Appendix A. Aquatic Invasive Species Strategy Team Implementation Actions and Milestones

(Monetary figures are provided where available)

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
Legislation and Research									
Legislative Milestone **The AIS Strategy team strongly supports the immediate passage and full funding of NAISA**. In fact, most, though not all, of the recommendations presented would be addressed with the enactment of legislation that has already been introduced—the National Aquatic Invasive Species Act of 2005 (NAISA--S. 770, H.R. 1591, H.R. 1592). That legislation includes titles such as Prevention, Research, Outreach and Education, Early Detection, Rapid Response, Control, Management, and Coordination. Passage of this legislation would support programs to achieve expeditious and measurable progress toward halting future species invasions of the Great Lakes and controlling established populations			109th Congress						
1	Canals and Waterways, Recreational Activities; Aquaculture; Maritime Commerce; Organisms in Trade	Pass comprehensive AIS legislation	109th Congress						
2	Organisms in Trade	By December 2005, Federal, State, Tribal and Provincial partners in the GLRC should affirm a commitment to reduce and eliminate the risk of unintentional and intentional releases of live non-native aquatic organisms that have the capability of becoming established and cause harm to humans, the economy, or the environment in the Great Lakes basin. In affirming this commitment as part of the final terms of the Great Lakes Regional Collaboration Action Plan, jurisdictions should commit to a precautionary approach in developing and implementing legislation, regulations and programs regarding future proposed importations and commerce involving non-native/non-naturalized aquatic organisms	Federal, state, tribal, provincial partners in the Great Lakes Regional Collaboration						
3	Recreational Activities	The Council of Great Lakes Governors, the Great Lakes Legislative Caucus and Great Lakes tribal leaders will work to ensure that state legislatures and tribal councils establish comprehensive AIS programs, including watercraft inspector education, and develop long term, stable funding mechanisms for them	CGLG GLLC Tribal Leaders	State Legislatures					
4	Recreational Activities	The Council of Great Lakes Governors, the Great Lakes Legislative Caucus and Great Lakes tribal leaders will support development and implementation of AIS state and tribal laws and regulations that prohibit the transport and spread of AIS	CGLG GLLC Tribal Leaders	State Legislatures; Stakeholders					

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
		and aquatic vegetation on watercraft							
5	Organisms in Trade	Federal, State, Tribal and Provincial governments should enact laws, regulations and programs to reduce and eliminate future introductions of live invasive species via pathways involving commerce and trade	All						
Recommendation 1: Prevention of AIS Introduction and Spread through Maritime Commerce									
Milestone 1.1 **(1) Immediately require, verify, and enforce (in the current shipping season under existing authorities) that ocean-going vessels in the no ballast on board condition (NOBOB) implement practices that are an improvement over current practices**									
1A	Maritime Commerce	The immediate requirement (in the 2005 shipping season under existing authorities) that ocean-going vessels in the no ballast on board condition (NOBOB) implement practices that are an improvement over current practices	USCG						
Milestone 1.2 **(2) Immediately require, verify and enforce best performing ship-board ballast water treatment and hull management methods for ocean-going vessels (with a set approval period), with continued upward ratcheting of the treatment floor as treatment performance improves. Approved treatment must be to an environmentally protective standard by 2011**					$6,000,000	$6,000,000	$6,000,000	$6,000,000	$6,000,000
2A	Maritime Commerce	The immediate application of best performing ship-board ballast water treatment and hull management methods for ocean-going vessels (with a set approval period), with continued upward ratcheting of the treatment floor as treatment performance improves. Approved treatment must be to the environmentally protective standard by 2011. This process should be conducted pursuant to the requirements provided in S. 770 as introduced, the National Aquatic Invasive Species Act	USCG						
2B	Maritime Commerce	All vessels entering the Great Lakes/St. Lawrence Seaway System will implement effective prevention requirements including ballast treatment, hull management, and other measures as may be determined necessary, enforceable and practicable, such that there are no more ship-mediated releases of AIS into the system	USCG						
Milestone 1.3 **(3) Immediately require monitoring, reporting, and public dissemination of all ballasting activities, prevention practices, and outcomes such that progress toward the goal is measurable and enforcement practical**									
3A	Maritime Commerce	The immediate requirement for monitoring, reporting, and public dissemination of all ballasting activities, prevention practices, and outcomes such that progress toward the goal is measurable and enforcement practical	USCG		$2,750,000	$2,750,000	$2,750,000	$2,750,000	$2,750,000
3B	Maritime Commerce	Consistent and continuous assessment of 1) inoculation pressure from ships, 2) populations of NAIS, and 3) rates of NAIS introduction and spread	NOAA		$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000
Milestone 1.4 **(4) Review and apply best-performing ballast water management practices to non-ocean-**									

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
going vessels operating exclusively within the Great Lakes (including application of ballast water treatment for new ships) to eliminate the spread of AIS already introduced into the system									
4A	Maritime Commerce	Review and application of best-performing ballast water management practices to non-ocean-going vessels operating exclusively within the Great Lakes (including application of ballast water treatment for new ships) to eliminate the spread of AIS already introduced into the system	Lake Carriers Association	GLP, USCG					
Milestone 1.5 **(5) Immediately and significantly expand research, testing, and evaluation of policies and technologies as alternatives to on-board treatment. Alternatives to be investigated should include (but not be limited to) cargo transfer, shore-based treatment, use of Clean Water Act discharge permits, and state/regional actions. Programs under which these investigations can be conducted include the Ballast Water Technology Demonstration Program and the Environmental Technology Verification Program. These investigations will hasten development of effective shipboard treatment systems. If ship-board treatments are shown to be inadequate, the team recommends implementation by 2011 of effective alternatives that prohibit ballast water from ocean-going ships from being discharged into the Great Lakes.**									
5A	Maritime Commerce	The immediate significant expansion of the Ballast Water Technology Demonstration Program, and EPA's Environmental Technology Verification program with the dual objective of hastening development of effective shipboard treatment systems and developing alternatives to on-board treatment such as (but not limited to) cargo transfer, shore-based treatment, or use of Clean Water Act discharge permits	NOAA, EPA		$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
Recommendation 2: Prevention of AIS Introduction and Spread Through Canals and Waterways									
Milestone 2.1 **(1) Complete construction of barrier II, make barrier I permanent, provide federal funds to operate both dispersal barriers in the Chicago Waterway system, and complete a study of options to for permanent hydrological and/or biological separation of the Great Lakes and Mississippi River systems**									
1A	Canals and Waterways	Provide full federal funding for existing barrier operations including the Chicago dispersal barriers and sea lamprey barriers	109th Congress	USACE, USFWS, USEPA			$17,500,000	$17,500,000	$17,500,000
1B	Canals and Waterways	By September 30, 2006, implement and fully fund the recommendations from the 2003 Chicago AIS Summit including: 1) completing a reconnaissance study of hydrologic separation of Lake Michigan from the Chicago Sanitary and Ship Canal, and 2) augmenting the two electrical barriers with technological alternatives/solutions including biological separation	109th Congress	USACE, USEPA	$1,500,000				
Milestone 2.2 **(2) Fully examine options and their economic benefits and costs to prevent the spread of AIS via the Lake Champlain Canal and other canal systems linking the Great Lakes with other basins**									
2A		Pursue limited hydrologic separation with overland transport of							

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
		recreational vessels, and use of a graving dock or seasonal lockage restrictions for commercial vessels on the Champlain portion of the New York State Canal System							
Milestone 2.3 **(3) Close or modify, through the use of physical barriers or control structures, canals that have fallen into disuse or disrepair—if rebuilt, prevent passage of aquatic invasive species**									
3A	Canals and Waterways	By September 30, 2010, close non-commercial canals through use of physical barriers or control structures	States, USACE	Congressional appropriation					
3B	Canals and Waterways	By September 30, 2007, conduct research to develop and test alternative barrier types and prevention approaches. Install those approaches to evaluate their effectiveness (i.e., demonstration projects). Conduct economic analyses to compare cost-effectiveness of various alternative approaches	USACE, USGS, NOAA						
3C	Canals and Waterways	By September 30, 2008, initiate a federally funded granting process for dispersal barrier effectiveness monitoring, research & development	USACE	Needs Congressional authorization and appropriation	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000
3D	Canals and Waterways	By September 30, 2007, investigate means to convey storm and wastewater discharges via canals without spreading AIS	USEPA, USACE, canal management agencies, NOAA, USGS						
3E	Canals and Waterways	By September 30, 2007, investigate alternative means for cargo transportation between the GL and adjacent watersheds in the U.S.	GLC, NOAA	Needs Congressional Authorization and Appropriation					
3F	Canals and Waterways	By September 30, 2007, prohibit the transgression of watersheds via canal connections by monitored AIS	Great Lakes States						
Milestone 2.4 **(4) Prohibit the development of new cross-drainage basin connections**									
4A	Canals and Waterways	By September 30, 2006, prohibit improvement of existing open-channel waterway connections between drainage basins	Congress, States						
4B	Canals and Waterways	By September 30, 2006, prohibit development of new open-channel connections between drainage basins	Congress, States						
Milestone 2.5 **(5) Address intermittent flood-related connections**									
5A	Canals and Waterways	By September 30, 2010, implement efforts to prevent intermittent flood-related connections between the Great Lakes and other watersheds	Congress	USACE, IL and other Great Lakes States, City of Chicago					
Milestone 2.6 **(6) Initiate measures to prevent or reduce the movement of AIS into stream segments opened up by dam/impediment removal or culvert construction, and fully consider benefits to native species and impacts from AIS when evaluating cost-benefits of proposed fish passage projects**									
6A		Initiate measures to prevent or reduce the movement of AIS into stream segments opened up by dam/impediment removal							

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
		or culvert construction, and fully consider benefits to native species and impacts from AIS when evaluating cost-benefits of proposed fish passage projects							
Milestone 2.7 **(7) Develop and implement AIS monitoring plans to provide comprehensive monitoring and reporting of AIS through the canal vector**									
7A		Develop and implement AIS monitoring plans to provide comprehensive monitoring and reporting of AIS through the canal vector							
Milestone 2.8 **(8) Fully fund the Great Lakes Fishery Commission's sea lamprey control program**									
8A	Canals and Waterways	Fund the sea lamprey control and research program	GLFC	Congress	$19,000,000	$19,000,000	$22,700,000	$23,380,000	$24,080,000
Recommendation 3: Prevention of AIS Introduction and Spread Through Trade of Live Organisms									
Milestone 3.1 **(1) Develop a list of species of concern for the Great Lakes basin and an immediate moratorium by the States on the trade of species on that list, until the species are screened and approved for trade**									
1A	Organisms in Trade	The Great Lakes Panel on Aquatic Nuisance Species has produced Model Guidance for Great Lakes Jurisdictions on AIS (1999). This should be reviewed, updated and strengthened. Existing and proposed laws in Minnesota (Chapter 84D "Harmful Exotic Species"), Florida and Michigan may provide good models	GLP		$50,000				
1B	Organisms in Trade	Great Lakes states should enact laws to prohibit sales and shipment of species listed on the moratorium list. This prohibition should remain in effect until a process to screen and fully evaluate risks is implemented	Great Lakes States						
1C	Canals and Waterways	By September 30, 2007, prohibit the use of potentially invasive organisms with the potential to survive in the Great Lakes in aquaculture operations subject to flooding	Great Lakes States						
1D	Organisms in Trade	An institution with legal expertise (such the Environmental Law and Policy Center, or the Environmental Law Institute) should provide a model law to assist states and encourage consistency	Congress Policy Center or Institute		$100,000				
Milestone 3.2 **(2) Implement provisions of the pending NAISA legislation, as introduced, that establish a federal screening process for organisms proposed for trade**									
2A	Organisms in Trade	The federal government should establish consistent guidelines for scientifically-based minimum information required for screening to be applied by those federal agencies with authority to regulate or restrict species movement	USFWS	Agencies with jurisdiction	$1,000,000	$1,000,000			
2B	Organisms in Trade	Industry should be brought into the development of the new screening process.	USFWS	Industry Sea Grant					
Milestone 3.3 **(3) Modify the pending NAISA legislation mandating that the screening process should**									

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
classify species proposed for trade into three lists—prohibited, permitted, and conditionally prohibited/permitted									
3A	Organisms in Trade	The federal government should promulgate federal regulations to be applied by federal agencies with authority to regulate or restrict species movement defining permitted, permitted conditionally/prohibited provisionally pending further information or prohibited lists, and the conditions or restrictions imposed on species in each category	USFWS	USGS Agencies with jurisdiction		$3,500,000			
3B	Organisms in Trade	The federal government, in consultation with state, tribal, and provincial governments, should ask the Great Lakes Panel on Aquatic Nuisance Species to produce a list of species that have a high likelihood of becoming invasive in the Great Lakes basin	USFWS GLP		$250,000				
3C	Organisms in Trade	By 2006, Federal, State, Tribal and Provincial authorities should collaborate to collect, share and make available to the public information on invasive species in trade, create networks to improve effectiveness and implementation, and to coordinate budgetary planning	Federal agencies State agencies		$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
3D	Organisms in Trade	USGS should lead the creation and maintenance of databases of information in cooperation with the U.S Fish and Wildlife Service (FWS), NOAA and the Smithsonian Environmental Research Center. These databases should include: a catalog of non-native, non-naturalized organisms currently or potentially in trade; a list of species proposed for importation and/or interstate commerce; a list of species which are being screened; a documentation of trends and practices in commerce, trade and cultural activities; and information on criminal activity. Where appropriate (except for criminal activity) information in the database should be made available to the public	USGS	USGWS NOAA Smithsonian States	$3,500,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Milestone 3.4 **(4) Modify NAISA to clearly state that the screening process established must place the burden of proof of non-injuriousness on the importer**									
4A	Organisms in Trade	Within 18 months of the promulgation of federal regulations, importers should be prohibited from importing any live species on the lists except in compliance with the uniform federal regulations The Fish and Wildlife Service to oversee implementation of the screening process and provide screening for any species proposed for importation that is not covered by another federal agency	USFWS	Importers			$3,500,000	$3,500,000	$3,500,000
Milestone 3.5 **(5) Allocate sufficient resources to heighten the number of species under the Lacey Act as "injurious," to prevent the interstate transportation of harmful species; FWS should list black, bighead, and silver carps as injurious under the Lacey Act**									
5A	Organisms in Trade	Congress should amend the Lacey Act or enact new legislation to include aquatic invertebrates and plants	Congress	USFWS					
5B	Organisms in Trade	Congress should provide authority and funding under the Lacey Act or enact new legislation to create an effective process to screen aquatic organisms proposed for importation. Congress	Congress	USFWS APHIS	$700,000	$700,000	$700,000	$700,000	$700,000

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
		should provide timelines to require agencies to make decisions on species listings in a timely manner. Congress should provide the funding and directive to APHIS to fully implement its existing authority to regulate aquatic plants and insects							
5C	Organisms in Trade	Congress should amend the Lacey Act or enact new federal legislation to prohibit, restrict, or allow proposed importations based on the results of the screening process	Congress	USFWS					
5D	Organisms in Trade	Congress should amend the Lacey Act to list the black, silver, bighead, and grass carp as injurious so that interstate transportation of live fish will be prohibited. (Black, silver and bighead carp should be the highest priority.)	Congress						
5E	Organisms in Trade	Regulations should be promulgated to implement the screening process recommended above to apply to live non-native, non-naturalized species which are already imported, proposed for sale or interstate commerce, but which have not yet become widespread or invasive	USFWS		$3,500,000				
5F	Organisms in Trade	Regulations should be adopted and implemented to prohibit, restrict, or allow sale, possession and interstate movement of species following screening	USFWS			$3,500,000	$3,500,000	$3,500,000	3,500,000
Milestone 3.6 **(6) Significantly increase resources for the enforcement of laws governing the trade of live organisms**									
6A	Organisms in Trade	The Great Lakes Fishery Commission should convene workshop of the Law Enforcement Committee of the Council of Lake Committees to discuss with federal, state, provincial and tribal law enforcement officers information needs, resource needs, and training needs for effective enforcement	GLFC	Law Enforcement Committee Council of Lake Committees	$75,000				
6B	Organisms in Trade	State and federal governments should provide state and federal agencies the authority, clear directive, tools, and funding necessary to effectively enforce ANS laws	Congress State legislatures						
6C	Organisms in Trade	Federal, state, tribal, and provincial agencies should increase enforcement personnel presence in and around areas operating in the sale of non-native aquatic organisms for commercial purposes	State, Federal, tribal, and provincial agencies						
6D	Organisms in Trade	Citizen suit provisions should be enacted as part of federal laws to improve enforcement, hold state and federal governments accountable for effective implementation and to bolster accountability	Congress						
6E	Organisms in Trade	Federal and state penalties associated with the sale of prohibited species of live organisms should be made much more strict	Congress State legislatures						
6F	Organisms in Trade	Federal, state, provincial, and tribal enforcement agencies should be provided with the authority and the training to effectively enforce AIS laws	Congress State legislatures	Law enforcement agencies	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000
Milestone 3.7									

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
(7) Develop and implement risk models for organisms in aquaculture									
7A	Aquaculture	Development and implementation of formal and *a priori* risk assessment protocols with an agreed upon process to assess and address risks before releases or escapement	States, Tribes		160,000	160,000	160,000	160,000	160,000
7B	Aquaculture	Development and implementation of formal and *a priori* decision models with an agreed upon process to decide on merits, costs, and benefits before releases or elevated risks of escapement	States, Tribes		160,000	160,000	160,000	160,000	160,000
7C	Aquaculture	Focus public and commercial aquaculture on native or naturalized species and gene pools	States, Tribes						
7D	Aquaculture	Implement a bi-national and tribal accord aimed at reducing risks of introduced non-native invasive species from public and private aquaculture operations consisting of a bilateral agreement on approved actions or at least decision processes by which desired introductions can be approved or disallowed; the appropriate level of taxonomic complexity at which to direct policies and procedures; cost bearing (sharing) for protection and remedy, and enforcement	States, Tribes		$25,000	$25,000	$25,000	$25,000	$25,000
7E	Aquaculture	Require the Implementation of the formal a priori risk assessment protocols contained in Brister and Kapuscinski's 2002 "Environmental Assessment Tool for Aquaculture in the Great Lakes Basin Version 1.2. with an agreed upon process to assess and address risks before development and investment of new aquacultural net pen operations in the Great Lakes	States, Tribes						
Recommendation 4: Establish a Great Lakes AIS Integrated Pest Management Program									
Milestone 4.1 **(1) Allocate funds for development and implementation of State and Interstate Aquatic Nuisance Species Management Plans through the Aquatic Nuisance Species Task Force, with a particular emphasis on the immediate use of techniques to control or slow the spread of AIS**									
1A	Canals and Waterways, Recreational Activities	Authorize a single binational or Federal agency (i.e., Lead Federal Entity) to coordinate development and implementation, with appropriate State, Tribal, Federal, and Canadian partners, of an integrated pest management program for priority AIS	Administration, Congress, Lead Federal Entity	Federal, State, Tribal, and local governments, nongovernmental organizations	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000
1B	Recreational Activities	By December 31, 2005, Congress will pass legislation that authorizes, and will appropriate by FY2007, $8 million annually to support USFWS allocations to Great Lakes State and Interstate Aquatic Nuisance Species Management Plans (Plans) approved by the Aquatic Nuisance Species Task Force (ANSTF). The plans must include rapid response technical plans	Congress	USFWS; ANSTF; states; tribes; other cooperators	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000
1C	Canals and Waterways	By September 30, 2006, fully fund and implement the recommendations in the National Management and Control Plan for Asian carp	USFWS	Requires Congressional authorization and appropriation	Budget to be determined	Budget to be determined	Budget to be determined	Budget to be determined	Budget to be determined
1D	Maritime	Containment of AIS spread by ships (salty and laker) of any							

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
	Commerce	populations of AIS not eradicated through rapid response							
1E	Organisms in Trade	Regional, federal, state/provincial and local agencies should work together early in the budgetary planning stages for AIS programs. Related appropriations requests should be presented to Congress under one umbrella, when appropriate, representing needs on a regional basis	Federal Agencies States Congress						
Milestone 4.2 **(2) Develop voluntary agreements and codes of best practices for industrial trade groups**									
2A		Develop voluntary agreements and codes of best practices for industrial trade groups							
Milestone 4.3 **(3) Encourage investigation of economic requirements and incentives (e.g., bonds or insurance) to prevent new introductions**									
3A		Encourage the investigation of economic requirements and incentives (e.g., bonds or insurance) to prevent new AIS introductions							
Milestone 4.4 **(4) Establish a revolving fund for rapid response actions**									
4A	Recreational Activities	By December 31, 2005, Congress will authorize, and will appropriate by FY2007, $2 million for a contingency fund to be used in rapid response actions conducted in accordance with approved Great Lakes State and Interstate Management Plans.	Congress	USFWS; ANSTF; States; Tribes; other cooperators	$2,000,000	Re-appropriate funds to restore fund to $2,000,000	Re-appropriate funds to restore fund to $2,000,000	Re-appropriate funds to restore fund to $2,000,000	Re-appropriate funds to restore fund to $2,000,000
Milestone 4.5 **(5) Establish an interagency, Great Lakes Federal Rapid Response Team, that will conduct activities on federal lands, and in other locations with State, Tribal, and local cooperation**									
5A	Recreational Activities	Congress will authorize, and appropriate by FY2007, $1,500,000 for the USFWS, NOAA, Sea Grant, EPA, USDA and other appropriate federal agency heads to establish the team in collaboration with the states and tribes	Congress	USFWS; NOAA (including Sea Grant); USEPA; USDA; other appropriate federal agencies	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
5B	Canals and Waterways, Recreational Activities	Government agencies responsible for AIS will develop an accessible, integrated and centralized program for recreational users to report and verify new infestations/invasions of AIS	USDA USFS USFWS NPS USGS SEFWA TEFWA USEPA	Budget to be determined	Budget to be determined	Budget to be determined	Budget to be determined	Budget to be determined	Budget to be determined
5C	Recreational Activities	Great Lakes Sea Grant programs will collaborate with state and tribal agencies to establish and promote volunteer AIS monitoring programs at marinas, harbors, and other locations that are at highest risk of introduction of AIS by recreational	GLSGN NPS USFWS USFS	SEFWA; TEFWA; resort and recreation associations;	90,000**	85,000**	85,000**	85,000**	80,000**

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
		and other activities based on volume of watercraft traffic and proximity to infested waters		conservation groups; lake associations; municipalities; businesses					
5D	Aquaculture	Response to unauthorized release or escapement with an agreed upon process to decide on responsibilities, cost-sharing, and reporting of remedial actions such that timely and effective actions may be taken before problems grow unmanageable	States, Tribes, Aquaculture facilities, Federal agencies		$350,000	$350,000	$350,000	$350,000	$350,000
Milestone 4.6 **(6) Allocate funds to implement a system of enhanced monitoring and ecological surveys in the Great Lakes**									
6A	Canals and Waterways, Recreational Activities	Congress will authorize and appropriate $2,000,000 for the USFWS, NOAA, USFS, and EPA to develop and implement, in cooperation with state, tribal, local, port, and other federal entities, a system of ecological assessments at Great Lakes locations at high risk of AIS invasion	Congress	USFWS; NOAA; USFS; USEPA; States; USGS	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
6B	Maritime Commerce	Statistically valid sampling of Great Lakes/St. Lawrence Seaway System harbors, connecting channels and ships, including a system for vouchering, identifying and reporting suspected AIS from ships, and an effective and adequately funded rapid response strategy, to prevent AIS establishment and dispersal about the basin							
Milestone 4.7 **(7) Support additional research to develop and implement new control methods for uncontrolled species of concern**									
7A	Recreational Activities	USEPA, USFWS, U.S. Geological Survey, USDA and NOAA (including Sea Grant) and states and tribes will develop and administer a $10 M annual grant program to fund research, development, demonstration, and verification of environmentally sound and cost-effective approaches to control and eradicate AIS	Congress	EPA; USFWS; USGS; USDA; NOAA (including Sea Grant); states; tribes	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000
Milestone 4.8 **(8) Establish a coordinated data management system, through the Smithsonian Institution, the Great Lakes Environmental Research Laboratory, or other suitable entity, to develop an accessible, integrated, and centralized database that allows for the reporting and tracking of AIS infestations**									
8A		Establish a coordinated data management system, through the Smithsonian Institution, the Great Lakes Environmental Research Laboratory, or other suitable entity, to develop an accessible, integrated, and centralized database that allows for the reporting and tracking of AIS infestations							
Milestone 4.9 **(9) Ensure overall coordination and accountability through the Invasive Species Council, including developing regular and comprehensive reports summarizing the status of AIS activities (including those of the ANS Task Force and the Great Lakes Panel on ANS in**									

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
implementing the National Invasive Species Management Plan), formulating a complete AIS federal budget request, overseeing progress in addressing AIS, evaluating the collective response to AIS, and communicating AIS needs and problems to Congress and the public. The National Invasive Species Management Plan should include specific focus on AIS in the Great Lakes									
9A		Improve coordination through the Invasive Species Council including developing regular and comprehensive reports summarizing the status of AIS activities (including the status of individual agencies' activities to implement the National Invasive Species Management Plan), formulating a complete AIS federal budget request, overseeing progress in addressing AIS, evaluating the collective response to AIS, and communicating AIS needs and problems to Congress and the public							
Recommendation 5: Education and Outreach									
Milestone 5.1 **(1) Support programs that educate Great Lakes boaters and anglers on how to take preventive actions against AIS**									
1A	Canals and Waterways	By September 30, 2007, fund and implement angler, cultural and stakeholder education programs and prohibit release of non-native organisms in rivers, canals and associated waterways	Great Lakes States, Sea Grant	Need Congressional appropriation	$5,000,000 (Also funds Actions 2 & 3)	$5,000,000 (Also funds Actions 2 & 3)	$5,000,000 (Also funds Actions 2 & 3)	$5,000,000 (Also funds Actions 2 & 3)	$5,000,000 (Also funds Actions 2 & 3)
1B	Recreational Activities	Governments, academia, businesses, and boating and fishing associations will collaborate to develop, coordinate, and implement cost effective AIS prevention programs and campaigns based on social science strategies and integrating, as appropriate, existing products or campaigns such as *Stop Aquatic Hitchhikers!*™	GLP GLSGN NPS SEFWA TEFWA USCG USEPA USFWS USFS	Boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations; municipalities; businesses	$730,000** **Included in Action 4.	$720,000**	$720,000**	$720,000**	$720,000**
1C	Recreational Activities	Develop and implement watercraft inspector training/education programs in each state and design and distribute materials including windshield fliers, winch post decals, and bait bucket stickers to encourage recreational users to adopt preventive behaviors	SEFWA TEFWA	Boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake	3,302,000**	3,200,000**	3,302,000**	3,200,000**	3,302,000**

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
				associations; municipalities; businesses					
1D	Recreational Activities	Develop public service announcements and purchase advertising in recreation-oriented media	GLSGN NPS SEFWA TEFWA USEPA USFS USFWS	Boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations; businesses	$110,000**	$80,000**	$80,000**	$80,000**	$80,000**
1E	Recreational Activities	Include AIS information and list infested waters in recreation safety and regulation publications	NPS SEFWA TEFWA USCG USFS USFWS		$19,000**	$19,000**	$19,000**	$19,000**	$19,000**
1F	Recreational Activities	Develop and distribute tip sheets for boaters and anglers.	GLP GLSGN NPS SEFWA TEFWA USCG USEPA USFWS USFS Businesses	Boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations; municipalities; businesses	$160,000**	$150,000**	$150,000**	$150,000**	$150,000**
1G	Recreational Activities	Identify and select the five most likely user groups	GLP GLSGN NPS SEFWA TEFWA USCG USEPA USFWS	Boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations;	$10,000**				

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
				municipalities; businesses					
1H	Recreational Activities	Develop standard guidance and target other recreational users	GLP GLSGN NPS, SEFWA TEFWA USCG USEPA USFWS Businesses	Aquaculture, live seafood, nursery, and aquarium trades; boating & fishing manufacturers & retailers; tourism, resort & recreation associations; chamber of commerce; conservation groups; lake assoc.; municipalities	$400,000**	$400,000**	$400,000**	$400,000**	$400,000**
1I	Recreational Activities	Feature AIS prevention messages and ways to minimize AIS impacts on boats and other recreational equipment at 70% of Great Lakes basin water access sites	GLSGN SEFWA TEFWA USFWS	USEPA; USFS; USCG; USGS; NPS; boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chambers of commerce; conservation groups; lake assoc.	$185,000**	$185,000**	$185,000**	$185,000**	$185,000**
1J	Recreational Activities	Provide information on AIS at visitor centers along key transportation corridors and at major boating and angling events	GLSGN SEFWA TEFWA USFWS	SDOT; USFS; NPS; boating and fishing manu-facturers and retailers; tourism, resort and recre-ation assoc.; chambers of commerce; conserve. groups; lake assoc.; municipalities; businesses	$285,000**	$125,000**	$285,000**	$125,000**	$125,000**
1K	Recreational Activities	Assess and evaluate AIS boater and angler outreach and education programs	GLSGN SEFWA TEFWA	USFWS, USFS, USCG; NPS; recreational boating and		$100,000**			$100,000**

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
				fishing associations					
1L	Recreational Activities	Use assessment and evaluation results to better understand, target, and manage recreational activities and to use the most effective methods	GLSGN SEFWA TEFWA	GLP; NPS; USCG; USEPA; USFS; USFWS; boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations; municipalities; businesses			$100,000**		$100,000**
1M	Recreational Activities	Develop marketing strategies to enhance distribution of new and existing AIS educational materials to schools and learning centers and provide training for teachers	GLSGN SEFWA	NPS; TEFWA; USFWS; USFS; boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations; municipalities; businesses	$46,000**				
1N	Recreational Activities	Thirty governments and organizations will collaborate to develop and produce and disseminate key AIS identification materials and conduct effective educational programs	GLSGN SEFWA TEFWA USFWS	GLP; NPS; USCG; USEPA; USFS; USGS	$1,650,000**		$1,650,000 **		$1,650,000 **
Milestone 5.2 **(2) Continue AIS-focused Hazard Analysis and Critical Control Point (HACCP) training and plan implementation including research and management agencies within and outside of the Great Lakes basin**									
2A	Canals and Waterways	By September 30, 2007, fund, design, and implement an "AIS consequences" education program for canal management agencies	Great Lakes Sea Grant Network, Canal Management						

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
			Agencies						
2B	Recreational Activities	Develop a model partnership between business, governments and academia to design and implement demonstration projects to build community-based capacity	GLSGN NPS SEFWA TEFWA USCG USEPA USFWS USFS Businesses	Boating and fishing manufacturers and retailers; tourism, resort and recreation associations; chamber of commerce; conservation groups; lake associations	$300,000**	$300,000**	$300,000**	$300,000**	$300,000**
2C	Recreational Activities	Communicate outreach and education successes with policy makers, resource managers, targeted audiences, and news media to other communities to encourage similar partnership programs	Everyone	Everyone			$20,000**		$20,000**
2D	Aquaculture	Continue AIS-Hazard Analysis and Critical Control Point training within and outside of the Great Lakes region	Great Lakes Sea Grant Network and North Central Regional Aquaculture Center						
Milestone 5.3 **(3) Support a program that educates all facets of the Great Lakes maritime commerce industry including ports, carriers, shippers, mariners, resource users and users of goods produced from cargoes transported to and from the Great Lakes by ships, about the urgency and cost-effectiveness of preventing/containing AIS, the status of prevention, and what is needed to advance prevention**									
3A	Canals and Waterways	By September 30, 2007, develop outreach plans for the shipping industries that use canals and waterways	Great Lakes Sea Grant Network, Shipping Industry						
3B	Maritime Commerce	All facets of the industry supporting maritime commerce in the Great Lakes, including ports, carriers, shippers, mariners, resource users and users of goods produced from cargoes transported to and from the Great Lakes by ships are aware of the risk and costs of importations of AIS by ships and the urgency and cost-effectiveness of preventing/containing them, the status of prevention, and what is needed to advance it							
Milestone 5.4 **(4) Support a new comprehensive AIS Organisms-in-Trade educational campaign including the bait industry, modeled on the Sea Grant AIS-HACCP and Pet Industry Joint Advisory Council/Sea Grant/USFWS HabitattitudeTM campaigns. Measurable objectives and timetables for these programs are included in Appendix F**									

GLP – Great Lakes Panel on ANS
GLSGN – Great Lakes Sea Grant Network
NPS – National Park Service
SDOT – State Departments of Transportation
SEFWA – State Environmental and Fish and Wildlife Agencies
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey

Action	Vector Team	Description	Lead	Affiliates	Funding				
					2006 (May require additional appropriations)	2007	2008	2009	2010
4A	Organisms in Trade	Funding should be provided to enable a new AIS Organisms in Trade educational campaign modeled on the Sea Grant AIS-HACCP and Sea Grant/USFWS Habitattitude campaigns	Congress	Sea Grant USFWS Industry					
4B	Organisms in Trade	Within 6 months of funding, the Great Lakes Panel on ANS should approve the highest priority draft educational materials and programs, based on listed species of highest concern, for development and use in the Organisms in Trade campaign. Funding sources should allocate funds based on this prioritization	Great Lakes Panel on Aquatic Nuisance Species	Organisms in Trade Educational Campaign Sea Grant Industry					
4C	Organisms in Trade	Within 12 months of Congressional funding, new educational materials and programs should be produced and made widely available	Organisms in Trade Educational Campaign	Sea Grant Industry					
4D	Organisms in Trade	Federal agencies should engage industry in development of codes of best practice, using the AIS-HACCP training program as a model	Organisms in Trade Educational Campaign USFWS NOAA APHIS	Sea Grant Industry					
4E	Organisms in Trade	Federal agencies should engage industry in the design and delivery of educational materials for consumers and industry members using the Habitattitide™ model	Organisms in Trade Educational Campaign USFWS NOAA APHIS	Sea Grant Industry					
4F	Organisms in Trade	Awareness materials must be made available in appropriate languages that inform readers of the dangers and consequences of releasing live aquatic organisms into the wild. Target live food sales and commerce (awareness activities should target all pathways not just live food)	Organisms in Trade Educational Campaign						
Milestone 5.5 **(5) Provide allocations for approved State and Interstate Aquatic Nuisance Species Management Plans**									
5A	Recreational Activities	Pass legislation to authorize and appropriate $32,442,000* over five years to support cost effective AIS outreach and education programs conducted by federal, state, tribal, agencies, academic programs and organizations. *Includes all O&E items	Congress	DOI (USFWS, NPS); NOAA; USDA; USFS; USEPA	$7,287,000* *Includes all **in 2006	$5,364,000* *Includes all ** in 2007	$7,296,000* *Includes all ** in 2008	$5,264,000* *Includes all ** in 2009	$7,231,000* *Includes all **in 2010
Total					$107,944,000	$102,123,000	$126,187,000	$122,803,000	$127,347,000

GLP – Great Lakes Panel on ANS
SEFWA – State Environmental and Fish and Wildlife Agencies
USDA – U.S. Department of Agriculture
GLSGN – Great Lakes Sea Grant Network
TEFWA – Tribal Environmental and Fish and Wildlife Agencies
USFS – U.S. Forest Service
NPS – National Park Service
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USFWS – U.S. Fish and Wildlife Service
SDOT – State Departments of Transportation
USEPA – U.S. Environmental Protection Agency
USGS – U.S. Geological Survey

Appendix B: Aquaculture Drafting Team Report

Aquaculture Drafting Team

I. Problem Statement

Aquaculture can be defined as the husbandry of aquatic organisms and implies the purposeful intent to nurture or promote the growth and survival of the targeted organism. Therefore, in the broadest sense, aquaculture includes state, federal, provincial, and tribal fish hatcheries; the aquarium or ornamental fish industry; water gardening suppliers; private, commercial fish farms; and baitfish operations dealing with both cultured and wild-caught organisms. Aquaculture has and will continue to be a possible vector for nonindigenous aquatic organisms and/or diseases into the Great Lakes. For example, there has been a long-standing practice of stocking Great Lakes waters with nonindigenous fish species raised in public hatcheries (e.g., coho and Chinook salmon) which is likely to continue into the foreseeable future. To date there are no self-sustaining populations of nonindigenous aquatic species in the Great Lakes that are from private, commercial fish farms (cf. Mills et al. 1993 or as listed on the Great Lakes Environmental Research Laboratory=s Web site: http://www.glerl.noaa.gov/res/Programs/invasive/) but that could soon change if Asian carp, such as the black or silver carp, gain entry from the Mississippi River drainage after their escape from fish farms in the southern United States. However, no matter what the source, it becomes apparent that a cohesive, coordinated basin-wide strategy and approach should be adopted across all political entities (including federal, state, and tribal) to ensure the efficient and effective prevention of aquatic invasive species.

The most likely aquaculture production pathways for aquatic invasive species and disease are through cultivation and sale of baitfish; fish for stocking in open waters or for fee fishing and/or biological control; and the culture and sale of both food fish and aquatic plants. For each of those sectors, the vector pathway can be both direct or indirect and to or from the environment. There is also the potential of interbasin transfer (into or out of the Great Lakes) through migration or transport whether accidental or purposeful. Therefore, a two-pronged approach, both regional and national, is essential to successfully prevent unwanted aquacultural introductions. In addition, parameters need to be defined within which aquacultural practices in the Great Lakes basin should operate to avoid the intentional or accidental introduction of aquatic invasive species and diseases which threaten native biodiversity, as well as compromise native gene pools and genetic diversity of native populations through interbreeding. Tackling these concerns will mean that a thorough risk assessment of each potential pathway is needed in order to develop the necessary regulations that would shut the actual vector pathway without economically impacting those businesses and practices which pose little or no risk. In addition, if a Great Lakes basin-wide strategy is developed for the aquaculture sector there needs to be an understanding of the impacts it might have on tribal hatcheries and facility operations in the context of any treaty relationships.

II. Establishment of Performance Based Goals with Prioritization

The overarching goal is to prevent the introduction and spread of aquatic invasive species or diseases into the Great Lakes basin from the aquaculture sector. Thus the number one priority is prevention. Prevention of unintended escapement, transfer, or disease transmission requires appropriate safeguards and biosecurity. Formal risk aversion and risk assessment protocols should be developed and rigorously adhered to throughout the basin. Early detection, rapid response, assessment, monitoring, control, outreach, education, and applied research are all activities that should be led by regulatory and management agencies except perhaps for outreach and education. There needs to be coordination and communication amongst all of the regulatory and management agencies in regard to all of these activities as well as a process for establishing what triggers a rapid response and who would be responsible. All decisions should be based on sound science and industry and tribal views must be considered. Responses must be targeted to species that are likely to survive and become pests based on the best information available, (e.g., use of predictive models à la Cynthia Kolar and Dave Lodge (cf. Kolar and Lodge 2002 and Leung et al. 2004).

III. Identify Ongoing Efforts

Even though the National Invasive Species Act (NISA) is relatively “silent” on aquaculture as a vector for the introduction of aquatic invasive species, reauthorization of the National Aquatic Invasive Species Act (NAISA) will charge the Task Force in conjunction with the Invasive Species Council to carry out activities to inform and

promote the voluntary cooperation and regulatory compliance of the aquaculture industry in regard to screening, monitoring, and control of the transportation of aquatic invasive species.

Currently there are a variety of ongoing efforts at the federal, state, tribal, regional, local, and private levels to prevent the introduction of aquatic invasive species or diseases from private, commercial aquaculture. This includes a number of states with laws and regulations limiting what can or could be grown or sold by the private sector. Many states also require fish health inspections before any fish can be exported to or imported from outside their borders. Unfortunately there is a lack of uniformity amongst or between the states and tribes in regard to fish health certification and what are accepted or prohibitive species and laws and regulations typically are silent on genetic stocks.

The Great Lakes Fishery Commission initiated and funded the development of an environmental assessment tool for aquaculture in the Great Lakes basin for both lake-based and land-based aquaculture facilities (Brister and Kapuscinski 2002). That tool is intended for use by the responsible jurisdictional management agency although aquaculturists can also benefit through use of the tool especially when used at the earliest stages of planning a new facility. The tool includes assessment pathways in regard to aquatic nuisance species, introduced species, diseases, and genetics including genetically engineered organisms.

Since 2001 the Great Lakes Sea Grant Network has provided hands-on workshops and developed curriculum materials for a Hazard Analysis and Critical Control Point (HACCP) approach to aquatic invasive species, first targeting wild baitfish harvesters and both public and private sector fish farmers (Gunderson and Kinnunen 2001) and then expanding it to include fishery managers and researchers as well as law enforcement personnel (Gunderson and Kinnunen 2004). To date over 425 private, state, federal, and tribal representatives from over 25 states and the Province of Ontario have been trained through the AIS-HACCP workshops held in 18 states. Many AIS-HACCP plans have been developed and are being used by many of the workshop participants. The U.S. Fish and Wildlife Service has adopted the AIS-HACCP approach and have implemented 82 HACCP plans covering 18 states. They also regularly conduct their own AIS-HACCP training at their National Conservation Training Center in Shepherdstown, West Virginia and host Sea Grant training at their Northeast Fishery Center in Lamar, Pennsylvania for tribal fishery operators and biologists. However, a number of the public aquaculture sector facilities have employed a Best Management Practice (BMP) approach as an alternative to a HAACP approach for addressing aquatic invasive species. While these methods differ in extent and particulars, it is desired that a formal process, whether a BMP or HACCP approach, be implemented for all aquacultural facilities.

IV. Alternative Approaches

V. Recommended Actions

#1

What: Development and implementation of formal and *a priori* risk assessment protocols.
When: Prior to regulatory approval or licensing of propagation, release, or sale of non-native species.
Who: A Great Lakes states, provinces, and tribal coalition.
Why: Actions undertaken by an individual political or commercial entity can have extensive and long-term impact throughout the basin.
Endpoint: Agreed upon process to assess and address risks before releases or escapement.
Costs: ?

#2

What: Development and implementation of formal and *a priori* decision models.
When: Prior to regulatory approval or licensing of propagation, release, or sale of non-native species.
Who: A Great Lakes states, provinces, and tribal coalition.
Why: Ensure well considered actions before intentional releases or elevating escapement risks.
Endpoint: Agreed upon process to decide on merits, costs, and benefits before releases or elevated risks of escapement.
Costs: ?

#3

What: Response to unauthorized release or escapement.

When: Prior to regulatory approval or licensing of propagation, release, or sale of non-native species.
Who: A Great Lakes states, provinces, and tribal coalition.
Why: Contain further risks or hazards.
Endpoint: Agreed upon process to decide on responsibilities, cost-sharing, and reporting of remedial actions such that timely and effective actions may be taken before problems grow unmanageable.
Costs: ?

#4

What: Focus public and commercial aquaculture on native or naturalized species and gene pools.
When: Prior to regulatory approval or licensing of propagation or release of non-native species.
Who: A Great Lakes states, provinces, and tribal coalition.
Costs: ?

#5

What: Implement a bi-national and tribal accord aimed at reducing risks of introduced non-native invasive species from public and private aquaculture operations.
When: Prior to recommend actions #1 through #4 as the basis for those.
Who: A Great Lakes states, provinces, and tribal coalition.
Why: All actions of prevention or remedy have international requirements and needs if they are to be successful.
Endpoint: A bilateral agreement on approved actions or at least decision processes by which desired introductions can be approved or disallowed; the appropriate level of taxonomic complexity at which to direct policies and procedures; cost bearing (sharing) for protection and remedy, and enforcement.
Costs: ?

#6

What: Continue AIS-HACCP training within and outside of the Great Lakes region.
When: Training will continue over the next several years.
Who: Efforts led by the Great Lakes Sea Grant Network and the North Central Regional Aquaculture Center.
Costs: ?

#7

What: Require the Implementation of the formal a priori risk assessment protocols contained in Brister and Kapuscinski's 2002 "Environmental Assessment Tool for Aquaculture in the Great Lakes Basin Version 1.2.
When: Prior to regulatory approval of any open-water net pen operations in waters of the Great Lakes.
Who: A Great Lakes states, provinces, and tribal coalition.
Why: New development undertaken by a commercial or public entity sets precedents that can have extensive and long-term ecological impacts throughout the basin.
Endpoint: Agreed upon process to assess and address risks before development and investment of new aquacultural net pen operations in the Great Lakes.
Costs: ?

VI. References

Brister, Deborah J., and Anne R. Kapuscinski. 2002. Environmental assessment tool for aquaculture in the Great Lakes Basin Version 1.2. Great Lakes Fishery Commission Miscellaneous Report, Great Lakes Fishery Commission, Ann Arbor, Michigan (available online at http://www.glfc.org/pubs/pub.htm#misc).

Gunderson, Jeffrey L., and Ronald E. Kinnunen, editors. 2001. ANS-HACCP: Aquatic Nuisance Species-Hazard Analysis and Critical Control Point training curriculum. Minnesota Sea Grant Publication No. MN SG-F11 and Michigan Sea Grant Publication No. MSG-00-400. 78pp.

Gunderson, Jeffrey L., and Ronald E. Kinnunen. 2004. AIS-HACCP: Aquatic Invasive Species-Hazard Analysis and Critical Control Point training curriculum, revised. Minnesota Sea Grant Publication No. MN SG-F11 and Michigan Sea Grant Publication No. MSG-00-400. 84pp.

Kolar, Cynthia S., and David M. Lodge. 2002. Ecological predictions and risk assessment for alien fishes in North America. Science 298:1233-1236.

Leung, Brian, John M. Drake, and David M. Lodge. 2004. Predicting invasions: propagule pressure and the gravity of Allee effects. Ecology 85(6):1651-1660.

Mills, Edward L., Joseph H. Leach, James T. Carlton, and Carol L. Secor. 1993. Exotic species in the Great Lakes: a history of biotic crises and anthropogenic introductions. Journal of Great Lakes Research 19:1-54.

VII. Parking Lot

Genetically modified organisms

Nalbone

1. Recommendations of conservative stocking of non-native sport fish need to be made in conjunction with the Habitat and Species: Native Fish and/or Sustainable Development: Fisheries drafting teams.
1. All recommendations need to be consistent with Tribes and First Nation goals.
2. There are NGOs working to ensure that Canada develops “freshwater” protocols for aquaculture and converts net-pen operations in Georgian Bay to closed system operations. http://www.georgianbay.ca/index.html see “environment” and “aquaculture.”
2. Final thoughts/Bottom line: Regarding areas that Great Lakes aquaculture will encounter the most scrutiny, in my experience it will be in open-water net pens and the husbandry or use of non-native (out-of basin) species and GMOs within the watershed. I will consider our work here a success from an NGO perspective if our recommendations address and make progress on those two points.

Appendix 1

Additional Uncited References

Allendorf, F.W. 1991. Ecological and genetic effects of fish introductions: synthesis and recommendations. Canadian Journal of Fisheries and Aquatic Sciences 48(Supplement 1):17-181.

Alverson, D.L., and G.T. Ruggerone. 1997. Escaped farmed salmon: environmental and ecological concerns. Pages 1-99 *in* Salmon aquaculture review., Volume 3, Part B. Environmental Assessment Office, British Columbia, Canada.

Bartley, D., and C.V. Casal. 1998. Impacts of introductions on the conservation and sustainable use of aquatic biodiversity. FAO Aquaculture Newsletter 20:15-20.

Epifanio, J., F. Utter, and D. Philipp. 2000. The effects of fish stocking on genetic level biodiversity. Pages 23-64. *in* J. Nalbone and E.L. Michael, editors. Taking stock of our future. Great Lakes United Conference Proceedings. Great Lakes United, Buffalo, New York.

Fuller, P.L., L.G. Nico, and J.D. Williams. 1999. Nonindigenous fishes introduced into inland waters of the United States. American Fisheries Society Special Publication Number 27. American Fisheries Society, Bethesda, Maryland.

Hindar, K., and B. Jonsson. 1995. Impacts of aquaculture and hatcheries on wild fish. Pages 70-87 *in* D.P. Philipp, J.E. Epifanio,.,E. Marsden, J. Claussen, and R.J. Wolotira, Jr., editors. Proceedings of the World Fisheries Congress, Volume 3. Oxford and IBH Publishing, New Delhi, India.

Horack, D. 1995. Native and non-native fish species used in state fisheries management programs in the United States. Pages 61-67 *in* H.L. Schramm and R.G. Piper, editors. Uses and effects of cultured fishes in

aquatic ecosystems. American Fisheries Society Symposium Number 15. American Fisheries Society, Bethesda, Maryland.

Krueger, C.C. and B. May. 1991. Ecological and genetic effects of salmonid introductions in North America. Canadian Journal of Fisheries and Aquatic Sciences 48(Supplement 1):66–77.

Utter, F., and J. Epifanio. 2002. Marine aquaculture: genetic pitfalls and potentialities. Reviews in Fish Biology and Fisheries 11:59-77.

Appendix 2

There were three major issues raised during the April 5, 2005 AIS Strategy Team conference call concerning the 3-31-05 draft : (1) net pen operations, (2) GMOs, and (3) the “Who” under most of the Recommended Actions. In regard to net pens, Recommended Action #7 was added which addresses this type of aquacultural operation. GMOs were asked to be deferred to the Habitat/Species Strategy Team, which Roger Eberhardt agreed to pursue. In the 3-31-05 draft, the “Who” for Recommended Actions #1-6 had “Bi-national and tribal authorities within the basin.” Because of questions as to who was to be the “bi-national” authority or authorities and the issue about the states, provinces, and tribes to be the “implementers” of any of these actions, it was deemed appropriate to change the “Who” to an as yet unformed “… Great Lakes states, provinces, and tribal coalition.”

Appendix C: Canals and Waterways Drafting Team Report

Canals and Waterways – Action Plan Summary

Canals facilitate the conveyance of bulk goods and commodities but also facilitate the spread of aquatic invasive species (AIS) within a watershed and allow cross-basin transfer of AIS between watersheds. Canal closure can recreate the geographic barriers that once separated the Great Lakes from other drainage basins. However, current uses of canals will influence the potential options for AIS control and management. This brief summary lists the top priorities, likely lead agencies and funding needs to address AIS spread via canals and waterways.

- Congress must pass a comprehensive federal bill by the end of the 109th Congress that funds aquatic invasive species prevention, including canals and waterways, ballast water and other pathways.
- Dispersal barriers will likely remain near term options of choice in the Chicago waterways, Lake Champlain Canal, other portions of the New York Canal System and potentially in the Ohio canals. Beginning October 1 2008 provide annual appropriations of $17.5 million including $10 million for dispersal barrier construction, $1million for barrier operations, and $500,000 for intensive monitoring of barrier performance. Administer the funds through the U.S. Army Corps of Engineers, USFWS, USEPA or other appropriate entity.
- Appropriate $5 million annually for Great Lakes AIS dispersal barrier applied research and outreach funded through NOAA – Sea Grant. Outreach efforts should target canals users and managers.
- Develop and implement AIS monitoring and assessment protocols. Rapid response plans must be developed and funding provided for the response when it is needed. Provide $10 million for assessment, monitoring and rapid response planning in Great Lakes canals funded through NOAA. Provide an additional $5 million for implementation of rapid response efforts funded through USEPA at a 75% federal cost share.

The Chicago Sanitary and Ship Canal – USACE, USEPA

The Chicago dispersal barrier project must receive full federal funding for construction ($9.1 million) and operation and maintenance ($500,000 annually) of Barrier II, improvement of Barrier I ($7 million plus operating and maintenance costs) and monitoring of the biological performance of the barrier system ($175,000 annually). Provide funding for a reconnaissance level study of means to fully prevent the movement of all AIS life stages via the waterway ($1.5 million) and investigation and implementation of additional barrier options including acoustic-bubble barriers ($2 million).

The Champlain portion of the NYS Canal Systems – NYS Canal Corporation

One alternative for the Champlain portion of the New York state Canal System is limited hydrologic separation with overland transport of recreational vessels, and use of a graving dock or seasonal lockage restrictions for commercial vessels. A second alternative is use of electrical, bubble, sound, or strobe light barriers alone and in combinations. A feasibility study may be needed to determine the best course of action. Similar alternatives may be applicable to other segments of the NYS Canal System.

The Ohio Canals and Other Canals and Waterways – Local management agencies, USACE

Where these canals have fallen into disuse or disrepair they should be closed or at the very least not be improved unless spread all life stages of AIS can be prevented. Development of new cross-drainage basin connections should not be undertaken. Action should be taken to address intermittent flood-related connections between drainages. Dam removal projects on natural waterways should consider the potential for opening extended stream segments to AIS and their associated undesirable consequences.

Assessment, Monitoring, Early Detection and Rapid Response – USFWS, NOAA, USGS, GL states, canal management agencies

Canal and waterway authorities should develop and implement AIS monitoring plans within the next two years. The monitoring plans should be coordinated within a regional context to provide comprehensive monitoring and reporting of AIS. Outreach and education programs should engage the public in monitoring and reporting efforts. Rapid response plans for species of concern should be ready for implementation as the monitoring plans are placed into action.

Canals and Waterways Action Plan

I. Problem Statement – Appendix I
Canals facilitate the conveyance of bulk goods and commodities and inadvertently facilitate the spread of aquatic invasive species (AIS) within a watershed and allow cross-basin transfer of AIS between formerly independent watersheds. Prevention of AIS spread via canals may be one of the more tractable scenarios for AIS management. As constructed waterways, elimination of the canal could recreate the geographic barrier that once separated the Great Lakes from another drainage basin. However, current uses of canals for navigation, trade, and waste and storm water discharges will generate significant economic impacts if canal modification is considered. This action plan addresses the spread of AIS through man-made canals and improvements to waterways.

Once established AIS are difficult to manage and potentially impossible to eliminate. The Great Lakes Fishery Commission currently spends nearly $16 million annually in efforts to control lamprey reproduction. The sea lamprey control and management effort takes advantage of the anadromous portion of the sea lamprey lifecycle employing toxicants, traps, sterile male release and is investigating use of sex and migratory pheromones. Other AIS may not offer such an Achilles heel. Since its inception the sea lamprey control program has cost approximately $300 million. The sea lamprey control program is testament to the value of preventing introduction and establishment of new AIS in the Great Lakes.

Canals in the Great Lakes region (Figure 1) can and do facilitate the spread of AIS. The zebra mussel and round goby spread from the Great Lakes to the Mississippi River drainage via the Chicago Sanitary and Ship Canal (San-Ship Canal). Asian carps could access the Great Lakes via this same route. The Chicago San-Ship Canal and its five associated waterways, connects Lake Michigan to the Mississippi River drainage basin via the Des Plaines River. The Ohio and Erie and Miami and Erie canals connect Lake Erie with the Ohio River drainage basin. The New York State Canal System provides connections among lakes Erie, Ontario, Champlain and the Atlantic Ocean.

Four intrabasin connections facilitate AIS spread between the lakes. These canals lie entirely within or share boundaries with Canada. The Welland Canal which lies entirely within Canada bypasses Niagara Falls; the Soo Canal which connects Lake Superior with Lake Huron and two diversion canals the Long Lac and Ogoki canals which connect the Hudson Bay drainage to the Great Lakes. All these canals are used to varying degrees by commercial and/or recreational vessels, for storm and or waste water conveyance, as water supplies, or as cooling water for industrial processes or for power production. Options to address AIS spread via these canals should address and accommodate existing uses to the fullest extent possible.

We ranked the canals for priority of action as: 1) the Chicago Sanitary and Ship Canal and associated waterways, 2) the Ohio and Erie and Miami and Erie canals, 3) the New York State Canal System, 4) the other intrabasin canals. This ranking is based on the immediacy of threats to the Great Lakes, the current status and development of the interbasin connection, and the degree of commercial navigation activity. Appendix I provides more detailed descriptions of these canals and waterways, their current uses and potential to facilitate AIS spread.

II. Performance Based Goals (Table 1 provides greater detail with lead agencies)
Prevention – Includes introduction of new AIS to U.S. waters and the spread of AIS into new watersheds.

- Pass a comprehensive federal bill by the end of the 109th Congress that addresses aquatic invasive species prevention, including canals and waterways. If passage of such a bill is not possible, integrate reconnaissance and feasibility funding into an authorized study.
- Provide full federal funding for existing barrier operations including the Chicago dispersal barrier and sea lamprey barriers in FY 2006 and subsequent years.
- Implement and fully fund the recommendations from the 2003 Chicago AIS Summit in FY 2006 including a reconnaissance to fully prevent the movement of all AIS life stages between Lake Michigan and the Chicago Sanitary and Ship Canal.

- Prevent intermittent flood-related connections between the Great Lakes and other watersheds by 2010
- No improvement of existing open-channel connections between drainage basins should occur where canals have fallen into disuse or disrepair
- Prohibit development of new open-channel connections between drainage basins.
- Close non-commercial canals through use of physical barriers or control structures by 2010.
- Ballast water mediated spread of AIS via canals and waterways remains a concern.

Assessment, Monitoring, Early Detection and Rapid Response

- Develop and implement comprehensive AIS monitoring plans for vertebrates, invertebrates, macrophytes and plankton in Great Lakes canals and waterways by 2007.
- Develop AIS rapid response plans for the Chicago waterways, New York State Canal System and Ohio canals for species of concern by January 2007.
- Develop communication strategies that coordinate observations and sightings from the public.

Control and Management

- Prohibit the transgression of watersheds via canal connections by monitored AIS after June 2007.
- Fully fund and implement the recommendations of the USFWS Asian carp management plan by January 2006.
- Prohibit the use of non-native organisms with the potential to survive in the Great Lakes in aquaculture operations subject to flooding.

Outreach and Education

- Fund and implement angler, cultural and stakeholder education programs and prohibit release of non-native organisms in rivers, canals and associated waterways.
- Fund, design, and implement an "AIS consequences" education program for canal management agencies
- Develop outreach plans for the shipping industries that use canals and waterways.

Applied Research

- Priorities include refinement, testing, demonstration projects, economic analyses etc. associated with alternative approaches.
- Initiate a federally funded granting process for dispersal barrier monitoring, research & development at $3 million annually by FY 2008
- Investigate alternative means for cargo transportation between the GL and adjacent watersheds in the U.S.
- Explore technologies and/or procedures to address AIS spread in canals & waterways (including feeder canals, lock structures, etc.) during flood events.

Human health

- Investigate means to convey storm and waste water discharges via canals without spreading AIS.

III. Ongoing Efforts – Appendix II

Chicago Sanitary And Ship Canal

Authorized by NISA (1996) a U.S. Army Corps of Engineers electric dispersal barrier near Romeoville, Illinois has been operational since April 2002 (Attachment 1). A second longer-life electric barrier is under construction with completion expected June 2005. The eight Great Lakes states provided a 25% cost-share for the $9.1 million project. Federal and state agencies, universities and private entities have conducted monitoring and research associated with the Chicago canal project. Four agencies monitor for Asian carp in the canal. A rapid response approach for Asian carp has been identified. Acoustic barriers and pheromones are under investigation as prevention measures. Proceedings of a May 2003 Invasive Species Summit hosted by the FWS and City of Chicago provide recommendations and ideas to prevent movement of AIS via the Chicago waterways (Attachment 2).

Asian Carp

The Asian Carp Working Group of the ANS Task Force is drafting an integrated management and control plan for bighead, black, grass, and silver carps with completion of the plan targeted for May 2005. The USGS Columbia Environmental Research Center is examining alarm pheromones to prevent dispersal of Asian carp

through canals and waterways. The University of Minnesota is building on the CERC alarm pheromone work research. Sale of live Asian carps is prohibited in the Chicago metropolitan area and effective May, 2005 transportation of live Asian carps will be illegal in Illinois.

New York State Canal System

FWS: Since 1999, the Lower Great Lakes Fishery Resources Office (LGLFRO) has conducted surveys of the New York State Canal System for AIS fish, plants, benthic inverts, and plankton and conducts education and outreach in partnership with NY Sea Grant. The LGLFRO funded a study to identify dispersal barrier options for the Erie Canal; the final report is in draft form. The University of Vermont and Lake Champlain Sea Grant Researchers are currently investigating invasive species barrier options for the Champlain Canal. A private company has suggested development of a graving dock as a barge or ferry conveyance system in the Champlain Canal.

Ohio Canal System

Examination of the potential for AIS spread particularly Asian carps and means of prevention via the Ohio canals is in the most preliminary stages. Existing canal uses and plans for improvements and associated economic developments may conflict with AIS prevention goals particularly if those goals involve modification of canal operations. The connections between the Ohio canals and Lake Erie are not currently improved enough to allow boats to pass from the canal to the lake but could allow AIS to spread. Current focus is on Asian carp prevention and control strategy more in terms of rapid response than permanent protection and prevention measures.

NAISA (Proposed Reauthorization)

The National Aquatic Invasive Species Act reauthorizes and expands the existing Dispersal Barrier Program. This includes continued operation and maintenance by the Army Corps of the Chicago Barrier System and improvements and upgrades to Barrier I. NAISA also calls for a study on the full range of options to prevent spread of species through the Chicago Ship and Sanitary Canal and would reimburse the State of Illinois for funds expended on planning, design, construction, operation and maintenance of the Dispersal Barrier. NAISA would also fund a monitoring program to track AIS movement in Chicago area waterways, Lake Champlain Canal, and other waterways. This Act would fund efforts to assess the efficacy of dispersal barriers and other measures to prevent spread and identify waterways suitable for barrier demonstration projects as well as prevention and mitigation planning for Corps projects involving interbasin waterways and connections that could create pathways for the spread of aquatic invasive species. NAISA authorizes over $12 million in funding for the elements of the Dispersal Barrier Program.

WRDA (Proposed Reauthorization)

Language in WRDA (2006) would authorize funds for Corps of Engineers operation of Barrier II, an overhaul of Barrier I to make it permanent and a reconnaissance study of means to biologically separate Lake Michigan from the Chicago canal system.

IV. Alternative Approaches – Appendix III

Barriers that avoid impacts to navigation will be easier to implement but will likely be less effective on a wide array of species. Commercial navigation impacts result in higher transportation costs for products and materials. Rail and truck transport also involve increased environmental (pollution) and safety impacts and may lack the needed capacity. Recreational boaters could encounter delays at boat lifts. The environmental benefits of AIS prevention need to be balanced against these costs.

Physical Barriers

Dams or berms are attractive because there is no reliance on a behavioral response for effectiveness, they are less subject to failure due to power loss and likely involve lower costs to construct, operate and maintain. Physical barriers impede movement of vessels, and may interfere with storm or sanitary discharges causing adverse health and economic impacts. Boat lifts and marine railways can move recreational-size boats around physical barriers. Movement of barges and other large commercial vessels would require a more involved marine transport system. In most cases a combination of barrier will be needed to address various AIS forms and life stages.

Flow separation would in most cases involve some physical barrier or control structure to be placed on the waterway. Theoretically, treated effluent could be used to fill a lock at a highpoint in the system. Paired with other behavioral barriers this could prevent the passage of many AIS. This concept involves extensive engineering and has limited applicability.

Boat lifts
Boat lifts, marine railways and graving docks could be used to move vessels over a land portage.
At least two vendors build and sell boatlifts with capacities to 150 gross tons; one with a capacity of 1000 gross tons. A 100-ton marine travel lift costs $400,000.

Behavioral Barriers
Electricity, acoustics, bubbles, lights and strobe barriers rely on organism response for effectiveness. These barriers are not effective on planktonic organisms or plants, are subject to power failures and involve operating and maintenance costs. These systems could direct organisms into containment or capture areas from which they could periodically be removed. The first temporary barrier on the San-Ship Canal cost about $1.5 million; the new barrier currently under construction with an operational date of June 2005, cost $9.1 million. Cost of an acoustic-bubble barrier for the Des Plaines River near the San-Ship Canal was estimated to be $1.5 million.

Chemicals
Toxicants can be used as a response measure but have limited application for an ongoing barrier approach. Water quality regulations and cost contribute to the limited applicability of long term chemical use. Other concerns include effect on non-target organisms, containment of the toxic effects, mixing of the chemical in the water column and the need to detoxify the chemical.

Pheromones are species specific and offer few or no safety concerns. Pheromones may soon be used to augment sea lamprey current control efforts. Work on identification and extraction of Asian carp fright and attraction pheromones is underway. Pheromones could augment response and control measures.

De-oxygenation
Increasing the biological oxygen demand, heating the water or bubbling nitrogen into the water column can remove oxygen. Effective on fishes and macroinvertebrates, it would have no effect on plants or plankton. Using nitrogen to remove oxygen in the Chicago Sanitary and Ship Canal was estimated to cost $250,000 per day.

Hot water may deter some species. In addition to the thermal effect, elevated temperatures reduce the dissolved oxygen concentration in water. Heat may not affect plants or phytoplankton. Thermal discharges tend to rise to the water surface and involve extended downstream effects. The thermal plume may kill some organisms and deter others however tolerant species may still be able to survive long enough to pass through the thermal barrier. A dedicated, consistent heat production source would be required.

Containment and Capture
Capture of all individuals of a population as a prevention measure is unlikely given the limitations on capture methods and habitat variability. Containment and capture of planktonic organisms would be difficult unless all water in the canal or waterway was passed through some a treatment or control structure.

V. Recommended Actions – Appendix IV
Pass a comprehensive federal bill by the end of the 109th Congress that funds aquatic invasive species prevention, including canals and waterways, ballast water and other pathways. Dispersal barriers will likely be near term options of choice in the Chicago waterways, Lake Champlain Canal, other portions of the New York Canal System and potentially in the Ohio canals. Beginning October 1 2008 provide annual appropriations of $17.5 million including $10 million for dispersal barrier construction, $1million for barrier operations, and $500,000 for intensive monitoring of barrier performance. Administer the funds through the U.S. Army Corps of Engineers, USFWS, USEPA or other appropriate entity.

Funding is required to support research and outreach efforts associated with dispersal barrier development and implementation. Appropriate $5 million annually for Great Lakes AIS dispersal barrier applied research and outreach funded through NOAA. Outreach efforts should target canals users and managers.

AIS monitoring and assessment protocols need to be developed and implemented and rapid response plans must be developed and funded for application when the need arises. Provide $1 million for assessment, monitoring and rapid response planning in Great Lakes canals funded through NOAA. Provide an additional $2 million for implementation of rapid response efforts.

The Chicago Sanitary and Ship Canal – USACE, USEPA
The Chicago dispersal barrier project must receive full federal funding for construction ($9.1 million) and operation and maintenance ($500,000 annually) of Barrier II, improvement of Barrier I ($7 million plus operating and maintenance costs) and monitoring of the biological performance of the barrier system ($175,000 annually). Provide funding for a reconnaissance level study of means to fully prevent the movement of all AIS life stages via the waterway ($1.5 million) and investigation and implementation of additional barrier options including acoustic-bubble barriers ($2 million).

The Champlain portion of the NYS Canal Systems – NYS Canal Corporation
One alternative for the Champlain portion of the New York state Canal System is limited hydrologic separation with overland transport of recreational vessels, and use of a graving dock or seasonal lockage restrictions for commercial vessels. A second alternative is use of electrical, bubble, sound, or strobe light barriers alone and in combinations. Additional analysis is needed to determine the best course of action. Similar alternatives may be applicable to other segments of the NYS Canal System.

The Ohio Canals and Other Canals and Waterways – Local management agencies, USACE
Where these canals have fallen into disuse or disrepair they should be closed or at the very least not be improved unless spread all life stages of AIS can be prevented. Development of new cross-drainage basin connections should not be undertaken. Action should be taken to address intermittent flood-related connections between drainages. Dam removal projects on natural waterways should consider the potential for opening extended stream segments to AIS and their associated undesirable consequences.

Assessment, Monitoring, Early Detection and Rapid Response – USFWS, NOAA, USGS, GL states, canal management agencies
Canal and waterway authorities should develop and implement AIS monitoring plans within the next two years. The monitoring plans should be coordinated within a regional context to provide comprehensive monitoring and reporting of AIS. Outreach and education programs should engage the public in monitoring and reporting efforts. Rapid response plans for species of concern should be ready for implementation as the monitoring plans are placed into action.

Control and Management – GL states
Prevent the accidental and intentional release of non-native organisms that could threaten the ecosystem.

Human health – Canal management agencies, USEPA, USGS
Interruption of water drainage could threaten human health and safety through flooding and disease. AIS prevention efforts in canals and waterways must consider and address these issues.

Figure 1. Great Lakes Canals and Diversions

Appendix C

Table 1. List of lead entities and recommended due dates for recommended canals and waterways actions.

Action Category	Recommended Action	Recommended Due Date	Lead Entities
Prevention	Pass a comprehensive federal bill that addresses aquatic invasive species prevention, including canals and waterways. If passage of such a bill is not possible, integrate reconnaissance and feasibility funding into an authorized study.	109th Congress – First session	Congress
	Provide full federal funding for existing barrier operations including the Chicago dispersal barriers and sea lamprey barriers	109th Congress – Both sessions	Corps of Engineers (Need Congressional Authorization and Appropriation)
	Implement and fully fund the recommendations from the 2003 Chicago AIS Summit including a reconnaissance study of hydrologic separation of Lake Michigan from the Chicago Sanitary and Ship Canal	September 30, 2006	Corps of Engineers (Need Congressional Authorization and Appropriation)
	Implement efforts to prevent intermittent flood-related connections between the Great Lakes and other watersheds	September 30, 2010	Corps of Engineers, State of Illinois, City of Chicago, Great Lakes States
	Prohibit improvement of existing open-channel waterway connections between drainage basins	September 30, 2006	Congress, States
	Prohibit development of new open-channel connections between drainage basins.	September 30, 2006	Congress, States
	Close non-commercial canals through use of physical barriers or control structures	September 30, 2010	States, Corps of Engineers (Need Congressional Authorization and Appropriation)
Assessment, Monitoring, Early Detection, and Rapid Response	Develop and implement comprehensive AIS monitoring plans for vertebrates, invertebrates, macrophytes and plankton in Great Lakes canals and waterways	September 30, 2007	States, U.S. Fish and Wildlife Service, U.S. Geological Survey (Need Congressional Authorization and Appropriation)
	Develop AIS rapid response plans for the Chicago waterways, New York State Canal System and Ohio canals for species of concern	September 30, 2007	States of Illinois, New York, and Ohio, NOAA, USGS, GLFC.
	Develop communication strategies that coordinate observations and sightings from the public.	September 30, 2007	Great Lakes States, Great Lakes Sea Grants (Need appropriation)
Control and Management	Prohibit the transgression of watersheds via canal connections by monitored AIS.	September 30, 2007	Great Lakes States
	Fully fund and implement the recommendations in the National Management and Control Plan for Asian carp	September 30, 2006	U.S. Fish and Wildlife Service (Need Congressional Authorization and Appropriation)
	Prohibit the use of non-native organisms with the potential to survive in the Great Lakes in aquaculture operations subject to flooding.	September 30, 2007	Great Lakes States

Outreach and Education	Fund and implement angler, cultural and stakeholder education programs and prohibit release of non-native organisms in rivers, canals and associated waterways.	September 30, 2007	Great Lakes States, Sea Grant (Need appropriation)
	Fund, design, and implement an "AIS consequences" education program for canal management agencies	September 30, 2007	Great Lakes Sea Grant Network, Canal Management Agencies
	Develop outreach plans for the shipping industries that use canals and waterways.	September 30, 2007	Great Lakes Sea Grant Network, Shipping Industry
Applied Research	Conduct research to develop and test alternative barrier types and prevention approaches. Install those approaches to evaluate their effectiveness (i.e., demonstration projects). Conduct economic analyses to compare cost-effectiveness of various alternative approaches.	September 30, 2007	Corps of Engineers, U.S. Geological Survey, National Oceanographic and Atmospheric Administration
	Initiate a federally funded granting process for dispersal barrier effectiveness monitoring, research & development at $3 million annually	September 30, 2008	Corps of Engineers (need Congressional Authorization and Appropriation)
	Investigate alternative means for cargo transportation between the GL and adjacent watersheds in the U.S.	September 30, 2007	Great Lakes Commission, NOAA (need Congressional Authorization and Appropriation)
Human Health	Investigate means to convey storm and waste water discharges via canals without spreading AIS.	September 30, 2007	U.S. Environmental Protection Agency, Corps of Engineers, canal management agencies, National Oceanographic and Atmospheric Administration, U.S. Geological Survey

Canals and Waterways Action Plan
Appendix I - Problem Background

Interbasin Connections

Chicago Sanitary and Ship Canal

Water diversions have affected the Great Lakes Basin since the early 1800s. Two interbasin diversions connect the Great Lakes Basin with the Hudson Bay basin and a third connects the Great Lakes with the Mississippi River basin. Two intrabasin canals connect Lakes Erie and Ontario (Figure 1). The most well known of the diversions began in 1848, when the Illinois and Michigan Canal was completed which enabled mule-drawn barges to move between Lake Michigan and LaSalle, Illinois on the Illinois River. Water from Lake Michigan was pumped into that canal at an average of about 500 cubic feet per second (cfs) (Quinn 1999). In 1900, the Illinois & Michigan Canal was replaced by the larger and deeper Chicago Sanitary and Ship Canal. The diversion volume increased to a maximum of 10,000 cfs in 1928. The present average diversion of 3,200 cfs was established by U.S. Supreme Court decree in 1967.

The Chicago San-Ship Canal conveys storm and waste water away from Chicago and its source of drinking water, Lake Michigan. The Canal is also used by commercial navigation to move bulk commodities (grain, fuel, coal) and construction materials to and from the Chicago region. The Port of Chicago on the Calumet River receives and ships materials via Great Lakes and international freighters. Most materials offloaded in Calumet harbor are transferred to truck or rail for movement to other regions. Recreational vessels also utilize this waterway to gain access from the Great Lakes to the Mississippi River and vice versa. The Chicago Lock often ranks as the Nation's busiest due to the high volume of recreational and sight-seeing vessels locking through as many as 50,000 vessels annually.

The Port of Chicago is commonly known for its Great Lakes connection on Lake Michigan. Yet its position on the U.S. Inland Waterway System is a strong and vital part of its maritime activity. Chicago is connected to a 14,500 mile network of inland rivers which provide for the movement of cargo by barge. Chicago is connected to the Illinois River System at two points: the Chicago Ship and Sanitary Canal (Chicago River) at downtown Chicago; and at the Calumet River, 12 miles south of downtown. Both of these channels are barge-navigable and connect to the Illinois system which joins the Mississippi River just north of Alton, Illinois.

While there may be slowdowns during winter months, the U.S. Corps of Engineers operates the system of locks year-round for navigation. Both domestic and international cargoes move upbound and downbound between the coastlines and within the system. Major cargoes downbound include (from most to least): iron ore, iron steel including scrap; primary iron & steel products; sand, gravel & other aggregate; liquid products such as petroleum and petroleum products & chemicals; corn, coal & coke, and slag. Upbound cargoes include petroleum and petroleum products; aggregates such as sand & gravel; coal & coke; salt; and primary iron and steel products. In 2004, loaded barges transited the U.S. Army Corps of Engineers' lock at Lockport, Illinois accounting for over $17 million tons.

A standard river barge can accommodate 1,500 short tons. Covered hopper barges are used for grain, sand, paper, steel and other weather-sensitive cargoes. Open hopper barges carry coal and aggregate. Tank barges hold petroleum, molasses, chemicals, edible oils, liquefied gases and other liquid bulk cargoes. Deck barges carry heavy machinery. LASH (Lighter Aboard SHip) barges are smaller barges

that are lifted aboard a special LASH ship for ocean transit. When they arrive at their destination, the barges are used to distribute the cargo inland by river.

The Chicago San-Ship Canal also supports extensive intracanal activity as goods are moved between docks along from the Des Plaines River into Chicago to support the construction of buildings and infrastructure in the City. In 2002 the most recent year for which data is available, nearly 23,800,000 tons of cargo traversed the Chicago Sanitary and Ship Canal and the Cal-Sag Channel in over 24,000 vessels. Lockport is the first main terminal stop in Chicago's Cook County from the south and into Lemont. Tows from the south are broken down at Lemont to accommodate the narrower channels and tugs with lowering pilot houses are employed to accommodate the lower bridge clearances. However, the channels are maintained at barge-navigable depths. Tows are moved northward along the Chicago Ship Canal or diverge easterly to the Cal-Sag Channel which enters the Calumet River at the O'Brien Lock.

Many of the terminals along the Calumet River and in Lake Calumet are private terminals handling only product to maintain private operations. Such cargoes may be scrap steel, salt or cement. However, there are national and local public terminals along the entire reach which specialize in barge stevedoring and those which handle both ship and barge cargoes. Terminal operations are handled by both union and non-union labor. Many terminals specialize in certain commodities (such as dry bulk or steel) with varying amounts of warehouse space and must be contacted individually for rates.

The Port of Chicago is a year-round inland waterway port. Its location in the heart of America provides connection to ocean-going vessels through several Gulf of Mexico ports along the Inland Waterway System from Brownsville and Corpus Christi, Texas to St. Marks, Florida. It is almost a 1,500 mile trip from Chicago to New Orleans and it is becoming as common in the summer as winter to see steel being transported northward to Chicago by barge.

Other major riverport cities which can be reached through the Inland Waterway System include: Lousiville, Pittsburgh and Cincinnati (via the Ohio River); Minneapolis/St. Paul (straight up the Mississippi River); Omaha (via the Missouri River); Tulsa (on the Arkansas River); Nashville (via the Cumberland River); and Knoxville (on the Tennessee River). The Inland Waterway System also includes the Tennessee-Tombigbee Waterway, which enters the Gulf of Mexico at Mobile.

The Chicago San-Ship Canal is the primary conduit for AIS movement between the Mississippi River and the Great Lakes drainage basins. Isolation of Lake Michigan from the San-Ship Canal would provide the most effective means of preventing continued spread of AIS via this waterway. Separation would however involve significant impacts to navigation affecting the transportation of cargo and people between the Des Plaines River and Lake Michigan. Alteration of the storm and waste water discharge could raise health concerns for the City of Chicago.

The Chicago Waterway system is managed by several entities, each with responsibility for a different aspect of canal operations. The Metropolitan Water Reclamation District of Greater Chicago, the U.S. Army Corps of Engineers Chicago and Rock Island districts, and the Illinois Department of Natural Resources share authority over the canal.

Indiana Canals

There are two waterways that connect the Lake Michigan and the Mississippi River drainage basins: Burns Ditch and Indiana Harbor Canal. Burns Ditch provides access for recreational vessels and conveys storm water from areas near the Lake Michigan coast in Indiana. There is a connection

between Burns Ditch and the Little Calumet River which in turn forms a confluence with the Calumet River downstream from the O'Brian Lock and Dam about seven miles from Lake Michigan.

The Indiana Harbor Canal was created when the Grand Calumet River was dredged and straightened in the early 1900's. The canal connects Indiana Harbor with the Grand Calumet River and was originally built for navigation access. Today however, its sole purpose is to convey storm water from near coastal areas of Indiana and parts of Illinois.

Both the Little Calumet River and Grand Calumet River flow in two directions, both East and West, with the position of the flow split dependent upon rainfall. During times of high water such as after heavy rains, the flow divide shifts to the west, with these rivers and canals carrying water from western Indiana and eastern Illinois into lake Michigan. In times of lower flow, these canals carry storm and wastewater discharge from a point near the Indian-Illinois border in eastward to the discharge point on Lake Michigan.

At this time there are no flow control structures on the Little Calumet River, Grand Calumet River, Burns Ditch or the Indiana Harbor Canal that would prevent the cross-basin migration of AIS into or out of Lake Michigan. Water quality may be a deterrent to AIS spread via the Indiana Harbor Canal; however spawning salmon are known to pass through this canal.

Modification of these canals to prevent the spread of AIS could involve changes in the stormwater discharge regime and the volume of the Lake Michigan diversion. Accommodation of storm water flows in the relatively flat areas of northeastern Illinois and northwestern Indiana is a sensitive subject and will require extensive study prior to implementation of AIS control devices. Since the Indiana canals are connected to the Cal-Sag Channel, control of AIS spread in the Chicago waterways will address the spread of AIS in the Indiana canals. Maintenance of these canals is handled by the U.S. Army Corps of Engineers and the State of Indiana.

New York State Canal System

The major branch of the New York State Canal System known as the Erie Canal provides connection between Lake Erie and the tidal Hudson River. Other components of the NYS canal system include: 1) the Oswego, connecting the Erie Canal to Lake Ontario; 2) the Cayuga-Seneca which connects the Erie to the two largest Finger Lakes; and 3) the Champlain, connecting the Erie to southern Lake Champlain. Outside of NY, this system connects to the Chambly Canal in Quebec providing recreational vessel access between northern Lake Champlain and the St. Lawrence River at Sorel-Tracy. A map of the NYS system may be accessed at: http://www.canals.state.ny.us/maps/index.html

The total length of the NYS Canal System is 524 miles. At 338 miles, the Erie Canal is the longest segment. The Champlain Canal (60 miles) the Oswego Canal (24 miles) and the Cayuga-Seneca Canal (12 miles) comprise the remainder of the system. The locks on the NYS canal system can accommodate vessels up to 300 feet long and 43.5 feet wide. The channel depth ranges from 12 to 14 feet. The NYS Canal System is managed by the New York State Thruway Authority's Canal Corporation.

Ohio Canals

Two major canal systems were developed across Ohio to serve as commercial transportation routes linking Lake Erie and the Ohio River. The 308-mile Ohio & Erie (O&E) Canal was completed in 1832 and the 250-mile Miami & Erie (M&E) Canal was opened in 1845. Both were supported by a large complex of feeder reservoirs and canals.

Large sections of both the mainline and feeder canals remain intact. Coupled with rivers to which they still discharge, both create hydraulic connections between the Lake Erie and Ohio River watersheds. Further, large floods may create direct (albeit temporary) connections between canals and rivers at some locations.

Less than 20% of the original canal lands remain property of the State. These properties, along with associated operation and maintenance and authority for sales of water, are overseen by Ohio DNR's Division of Water.

Both the O&E and M&E are managed for commercial and recreational purposes. The Division of Water has contracts for municipal and industrial withdrawals of raw water in both systems. A variety of recreational facilities are operated along the canals by the National Park Service, ODNR Parks, municipal and county metroparks, and private interests. A section of the O&E has been designated a National Heritage Corridor, thus spurring interest in additional development there and at other Canal locations. The canals also are popular fishing destinations. To support the myriad uses, management of appropriate water levels and flow through the canals is a high priority for the Division of Water.

Impediments to movements such as large falls and hanging outflows make it unlikely that invasive species could move directly from the Lake Erie watershed to the Ohio River. While such obstacles exist in the opposite directions, they probably are not impassable barriers (especially under extreme flood conditions). Thus, our greatest concern is that Asian carp could navigate the systems and enter Lake Erie. While the likelihood of this occurring unaided is low in both canals, the O&E is a greater concern for passage. Recreational development and usage in these systems increases the likelihood of inadvertent transfer of AIS.

Intrabasin Connections

Hudson Bay Diversions

The two man-made connections that affect Great Lakes water levels are the Long Lac and Ogoki diversions. Since the early 1940s, the Long Lac and Ogoki diversions channeled water from the Hudson Bay Basin to the Great Lakes Basin. The Long Lac Diversion was originally constructed to carry logs south to Lake Superior, but it and the Ogoki Diversion both now support hydropower generation facilities. The annual discharge from these diversions ranges from 1,100 to 8,000 cfs, and average 5,000 cfs. These diversions are governed by an exchange of notes between the U.S. and Canada.

New York State Barge Canal

The New York State Barge Canal moves an average of 1,000 cfs from the upper Niagara River at Buffalo to Lake Ontario.

Welland Canal

The Welland Diversion and New York State Barge Canal are intrabasin diversions that transfer water from the Lake Erie to Lake Ontario. The Welland Diversion was reconstructed in 1882 to create the Welland Canal, and since 1900 the flow in that canal has averaged 8,500 cfs. The Welland Canal lies entirely in Canada and is there fore beyond the scope of this document; it is mentioned here only for reference.

St. Lawrence Seaway

The St. Lawrence Seaway allows large, ocean-going ships and recreational vessels to pass from the Atlantic coast to Lake Ontario. The Seaway is a significant corridor for cargo passing into and out of the Great Lakes region. In 2004 4,060 vessels transited the St. Lawrence Seaway and Welland Canals. The table below lists 2004 tonnage conveyed by these vessels through the combined Seaways: Montreal-Lake Ontario Section and Welland Canal Section (St. Lawrence Seaway Management Corporation, December 31, 2004).

Table I-1. Freight tonnage in the St. Lawrence Seaway in 2004 in thousands of tons.

Grain	9,200
Iron ore	10,200
Coal	4,100
Other bulk goods	15,000
General cargo	4,200
Containers	15
Total (inbound and outbound)	42,400

Reference

Quinn, F. H. 1999. Anthropogenic changes to Great Lakes water levels. Great Lakes Update 136.

Canals and Waterways Action Plan
Appendix II - Ongoing Efforts

U.S. Army Corps of Engineers/Federal, State, and local partners

Chicago Sanitary and Ship Canal

Section 1202 of the National Invasive Species Act of 1996 (NISA) authorized the Corps to "investigate and identify environmentally sound methods for preventing and reducing the dispersal of aquatic nuisance species between the Great Lakes-Saint Lawrence drainage and the Mississippi River drainage through the Chicago River Ship and Sanitary Canal, including any of those methods that could be incorporated into the operation or construction of the lock system of the Chicago River Ship and Sanitary Canal." The Corps was directed to report on 1) which of the methods that are identified under the study are most promising with respect to preventing and reducing the dispersal of aquatic nuisance species; and 2) ways to incorporate those methods into ongoing operations of the United States Army Corps of Engineers that are conducted at the Chicago River Ship and Sanitary Canal. NISA also authorized funding for the demonstration project, and Congress appropriated funds in subsequent years.

To carry out this directive, the Corps convened a Dispersal Barrier Advisory Panel consisting of federal, state, and local partners and stakeholders. Federal partners include USFWS, USEPA, and the U.S. Coast Guard. The panel considered a full range of options and finally recommended an electrical barrier in the Chicago Sanitary and Ship Canal as a dispersal barrier demonstration.

An electrical barrier was constructed and has been operational since 2002. This barrier is considered a demonstration project and, as such, has only a three to five-year projected lifespan. Upon the recommendation of the Dispersal Barrier Advisory Panel, the Corps used their Continuing Authorities Program Section 1135 to design a second electrical barrier approximately 1,000 feet downstream of the existing barrier and initiate a first phase of construction. This second barrier is designed to have a 20-year service life, with design improvements based on actual performance of the demonstration barrier. The first phase of construction was initiated in 2004. Additional federal funding was obtained in late

2004 to initiate the second phase of construction. The remaining non-Federal funding needed to initiate and complete the second phase of construction is anticipated in spring 2005. The second barrier is scheduled to be fully completed in FY 2005.

FWS/USEPA: Partially funded an on-going study of the movement of common carp across an electrical barrier in the Chicago Sanitary and Ship Canal to evaluate its potential effectiveness against Asian carp

FWS/Corps of Engineers and Others: Beginning in 1995, the FWS La Crosse Fishery Resource Office lead development of multi-agency annual sampling event to monitor the range expansion of round gobies in the Chicago Sanitary and Ship Canal – the Round Goby Round-up. That effort continues today including documentation of Asian carp ranges in the Upper Illinois and Des Plaines rivers.

FWS, Corps of Engineers, IL DNR and Metropolitan Water reclamation District of Greater Chicago: The FWS is cooperating with the Corps of Engineers, State of Illinois, and local partners in a monthly program of fish sampling in the Chicago Waterway System to monitor the movement of bighead and silver carp from the Mississippi and Illinois Rivers toward Lake Michigan. All partners are prepared to increase the frequency of monitoring if implementation of an Asian carp rapid response plan is warranted.

FWS/City of Chicago: The FWS and City of Chicago co-hosted an aquatic invasive species summit in 2003 to develop ideas for preventing the exchange of aquatic invasive species between the Great Lakes and Mississippi River basins through their canal connections in the Chicago metro area. More than 70 participants contributed their time and the results have been captured in a proceedings and a summary document. FWS and the City of Chicago are now working on distributing the document and promoting the recommendations from the summit in various venues.

USFWS/many federal/state/local partners

Asian carp integrated management and control plan

The Aquatic Nuisance Species Task Force (ANSTF), an intergovernmental entity established under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (Act, 16 U.S.C. 4701-4741), is responsible for coordination of national efforts to prevent the introduction and spread of invasive species such as Asian carp. The ANSTF is co-chaired by the U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration (NOAA). The ANSTF determined that Asian carp are nuisance species that warrant active control by resource management agencies, so the FWS was asked to form an Asian Carp Working Group (ACWG). The ACWG is drafting an integrated management and control plan for four species of Asian carp (bighead carp, black carp, grass carp, and silver carp). The plan will include a variety of control strategies and specific actions to be taken by federal, state, and local agencies and by the private sector to eradicate, limit the spread, prevent additional introductions, and reduce the impacts of the Asian carp existing population. In addition, the ACWG will identify applied research issues to fill any data that may exist in our ability to prevent and control Asian carp spread. Completion of the draft management plan is targeted for May 2005, with a final plan targeted for ANSTF approval by the ANSTF by May September 2006.

USGS/FWS: USGS is conducting a study at the Columbia Environmental Research Center (CERC), with Science Support Program Funding received from the FWS Region 3 allocation, to determine the potential of pheromones in Asian carp management. The objectives of the research include evaluating the efficacy of alarm pheromone as a repellant. An effective alarm pheromone could be used to prevention of dispersal of Asian carp through canals and waterways.

FWS: Region 3 is supporting research at the University of Minnesota to build on the alarm pheromone research being conducted at CERC. Researchers at the University and CERC are collaborating cover various aspects of pheromone research.

FWS: Lower Great Lakes Fishery Resources office has an on-going project on the New York State Canal System (including the Erie Canal, Oswego Canal, and Cayuga-Seneca Canal portions). This work has occurred since 1999 and includes various biological surveys of the canal system for aquatic invasive species (fish, plants, benthic inverts, and plankton) and education/outreach initiatives in partnership with NY Sea Grant. Fish surveys are currently conducted twice per year and a plant survey once per year. Education and outreach efforts include an Erie Canal Fact Sheet and brochure, workshops to train science educators about the canal system and its role as a vector in AIS spread, and both general and canal-specific outreach events.

FWS: In FY03, the LGLFRO initiated a Round Goby "Round-Up" in the Erie Canal to identify the eastward range expansion of gobies from Lake Erie into the Canal. This project utilizes both staff and angler volunteers to collect gobies. The volunteer angler portion is conducted as a one-day event in late summer, whereas staff surveys will be conducted more frequently. The goby roundup has also included stomach analyses to determine diet preferences. Staff also respond to angler reports of goby (and other AIS) catches in the Canal each year.

USFWS: The LGLFRO has also funded a study being undertaken by a consultant to identify dispersal barrier options that could be used in the Erie (?) canal. This research was started in 2003 and the report is now in the draft stage. It identifies potential locations for a barrier and discusses the major barrier options and their effectiveness and feasibility.

USFWS: The LGLFRO collaborated with New York State DEC and the New York Canal Corporation to initiate a recreational boater survey of those users of the Canal to identify their habits and knowledge about AIS. Surveys were received in FY04 and the final report is currently in the draft stage.

NISA 1996 (Existing Law)
Section 1202 of the National Invasive Species Act of 1996 authorized a Dispersal Barrier Demonstration Program that charged the Army Corps of Engineers, in consultation with the Aquatic Nuisance Species Task Force, to investigate and identify environmentally sound methods to prevent the dispersal of aquatic nuisance species between the Great Lakes and Mississippi River via the Chicago Ship and Sanitary Canal.

The Army Corps was also charged with reporting on promising methods and ways to incorporate those methods into ongoing Corps operations on the Canal.

The research program was authorized at $750,000.

Since then, construction has obviously begun on two barrier systems. Barrier one has since been operated by the Corps under this Demonstration Program authority. Construction on Barrier Two began in 2004 with funds from Section 1135 of the Water Resources Development Act.

NAISA (Proposed Reauthorization)
The National Aquatic Invasive Species Act reauthorizes and expands the existing Dispersal Barrier Program. Provisions of this bill would provide for:

- Continued operation and maintenance by the Army Corps of the Chicago Barrier System
- Improvements and upgrades to Barrier One (language in NAISA will likely be updated with WRDA language)
- A feasibility study on the full range of options to prevent spread of species through the Chicago Ship and Sanitary Canal
- Reimbursement of the State of Illinois for funds expended on planning, design, construction, operation and maintenance of the Dispersal Barrier
- A monitoring program to track the movement of aquatic invasive species through the Chicago Ship and Sanitary Canal, Lake Champlain Canal, and other waterways; assess the efficacy of dispersal barriers and other measures to prevent spread; and identify waterways suitable for barrier demonstration projects
- Prevention and mitigation planning for Corps projects involving interbasin waterways or other canals that could create pathways for the spread of aquatic invasive species
- Over $12 million in authorized funding for the elements of the Dispersal Barrier Program

WRDA (Proposed Reauthorization)
Language in WRDA (2006) would authorize funds for Corps of Engineers operation of Barrier II, an overhaul of Barrier I to make it permanent and a reconnaissance study of means to biologically separate Lake Michigan from the Chicago canal system.

State
University of Vermont, and Lake Champlain Sea Grant Researchers are currently investigating invasive species barrier options for the Champlain Canal, with funding from the National Sea Grant Office; project completion date 3/10/05. The research consists primarily of literature searches, with some survey and group process activities to develop socio-economic information. Six alternatives have been investigated:

Alternative One: No Action (i.e. no change in canal engineering or operations)
Alternative Two: Close the Champlain Canal
Alternative Three: physical/mechanical modification of canal and or locks. Modifications would consist of limited hydrologic separation with provisions for overland transport of recreational vessels, and use of graving dock or seasonal lockage restrictions for commercial vessels.
Alternative Four: Electrical, bubble, sound, or strobe light barriers (alone and in combinations)
Alternative Five: Chemical/Water Quality Barrier
Alternative Six: Biological Barrier

Alternatives three and four will be forwarded as the preferred alternatives.

[Workshop Note: New York State Canal System: A Pathway for Aquatic Nuisance Species. September 30, 1998. Workshop Proceedings July 1999. USFWS, Lower Great Lakes Fishery Resources Office, Northeast Exotic Species Program, 405 North French Road, Suite 120-A, Amherst, NY, 14228.]

Canals and Waterways Action Plan
Appendix III –Alternative Approaches

There are many possible approaches to create a barrier to fish passage via canals. Barriers that rely on a behavioral response form the organism may also be effective on macroinvertebrates (large crustaceans) but will have no or limited effect on microinvertebrates, macrophytes, and plant and animal plankton. Each behavioral barrier has limitations unique to that technology, also as a technological approach these are subject to catastrophic failure due to power outages, natural and man-made disasters.

Consider water, the medium in which aquatic invasive species live, if one removes the habitat the risk of spread diminishes to or near to zero. This is why physical barriers such as dams or berms are attractive. There is no

reliance on a behavioral response for effectiveness, they are less subject to failure due to power loss and likely involve lower cost to construct, operate and maintain. The problem with physical barriers is that they contradict the specific reason most canals were constructed – to move people and cargo via water instead of land. Further, where canals convey storm or sanitary discharges physical barrier may interrupt of interfere with the flow causing adverse health and economic impacts.

There are means available such as boat lifts and marine railways to move boats around physical barriers. Large forklifts can move recreational vessels around or over physical impediments. Marine rail systems move vessels overland and boat lifts likewise can move a vessel over a land bridge. These systems are more applicable to non-commercial vessels. Movement of barges and other commercial vessels would require a more involved marine transport system.

Boat lifts to move vessels around a physical barrier. Electric, acoustic, bubble barriers; all these are effective on fish and possibly macroinvertebrates (crayfish) but have limited or no effect on planktonic life forms. An ideal approach would separate the Great Lakes from cross-basin connections and re-establish the geographic barriers to AIS with minimal impact on current canal uses. In most cases a combination of barrier will be needed to address various AIS forms and life stages. Though effective, permanent weirs or berms may only be a consideration if existing traffic is minimal and primarily recreational and can be moved across the obstacle by some means. This sort of physical separation or closure is likely impractical for large commercial canals.

Boat lifts (i.e. Marine Travellift®)
At least two vendors build and sell boatlifts. Boat lifts up to 150 gross tons capacity are in common use in many marinas and could conceivably be used to move recreational vessels around canal barriers. At least two vendors build and sell boatlifts with capacities to 150 gross tons – one of these vendors produces lifts with a capacity of 1000 tons. The 100-ton marine travel lift costs $400,000. Additional costs include operation, maintenance, and insurance against vessel damage during boat transport.

Marine Railways
Marine railways offer a second solution to this same dilemma. Two marine railways exist on the Trent-Severn Canal, which connects Lake Ontario to Georgian Bay/Lake Huron. The first railway has been in operation since 1917, when it was hastily constructed in lieu of locks as WWI imposed cost/time constraints to completion of a lock system. "Boats, floated on to the partially submerged car, are cradled by a variety of slings. A unique double track uses an offsetting cam principle to keep the carriage nearly level at all times, save for a slight tilt to facilitate loading and offloading." (quote source below). A larger railway was installed immediately adjacent to the first in 1977 during canal upgrades. "Although replacing the marine railway with a conventional lock would have been simpler, the land portage over the 17.7 meter height of land was necessary to prevent the possible migration of the parasitic sea lamprey into the Lake Simcoe fishery." (see: http://collections.ic.gc.ca/waterway/ov_eng_i/bigchute.htm). Marine railways also continue to exist in old shipyards (Shelburne, VT; Greenport, NY) and may have broader application as boat transportation devices around invasive species barriers. Vessels transiting the Trent-Severn Lockage are charged per foot length of vessel. Some examples are: single lock and return – $0.85; single day – $1.50; transit one-way – $4.25; six-day – $4.60 and seasonal – $8.10. Construction costs of marine railways are unknown; as with boat hoists, additional costs would include operations, maintenance, and insurance against vessel damage.

Graving Docks
Other technologies originally conceived at marine construction/maintenance sites may offer a third option for passage of commercial vessels. Graving (or dry) docks are really locks that could be added to enable commercial transits sans AIS. Historically, dry docks are used for hull maintenance or major repairs. This same technology could (in theory), be used to block movement of AIS. As above, this concept involves extensive engineering and would be limited to those canals where commercial transits are rare (and acceptably slow) events. Graving or "dry" docks have been suggested by Lake Champlain Transportation Company engineers as one solution for commercial vessels enroute to Lake Champlain. This technology would only be acceptable for atypical delivery schedules (i.e. new vessel delivery, work barge transits, etc.). As with other vessel servicing operations, canal management agencies would likely incur insurance costs associated with potential vessel damage during dry dock AIS "sanitizing" operations.

Seasonal Lockage Restrictions

Lockage of commercial vessels during cold weather only might also be implemented to manage AIS risk. Operating locks during seasons when AIS are less active or planktonic life stages are not present could reduce the risk of AIS spread during locking activities.

Electric Barriers

This approach was implemented as the recommended barrier for the Chicago Sanitary and Ship Canal. Electric barriers are effective on fish or other organisms that can perceive and retreat from the discomfort of the electric pulse and are able to swim against the flow of water. Organisms such as fish or mussel larvae and plankton that are too small to swim against the current will simply be pushed through the barrier field. The electric barrier has no effect on plants or phytoplankton.

Electric barriers have no effect on vessel navigation equipment but do involve safety concerns for people in the water. A person in the energized field would be unable to control their muscles to swim; therefore people operating boats near an electric fish barrier should wear PFDs. Electrical arcing has been observed between barges on a single tow on the Chicago Canal. For this reason the U.S. Coast Guard requires tows to be assembled with steel cable to ground the entire vessel.

Electric barriers are subject to power failures hence requiring back-up power systems. Equipment failures may also occasionally occur resulting in loss of protection. The first temporary barrier on the San-Ship Canal cost about $1.5 million; the new barrier currently under construction with an operational date of June 2005, cost $9.1 million.

Acoustic Barriers

Acoustic barriers have been proven effective on schooling species and where the fish can be guided to an alternative are for movement. Experience with their use as a “fence” across a canal or river is limited. Acoustic barriers are attractive in that they offer no safety concerns, can target one kind of species over another, potentially allowing native species to pass while turning away target species. Acoustic barriers combined with bubbles are being examined for use on the Chicago San-Ship Canal for bighead and silver carps. Audiograms for these two species of carp have been developed which will allow for focused application of the frequency to be more effective on the target organisms. Construction cost for an acoustic-bubble barrier for the Des Plaines River near the San-Ship Canal was estimated to be $1.5 million.

Merely projecting sound into the water can have mixed success. The projected sound may not disperse evenly through the water column or across a canal. Fish can become acclimated to a single frequency ro tone so the frequency my have to change periodically to avoid this effect. Multiple projectors will be required to develop adequate intensity or frequency ranges throughout the protected area. Acoustic barriers do require periodic maintenance of the speakers or projector arrays. Service cycles and canal uses need to be considered.

Visual barriers

Lights, strobes and bubbles barrier rely on behavioral response for effect and will be most effective on fish. Fish can become acclimated to bubbles and other visual cues. Combining bubbles with acoustic barriers has shown promise for use as a fence in canals with Asian carps. Lights and strobes may not be effective in turbid water. Bubble screens may be deflected by strong currents or discharges such as below a lock.

Pheromones

Use of fright pheromones is highly attractive as this could be species specific, offer few or no safety concerns and no impacts to navigation or other existing canal uses. Pheromones have been isolated from sea lampreys and offer and exciting opportunity to augment sea lamprey current control efforts. Introduction of a pheromone (hormone) to the environment has to be proven safe and effective. Fright pheromones may not occur in all species and rely on a behavioral response. Other environmental cues may result in a “confused” message affecting the effect of the response to the pheromone. Work on identification and extraction of a fright pheromone in Asian carp is underway, however this work takes time. If the pheromone is isolated, it will have to be proven as effective and safe for use in canals and waterways.

Heat

Where available waste heat from power plants may be considered to create a hostile environment in a section of canal, allowing the receiving waters to reach an elevated temperature will reduce the dissolved oxygen concentration making it inhospitable for many organisms. Thermal barriers may not affect plants or phytoplankton. Creating a consistent high temperature zone may be difficult, particularly in temperate regions. Thermal discharges will tend to rise t the top of the water column and will likely involve extended downstream effects. The thermal plume may be warm enough to kill some organisms and deter others however tolerant species may still be able to survive long enough to pass through the thermal barrier.

A dedicated power plant or heat producing discharge would also be required. Intermittent heat production from a power plant operating on electrical demand would not create the consistent environment required for a barrier. A dedicated power production facility to operate electrical or other barriers or a boa by-ass system could augment an integrated barrier approach.

De-oxygenation

Removing oxygen from the water column is possible using heat as mentioned above or by bubbling nitrogen into the water column. Removing oxygen from the water would deter fishes and may affect macroinvertebrates but would have no effect on plants or animal or plant plankton. Bubbling nitrogen into the water column can be expensive depending on the volume of water to be treated. Using nitrogen to remove oxygen in the Chicago Sanitary and Ship Canal was estimated to cost $250,000 per day.

Toxicants

Toxicants can be used as a response measure but have limited application for an ongoing barrier approach. Water quality regulations and sheer cost contribute to the limited applicability of long term chemical use. Seasonal or short term application of chemicals can be effective. In sea lamprey control for example, streams are treated in the fall when larval sea lamprey emerge from burrows to begin the parasitic stage of their life cycle. The toxin is relatively specific for lampreys with minor effects on most bony fishes but some effect on other cartilaginous fishes including sturgeon. Over its fifty-year history the sea lamprey control program has cost approximately $300 million dollars with a current annual cost of $15.9 million.

Though Eurasian ruffe are sensitive to the lamprey toxin TFM, species specific toxins do not exist for most other fish. Application of piscicides in canals or waterways offers many challenges including containment of the toxic effects, thorough and even mixing of the chemical in the water column and the potential need to detoxify the chemical at a downstream location.

Physical Barriers

Dams, weirs and other water control structures can effectively deter upstream movement of AIS. Many species are incapable of jumping over even low dams or weirs. Asian carp however, renown for their leaping ability would have little problem getting past a 15-inch high lamprey barrier. A more significant dam, weir or berm would be required to stop Asian carps. Physical barriers that stopped water flow or resulted in a treated water connection could effectively stop the spread of most AIS including plant and animal plankton. Physical barriers do not rely on a behavioral response of the organism to be effective and could have lesser reliance on technology than acoustic or electric barriers therefore may be less prone to catastrophic failure in the event of power loss.

Physical barriers have the obvious consequence however of interrupting water movement and so may interfere with storm and wastewater discharges and would certainly create the need for a boat lift, marine railway or other means of transporting vessels past the barrier. In commercial waterways movement of cargo would be affected, possibly requiring use of alternative means of cargo movement such as rail or truck. Alternatively means of moving large vessels could be examined; however the vessels themselves could carry organisms in residual hull water or on the hull surfaces.

Containment and Capture

Containment and capture is perhaps more of a response option than a barrier. Potentially a guiding barrier could be used to direct fish or other responding organisms into containment or capture areas from which they could periodically be removed. Capture of all individuals of a population as a prevention measure is unlikely given the

limitations on capture methods and habitat variability. Containment and capture of planktonic organisms would be difficult unless all water in the canal or waterway was passed through some sort of treatment or control structure.

Drainage Basin Separation

Separation of drainage basins would in most cases involve some physical barrier or control structure to be placed on the waterway. The concept involves prevention the mixing of waters from the Great Lakes and a canal or transbasin waterway. Theoretically this sort of separation could allow commercial and recreational vessels to pass through an area of treated waters or some sort of lock combined with other barrier approaches that could prevent the passage of AIS. The lock could be located at the high point in a system forming a flow divide; discharge from the lock would flow towards the lake or to the waterway depending on which gate was open. This concept would require extensive engineering and if possible may only be applicable in limited situations.

Costs Associated with Approaches

Known costs for possible approaches are listed above. Additional costs associated with the approaches involve impacts to recreational and commercial navigation. Impacts to commercial navigation may impart higher transportation costs for products and raw materials. Alternative modes of transportation involve secondary environmental and safety impacts such as vehicular and rail accidents and pollution. Recreational boaters could encounter delays if their boat must be lifted from one side of a barrier to another. Further, the environmental benefit of preventing AIS spread must be weighed against the benefits of dam removal for native species rehabilitation.

Impacts to Commercial Navigation

Barriers that avoid impacts to navigation will be easier to implement but are likely to be less effective on a wide array of species, particularly non-fish species. Significant alteration or interruption of navigation on commercial canals and waterways would significantly affect commercial navigation and transportation of bulk goods and cargoes. For example, in 2004 4,060 vessels transited the St. Lawrence Seaway and Welland Canals. The table below lists tonnage conveyed by these vessels that year through the combined Seaways (Montreal-Lake Ontario Section and Welland Canal Section): Source: St. Lawrence Seaway Management Corporation, December 31, 2004

Table IV-1. Freight tonnage in the St. Lawrence Seaway in 2004 in thousands of tons.

Grain	9,200
Iron ore	10,200
Coal	4,100
Other bulk goods	15,000
General cargo	4,200
Containers	15
Total (inbound and outbound)	42,400

Shifting of this cargo to truck would in many cases be prohibitively expensive requiring thousands of trucks to haul the same volume of material. For instance, based on the Great Lakes Commission modal shift study (1993) moving 42.4 million tons of cargo in trucks would require would require approximately 1,927,273 trucks. To move this cargo by rail would require the use of about 424,000 100-ton rail cars. Obviously both rail and truck would involve higher transportation costs as well as increased environmental and safety impacts. These higher costs of shipment need to be balanced against the environmental benefits of AIS prevention.

Ships coming into Port of Chicago transfer the bulk of their cargo to rail or truck rather than onto barges. Few barges in the San-Ship Canal move from the canal onto and across Lake Michigan, with most of the barge traffic performing intracanal operations. In 2002 the most recent year for which data is available, nearly 23,800,000 tons of cargo traversed the Chicago Sanitary and Ship Canal and the Cal-Sag Channel in over 24,000 vessels.

Avoiding adverse impacts to commercial navigation was one of the underlying tenets of the original Chicago San-Ship Canal barrier project. Achieving biological separation of the lake and rivers in the Chicago area without impacts to navigation stands as a major challenge to full prevention of AIS movements through the

waterways. The location of the existing electric barrier would likely be unsuitable for an approach that could affect vessel movement. Locating a basin separation closer to the lake would allow barges to continue to operate within the canal system requiring transfer of materials around a barrier of some sort to the Port of Chicago or Chicago Harbor.

Recreational users of canals will be likely to voice opposition to canal closure unless they can be guaranteed relatively easy and free or inexpensive passage over the proposed barrier. Provided passage over a barrier offers no greater delay or safety risk than lockage, recreational boaters may be willing to accept the inconvenience in order to protect the resource.

Benefits Associated with Approaches

The ecosystem benefits associated with any of the proposed approaches are associated with continued long-term sustainable use of existing resources. This includes expenditures on recreational activities as well as the value of commercial exploitation of Great Lakes fishes. Great Lakes sport and commercial fisheries are valued at more than $4.5 billion annually, provide recreation to 5 million anglers annually, and support 75,000 jobs.

Additional benefits lay in the long-term protection of the Great Lakes ecosystem, avoidance of expensive, long-term control efforts as for example is involved with control of the sea lamprey and prevention of infrastructure impacts as for example is involved with water intake structures and zebra mussels. Species-specific approaches, though desirable from the aspect of collateral ecosystem impacts, require extensive research and costly long-term, ongoing control efforts. Prevention avoids the need to ongoing control and management of AIS populations and impacts.

The annual cost of the sea lamprey control program in the Great Lakes exceeds $15.9 million. The cumulative cost of sea lamprey control on the Great Lakes since 1950 equals nearly $300 million. This figure does not include the millions spent on research or the costs associated with restoration of lake trout in the upper Great Lakes.

Expenditures by New York and Vermont anglers who targeted Lake Champlain trout and Atlantic landlocked salmon were valued at $37,398,827 and $24,501,250, respectively, in 1997 (Gilbert, 2000). These expenditure data and the threat posed to trout and salmon restoration were key justifications for adoption of the *Long Term Program of Sea Lamprey Control in Lake Champlain*. The estimated annual cost of current sea lamprey management is $612,000 per year (Final Sea Lamprey EIS, Mgmt Cooperative, 2001).

Output impacts of current boating expenditures (trip plus marina non-trip related) on Lake Champlain region were $5,215,731 (direct), $1,389,669 (indirect), $1,727,657 (induced), and $8,333,056 (total) in 2003. Data for NY portion of GL are $86,883,115 (direct), $28,490,955 (indirect), $32,351,971 (induced), and $147,726,042 (total) (Connelly et al., New York Sea Grant, 2004). The direction or the degree that these impacts will change with continued invasions of AIS is unknown. However, a "significant" number of boaters in this survey listed "increased pollution control (air, noise, weeds) as important. This suggests a very strong connection between boating activity levels, and water quality/AIS issues.

Feasibility Associated with Approaches

Barriers (electric or acoustic) for fish are commercially available and in many cases the most applicable to existing canal operations with minimal interference. Short of canal closure, combinations of barrier methodologies will likely be required for greatest effectiveness. Preventing the spread of planktonic organisms remains the greatest challenge to AIS spread via canals and waterways. To date, no barrier exists that effectively removes or kills phyto- and zooplankton from water without affecting traditional or existing canal uses. For this reason, biological separation of the Great Lakes from nearby geographically distinct watersheds remains the surest means of preventing AIS spread to and from the Great Lakes.

Where possible, transportation over or around a physical barrier seems the surest way to prevent the range expansion of AIS via canals. For recreational vessels and perhaps smaller commercial vessels, lifts, marine railways and or temporary graving docks may prove most feasible. Unloading and movement of cargo in land-based transport modes is potentially feasible, but expensive and carries with it increased air pollution and safety impacts. Theoretically, large vessels could be locked through a high-point lock filled with treated sanitary, storm

or other water. The lock would discharge the treated water in either direction rather than moving up- or downstream water with the ship. Much like the locks in the Panama Canal, this lockage system is possible but presents many as yet unaddressed challenges.

References
U.S. Fish and Wildlife Service and Lake Champlain Fish and Wildlife Management Cooperative. 2001. Final supplemental environmental impact statement; a long-term program of sea lamprey control in Lake Champlain. 358 pp.

Gilbert, A. 2000. Lake Champlain Angler Survey 1997. Restoration and Enhancement of Salmonid Fisheries in Lake Champlain. Federal Aid in Sport Fish Restoration Grant Number: F-23-R. Vermont Fish and Wildlife Department. 87 pp.

Connelly, Nancy A., T.L. Brown, and D.L. Kay. 2004. Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts. New York Sea Grant, SUNY at Stony Brook Stony Brook, NY

Canals and Waterways Action Plan
Appendix IV – Recommended Actions

Pass a comprehensive federal bill by the end of the 109th Congress that funds aquatic invasive species prevention, including canals and waterways. The bill must address ballast water and other modes of introduction as well as pathways for spread.

A major obstacle in AIS prevention in canals and waterways is funding. Funding for the Chicago dispersal barrier has been obtained through special appropriations, extensions of NISA 1996, external grant funding from federal and non-federal sources. This process significantly slowed construction and reduced the magnitude of Barrier I and places long term operation of Barrier II in limbo. Likewise, monitoring of the Chicago barrier project has been funded by a variety of granting agencies and other state and federal partners. Dedicated funds for monitoring of the barrier project are essential to the efficient operation of the Chicago project and for development and application of dispersal barriers in other locations.

Dispersal barriers will likely be near term options of choice in the Lake Champlain Canal, other portions of the New York Canal System and potentially in the Ohio canals. Beginning October 1 2008 provide an annual appropriation of $17.5 million including $10 million for dispersal barrier construction, $1million for barrier operations, and $500,000 for intensive monitoring of barrier performance. These funds would be administered through the U.S. Army Corps of Engineers or other appropriate entity.

Outreach
$5 million for Great Lakes AIS dispersal barrier research and outreach funded through NOAA

AIS Monitoring and Assessment and Rapid Response
$1 million for assessment, monitoring and rapid response in Great Lakes canals funded through NOAA

The Chicago Sanitary and Ship Canal
The Chicago dispersal barrier project must receive full federal funding for construction ($9.1 million) and operation ($250,000) of Barrier II, improvement of Barrier I ($7 million) and monitoring of the biological performance of the barrier system ($175,000). The Chicago dispersal barrier project provides AIS protection for the Great Lakes as well as the Mississippi River drainage basins thus benefiting over half the Nation. Barrier II is expected to become operational in June 2006, funding for its operation will be needed this year and in subsequent years. Additional funding should be provided to implement the recommendations from the May 2003 Chicago AIS Summit to prevent AIS spread via the Chicago waterway system (Attachment 2). These included a reconnaissance level study of means to fully prevent the movement of all AIS life stages via the waterway, closure of cross-waterway connections with the Des Plaines and I&M Canal and investigation and implementation of additional barrier options including acoustic-bubble barriers.

The Champlain portion of the NYS Canal Systems

Two alternatives have been identified for the Champlain portion of the New York State Canal System. These include physical/mechanical modification of canal and or locks. Modifications would consist of limited hydrologic separation with provisions for overland transport of recreational vessels, and use of graving dock or seasonal lockage restrictions for commercial vessels. The second alternative is use of electrical, bubble, sound, or strobe light barriers alone and in combinations. Additional analysis is needed to determine which alternative is best. Actions to address AIS movement in main stem (Erie/Barge) of the NYS Canal System have not been investigated, though these same alternatives may be applicable to all segments of the NYS Canal System. The New York State Canal Corporation would likely be the responsible agency for these actions possibly with the U.S. Army Corps of Engineers as a federal partner.

The Ohio Canals and Other Canals and Waterways

Open-channel connections (canals) between drainage basins offer a means for AIS range expansion. Where these canals have fallen into disuse or disrepair they should be closed or at the very least not be improved unless all life stages of AIS can be prevented from using them to expand their range. Development of new cross-drainage basin connections should not be undertaken. Action should be taken to address intermittent flood-related connections between drainages. Dam removal projects on natural waterways should consider the potential for opening extended stream segments to AIS and their associated undesirable consequences. Responsibility for these actions will likely fall to the U.S. Army Corps of Engineers, canal management agencies or state agencies.

Assessment, Monitoring, Early Detection and Rapid Response

Federal appropriations in the amount of $10 million are needed to support development and implementation of AIS monitoring plans for vertebrates, invertebrates, macrophytes and plankton. Authorities responsible for canal operation and waterway maintenance or management (U.S. Army Corps of Engineers, local management agencies) should work with state natural resource agencies, the USFWS and USEPA to facilitate planning and implementation of the monitoring plans. Monitoring plans should be developed in a regional context to provide comprehensive monitoring and reporting of AIS. These plans should be put into practice at the earliest possible time, preferably in the next two years. The USGS and NOAA should receive necessary funding to support behavioral and life history studies. The Great Lakes Sea Grant Network should be provided $5 million through NOAA to develop and implement outreach and education programs that complement the monitoring plans to involve and engage the public to assist in reporting as often only a handful of agency personnel are asked to cover large geographic areas.

These same authorities should develop rapid response plans to accompany the monitoring plans for species of concern within their region. The response plans should be ready for implementation as the monitoring plans are placed into action. The cost for rapid response actions can be very high; a standing fund must be established that provides a 75% federal match to non-federal funds for implementation of rapid response actions.

Control and Management

The USFWS expects to complete the Asian carp management plan in 2005. Recommendation within that plan should be receive full federal funding for implementation as recommended.

Though canals and waterways offer a means of spread for AIS, intentional introduction and accidental release of non-native organisms is a pathway that must be addressed at the state and federal levels. Flooding of waterways allows aquatic organisms in aquaculture operations the means to spread quickly from the source of introduction into an open system. Operations that use non-native organisms must ensure that these species cannot escape into the wild under flood conditions. The Great Lakes state agencies should be lead in these efforts.

Intermittent flood-related connections between waterways or drainage basins should be examined for their potential to allow or facilitate AIS spread. Action should be taken by appropriate canal management agencies to redirect or contain flood waters where these connections occur and may allow AIS spread.

Outreach and Education

Outreach and public education remains a powerful and important tool in the prevention and control of AIS introduction and spread. Fund and strengthen existing angler, cultural and stakeholder education programs and implement new initiatives where necessary to prohibit release of non-native organisms in rivers, canals and associated waterways. Lead agencies would include the Great Lakes Sea Grant Network, and canal and waterway management agencies.

Canal and waterway management agencies may not be fully aware of the potential for the systems under their control to spread AIS. These agency decision makers require information on species of concern, known and potential impacts, mechanisms of spread and means for AIS management and control. These goals can be accomplished through a coordinated AIS education program for canal management agencies. Such a program should be included in the USFWS Asian carp management plan that could draw upon and tie together existing educational and outreach resources and programs. Information on non-Asian carp species could be disseminated by the same means. Similar outreach initiatives should be developed for canal and waterway users, both commercial and recreational so that they too can become part of the solution and monitoring system for AIS spread in waterways and canals.

Applied Research

Where canal closure is not an option, dispersal barriers may remain a primary means for controlling AIS spread. Priorities for applied research include needs for refinement, testing, demonstration projects and economic analyses of dispersal barrier alternatives. Currently no dedicated source of funding exists for this work; the majority of support has come from competitive grant applications within broad AIS investigative areas. Providing $3 million annually in dedicated federal funding will facilitate development of dispersal barrier alternatives for application in canals and waterways to prevent AIS range expansion. The funds could be handled through the USEPA, NOAA or other granting agency.

The modal shift study conducted by the Great Lakes Commission (GLC) in 1993 investigated the potential for alternative modes of cargo shipment in the Great Lakes region. The study examined the physical capacity and environmental impacts of shifting ship-transported cargo to rail or truck. The study did not however, include in the analysis the impacts of AIS delivered via ballast in ocean-going vessels. The GLC is currently revising the 1993 study however the new work also does not include AIS impacts in the cost analyses. Impacts of AIS on the Great Lakes economy and ecosystem must be included to equitably assess the environmental benefits and impacts of modal shifts in the Great Lakes region. The GLC and NOAA should coordinate in this effort.

Based on current technology, few if any alternatives exist that will prevent the passage of all AIS life stages in and open waterway and still allow the unencumbered movement of vessels. Until that technology is identified and developed, other options for movement of vessels or cargo separate from water merit consideration. These options include boat lifts, marine railways and possibly graving docks to remove the vessel from the contaminated medium, move it over or around an obstacle or land bridge and float it in water on the far side of the AIS barrier.

Human health

Canals and waterways are used to convey storm and wastewater. Interruption of these actions could threaten human health and safety through flooding and disease. Canal and waterway modifications to prevent spread of AIS will have to consider and address these issues. Downstream passage of planktonic organisms offers the greatest challenge for AIS prevention in waterways and canals. Organisms that can react to behavioral stimuli can be deterred from moving through an area of discomfort created by a barrier. Planktonic organisms will have difficulty moving upstream without some facilitation associated with watercraft or bait bucket transfer. Lead agencies include NOAA, USGS, USEPA, U.S. Army Corps of Engineers and local canal management agencies.

Canals and Waterways Action Plan
Attachment 1

Aquatic Nuisance Species Dispersal Barrier Demonstration Study:
Dispersal Barrier I in the Chicago Sanitary and Ship Canal

- Funding through May 2004: $3,857,365 federal; $576,648 non-federal
- The electric barrier provides protection from invasive fish spread for 32 states and Ontario
- During 35 months of operation only one tagged fish has crossed the electric barrier
- The demonstration barrier needs immediate improvement and should form part of a two-barrier system
- A second, electric barrier with a 20-year design life to stop the interbasin transfer of invasive fish is under construction
- Federal funding should be provided to appropriate federal and state agencies to operate, maintain and improve the dispersal barriers

Introduction

Background and Funding History

In the National Invasive Species Act of 1996 (NISA), Congress authorized the U.S. Army Corps of Engineers (USACE) to initiate a dispersal barrier demonstration study in the Chicago Sanitary and Ship Canal ("Canal" hereafter). Shortly after receiving authorization for the project, USACE Chicago District assembled a multiagency Dispersal Barrier Advisory Panel ("Panel" hereafter) comprised of Canal stakeholders; there are currently over 50 participants on the Panel. To date Congress has provided the U.S. Army Corps of Engineers with just over $2.9 million for the project. In addition, more than a dozen public and private entities have contributed funding for the barrier project.

Federal Agencies	Contribution	Non-Federal Entities	Contribution
USACE	$2,907,931	Illinois DNR	$189,833
USEPA	$575,434	Great Lakes Fishery Commission	$138,455
USFWS	$205,000	Great Lakes Protection Fund	$79,000
National Sea Grant	$101,000	Illinois International Port Authority	$75,000
International Joint Commission	$40,000	Metropolitan Water Reclamation District of Greater Chicago	$58,699
USGS-BRD	$28,000	University of Illinois	$20,039
		Illinois Natural History Survey	$8,000
		City of Chicago	$8,000
Total	**$3,857,365**	**Total**	**$576,648**

The Electric Barrier

Panel members agreed that in the near term the dispersal barrier should avoid interference with existing uses of the Canal. After careful review of biological, chemical and physical approaches for possible near-term prevention strategies, the Panel recommended that a series of two electric barriers be constructed in the Canal. Severe budget limitations caused significant changes in the project scope including construction of a single electric barrier, omission of a back-up generator and use of steel cables instead of railroad rails for electrodes which reduced the life of the project from 20 to three years. These project modifications compromised the integrity of the design recommended by the

Advisory Panel. The first electric barrier became operational on April 18, 2002. The barrier is located on the Canal near Romeoville, Illinois, approximately 30 miles downstream from Lake Michigan.

Monitoring Results

Results of a comprehensive field monitoring program and laboratory trials have shown that the electric barrier repels large fish with a high degree of success. During the course of the project, 118 common carp with surgically implanted radio tags have been released below the barrier. Today, 117 of these fish remain below the barrier. One crossed the barrier in April 2003, apparently in conjunction with the passage of a barge. No other tagged fish have passed through the barrier since that incident.

Research at an Illinois Department of Natural Resources fish hatchery has shown that the existing electric barrier (Barrier I) may not repel small fish when they are high in the water column. A field effects study confirmed barges affect the integrity of the electric field. A second barrier (Barrier II) currently in construction will ensure that the barrier will repel small fish and prevent fish from moving through the barrier in conjunction with passage of a barge. Construction of Barrier II is expected to be completed during the summer of 2005. Barrier I is expected to wear out beginning about April 2005.

Electric Barrier is a First Step

The electric barrier is a good first step toward creating a dispersal barrier for fish, but it falls short of stopping all species and is not the final answer even for fish. In the near term, the greatest likelihood of success against multiple fish species and different sizes of fish will be produced by a combination of electricity and other barrier technologies. The next most readily available technology is an acoustic bubble array. This technology could augment and complement the electric array currently in place.

Asian Carp Next Concern

Presently, the species of greatest concern are bighead and silver Asian carp. These large-bodied, plankton-eating fish have become the most abundant species in many parts of the Illinois and Mississippi rivers. The Great Lakes Fishery Commission has stated that Asian carp have the potential to disrupt the Great Lakes food web and thus threaten the $4.7 billion sport and commercial fisheries of the Great Lakes. Asian carp have been captured only 22 miles below Barrier I. Laboratory research has shown these fish, when small (<5 inches), can pass through the existing electric barrier but are more effectively deterred by the acoustic bubble array.

Monthly monitoring has not yet detected Asian carp near the barrier, but these fish have the ability to travel as far as 50 miles per month. This underscores the immediate need for Barrier II and additional barrier technologies. If these fish reach the Canal before the second barrier is constructed, they could get past the existing barrier. An Asian carp emergency rapid response plan has been drafted and is awaiting approval by the director of the Illinois Department of Natural Resources. The response plan depends on the operation of Barrier I. If Barrier I fails before Barrier II is operational, these fish will be able to advance unimpeded to Lake Michigan and from there to the other Great Lakes.

The Future

Stopping *All* Aquatic Invasive Species

Even with a series of barrier technologies, the risk of failure remains as long as we rely on animal behavior for success. Near-term approaches will likely only affect organisms that swim. The long-term objective must be to prevent *all* aquatic invasive species at all life stages from spreading through the Canal. Additional barrier approaches will be required for nonswimming, planktonic species. Ultimately canal modification or closure may have to be considered.

Hydrologic Separation of Lake and Canal

Participants in a May 2003 Aquatic Invasive Species Summit hosted in Chicago by Mayor Daley and the U.S. Fish and Wildlife Service, identified complete hydrologic separation of the Great Lakes and the Mississippi River basins as the most effective long-term solution for preventing the interbasin transfer of aquatic invasive species. Hydrologic separation of the Canal and Lake Michigan would be an enormous undertaking involving significant modifications to the current operations of the Canal. Storm and sanitary discharges would still need to be conveyed away from Lake Michigan. Freight and bulk material distribution centers might be modified so that Great Lakes vessels and Canal vessels used different loading docks or new locks would have to be designed that would prevent the exchange of water between the Canal and Lake Michigan.

Need for Federal Funding

Given the binational scope and magnitude of the invasive species problem and the documented and potential effects on regional economies, federal authorization and funding is needed for additional near-term approaches and to investigate the feasibility of long-term solutions such as modification or closure of the canal. Appropriate federal or state agencies should receive authorization and funding to operate *and* improve Barrier I and for design, construction and operation of Barrier II.

The State of Illinois has provided the matching funds required under the Army Corps of Engineers 1135 program to construct Barrier II. Actions taken at this single location in Illinois have the potential to benefit 31 other states in both the Great Lakes and Mississippi River drainage basins. It is in the federal interest to operate and maintain the full array of the aquatic nuisance species dispersal barriers in the Canal. Federal funding could be provided through amendments to the National Aquatic Invasive Species Act (NAISA) or other new legislation for the feasibility study and additional short- and long-term solutions. The existing language in NAISA provides for additional funding for and a longer service life of the barrier project. As of the writing of this report, Congress had not yet passed this critical piece of legislation.

Document “Closing the Revolving Door, Summary of the Aquatic Invasive Species Summit Proceedings” of May 14-15, 2003, Chicago Illinois, inserted here. Available from the City of Chicago

Appendix D: Maritime Commerce Drafting Team Report

Maritime Commerce Vector Drafting Team Report

1. Problem Statement

Transoceanic maritime commerce is the leading vector for the unintentional introduction of non-native aquatic invasive species (NAIS) into the Great Lakes/St. Lawrence Seaway System (GLSLSS), and globally. Intra-basin shipping within the system is a ready vector for subsequent NAIS spread. Organisms in various life stages become entrained in ballast water (BW), and/or adhere to ship hulls, anchor chains and sea chests. As ships move about the globe, the organisms are transferred to new ecosystems where they may propagate and ultimately overwhelm the native species or destroy habitat. Commercial ballast operations are the known or suspected source of about 65% of the established NAIS reported in the GL between 1959, when the modern GLSLSS began operation, and 2001. The number of likely BW introductions reported is increasing over time. Costs from zebra mussels alone are estimated at $500 million per year, and growing.

Governments and the international shipping industry began to act on this problem in late 1980s, after the lakes had been invaded by several ship-mediated species, particularly the zebra mussel. In 1989, a voluntary open-ocean ballast water exchange program for the Great Lakes was initiated by Canada, followed by mandatory exchange requirements initiated by the U.S. in 1993. The USCG is responsible for verification and enforcement of the U.S. BWE requirements. On-vessel ballast treatment technologies have been explored for many years, but development of effective technologies has not yet occurred. More recently (2001), the U.S. and Canadian Seaway Agencies instituted a "Code of Best Management Practices" for all vessels entering the Great Lakes. Despite these and other actions, new AIS attributed to maritime commerce continue to be reported in the GLSLSS at an alarming and unacceptable rate. In response to the lack of effective federal regulations, many GL states are either considering, or have enacted, preventative ballast water regulations within their waters.

There are several possible actions governments could now take to better address the problem. All come with a price tag, some higher than others. However, costs of solving the problem will prevent far more expensive environmental damage from continued invasions, control costs, and direct losses to the fishing industry (commercial, tribal, and sport). A regional response coordinated among the various levels of government participating in this collaboration process will be most effective and efficient for both the maritime industry and the environment.

2. Performance Based Goals with Prioritization

2.1. Prevention of New Introductions– All vessels entering the GLSLSS implement effective prevention requirements including ballast treatment, hull management, and other measures as may be determined necessary, enforceable and practicable, such that there are no more ship-mediated releases of NAIS into the GLSLSS.

2.2. Early Detection and Rapid Response – Statistically valid sampling of GLSLSS harbors, connecting channels and ships, including a system for vouchering, identifying and reporting suspected NAIS from ships, and an effective and adequately funded rapid response strategy, to prevent NAIS establishment and dispersal about the basin.

2.3. Assessment and Monitoring--Consistent and continuous assessment of 1) inoculation pressure from ships, 2) populations of NAIS, and 3) rates of NAIS introduction and spread.

2.4. Control and Management – Containment of NAIS spread by ships (salty and laker) of any populations of NAIS not eradicated through rapid response.

2.5. Outreach and Education -- All facets of the industry supporting maritime commerce in the Great Lakes, including ports, carriers, shippers, mariners, resource users and users of goods produced from cargoes

transported to and from the Great Lakes by ships are aware of the risk and costs of importations of NAIS by ships and the urgency and cost-effectiveness of preventing/containing them, the status of prevention, and what is needed to advance it.

2.6 Applied Research -- Productive collaborative and competitive research aimed at delivering effective prevention methods, monitoring protocols, and rapid response procedures specifically suited to Seaway-sized bulk cargo and tanker vessels which frequent the GLSLSS.

2.7 Human health -- No pathogenic NAIS are discharged into the GLSLS from ships.

3. Ongoing Efforts

3.1 International: The International Maritime Organization (IMO) recently developed a treaty that would govern BW discharge by ships in international trade globally. The treaty estimates a discharge level for viable organisms in BW that is environmentally protective, and sets deadlines for compliance. Three years prior to the deadline, the IMO will review the practicability of the standard in light of available technology. Existing Seaway-sized ships would have to comply in 2014 at the earliest. The agreement allows more stringent domestic measures. The U.S. and Canada are considering ratification of the agreement.

3.2 Federal: USCG regulations promulgated in 1994 require BW management on ships entering U.S. waters of the GL after operating outside the Exclusive Economic Zone of both the US and Canada. Regulators currently examine all ballasted vessels entering the GL for compliance with operating, record-keeping and reporting requirements. Congress later expanded the mandatory program nationwide. The USCG is developing BW discharge standards. A national *Ballast Water Technology Demonstration Program (implemented by NOAA)* funds research and development of ballast treatments. The program received $3.5 million in FY 05. Legislation to reauthorize the maritime commerce-related provisions of NISA has been pending since 2002, which could alter or codify the provisions of the IMO convention and the Coast Guard program. **Canada** has voluntary guidelines for ships. The statutory authority to replace the Canadian guidelines by regulations has been provided through an amendment to the *Canada Shipping Act* that came into force in October 1998. Bill C-14 expands these authorities in the *Canada Shipping Act, 2001.* Transport Canada intends to incorporate the requirements of the IMO Convention in regulations under the *Canada Shipping Act 2001,* in the year 2006.

3.3 Regional: *The Great Lakes Panel on Aquatic Nuisance Species* was established by Congress in 1990 to identify priority issues for the binational Great Lakes region regarding all NAIS vectors. The panel comprises government (state, provincial, federal, tribal), business and industry, universities, citizen environmental groups and user groups. In 2003, consensus-based recommendations were developed to advance NAIS prevention and control. *The Great Lakes NOBOB Assessment Program* assessed the biological conditions in NOBOB tanks and to better understand and document the effectiveness and limitations associated with BWE. The Final Report of this program was released in April 2005. A *GL Ballast Technology Demonstration Program* (GLBTPD) is researching and demonstrating technologies potentially applicable to GL ships. As an outgrowth of the GLBTDP, an industry collaborative is launching a *Great Ships Initi*ative to facilitate industry support for development of effective and efficient prevention methods by ships visiting the Great Lakes from overseas.

3.4. State laws – Several Great Lakes states have introduced, and Michigan has enacted legislation to regulate ballast operations of ships. These bills cite the need for states action in light of slow response at the federal level.

3.5 Litigation – In March 2005, a federal court ordered EPA to rescind its exemption of BW discharges from permit requirements of the Clean Water Act. New York attorney general has filed petitions with the U.S. Coast Guard contesting its approach to implementing NISA requirements.

4. Possible Actions

The objectives are to stop maritime introductions of new NAIS into the GL, and the spreading of AIS already introduced. Possible actions, which are not mutually exclusive, include:

4.1. Current Approach: Without new action by state or federal governments, controls on the maritime vector will likely follow the scope and schedule of the IMO framework, pending implementing legislation (S.363), and federal programs described above. This approach could eventually stop BW-caused NAIS introductions (if applied to salties and coastwise shipping) and spread (if applied to lakers) and does not interrupt shipping patterns. The USCG's existing NISA authority to require treatment instead of BWE is debatable. Research is underway on treatment systems that must meet challenging design constraints. The current approach has not provided timely protection from BW, so some states have started to regulate, or are considering regulation, on their own.

4.2. Cargo Transfer: Construct a facility to transfer cargo from salties to lakers at a choke point into the GL. This would ensure that only freshwater taken from the Great Lakes is discharged into the Great Lakes, greatly decreasing the likelihood of new BW introductions of NAIS. Costs include land acquisition, construction and operation of the transfer facility, retrofitting or replacing laker fleets, extra cargo handling, and significant delays to shipping schedules. At this time, there is not enough information to determine the extent to which existing shipping patterns would be altered. Possible alterations could be significant and include shifts in cargo transportation modes to train or truck, and the relocation of receiving industry to saltwater coasts. While offering greater protection to the Great Lakes, this regional approach would not stop the spread of NAIS already in the GL, and risks transferring the NAIS problem to another location, likely the SLS. This approach would require a design analysis and detailed cost study before it could be pursued. It would certainly require new legislation and Canadian agreement. Given existing information, the required agreement of Canada is doubtful.

4.3. Shore-Based BW Treatment/Recycling Facilities: Develop land-based or barge-based BW Treatment/Recycling facilities (1) at a choke point to the GL, and/or (2) at selected ports. Options include using these facilities as an alternative, emergency back-up, or in addition to ship-based treatment. Would likely require salties to install a standardized BW discharge manifold to allow the pump-out/flushing/refilling of BW tanks at such facilities. Costs include construction of land- or barge-based facility, operating costs by governmental entities; and modifications to vessels. Recycling BW, where feasible, could allow operation with zero BW discharge. Barge-based facilities could adjust capacity as needed. Delays are likely if treatments occur at a single choke point facility, which suggests the use of multiple port-based facilities so that cargo loading/unloading and BW transfers could happen together, avoiding the cost of an extra stop. This approach would require design analysis and detailed cost study before it could be pursued. The USCG's existing NISA authority to require ships to install BW pump-out piping and couplings is debatable.

4.4 NOBOB Residuals Management: Require actions of all ships with BW tanks that enter the GL in the unballasted condition ("No-Ballast-On-Board" ships, or NOBOBs) to flush residuals in the open ocean, strip them at ports of origin, clean them out of their tanks on a regular maintenance schedule, or otherwise manage them to reduce their risk to the GL. Benefits include the immediate incremental improvement in prevention of NAIS introductions. Costs of the flushing option include time of the crew, a possible decrease in cargo capacity to off-set the flushing BW, and enforcement, but no new water treatment equipment on the ships or ashore. This may not be immediately feasible for all ship designs or all levels of crew ability. Stripping would likely require installation of auxiliary stripper pumps (i.e. educators, already available) and pipes. Enforcement and verification represent a technical hurdle that will have to be addressed if these requirements are to be implemented as regulations.

4.5. Require Best Performing Ship-Board Treatment Immediately, with Upward Ratcheting Until Fully Protective: Develop a biologically protective BW discharge standard for salties and coastwise trade ships entering the GL that will apply when technology becomes available, with an immediate requirement to implement best performing ship-board treatment. As treatment technology improves, requirements will be

tightened until the standard is met, but ships will be permitted to use approved treatment systems they install and effectively operate for a guaranteed period. It is possible that the best performing treatment currently available already exceeds the effectiveness of BWE. Improved BWE practices, such as more thorough purges of ballasted tanks (empty-refill if feasible, or more BW tank volumes exchanged), and routine tank and hull maintenance measures to remove NAIS should be investigated, developed and required. Costs include treatment installation on each ship and upgrading these installations after the approval period, but probably not more than once per ship. They also include monitoring and enforcement. New statutory authority may be necessary. Immediate improvements in prevention are expected as soon as something better than BWE is approved and required. Early experience with shipboard treatment also should expedite the development of technology that can meet biologically protective standards. This approach also substantially enhances capacity to attenuate the spread of NAIS through forcing development and implementation of shipboard treatments that could be applicable to lakers.

4.6. Accountability: Establish clear protocols and require added infrastructure necessary to assure careful and comprehensive information gathering on NAIS that may be associated with specific ships. Require all ship with BW tanks in the GLSLSS to have tamper-proof meters that automatically document the volumes, salinity, time and GPS location of BW taken on or discharged anywhere; require regular, standardized NAIS inspections of hulls and other ship infrastructure; and require regular submittal of the data to the USCG. The data would aid education and training of mariners, efficient enforcement by regulators, and the investigation of AIS infestation sources by researchers. Prompt implementation is quite feasible: monitoring technology is readily available, and the USCG has clear NISA authority to adopt implementing regulations without awaiting new AIS legislation.

4.7. Require Ship-Board Treatment that Meets Environmentally Protective Standard Before GLSLSS Entry by an Early Date Certain.

Develop a biologically protective BW discharge standard for salties and coastwise ships entering the GLSLSS that will apply at date certain. Ships that are unable to meet the standards must use an alternate but equally effective method, such as those described in Sections 4.1 - 4.6, or they will be denied entry. Benefits include forcing the development of ship-board treatment within a reasonable time frame, which will dramatically reduce the risk of new NAIS and subsequent economic/environmental damage. Costs included treatment installation on each ship, monitoring, and enforcement, or the costs associated with the alternatives listed above. If it results in the rapid development of effective treatment by ships, this approach would also improve capacity for attenuating spread of NAIS by laker ships.

5. Recommended Actions

This group urges the collaboration to support federal legislative proposals to reauthorize NISA that would advance the recommendations below. Requirements that are national in scope will deliver the greatest protections for the GL, but regional efforts should move ahead irrespective of national deliberations**.** Both national and regional efforts should be well coordinated with Canada and its provinces. Specific recommendations include:

Ship-Board Treatment: The group considers treatment to include all methods of risk reduction used on board ships in both the ballasted and unballasted condition, including technology and management practices. By consensus, this group recommends that policies be undertaken which will deliver effective ship-board treatments/management measures that will eliminate ship-mediated introductions and spread of NAIS. Back-up approaches such as those described in Section 4.2 (cargo-transfer) and 4.3 (shore-based treatment), should be studied, however, so long as that study does not detract from the pursuit of the primary recommendations.

Best Performing Treatment Now: The group recommends achieving the above goal through the approach outlined in Action 4.5, i.e., the immediate requirement of:

a) methods that can be implemented by the 2007 shipping season and which have a reasonable prospect of improving the effectiveness of BWE by ships visiting the GLSLSS in the NOBOB condition, such as those outlined in Section 4.4 (NOBOB residual management), and

b) vetted and approved "best performing" ship-board technology, with upward ratcheting (given a set approval period) to achieve biologically protective ship-board treatment.

The same approach should be used for hull and other ship infrastructure treatments as ballast water. In addition, though initially limited to management practices, this approach should be applied to lakers to address the spread NAIS already introduced into the GLSLSS.

A minority of the group held that there should also be a deadline certain after which ships must treat to the environmentally protective level (see dissenting opinion attached and 4.7 above).

By consensus, the group does not favor the Current Approach, Action 4.1., because it is limited to BW as opposed to the whole ship, and contains deadlines that are both soft and distant, meanwhile relying upon BWE as the only treatment method.

Accountability: By consensus, we recommend Action 4.6, i.e., that the USCG initiate proceedings to promulgate regulations under NISA mandating increased monitoring and reporting of ballasting activities, prevention practices and outcomes, without awaiting the end of the Collaboration, so they apply the 2007 shipping season.

Other Ship-mediated NAIS management priorities – By consensus, the group recommends funding for other maritime vector management priorities (early detection, rapid response, monitoring, assessment, control, management, outreach, communication and research,) if it does not divert funds from the other recommendations, above.

Appendix E: Organisms in Trade Drafting Team Report

Organisms In Trade
Aquatic Invasive Species Strategy Team
Great Lakes Regional Collaboration
April 20, 2005 draft

Problem Statement

Importation, interstate commerce and trade are among the most dangerous pathways for introduction of invasive species in the Great Lakes ecosystem. Most federal and state approaches to reducing and eliminating the release of aquatic invasive species from pathways involving trade and commerce are reactive instead of precautionary and preventative. A lack of political will to curb the trade of destructive invasive species, a lack of sufficient resources to complete the cumbersome process to list species as injurious, and the lack of an effective screening process to evaluate proposed importations have created a trade regime that leaves the waters of the United States extremely vulnerable. Moreover, introduced invasive species often do not reveal themselves as such immediately and this lag time presents resource managers with unaffordable, if any, effective control options.

The trade of live organisms is vibrant. According to the U.S. Fish & Wildlife Service, in 2002, no fewer than 223 million fish were imported into the United States, in addition to 47,000 mammals; 379,000 birds; 2,000,000 reptiles; and 49,000,000 amphibians. This is a significant volume of organisms, yet serious problems and many loopholes in the trade regime exist. For instance:

- Regulations concerning the trade and transportation of live aquatic organisms occurs at all levels of government. These federal, state, and local programs addressing the trade of live organisms have evolved without coordination and are often reactionary.
- Currently, there is only one person at the U.S. Fish and Wildlife Service tasked with evaluating potentially injurious wildlife species (implementing the Lacey Act), despite a backlog of hundreds of species of potential concern.
- A very small number of species are listed under the Lacey Act as "injurious" (thus prohibiting live interstate transportation of those species). The Lacey Act listing often does not include many species that have been banned in most states.
- While the Fish and Wildlife Service has the authority to put forth emergency regulations concerning problematic species, it has instead operated through a cumbersome notice-and-comment process, thus delaying or stopping regulations while at the same time encouraging importers to race to get species in trade before a ban might occur.
- Although 223 million live fish were imported in 2002, there are only 97 inspectors that work at 32 ports where fish or wildlife are imported.
- Federal and state law enforcement officers are stretched thin, making it virtually impossible for proactive enforcement to occur. For example, while almost all of the baitfish used in the Great Lakes region is imported, law enforcement officers are unable to go beyond a few spot checks. Moreover, penalties for violations are inadequate, with penalties mostly considered misdemeanor infractions and fines too small (averaging around $100 and rarely exceeding $5000 for large aquaculture operations) to make a difference.[1]
- Most requirements for licenses to sell live fish lack substance. There are few requirements for licenses other than a payment of a fee and a documentation of sales.
- Hobby fish associated with the aquarium pet trade are mostly exempted from protective laws.

The response to the impending invasion of the Great Lakes by two species of Asian carp-the silver and bighead carps-provides a stark example of just how broken the current regime is. The potentially injurious Asian carp were imported into the southern United States to keep aquaculture facilities clean and to serve the food fish

industry. The species escaped into the Mississippi River after massive floods in the 1980s and early 1990s. By 1997, the species had become established, abundant, and destructive in the Illinois River system; they have since been migrating northward at a steady pace. Even with the U.S. Army Corps of Engineers spending millions of dollars since the late 1990s to construct dispersal barriers to keep the species out of the Great Lakes, millions of live Asian carp were, until 2005, being transported into the basin for sale at fish markets. While states were forced to take a piecemeal approach to regulating a species with almost no commercial or sport value, the carps remain unlisted as "injurious" under the Lacey Act, a simple action that would prohibit interstate transportation. Clearly, the regulations governing the importation, transportation, and sale of live aquatic organisms are severely flawed. Steps must be taken immediately to address these critical problems.

Enforcement: Four problems characterize weaknesses in enforcing laws to reduce or eliminate introduction of organisms into the Great Lakes from trade pathways: a) limited resources to police, inspect and levy fines and to educate and train enforcement staff; b) real limits in authority of state and federal laws; c) fines that are too low to deter violations; and d) lack of or limited political will to exercise authority under existing and federal laws.

Pathways Considered: For the purposes of this section, pathways involving commerce and trade include the following priorities:[2]

- Recreational (bait, hobby fish, plants and invertebrates in water gardens and backyard ponds)
- Aquaculture
- Food (live seafood and fish, including packing material)
- Cultural practices

For the most part, the greatest risk of invasive species being released into the Great Lakes comes from trade involving live organisms and thus, the recommendations in this document apply to live organisms. We note, however, that unintended and potentially injurious species may be imported in packing material or as pathogens associated with dead species in trade for food or other uses. The recommendations in this report apply to organisms being imported into the US, as well as species that may be native to other parts of the US, but potentially harmful to the Great Lakes ecosystem.

Strategic Framework Summary

Priority recommendation – The U.S., in cooperation with state and tribal governments and supported by provincial governments, should adopt legislation and rules implementing regulations to control importation, sale and interstate trade of species based on a screening process that places species proposed for trade into one of three categories:

- Permitted for importation and interstate commerce,
- Conditionally permitted and/or provisionally prohibited pending further information, or
- Prohibited for importation and interstate commerce.

Legislation to establish the screening process, classification lists, and rules restricting trade should include a policy goal that agencies must use a precautionary/preventative approach in order to reduce and eliminate risks. In the implementation of the screening process, prospective importers should be allowed to petition to have a species added to the white list. However, all species should be presumed to be potentially invasive and thus, prohibited until proven safe. The burden of proof to present documentation to meet science-based criteria for screening should be on the importer or introducer.

In developing a screening approach and rules to regulate species following screening, the system can and should be developed in such a way as to prevent potential conflict with international trade agreements. It is noted that other countries, including Australia and New Zealand, are using similar screening and listing processes and have not been challenged under trade laws. Several steps can be taken to avoid potential conflicts with international trade agreements, including ensuring uniform application to all species and businesses; developing objective,

scientifically-based information requirements to be met by importers; providing funding and requiring a professionally administered screening process that reduces delays in reviewing proposed importations; and reviewing existing international guidelines, criteria, as well as other countries' screening processes for consistency.

Interim Steps: Ideally, swift and timely federal action would establish the needed federal screening process. However, because federal action in the 109th Congress may not be forthcoming, implementation should be pursued simultaneously on the bi-national, federal, and state levels, and by industry. Federal lawmakers should immediately amend the Lacey Act or adopt new legislation to implement a screening process and create white, gray and black lists and regulations to restrict the trade of species on the lists.

State and provincial action in the interim is necessary due to the difficulty in obtaining rapid federal action. Great Lakes states and provinces should immediately adopt black lists of species that are prohibited for sale within their borders, to serve as a moratorium until federal screening and lists are established. Furthermore, even assuming enactment of new federal law(s), federal agencies will need time to promulgate implementing rules and regulations. As in the past, action by the states may spur federal action. Regional institutions can assist the states by providing model legislation and creating a uniform list of species of concern in the Great Lakes.

Core funding for educational programs should be provided to federal and state agencies because this vector will never be completely closed - the growing need for education will track the expansion of global commerce. Working through responsible partners in industry, ongoing consumer education will minimize AIS risk. Incentives should be provided to industry to implement AIS prevention training programs for industry personnel. Training should be provided to federal and state agencies involved in trade.

Performance Based Goals, Objectives, Actions and Resources Needed

The overall goal is to eliminate the intentional and unintentional introduction of live, non-native/non-naturalized aquatic organisms that may become established and cause harm to humans, the economy, or the environment in the Great Lakes.

1. Goal: By December 2005, Federal, State, Tribal and Provincial partners in the GLRC should affirm a commitment to reduce and eliminate the risk of unintentional and intentional releases of live non-native aquatic organisms that have the capability of becoming established and cause harm to humans, the economy, or the environment in the Great Lakes basin. In affirming this commitment as part of the final terms of the Great Lakes Regional Collaboration Action Plan, jurisdictions should commit to a precautionary approach in developing and implementing legislation, regulations and programs regarding future proposed importations and commerce involving non-native/non-naturalized aquatic organisms.

Actions needed to achieve goal #1:

- By 2005, Federal, State, Tribal and Provincial governments should affirm commitment by signing GLRC Action Plan.
- Starting in 2005, Federal, State, Tribal and Provincial governments should enact laws, regulations and programs to reduce and eliminate future introductions of live invasive species via pathways involving commerce and trade.

2. Goal: By 2006, the federal government should establish a federal list of species of concern for the Great Lakes basin ecosystem, and each of the states should impose a moratorium on the importation and trade of those species. If the federal governments fail to develop a federal screening process in a timely manner, states should be encouraged to expand their lists and screening processes to include species that are permitted, permitted conditionally/provisionally, or prohibited for sale and trade.

Actions needed to achieve goal #2:

- The federal government, in consultation with state, tribal, and provincial governments, should ask the Great Lakes Panel on Aquatic Nuisance Species to produce a list of species that have a high likelihood of becoming invasive in the Great Lakes basin.
- An institution with legal expertise (such the Environmental Law and Policy Center, or the Environmental Law Institute) should provide a model law to assist states and encourage consistency.
- Great Lakes states should enact laws to prohibit sales and shipment of species listed on the moratorium list. This prohibition should remain in effect until a process to screen and fully evaluate risks is implemented.

Interim steps for goal #2: The Great Lakes Panel on Aquatic Nuisance Species has produced Model Guidance for Great Lakes Jurisdictions on AIS (1999). This should be reviewed, updated and strengthened. Existing and proposed laws in Minnesota (Chapter 84D "Harmful Exotic Species"), Florida and Michigan may provide good models.

3. Goal: By 2006, Federal, State, Tribal and Provincial authorities should collaborate to collect, share and make available to the public information on invasive species in trade, create networks to improve effectiveness and implementation, and to coordinate budgetary planning.

Actions needed to achieve goal #3:

- USGS should lead the creation and maintenance of databases of information in cooperation with the U.S Fish and Wildlife Service, NOAA and the Smithsonian Environmental Research Center. These databases should include:
  - A catalog of non-native, non-naturalized organisms currently or potentially in trade;
  - A list of species proposed for importation and/or interstate commerce;
  - A list of species which are being screened (pursuant to Goal 4, below);
  - A documentation of trends and practices in commerce, trade and cultural activities;
  - Information on criminal activity.
- Where appropriate (except for criminal activity) this information should be made available to the public.
- Regional, federal, state/provincial and local agencies should work together early in the budgetary planning stages for NIS programs. Related appropriations requests should be presented to Congress under one umbrella, when appropriate, representing needs on a regional basis.

4. Goal: By 2007, federal law should provide for the creation and implementation of a uniform screening process and the creation of a system of permitted, permitted conditionally/prohibited provisionally pending further information and prohibited lists of species. Implementation of the screening process should place the burden of proving safety or risk on the importer/trader. By 2007, federal law should prevent the importation and sale of live non-native, non-naturalized aquatic organisms that have the capability of becoming established and causing harm to humans, the economy, or the environment of the Great Lakes basin, except in accordance with the screening and listing process.

Notes: It may be possible to accomplish part of this goal under the existing authority of the Lacey Act. However, for this to succeed, Congress must give the U.S. Fish and Wildlife Service the funding and direction to implement existing law to its fullest extent. Failing that, Congress should enact new legislation.

If the Lacey Act is amended, the current standard in the Act should be maintained, which establishes a test of injuriousness based on harm to the "interests of human beings, horticulture, forestry, or agriculture, or to the wildlife and wildlife resources of the United States."

Actions needed to achieve goal #4:

- Congress should amend the Lacey Act or enact new legislation to include aquatic invertebrates and plants;
- Congress should provide authority and funding under the Lacey Act or enact new legislation to create an effective process to screen aquatic organisms proposed for importation. Congress should provide timelines to require agencies to make decisions on species listings in a timely manner. Congress should provide the funding and directive to APHIS to fully implement its existing authority to regulate aquatic plants and insects.
- Congress should amend the Lacey Act or enact new federal legislation to prohibit, restrict, or allow proposed importations based on the results of the screening process.

Interim steps for goal #4: Following the provision of direction, authority and adequate appropriations, either under existing or new law, the federal government should:

- Within 6 months, establish consistent guidelines for scientifically-based minimum information required for screening to be applied by those federal agencies with authority to regulate or restrict species movement;
- Within 12 months, promulgate federal regulations to be applied by federal agencies with authority to regulate or restrict species movement defining permitted, permitted conditionally/prohibited provisionally pending further information or prohibited lists, and the conditions or restrictions imposed on species in each category;
- Within 18 months following completion of the above, importers should be prohibited from importing any live species on the lists except in compliance with the uniform federal regulations;
- Direct the Fish and Wildlife Service to oversee implementation of the screening process and provide screening for any species proposed for importation that is not covered by another federal agency.

5. Goal: By 2007, federal laws, policies, and regulations will be enacted and/or amended to prevent the sale, possession and interstate transportation of live non-native aquatic organisms that have the capability of becoming established and causing harm to humans, the economy, or the environment of the Great Lakes basin. By 2007, the federal screening process and the permitted, permitted conditionally/prohibited provisionally pending further information and prohibited lists of species recommended above (Goal 4) should be applied to species already imported into the U.S., and to species native to parts of the US outside of the Great Lakes region that are proposed for sale or interstate commerce, but which have not yet become widespread or problematic.

Actions needed to achieve goal #5:

- By 2005, Congress should amend the Lacey Act to list the black, silver, bighead, and grass carp as injurious so that interstate transportation of live fish will be prohibited. (Black, silver and bighead carp should be the highest priority.)
- Regulations should be promulgated to implement the screening process recommended above to apply to live non-native, non-naturalized species which are already imported, proposed for sale or interstate commerce, but which have not yet become widespread or invasive;
- Regulations should be adopted to prohibit, restrict, or allow sale, possession and interstate movement of species following screening.

6. Goal: By 2007, the state and federal governments should provide state and federal agencies the authority, clear directive, tools, and funding necessary to effectively enforce ANS laws.

Actions needed to achieve goal #6:

- Federal and state governments receive authorizations and appropriations and provide the resources;
- Federal, state, tribal, and provincial agencies should increase enforcement personnel presence in and around areas operating in the sale of non-native aquatic organisms for commercial purposes;
- Citizen suit provisions should be enacted as part of federal laws to improve enforcement, hold state and federal governments accountable for effective implementation and to bolster accountability;
- Federal and state penalties associated with the sale of prohibited species of live organisms should be made much more strict;
- Federal, state, provincial, and tribal enforcement agencies should be provided with the authority and the training to effectively enforce ANS laws.

Interim steps for goal #6:

- The Great Lakes Fishery Commission should convene workshop of the Law Enforcement Committee of the Council of Lake Committees to discuss with federal, state, provincial and tribal law enforcement officers information needs, resource needs, and training needs for effective enforcement.

Goal 7: Working through responsible partners in industry, ongoing consumer education will be needed over the coming decades as global trade expands. By 2007, funding should be provided to enable a new AIS Organisms in Trade educational campaign modeled on the Sea Grant AIS-HACCP and Sea Grant/USFWS Habitattitude campaigns.

Actions needed to achieve goal #7:

- Congress should provide funds to the National Sea Grant Office and USFWS for the Organisms in Trade educational campaign.
- Federal agencies should engage industry in development of codes of best practice, using the AIS-HACCP training program as a model.
- Federal agencies should engage industry in the design and delivery of educational materials for consumers and industry members using the Habitattitide model.
- Industry should be brought into the development of the new screening process.
- Awareness materials must be made available in appropriate languages that inform readers of the dangers and consequences of releasing live aquatic organisms into the wild. Target live food sales and commerce (awareness activities should target all pathways not just live food).

Interim steps for goal #7:

The Organisms in Trade educational campaign should focus first on the creation of educational materials and programs to explain the new federal list of species of concern (Goal 2) for the Great Lakes basin ecosystem. It should be tailored locally to provide messages about the individual state's moratoria on the importation and trade of listed species of concern. Materials and programs should also target those for whom English is a second language.

Within 6 months of funding, the Great Lakes Panel on ANS should approve the highest priority draft educational materials and programs, based on listed species of highest concern, for development and use in the Organisms in Trade campaign. Funding sources should allocate funds based on this prioritization.

Within 12 months of Congressional funding, new educational materials and programs should be produced and made widely available.

Who is responsible for goal #7?

To effectuate the AIS Organisms in Trade educational campaign, federal agencies, tribes, NGO's, foundations, and industry should:

1. Support adoption and/or amendment of federal and state statutes concerning AIS organisms in trade through education and advocacy.
2. Cooperate to secure and then allocate funding to support the campaign.
3. Conduct educational programs and distribute awareness materials to agency resource management and enforcement personnel, wholesale suppliers, retail pet and plant shops, fish markets, baitfish dealers, hobbyists and other consumers.

---

[1] *Legal Tools and Gaps Relating to Commerce in Exotic Live Fish: Phase I Report to the Great Lakes Fishery Commission*, Environmental Law and Policy Center, July, 2003. Ann Alexander.

2 A comprehensive list of pathways, including additional examples of risks from commerce and trade, is available from Invasive Species Pathways Team, Final Report of the Pathways Team, October, 2003. Campbell, F., Kriesch.

Appendix F: Recreational Activities Drafting Team Report

Recreational Activities Vector
April 20, 2005

I. Problem Statement

Recreation is important to the vitality of the Great Lakes. Boating, fishing and other recreational activities are essential to the region's quality of life, providing significant social, aesthetic, educational, and economic benefits. More than 4 million registered boaters enjoy access to the Great Lakes, contributing $3.8 billion each year to the region's economy, while nearly 2 million anglers contribute $1.3 billion. Combined with non-residents, they spend 40 million days annually on the water.

More than 162 non-native aquatic species, many of them invasive, have become established in the Great Lakes basin. It is widely recognized that boating, angling, as well as other recreational activities such as waterfowl hunting and scuba diving, can unintentionally introduce aquatic invasive species (AIS) to and spread them within the Great Lakes basin, thereby threatening the vitality and health of the ecosystem and the region's quality of life. Recreational activities contribute to unintentional AIS introduction and spread primarily because plants and animals 'hitchhike' on boats, motors, or trailers.

Aquatic invasive species diminish the quality of the Great Lakes and have negative consequences for recreational users. Sea lampreys, zebra mussels, ruffe, gobies and water fleas have damaged highly prized recreational fisheries. Zebra mussels foul boat hulls and motors, create hazards on beaches and contribute to poisoning recreational waters. Purple loosestrife degrades wetland environments and spawning habitat. Eurasian water milfoil interferes with boating.

Many recreation and tourism businesses, government agencies and citizen organizations recognize that it is in everyone's interest to take actions to prevent the introduction of AIS to and slow AIS spread within the Great Lakes basin. Partnerships between all levels of government, recreational users and businesses, research and educational programs and citizen organizations need to be created and expanded to reduce the risk of AIS introductions/spread from recreational activities and to limit/control AIS damage to the ecosystem and to recreational uses. Protecting the Great Lakes ecosystem and the region's recreation-oriented economic sectors from the serious negative effects of AIS will require concerted, coordinated and continuous cooperation on comprehensive, environmentally sound, and effective strategies.

II. Prioritized Performance-Based Goal

As of 2010, no new aquatic invasive species will be introduced to, established within, or spread about the Great Lakes basin through recreational activities.

III. Ongoing Efforts

Federal, Great Lakes regional, state, tribal and local governments, citizen organizations, educational institutions/programs, businesses, industries and recreational user groups have made considerable efforts to prevent the introduction and slow the spread, as well as mitigate the impacts of AIS. These efforts have included creating policies, enacting legislation, conducting research, strategic planning, educating stakeholders and producing and distributing a great variety of educational materials. An important outcome of these efforts has been beginning the building of capacity for regional collaboration in the Great Lakes region toward AIS prevention and control. Further details on many of these products, programs and initiatives are in Appendix A. As effective as some of these individual efforts have been, even greater capacity, collaboration and financial support is essential to accomplish the goal of preventing AIS introduction and slowing their spread.

IV. Alternative Approaches

Voluntary and mandatory approaches have been used to engage different recreational stakeholders in efforts to prevent AIS introductions and to slow their spread. Recreational resource use has positive values, so it is most effective to use constructive approaches that encourage responsible behavior. Laws, regulations and enforcement are important to establish appropriate authority and accountability at various levels of government, as well as to guide and support educational programs. Early detection and rapid response, control and management have important places in an integrated approach to this problem. Strategically focused, comprehensive outreach and education programs for recreational users that empower and support individuals, organizations and communities have the greatest potential for preventing introductions of AIS and slowing the spread of already established species.

V. Recommended Strategies:

The Team recommends that the Great Lakes region prevent AIS introduction and slow the spread through effective public outreach and education programs focused on prevention, complemented by appropriate laws, regulations and enforcement. Minimize AIS damage through rapid response, control and management. These recommended strategies include outcome based objectives and actions that are essential to achieving the goal. An implementation table for all of the recommended actions, including leads, partners and costs is in Appendix B.

OUTREACH AND EDUCATION

Strategy: Target recreational users, especially boaters and anglers, with effective outreach and education.

Outreach and Education Objectives:

1) By December 31, 2005, existing authorities will have the necessary financial resources to develop and conduct cost effective AIS outreach and education programs for recreational users of the Great Lakes.

Action 1 - Congress will enact legislation to authorize and appropriate $32.4+ million over five years to support cost effective AIS outreach and education programs conducted by federal, state, tribal, agencies, academic programs and organizations that address objectives 2-6: See the Implementation Table in Appendix 3 for supporting detail.

2) By 2010, more than 4 million boaters and 2 million anglers will be aware of AIS issues and their responsibility to prevent and slow the spread.

Action 1 - Governments, academia, businesses, and boating and fishing associations will collaborate to develop, coordinate, and implement cost effective AIS prevention programs and campaigns based on social science strategies and integrating, as appropriate, existing products or campaigns such as *Stop Aquatic Hitchhikers!TM*.

3) By 2007, more than 70% of Great Lakes boaters and anglers (more than 95% by 2010) will take preventive actions against AIS, an increase of 20-30% in each state.

Action 1 – Develop watercraft inspection education programs in each state to encourage recreational users to adopt preventive behaviors.

Action 2 - Develop public service announcements and purchase advertising in recreation-oriented media.

Action 3 - Include AIS information and list infested waters in recreation safety and regulation publications.

Action 4 - Develop and distribute tip sheets for boaters and anglers.

Action 5 - Feature AIS prevention messages and ways to minimize AIS impacts on boats and other recreational equipment at 70% of Great Lakes basin water access sites.
Action 6 - Provide information on AIS at visitor centers along key transportation corridors and at major boating and angling events.

4) By 2010, five recreational user groups that are most likely to introduce and spread AIS will adopt preventive behaviors.
Action 1 – Identify and select the five most likely user groups.
Action 2 – Develop standard guidance and target the other recreational users.

5) By 2010, 40 communities deemed to be at highest risk for impacts from AIS will be conducting AIS recreational boater and angler outreach and education campaigns, including watercraft inspection education programs at access points.
Action 1 - Develop model partnerships between business, governments and academia to design and implement demonstration projects to build community-based capacity.
Action 2 - Communicate outreach and education successes with policy makers, resource managers, targeted audiences and news media to other communities to encourage similar programs.

6) By 2010, Great Lakes boater and angler AIS outreach and education programs will have been proven effective.
Action 1 - Assess and evaluate AIS boater and angler outreach and education programs throughout their development and implementation.
Action 2 - Use assessment and evaluation results to better understand, target, and manage recreational activities and to use the most effective methods.

7) By 2010, the next generation of Great Lakes recreational users will be aware of AIS problems and prevention strategies.
Action 1 - Develop marketing strategies to enhance distribution of new and existing AIS educational materials to schools and learning centers and provide training for teachers.

EARLY DETECTION AND RAPID RESPONSE (ED&RR)

Strategy – Give government agencies the necessary legislative authority and financial resources to conduct effective early detection and rapid response programs.

Early Detection Objectives:

1) By December 31, 2007, government agencies will have enhanced resources to assess and detect AIS in the Great Lakes.
Action 1 - Congress will authorize and appropriate $2,000,000 for the United States Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), U.S. Forest Service, and Environmental Protection Agency (EPA) to develop and implement, in cooperation with state, tribal, local, port, and other federal entities, a system of ecological assessments at Great Lakes locations at high risk of AIS invasion.

2) By December 31, 2007, Great Lakes boaters, anglers and others will be able to report new AIS infestations to a centralized system.
Action 1 - Government agencies responsible for AIS will develop an accessible, integrated and centralized program for recreational users to report and verify new infestations/invasions of AIS.

3) By December 31, 2007, 70% of Great Lakes boaters and anglers will be skilled at AIS identification and understand the risks posed by AIS introduction and spread.
Action 1 - Thirty governments and organizations will collaborate to develop, produce and disseminate key AIS identification materials and conduct effective educational programs.

4) By December 31, 2007, 35% of Great Lakes boaters and anglers will participate in early detection programs and report AIS found in previously un-infested waters.
Action 1 - Great Lakes Sea Grant programs will collaborate with state agencies to establish and promote volunteer AIS monitoring programs at marinas, harbors, and other high risk locations.

Rapid Response Objectives:

1) By December 31, 2007, state and interstate Aquatic Nuisance Species Management Plans will have rapid response plans and financial support.
Action 1 – By December 31, 2005, Congress will pass legislation that authorizes, and will appropriate by FY2007, $50 million annually to support USFWS allocations to state and interstate Aquatic Nuisance Species Management Plans (Plans) approved by the Aquatic Nuisance Species Task Force. By December 31, 2007, the Plans must include rapid response tactical plans that (1) are developed in partnership with angler and boater representatives; (2) help recreational users understand the costs/benefits of action and inaction; (3) ensure accurate and expeditious flow of information among response team members and recreational stakeholders; and (4) include feedback loops to provide effective communication among agencies and stakeholders throughout implementation.
Action 2 - By December 31, 2005, Congress will authorize, and will appropriate by FY2007, $2 million for a contingency fund to be used in rapid response actions conducted in accordance with approved Great Lakes state and interstate management plans.

2) By December 31, 2005, a USFWS Great Lakes Aquatic Invasive Species integrated pest management program will be authorized and funded to respond rapidly to new AIS invasions on federal lands and in other locations as requested by state and tribal governments.
Action 1 – Congress will authorize, and appropriate by FY2007, $15 million annually to support the program, modeled after the Great Lakes Fishery Commission's Sea Lamprey Control.

3) By December 31, 2005, a federal interagency Great Lakes rapid response team will be authorized and funded, and conducted in collaboration with states and tribal governments.
Action 1 – Congress will authorize, and appropriate by FY2007, $1,500,000 for the USFWS, NOAA, Sea Grant, EPA, USDA and other appropriate federal agency heads to establish the team in collaboration with the states and tribes.

4) By December 31, 2005, Congress will pass legislation to authorize, and will appropriate by FY2007, support to develop approaches to control and eradicate AIS.
Action 1 - EPA, USFWS, U.S. Geological Survey, USDA and NOAA (including Sea Grant) and states and tribes) will develop and administer a $10 M annual grant program to fund research, development, demonstration, and verification of environmentally sound and cost-effective approaches to control and eradicate AIS.

CONTROL AND MANAGEMENT

Strategy: Establish programs that interrupt the pathways of AIS introduction and spread.
Objectives:
1) By December 31, 2005, Congress will reauthorize the National Invasive Species Act.

2) By December 31, 2006, EPA, USFWS, U.S. Geological Survey, USDA and NOAA (including SG) and states and tribes will initiate a research program with other federal agencies to develop control methods for aquatic invasive species.
Same as RR Objective 4.

3) By December 31, 2007, develop a federal capacity to control and manage aquatic invasive species, in addition to sea lamprey. Same as RR Objective 2.

4) State ANS Management Plans in the Great Lakes region will be developed and fully funded for effective implementation. See RR Objective 1, Action 1.

LAWS, REGULATIONS AND ENFORCEMENT

Strategy: Adopt effective laws and enforce them.
Objectives:
1) States and tribes will establish comprehensive AIS programs and provide long term funding to support them.
Action 1 – The Council of Great Lakes Governors, the Great Lakes Legislative Caucus and Great Lakes tribal leaders will work to ensure that state legislatures and tribal councils establish comprehensive AIS programs, including watercraft inspector education, and develop long term, stable funding mechanisms for them.

2) States, federal agencies, and tribes will adopt consistent regulations prohibiting the transport of AIS and aquatic vegetation.
Action 1 - The Council of Great Lakes Governors, the Great Lakes Legislative Caucus and Great Lakes tribal leaders will work with relevant stakeholders to develop and implement consistent state and tribal AIS laws and regulations that promote stewardship education and prohibit the willful and knowing transport of AIS and aquatic vegetation on watercraft.

3) At least 240,000 Great Lakes boaters, anglers and other recreational users will be aware of federal, state and tribal AIS regulations.
Action 1 - Federal, state and tribal governments will provide information on AIS regulations and preventive behaviors to boaters, anglers, marina slip owners, boat haulers, and other businesses in cost effective formats.

Recreational Activities Appendix A – Ongoing Efforts
Recreational Activities Appendix B – Implementation Table

Recreational Activities Team Appendix A: AIS Efforts of various government and non-government organizations.

Sector and Agency / Organization			Programs and Activities								
			Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Other
Government	Federal	President's Office		√		√					
		Department of State (DOS)	√		√		√	√			
		US Forest Service	√			√	√	√	√	√	
		U.S. Fish and Wildlife Service	√			√	√	√	√		
		National Park Service	√			√	√	√	√	√	
		U.S. Coast Guard			√			√			

Sector and Agency / Organization			Programs and Activities								
			Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Other**
		***NOAA's GLERL**	√			√		√			
		International Joint Commissions				√		√	√	√	√
	Regional	**GLP on ANC**	√	√		√	√ model programs	√	√	√	
		GL Commission									
	Tribal				√						

Sector and Agency / Organization			Programs and Activities								
			Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Other
	State	Minnesota			√			√	√		√
		Wisconsin			√	√		√			
		Illinois			√			√	√	√	
		Indiana	√	√	√	√	√	√	√	√	
		Michigan	√	√	√	√	√	√	√	√	
		Ohio		√					√		

Sector and Agency / Organization		Programs and Activities								
		Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Other
	Pennsylvania	√	√	√	√	√	√	√		
	New York			√						
	Local									
Educational Institutions and Programs	GLSGN	√			√		√	√	√	
	Minnesota Sea Grant	√			√		√	√	√	
	Wisconsin Sea Grant	√			√		√	√	√	
	Illinois-Indiana Sea Grant	√			√		√	√	√	

Sector and Agency / Organization		Programs and Activities								
		Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Other
	Michigan Sea Grant	√			√		√	√	√	
	Ohio Sea Grant	√			√		√	√	√	
	Pennsylvania Sea Grant	√			√		√	√	√	
	New York Sea Grant	√			√		√	√	√	
Environmental/Outdoor/Conservation organizations / Associations	Great Lakes Sport Fishing Council		√		√		√	√	√	√
	TIP of the Mitt Watershed Council				√		√	√	√	
	Michigan Lake and Stream Associations				√		√	√	√	

Sector and Agency / Organization		Programs and Activities								
		Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Other**
	Nature Conservancy					√	√	√	√	
Other Citizen Organizations						√				
Business Associations	**Michigan Boating Industry Association**	√	√		√	√	√	√	√	
Industry Associations										

Notes: * (GLERL) NOAA's Great Lakes Environment Research Laboratory ** (GLP on ANS) Great Lakes Panel on Aquatic Nuisance Species
***(GLSGN) Great Lakes Sea Grant Network

Recreational Activities Team Appendix B: AIS efforts of various government and non-government organizations.

Sector and Agency / Organization			Programs and Activities								
			Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
Government	**Federal**	**President's Office**		• Presidential Executive Order established the National Invasive Species Council, and listed Federal agency duties to prevent invasive species introductions, and control their populations		• Presidential Executive Order for creation of a cabinet-level interagency Task Force for The Great Lakes Regional Collaboration (GLRC) including Issue Area Strategy Teams. One Strategy Team is charged to address Stop the introduction and spread of non-native aquatic invasive species					
		Department of State (DOS)	• Hosted a meeting on developing a Global Invasive Species Network to link all existing databases on invasive species. A steering committee was established, and proceedings of that meeting cis available at NBII website:		• Negotiating agency for Convention on Biological Diversity including Invasive Alien Species and other international negotiations like APEC. • Helping to ratify strategy for trade practices between small islands in Caribbean and United States regarding invasive species. • Scoping Meeting of DOS, NISC, USDA, COI, and others including Canada regarding plans to address the shared IAS problem along with the U.S./ Canada border.		• Provides funding (12 million $) to GL Fishery Commission	• Support Habitattitude™ to promote to an international audience, specifically the aquaculture industry, and DOS will be seeking ways to represent the initiative. • Exchange IAS knowledge and experiences in International meetings. • Capacity building (workshops) in world through OeS Grant Program and proceedings in web.	Leads development and implementation of Management and Control Plans (e.g., Ruffe, Asian carp, etc.)		

Sector and Agency / Organization	Programs and Activities								
	Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
US Forest Service	Rusty crayfish and spiny water flea *Bythotrephes cederstroemiflea)* surveys for Early Detection. The Ottawa National Forest (ONF), The Superior National Forest continued invasive species surveys, The ONF, Michigan DNR and University of Notre Dame continued experimental control methods and monitoring.			The Regional Forester has approved a region-wide Aquatic non-native invasive species (NNIS) Sub-Committee to develop a multi-year plan to help implement ANS Management Plans to encourage initiatives that include aquatic invasive, addresses the use of pesticides and aquatic herbicides, development of equipment related to Best Management Practices for aquatic invasive. The Superior National Forest implementing a 5-year action plan for managing NNIS. Actions completed in 2004 include: NNIS training sessions for public and partners.	USFS has membership and participates in the Asian Carp Working Group to help develop management plan. USFS controlled several acres of invasive plants on land and in water through snorkel-pulling, cut-stump herbicide treatments, mowing, and disking. Works with partners during FERC hydropower relicensing to develop both monitoring plans and invasive quatic plant management plans	NNIS displays for county fairs. The Superior National Forest also completed an inventory of boat launches and identified places for new or replacement of "Stop the Spread" signs. Developing cost share agreements with USF&WS and partners for educational kiosks at several aquaria to highlight aquatic invasive problems	USFS developing various communicatio n tools for both terrestrial and aquatic invasives	Reduced invasive species transport via recreational boaters by providing education and funding for publication of indentification cards.	

Sector and Agency / Organization	Programs and Activities								
	Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
U.S. Fish and Wildlife service	Conducted Economic impact analysis on aquatic invasive species, assessment of new populations of invasive species and documentation of population and abundance of existing invasive species. Assessed awareness among recreational boaters. Supports applied research by USGS and academia		Develops rules for listing species as Injurious under the Lacey Act. Enforces Lacey Act.	The Aquatic Invasive Species (AIS) Team will develop Action Plan, which will be included in the Great Lakes strategy to protect and restore the lakes. Leads development of Management and Control Plans (e.g., Ruffe, Asian carp, etc.) Co-Chair of ANSTF Provides staff support to the ANSTF	Monitoring and Control of ANS and recreational activities. Leads coordination and implementation of Management and Control Plans (e.g., Ruffe, Asian carp)	Chair of ANSTF's Communication, education and outreach committee: National Public Awareness and Partnership Campaign to stop Hitchhikker and Habitattitude TM targeted towards recreation users. Supported by interactive websites and cooperative marketing materials with more than 160 partners in Stop Aquatic Hitchhikkers. Alpena Fishery Resource Office: educates partners and stakeholders though meetings, distribution of educational materials, Awareness Week Program, festivals, Maintains update and inform through websites, TV and newspapers, hosts volunteers from community, colleges, and universities. LGLFRO (Lower Great Lakes Fishery resource Office) in Amherst conduct educational and outreach activites: Presentations to anglers and recreation users, meetings, Fish and Wildlife Festivals.	Develops fact sheets and other printed materials Is developing video Maintains website containing outreach materials		
National Park Service									

Sector and Agency / Organization	Programs and Activities								
	Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Others
COAST Guard		.				The USCG has a well-defined and active public outreach program. Members of the USCG and the USCG Auxiliary show recreational boaters the videotape, "Stop Exotics - Clean Your Boat," at a variety of marine events throughout the Great Lakes reminding the recreational boaters of the steps they can take to minimize the spread of AIS..			

Sector and Agency / Organization	Programs and Activities								
	Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
***NOAA's GLERL**	The mission of the NOAA National Center for Research on Aquatic Invasive Species (NCRAIS) is to maximize the benefits and effectiveness of NOAA's research investments towards understanding, preventing, responding to, and managing aquatic species invasions in U.S. coastal ecosystems. The NCRAIS of NOAA ensures that NOAA's Research on AIS is national in scope. The Center's broad goal is to foster, coordinate, and support aquatic invasive species research throughout and across NOAA. NCRAIS of NOAA assures cross-NOAA leadership, communication, and coordination across U.S. coastal ecosystems. Working with Smithsonian Environmental Research Center on analysis and development of a Report to Congress on the effectiveness of ballast water exchange in controlling invasive species in Great Lakes basin and Chesapeake Bay			The NCRAIS is to lead development and administration of a long-term NOAA strategic plan for research on aquatic invasions based on the National (Invasive Species) Management Plan.		One prioritized NCRAIS activities focus on *establishment of The Great Lakes Aquatic Non-indigenous Species Information System* (GLANSIS) to ensure a comprehensive, up-to-date, easily accessible quality on-line information system on Great Lakes ANS based on a screening process and criteria for determining which species should be listed and how to verify and add new species in the future as needed			

Sector and Agency / Organization		Programs and Activities								
		Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Others
	International Joint Commission									Binational, interagency tracking and coordination of research (http://ri.ijc.org), resource management and policy
Regional	**GLP on ANS					Develop model management programs such as monitoring, early detection, and rapid response			Develop model policy and management documents to guide/educate policy makers and state resource agencies in prevention and control work	
	GL Commission									
Tribal				Infancy stage of implementing invasive species management programs. The St. Regis Tribe has the most developed out of the 7 NY tribes.						

Sector and Agency / Organization			Programs and Activities								
			Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Others
	State	Minnesota			Minnesota DNR conducts many activities statewide to help prevent the spread of invasive species via recreational activities: watercraft inspections and law enforcement including outreach and extension programs			• MDNR conducts awareness program through radio and television ads and public service announcements, signs at water accesses, information in fishing and boating booklets, distribution of educational materials and ID cards, placing ads on top of gas pumps, and more.	• The 2004, MDNR new brochure entitled Help Stop Aquatic Hitchhikers! Provides information about precautions that can be taken to avoid spreading aquatic invasive species.		• ONF provided funding for printing Eurasian water milfoil identification cards, using artwork donated by Minnesota DNR. These cards are distributed at several locations.

Sector and Agency / Organization	Programs and Activities								
	Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
Wisconsin			Watercraft Inspection It also involves inspection of boats to ensure they are "clean" and demonstrating public how to properly clean their boats, trailers, and boating equipment. The DNR had 20 watercraft inspectors.	The Nature Conservancy worked with Land O' Lakes Fish and Game Club to help USFS personnel to dig up 9 acres of Japanese barberry near Plymouth Lake. (Some hidden bellow this)		DNR Sponsors Clean Boats, Clean Waters Volunteer Program. Dissemination of information to anglers and recreational boaters to ensure awareness of AIS identity and precautions to avoid AIS spread. It also install signs at boat landings informing boaters of the infestation status, state law, and steps to prevent spreading invasive species. Information and Education programs are conducted in close cooperation with UW Extension and Wisconsin Sea Grant and professionals and citizens statewide to teach boaters, anglers, and other water users how to prevent AIS transport when moving their boats and other potential mechanisms of introduction, including aquarium pet release and water gardening. Many educational tools are used to reach the public, including brochures and publications, watch cards and wild cards, public service announcements and displays at parks, sport shows, convention and symposiums. Clean Boats, Clean Waters Volunteer Program offers training on how to organize a watercraft inspection program, how to inspect boats and equipment, and how to interact with the public. Volunteers are also encouraged to help monitor for aquatic invasive species. Workshops are open to adults and youth, and adult groups are encouraged to work with local youth partners. A full time UW Extension staff person coordinates this effort.			

Sector and Agency / Organization	Programs and Activities								
	Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Others
Illinois			Developing and amending rules and are in process of passing legislation, which will prohibit certain species as bait, pets, etc. from being transported and therefore spread unintentionally. This is not directed per se at recreational use, but at the bait, live food, pet, aquaculture, and other pathways of introduction			Conducting an aggressive outreach/ education campaign for recreational activities in conjunction with Sea Grant. These include several pages in fishing information booklet on invasive species, as well as including information in the packet for all boat renewals in Illinois. Radio and TV ads have also been used, and a small article in our Outdoor Illinois Magazine.			
Indiana						Fact sheets for ANS, upon completion, will be available on Indiana DNR's website.	Indiana DNR is developing fact sheets for AIS populations already established in the state or species posing a risk of introduction/spread into state waters. Each fact covers preventing AIS spread, including information that anglers and recreational boaters can use to reduce the possibility of transporting AIS hitchhikers.	.	
Michigan	Michigan DNR (Fisheries) and University of Notre Dame continued experimental control methods and monitoring for rusty crayfish in Lake Ottawa for USFS.					Michigan DEQ, Office of the Great Lakes sponsors and funds several outreach and education efforts on AIS awareness targeted particularly towards boating and fish related activities.			

Sector and Agency / Organization	Programs and Activities								
	Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
Ohio		The ODNR-Division of Wildlife and the Ohio DOA have each taken regulatory initiatives to control the introduction of AIS into Ohio waters. The ODNR-Division of Wildlife revised the Ohio Administrative Code to Control the introduction of AIS in Ohio waters. OAC 1533.632 defines what species are allowed to be raised under an Ohio Aquaculture permit. The Ohio DOA prohibited importation of diseased fish into Ohio specifies the requirements for fish importation. Salmonids and all fish will need disease free certificate.					Disseminate all needed information and education materials that most other states do.		
Pennsylvania			Pennsylvania Fish and Boat Commission promulgated regulations prohibiting the sale, transport, and possession of certain live aquatic invasive species. In addition to all snakehead species listed in 9/2002, 25 Pa Code Chapters 63, 71, and 73 were amended to prohibit barter, sale, and transport. Possession of some species was also restricted. Prior to these amendments, only the release of species from one basin into another was prohibited.				People are informed of these regulations through several press releases and summarized in the PA Summary of Fishing Regulations and Laws booklet, which is provided at the time a PA fishing license is purchased.		

Sector and Agency / Organization		Programs and Activities								
		Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Others
	New York									
	Local									
Educational Institutions and Programs	***GLSGN									
	Minnesota Sea Grant									
	Wisconsin Sea Grant							Helping in Information and Education programs with close cooperation with Wisconsin State and UW Extension.		
	Illinois-Indiana Sea Grant									
	Michigan Sea Grant									
	Ohio Sea Grant									

Sector and Agency / Organization		Programs and Activities								
		Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
	Pennsylvania Sea Grant									
	New York Sea Grant									
/Environmental/Outdoor/Conservation organizations / Associations	Great Lakes Sport Fishing Council							Open, accessible Web site		Member, Ruffe Control Committee, Chicago Waterway Barrier Committee, Asian Carp Task Force, Great Lakes Panel on ANS
	Great Lakes United									
	Alliance for the Great Lakes									

Sector and Agency / Organization		Programs and Activities								
		Research	**Policy and Legislation**	**Regulation & Enforcement**	**Planning**	**Control and Management**	**Outreach**	**Materials**	**Educational Programs**	**Others**
	Tip of the Mitt Watershed Council		Support legislation							Administer an AIS information and Education grants program for the Michigan Office of the Great Lakes.
	Michigan Lake and Stream Associations									
	Nature Conservancy					The Nature Conservancy (TNC) worked with Land O' Lakes Fish and Game Club to help USFS personnel to dig up 9 acres of Japanese barberry near Plymouth Lake. TNC is working to promote trade practices that minimize the spread of invasive species through the organizations of Clean Trade Program with support of DOS. TNC recently initiated the Pacific Islands Invasives Learning Network (PIILN) with startup funds from the DOS for capacity building among island states in Micronesia and eventually expand Polynesia under the oversight of the South Pacific Regional Environmental Program.				

Sector and Agency / Organization	Programs and Activities								
	Research	Policy and Legislation	Regulation & Enforcement	Planning	Control and Management	Outreach	Materials	Educational Programs	Others
Other Citizen Organizations					Land O' Lakes Fish and Game Club worked with The Nature Conservancy (TNC) and to help USFS personnel to dig up 9 acres of Japanese barberry near Plymouth Lake.				
Business Associations									
Industry Associations									

Notes: * (GLERL) NOAA's Great Lakes Environment Research Laboratory ** (GLP on ANS) Great Lakes Panel on Aquatic Nuisance Species
***(GLSGN) Great Lakes Sea Grant Network

Appendix G: Comments

The Strategy Team co-chairs received two additional comments upon completion of the Action Plan, both relating to the issue of legislation.

1. Comment from the U.S. Great Lakes Shipping Association: The U.S. Great Lakes Shipping Association supports the passage of invasive species legislation in the 109th Congress but has not yet clarified its position with regard to any specific legislation.

2. Comment from the U.S. Coast Guard: The [U.S.] Coast Guard does not agree to a recommendation which specifies a particular piece of legislation. Rather, we support reauthorization of NISA with a ballast water specific section that gives the authority to continue to regulate ballast water and develop a ballast water discharge standard.