Great Lakes Panel on Aquatic Nuisance Species
Priorities for Aquatic Invasive Species Prevention and Control
November 10, 2020

1. Prevention
   a. Support further development and updates to the GLP/NOAA-GLANSIS risk assessment clearinghouse by promoting its use among managers and contributing risk assessment reports for both AIS pathway and species
   b. Conduct an assessment of bait fish VHS screening and transfer policies in the states and provinces, with consideration of efforts to harmonize screening approaches and regulations governing transfer.
   c. Assess the risk of Asian carp introduction and establishment in the Great Lakes that may be posed by other vectors, such as organisms in trade (e.g., wild-caught live bait and live food fish)
   d. Examine the motivations of stakeholders relating to AIS movement and release in order to better focus outreach, regulatory, and legislative efforts.
   e. Establish a communication network between stakeholders to facilitate effective information exchange in AIS-related areas such as research; prevention and control technology; resource management needs; detection and sightings of AIS; policy and legislative developments, and information and education.
   f. Develop communication and educational tools (including fact sheets, websites, locally-based forums, education/training programs, etc.) to disseminate prevention messages and best management practices to stakeholders concerning AIS introduction and spread. Information should be framed around the benefits of AIS prevention in an attempt to encourage the widespread practice of these measures on a long-term basis.
   g. Disseminate fact sheets, identification cards and other educational materials to inform established citizen groups and build community-based capacity (e.g. lake associations, volunteer water quality monitoring groups, conservation and other water use groups) to advance prevention, early detection, monitoring and rapid response.
   h. Publicize and distribute on a jurisdictional basis AIS legislation and regulations, listings of prohibited and regulated species, and lists of infested waters in recreational safety and regulation publications, as well as through a variety of outreach activities and materials, targeting stakeholders.
   i. Build upon existing outreach programs at a local, state, provincial and regional levels to ensure that all pathways of AIS introduction and spread are addressed, targeting appropriate stakeholders.
   j. Implement voluntary certification training programs to address specific aspects of AIS prevention and best management practices such as watercraft inspection, use of native species for horticulture, HACCP-AIS training, the Clean Marinas Program, etc.
   k. Establish active partnerships between resource management agencies and the commercial stakeholders to raise awareness and advance regional policies, state/provincial management plans, and information dissemination.

1.1 Shipping Pathway
   a. Encourage and support development and shipboard testing of USCG-approved ballast water treatment systems that meet the operational requirements of the Great Lakes domestic fleet, using a representative sample of the various laker types and sizes.
   b. Encourage and support full-scale shipboard testing of both IMO and USCG type-approved ballast water management systems over the range of environmental conditions typically encountered in the Great Lakes especially very low salinity (<<1 ppt), very low temperature (<5°C), algal blooms, and high turbidity (suspended solids), to assure efficacy on ships operating within the Great Lakes ecosystem.

c. Support the development of rapid screening methods, such as genomics, eDNA, and other physical/chemical methodology to 1) enable accurate compliance monitoring with regulatory ballast water discharge standards, and 2) quickly detect and identify live organisms and species diversity in environmental water samples, especially ballast water.

d. Establish harbor monitoring program within the Great Lakes and seaway systems using various organism and species collection and identification methods, including eDNA, to inform risk and provide a basis for possible use of BMPs or specific treatments.

e. Support ballast water and aquatic invasive species policy coordination between the United States, Canada, and the St. Lawrence Seaway.

f. Support various mechanisms including the Great Lakes Ballast Water Collaborative that encourage communication, coordination and alignment on ballast water technology, science, and policy among U.S. and Canadian federal and state/provincial regulators, the shipping industry, and the scientific and engineering communities.

g. Compile and disseminate updated scientific and technology information concerning AIS introduction and spread that is relevant to the needs of the maritime commerce industry.

h. Compile information about, and viability of, potential on-shore treatment of ballast in the Great Lakes region.

i. Advance work on risk reduction based on best management practices or interim treatments and other measures that could be considered outside of USCG-approved ballast water management systems

1.2 Organisms in Trade Pathway

a. Quantify the pathway invasion risk of sub-pathways of trades in live organisms, including less well-understood pathways such as: fish and bait haulers; biological supplies; live fish; Internet trade

b. Conduct risk assessments for fishes, plants, mollusks, amphibians, reptiles and crustaceans known to be in trade to identify a list of high and low risk species and recommend those high risk species to the Great Lakes St. Lawrence Governors and Premiers for consideration for the "Least Wanted AIS" list. Risk assessment efforts and programs include:
   • Supporting research to advance the understanding of aquatic invasion biology, particularly characteristics of successful/unsuccessful invasions and invaders.
   • Quantifying the life history characteristics that lead to successful invasions (e.g., propagule pressure and trophic disruption).
   • Researching species attributes to complement the development of risk assessment tools.
   • Developing future models that account for changes associated with climate change and variability.
   • Continuing to review the state of risk assessment globally to identify the most accurate and cost-effective methods.

c. Work with industry partners to develop lists of what species are moved through the various sub-pathways of trade in live organisms, and quantify the trade volume, economic values, and the costs and benefits of those species

d. Develop consistent regulated species lists based on the documented risk of those species

e. Develop management practices to address the mechanisms of AIS introduction and spread associated with known OIT pathways

f. Continue to support and promote the use of the on-call ID experts database developed by NOAA-GLANSIS across various taxa, including to industry for their reference

g. Increase communication/awareness about low risk species available in trade, including tropical species, building on work conducted by Illinois-Indiana Sea Grant through the Great Lakes Restoration Initiative

h. Develop targeted outreach strategy and materials for both aquaculture consumers and suppliers

- Leverage marketing efforts of retailers with a vested interest in conservation activities for outreach efforts to their customer base (e.g. information in catalogues)
i. Continue to support regional forums to bring experts and industry together to work on issues related to OIT
j. Engage and partner with industry to develop new prevention initiatives, including
    - Engaging industry to secure their buy-in to prevent injurious species from moving through trade
    - Engage directly with commercial suppliers to understand what type of alternative species or solutions work for them in order to maintain economic feasibility but promote responsible sales of species
    - Developing a pet shop "certification" program or models to ensure that only low risk or native species that are sold, targeted specifically to shop owners
    - Develop voluntary best management practices with industry for industry, including accurate labeling of species and ensuring shipments are free of hitchhikers
k. Research the behavior of the end user and the motivation behind releasing organisms in trade into the wild to quantify release rates and identify areas where releases are most likely to occur.
l. Support the use of detailed procedures such as HACCP (Hazard Analysis and Critical Control Point) to develop a uniform system of prevention throughout the diverse range of facilities across the region
m. Develop model legislation as part of a framework for regional consistency on laws and regulations needed for the OIT vector and to educate prosecutors on why it is important to take AIS violation cases to court
n. Implement national AIS public awareness campaigns including Habitattitude™, Be a Hero Release Zero, RIPPLE, and the national ANS Task Force's Stop Aquatic Hitchhikers!
    - Engage industry through state/provincial agencies in the design of new educational tools and delivery of existing tools for consumers and industry members using Habitattitude™, Be a Hero Release Zero, and RIPPLE as models .
o. Develop a new AIS Organism in Trade program modeled after the AIS-HACCP to develop best management practices for risk reduction focused on sub-pathways that have not already been addressed through other programs (e.g., biological supplies, live food, aquaculture, etc.) and species of concern for the Great Lakes region.
    - Implement each jurisdiction's existing OIT outreach campaign(s) to support adoption of this risk-reduction program. Educational tools should be made available in appropriate languages to inform of the dangers and consequences of releasing live aquatic organisms into the wild.
p. Continue to support, expand, and improve the implementation of HACCP across the various OIT pathways in the Great Lakes basin through:
    - Identifying the responsible agency for compliance and what organizations are utilizing it,
    - Improving record keeping and information sharing,
    - Implementing a verification and/or certification program for participants,
    - Developing incentives for implementing HACCP procedures,
    - Identifying specific impediments to HACCP implementation and methods to overcome those barriers,
    - Hosting/supporting training workshops to ensure high quality implementation, and
    - Standardizing best management practices across the basin.

1.3 Recreational Activities Pathway
a. Identify and prioritize locations for establishing outreach events and decontamination/inspection stations.

b. Support development of consistent regulations and policies among the states and provinces, including concerning personal watercraft, bait fish, and other avenues of potential AIS transfer.
c. Quantify the relationship between propagule pressure and invasion risk for species of concern in this pathway, especially at the levels of propagule introduction anticipated through various types and lengths of recreational boating trips.
   • Incorporate use of these models into natural resource manager decision-making processes
d. Investigate the efficacy of management strategies and programs to reduce the risk of AIS contamination within key boat and trailer niche areas.
e. Using the model of community based social marketing, develop science-based public service announcements and advertisements targeted for recreation-oriented media.
f. Evaluate messaging, outreach, and educational material in this pathway to identify and share best practices for an effective community-based social marketing model of outreach.
g. Identify specific recreational user groups that are not being effectively reached through current outreach campaigns and prioritize those groups for development of targeted messaging/campaigns.
h. Create a guide for jurisdictions outlining various best management practices and activities for pathway management/prevention and the levels of investment associated with each to support efficient use of resources by jurisdictions.
i. Evaluate the risk of introduction and/or secondary spread of AIS by small vessels, including small commercial vessels not subject to federal ballast management regulations and larger recreational vessels that cannot be trailered.

1.4 Canals and Waterways Pathway
a. Engineer, design, and construct one or more AIS control point(s) to prevent the movement of Asian carp and other AIS through the Chicago Area Waterway System between the Mississippi River and Great Lakes basins
b. Develop effective lock or approach channel treatment technologies that enable vessel movement and prevent AIS transfer through lock structures.
   i. Evaluate the effectiveness and ecological and structural impacts of lock or approach channel treatment methods and technologies.
   ii. Examine health and human safety issues surrounding treatment methods.
   iii. Conduct scale testing of the effectiveness of artificial canals that would be used to treat barges and other vessels for AIS (e.g., heat, CO2, water guns, acoustics, vacuum system).
   iv. Test and evaluate the effectiveness of technologies designed to repel or deter organism from entering locks or channels (e.g. fish deterrents like acoustic barriers, heat, CO2).
   v. Develop tools for trapping/attracting fish in locks/canals.
c. Identify ways to mitigate the risk of AIS transfer when barges move through electric barriers not in single file (e.g., four barge configuration creating a "duck pond")
d. Identify and fully assess potential AIS risks associated with canal and waterway systems linking the Great Lakes and to basins other than the Mississippi River, including the costs and benefits of efforts to mitigate risks
e. Close or modify canals that have fallen into disuse or disrepair, incorporating AIS prevention measures in cases of canals subject to repair
f. Support the incorporation of AIS risk analysis in the development of fish passage improvement efforts and decision-making to prevent range expansion of AIS

2. Detection and Response
a. Consider climate change projections for priority species when implementing early detection and monitoring programs

b. Build all-inclusive communication networks between researchers, Sea Grant and extension agents, state/provincial natural resource managers, AIS monitoring personnel and policy makers to implement early detection, monitoring, and rapid response activities
c. Report all AIS sightings and new infestations, including Canada, to the United States Geological Survey Nonindigenous Aquatic Species database
d. Expand early detection and rapid response capacity for priority species, and increase coordination between regional state, provincial, federal and tribal agencies for those species

2.1 Detection
a. Review and develop standardized methods for surveillance monitoring of high risk invasive species, quantifying detection limits, documenting sources or errors, interpreting result, and determining appropriate sampling periodicity
b. Expand development of genetic markers for high risk invasive species predicted to invade the Great Lakes
c. Establish relative detection sensitivity of next generation genomic tools, particularly for high-throughput sequencing
d. Implement coordinated monitoring programs based on the identification and prioritization of high risk sites for early detection surveillance established by the Interstate Early Detection and Rapid Response Working Group
e. Spatially quantify the risk of introduction by all invasion pathways in Canada across the Great Lakes to identify priority sites for surveillance to detect new AIS introductions, and continue to update those models for both the United States and Canada
f. Establish eDNA production and degradation rates, collection methods, detection limits and error rates of molecular (genetic) methods; including research to improve the ability of these methods to detect rare, non-native species within large assemblages of abundant native species
g. Improve and apply ecological forecast methods that identify areas vulnerable to newly introduced species and predict likely dispersal pathways and potential natural barriers that might impede or slow dispersal
h. Implement the framework for early detection and monitoring established by the Interstate Early Detection and Rapid Response Working Group
i. Increase monitoring, including environmental DNA monitoring, of priority water bodies in the region

2.2 Response
a. Create an efficient communication mechanism (e.g., Memorandum of Understanding) identifying leadership that is authorized to facilitate a collaborative rapid response effort to new invasions
b. Identify policy and management barriers to effective assessment, response, and informed management decisions following the discovery of new AIS, and develop specific permitting procedures to address those barriers
c. Establish a binational memorandum of understanding among key jurisdictions (including state, provincial and federal governments in the U.S. and Canada) that facilitates the development and implementation of a coordinated rapid response protocol among the jurisdictions involved
d. Establish a memorandum of understanding between federal agencies and state/provincial agencies that facilitates the timely allocation of funding to implement a coordinated rapid response protocol among the jurisdictions involved
e. Review availability (legal, specificity, toxicity) and effectiveness of existing control tools for the range of taxonomic groups and high risk species that may invade the Great Lakes
f. Develop an integrated suite of environmentally and socially acceptable control and eradication tools for localized rapid response for those taxonomic groups (e.g., crustacean) for which no tools exist.

3. Management and Control
   a. Identify priority species for control and make specific recommendations for management needs
   b. Maintain and update the existing NOAA-GLANSIS review of the availability (legal, specificity, toxicity) and effectiveness of existing control tools for established species and conduct a gap analysis based on this review to identify needs for new control strategies
   c. Develop and implement a process to identify management needs for priority species without a management collaborative in place (e.g., through a GLP ad hoc committee)
   d. Reach out to other ANS panels to learn how they assist in the development and/or implementation of new control strategies
   e. Improve communication by compiling individual species' control information (available from NOAA-GLANSIS species profiles) into a clearinghouse of available control methodologies
   f. Develop an integrated suite of environmentally and socially acceptable control and eradication tools for priority established invasive species
   g. Develop and refine containment systems for established but localized invasive species to slow or prevent ongoing spread and anthropogenic dispersal.
   h. Review and conduct life history and basic biology studies of priority established invasive species to identify behaviors, life history traits, and/or physiologies that may make them more responsive to certain management strategies, including biological control agents. This should include studies across both native and introduced ranges
   i. Develop decision support tools that consider multiple site-specific inputs in order to quantify the efficacy of different eradication, control or containment approaches as well as combinations of those approaches

4. Other
   a. Incorporate considerations for AIS prevention and control relevant to changing climatic conditions into state AIS management plans
   b. Conduct risk assessments for "horizon" AIS species, developing future models that account for changes associated with climate change and variability
   c. Develop and promote standard methods to evaluate education and outreach programs in terms of target audience knowledge, behaviors, and beliefs
   d. Assess education and outreach programs to identify and share best practices for an effective community-based social marketing model of outreach

4.1 Research
   a. Quantify community and species patterns at high risk invasion sites to provide baseline reference measurements that will (1) enable ecological change to be measured if new AIS become established; (2) aid identification of new invasive species; and (3) help quantify differences resulting from management efforts.
   b. Determine biological impacts of AIS, including associated pathogens and parasites, on native species, human health, and aquatic biodiversity, including the prevalence of cumulative impacts involving AIS to aquatic ecosystems.
   c. Develop a priority list of established species or predicted imminent invaders where data on impacts is uncertain, lacking, or inconclusive

4.2 Economic Impacts
   a. Establish a clearinghouse to store developed and vetted economic tools and information that may assist resource managers and stakeholders in the evaluation of economic impacts associated with AIS prevention and control.

- Compile current and historical costs (e.g., physical, biological, chemical, economic, recreational, societal) to the Great Lakes ecosystem caused by AIS.
- Compile costs and benefits information for AIS policy options using the value of sectors that may be impacted, e.g., the size and characteristics on the sport fishing sector
- Assess the need for and develop tools to assess the economic impacts of AIS within the Great Lakes ecosystem.

b. Develop informational materials on the economic and ecological risks regarding AIS invasions, including benefit-cost assessment to raise awareness among stakeholders, especially policy makers, on the value of preventing new introductions

c. Design marketing strategies that identify and utilize information on economic, environmental, human health and societal impacts to effectively influence the public's values and perceptions concerning AIS issues. As part of these strategies, AIS prevention and control messages should target groups associated with identified pathways.

4.3 Funding

a. Support Congressional authorization and appropriation of adequate funding to the U.S. FWS, NOAA, and other agencies under NANPCA/NISA to fully implement activities of the ANSTF, regional ANS panels and state ANS management plans

b. Support Congressional appropriation of authorized funds under the Vessel Incidental Discharge Act to fully implement the AIS prevention activities outlined within

c. Support continued and/or enhanced funding of regional programs that can fund a diverse array of efforts, such as the Great Lakes Restoration Initiative

d. Understand and document resources and capacity needed to support effective AIS prevention and control programs
- Communicate these needs to policy makers at the state/provincial and federal levels, emphasizing the establishment of legislative mandates and funding authorizations to implement AIS prevention and control programs

e. Support funding for priority AIS work and initiatives identified by the Great Lakes Panel on Aquatic Nuisance Species, the ANSTF, and state/provincial AIS management plans, including activities such as species and pathway risk assessments, research on AIS prevention and control measures, and education and outreach to user groups and the public

4.4 Information-Sharing

a. Develop and implement, as feasible, information management tools, such as the Great Lakes-St. Lawrence Research Inventory (searchable database developed by the Council of Great Lakes Researchers serving under the International Joint Commission) to maximize effective use of existing information on AIS prevention and control.

b. Identify and utilize programs that serve in a regional clearinghouse capacity to advance information management in the following areas: 1) comprehensive inventory of I/E materials on AIS prevention and control in the Great Lakes region; 2) a reference service to respond to general inquires and requests for materials; 3) agency contact information; 4) internet services that provide extensive linkages to relevant web sites within and beyond the Great Lakes region; and 5) updated GIS maps/data describing current species-specific distribution trends in North America.

c. Ensure accessibility of information on invasive species from other countries, including the translation of foreign research.

4.5 Education

a. Incorporate as part of K-12 curriculum and youth group programs (e.g., boy scouts, girl scouts, 4-H, etc.), the biology of AIS, ecological and economic impacts, prevention and control strategies, and the importance of protecting the Great Lakes as a regional resource.

b. Develop "invasion biology" academic programs at higher level institutions for researchers, resource managers, and scientists.
c. Conduct workshops on a local, state, provincial and regional level, targeting educators, on current AIS issues to raise awareness, increase partnerships, and share resources to address AIS and associated impacts. Curriculum development on AIS topics should be coordinated with existing public school curriculum to meet state or provincial standards.
d. Develop a web-based clearinghouse for AIS public outreach, training and formal education opportunities in the Great Lakes region.
e. Use marketing strategies to enhance distribution of new and existing AIS programs to schools and learning centers and provide teacher training.
f. Integrate evaluation components into education and outreach programs to assess programmatic effectiveness.