

IJC GLEEM REPORT APPENDICES

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Appendix I: Project Phases and Execution

Phase 1 Research Design and Instrument Development	Timelines	Deliverables
Project start-up meetings with IJC staff to discuss objectives, scope of project, select objectives/relevant indicators and draft research design	November	Draft Research Design and identification of application objectives; refine scope
refined research design, generated participant lists and backgrounders, survey instrument; pre-test	December-February	Survey Instrument Recruitment Package Participant Lists Research ethics application
Research Ethics Board (REB) Submission	February-March	REB approval
Finalize survey instrument, communications docs and participant lists; French translation of backgrounders and surveys	January-April	Participant Spreadsheets, final versions of survey instrument
Field survey(s); begin preparing SPSS for data entry	May 6	Report on survey administration
First, second and final reminders to non-respondents Close of survey	May 19 May 25 June 1 June 8	Weekly updates on response rates
Coding workshop with PhD students	June 10	Preliminary report on coding framework and workshop
Data aggregation in SPSS; application of coding; inter-rater reliability weighting	June – July	Preliminary data reports; proposed coding framework
Inter-rater reliability coding of open-ended responses	June – July	qualitative survey responses
Summarize results; Analyze and report on efficacy of the model	June-July	Quantitative survey results and summary statistics/tables/figures
First Draft of Report	July 24	First draft of summary report for IJC staff
Conference call with IJC staff to discuss first draft, findings,	July- August	Reviewed draft report and identify required revisions/additions
Report revisions	August 31	
Final Report to IJC	September 31	Final report

Appendix II: Review of General Objectives for Selection of Test Cases

Selection Criteria	General Objectives								
	(i) safe drinking water	(ii) swimming & rec use	(iii) fish and wildlife consumption	(iv) free from harmful pollutants	(v) Wetlands and Habitats	(vi) free from harmful nutrients	(vii) intro & spread aquatic and terrestrial invasive species	(viii) contaminated groundwater	(ix) other substances
Clearly stated goal	Y	Y	Y	N	N	Y	Y	N	N
Existing IJC Indicators in Use (Programs & Measures)	N	Y	N	N	?	P	N	N	N
Existing Indicators by Parties	Y	Y	Y	Y	Y	Y	P	N	N
Existing Indicators by Others	Y	Y	Y	?	P	Y	Y	N	N
Clearly Associated Programs & measures in GLWQA	Y	Y	Y	N	Y	Y	Y	Y	N
Associated Annex Identifiable Survey Participants	N	N	N	Y	Y	Y	Y	Y	N
PEI work by IJC	N	N	P	Y	Y	?	Y	N	P
Knowledge & Expertise of team members	Y	Y	Y	P	P	Y	Y	P	P
Criteria Score	6	7	6	4	5	7	7	2	0
Y = Yes							<i>(Score primarily associated with aquatic invasive species)</i>		
N = No									
P = Partial									

Appendix III: SPSS Quantitative Coding

General Objective (ii)

Survey Question	Question Number	Variable Name	Possible Responses
On a scale of 0 to 5, where do you think we are in terms of achieving General Objective (vii) of the Great Lakes Water Quality Agreement - that the Great Lakes should be free from the introduction and spread of aquatic invasive species that adversely impact the quality of the waters of the Great Lakes?	1	AcheiveOb2	0 – Not achieved at all 1 – Very little achieved 2 – Some achievement 3 – Partially achieved 4 – Mostly achieved 5 – Fully achieved
Is there any explanation or justification you would like to provide for your answer?	1.1	NA	Open
For each of the programs below, please indicate the contribution of that program to General Objective (vii) in the GLWQA.	2	NA	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Source water protection programs	2a	Cont1	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Waste water treatment programs	2b	Cont2	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Nutrient management programs	2c	Cont3	No Contribution = 0 Low Contribution = 1

			Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Performance based watershed plans/programs	2d	Cont4	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Local water quality monitoring programs	2e	Cont5	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Public health monitoring programs	2f	Cont6	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Nongovernment/ community monitoring and reporting programs	2g	Cont7	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Non-government certification/flag designation programs	2h	Cont8	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6

Please identify any other programs and measures that contribute to the accomplishment of General Objective (vii) and use the scale above to indicate the contribution of that program or measure.	2.1	NA	Open
Do you have any comments on the programs that are particularly effective or gaps in program coverage?	2.2	NA	Open
In your opinion, do the indicators discussed in the backgrounder and listed below accurately demonstrate the condition of that objective today?	3		Yes = 1 No = 2 No Opinion = 3
Number/percentage of beach advisories per season	3a	Ind1	Yes = 1 No = 2 No Opinion = 3
Number/percentage of beach closures per season	3b	Ind2	Yes = 1 No = 2 No Opinion = 3
Number/percentage of days beaches are open and safe for swimming per season	3c	Ind3	Yes = 1 No = 2 No Opinion = 3
Are there any comments you would like to provide related to the indicators in the question above?	3.1	NA	Open
Are there other indicators or data that should be considered to better evaluate an report on the state of this Objective over time? If so, please list (indicating if data is available and where it might be found).	3.2	NA	Open
How many years have you worked on Great Lakes issues?	4	GLWorkYears	Less than 12 months = 1 1-3 years = 2 4-6 years = 3 7-10 years = 4 11-15 years = 5 16-20 years = 6 21-25 years = 7 more than 25 years = 8
How much of your time do you spend engaged in work related to this General Objective of the GLWQA?	5	GLTime	1-20% = 1 21-40% = 2 41-60% = 3 61-80% = 4 81-100% = 5
Are your responses or comments based on a basin-wide perspective, particular lake, or other scale?	6	GLScale	Basin wide = 1 Lake Erie = 2 Lake Ontario = 3

			Lake Michigan = 4 Lake Huron = 5 Lake Superior = 6
Are your responses or comments based on a basin-wide perspective, particular lake, or other scale? (Open answer)	7	NA	Other = Open
What field or discipline best describes your educational background/training?	8a	OcField	Science = 1 Engineering = 2 Medical = 3 Law = 4 Business = 5 Economics = 6 Social Science = 7 Arts = 8
What field or discipline best describes your educational background/training? (Other)	8b	NA	Open
How would you classify the organization for which you work?	9A	OcOrg	University/Research Institution = 1 Local/Municipal government = 2 State/Provincial government = 3 Federal government = 4 International/Transboundary government = 5 First Nations/Metis/Tribal/Indigenous = 6 Watershed/regional authority = 7 Industry/private sector = 8 Environmental non-government organization = 9
How would you classify the organization for which you work? (Open)	9b	NA	Open
Are you affiliated with an Annex Committee under the Great Lakes Water Quality Agreement? If so, can you indicate which Annexes you are affiliated with?	10	NA	Open
In no particular order, please identify the top five experts related to this GLWQA Objective.	11	NA	Open

General Objective (vii)

Survey Question	Question Number	Variable Name	Possible Responses
On a scale of 0 to 5, where do you think we are in terms of achieving General Objective (vii) of the Great Lakes Water Quality Agreement - that the Great Lakes should be free from the introduction and spread of aquatic invasive species that adversely impact the quality of the waters of the Great Lakes?	1	AcheiveOb7	0- Not achieved at all 1 - Very little achieved 2 - Some achievement 3 - Partially achieved 4 - Mostly achieved 5 - Fully achieved
Is there any explanation or justification you would like to provide for your answer?	1.1	NA	Open
For each of the programs below, please indicate the contribution of that program to General Objective (vii) in the GLWQA.	2	NA	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Programs/regulations blocking dispersal pathways;	2a	Cont1	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Risk assessment programs for new introductions;	2b	Cont2	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Programs/regulations for aquaculture, aquarium and bait industries;	2c	Cont3	No Contribution = 0 Low Contribution = 1 Low-Medium = 2

			Medium = 3 Medium-high = 4 High = 5 Complete = 6
Programs/regulations for recreational activities;	2d	Cont4	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Community education, awareness programs;	2e	Cont5	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Border control/inspection programs;	2f	Cont6	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Monitoring/surveillance programs;	2g	Cont7	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Information-sharing protocols;	2h	Cont8	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Rapid response protocols;	2i	Cont9	No Contribution = 0

			Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Programs for preapproving eradication/containment technologies.	2j	Cont10	No Contribution = 0 Low Contribution = 1 Low-Medium = 2 Medium = 3 Medium-high = 4 High = 5 Complete = 6
Please identify any other programs and measures that contribute to the accomplishment of General Objective (vii) and use the scale above to indicate the contribution of that program or measure.	2.1	NA	Open
Do you have any comments on the programs that are particularly effective or gaps in program coverage?	2.2	NA	Open
In your opinion, do the indicators discussed in the backgrounder and listed below accurately demonstrate the condition of that objective today?	3		Yes = 1 No = 2 No Opinion = 3
Programs/regulations blocking dispersal pathways;	3a	Ind1	Yes = 1 No = 2 No Opinion = 3
Number of new introductions;	3b	Ind2	Yes = 1 No = 2 No Opinion = 3
Size of existing AIS populations;	3c	Ind3	Yes = 1 No = 2 No Opinion = 3
Acres (or tributary miles) controlled for invasive species;	3d	Ind4	Yes = 1 No = 2 No Opinion = 3
Number of monitoring activities conducted;	3e	Ind5	Yes = 1 No = 2 No Opinion = 3
Number of rapid responses or exercises conducted;	3f	Ind6	Yes = 1 No = 2 No Opinion = 3

Number of control projects undertaken;	3g	Ind7	Yes = 1 No = 2 No Opinion = 3
Number of control technologies and methods field-tested.	3h	Ind8	Yes = 1 No = 2 No Opinion = 3
Are there any comments you would like to provide related to the indicators in the question above?	3.1	NA	Open
Are there other indicators or data that should be considered to better evaluate an report on the state of this Objective over time? If so, please list (indicating if data is available and where it might be found).	3.2	NA	Open
How many years have you worked on Great Lakes issues?	4	GLWork	Less than 12 months = 1 1-3 years = 2 4-6 years = 3 7-10 years = 4 11-15 years = 5 16-20 years = 6 21-25 years = 7 more than 25 years = 8
How much of your time do you spend engaged in work related to this General Objective of the GLWQA?	5	GLTime	1-20% = 1 21-40% = 2 41-60% = 3 61-80% = 4 81-100% = 5
Are your responses or comments based on a basin-wide perspective, particular lake, or other scale?	6	GLScale	Basin wide = 1 Lake Erie = 2 Lake Ontario = 3 Lake Michigan = 4 Lake Huron = 5 Lake Superior = 6
Are your responses or comments based on a basin-wide perspective, particular lake, or other scale? (Open answer)	7	NA	Other = Open
What field or discipline best describes your educational background/training?	8a	OcField	Science = 1 Engineering = 2 Medical = 3 Law = 4 Business = 5 Economics = 6

			Social Science = 7 Arts = 8
What field or discipline best describes your educational background/training? (Other)	8b	NA	Open
How would you classify the organization for which you work?	9A	OcOrg	University/Research Institution = 1 Local/Municipal government = 2 State/Provincial government = 3 Federal government = 4 International/Transboundary government = 5 First Nations/Metis/Tribal/Indigenous = 6 Watershed/regional authority = 7 Industry/private sector = 8 Environmental non-government organization = 9
How would you classify the organization for which you work? (Open)	9b	NA	Open
Are you affiliated with an Annex Committee under the Great Lakes Water Quality Agreement? If so, can you indicate which Annexes you are affiliated with?	10	NA	Open
In no particular order, please identify the top five experts related to this GLWQA Objective.	11	NA	Open

Appendix IV: Open-ended Responses

General Objective (ii)

Question 1.1:

Is there any explanation or justification you would like to provide for your answer?

Responses
identification of the water shed with all point and non point source pollution is aiding in water quality /predictive modeling studies.
We are using an inaccurate measure. E coli or fecal coliform monitoring does not directly measure the potential for illness, and studies have shown that these bacteria can be endemic in the sand. Positive tests therefore do not necessarily mean that there is a health risk, only the potential for a health risk to exist. So, given this, we do not know to what extent environmental quality concerns actually restrict recreation. We need a better indicator. In addition the increased frequency of toxic algae blooms is adding another environmental concern that is not monitored at the same frequency or geographical extent as bacteria monitoring.
It depends on the lake and locations greatly
Canada and Ontario, along with local communities, have moved forward in undertaking necessary changes to achieve the goal. However, more work needs to be done.
The recreational water quality varies between the different points we sample. While some sites show excellent water quality almost throughout the summer, others show a water quality that is deteriorating, so we have some work to do to reach an all around quality of water that is acceptable for swimming.
There is still a lot of work required in the field of source protection.
I am under the impression that the beaches in Ontario are safe but it is mainly adverse environmental events that prompt beach closures i.e. weather that mixes wildlife feces into the water
The agreement acknowledges support for work on existing threats namely, blue-green algae blooms.
Many of the reasons that beaches were closed/posted in the early stages of the Agreement have been adequately dealt with (ie poorly treated wastewaters, Combined-sewer overflows, etc). However beaches may be closed due to other faecal sources (birds) instead - which may or may not have the same health risks. As well, climate change factors may begin to affect posting rates - as beaches are often posted after severe weather effects as a precaution. As more frequent weather effects occur, more postings will follow
Increased participation in initiatives to protect and promote the overall health and safety of recreational waterfront areas (for example Blue Flag)
The success of GLWQA objective can be measured by rising level of awareness within the general public as they obtain some pre-knowledge of the current status of the particular beach that they wish to attend for the day. The main inquiry is whether a beach has a closed sign or warning posted. There are quite a few 'hits' on the Health Units Beach website.

Beaches are still posted with advisories or closed too frequently. And the data we use to post beaches with advisories or close them should be real-time data. This technology is available and should be used to test all Great Lakes beaches. We also need to do a better job of standardizing data collection at beaches and monitoring beach health, how decisions are made about advisories and closures, and how this information is conveyed to the public and tracked year to year.

Land use changes, population increases are adding more load to the system. Bays continue to be at risk

Please check out www.theswimguide.org for day to day beach updates on Great Lakes as well as yearly charts on sampling. The Swim Guide also publishes reports on year to year changes. As a product of our organization I know the data well and understand how poorly we are doing trying to meet the goal of swimming the Great Lakes. For example....one of the least understood threats to Great Lakes swimming is the loss of beaches and loss of regular sampling to ensure good communication around swimmable water. Please see data from last 2 years for all beaches on Great Lakes. In summary: For all 1012 beaches we have on the Great Lakes 2014 Average days passed wq tests 71.31% days failed wq tests 8.59% days with no data 20.11% 2013 Average days passed wq tests 85.51% days failed wq tests 9.54% days with no data 4.95% For Lake Superior (93 beaches) 2014 Average days passed wq tests 82.70% days failed wq tests 3.82% days with no data 13.48% 2013 Average days passed wq tests 82.10% days failed wq tests 4.30% days with no data 13.60% Lake Michigan (272 Beaches) 2014 Average days passed wq tests 90.42% days failed wq tests 4.33% days with no data 5.25% 2013 Average days passed wq tests 96.31% days failed wq tests 2.64% days with no data 1.05% Lake Huron (213 beaches) 2014 Average days passed wq tests 70.61% days failed wq tests 5.58% days with no data 23.80% 2013 Average days passed wq tests 97.46% days failed wq tests 2.53% days with no data 0.01% Lake Erie (125 Beaches) 2014 Average days passed wq tests 54.48% days failed wq tests 21.14% days with no data 24.37% 2013 Average days passed wq tests 69.32% days failed wq tests 28.43% days with no data 2.25% Lake Ontario (284 Beaches) 2014 Average days passed wq tests 58.71% days failed wq tests 10.74% days with no data 30.55% 2013 Average days passed wq tests 76.88% days failed wq tests 14.38% days with no data 8.74%

The bars charts provided on the previous page indicate that beaches are open (not posted 80 % of time for all lakes – that is the major piece of info. The numbers quoted in text beside the chart indicates worse conditions, in Ontario - - which is asuance from the chart.

Waste water treatment plants in Ontario all too often have by-passes of sewage/partially treated sewage after heavy rainfalls. Private sewage disposal systems adjacent to Great Lakes have had no on-going monitoring program to ensure proper functioning.

GLRI provided significant funding to remediate beaches that reported the most closures/advisories. Now those beaches with corrective actions are open most of the time with few or no closures/advisories. There are several options to restore beaches and protect them from contamination sources either from chronic discharges or stormwater run off. The tools are available. The fixes are implemented when the funding and local politics support the project.

My response is based on the results of our beach monitoring program.

The issue is very complex. I don't think we will ever truly achieve this objective.

I don't see a general decrease in beach closures and advisories, only inter-annual variation. Successes tend to be local.

Question 2.1: Please identify any other programs and measures that contribute to the accomplishment of General Objective (ii) and use the scale above to indicate the contribution of that program or measure.

Responses
None known
Monitoring based programs in general only provide already know information, does not really solve the problems.
I believe the above scale is too vague to be able to adequately assess the contributing factors to Great Lakes restoration. It's particularly problematic since it doesn't align to the Annexes, making it difficult to tie any of the progress in to the GLWQA. Furthermore, it isn't clear which programming is being referenced, and which actor for each components of programming.
Provide incentives (financial or otherwise) to individuals/companies to implement measures to mitigate or eliminate operations/activities that contribute to adverse water quality, and monitor to ensure their effectiveness could contribute highly in achieving the general objective.
Septic tank reassessment program under part 8 of the OBC
Stormwater control programs - especially decoupling of CSOs is a "high contribution" in some municipalities. Other beach programs - such as beach grooming, bird control etc. also provide "medium to high" contributions
Conservation authorities deserve specific mention related to their roles as advocates for the promotion and protection of surface water quality and quantity.
www.theswimguide.org
Note - the following are not 'wastewater treatment programs 1. Interception of CSOs and transport / treatment of CSO waters at another location - High Contribution 2. Interception and treatment of direct stormwater discharges to a beach area, (discharges from separated stormwater collection systems - High Contribution 3. Interception and treatment of overland flow from rural sources (such as feed lots, septic tanks) for rural beaches- High Contribution. As well, I interpret the term 'nutrient management' to relate to P and N control, not E Coli control
Remedial Action Plan activities - high contribution
Enforcement of the Sanitation Codes; give support to local communities to identify impaired on-site septic systems. Estimates show 25% failure rate of inspected systems. Drainage ditches are the first surface water to receive gross contamination. Ditches transport pollution to larger rivers that eventually empty into the Great Lakes. Beaches with a nearby ditch, creek, river, etc are vulnerable to stormwater contamination.
GLRI/GLNPO Great Lakes Restoration project funding- high contribution Community infrastructure improvements-medium-high contribution

Question 2.2: Do you have any comments on specific programs that are particularly effective or gaps in program coverage to achieve General Objective (ii)?

Responses
No
Blue-green algae blooms, where the potential exists, need to be monitored in addition to bacteria.
There's no on-going tri-lateral process for both levels of government to engage with non-government organizations and First Nations governments on activities or policy on a regular basis.
None.
Locally the source water protection has focused primarily on well-head protection and drinking water supply - limited to no focus on protection of recreational water quality. Conservation authorities provide specific focus on protection and promotion of surface water quality and quantity, however this is primarily from an aquatic environment perspective, with limited to no public health lens. Increased collaboration among agencies and stewardship organizations will be necessary to fully identify and implement climate change adaptation and mitigation strategies for the Great Lakes.
Public Health monitoring programs & other programs can benefit from putting in place at their local beaches properly equipped modeling programs that have multiple years of recorded data which links daily environmental conditions & possible physical contaminants to the levels of bacteria found in the near shore beach water. The other missing link is "the epidemiology" of any illness outbreaks that can be linked to beach use. This "epi" study is very hard to link to beach use.
Monitoring has provided data and incentives but watershed protection (septic tanks, manure) treatment e.g. season disinfection etc. have not been implemented using a risk based approach.
Gap - the relative risk of E Coli from animal discharges vs. those from human sewage.
Gaps - large scale polluters such as industry and municipal WWTP need more enforcement or financial assistance. Biggest bang for the buck.
Niagara Water Strategy and WaterSmart Niagara has programs that benefit the achievement of the General Objective.
Helpful programs include the IDEP and MS4. Illicit Discharge Elimination Program = IDEP and is part of the NPDES program Municipal Separate Storm Sewer System = MS4 and is also part of the NPDES program.

Question 3.1: Are there any comments you would like to provide related to the indicators in the question above?

Responses
<p>It has been my experience that the inputs and indicators (fecal bacteria, rain events, # of bathers, etc.) used to close beaches (or keep them open, depending on which you are reporting) are not highly correlated with adverse conditions, and even when a comprehensive approach is used to achieve some reliable level of predictive modeling of beach water quality, the response time from when samples are taken to when results are received is not reflective of the time period of concern - i.e. a storm event occurs on Monday so a sample is sent to the lab, we get results back on Wednesday afternoon and decide to close the beach, while at the same time taking a follow-up sample, which we receive result for on Friday at which time we decide to reopen the beach. The problem? The incident occurred on Monday, was likely resolved by the end of the day Monday, or early Tuesday morning, but the beach was actually closed from Wednesday afternoon to Friday afternoon.... Not indicative of the actual adverse water quality event.</p>
None
<p>The indicator does not directly measure the health risk. Therefore we are overstating the risk. At this point, it's still our best option available, but we need to develop an indicator that can be widely used that actually assesses health risk, not just E coli or fecal coliform presence, which only tells us that there's a potential risk that disease-causing organisms are present.</p>
if these advisories are based on the measurements
<p>Given that recreational water quality objectives can vary between jurisdiction, this information does not reflect the overall picture of water quality in the Great Lakes. A safe an open beach in one jurisdiction may have unacceptable water quality in another and would warrant an advisory. Nor does it provide a way to determine if water quality is improving or deteriorating over the years.</p>
It's only a snap shot in time and not showing real time data.
None
<p>These indicators provide good information on the relative condition of beaches with some indication of year over year successes or long term trends. They should not be used to compare US vs CA given the difference in standard used to determine beach postings.</p>
<p>Percentage of days "open" may not be a viable indicator metric for waterfront recreation areas where water temperature restricts the total number of beach opening days. In addition to beach advisories (based on exceedance of the Health Canada recreational water guideline of 100 CFU of E. coli per 100ml) other criteria may be valuable indicators of beach water quality and should be considered. Additionally, many jurisdictions use a risk assessment approach to beach advisories, rather than a hard threshold value of E.coli presence. As such, some jurisdictions may have less frequent advisories than others.</p>
<p>As my last comment - I still believe that the amount of consistent & relative data only exists in a few jurisdictions. The reason beaches are closed or posted reflects entirely on a "snap shot sample" that was taken 24 hours earlier.</p>
<p>I said no for all of these indicators because the way that beaches are monitored differs from beach to beach and the way that decisions are made about when to post advisories or close beaches is different from jurisdiction to jurisdiction. We need standardized monitoring protocols and decision make in order to track beach advisories/closures over time. I think it is more compelling to track advisories and closures than it is to track open beach days.</p>

<p>The current FIB system used does not correlate to pathogens eg viruses and toxic algae risks. They do not provide source tracking information. About one hundred years ago, concerns about polluted water triggered the International Joint Commission study of transboundary contamination across the Great Lakes, one of the largest-ever studies of its kind. Today, the Great Lakes basin still faces numerous contamination issues. Many sites along its shoreline require restoration and protection (including the Areas of Concern) and major investments in restoration have been made by federal, state and local governments. Key questions that have emerged as these restoration projects are moving forward include 1) Is nearshore water quality getting better or worse?; 2) Where is the pollution coming from?; and 3) What restoration and policy actions affect nearshore water quality? To answer these questions, water quality changes over the past 100 years in key areas along the Great Lakes basin, using microbial source tracking (MST) is needed to identify the current sources of fecal contamination</p>
<p>You need to add the number of days or frequency a beach is monitored. Also.. the number of monitored beaches on a Lake. If sampling frequency and number of beaches are declining as decrease in beach advisories is misleading indicator for how swimmable are the Great lakes.</p>
<p>I have answered yes above with reluctance - relative to No and relative to No opinion options. We are in a mature regulatory environment (fashioned over a period of 3 - 5 decades); we use what we know. A more ideal indicator would be the 3 indicators above, but based on a true pathogen measurement, with a 0.1 - 1 hour turnaround time for the measurement, and a risk estimate to full exposure (whole body immersion) to human health. We're a substantial way from that ideal.</p>
<p>Local factors such as a high bird populations or frequent rain can negatively influence the number of beach postings but are not a reflection of the health of the ecosystem.</p>
<p>In Ontario the data is misleading as many beaches are only monitored by public health on a weekly basis. If monitoring results, result in a beach posting, that posting may stay in place for a week before another monitoring sample is collected and the beach is reopened upon acceptable results. If monitoring samples are collected more frequently (ie, daily) it may find that instead of being posted for 7 days that beach may have only really needed to be posted 3 days.</p>
<p>Number and percentage should be carefully reviewed in context. A better approach may be to list the beaches that report exceedances and review the data over monitoring season. If data show spikes, then stormwater is more likely. If data show consistently high levels, then chronic discharges are more likely. Better progress seems to happen when specific information is gathered and targeted.</p>
<p>The technology for managing beaches relies on 1-2 day old data so the monitoring regime is skewed. The # of beach advisories, closures, and open/ "safe" swimming days are inaccurate 70% of the time using the persistence model.</p>
<p>Beach advisories and beach closures are state-derived indicators; discrepancies between states are directly related to individual state regulations. While all three of these are influenced by that information, 'open and safe' implies a comprehensive assessment (whether that is the intention of the question or not).</p>

Question 3.2: Are there other indicators or data that should be considered to better evaluate and report on the state of this Objective over time? If so, please list (indicating if data is available and where it might be found).

Responses
Recent research being done out of Niagara has shed some light onto just how difficult predictive modeling can be. In a nutshell, each beach is different and has different environmental inputs that dictate adverse events. The bottom line is that water sampling for fecal coliforms is perhaps the best we have currently, but we have to consider the time delay that collecting this information represents. If there was a way to use the actual sample results as opposed to the delayed, less representative # of days the beach was closed, this may provide a more high-fidelity answer to water quality concerns over the long run.
None
We need ongoing research to develop a new indicator. To my knowledge, one does not exist today that could be widely, affordably used.
correlation with rainfall
To obtain a clearer picture of the state of water quality, pollution parameters (i.e. E.coli) should be identified and quantified throughout the season. This would also permit a historical review of water quality and help determine if measures implemented to improve water quality are effective.
General health of the animal and flora of the lake.
Levels of phosphate/nutrient/dissolved oxygen may be a viable indicators related specific recreational water concerns such as Blue Green Algae events.
See my previous comments about the need for beach modelling
I think reporting on beach advisories and closures are the right indicators, but that more work needs to be done in how beaches are monitored and how decisions about beach advisories/closures are made at beaches throughout the region.
new microbial source tracking (MST) tools should be used to assess impacts of sewage and other sources of fecal contamination throughout the Great Lakes at appropriate spatial scales.
Frequency of Beach monitoring. Number of beaches per Lake
please see previous comment
The standard in Ontario of only sampling beaches once per week is inadequate as this sampling frequency does not provide enough information to characterize the water quality of the beach. To effectively characterize beach water quality and to be able to effectively report to the public on the safety of a beach for swimming, monitoring samples should be carried out on a daily bases for any beach that experiences fluctuations in E. coli results.
A better approach may be to list the beaches that report exceedances and review the data over monitoring season. If data show spikes, then stormwater is more likely. if data show consistently high levels, then chronic discharges are more likely. Better progress seems to happen when specific information is gathered and targeted. A sanitary survey could identify which beaches are more vulnerable to pollution and which ones are not. Target the beaches that are more vulnerable and identify the sources of pollution. Then address the sources of pollution. The remedies or corrective actions may be simple and easily implemented.

Look at BUIs and predictive modeling data as well as beach remediation and CSO/ SSO improvements communities have made.

Change in number of advisories. Management actions to address compromised water quality.

General Objective (vii)

Question 1.1: Is there any explanation or justification you would like to provide for your answer?

Responses
the three main pathways (canals and waterways, ballast, and the trade of live organisms are being addressed, but laws and regulations are still not sufficient to ensure that new AIS do not enter the system via those pathways. The Chicago canal, for instance, needs blocking. Ballast water standards are weak, do not chase technology, and exempt the domestic shippers. There is NO screening process in place prior to an importation to assess the risk of a species, so our borders are wide open. On the other hand, lots of activity and awareness, hence "some achievement." Still a long way to go.
I don't believe this annex committee has done anything beyond trying to check boxes.
We have stopped for the most part the introduction of new ones, but still have a ways to go with dealing with established ones, particularly dreissinids.
AIS continue to spread across the great Lakes , however number of new introductions have been reduced.
There is little evidence that the Great Lakes are free from introduction of AIS. There is evidence that the invasion rate has slowed, and there are seemingly effective programs related to ballast water exchange and with electric barriers in the Chicago Sanitary and Ship Canal. Nevertheless, preventing introduction is an unmeasurable (one cannot measure the absence of something with full certainty), and perhaps and unachievable goal. Is the real measure of success that rates of introduction decrease to minimal levels? Once an invader is in the system, there is practically nothing that can be done to reduce spread.
"Free from the introduction and spread" is a binary statement, so if you take it at face value the answer can only be zero. You could also ask "is the current suite of activities sufficient to get to being free from the introduction and spread etc." and the answer would be maybe 1 or 2.
Credit to DFO research which identified brine flushing as a means of curtailing introduction by ballast water. Mutual Aid Agreement (MAA) among GL states and Ont. is a major step forward. Federal govts. (US and Canada) need to better leverage Annex 6 to clarify federal role/contribution to complement the MAA. Canada needs to get on with regulations in support of inevitable adaptation of IMO standard, and US federal govt. needs to resolve any outstanding issues re Coast Guard and EPA regulatory role.
Great strides have been made in ballast water and state/providence legislative efforts, but the introduction through interbasin transfer locations (CAWS) through the global trade of aquatic organisms, movement within the great lakes of AIS through shipping (Laker) ballast, and many other pathways limit the response to say that the GL are free from introduction and spread.
Introduction from overseas ballast water largely addressed. Interbasin ballast water and other major pathways (e.g. aquarium trade; water gardens) are not well addressed. Existing invasive species continue to spread and populations of some species increase, however full basin control of spread may not be possible for established species.
This question should be directed to subject matter experts in this area, which I am not. This is difficult for me to comment on given this isn't my area of expertise; nor has the new State of the Great Lakes report been published which will include indicators lined up to this

<p>particular General Objective (this info will be available during the Great Lakes Public Forum in 2016). The GLWQA General Objectives are also goals to work towards... they do not indicate a set numerical level to achieve for the issue; so not sure how the question can be answered (what are the chances we will ever be 100% completely free of all AIS?).</p>
<p>Ballast water is well regulated to prevent new introductions, but other vectors are mostly unregulated. There is little achievement towards reducing spread.</p>
<p>Complete eradication or prevention ("should be free") is a very high bar and some would argue unattainable. Recognizing that high standard, progress to date has been partial.</p>
<p>For one important invasive species - the sea lamprey - we have achieved a lot with respect to limiting their adverse impacts. We have constructed barriers to movement of invasive species from the Mississippi R system into the Great Lakes - although these barriers are not risk-free. We have substantially raised awareness about the issue, and made some progress on policy (e.g., ballast water exchange) to lower invasion risks. But we still have a lot of invasive species that continue to adversely affect our waters.</p>
<p>Programs that address sea lamprey have been largely successful. On the other hand, we may have lost the battle against invasive mussels. In addition, at times invasive species programs have not been coordinated well, i.e. across jurisdictions/ecosystems or across multiple species. We have only begun to investigate the systematic drivers that impact invasive species populations, or the way invasive species populations interact with systematic drivers to affect the ecosystem.</p>
<p>Significant federal, state, and provincial efforts toward prevention of aquatic invasive species meet the intent of the agreement's commitments and support the objectives. While the focus has been largely on Asian carps, the efforts have broad impact. Of special note is the continuing evidence of success of current Ballast water exchange regulations. New regulations and legislation in Canada (federal and provincial) and in the United States contribute to success. There is more to do but this annex is one with significant progress.</p>
<p>rate of new introductions have slowed, though no established species have been eradicated from the basin.</p>
<p>rates of introduction appear to be down</p>
<p>Many harmful introductions already happened - some indication that the rate of new introductions is slowing ; though I am not entirely clear about this data/ whether there is reliable and adequate monitoring underway. My impression is there remains work to be done regarding ballast discharges, and also on bait markets/BMP's, the aquarium trade (esp for aquatic plants) and the fresh fish trade.</p>
<p>With few exceptions, the federal Great Lakes navigation system (i.e., ballast water, barges and barge canals, direct hydraulic connection) is largely responsible for for AIS introduction and dispersal. Political will is lacking to embrace the suite of potential solutions and move to a technology-forcing regulatory framework (chemical and non-chemical solutions) to better achieve the goal within a more reasonable time frame. Thus, Great Lakes controls have experienced only incremental gains to the status quo due by selecting "winners" and "losers" with respect to ballast water technologies. In other words, a select handful of influential beltway bandits have intentionally focused on "non-chemical" solutions due to a political agenda versus what's best for the lakes in the both the short and long term.</p>
<p>Great Lakes will never be "free" from introduction and spread. I assume that this means "new introductions" into the basin. Only recent achievements likely related to mid-ocean ballast water exchange requirement for trans-oceanic freighters and CAWS electrical barrier -</p>

these may have reduced "new" introductions. Virtually nothing has been done to stop spread within GL
There is some achievement at beginning to close down some of the invasion pathways. Ballast water exchange requirements are a large step forward. Ballast water treatment implementation will be huge, but continued delay is a problem. States are beginning to work on an early detection system, and have a mutual aid agreement to help with new invasions when found. States are increasing their numbers of prohibited species, and some are starting to include risk assessment in their decision making. We still have a long way to go, but there are encouraging signs that there are solutions, and groups are working to implement them.
We have already allowed invasions that have had significant impacts, and these are here to stay.
there is a free-wheeling market for exotics in the trade sector.....e.g., no regulation of bait for fish... what constitutes 'invasive' is impossible to determine temporally
Annex 6 is part of an on-going effort. While no new introductions of AIS have been discovered in the Great Lakes since 2006 (e.g., bloody red shrimp), spread of new and existing AIS continues inland throughout the basin varying in rate depending upon the species and jurisdiction. Efforts, resources and regulations vary by jurisdiction and prevention efforts are only as strong as the weakest link.
Besides success in the decades-long effort to control sea lamprey and more recent success in ballast water regulations and enforcement, all pathways for the introduction of new AIS are wide open to the Great Lakes. Unlike terrestrial invasive species, AIS move around from lake to lake (ruffe is the only exception thus far). So, once introduced, controlling geographic spread is nearly impossible for most AIS. Rapid response is a worthwhile effort, but regulations shutting off pathways of AIS introductions in the U.S. and Canada are generally inadequate or non-existent.
The GLs have been devastated by AIS, and AIS continue to proliferate. Fisheries, and the fishing industry has suffered greatly, with no end in sight. Despite the obvious and abundant historical data regarding the devastation of AIS, the "barn door" for AIS invasions, shockingly, remains open. While some measures have been taken to reduce risk of invasion with some vectors, those measures are not commensurate with the extraordinarily high damage that AIS can inflict. Ballast water discharges from foreign shippers are still ongoing. Canals and waterways are still an open vector. And the list goes on. Given the high economic costs to governments, industry, and society in general, it is truly remarkable that the U.S. and Canadian governments continue to fail to properly address AIS.
Many, but among others, the difficulties to align efforts among neighbouring jurisdictions, the lack of permanent financial and human resources necessary to fight effectively against AIS, the lack of knowledge on AIS and the invasion and establishment requirements, and political interference within and among jurisdiction.
We are making progress, but we have a long way to go if our ultimate objective is freedom from "introduction and spread." I'm not sure the region will ever fully realize this objective. There will continue to be changes in human activity, trade, climate, etc. that create new AIS threats that we will need to continually track and adapt our management approaches in order to effectively address AIS threats in the future.

Question 2.1: Please identify any other programs and measures that contribute to the accomplishment of General Objective (vii) and use the scale above to indicate the contribution of that program or measure.

Responses
Risk assessment are proving effective at identifying "hot spots" to help focus monitoring resources.
Programs to manage high priority existing invasive species to minimize impacts and further spread - medium-high contribution
State-state and federal-state coordination has been critical on a range of these issues.
The sea lamprey control program seems to have reduced the spread and growth of the population in the Great Lakes.
Binational Ballast water monitoring Early detection surveys including eDNA surveys Science to improve early detection and new techniques Continuing success of the Great Lakes Fishery Commission's Sea Lamprey control program.
ballast water regulations (high contribution)
I marked my view of the potential for these programs. None of them are operating at an adequate level yet.
Annex 6 provides an opportunity for coordination. So far, it hasn't played a strong role because it has not been fully implemented. The Great Lakes Panel on ANS Information and Education Committee's AIS "Index of AIS Communication and Education Campaigns and Program" provides an excellent snapshot of the resources available and on-going throughout the basin. However, community education programs need to be strengthened and broadened to get a step up on prevention.
There is a lot of work going on related to development of new monitoring techniques as well as management and control technologies (which I think is different than the pre-approval process; pre-approval can only happen once the technology is fully developed).

Question 2.2: Do you have any comments on the programs that are particularly effective or gaps in program coverage?

Responses
The ACRC (Asian Carp Regional Coordinating Committee) has been moderately effective in demonstrating how many agencies can work together. Also, the Governors' "Mutual Aid Agreement" for assessment and rapid response demonstrates a willingness on the part of the states and provinces to work together.
I think all of the programs listed above have promise, but few have much practical implementation, or implementation is just beginning, so there is little evidence to evaluate effectiveness.
Border inspections made a significant difference identifying and controlling Asian carps introduction. Monitoring by MNR and DFO in Canada, and monitoring and response by Illinois in the US have been successful, again with Asian carps. Recreational boat hull cleaning has also been effective.
regulations that prohibit the sale, distribution of high risk, or known invasive species from being shipped or sold are very cost effective in preventing the introduction before the need for expensive management and education/research costs are needed. With the largest

gaps being the fact that regulations and the species covered vary from state to state and have no continuity.
Any measure to disrupt pathways of arrival and prevent new introductions are by far the most effective method of dealing with invasive species.
USACOE's analyses of pathways and points of weakness have been excellent. However, they are not necessarily matched by the impetus to act (e.g., around CAWS) which obviously is a much larger political decision.
I am not sufficiently familiar with the programs to provide additional comments.
The sea lamprey control program is highly effective.
most of those listed above could be significantly more effective, but have not been fully realized/implemented yet.
USEPA regulations for ballast water and US Coast Guard treatment technology vetting have been particularly effective. Canada has done very little or actually "blocking" for any ballast water regulations.
Ontario, as yet, has no rapid response protocol nor actual resources to do so - in my experience - to deal with early introductions. This is a missing link
Research and development is being focused on "non-chemical" solutions at the expense of otherwise plausible alternatives. For example, while the Great Ships Initiative is a successful working platform for ballast to test research and potential solutions, its preoccupation with non-chemical solutions has delayed otherwise meaningful progress that could have been attained since the passage of the 1990 Nonindigenous Aquatic Nuisance Species Prevention and Control Act.
Gaps - Most of these have not been implemented in a meaningful manner (e.g. legislation, regulation). Effective - CAWS electrical barrier; BWE
The public awareness campaigns are the most advanced.
Funding through GLRI has provided enormous impacts. First regional AIS public outreach campaign by the Great Lakes Sea Grant Network, led by Minnesota, has generated over 21.2 M impressions targeting 18 pathways for introduction and spread of AIS. Results show significant increases in awareness and behaviours. While successful, there remain gaps based on emphasis on AIS by jurisdictions related to policy, regulations (e.g., consistency), enforcement, authority, risk assessment, and outreach (e.g., lack of message consistency, lack of using best methods and media based on market research; some jurisdictions developing own campaigns rather than using existing successful ones).
While rapid response is a worthy activity, too often it diminishes or distracts from what should be the primary focus, i.e. "prevention". Most of the AIS in the GLs today would have escaped rapid response activities. The greatest gap is the failure to enact legislation that would ensure prevention of invasion.

Question 3.1: Are there any comments you would like to provide related to the indicators in the question above?

Responses
I generally don't like numeric indicators (like tributary miles), as they really don't indicate much.
Numbers of activities or technologies do not necessarily relate to the condition of the objective. Just because activity is ongoing does not make it effective.
Program outputs are not meaningful as success indicators. Presence/absence of populations in various stages is what counts. Comprehensive monitoring is essential to know what that status is.
Sorry, I don't understand what this section is asking.
None of the indicators, on their own will measure whether the objective is being achieved, but the relevant indicators need to be viewed together.
Monitoring should be prioritized for high risk species within pathways, rather than monitoring for new introductions in the environment.
The indicator needs to be a bottom line, like numbers of new introductions and size of existing populations.
I am not sure I understand this question completely. I interpret it as asking whether the indicators themselves are accurately measured, not whether the indicators accurately reflect achievement of the GO. I indicated "no opinion" as to two due to lack of knowledge. I indicated "no" for monitoring activities because some monitoring data collected for purposes other than invasive species control could be used in invasive species programs but monitoring activities are not sufficiently coordinated to use the data for both purposes.
all of the above are necessary, but remain insufficient as they fail to get to actual impact of species and may contain counter-intuitive feedbacks (e.g., number of new introductions may be biased by a lag time between introduction and discovery ... an increased number of monitoring activities reduces the time lag and so may artificially and temporarily increase the 'number of new introductions').
Like any prevention program, measuring how well we're doing requires thoughtful consideration and is a difficult task. The "number of technologies tested" is really no measurement at all if a technology is not implemented, which industry lobbyists have been extremely effective at undermining. At the end of the day, the primary goal is to stop future introductions. While zero tolerance is a lofty goal, the narrative is really about risk reduction, at what cost, and who pays.
I tended to lean towards no or no opinion because I currently don't know how well these programs are being resourced. Where are the gaps in implementation? What is the current state of programming. I may not be as knowledgeable as others on this subject. Acknowledge that these would be related to new introductions and size of populations. Number of monitoring programs doesn't provide an indication of effectiveness of the monitoring program unless you relate to other indicators. It's a challenge to evaluate the programs/tools in isolation. I'm not current on this objective compared to other experts. And I acknowledge this could have an impact on some of my responses.
Size/acres currently apply only to Sea lamprey and may be misleading about overall efforts (minimal) to control other AIS. Number of monitoring activities/RR/control technologies are meaningless as number may not be correlated to effectiveness.

Generally "counting" how often an activity occurs has very little to do with effectiveness. The activity needs to be designed to prevent new invasions, rapidly find and eliminate new incursions, or mitigate the impacts of established species. Effective programs will accomplish these, and the indicators must reflect successful design and implementation. For example, you could do a lot of monitoring, but if you are not using the right tools, in the right places, looking for the right species, you can't have an effective program.

indicators need to be more specific relative to type of invasive population, and need to be more focused on impacts rather than quantifying amount of invasions.

I'm not certain that I understand the question

'Yes' answers above represent only partial conditions for any one objective of the GLWQA. If the question is specifically about the background, then answers would be no. Use of the word "condition" seems a bit confusing because the plan does not target a specific "desired state."

The decades-long sea lamprey control program is the only real success story at the cost of multi-millions of dollars. It is not feasible to launch that kind of effort on the other 187 known AIS in the Great Lakes. That is why more effort is necessary on preventing further introductions of AIS from all pathways to the Great Lakes. This is an important arena for social science/policy research. Prevention does not attract public and policy attention and financial resources because of the perceived lack of a crisis. Once a new AIS is detected, even if treated as a crisis in the media, it is often too late to do much to control numbers and geographic spread. How do we meaningfully shift policy, science and regulation emphasis from "react after the fact" to "prevention?"

A number of rapid response exercises and control projects can be undertaken, but the effectiveness of any of these is questionable because there is no specific measurable. The measurable is the response action, not how effective the action was at eradication.

Counting the number of activities (monitoring, responses, control projects, etc.) is useful and good information that we should track; however, I don't think that really gets at the objective we are trying to achieve. What we really want to achieve is no new introductions of AIS and stopping the spread of existing AIS. But, we need to put those indicators in context. The only way to really know if we are achieving those things is through comprehensive and proactive monitoring and surveillance. Before we start counting new introductions or species/acres controlled, we need to understand the existing populations sizes/distributions. We also need to understand the effectiveness of our monitoring efforts - how good are we at detecting species?? Until we know that, we can't actually know if there are no new introductions. I also think it is useful to track how we are doing at addressing the various pathways of introduction and spread.

Question 3.2: Are there other indicators or data that should be considered to better evaluate and report on the state of this Objective over time?

If so, please list (indicating if data is available and where it might be found).

Responses
rapid response indicator needs to be re-written. Should be number of responses that resulted in successful eradication or containment of an invasive species. Rapid responses are generally only effective in very specific (and limited) circumstances. The number of responses attempted would be irrelevant if the majority are unsuccessful.
As above, the number of high risk species still in transport pathways.
Associating funding provided with results (e.g., funding for sea lamprey control, funding for Asian carp work).
Emerging data on species IMPACT (e.g., http://www.glerl.noaa.gov/ftp/publications/tech_reports/glerl-161/tm-161.pdf) needs to be incorporated.
How much money is appropriated annually at the federal levels to stop AIS introductions and controls?
% of GL jurisdictions with regulations/legislation that would restricted introduction and spread of AIS. Enforcement effort for those regulations/legislation.
Following the monitoring example - has a comprehensive regional monitoring program been designed? is it being properly implemented? Numerical factors can be tied to the plan.
see above.
No social science indicators are included such as: science literacy, awareness, knowledge, understanding, skills, behaviours, pathways addressed, or impressions generated.
number of anthropic vectors present in the studied area
Distribution, frequency and species focus of monitoring and surveillance activities Effectiveness of monitoring techniques (e.g., rate of species detection)

Appendix V: Detailed Data Summaries

Breakdown of Responses by Program and Measure for General Objective (ii)

Question 2a: source water protection programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Contribution	2	5.4	6.7	6.7
	Low Contribution	6	16.2	20.0	26.7
	Low-Medium	4	10.8	13.3	40.0
	Medium	8	21.6	26.7	66.7
	Medium-high	5	13.5	16.7	83.3
	High	4	10.8	13.3	96.7
	Complete	1	2.7	3.3	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2b: waste water treatment programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Contribution	1	2.7	3.3	3.3
	Low-Medium	4	10.8	13.3	16.7
	Medium	7	18.9	23.3	40.0
	Medium-high	6	16.2	20.0	60.0
	High	11	29.7	36.7	96.7
	Complete	1	2.7	3.3	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2c: nutrient management programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Contribution	1	2.7	3.3	3.3
	Low Contribution	2	5.4	6.7	10.0
	Low-Medium	4	10.8	13.3	23.3
	Medium	8	21.6	26.7	50.0
	Medium-high	5	13.5	16.7	66.7
	High	10	27.0	33.3	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2d: performance based watershed plans/programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	3	8.1	10.0	10.0
	Low-Medium	5	13.5	16.7	26.7
	Medium	7	18.9	23.3	50.0
	Medium-high	9	24.3	30.0	80.0
	High	6	16.2	20.0	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2e: local water quality monitoring programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	1	2.7	3.3	3.3
	Low-Medium	4	10.8	13.3	16.7
	Medium	12	32.4	40.0	56.7
	Medium-high	7	18.9	23.3	80.0
	High	6	16.2	20.0	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2f: public health monitoring programs

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Low-Medium	4	10.8	13.3	13.3
	Medium	10	27.0	33.3	46.7
	Medium-high	6	16.2	20.0	66.7
	High	9	24.3	30.0	96.7
	Complete	1	2.7	3.3	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2g: NGO/community monitoring and reporting programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	7	18.9	23.3	23.3
	Low-Medium	7	18.9	23.3	46.7
	Medium	12	32.4	40.0	86.7
	Medium-high	3	8.1	10.0	96.7
	High	1	2.7	3.3	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Question 2h: NGO certification/flag designation programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	6	16.2	20.0	20.0
	Low-Medium	7	18.9	23.3	43.3
	Medium	8	21.6	26.7	70.0
	Medium-high	7	18.9	23.3	93.3
	High	2	5.4	6.7	100.0
	Total	30	81.1	100.0	
Missing		7	18.9		
Total		37	100.0		

Breakdown of Responses to Q2 by Program and Measure for General Objective (vii)

Question 2a Programs/regulations blocking dispersal pathways

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Low Contribution	2	4.7	5.1	5.1
Low-Medium	9	20.9	23.1	28.2
Medium	6	14.0	15.4	43.6
Medium-high	6	14.0	15.4	59.0
High	11	25.6	28.2	87.2
Complete	5	11.6	12.8	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

Question 2b: Risk Assessment Programs for new introductions

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Low Contribution	6	14.0	15.4	15.4
Low-Medium	5	11.6	12.8	28.2
Medium	11	25.6	28.2	56.4
Medium-high	7	16.3	17.9	74.4
High	8	18.6	20.5	94.9
Complete	2	4.7	5.1	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

Question 2c: Programs/regulations for aquaculture, aquarium and bait industries

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Low Contribution	8	18.6	20.5	20.5
Low-Medium	8	18.6	20.5	41.0
Medium	6	14.0	15.4	56.4
Medium-high	8	18.6	20.5	76.9
High	7	16.3	17.9	94.9
Complete	2	4.7	5.1	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

Question 2d: Programs/regulations for recreational activities

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Low Contribution	6	14.0	15.4	15.4
Low-Medium	9	20.9	23.1	38.5
Medium	10	23.3	25.6	64.1
Medium-high	10	23.3	25.6	89.7
High	3	7.0	7.7	97.4
Complete	1	2.3	2.6	100.0
Total	39	90.7	100.0	
Missing	4	9.3		

Total	43	100.0		
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Question 2e: Community Education/awareness programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	5	11.6	12.8	12.8
	Low-Medium	4	9.3	10.3	23.1
	Medium	16	37.2	41.0	64.1
	Medium-high	7	16.3	17.9	82.1
	High	6	14.0	15.4	97.4
	Complete	1	2.3	2.6	100.0
	Total	39	90.7	100.0	
Missing		4	9.3		
Total		43	100.0		

Question 2f: Border control/inspection programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	4	9.3	10.3	10.3
	Low-Medium	4	9.3	10.3	20.5
	Medium	10	23.3	25.6	46.2
	Medium-high	11	25.6	28.2	74.4
	High	7	16.3	17.9	92.3
	Complete	3	7.0	7.7	100.0
	Total	39	90.7	100.0	

Missing	4	9.3		
Total	43	100.0		

Question 2g: Monitoring/surveillance programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	2	4.7	5.1	5.1
	Low-Medium	7	16.3	17.9	23.1
	Medium	13	30.2	33.3	56.4
	Medium-high	7	16.3	17.9	74.4
	High	7	16.3	17.9	92.3
	Complete	3	7.0	7.7	100.0
	Total	39	90.7	100.0	
Missing		4	9.3		
Total		43	100.0		

Question 2h: Information sharing protocols

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	3	7.0	7.7	7.7
	Low-Medium	10	23.3	25.6	33.3
	Medium	11	25.6	28.2	61.5
	Medium-high	10	23.3	25.6	87.2
	High	4	9.3	10.3	97.4
	Complete	1	2.3	2.6	100.0
	Total	39	90.7	100.0	

Missing	4	9.3		
Total	43	100.0		

Question 2i: Rapid Response Protocols

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Contribution	6	14.0	15.4	15.4
	Low-Medium	6	14.0	15.4	30.8
	Medium	11	25.6	28.2	59.0
	Medium-high	6	14.0	15.4	74.4
	High	8	18.6	20.5	94.9
	Complete	2	4.7	5.1	100.0
	Total	39	90.7	100.0	
Missing		4	9.3		
Total		43	100.0		

Question 2j: Programs for pre-approving/eradication/containment technologies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Contribution	2	4.7	5.1	5.1
	Low Contribution	11	25.6	28.2	33.3
	Low-Medium	8	18.6	20.5	53.8
	Medium	5	11.6	12.8	66.7
	Medium-high	8	18.6	20.5	87.2
	High	4	9.3	10.3	97.4

Complete	1	2.3	2.6	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

3a: Programs/regulations blocking dispersal pathways

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	25	58.1	64.1	64.1
No	8	18.6	20.5	84.6
No Opinion	6	14.0	15.4	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

3b: Number of new introductions

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	30	69.8	76.9	76.9
No	5	11.6	12.8	89.7
No Opinion	4	9.3	10.3	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

3c Size of existing AIS populations

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	26	60.5	66.7	66.7
No	7	16.3	17.9	84.6

No Opinion	6	14.0	15.4	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

3d: Acres (or tributary miles) controlled for invasive species

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	17	39.5	43.6	43.6
No	14	32.6	35.9	79.5
No Opinion	8	18.6	20.5	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

3e Number of monitoring activities conducted

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	16	37.2	41.0	41.0
No	14	32.6	35.9	76.9
No Opinion	9	20.9	23.1	100.0
Total	39	90.7	100.0	
Missing	4	9.3		
Total	43	100.0		

3f Number of rapid responses or exercises conducted

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	15	34.9	38.5	38.5

	No	15	34.9	38.5	76.9
	No Opinion	9	20.9	23.1	100.0
	Total	39	90.7	100.0	
Missing		4	9.3		
Total		43	100.0		

3g Number of control projects undertaken

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	17	39.5	43.6	43.6
	No	15	34.9	38.5	82.1
	No Opinion	7	16.3	17.9	100.0
	Total	39	90.7	100.0	
Missing		4	9.3		
Total		43	100.0		

3h Number of control technologies and methods field-tested

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	18	41.9	46.2	46.2
	No	13	30.2	33.3	79.5
	No Opinion	8	18.6	20.5	100.0
	Total	39	90.7	100.0	
Missing		4	9.3		

Total	43	100.0		
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