Assessment	MNRF	E. Brown (erin.n.brown@ontario.ca)	HS
40	Lower food web energy transfer connectivity study	MNRF	Tim Johnson (tim.johnson@ontario.ca)	HS
41	Multi-species, open lake acoustic telemetry (fish movement and behaviour)	MNRF (w/ DFO, USFWS, NYSDEC, USGS, TRCA, universities (Windsor, Carleton, Toronto and Queens))	Tim Johnson (tim.johnson@ontario.ca)	HS
42	Hamilton Harbor stocked walleye assessment (MNRF)	MNRF/DFO	Jon Midwood (Jon.Midwood@dfo-mpo.gc.ca)	HS
43	Does hatchery-rearing lead to heritable epigenetic changes in Lake Trout?	SUNY University at Buffalo	Trevor Krabbenhoft (tkrabben@buffalo.edu)	HS
44	Additional multibeam + side scan support	USFWS	Dimitry Gorsky (dimitry_gorsky@fws.gov)	HS
45	Ontario spawning shoals	USFWS	Dimitry Gorsky (alexander_gatch@fws.gov)	HS
46	Identifying lake trout spawning distributions and habitats	USFWS, USGS, NY DEC	Alex Gatch (alexander_gatch@fws.gov)	HS
47	Lakewide spring preyfish survey (USGS, NYSDEC, NDMNRF)	USGS	B. Weidel (bweidel@usgs.gov)	HS
48	Coregonine tributary use survey	USGS	Brian O'Malley (bomalley@usgs.gov)	HS
49	Can substrate remediation improve coregonine reproduction?	USGS, USFWS, NYSDEC	B. Weidel (bweidel@usgs.gov)	HS
50	Lake Ontario Teledyne G3 Glider Missions	DFO	Warren Currie (Warren.Currie@dfo-mpo.gc.ca)	HS; NB
51	Long term monitoring (Hamilton Nearshore-Offshore Transect)	DFO	Warren Currie (Warren.Currie@dfo-mpo.gc.ca)	HS; NB
52	Mysid program – fall survey	DFO	Warren Currie (Warren.Currie@dfo-mpo.gc.ca)	HS; NB
53	Long term monitoring (stn 81)	DFO/MNRF	Warren Currie (Warren.Currie@dfo-mpo.gc.ca)	HS; NB
54	Nearshore Phytoplankton & Zooplankton	EPA GLNPO	Annie Scofield (scofield.anne@epa.gov)	HS; NB
55	Lake Ontario Lower food web monitoring/productivity (also see Glider Missions)	DFO	Warren Currie (Warren.Currie@dfo-mpo.gc.ca)	HS; IS; NB
56	Whole Lake Quagga Mussel Body Condition Assessment	NOAA	Ashley Elgin (ashley.elgin@noaa.gov)	IS
57	Watershed modeling	ECCC	Yongbo Liu (Yongbo.Liu@ec.gc.ca)	NB
58	Integrated ecological and hydrodynamic modeling	ECCC	David Depew (David.Depew@ec.gc.ca)	NB
59	Tributary Water Quality Monitoring (also see Connecting Channels Water Quality Monitoring)	ECCC-WQMSD-TRCA-MECP	Tracie Greenberg (Tracie.Greenberg@ec.gc.ca)	NB
60	Water Quality & Biology monitoring (Spring & Summer Monitoring Surveys)	EPA GLNPO	Annie Scofield (scofield.anne@epa.gov)	NB
61	Coastal Wetlands Monitoring Program	EPA GLNPO	Matthew Pawlowski (pawlowski.matthew@epa.gov)	NB
62	Lake Ontario Tributary Interagency (Ontario) Monitoring network	MECP	Ryan Sorichetti (ryan.sorichetti@ontario.ca)	NB
63	Lake Ontario Western Basin Nearshore Intensive Water Quality study 2023	MECP	Nadine Benoit (Nadine.benoit@ontario.ca) Ryan Sorichetti (ryan.sorichetti@ontario.ca)	NB
64	Aquatic microbiome characterization in the western-basin Lake Ontario tributaries and nearshore project	MECP	Janis Thomas (janis.thomas@ontario.ca)	NB
65	Glider deployments (GLOS) – NOAA GLERL, activities will be coordinated	NOAA/CIGLR	Russ Miller (rusmil@umich.edu)	NB
66	Chl a remote sensing (all year) and in situ optical property sampling (GLNPO surveys)	NOAA/MTRI with EPA GLNPO	Mike Sayers (mjsayers@mtu.edu)	NB
67	Tributary Water Quality Monitoring; NYSDEC Program	NYSDEC	A. Prestigiacomo (anthony.prestigiacomo@dec.ny.gov)	NB
68	Tributary Water Quality Monitoring; FLLOWPA Counties	NYSDEC	A. Prestigiacomo (anthony.prestigiacomo@dec.ny.gov)	NB
69	Nutrient stormwater loading and speciation	TRCA	Krista Chomicki (kchomicki@trca.on.ca)	NB
70	Coastal wetlands winter water quality parameters	TRCA-OTU	Krista Chomicki (kchomicki@trca.on.ca)	NB
71	Cladophora monitoring (coordination with EPA)	USGS	Mary Anne Evans (maevans@usgs.gov)	NB
72	Lake Ontario Embayment Continuous Productivity Monitoring	USGS	Andrew Kowalczk (akowalczk@usgs.gov)	NB

* Project number reflects entry based on alphabetical sorting by priority and agency; this number reflects no other rank, order, or priority.

Appendix 3. List of agency and partner abbreviations and full name.

ABBREVIATION	NAME
CIGLR	Cooperative Institute for Great Lakes Research
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EPA	United States Environmental Protection Agency
EPA GLNPO	United States Environmental Protection Agency Great Lakes National Program Office
EPA ORD	Environmental Protection Agency Office of Research and Development
MECP	Ministry of the Environment, Conservation and Parks
MNRF	Ontario Ministry of Natural Resources
NOAA	National Oceanic and Atmospheric Administration
NOAA GLERL	National Oceanic and Atmospheric Administration Great Lakes Environmental Research
NYS DEC	New York State Department of Environmental Conservation
RAEON	Real-Time Aquatic Ecosystem Observation Network
SUNY BUFFALO	State University of New York University at Buffalo
SUNY ESF	State University of New York College of Environmental Science and Forestry
TRCA	Toronto and Region Conservation Authority
UFI	Upstate Freshwater Institute
UMD NRRI	University of Minnesota Duluth, Natural Resources Research Institute
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USGS GLSC	United States Geological Survey Great Lakes Science Center