

# 2018–19

# Report to

# Congress

---

**AQUATIC NUISANCE SPECIES TASK FORCE**



# Aquatic Nuisance Species Task Force Report to Congress 2018-2019

## Table of Contents

Executive Summary .....	2
Introduction .....	4
Coordination .....	7
Prevention .....	12
Early Detection and Rapid Response .....	15
Containment and Control.....	20
Research.....	23
Education and Outreach .....	27
ANS Task Force Regional Panels.....	29
Conclusion .....	36

## Executive Summary

Aquatic nuisance species (ANS) are nonindigenous species that threaten the diversity or abundance of native species, the ecological stability of infested waters, or any commercial, agricultural, aquacultural, or recreational activities dependent on such waters. As the world trade network continues to grow, new markets and trade routes continually open. This growth will likely increase the number and frequency of new species introductions. Unchecked, ANS have the potential to imperil public health and transform ecosystems, resulting in widespread environmental degradation. ANS threaten sectors of the Nation's economy that depend upon natural resources and native ecosystems. Aquaculture, tourism, recreation, shipping, and water resource infrastructure, including hydropower facilities and municipal water supplies, may be adversely impacted by ANS. Proactive and coordinated management is necessary to protect the waters of the United States from ANS.

Congress established the Aquatic Nuisance Species Task Force (ANS Task Force) with the passage of the Nonindigenous Aquatic Nuisance Prevention and Control Act<sup>1</sup> (NANPCA) in 1990, which was reauthorized with the passage of the National Invasive Species Act (NISA) in 1996 (collectively, the Act). Under Section 1202 of the Act, the ANS Task Force is charged with the responsibility of developing and implementing a program for waters of the United States to prevent the introduction and dispersal of ANS; to monitor, control, and study such species; and to disseminate related information. The ANS Task Force is co-chaired by the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration and consists of 13 Federal agency representatives and 13 ex-officio representatives. These members work in conjunction with six regional panels and issue-specific committees to coordinate efforts among agencies as well as efforts of the private sector and other North American interests.

Section 1202(k)(2) of the Act requires the ANS Task Force to submit a report to Congress detailing progress in carrying out Section 1202 of the Act. This report is designed to familiarize readers with the ANS Task Force and to highlight work conducted by the Federal and ex-officio members of the ANS Task Force and its regional panels during fiscal years (FY) 2018 and 2019. It serves to demonstrate the continuing progress of the ANS Task Force in the development and implementation of a comprehensive ANS program for the United States. This report is not a comprehensive summary of ANS efforts throughout the Nation, but instead illustrates the wide range of efforts occurring under the auspices of the ANS Task Force. Accomplishments in this report are divided into six ANS management goals: coordination, prevention, early detection and rapid response (EDRR), containment and control, research, and education and outreach. Collectively, these goals make up the mission of the ANS Task Force.

In 2019, the ANS Task Force embarked on efforts to prepare its Strategic Plan for 2020-2025, which will guide the work of the ANS Task Force for the next 5 years. The ANS Task Force Strategic Plan for 2020-2025 establishes six goals:

- **Coordination:** Coordinate a national ANS program for waters of the United States
- **Prevention:** Develop strategies to prevent the establishment and spread of existing ANS in the waters of the United States
- **Early Detection and Rapid Response:** Facilitate early detection and rapid response efforts to identify and respond to new species detections in a timely manner to prevent their establishment and spread

---

<sup>1</sup> 16 U.S.C. § 4701 et seq.

- **Control and Restoration:** Facilitate capabilities to contain and control established ANS and restore native species and ecosystems
- **Research:** Facilitate research on ANS threats, impacts, and controls
- **Outreach and Education:** Conduct outreach and education to increase awareness concerning the threats of ANS

The six goals within the ANS Task Force Strategic Plan for 2020-2025 (Strategic Plan) contain objectives and strategies intended to be implemented in the next 5 years, creating a roadmap for the ANS Task Force to prevent, respond to, and manage ANS. By working together, and with partners, the ANS Task Force looks forward to implementing its new Strategic Plan and expanding their efforts to protect the Nation's waters from ANS.

## Introduction

ANS are one of the most significant threats to aquatic ecosystems in the United States. ANS, as defined in Section 1003 of the Nonindigenous Aquatic Nuisance Prevention and Control Act in 1990, are nonindigenous species that threaten the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent on such waters. The term “ANS” is often also commonly referred to as, or used interchangeably with, aquatic invasive species (AIS).

ANS may threaten ecological processes or natural resources within fresh, estuarine, or marine waters.<sup>2</sup> Such organisms readily colonize and transform habitats; particularly harmful ANS displace native species, change community structure and food webs, and alter fundamental ecosystem processes, such as nutrient cycling and sedimentation.<sup>3</sup>

In addition to harming ecosystems, ANS may also have adverse effects on fisheries, power production and infrastructure, decrease water availability and quality, block water transport routes, decrease property values, and degrade the aesthetic quality of recreation and tourism sites. Although the costs attributable to ANS are difficult to calculate, global costs of invasions have been estimated at \$1.288 trillion over the past few decades (1970-2017), with an annual mean cost of \$26.8 billion.<sup>4</sup> Specific costs to the United States include \$5.4 billion per year to manage invasive fish populations,<sup>5</sup> at least \$1 billion per year to manage zebra and quagga mussels, and another \$1 billion per year to control aquatic weeds.<sup>6,7</sup>

Human health and safety are also at risk from ANS. Many infectious diseases, including malaria, West Nile virus, and yellow fever rely on transmission by mosquitoes and biting flies that are aquatic for much of their lifespan. Other pathogens and parasites may depend on aquatic mollusks, fish, or other aquatic animals for completion of their transmission cycles.<sup>8</sup> For example, invasive apple snails may serve as a host for multiple disease-causing organisms, including ringworm, intestinal flukes, and the human endoparasite rat lungworm.<sup>9</sup> In the 1990s, discharged ballast water released the cholera bacterium, *Vibrio cholera*, into South American waters. The epidemic that followed demonstrated that the movement of water over large distances can introduce pathogens to new areas. ANS may also facilitate ecosystem changes that favor the outbreak of pathogens; for example, the filter feeding behavior of zebra mussels in the Great Lakes has promoted blooms of toxic, blue-green alga.<sup>10</sup> The effect on public health extends

---

<sup>2</sup> Gallardo, B., Clavero, M., Sánchez, M. I., & Vilà, M. (2016). Global ecological impacts of invasive species in aquatic ecosystems. *Global change biology*, 22(1), 151-163.

<sup>3</sup> Havel, J. E., Kovalenko, K. E., Thomaz, S. M., Amalfitano, S., & Kats, L. B. (2015). Aquatic invasive species: challenges for the future. *Hydrobiologia*, 750(1), 147-170.

<sup>4</sup> Christophe D., Leroy B., Vaissière A., Gozlan R., Roiz D., Jarić I., Salles J., Bradshaw C., Courchamp F. 2021. High and rising economic costs of biological invasions worldwide. *Nature* (2021): 1-6.

<sup>5</sup> Pimentel, D., Lach, L., Zuniga, R., Morrison, D., 1999. Environmental and economic costs associated with introduced nonnative species in the United States. Manuscript, pp. 1-28.

<sup>6</sup> Pimentel, D., Zuniga, R., & Morrison, D., 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecological Economics*, 52(3 SPEC. ISS.), 273-288.

<sup>7</sup> Rockwell, H. W. (2003). Summary of a Survey of the Literature on the Economic Impact of Aquatic Weeds. The economic impact of aquatic weeds.

<sup>8</sup> Conn, D. B. (2014). Aquatic invasive species and emerging infectious disease threats: A One Health perspective. *Aquatic Invasions*, 9(3).

<sup>9</sup> Mazza, G., & Tricarico, E. (Eds.). (2018). *Invasive species and human health* (Vol. 10). CABI.

<sup>10</sup> Neill, P. E., & Arim, M. (2011). Human health link to invasive species. *Encyclopedia of environmental health*, 116

beyond disease and parasites; direct human injury may also result from ANS. For instance, hazards may occur from collisions between boaters and jumping silver carp, wounds from sharp-edged mussel shells on beaches and recreational areas,<sup>11</sup> or stings from the venomous spines of lionfish.<sup>12</sup>

ANS can arrive in new ecosystems through many different pathways and vectors,<sup>13</sup> but most invasive species are transported because of human activity.<sup>14</sup> Global trade and intercontinental travel have been cited as major causes of biological invasion. For example, it is widely accepted that invasive zebra and quagga mussels were introduced to the Great Lakes region through ballast water discharge from ships arriving from foreign ports. Since their introduction, zebra and quagga mussels have plagued waterways throughout the Great Lakes region and expanded their range across the nation, all the while disrupting native ecosystems, clogging water intake pipes, and impacting recreational activities. As the world trade network continues to grow, new markets and trade routes continually open. This growth will increase the number of new species that are introduced and the frequency with which such introductions are repeated.

To combat this threat, the ANS Task Force was established by Congress with the passage of the NANPCA in 1990, reauthorized by the NISA in 1996 (collectively, the Act). The Act charges the ANS Task Force with developing and executing a program that:

- Prevents the introduction and dispersal of ANS;
- Monitors and controls species;
- Conducts research on methods to monitor, manage, control, and eradicate such species;
- Coordinates ANS programs and activities of ANS Task Force members and affected state agencies; and
- Educates and informs the general public and program stakeholders about the management of these species.

Section 1202(k)(2) of the Act requires the ANS Task Force to submit a report to Congress detailing progress in carrying out the provisions of the Act. In response to this requirement, this report highlights key activities conducted by the Federal and ex-officio members of the ANS Task Force and its regional panels during FYs 2018 and 2019 to demonstrate the continuing progress of the ANS Task Force in the development and implementation of a comprehensive ANS program for the United States. Accounting for each individual ANS endeavor would be a daunting task as efforts under the ANS Task Force are conducted at national, regional, and state levels and involve numerous Federal and state agencies, universities, conservation groups, industry leaders, and other stakeholders. As such, this report is not a comprehensive summary of ANS efforts throughout the Nation but instead illustrates the wide range of efforts occurring under the auspices of the ANS Task Force.

### ***ANS Task Force Members***

The ANS Task Force consists of 13 Federal agency representatives as well as 13 ex-officio members that represent national or regional interest groups. Working together, and with partners, the ANS Task Force

---

<sup>11</sup> Grubb, Christopher. "Worthy of Their Name-Addressing Aquatic Nuisance Species with Common Law Public Nuisance Claims." *Chi.-Kent L. Rev.* 87 (2012): 237

<sup>12</sup> Akins, J. L., Buddo, D. S. A., Green, S. J., & Lozano, R. G. (2012). *Invasive Lionfish: a Guide to Control and Management*. Gulf and Caribbean Fisheries Institute.

<sup>13</sup> Ruiz, G. M., & Carlton, J. T. (2003). *Invasive species: vectors and management strategies*. Island Press.

<sup>14</sup> Ricciardi, Anthony, William WM Steiner, Richard N. Mack, and Daniel Simberloff. "Toward a global information system for invasive species." *BioScience* 50, no. 3 (2000): 239-244.

members strive to fulfill their responsibilities outlined in the Act and advance priority actions identified in the ANS Task Force Strategic Plan.

*Federal members of the ANS Task Force:*

- U.S. Fish and Wildlife Service – co-chair
- National Oceanic and Atmospheric Administration – co-chair
- Bureau of Land Management
- Bureau of Reclamation
- Department of State
- Environmental Protection Agency
- National Park Service
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service
- U.S. Department of Transportation, Maritime Administration
- U.S. Forest Service
- U.S. Geological Survey

*Ex-officio members of the ANS Task Force:<sup>15</sup>*

- Great Lakes Commission
- Lake Champlain Basin Program
- Chesapeake Bay Program
- San Francisco Estuary Partnership
- American Public Power Association
- American Water Works Association
- Association of Fish and Wildlife Agencies
- Gulf States Marine Fisheries Commission
- Mississippi Interstate Cooperative Resources Association
- Native American Fish and Wildlife Society
- Smithsonian Environmental Research Center
- Tahoe Regional Planning Agency

---

<sup>15</sup> Two members co-represent the Native American Fish and Wildlife Society

## Coordination

ANS may be transported through a variety of different pathways, including ballast water and on hulls of ships, recreational watercraft, seaplanes, and marine debris; on fishing equipment; through the importation of nonnative species for food, pets; and other purposes. The ease of transport, combined with the fact that ANS encompass numerous taxa, warrants the development of multiple strategies to effectively manage this threat. Effective communication and collaboration are also paramount to prevent the introduction, establishment, and spread of ANS, as well as minimize adverse impacts to the environment, human health, cultural resources, and the economy.

The ANS Task Force was created by Congress to coordinate ANS efforts between Federal, state, tribal, and local agencies; the private sector; and other North American interests. To achieve this goal, the ANS Task Force works within its membership, and in conjunction with its six regional ANS panels and issue-specific committees, to provide a national and regional infrastructure. This multi-level collaboration provides opportunities to share resources, expertise, and ideas across agency and organizational lines; identify priorities and emerging issues; define future ANS Task Force roles and responsibilities; and establish a harmonized approach to ANS management.

### ***Strategic Planning for 2020-2025***

In 2019, the ANS Task Force embarked on efforts to update its Strategic Plan. The ANS Task Force members and regional panels reviewed past accomplishments and identified ANS priorities for the next five years that can be achieved using existing resources and are consistent with the national focus of the ANS Task Force. In November 2019, the ANS Task Force finalized its Strategic Plan for 2020-2025. This Plan builds upon previous work of the ANS Task Force by establishing six goals, each with a targeted set of objectives and associated strategies that are intended to be completed in the next 5 years. The goals of this plan are:

- **Coordination:** The ANS Task Force was created to facilitate cooperation and coordinate efforts among Federal, state, tribal, and local agencies, the private sector, and other North American interests. This goal focuses on maximizing the organizational effectiveness of the ANS Task Force by establishing effective processes that create opportunities for members and participants to work collaboratively across agency and organizational lines. The objectives under the Coordination Goal include strengthening cooperation at national, regional, state, and community levels and establishing processes to prioritize and address ANS management needs.
- **Prevention:** Preventing harmful introductions before they occur is the most effective means to avoid the risk of ANS. Long-term success in prevention will reduce the rate of introductions, the rate of establishment, and avoid many of the long-term economic, environmental, and social costs associated with ANS. The objectives under the Prevention Goal focus on efforts to evaluate and refine risk analysis procedures, conduct pathway assessments, and expand implementation of regulatory and non-regulatory approaches to interdict ANS.
- **Early Detection and Rapid Response:** When prevention measures fail, it is essential to detect new invasions and respond quickly to keep the species from becoming established and spreading. By slowing the range expansion of ANS, Early Detection and Rapid Response avoids the need for costly long-term control efforts. Objectives under the Early Detection and Rapid Response Goal include evaluating existing monitoring programs, determining needs for additional early detection monitoring, prioritizing potential ANS threats and management needs, and building capacity to respond rapidly to newly detected species.



- **Control and Restoration:** In those cases where ANS populations are abundant and widespread, implementing management actions to minimize their impacts and long-term costs may be needed. Habitat restoration is also important to guard against future invasions and to minimize harm from ANS. The objectives under the Control and Restoration Goal include evaluation and support for ANS control and management plans, development of innovative control, restoration, and ANS mitigation techniques.
- **Research:** Information and research can quantify and clarify the effects that ANS are having on native species and habitats, socioeconomics, and human health. Research supports all facets of the Strategic Plan and is necessary to increase the effectiveness of prevention and management of ANS. To ensure that ANS research addresses critical needs, the objectives under the Research Goal focus on prioritizing research needs at regional and national levels and working to ensure research priorities are funded.
- **Outreach and Education:** One of the largest obstacles facing managers can be the lack of understanding by the public regarding the wide-ranging impacts of ANS and actions that should be taken to prevent their introduction and spread. Educating people about ANS threats, the importance of their actions, influencing motivations, and removing barriers to actions will help to achieve and sustain the goals outlined in the Strategic Plan. Accordingly, objectives under the Outreach and Education Goal focus on assessing the efficacy of existing outreach campaigns and programs and developing more effective messages to influence targeted audiences.

The Strategic Plan is an umbrella strategy that presents a coordinated approach to prevent, respond to, and manage ANS. This involves taking advantage of what has been learned and creating next steps that are well planned and coordinated. The success of the Strategic Plan depends on the ability of the ANS Task Force to work collaboratively with Federal agencies, states, tribes, industries, nonprofits, and stakeholders to realize the ANS Task Force’s goals and expand efforts to protect the Nation’s waters from ANS.

### ***State and Interstate ANS Management Plans***

The Act recognized that states and tribes are integral partners in the battle against ANS and, accordingly, authorized the Director of the U.S. Fish and Wildlife Service (USFWS) to make grants available to states, tribes, and interstate organizations that have State or Interstate ANS Management Plans approved by the ANS Task Force. There are 44 ANS Task Force-approved State or Interstate ANS Management Plans.<sup>16</sup> Together, these plans create the framework of a national ANS program and support the ANS Task Force mission and strategic goals. The ANS Task Force provides guidance to states to help facilitate plan development and review. Once approved by the ANS Task Force, the plan is implemented by state agencies, local programs, cooperating Federal agencies, and others to prevent and control ANS infestations in an environmentally sound and cost-effective manner.

In 2018 and 2019, USFWS continued to provide funds to support plan implementation through its State and Interstate Aquatic Nuisance Species Management Plan (SIANSMP) grant program. This funding may be the only dedicated source of ANS funds for some states; while for others, the annual allocation represents a portion of a state’s total ANS budget. States use SIANSMP funds in various ways; for

---

<sup>16</sup> There were 44 plans in 2018. At the time of publication, there was 45 approved plans as the ANS Task Force approved the Alabama State ANS Management Plan in November 2021.

example, some may use funds to support a State ANS Coordinator position, whereas other states conduct on-the-ground, collaborative projects. In 2016, funding for the SIANSMMP program doubled from \$1 million to \$2 million and was maintained through the 2019 reporting period.<sup>17</sup> This new funding level translated to approximately \$46,500 for each plan, as available funding is distributed equally among the states that apply for annual funding.

### ***National ANS Management and Control Plans***

Section 1202(e) of the Act authorizes the ANS Task Force to develop cooperative efforts to control established ANS, when warranted, and minimize the risk of harm to the environment and public health and welfare. These efforts are organized into a comprehensive management plan that is developed by Federal and state agencies, nongovernmental organizations, industry representatives, subject matter experts, and others. Once drafted, the plans undergo review by ANS Task Force members and regional panels, with opportunities for public review, to ensure the actions proposed by the plan will be effective to minimize the impact to areas where ANS have already invaded and prevent spread into additional habitats. The implementation of these plans, once approved by the ANS Task Force, requires participation of Federal, state, and regional entities.

There are currently nine National ANS management and control plans approved by the ANS Task Force.

- Brown Tree Snake, *approved June 1996.*
- Eurasian Ruffe, *approved November 1996.*
- European Green Crab, *approved November 2002.*
- Mitten Crabs, *approved November 2003.*
- Caulerpa species (an invasive algae), *approved October 2005.*
- Snakehead, *approved November 2006, revision approved May 2015.*
- New Zealand Mudsnail, *approved May 2007.*
- Asian carp (Black Carp, Bighead Carp, Grass Carp, and Silver Carp), *approved November 2007.*
- Lionfish, *approved May 2015.*

In addition to these nine plans, the WRP drafted the Quagga Zebra Mussel Action Plan for Western U.S. Waters (QZAP), which was approved by the ANS Task Force in 2010.

### ***Other ANS Task Force Coordination Efforts***

The ANS Task Force has developed several tools to serve agencies, organizations, and the general public. For example, the ANS Task Force's website is designed to archive ANS Task Force meeting minutes, agendas, presentations, plans, and other documents drafted by ANS Task Force members, regional panels, or subcommittees. The website also functions as a clearinghouse for ANS information and provides general information on ANS biology, impacts, and legislation, as well as more detailed information and guidance on other topics such as prevention, monitoring, and control.

In FY 2018 and 2019, the ANS Task Force continued to work collaboratively with industry and other stakeholders affected by ANS Task Force and regional panel activities. For example, the ANS Task Force and its ANS partners collaborated with the manufacturers of boats and associated equipment to develop guidelines and best practices to reduce the likelihood of spreading ANS. This work resulted in the development of the American Boat and Yacht Council's Technical Information Report (TIR) published in 2018 titled, "T32: Design

---

<sup>17</sup> Although outside the timeframe of this report, it should be noted that funding for the SIANSMMP grant program increased to \$3.8 million in 2020 and \$4 million in 2021.

Considerations in Consideration of Aquatic Invasive Species.” The TIR has helped facilitate watercraft inspection and decontamination programs in the West and “Clean, Drain, Dry” best practices for watercraft recreationalists throughout the United States.

Several ANS Task Force members continued to improve communication and collaboration by developing internal strategies to improve ANS management. For example, the U.S. Forest Service (USFS) Pacific Northwestern Region completed the Regional Aquatic Invasive Species Monitoring Strategy in 2019 and will begin to deploy the strategy in 2020. The Region will be covered by a “boots on the ground” approach, with personnel trained in identification of focal species. In 2018 and 2019, the U.S. Army Corps of Engineers (USACE) Invasive Species Leadership Team continued to collaborate with other ANS Task Force members, regional invasive species councils, Federal and state agencies, and additional stakeholders to coordinate ANS policy, regulations, and best management practices that influence USACE missions. Likewise, the USFWS staff provided technical and field assistance, grants management, and capacity building across the nation to enhance ANS management. As an example, USFWS allocated approximately \$930,000 in FY 2018 and 2019 to partners to implement the highest priority actions from the ANS Task Force-approved QZAP, with the ultimate goal of safeguarding the west from further spread of these invasive mussels.

Using QZAP as a foundation, the Department of the Interior (DOI) began the *Safeguarding the West from Invasive Species*<sup>18</sup> initiative in 2017, a package of actions that were developed through collaboration with western governors and Federal, state and tribal agencies to protect areas in the West from the economic and ecological threats posed by invasive mussels. Through this initiative, the DOI spent \$13.8 million in FY 2018<sup>19</sup> and \$17 million in FY 2019<sup>20</sup> to prevent, contain, and control invasive mussels nationwide. Examples of the work conducted under the Safeguarding the West initiative by ANS Task Force members included:

- The Bureau of Land Management (BLM) facilitated interagency and multi-partner meetings in 2018 and 2019 to identify and fund projects and programs to implement inter-jurisdictional containment strategies for quagga mussels in the lower Colorado River;
- The Bureau of Reclamation (Reclamation) collaborated with the U.S. Geological Survey (USGS), USACE, and Molloy & Associates in 2018 on a prize challenge seeking innovative theoretical solutions to eradicate mussels from large reservoirs, lakes, and rivers in a cost-effective and environmentally sound manner;
- The National Park Service (NPS) made an additional \$1.2 million available in 2018 to western parks for zebra and quagga mussel prevention and containment programs, including housing and shelter for boat ramp crews, watercraft decontamination equipment, and a contract for mussel detection dog services; and
- BLM, Reclamation, NPS, and USFWS signed a 5-year interagency agreement to fund, pending annual appropriations, a regional database used to track and report watercraft inspections as well as training sessions for inspection and decontamination across the West.

---

<sup>18</sup> The Safeguarding the West from Invasive Species document can be found at:

[www.doi.gov/sites/doi.gov/files/uploads/safeguarding\\_the\\_west\\_from\\_invasive\\_species.pdf](http://www.doi.gov/sites/doi.gov/files/uploads/safeguarding_the_west_from_invasive_species.pdf)

<sup>19</sup> The 2018 Progress Report of Safeguarding the West from Invasive Species document can be found at:

[www.doi.gov/sites/doi.gov/files/uploads/safeguarding\\_the\\_west\\_progress\\_report\\_february\\_2018\\_final.pdf](http://www.doi.gov/sites/doi.gov/files/uploads/safeguarding_the_west_progress_report_february_2018_final.pdf)

<sup>20</sup> The 2019 Progress Report of Safeguarding the West from Invasive Species document can be found at:

[www.doi.gov/sites/doi.gov/files/safeguarding-the-west-progress-report-2019-feb-508.pdf](http://www.doi.gov/sites/doi.gov/files/safeguarding-the-west-progress-report-2019-feb-508.pdf)

Since 2014, the eight Great Lakes states have been working together with the Canadian provinces of Ontario and Quebec to coordinate and provide input on ANS prevention, early detection, and response activities. The Great Lakes Commission (GLC) and The Nature Conservancy manage implementation of project activities with Great Lakes Restoration Initiative (GLRI) funding from USFWS. In 2018 and 2019, key outputs from these efforts included ANS surveillance and response frameworks for the Great Lakes region, three mock ANS response exercises, aquatic plant surveillance at multiple sites, and completion of an aquatic plant pathway risk assessment for the region.<sup>21</sup> Activities are focused on developing a draft plan for interstate communication as part of a response; conducting a response exercise to test the draft communications plan; and continuing aquatic plant surveillance at priority sites.

The GLC is also working with The Nature Conservancy and a binational working group of U.S. and Canadian state, provincial and Federal representatives to develop the Blue Accounting framework as a common approach to monitoring Great Lakes water resources. Under this framework, decision-makers will understand how strategies and investments implemented by many organizations are collectively addressing goals identified in regional plans and agreements, and where critical gaps in investment remain. As part of this effort, progress on regional invasive species prevention and control goals will be tracked and reported. In 2018 and 2019, key outputs from these efforts included:

- Publication of the Great Lakes surveillance site prioritization tool for AIS detection;
- Publication of information on regional harmonization of prevention policies for the trade in live organisms and recreational boating pathways; and
- Engagement with other forums to align and integrate Blue Accounting with regional reporting mechanisms including the binational Great Lakes Water Quality Agreement and the GLRI.

---

<sup>21</sup> Updates and additional information on the Blue Accounting Project can be found at: [www.blueaccounting.org](http://www.blueaccounting.org)

## Prevention

Preventing harmful introductions before they occur is the most cost-effective and environmentally protective means for managing ANS. Prevention can be accomplished by employing measures such as decontaminating and treating water, watercraft, and gear that could transport ANS; restricting the importation or release of potentially harmful species; and enforcing current laws and regulations designed to eliminate the introduction and spread of ANS. To advance such efforts, ANS Task Force members have utilized public awareness campaigns, risk assessment tools, and other mitigation efforts to prevent new species from entering the country or crossing state lines. Key prevention activities that occurred in 2018 and 2019 are highlighted below with a focus on pathways that have been identified as high priority by the ANS Task Force.

### ***Watercraft Inspection and Decontamination***

Watercraft moving from one waterbody to another remains a significant pathway for ANS. Organisms can attach to boats, become tangled on propellers or boat trailers, or survive within bilge water, ballast tanks, and motors. If introduced into a new waterbody, ANS can negatively impact the quality of boating and other outdoor recreation experiences by displacing native fish populations, decreasing water quality, damaging watercraft, and closing public boat ramps.

Several ANS Task Force members have contributed to efforts that reduce the spread of ANS via watercraft. For example, the BLM provided FY 2018 funds to Colorado Parks and Wildlife (CPW) to print and distribute educational brochures, maintain and purchase boat decontamination equipment, and modernize their watercraft inspection and decontamination (WID) stations. USFS has a Cost Share Agreement with CPW for boat inspection and decontamination programs on 10 reservoirs across five National Forests. CPW's ANS prevention program has kept the state's waters free from invasive mussel populations; accordingly, it serves as a model program for the United States. The core of the program focuses on inspection and decontamination of mussel infested boats using 70 WID stations across the state, which conduct over 450,000 inspections and 5,000 decontaminations annually.

ANS Task Force members are committed to protecting the Columbia River Basin (CRB), as it is one of the only major river basins in the United States that has not been impacted by invasive quagga or zebra mussels. To further protect the CRB from invasive species, USACE participates in an ongoing state-managed program to establish and operate WID stations in Idaho, Montana, Oregon, and Washington. To date, the program has been successful in intercepting numerous ANS threats, thereby helping to prevent the introduction of zebra and quagga mussels (based on monitoring data) to the CRB. In addition, Reclamation provided approximately \$4.3 million dollars in FY 2018 and \$4 million dollars in FY 2019 to support nearly 50 projects focused on keeping invasive Dreissenid mussels out of the CRB and containment of mussels in the lower Colorado River. This included purchasing or improving WID stations within California, Nevada, Montana, Arizona, and Washington; supporting the Washington Department of Fish and Wildlife's monitoring activities at high-risk water bodies; and providing increased enforcement at AIS WID stations through the Oregon State Marine Board. USFWS and Bonneville Power Administration also continue to support the Pacific States Marine Fisheries Commission's Watercraft Inspection and Training Program. This professional training ensures that WID programs across the West are consistent and of high-quality and advances the efforts of USFWS' 100th Meridian Initiative, the Western Regional Panel (WRP), and priorities in the QZAP. To date, thousands of individuals have been trained through this program.

## ***Vessel Management***

As highlighted in Section 1002 of the Act, the discharge of ballast water has been responsible for the introduction of several ANS. To address this pathway, the “Vessel Incidental Discharge Act” (VIDA) was signed into law on December 4, 2018. The VIDA restructures how EPA and USCG regulate incidental discharges, primarily from commercial vessels, into waters of the United States and the contiguous zone. Specifically, the VIDA requires EPA to develop new national standards of performance for commercial vessel discharges and the U.S. Coast Guard (USCG) to develop corresponding implementing regulations. In 2018 and 2019, these ANS Task Force member agencies developed proposed national standards of performance in consultation with interested governors. The proposed standards – once finalized and implemented through corresponding USCG regulations addressing implementation, compliance, and enforcement – would reduce the discharge of pollutants from vessels and streamline the current patchwork of Federal, state, and local vessel discharge requirements. In addition, EPA is proposing procedures for states to follow if they choose to petition EPA to issue an emergency order; to review any standard of performance, regulation, or policy; to request additional requirements with respect to discharges in the Great Lakes; or to apply to EPA to prohibit one or more types of vessel discharges proposed for regulation in this rulemaking into specified waters to provide greater environmental protection. The VIDA also requires a report to Congress detailing ballast water delivery and management and invasions resulting from ballast water discharge. It is expected that this report to Congress will be ready for review in 2022. EPA and USGS continue to provide progress updates to the other ANS Task Force members as well as opportunities to review these products as they are being developed.

In addition to their work on VIDA work products, USCG and EPA also participate in the Caribbean Coral Reef Partnership. In 2019, the Partnership was informed about the rapid spread of Stony Coral Tissue Loss Disease throughout the Caribbean, a lethal disease that rapidly destroys the soft tissue of many different species of coral. In response, the USCG Office of Operating and Environmental Standards published Marine Safety Information Bulletin 007-19, “Ballast Water Best Management Practices to Reduce the Likelihood of Transporting Pathogens That May Spread Stony Coral Tissue Loss Disease.” The Bulletin seeks to ensure that the maritime industry has the information it needs to mitigate ballast water as a potential contributing factor to the spread of the disease.

## ***Organisms in Trade***

As the world trade network continues to grow, the number of aquatic organisms purchased, shipped, and transported through pet, aquarium, live bait, and water garden trades has escalated. The importation of organisms through trade has allowed ANS to be introduced and spread through escape, intentional release, or by hitchhiking on intentionally imported species.<sup>22</sup> Risk screening is an important management tool to identify ANS risks from the live animal and plant trade. The USFWS’ risk assessment program for nonnative aquatic species centers on the preparation of Ecological Risk Screening Summaries (ERSS) to rapidly screen nonnative species that may pose a risk to the natural environment, human health, or the economy if introduced in the United States. This is technically incorrect and should read: The ERSS tool classifies species as high, low, or uncertain risk based on history of invasiveness and similarity of climate between the species’ established range and the contiguous United States. In FY 2018 and FY 2019, a total of almost 1,000 ERSSs were reviewed, finalized, and made accessible to ANS Task Force members, regional panels, as well as state partners and the public. Approximately 12 percent of completed ERSSs have

---

<sup>22</sup> Padilla, Dianna K., and Susan L. Williams. “Beyond ballast water: aquarium and ornamental trades as sources of invasive species in aquatic ecosystems.” *Frontiers in Ecology and the Environment* 2, no. 3 (2004): 131-138.

identified species posing high risk to the contiguous United States if introduced. Numerous states and other partners have used ERSS results to identify species in need of more in-depth risk assessment, inform prohibited species lists or watch lists, identify target species for early detection, and determine the appropriate response to a new detection.

USFWS acquired voucher specimens and tissue samples from aquatic species deemed high-risk to become invasive in the United States. The tissue samples were used to develop and validate genetic markers for future screening in U.S. waterways. In FY 2018 and 2019, USFWS created a list of 13 priority fish and invertebrate species for this project and identified 21 contacts from 12 countries (Canada, Czech Republic, England, Finland, Germany, Italy, Norway, Poland, Romania, Russia, Sweden, the United States) who committed to sending samples. By the close of FY 2019, specimens and tissue samples from seven species (ruffe, tench, Asian swamp eel, Oriental weatherfish, red swamp crayfish, round goby and bloody red shrimp) were delivered to the USFWS Northeast Fishery Center genetics laboratory for marker development.

### ***Interbasin Transfer***

When water is moved from one basin to another, ANS may also be transferred. This can introduce nonnative species to a new basin, which can become invasive and threaten the area's plants, wildlife, and water supply infrastructure. To mitigate this pathway on an Illinois Waterway, USACE and the State of Illinois signed an agreement to complete Pre-Construction Engineering and Design for the Brandon Road Project in December 2019. The agreement allowed construction to begin on an ANS deterrent between the Mississippi River and the Great Lakes Basin, located along the Des Plaines River in Joliet, Illinois. The nuisance species of focus are bighead carp, silver carp, black carp, and scud. The project includes non-structural and structural measures to prevent species movement through swimming, floating, or hitchhiking upstream from the Mississippi River Basin into the Great Lakes Basin. The project will utilize multiple measures including lock flushing, acoustic fish deterrents, an electric fish barrier, and a bubble curtain. Construction is expected to take 6-8 years to complete after appropriations are received.

## Early Detection and Rapid Response

When a new species introduction is detected, prompt action is often required to keep ANS from becoming established and spreading to new areas. Early Detection and Rapid Response (EDRR) is an effective strategy to increase the likelihood that localized ANS populations will be found, contained, or eradicated before the species becomes widely established, thereby avoiding the need for costly, long-term control efforts. EDRR involves monitoring habitats to discover new species soon after introduction, reporting sightings of previously unknown species in an area, and working quickly to remove or contain potential ANS. Members of the ANS Task Force are refining reporting and data collection mechanisms as well as developing and testing novel approaches, such as molecular-based tools, to enhance EDRR. Key EDRR activities that occurred in 2018 and 2019 are highlighted below.

### ***Database Management***

Several ANS Task Force members continue to advance and utilize tools to assist EDRR efforts. For example, the USFS Northern Region is working with state AIS leads, regional resource advisors, GIS specialists, and technical experts to develop a region-wide, web-based ANS geodatabase that will be updated annually. Furthermore, USGS continues to manage the Nonindigenous Aquatic Species (NAS) information resource as a central repository for accurate and spatially referenced accounts of ANS across the Nation. The program monitors, analyzes, and records sightings of nonindigenous aquatic species and provides information about introduction pathways, geographic distribution, ecology, and the impacts of ANS. In 2017, the Flood and Storm Tracker (FaST) Maps were added to the NAS database to help assess impacts of nonindigenous aquatic species distributions due to flooding associated with storms. These maps help natural resource managers determine potential new locations for individual species or to develop a watchlist of potential new species within a watershed. Since the creation of the USGS NAS FaST map tool, nine storm maps have been created to assess potential ANS spread due to flooding associated with storms. The 2018 and 2019 storm seasons included five significant flood events (Hurricanes Florence, Lane, and Michael, 2018; Hurricane Dorian, 2019; and the midwest spring flood that occurred in the Upper Mississippi River Basin, 2019). For these events, the FaST maps were enhanced, based on stakeholder input, to refine the drainage scale from eight-digit hydrological units codes (HUC) to 10-digit HUCs. This enhancement provides additional fine-scale information on flood conditions and allows a more granular view of potential invasive and introduced species movement.

To improve the utility of the NAS Program and Alert System, the Alert Risk Mapper (ARM) tool was created in 2018 through a grant from Gulf and South Atlantic Regional Panel and USFWS. The ARM tool develops credible scenarios of a nonindigenous species' potential movement within a newly colonized drainage based on its mobility and drainage barriers (dams and waterfalls) and is used to develop short-term risk assessment maps that accompany nearly all USGS NAS Database Alert emails. Maps from ARM indicate lakes, river reaches, and other waterbodies at risk of invasion from a new nonindigenous species sighting. In FY 2019, the NAS program sent out 240 ARM maps to more than 1,000 subscribers and managers across the United States. NAS scientists are continuously looking to enhance this tool by adding more data that is informative to stakeholders; for example, a national salinity zones layer has been added to the ARM tool to help determine the downstream limit of movement for many species based on their ability to tolerate saltwater.

### ***Surveillance Tools***

Whether to inform early detection efforts for invasive species or to locate or assess recovery of imperiled species, eDNA surveillance is becoming more commonly used to detect the presence and relative



abundance of rare species.<sup>23</sup> The use of eDNA as a surveillance tool is rapidly expanding, with a wide range of research projects designed to increase knowledge of how this approach compares to traditional biological survey methods.

USGS has considerable capacity and capabilities in genetics, genomics, and microbiology and has been a leading federal agency conducting research on eDNA.<sup>24</sup> In FY 2019, USGS allocated close to \$2 million to eDNA research. Since 2011, USGS has authored at least 74 eDNA publications, including studies on invasive zebra mussels, New Zealand mudsnails, round goby, invasive carp, Burmese pythons, and Eurasian watermilfoil and various species of conservation concern.<sup>25</sup> These studies aim to:

- Improve field and laboratory methods, including examining the ability to use remotely collected eDNA samples;
- Provide genetic marker validation and standard eDNA protocol development, including the development of loop-mediated isothermal amplification (LAMP) assays;
- Assess the abundance of target organism using eDNA;
- Assess aspects of biological communities using eDNA; and
- Evaluate the efficacy of control measures for invasive species using eDNA.

Baitfish are typically small minnow species that are transported by the thousands; consequently, it is nearly impossible to detect and remove unwanted, potentially invasive, species from the hauling tanks. To address this concern, the USGS-trained Illinois Department of Natural Resources, Michigan Department of Natural Resources, Ohio Department of Natural Resources law enforcement as well as USFWS biologists to use portable eDNA LAMP detection kits to test for the presence of invasive carp in baitfish shipments. Building on this success, state and Federal biologists began using the kits for rapid on-site eDNA testing in 2018. In 2019, USGS delivered requested refinements to the assay and agencies began using the tool to establish probable cause for investigations of the bait and supply chain to ensure invasive carp and other invasive fish were not sold to anglers or stocked into fish ponds as food fish.

In 2018, USGS also developed a portable eDNA detection kit assay for round goby and trained the Wisconsin Department of Natural Resources (DNR) on its use. The round goby is currently invading Wisconsin waters from the Great Lakes. The portable eDNA detection kit is allowing Wisconsin DNR biologists to confirm and respond to angler reports of round goby captures or sightings with rapid on-site eDNA testing for this species that is nearly impossible to capture by traditional methods when it is at low densities.

In 2018 and 2019, the USGS and USFWS collaborated to develop a modeling approach to eDNA analysis that greatly improves interpretation of eDNA data. Combined with rigorous eDNA sampling on the Upper Mississippi River, this has resulted in substantial improvement in how USFWS conducts eDNA monitoring for

---

<sup>23</sup> Larson, E. R., Graham, B. M., Achury, R., Coon, J. J., Daniels, M. K., Gambrell, D. K., & Suarez, A. V. (2020). From eDNA to citizen science: emerging tools for the early detection of invasive species. *Frontiers in Ecology and the Environment*, 18(4), 194-202.

<sup>24</sup> Tam, C.K., Daniel, W.M., Campbell, E., English, J.J., and Soileau, S.C., 2021, U.S. Geological Survey invasive species research – Improving detection, awareness, decision support, and control: U.S. Geological Survey Circular 1485, 28 p., <https://doi.org/10.3133/cir1485>.

<sup>25</sup> Summaries and Publications of USGS research on invasive species can be found at: [www.usgs.gov/programs/invasive-species-program/science](http://www.usgs.gov/programs/invasive-species-program/science)

invasive carp and three peer-reviewed publications.<sup>26</sup> The new model also determines if adequate sampling intensity was completed or if additional samples need to be collected to achieve reliable detection.

### ***Surveillance and Early Detection***

Monitoring programs designed to detect new invasions increase the feasibility of eradication and help to avoid the need for costly long-term control efforts. As an example, timely detection of zebra and quagga mussels is essential to prevent further spread and minimize damage to water facility infrastructure and fisheries; accordingly, many ANS Task Force members are actively engaged in invasive mussel monitoring efforts. The USFS Northern Region participates in a Montana Fish, Wildlife, and Parks-led ANS monitoring and detection program. In 2019 monitoring crews systematically collected over 2,000 samples at 278 waterbodies across the state.<sup>27</sup> BLM worked with the State of Utah in 2018 and 2019 to staff biological technicians at Pelican Lake and Yuba Reservoir to check for self-certification compliance and conduct boat interdictions, inspections, decontaminations, and boater education programs. BLM also collected plankton samples at Pelican Lake to monitor for the presence of invasive mussels; to date, mussel veligers have not been detected at this location.

BLM funding was also used to conduct fish surveys on the Muddy River in southern Nevada. This project is a continuation of work that started in 2012 with the installation of fish barriers on the Muddy River to prevent upstream migration of invasive species from Lake Mead. The surveys provide information about any new or re-invasions as well as the location and density of existing invasive fish populations so that the feasibility of removal can be evaluated.

The State of Alaska remains free from invasive mussels; however, Alaskan waters are under threat from *Elodea*. This aquatic plant was first documented in areas including Fairbanks, Anchorage, Kenai, and the Mat-Su Borough. To prevent additional spread, BLM began an *Elodea* survey of lakes and rivers within the Central Yukon management area in the summer of 2019. The initial survey focused on Grayling Lake, which is a large, road-accessible lake that is often used by floatplane owners as a pickup and drop-off point before venturing into more remote areas. *Elodea* was not detected in 2019; further sampling and educational efforts will continue into subsequent years.

In 2019, USGS researchers joined partners in central Florida for a bi-annual “Fish Slam” that monitors new introductions and documents range expansion of known nonnative fishes, focusing on urban lakes, ponds, and streams that are infrequently sampled for ANS. At this event, 35 fishery biologists from 10 organizations participated in the 2-day Fish Slam on the Treasure Coast<sup>28</sup> (Indian River, St. Lucie Counties) and central Florida areas (Orange, Seminole Counties). On Treasure Coast, two species of invasive fish were collected that have not been recorded in the area since the 1970s. Seven adult koi were collected from Starke Lake in Orange County; no juvenile koi were collected or observed, leading biologists to

---

<sup>26</sup> Mize, E.L., R.A. Erickson, C.M. Merkes, N. Berndt, K.D. Bockrath, J. Credico, N. Grueneis, et al. 2019. “Refinement of eDNA as an Early Monitoring Tool at the Landscape-Level: Study Design Considerations”:

<https://doi.org/10.1002/eap.1951>; Fritts, A.K., Knights, B.C., Larson, J.H., et al. Development of a quantitative PCR method for screening ichthyoplankton samples for bigheaded carps. *Biol Invasions* 21, 1143-1153 (2019).

<https://doi.org/10.1007/s10530-018-1887-9>; and Erickson RA, CM Merkes, E Mize. 2019. Sampling designs for landscape-level eDNA monitoring programs. *Integrated Environmental Assessment and Management* 15:760-771

<sup>27</sup> Additional information on the Montana Fish, Wildlife, & Parks early detection and monitoring program can be found at: <https://fwp.mt.gov/binaries/content/assets/fwpc/conservation/ais/reports/2019-fwpc-monitoring-report.pdf>

<sup>28</sup> Additional information on the USGS Fish Slams can be found at: [www.usgs.gov/centers/wetland-and-aquatic-research-center-warc/science/treasure-coast-and-central-florida-fish?qt-science\\_center\\_objects=0#qt-science\\_center\\_objects](http://www.usgs.gov/centers/wetland-and-aquatic-research-center-warc/science/treasure-coast-and-central-florida-fish?qt-science_center_objects=0#qt-science_center_objects)

believe that the population is not reproducing. African jewelfish were also collected from Starke Lake, representing the northern-most collection of this species in Florida.

Following reports of *Hydrilla* occurring in the southern portion of the Connecticut River in 2018, a task force was formed by the Northeast Aquatic Nuisance Species (NEANS) Panel to perform a preliminary survey of the river from central Vermont and New Hampshire to southern Connecticut. *Hydrilla* was not found in the New Hampshire or Vermont portions of the river, yet *Hydrilla* became common south of the Connecticut border with portions of the river alarmingly choked with the weed.<sup>29</sup> Additional surveillance will be needed to document the extent of the existing population and determine if *Hydrilla* is moving north.

### **Rapid Response Efforts**

Rapid response to a new species detection is critical to increase the likelihood that localized invasive populations will be found, contained, and eradicated before they become widely established. To prepare for this event, ANS Task Force members work with the states and other partners to develop rapid response plans and conduct exercises. For example, several ANS Task Force members and its WRP participate on the 100th Meridian Initiative Columbia River Basin Team that has been working proactively since 2003 to prevent the spread of ANS in the CRB. As part of ANS prevention activities, the *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species* was developed in 2008 and is tested annually with Rapid Response tabletop exercises. Furthermore, as part of the Safeguarding the West Initiative, ANS Task Force members partnered with state agencies, tribes, and nongovernmental organizations to produce a manual<sup>30</sup> in 2019 to facilitate compliance with Section 7 of the Endangered Species Act during Dreissenid mussel rapid response in the CRB. The manual will reduce the regulatory burden associated with Section 7 consultation, allowing action agencies to proceed expeditiously in addressing the critical need to contain/control an infestation. Additional outcomes include improved coordination and preparedness among partners engaged in invasive mussel rapid response planning in the CRB.

In addition to their efforts to ensure preparedness, ANS Task Force members have assisted in situations that have warranted rapid response to a new ANS introduction. For example, a small dive quarry in Carroll County, Maryland, reported an unknown mussel to the Chesapeake Bay Program (CBP) and Maryland Department of Natural Resources (MDDNR) in 2018, which was later confirmed to be a zebra mussel. The CBP and MDDNR worked with the Carroll County government to create a plan for eradication and contracted the ASI Group Ltd. to treat the quarry with 460 tons of a 20-percent potassium chloride solution between August 15, 2019, and August 23, 2019.<sup>31</sup> Bioassay stations throughout the quarry were set up, which indicated 100 percent mortality of the mussel population following the treatment. Post-treatment dives have confirmed that the treatment was effective; yet potassium chloride levels will be maintained to prevent further infestations.

---

<sup>29</sup> Bugbee G., Summer E. Stebbins. 2019. Connecticut River Gateway Conservation Zone Invasive Aquatic Vegetation Survey Aquatic plant management options. The Connecticut Agricultural Experiment Station Report. [https://portal.ct.gov/-/media/CAES/Invasive-Aquatic-Plant-Program/Publications/Survey-Information/CTRiverReport\\_2019\\_Final.pdf](https://portal.ct.gov/-/media/CAES/Invasive-Aquatic-Plant-Program/Publications/Survey-Information/CTRiverReport_2019_Final.pdf)

<sup>30</sup> Dreissenid Mussel Rapid Response in the Columbia River Basin: Recommended Practices to Facilitate Endangered Species Act Section 7 Compliance, Prepared for the U.S. Fish and Wildlife Service and Pacific States Marine Fisheries Commission by: Lisa DeBruyckere of Creative Resource Strategies, LLC October 2019. [https://permanent.fdlp.gov/gpo143132/ESAManual\\_Final\\_5Oct2019.pdf](https://permanent.fdlp.gov/gpo143132/ESAManual_Final_5Oct2019.pdf)

<sup>31</sup> Clarke W. 2021. Pulling the Mussels. Chesapeake Quarterly: 20(2). [www.chesapeakequarterly.net/V20N2/main3/](http://www.chesapeakequarterly.net/V20N2/main3/)

In August 2019, the New York State Department of Environmental Conservation (NYSDEC) received a report from an angler that a northern snakehead had been caught in the Hudson River. In response, the NYSDEC and USFWS employed a combination of eDNA and electrofishing surveys to look for any evidence of northern snakehead in the area. No northern snakehead DNA was detected in any of the samples and no individuals were found. At this time no further surveys are planned.

In October 2019, northern snakehead were discovered in a private pond in Gwinnett County, Georgia, by a local angler. After the Georgia Department of Natural Resources determined there were no threatened or endangered fish species in the pond, the water level was lowered, sport fish were removed and held in refugia, and a piscicide (rotenone) was applied. Fin clips of all 34 snakehead removed were collected for DNA analysis by USFWS. The DNA results indicated two cohorts of juveniles, most from the same parentage as the two adults initially collected, and 13 subadults that did not appear to be offspring of either sampled adult. Subsequent surveys have not produced any additional snakehead.

On the U.S. West Coast, BLM led a multi-stakeholder, 5-day snorkel survey in 2019 that covered 30 river miles to track the invasion of nonnative Sacramento pikeminnow in the North Fork Eel River, California.<sup>32</sup> Overall, nine adult pikeminnow were found and an eradication effort was able to remove three females. The removal of these fish likely provides a significant setback for pikeminnow invasion in the North Fork Eel River.

---

<sup>32</sup> Bureau of Land Management. 2019. Aquatic Invasive Species Highlights FY 2018 and 2019. U.S. Department of the Interior, Bureau of Land Management, Washington, DC.

## Containment and Control

ANS do not recognize borders and readily cross geographic and jurisdictional boundaries. Accordingly, effective containment and control measures are needed to slow the rate of range expansion, lessen impacts to public interests, and increase the likelihood of eradication. To succeed, adequate coordination, funding, public awareness, and management expertise are critical. The ANS Task Force members and regional panels have conducted ecosystem-level approaches to control ANS that include eradication, population suppression, and limiting spread. Key containment and control activities that occurred in 2018 and 2019 are highlighted below.

The ANS Task Force and its members have developed comprehensive ecosystem programs or strategies that encompass multiple regions. For example, USFS treated 3,711 acres of lakes and 45 miles of streams in Texas, Virginia, Arkansas, Florida, and Louisiana for aquatic invasive plants in 2018. The following year, the agency treated 5,689 acres of lakes and 45 miles of streams in Texas, Florida, Virginia, Arkansas, Alabama, Louisiana, and Mississippi for aquatic invasive plants. In addition, USFS treated 0.25 miles of high-value streams in Puerto Rico for invasive fish.

In Utah, BLM worked with the state to create a management plan<sup>33</sup> to eradicate common carp from Pelican Lake. Their plan eradicated most fish species from the lake and was followed by repopulating largemouth bass and bluegill from a local source. This effort supported Utah's Initiative on Blue Ribbon Fisheries by managing Pelican Lake as a quality warm water sport fishery.

USGS, in collaboration with USFWS, Missouri Department of Conservation, Illinois Department of Natural Resources, and Kentucky Department of Fish and Wildlife Resources, has been testing and modifying a very successful method of harvest for bighead and silver carp that was originally developed in China. This modified unified method (MUM)<sup>34</sup> uses several types of nets and procedures to consecutively push carp from compartments and block them from returning, and thus eventually concentrating the carp in a collection zone where the fish are harvested. USGS has adapted these concepts, incorporating technologies such as side-scan sonar, underwater loudspeakers mounted on boats, specialized electrofishing methods, and using seines instead of trap nets for the final harvest. The process has been very successful. For example, in 2018, USGS collaborated with the State of Missouri to remove 240,000 pounds of fish from a 300-acre lake near St. Louis, Missouri. Subsequent trials of the MUM in Illinois and Kentucky indicate the method is amenable to a variety of habitat types. However, these methods are still new and additional research is needed to further quantify and improve efficiency, or to evaluate use of the method for new purposes, such as rapid response to new carp invasions.

For some ANS, eradication may not be logistically or economically feasible; accordingly, many control efforts are long-term operations aimed to keep ANS below a specified threshold to minimize their impacts. For example, USDA partnered with USACE in 1959 to manage alligator weed throughout the southeastern United States using a weed flea beetle as a method of biological control.<sup>35</sup> In many states, the beetles cannot survive the winter and must be reintroduced each year. To assist, USACE has conducted annual

---

<sup>33</sup> Details on this project are within the BLM Environmental Assessment: Pelican Lake Treatment DOI-BLM-UT-G010-2014 0113:

[https://eplanning.blm.gov/public\\_projects/nepa/39013/52680/57371/Final EA, DR, and FONSI 11032014 PDF.pdf](https://eplanning.blm.gov/public_projects/nepa/39013/52680/57371/Final_EA,_DR,_and_FONSI_11032014_PDF.pdf)

<sup>34</sup> Chapman, D.C., 2020, "Modified Unified Method" of carp capture: U.S. Geological Survey Fact Sheet 2020-3005, 2 p., <https://doi.org/10.3133/fs20203005>.

<sup>35</sup> Additional information in the USACE's effort to control alligator weed is summarized here: [www.saj.usace.army.mil/Missions/Environmental/Invasive-Species/Management/](http://www.saj.usace.army.mil/Missions/Environmental/Invasive-Species/Management/)

flea beetle collections, shipping the beetles to state and Federal governments throughout the southeastern United States. Since 1982, a total of 1,713,000 insects have been shipped to 11 states and Puerto Rico. In 2019 alone, 40,000 insects were shipped to 13 different agencies across 8 different states, and a video was put together for education and outreach ([www.youtube.com/watch?v=Aqny06xTEXk&t=1s](http://www.youtube.com/watch?v=Aqny06xTEXk&t=1s)).

### ***ANS Collaboratives***

USGS, in partnership with the Great Lakes Commission (GLC), Great Lakes Fisheries Commission, and National Oceanic and the Atmospheric Administration (NOAA), established the Invasive Mussel Collaborative (IMC) in 2015 to advance scientifically sound technology for invasive mussel control to produce measurable ecological and economic benefits.<sup>36</sup> The Collaborative provides a framework to identify the needs and objectives of resource managers; prioritize the supporting science; implement communication strategies; and align science and management goals into a common agenda for invasive mussel control. In 2018 and 2019, key outputs from these efforts included:

- Development of the *Strategy to Advance Management of Invasive Zebra and Quagga Mussels*<sup>37</sup> that is intended to drive investments, policy, and research on invasive mussels across the Great Lakes Basin and beyond;
- Completion of a communications video highlighting the work of the IMC and the Strategy;
- Implementation of a control method demonstration and evaluation project using the molluscicide Zequanox® at Good Harbor Reef in Lake Michigan;
- Summarization of available control methods and associated literature, case studies, and permitting information;
- Continued population of a Research Program and Project map explorer tool that collates current and ongoing invasive mussel research activities into an easy-to-navigate map that provides information about projects across North America and provides geographic context for this research; and
- Expansion of existing NPS and Michigan Department of Natural Resources projects to remove invasive mussels in Lake Michigan.

USGS and GLC have lead the Great Lakes *Phragmites* Collaborative (GLPC) to improve communication and collaboration leading to more coordinated, efficient, and strategic approaches to managing nonnative *Phragmites* across the Great Lakes Basin. The *Phragmites* Adaptive Management Framework (PAMF) was developed through the GLPC to change the way *Phragmites* management is done throughout the Great Lakes Basin and to help inform effective and efficient *Phragmites* management.<sup>38</sup> The PAMF model was piloted in August 2018 and has since undergone improvements to the program's design, implementation, and modeling structure. PAMF has three critical pieces: a monitoring protocol, a learning model that predicts how *Phragmites* will respond to different management alternatives, and a central database where the results from all management efforts are reported. Data provided by all participating land managers across the basin fuels the adaptive management process and provides site-specific management guidance that is optimized to reduce *Phragmites*, while minimizing management costs. Other key outputs from the GLPC in 2018 and 2019 included:

---

<sup>36</sup> For more details on the Invasive Mussel Collaborative visit: <https://invasivemusselcollaborative.net/>

<sup>37</sup> The Strategy to Advance Management of Invasive Zebra and Quagga Mussels can be found at: <https://invasivemusselcollaborative.net/resource/strategy-to-advance-management-of-invasive-zebra-and-quagga-mussels/>

<sup>38</sup> More information on the Phragmites Adaptive Management Framework can be found at: [www.greatlakesphragmites.net/pamf/about-pamf/](http://www.greatlakesphragmites.net/pamf/about-pamf/)

- Establishment of a Common Agenda to guide the work of the GLPC based on the principles of collective impact;
- Completion of a community assessment to gain a shared understanding of where gaps and opportunities exist;
- Convening the *Phragmites* Symbiosis Collaborative, a forum for researchers to share and collaborate on their microbial and genetic research; and
- Providing the *Phragmites* management guidance for 206 enrolled management units.

## Research

All aspects of ANS management are supported by knowledge of ANS biology, potential impacts, pathways, and interaction with native ecosystems. Although understanding of ANS has dramatically increased in recent years, there is still much to be learned. Accordingly, ANS Task Force members conduct research to further our understanding of ANS, using this knowledge to develop more effective prevention, surveillance, control, and eradication methods. Key research activities that occurred in 2018 and 2019 are highlighted below, with a focus on research areas that have been identified as high priority by the ANS Task Force.

### ***Invasive carp***

Invasive carp, a collective term for bighead carp, silver carp, black carp, and grass carp continue to threaten river and lake systems of the United States. In response, coordinated action as well as a growing number of technologies are currently under development or have been proposed for use in controlling populations and preventing additional spread of invasive carp. This report summarizes key efforts by ANS Task Force members; additional details can be found in the Invasive Carp Regional Coordination Committee's annual action plans and reports.<sup>39</sup>

In 2018 and 2019, USGS continued ANS research on advanced technologies, with a specific focus on invasive carp. This included construction of an electro-olfactogram (EOG) apparatus to identify potential compounds for use as attractants to enhance invasive carp removal efforts. The EOG study is designed to assess the similarities and differences in the relative strength of the olfactory response across the various amino acids among the primarily herbivorous grass carp and filter feeding silver and bighead carp. Once the EOG studies have been completed, the next step will be to conduct laboratory behavior studies to determine if the electrical responses observed using EOG can be matched with attraction or avoidance behavior in these invasive carp species. Researchers at USGS, in collaboration with Joliet Junior College, are also currently evaluating the use of chemical stimuli and food attractants to concentrate bigheaded carp for removal. A pilot study was completed in May 2018 in which trap nets were set throughout the Starved Rock pool of the Illinois River to test if nets baited with attractant flavors were more effective at capture than un-baited nets. Preliminary data suggest the food attractant increases and concentrates fish in areas for removal. Behavioral tests to characterize the response of silver carp and grass carp to these potential attractants are currently in progress using avoidance/preference chamber tank experiments and in pond studies.

In addition to their work on attractants, USGS and their partners addressed the regulatory compliance and engineering feasibility for the use of carbon dioxide as a behavioral deterrent and lethal control to invasive carp and other invasive species. In 2018, USGS and USFWS obtained a Section 3 registration from EPA for carbon dioxide as a new aquatic pesticide – now registered as Carbon Dioxide-Carp. USGS is also currently working to understand and address regulatory compliance with water quality standards for this new chemical control method. An engineering feasibility study within a navigation lock in Wisconsin was also conducted to demonstrate the installation and operation of a large-scale carbon dioxide infusion system.

---

<sup>39</sup> Reports and action plans for the Invasive Carp Regional Coordinating Committee can be found at: <https://invasivecarp.us/PlansReports.html>



Data were collected on operational costs, fish behavior, non-target organisms, human health risk assessment, and water quality and are currently being processed and analyzed.<sup>40</sup>

USGS, in collaboration with state partners and USFWS, developed a decision support tool for prioritizing research on invasive carp and to examine the effect of commercial harvest in particular areas of the system. The model is informed by data from the USGS-managed acoustic telemetry array that includes over 500 receivers across more than 250 river miles in the Illinois River waterway. The centralized database (FishTracks Telemetry Database) for the array contains over 35 million detection records. This data is being utilized to generate model-based evaluations of differing control strategies used for invasive carp in the Illinois River (i.e., different levels and spatial allocations of mortality and upstream movement deterrence). As an example, the model identified a need to increase tagging efforts on immature invasive carp below Started Rock Lock and strongly supported continued commercial harvest of invasive carp in the Peoria Pool of the Illinois River.

Since 2014, USGS, in collaboration with the University of Toledo, Ohio Department of Natural Resources, and Michigan Department of Natural Resources, has conducted sampling to determine where and under what hydraulic conditions grass carp spawn to inform efforts to eradicate grass carp in Lake Erie. In 2018 and 2019, USGS captured viable eggs or larvae in the Sandusky and Maumee rivers, two of the largest tributaries to Lake Erie, and have indirect evidence of potential spawning in a third, yet unknown, river.<sup>41</sup> This data was put into a fluvial drift model to determine where grass carp spawn in the Sandusky River within a 1.2 mile (2 km) range. This information has been used by management agencies to remove dozens of adult grass carp while they were spawning.

### **Amphibians**

The North American bullfrog (*Lithobates catesbeianus*) is a known vector for the fungus *Batrachochytrium dendrobatidis* (Bd), which causes Chytridiomycosis, a disease linked to population declines in amphibians.<sup>42</sup> North American bullfrogs are native to the central and eastern United States, but have been intentionally introduced and become invasive in many areas of the western United States, including Hawaii.<sup>43</sup> In 2019, BLM and USGS collaborated with Colorado Mesa University to study the distribution of bullfrogs and Bd in relation to native amphibians in Colorado's McInnis Canyons and Dominguez-Escalante National Conservation Areas. The survey combines traditional field surveys with eDNA technology to improve estimates of detection and disease screening. The next stages of the study will develop new eDNA assays for native amphibians, which will allow for better documentation of the distribution of these species. This information will greatly contribute to the limited information on amphibian diversity within BLM lands and evaluate the potential impacts of Bd.

### **Dreissenid Mussels**

Efforts to manage Dreissenid mussel populations that target early life stages with low concentrations of a control agent may reduce application costs and minimize adverse effects to non-target organisms.

---

<sup>40</sup> Donaldson, Michael R., et al. "Carbon dioxide as a tool to deter the movement of invasive bigheaded carps." Transactions of the American Fisheries Society 145.3 (2016): 657-670.

<sup>41</sup> Embke, Holly S., et al. "First direct confirmation of grass carp spawning in a Great Lakes tributary." Journal of Great Lakes Research 42.4 (2016): 899-903.

<sup>42</sup> Borzée, Amaël, et al. "Introduced bullfrogs are associated with increased *Batrachochytrium dendrobatidis* prevalence and reduced occurrence of Korean treefrogs." PloS one 12.5 (2017): e0177860.

<sup>43</sup> Current distribution can be found on the USGS NAs database: NAS database, <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=71>.

Accordingly, USGS researchers collaborated with BLM, USFWS, National Mississippi River Museum, University of Wisconsin-Platteville, and University of Dubuque in 2019 to evaluate the efficacy of low carbon dioxide concentrations in preventing zebra mussel larval settlement and biofouling in a harbor on the upper Mississippi River. The lowest carbon dioxide concentration tested was effective for preventing all zebra mussel settlement with minimal impacts to native species.<sup>44</sup> Next steps for this project are to modify and refine carbon dioxide treatments for application in specific settings.

USGS also partnered with the Minnesota Aquatic Invasive Species Research Center and several local counties, lake associations, and watershed districts to apply a low-dose copper treatment (EarthTecQZ®) to an enclosed bay in Lake Minnetonka, Minnesota.<sup>45</sup> When compared to an untreated bay within the same lake, it was found that the copper application substantially reduced zebra mussel abundance in all life stages and the response of native populations appeared minimal. USGS and partners will continue to evaluate the long-term suppression of zebra mussel populations and the response of the native community. Studies will also provide cost – benefit estimates of low dose copper treatments and treatment frequency to maintain Dreissenid mussels at target management levels.

In December of 2017, Reclamation, in collaboration with USGS, USACE, and Molloy & Associates, launched a prize competition seeking innovative solutions for the eradication of invasive mussels in a cost-effective and environmentally sound manner. More than 100 solutions were submitted to win this \$100,000 prize. Of those solutions submitted, 67 met the minimum requirements and were judged. Reclamation selected three winning submissions; Steven Suhr and Marie-Claude Senut, founders of Biomilab, LLC, received a full award of \$80,000 for their idea while two others each received \$10,000.<sup>46</sup> Reclamation partnered with the winning teams to further explore their idea to use genomic modification to induce a lethal malignant hemic neoplasia in mussels that can be transferred from one mussel to another. A cooperative agreement with Biomilab has been established and the project is making significant progress. Biomilab has set up a mussel aquaculture facility and is currently developing methods for culturing mussel cells, examining mussel chromosomes, and identifying gene targets.

### ***Aquatic Weeds***

In 2015, Alaska's Whiting Harbor became infested with carpet tunicates (*Didemnum vexillum*), which quickly threatened native ocean life by carpeting the seafloor with a dense, unsightly mat. BLM, in partnership with the Alaska Department of Fish and Game and Smithsonian Environmental Research Center, is refining a control technique that utilizes a floating barrier to apply and contain a chlorine biocide. The testing phase was completed in 2019 and is currently being analyzed for treatment effectiveness.<sup>33</sup>

### ***eDNA***

To increase confidence in the use of eDNA for species detection, USGS scientists have completed an evaluation of the repeatability and reproducibility of eDNA assays for Dreissenid mussels in the Pacific Northwest. Findings suggest a high probability that different samples analyzed with the same assay or at

---

<sup>44</sup> Waller, D. L., Bartsch, M. R., Lord, E. G., & Erickson, R. A. (2020). Temperature-Related Responses of an Invasive Mussel and 2 Unionid Mussels to Elevated Carbon Dioxide. *Environmental toxicology and chemistry*, 39(8), 1546-1557.

<sup>45</sup> This project is summarized on the Minnesota Aquatic Invasive Species Research Center website: <https://maisrc.umn.edu/copper-control>

<sup>46</sup> DOI Report on Prize Competitions, Fiscal Years (FY) 2019-20, [www.doi.gov/sites/doi.gov/files/fy19-20-full-prize-report-including-appendices.pdf](http://www.doi.gov/sites/doi.gov/files/fy19-20-full-prize-report-including-appendices.pdf).

the same lab will yield the same detection result, and a high probability that two identical samples analyzed with different assays or at different labs will yield the same detection result. The results provide strong support that eDNA, in general, has the potential to provide repeatable and reproducible evidence under varying laboratory conditions and for different sample water chemistries.<sup>47</sup>

Although eDNA assays are an effective tool to detect organisms in the water, finding organisms that are not very abundant continues to be a challenge as it requires numerous samples. To address this challenge, researchers from USGS and Monterey Bay Aquarium Research Institute have created a water quality sampling and processing robot. The robotic auto-sampler is being tested for its efficacy to detect target organisms and pathogens using eDNA filtered from water samples. Since this technology is integrated into the USGS stream gauge network, the robot also provides additional data such as streamflow and water quality, which help scientists interpret the eDNA data, understand how the organism is behaving, and forecast risk. Preliminary results indicate the greatest current benefit of robotic sampling is the cost savings for high frequency biosurveillance at remote or hard to access sites.

Reclamation's Ecological Research Laboratory looked at three different DNA amplification methods (conventional polymerase chain reaction (PCR), quantitative polymerase chain reaction (qPCR), and LAMP assays) to determine which one would work best for the detection of Dreissenid mussel eDNA.<sup>48</sup> Understanding the limits and advantages of each assay are important to ensure that the best eDNA methods are being applied as new methods and technologies continue to be developed. The analysis showed that the qPCR method could detect more positives than conventional PCR. The LAMP assay was the least effective of the three as it failed to provide consistent results and does not allow for sequencing, which is a critical part of the species confirmation process. The move to using qPCR will be ongoing for the Ecological Research Laboratory as knowledge of this method continues to expand.

---

<sup>47</sup> Sepulveda, Adam J., Patrick R. Hutchins, Craig Jackson, Carl Ostberg, Matthew B. Laramie, Jon Amberg, Tim Counihan, Andrew Hoegh, and David S. Pilliod. "A round-robin evaluation of the repeatability and reproducibility of environmental DNA assays for dreissenid mussels." *Environmental DNA* 2, no. 4 (2020): 446-459.

<sup>48</sup> Molecular Methods for the Ecological Research Laboratory, Research and Development Office Science and Technology Program (Final Report) ST-2019-1748-01, [www.usbr.gov/research/projects/detail.cfm?id=1748](http://www.usbr.gov/research/projects/detail.cfm?id=1748).

## Education and Outreach

Gaps in public awareness and willingness to take preventive action remain one of the largest management obstacles to stop the introduction and spread of ANS. Many ANS have been introduced through the actions of uninformed members of the public; for example, disposing of live bait, launching a boat contaminated with ANS, releasing pets or dumping aquarium water into the environment, or stocking a private waterbody, can all lead to the introduction of ANS. Robust public awareness campaigns are needed to educate the public and encourage them to take steps to prevent the introduction and spread of ANS. Such campaigns also facilitate on-the-ground action through stewardship programs and public events. ANS Task Force members have promoted ANS campaigns as well as created a wide variety of public education materials that has been distributed across the country. Key education and outreach activities that occurred in 2018 and 2019 are highlighted below.

### ***ANS Task Force Member Education and Outreach Efforts***

The ANS Task Force works alongside its partners to implement two national ANS campaigns: Stop Aquatic Hitchhikers!<sup>49</sup> and Habitattitude<sup>TM</sup>.<sup>50</sup> The Stop Aquatic Hitchhikers! campaign empowers recreational water users to take action to prevent the spread of ANS; the Habitattitude<sup>TM</sup>. campaign inspires and educates people to be responsible pet owners and environmental stewards. In 2019, USFWS and the Pet Industry Joint Advisory Council rebranded and refreshed the Habitattitude<sup>TM</sup>. campaign. Changes to the campaign website were made to appeal to younger generations with their appetite for visually engaging media platforms, and to address the growing popularity of reptiles including iguanas and Argentine tegus as pets. The campaign was also expanded to include information for water gardeners and classroom educators.

ANS Task Force members and regional panels continue to promote ANS education across the country. For example, BLM renewed and expanded their agreement with Wildlife Forever in 2018 to promote behavior change and best practices among outdoor recreation users. Advertisements using the Clean Drain Dry messaging were placed in numerous game and fish publications, regulation booklets, and guides. It is estimated that these advertisements reach over five million sportsmen annually.

In 2018, USFWS led the development of an invasive species communications framework for Alaska. This plan is meant to help identify areas where resources can be leveraged to address shared communication objectives in a coordinated fashion. The objectives and audiences in the plan were identified collaboratively by a multi-stakeholder group during a series of facilitated workshops. Participants agreed to use a common slogan of “Keep Alaska Wild and Free of Invasive Species” until the phrase was vetted with target audiences. After vetting, a common brand for public recognition will be established. This plan is a living document that will be revised as necessary to accomplish the objectives. Examples of key audiences include educators, outdoor enthusiasts, industry representatives, and legislators.

The USFS Northern Region is coordinating with Recreation.gov to include ANS information in the “Need to Know” section of the reservation confirmation. The region also partnered with Montana Fish, Wildlife, and Parks to plan workshops with campground hosts and seasonal rangers on communicating ANS information, impacts, and Montana regulations to visitors. In 2019, the USFS Dakota Prairie Grasslands office partnered with USACE, North Dakota Parks and Recreation, North Dakota Game and Fish, and Ransom County Park Board to ensure consistent ANS public education and outreach messages along the

---

<sup>49</sup> <https://stopaquatic hitchhikers.org/>

<sup>50</sup> [www.habitattitude.net/](http://www.habitattitude.net/)

Sheyenne River Water Trail. The Trail allows the public to travel through Federal, state, county, and private lands, providing an excellent opportunity to engage the public and align best practices across agencies for environmental stewardship. USFS also has an agreement with Missoula County to fund a roving ANS inspector to provide education and outreach at county fairs, fishing derbies, and other events throughout the upper Columbia Basin.

The 2019 Great Lakes AIS Landing Blitz was a multi-agency outreach event focused on recreational boaters and related audiences. This effort was led by the GLC and used the coordination opportunities provided through the GLP to leverage state, provincial and local resources. The event took place over a 2-week period, emphasizing the need to clean, drain, and dry boats whenever they come out of the water, and dispose of any unwanted bait in the trash. During these 2 weeks, over 1,400 public and private boat landings in Great Lakes states and provinces participated in educating approximately 115,000 people about aquatic invaders and steps that can be taken to prevent their spread. Ninety-four percent of participating boat landings also hosted boat inspections, leading to over 130,000 inspections.<sup>51</sup>

Two YouTube videos were produced for education and outreach at the USACE Engineer Research and Development Center. The first, entitled “Flowering Rush: Controlling an Invasive Species through Innovation and Partnership with the Walla Walla District,”<sup>52</sup> describes the challenges of managing flowering rush, an invasive plant, within the Columbia River Basin. The video, entitled “Harmful Algal Bloom Interception, Treatment, and Transformation System (HABITATS) project,”<sup>53</sup> focuses on harmful algal bloom mitigation. HABITATS is a demonstration project to assess the performance and scalability of new technologies to remove and dispose of harmful algal bloom biomass in large water bodies.

In 2017, USFWS was approached by the Steve and Marjorie Harvey Foundation to assist with their mentoring camp for boys. Since this time, USFWS has held an annual education and outreach event for more than 200 boys that exposes the inner-city, at-risk youth to other aspects of natural resources management, including invasive species awareness. In 2019, the Foundation added an additional camp, called “Girls Who Rule the World,”<sup>54</sup> which delivered a four-station program for female participants that included fishing, aquatic ecology, careers in natural resources, and invasive species.<sup>55</sup> The success of these camps would not be possible without the use of the Gulf and South Atlantic Regional Panel’s Traveling Trunk of Invasive species and support from the Georgia Department of Natural Resources.

---

<sup>51</sup> Additional information on the Great Lakes Aquatic Invasive Species Landing Blitz can be found at: [www.glc.org/work/blitz](http://www.glc.org/work/blitz)

<sup>52</sup> View the video at: [www.youtube.com/watch?v=fDWChNwJMIM](https://www.youtube.com/watch?v=fDWChNwJMIM)

<sup>53</sup> View the video at: <https://www.youtube.com/watch?v=XTR5n1oCZFQ&t=4s>

<sup>54</sup> More information on the “Girl Who Rule the World” program can be found at: <https://theharveyfoundation.org/programs/gwrtw/>

## ANS Task Force Regional Panels

Six regional panels have been established under the ANS Task Force as a critical and effective mechanism for achieving the goals of the ANS Task Force and a means to unify local actions into a regionally coordinated response. The regional panels that have been established under the ANS Task Force include:

- Great Lakes Regional Panel (established 1991)
- Western Regional Panel (established 1997)
- Gulf and South Atlantic Regional Panel (established 1999)
- Northeast Aquatic Nuisance Species Regional Panel (established 2001)
- Mississippi River Basin Regional Panel (established 2002)
- Mid-Atlantic Regional Panel (established 2003)

Members of the six regional panels include representatives of state and Federal agencies, tribes, nongovernmental organizations, commercial interests, as well as Mexico and Canada. The roles of each panel, as defined by Section 1202 of the Act, include identifying regional ANS priorities, coordinating ANS program activities in the region, providing advice to public and private interests concerning ANS management and control, and making recommendations to the ANS Task Force.

The Act authorized \$300,000 to DOI, to be used by the Director of the U.S. Fish and Wildlife Service to fund regional panels. Funds are distributed equally among the panels. Total funding for the six regional panels remained steady with an annual allocation of \$300,000 until 2013, when funding was reduced by 20 percent to \$240,000 as a result of budget sequestration. It remained at this level until 2019, at which time panel funding was increased to \$276,000.<sup>55</sup>

The six regional panels provide a host of services and products that foster communication, cooperation, and collaboration that help ensure that the ANS Task Force meets its legislative mandates. Products produced by the regional panels have provided guidance for its members to manage ANS. Furthermore, each panel creates a forum that allows for information sharing, collaboration, and coordination and ensures that local and regional operations are efficient and avoid duplication of efforts and use of resources. They leverage expertise and knowledge, providing shared insights into what resources are available and what ANS efforts work within their respective region. The unique position of the regional panels also allows them to coordinate with a broad spectrum of parties on a wide range of complex ANS issues across intra-regional boundaries.

Key accomplishments during 2018 and 2019 from each regional panel are highlighted below. These summaries illustrate the highest priority work of each panel, but do not provide a comprehensive overview of the many ANS coordination, prevention, EDRR, research, and education and outreach efforts that are conducted through the auspices of the panel and its membership.

### ***Great Lakes Panel on Aquatic Nuisance Species***

The mission of the Great Lakes Panel (GLP) is to coordinate the development of education, research, and policy to prevent new aquatic invasive species from entering the Great Lakes basin and to control and mitigate those AIS populations already established. The GLP focuses its efforts in three broad areas – Information/Education, Research Coordination, and Policy Coordination. Each focus area is supported through a committee comprised of Great Lakes Panel members with relevant interests and expertise.

---

<sup>55</sup> Although outside the time frame of the report, it should be noted that funding for the regional panels increased in 2020 to \$300,000, the fully authorized amount.

The GLP also convenes ad hoc committees to address specific issues that emerge or assume tasks not covered by the standing committees. Key activities from the GLP's committees that occurred in 2018 and 2019 included:

- The GLP's Grass Carp Ad Hoc Committee tracked and reported on activities and the progress of member agencies and other partners in addressing grass carp priorities identified by the GLP; summarized existing grass carp regulations by Great Lakes jurisdiction; worked with the Council of Great Lakes Fishery Agencies to develop and distribute a letter to states that allows stocking of diploid grass carp, encouraging changes to their policies that would reduce the risk of introduction and spread; and developed and distributed a grass carp regulatory enforcement questionnaire to assess priorities related to compliance and enforcement of triploid and diploid grass carp regulations and potential areas of risk.
- The Risk Assessment Ad Hoc Committee was established in 2016 to improve regional species and pathway risk assessment coordination and to develop a scope of work for the development of a risk assessment clearinghouse. This work of the committee continued into 2018 and 2019, with major accomplishments in drafting a set of recommendations for development of a risk assessment clearinghouse; identifying and working with NOAA Great Lakes Aquatic Nonindigenous Species Information System<sup>56</sup> to implement the clearinghouse recommendations; and supporting initial population of the clearinghouse by developing 3,179 species risk assessment summaries.
- In 2018 and 2019, the GLP continued its outreach to other groups and forums engaging in and/or supporting AIS prevention and control including the Great Lakes Restoration Initiative, the Great Lakes Water Quality Agreement Annex 6 subcommittee, various regional species collaboratives, and other similar entities. This outreach provides an opportunity for the GLP to identify and coordinate priority activities and identify opportunities for making progress. The GLP also continues to serve as a valuable forum for these partner groups to convene their own meetings around GLP meetings.
- A 2018 review of Great Lakes regional AIS priorities highlighted Organisms in Trade (OIT) as a priority pathway for which the GLP could contribute greater regional coordination. Recognizing that the GLP provides a venue to bring key agencies, groups, and experts together to advance work to prevent AIS introduction and release via the OIT pathway in the Great Lakes region, an ad hoc committee was established to coordinate regional OIT initiatives with partners and advance near-term actions to address the OIT pathway.

### ***Western Regional Panel on Aquatic Nuisance Species***

The mission of the WRP is to protect western aquatic resources by preventing the introduction and spread of nonnative invasive or nuisance species into western marine, estuarine, and freshwater systems through the coordinated management and research activities of state, tribal, Federal, commercial, environmental, research entities, industries, and other regional panels. The WRP is governed by an Executive Committee, which is elected by membership and meets monthly. The Invasive Species Action Network provides coordination services for the WRP. The accomplishments of the WRP are completed by the voluntary efforts of the membership serving on committees or workgroups. Key accomplishments from the WRP's committees and workgroups that occurred in 2018 and 2019 include:

---

<sup>56</sup> The risk assessment clearinghouse within the Great Lakes Aquatic Nonindigenous Species Information System can be viewed at: [www.glerl.noaa.gov/glansis/riskAssessment.html](http://www.glerl.noaa.gov/glansis/riskAssessment.html)

- Annual meetings were held in Tacoma, Washington (2018) and Missoula, Montana (2019). Each meeting had approximately 120 attendees and serves as an invaluable forum that brings together leaders in ANS management from across the Nation. The WRP also hosts an all-member teleconference in April annually. In spring 2019, the WRP hosted the ANS Task Force at Lake Tahoe, sponsored by the Tahoe Regional Planning Agency.
- The Coastal Committee created a best practice guidance document for marine biofouling management for recreational boats. This effort involved coordination between Pacific states to develop consistent responses to the U.S. Environmental Protection Agency (EPA) and USCG during the VIDA regulation development process.<sup>57</sup>
- The Watercraft Inspection and Decontamination Think Tank Committee<sup>58</sup> continues to provide a forum for facilitated information sharing and relationship building for effective problem solving between watercraft inspection and decontamination professionals. In 2018, the Committee members developed standard specifications for on-demand hot water decontamination systems and trailered mobile decontamination units. They also provided research recommendations to Reclamation and developed decontamination protocols for specific watercraft components.
- The Education and Outreach Committee hosted a webinar in 2018 to highlight outreach efforts by the Invasive Species Action Network, North American Invasive Species Management Association, and USFWS.
- The Seaplane Inspection and Decontamination Workgroup completed the “ANS Inspection Procedures for Amphibious Aircraft (2019)”<sup>59</sup> and hosted a webinar in partnership with the Seaplane Pilots Association.

A large focus of the WRP continues to be to safeguard the West from the spread of quagga and zebra mussels. The WRP has produced numerous documents and other work products to support efforts at Federal, state, and local levels. Examples of this work from 2018 and 2019 include:

- Developed and published the “Laboratory Standards for Dreissenid (Quagga and Zebra Mussel) Veliger Analysis in 2018.”
- Developed and published “Dreissenid (Quagga and Zebra) Mussels Sampling and Monitoring Field Protocol.”<sup>60</sup>
- Contributed to and adopted the Pacific States Marine Fisheries Commission paper, “A Review of Chemical Use Associated with Watercraft Decontamination to Address AIS,” a supplement to the WRP-adopted “Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination.”<sup>61</sup>

---

<sup>57</sup> The Western Regional Panel marine biofouling guidance document can be found at:

[https://westernregionalpanel.org/wp-content/uploads/2021/07/RecBoat\\_biofouling\\_guidance\\_FINAL.pdf](https://westernregionalpanel.org/wp-content/uploads/2021/07/RecBoat_biofouling_guidance_FINAL.pdf)

<sup>58</sup> These standards are used in multiple documents, which can be located on the Watercraft Inspection and Decontamination Committee webpage: <https://westernregionalpanel.org/decontamination-thank-tank-committee/>

<sup>59</sup> The ANS Inspection Procedures for Amphibious Aircraft can be found at: <https://westernregionalpanel.org/wp-content/uploads/2020/05/WRP-ANS-Inspection-Procedures-for-Amphibious-Aircraft-Final-2019.pdf>

<sup>60</sup> The Western Regional Panel Dreissenid (Quagga and Zebra) Mussels Sampling and Monitoring Field Protocol can be found at: <https://westernregionalpanel.org/wp-content/uploads/2020/09/WRP-ZQM-Sampling-and-Monitoring-Protocol-FINAL-Update-2020.pdf>

<sup>61</sup> Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination can be found at: <https://invasivemusselcollaborative.net/wp-content/uploads/2018/11/UMPS-III-7-14-2016.pdf>



- Participated in a multi-year dialogue with the marine industry that led to the “2018 American Boat and Yacht Council’s T-32 Report: Design Considerations in Consideration of Aquatic Invasive Species.”<sup>62</sup>
- Concluded the Building Consensus in the West Workgroup to develop model legal provisions and programmatic operational standards for multi-jurisdictional watercraft inspection and decontamination programs and drafted a final report titled, “The Building Consensus in the West Workgroup: Final Activity Report 2011-2019.”
- Drafted and published the “Quagga Zebra Action Plan for Western U.S Waters Status Update Report in 2019.”<sup>63</sup>
- Contributed to the Western Governors’ Association’s Invasive Mussel Leadership Forum.

### ***Gulf and South Atlantic Regional Panel***

The GSARP works to preserve the natural environment and biodiversity of the southeast region by mitigating the impacts of established ANS and preventing new ANS introductions. Through the biannual meetings of the GSARP, members are able to develop working relationships to facilitate communication and coordinate ANS management activities across the region. The GSARP holds two in-person meetings and two virtual meetings each year to improve communication and working relationships across the region. Key activities from GSARP in 2018 and 2019 include:

- An updated GSARP website<sup>64</sup> to include several new features: a custom view into the USGS’ NAS database that focuses just on GSARP states; regional specific ANS alerts from the USGS alert system; and a list of the top ten invasive species that are threatening the region with links to fact sheets that can provide more information on their invasion history.
- The continued updates to and availability of an educational outreach trunk to inform the public about the impacts associated with ANS. Currently, the trunk consists of a manual of talking points, a PowerPoint presentation, and profiles and hands-on specimens for five invasive plant species and nine animal species. The trunks are a common request from state and Federal agencies, conservation and environmental groups, and secondary level educators. They have been utilized for 1,469 days since they were made available to the public in the summer of 2012.
- The completed fifth cycle of the panel’s small grants program. Over the past 5 years, 33 projects have been funded totaling approximately \$710,000. In 2018, the program funded seven projects totaling \$154,235, addressing *Salvinia*, *Hydrilla*, invasive carp, northern snakehead, invasive black bass, and *Myxobolus cerebralis* (the causative agent of whirling disease). Six projects were selected for funding totaling \$140,189 through the 2019 funding opportunity. These projects addressed invasive species eDNA data standards, model bait regulations, and risk analysis for injurious fish species, lionfish, human health risks, and apple snails. Grants recipients are requested to present their results at one of the biannual meetings to help disseminate the information across the region and to increase coordination between academia and the State and Federal ANS managers.

---

<sup>62</sup> The American Boat and Yacht Council’s T-32 Report: Design Considerations in Consideration of Aquatic Invasive Species is located at: <https://abycinc.org/store/viewproduct.aspx?id=12011631>

<sup>63</sup> The 2019 Quagga Zebra Action Plan for Western U.S Waters Status Update Report is located at: <https://westernregionalpanel.org/wp-content/uploads/2019/11/WRP-QZAP-Status-Update-Report-2019-FINAL.pdf>

<sup>64</sup> Gulf and South Atlantic Regional Panel webpage: <https://www.gsarp.org/>

### **Mid-Atlantic Panel on Aquatic Invasive Species**

The mission of the Mid-Atlantic Panel on Aquatic Invasive Species (MAPAIS) is to assist state and Federal agencies, and other stakeholders, in developing and implementing strategic, coordinated, action-oriented approaches to prevent and control aquatic invasive species in the Mid-Atlantic region and to coordinate and communicate these activities with the other Regional Panels, the ANS Task Force, and other partners.

In 2018, MAPAIS worked with USGS to create a NAS regional map<sup>57</sup> to focus on ANS found in the Mid-Atlantic states and their immediate neighboring states. This regional view facilitates the ability of panel member states to track species near their borders and proactively prepare for EDRR of those species. The Panel also receives updates from state AIS managers on emerging species of concern at its biannual meetings and continually evaluates and updates MAPAIS priorities and standard operating procedures to keep pace with emerging issues.

Since 2007, the Panel has used most of its funding to conduct an annual small grants competition to fund activities that address MAPAIS' mission and regional priorities. Below is a list of the highest priorities for the panel and select projects the panel chose to fund in 2018 and 2019 to address these priorities:<sup>58</sup>

- 1) Conduct research on AIS issues in the region such as prevention, early detection, rapid response, emerging invasions, and how climate change may influence AIS. Supporting project(s) included:
  - Using environmental DNA to detect emerging amphibian pathogens (Chytrid, Ranavirus)
  - Using environmental DNA to detect early stages of New Zealand mudsnail invasion in Pennsylvania
  - Using airborne Light Detection and Ranging (LiDAR) data to detect *Phragmites* in tidal marsh-forest ecotones
  - Examining impacts of two functionally distinct invaders (New Zealand mudsnail and Didymo) on facilitation and community succession
  - Quantifying multiple ecosystem-level threats to the upper Juniata River system (Pennsylvania) from the invasion of rusty crayfish
- 2) Develop outreach and educational materials for classrooms and specific populations to prevent the introduction and spread of AIS. Supporting project(s) included:
  - Promoting tidal and marine invasive species awareness and response among diverse stakeholders in Delaware
- 3) Develop vector management strategies for states and the region. Supporting project(s) included:
  - An analysis of the recreational vector and associated pathways to aid in the prevention of invasive species introductions in Mid-Atlantic waterways
- 4) Conduct innovative approaches to AIS control/eradication, or control/eradicate a high priority AIS population. Supporting project(s) included:
  - Determining best population control approaches for the northern snakehead in Jug Bay tidal freshwater marshes

### **Mississippi River Basin Panel on Aquatic Nuisance Species**

The Mississippi River Basin Panel on Aquatic Nuisance Species (MRBP) assists state and Federal agencies, and other stakeholders, in developing and implementing strategic, coordinated, action-oriented approaches to prevent and control aquatic invasive species in the Mississippi River Basin region and to

---

<sup>57</sup> The Mid-Atlantic regional species map can be found at: <https://www.midatlanticpanel.org/>

<sup>58</sup> A list of projects funded by the Mid-Atlantic Panel on Aquatic Invasive Species can be found at: <http://www.midatlanticpanel.org/research/>

coordinate and communicate these activities with the other regional panels, the ANS Task Force, and other partners. The MRBP continues to meet every 9 months to facilitate coordination and implementation of regional ANS programs and projects, identify priorities and emerging issues, and develop recommendations for the ANS Task Force.

In 2018, MRBP began a study to better understand the Buddhist “live release” practice of returning animals, commonly purchased from pet stores or aquarium stores, back to their natural environment and to develop an approach that reduces the risk of introducing ANS into the environment, while respecting this tradition. The major finding of the study was that collaborations between natural resource managers and Buddhist community leaders can educate practitioners of ceremonial live release about associated ANS risks, meet practitioners’ religious needs, and help prevent the spread of invasive species.

An analysis of the aquatic live bait pathway was also conducted in the 28 states of the Mississippi River Basin to summarize the state and Federal laws, regulations, policies and procedures that pertain to the production, harvest, transport, sale and use of live aquatic bait in the basin. Several potential AIS and pathogen risks were identified including the need to watch for new ANS and pathogens arriving in bait originating from wild-harvested waters. Results of a survey of aquatic bait regulations and policies in Mississippi River basin states found that regulations vary widely, but generally demonstrate that all states recognize the risk posed by the live aquatic bait pathway.<sup>59</sup>

Also in 2018, the Mid-Atlantic and Mississippi River Basin regional panels partnered with the Virginia Department of Game and Inland Fisheries to hold the First International Snakehead Symposium. This event brought together international snakehead experts for technical sessions and panel discussions on the biology, ecology, monitoring, and control of this high-risk invader. The symposium was attended by over 80 participants and a summary of the symposium – Proceedings of the First International Snakehead Symposium – was published by the American Fisheries Society in September 2019. In 2019, the Mid-Atlantic Panel on Aquatic Invasive Species hosted a Mid-Atlantic Lakes Forum that brought together over 50 state and local lake managers and other professionals to encourage information sharing and multi-jurisdictional partnerships on the prevention and control of AIS in lakes.

In 2019, the Mississippi River Basin Panel on Aquatic Nuisance Species hosted a field sampling workshop for invasive carp at Lake Barkley, Kentucky in collaboration with Wisconsin Sea Grant, USFWS, USGS, and the Kentucky Department of Fish and Wildlife Resources. The workshop featured experts from around the country who provided participants background and technical information on capture techniques for invasive carp and gears such as the modified-unified method, hydroacoustics, multiple electrofishing systems, dozer trawl, pound net, Merwin net, and commercial fishing nets. Live, on-the-water demonstrations were conducted for many of the techniques, which included information such as where and how to deploy and operate gear. Presentations and field demonstrations were professionally recorded resulting in a collection of 17 videos that are publicly available online.<sup>68</sup>

---

<sup>59</sup> Live Aquatic Bait Pathway Analysis, State of the live bait industry and its laws, regulations and policies in the Mississippi River Basin. 2019. A report prepared for the Mississippi River Basin Panel on Aquatic Nuisance Species.

[www.glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf](http://www.glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf)

[www.ssa.gov/accessibility/checklists/word2010/default.htm](http://www.ssa.gov/accessibility/checklists/word2010/default.htm)

<sup>68</sup> Training videos for fisheries managers cover techniques for sampling invasive carp species can be viewed at: Training videos for fisheries managers cover techniques for sampling invasive carp species

### ***Northeast Aquatic Nuisance Species Panel***

The mission of the NEANS Panel is to protect the marine and freshwater resources of the Northeast from ANS through commitment and coordinated action. The NEANS Panel's activities focus on promoting member communication, coordination, and collaboration through meetings, workshops, training opportunities, and the production and distribution of outreach and education products. In addition to biannual meetings, the panel also convenes mid-term conference calls to keep the panelists well-connected and to prepare recommendations for the ANS Task Force. The NEANS Panel also maintains group email lists for panel members and interested individuals and organizations.

In 2018 and 2019, the Panel continued to support marine Rapid Assessment Surveys (RAS). The goal of the RAS is to monitor marine species, track trends in distribution, detect new marine invaders, and document regional patterns of established invaders. Since the first survey in 2000, the RAS have identified new marine invaders to the U.S. Northeast and documented range shifts of existing populations. The 2018 RAS, focused on docks and marinas from Buzzards Bay, Massachusetts, to Casco Bay, Maine. No new ANS were documented in the 2018 RAS, yet several established ANS were observed more frequently and in a wider geographic range than past surveys. A separate RAS from Rhode Island to New York was conducted in August 2019, which detected two new ANS since the area was surveyed 6 years before, as well as several northern range expansions and a consistent presence of previously established ANS.<sup>60</sup>

The NEANS Panel also funded a successful rapid response project for variable-leaved watermilfoil on Long Lake, Maine. The invasive plant was discovered in the lake in 2017; a control team was immediately deployed to remove the milfoil by hand. In 2018, the crew returned to Long Lake to remove any remaining plants and work towards eradication of this weed.

In 2018, the NEANS Spread Prevention Work Group collected *Hydrilla* samples from the Connecticut River, conducted DNA analysis, and developed outreach products such as outdoor signs, tabletop displays, and floating key chains with QR code. The Work Group also collaborated with the USACE and other agency and private sector partners to host classroom and field *Hydrilla* monitoring and sampling training on the Connecticut River.<sup>61</sup>

In conjunction with its June 2019 meeting, the NEANS Panel hosted a classroom and field training workshop for *Hydrilla* survey and monitoring. Presenters, trainers, and other experts from the USACE, University of Florida, and private lake consultants brought their expertise to the workshop. Participants spent a day in the field surveying the northern-most documented *Hydrilla* site in the Connecticut River, which included demonstrations of aquatic plant mapping and *Hydrilla* tuber sampling. The workshop follows significant NEANS Panel investment in *Hydrilla* projects including the *Hydrilla* Initiative Project, community based social marketing approaches, and supporting surveillance and genetics analysis.

---

<sup>60</sup> Pederson, J., et al. "Rapid Assessment Survey of marine bioinvasions of southern New England and New York, USA, with an overview of new records and range expansions." *BioInvasions Records* 10.2 (2019): 227-237.

<sup>61</sup> Connecticut River Hydrilla Control Project Five-Year Management Plan. 2020. [www.northeastans.org/wp-content/uploads/2021/02/CT-River-Hydrilla-Project-Five-Year-Management-Plan-FINAL.pdf](http://www.northeastans.org/wp-content/uploads/2021/02/CT-River-Hydrilla-Project-Five-Year-Management-Plan-FINAL.pdf)

## Conclusion

This report is transmitted to fulfill the requirements of Section 1202(k)(2) of the NANPCA of 1990, as amended by the National Invasive Species Act of 1996, and highlights the activities of the ANS Task Force members during the FYs 2018 and 2019. As demonstrated by this report, considerable success has been achieved in the prevention, detection, eradication, control, research, and outreach efforts of ANS.

In 2019, the ANS Task Force reviewed their past accomplishments and identified emerging threats, using this information to chart the next steps for the ANS Task Force. These priorities are captured in the Strategic Plan for 2020-2025. This new Strategic Plan provides a framework to guide the ANS Task Force over the next 5 years. The plan's six goals, each with a targeted set of objectives and associated strategies, presents a coordinated approach consistent with the national focus of the ANS Task Force. Implementation of the Plan will require participation from Federal agencies, states, tribes, industries, nonprofits, and stakeholders. The ANS Task Force looks forward to continuing their collaborative work with these partners to further their mission to protect the Nation's waters from the threat of ANS. We invite you to participate in ANS Task Force meetings, subcommittee meetings, and regional panel meetings to learn more about ANS Task Force activities.