

Quagga and Zebra Mussel Action Plan for Western Waters Status Update Report



Zebra mussels
(*Dreissena polymorpha*)



Quagga mussels
(*Dreissena rostriformis bugensis*)

April 2019



WESTERN REGIONAL PANEL
ON AQUATIC NUISANCE SPECIES

The Western Regional Panel on Aquatic Nuisance Species

The Western Regional Panel (WRP) on Aquatic Nuisance Species (ANS) was formed in 1997 by a provision in the National Invasive Species Act of 1996 (P.L. 101-636), the amendment to the Nonindigenous Aquatic Nuisance Control and Prevention Act (NANCPA) of 1990. The WRP is an advisory group to the Aquatic Nuisance Species Task Force (ANSTF) and is one of six Regional Panels. The WRP is composed of representatives from 19 western states, four Canadian provinces, federal agencies, tribes, private industries and non-governmental organizations. The purpose of the WRP is to coordinate ANS efforts in western North America to help limit the introduction, spread and impacts. The spread of invasive species has caused significant economic and ecological problems throughout North America raising concerns for western aquatic ecosystems and water delivery systems.

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Table of Contents

Acknowledgments	3
<i>Report Contributors</i>	3
Introduction	4
<i>The Quagga-Zebra Mussel Action Plan for Western Waters (QZAP) and Related Efforts</i>	4
<i>Purpose of this QZAP Status Update Report</i>	5
<i>Process for Developing this QZAP Status Update Report</i>	5
The Problem: Zebra and Quagga Mussels	7
Current Status of QZAP Action Items	8
A. <i>Increasing Capacity to Address Invasive Mussels</i>	8
*A.1. State and Interstate ANS Management Plan funding and QZAP implementation	8
A.2. Federal coordination and implementation of QZAP	8
B. <i>Prevention</i>	9
*B.1. Implement mandatory watercraft inspection and decontamination (WID) at infested waters [Containment]	9
*B.2. Continue the development of effective watercraft inspection and decontamination protocols and standards	9
*B.3. Develop standard and effective equipment inspection and decontamination protocols	10
*B.4. Adopt standard watercraft and equipment inspection and decontamination protocols in Western States	10
*B.5. Establish and implement strong, consistent law enforcement programs in each western state	10
*B.6. Develop a standardized risk assessment model and strategy for water bodies	10
B.7. Expand mandatory watercraft inspection and decontamination capacity for uninfested regions	11
B.8. Develop and implement programs to intercept contaminated equipment	11
B.9. Expand use of ANS Hazard Analysis Critical Control Point (HACCP) Planning	11
C. <i>Early-Detection Monitoring</i>	11
*C.1. Expand early-detection monitoring programs to all western water jurisdictions	11
*C.2. Develop standard field protocols for early-detection monitoring	11
C.3. Improve veliger sample analysis methods	11
C.4. Coordinate early detection monitoring programs	11
D. <i>Rapid Response</i>	11
*D.1. Create and maintain a rapid response fund	11
*D.2. Finalize rapid response notification database	12
D.3. Complete and maintain rapid response plans for all western states	12
D.4. Designate and train rapid responders	12
D.5. Planning for short-term environmental impacts resulting from rapid response	12

Table of Contents (cont.)

<i>E. Containment or Management of Existing Populations</i>	<i>12</i>
<i>*E.1. Develop tools and best management practices for preventing and minimizing mussel movement and settlement within water distribution systems and other infrastructure</i>	<i>12</i>
<i>E.2. Implement reliable and cost-efficient control tools for water distribution systems.</i>	<i>13</i>
<i>E.3. Develop open-water control tools</i>	<i>13</i>
<i>E.4. Develop closed-water system control tools</i>	<i>13</i>
<i>E.5. Support designing infrastructure for long-term control</i>	<i>13</i>
<i>E.6. Improved understanding of mussel control</i>	<i>13</i>
<i>E.7. Develop programmatic National Environmental Policy Act guidance</i>	<i>14</i>
<i>F. Outreach and Education.</i>	<i>14</i>
<i>*F.1. Adopt consistent outreach messaging and enhance coordination of efforts</i>	<i>14</i>
<i>F.2. Conduct social science research</i>	<i>14</i>
<i>F.3. Increase audience effectiveness assessments</i>	<i>14</i>
<i>F.4. Expand availability of existing outreach material</i>	<i>14</i>
<i>F.5. Make better use of television and radio.</i>	<i>14</i>
<i>F.6. Provide more opportunities for youth education</i>	<i>15</i>
<i>G. Research</i>	<i>15</i>
<i>G.1. Determine physiological tolerances</i>	<i>15</i>
<i>G.2. Develop method to track dispersal via genetic fingerprints</i>	<i>15</i>
<i>G.3. Develop alternative decontamination methods</i>	<i>15</i>
<i>G.4. Develop biological control methods</i>	<i>15</i>
<i>G.5. Develop eco-friendly chemical control methods</i>	<i>15</i>
Summary	16
Appendix A—WRP Member List 2019	17
Appendix B—USFWS Reported Expenditures of QZAP Appropriations Fiscal Year 2010-Fiscal Year 2018	24
Appendix C—Acronyms.	28

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Acknowledgments

This Quagga-Zebra Mussel Action Plan for Western Waters (QZAP) Status Update Report (Report) was prepared by the Western Regional Panel (WRP) on Aquatic Nuisance Species (ANS) to inform ongoing partnership efforts to minimize the spread and impacts from zebra and quagga mussels in the Western United States. The QZAP was produced by the WRP and approved by the ANS Task Force (ANSTF) in February 2010. The time, energy, and input of the nineteen western states, federal agencies, tribes, four provinces, private industry and nongovernmental organizations that make up the WRP was invaluable. QZAP action items collectively guide and further ANS prevention, containment and management to address the ecological and economic impacts of invasive quagga and zebra mussels into the future. This Report documents the current status of those action items.

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Introduction

The goal of the WRP is to protect limited western aquatic resources by preventing the introduction and spread of ANS into marine and freshwater systems through coordinated management and research between state, provincial, tribal, federal, commercial, environmental, and research entities and the other five regional ANS panels.

The WRP is the lead organization charged with coordination of ANS efforts in the western United States. Over the last decade, the WRP has facilitated communication and collaboration between jurisdictions across the West to improve management of invasive zebra and quagga mussels. The WRP authored the QZAP and gained approval for the plan from the ANSTF.

Since that time, the WRP has provided opportunities for dialogue that resulted in creation of science-based inspection and decontamination standards for preventing and containing the overland spread of mussels by recreational watercraft, as well as standards for sampling and monitoring lakes and reservoirs for invasive mussels. Members of the WRP and their respective organizations have made significant contributions in advancing zebra and quagga mussel management and this Report is intended to summarize those accomplishments. It does not document progress on this issue at a national level.

The Quagga-Zebra Mussel Action Plan for Western Waters and Related Efforts

In 2007, invasive quagga mussels were detected in Lake Mead National Recreation Area and subsequently in the lower Colorado River Basin and associated waters. An action plan was requested by Senator Feinstein to detail actions needed to stop the spread of invasive mussels from the lower Colorado River into new western waters. This request was discussed at the Fall 2008 ANSTF meeting and delegated to the WRP. The WRP formed two committees, a steering committee and a writing committee, to develop the document over the next year. The completed QZAP was approved by the ANSTF in February 2010.

The QZAP summarized the current strategies that addressed the zebra and quagga mussel invasion in the West, and identified and prioritized specific actions needed to comprehensively prevent further spread of these mussels, respond to new

infestations, and manage existing infestations. QZAP was to serve as a common ‘road map’ of priorities for water or recreational management entities and their partners.

Following QZAP’s publication, the western state ANS programs formed the Western Invasive Species Coordinating Effort (WISCE) in 2011. The purpose of the WISCE organization is to provide an open dialogue among western state ANS coordinators regarding ANS management and state program implementation. The members of this group coordinate via monthly conference calls and webinars, and at least one in-person meeting a year. The states recognized the tremendous distances boaters travel and the value of working together to provide better resource protection against mussels, while gaining program efficiencies and maintaining outstanding outdoor recreation. WISCE’s original focus was to engage with, and encourage, the National Park Service (NPS) to contain mussels in infested waters through mandatory watercraft inspection and decontamination. This remains the primary focus of WISCE but has since expanded to include any agency that owns or manages infested waters or high priority waters for prevention. WISCE coordinates on various aspects of state ANS program management.

The WRP membership reviewed QZAP in 2013 and members indicated that the priorities specified in the original document continued to be the highest priorities for western waters, and that progress at that point had not been substantial. The review was presented to the ANSTF and it was decided that revising or updating the plan was not needed at that time.

The Building Consensus (BC) in the West workgroup of the WRP formed in 2013 following a workshop held the previous year in Phoenix, Arizona by Oregon Sea Grant (OSG), the National Sea Grant Law Center (NSGLC), the National Association of Attorneys General (NAAG) and the US Fish and Wildlife Service (USFWS). The workshop was attended by Assistant Attorneys General, State Law Enforcement Chiefs and State ANS Coordinators and was conducted to better understand legal barriers that hinder the implementation of the QZAP. From 2013-2018, the WRP membership engaged in BC, consisting of a facilitated dialogue among State ANS Coordinators and the NPS, alongside NSGLC, OSG, NAAG and the Association of Fish and Wildlife Agencies (AFWA), to develop a model legal framework and science-based standards for implementing state watercraft inspection and decontamination (WID) programs. Tremendous progress has been made through this

multifaceted partnership, including development of not only the legal framework, but also standards for field monitoring, laboratory processing, and WID protocol, training, quality control, data sharing and communications.

In 2014, the US Army Corp of Engineers (USACE) was authorized by the Water Resources Reform and Development Act (WRRDA) to engage in the Columbia River Basin (CRB) ANS programs, and established a rapid response fund in addition to support existing WID stations and the establishment of new WID stations. This funding also supports monitoring programs in the four Pacific Northwest states. In 2018, authorization was expanded to include the Upper Missouri, Upper Colorado, South Platte and Arkansas River basins.

In 2017, the Department of the Interior (DOI) embarked on its Safeguarding the West (STW) initiative intended to bolster efforts to combat zebra and quagga mussels in the West and strengthen partnerships between federal, state and tribal agencies working collectively on invasive mussel prevention and containment. Many WRP members contributed to the six committees that formulated the STW action plan and continue to work on its implementation.

The Western Governors' Association (WGA) engaged with DOI and western states on STW and numerous other projects related to invasive species following the passage of its 2016 resolution (e.g. the top fifty invasive species list, data standards). On February 28, 2018, ANS managers from several western states met with the leadership of DOI and WGA. The state ANS coordinators recommended, among other things, that the WGA host a forum of western leaders to discuss high-level strategies to contain the spread of invasive quagga and zebra mussels in the West.

Later in 2018, the WGA embarked on the Biosecurity and Invasive Species Initiative, highlighting zebra and quagga mussels as an important threat to western states. The WRP Executive Committee elected to participate in the development of an Invasive Mussel Leadership Forum and engaged in regular dialogue with WGA and DOI, in addition to providing leadership for the Forum's planning committee. The WGA Invasive Mussel Leadership Forum was planned for January 2019, but cancelled due to the partial government shutdown. The Forum has been rescheduled for August 2019 in Las Vegas, NV.

As more partners engage in the fight against zebra and quagga mussels in the West, the QZAP is referenced as the "road map" to follow. However, with a decade of action, including successes and

challenges, it is increasingly important to share past accomplishments in order to appropriately determine future needs. The WRP developed this Report to compile relevant information for each original action item and document the status of each item.

Purpose of this QZAP Status Update Report

The purpose of the QZAP Status Update Report is to document the status of the 2010 QZAP action items and to provide references for those accomplishments when available. Urgency for coordinating effective implementation of zebra and quagga mussel management in the West remains as high as when the QZAP was originally drafted. The Report records not only progress made over the last decade, but also provides direction and informs future decision making for quagga and zebra mussel management in the West. Any new needs identified through dialogue surrounding this Report will be included in an updated recommendations for the future implementation of the QZAP document being developed by the WRP.

Process for Developing this QZAP Status Update Report

On October 23, 2018, the WRP Executive Committee voted to draft the Report, along with the BC Activity Report. These documents contribute to the current state of knowledge and inform planning efforts. The WRP membership discussed moving forward with developing these documents at the Annual Business Meeting in Tacoma, Washington on October 25, 2018.

The WRP Executive Committee continued discussion regarding process and key inputs at its monthly meeting in November 2018. The WRP Chair and Coordinator discussed process with a subset of states, WGA and DOI leadership at the *Biosecurity and Invasive Species Workshop* on November 14, 2018 in Helena, Montana.

The WRP Chair volunteered to solicit input directly from WRP members and compile the information for detailed membership review. Most of the input and data compilation work was completed in November-January, with review taking place in January-April per the timeline below:

- The WRP Chair reviewed the draft Report with WISCE (State ANS Coordinators) at its monthly meeting on November 27, 2018 and gathered input.

- The WRP Chair reviewed the draft Report with the WRP Education Committee on December 6, 2018 and gathered input focused on the education and outreach portion.
- The WRP Chair reviewed the draft Report with the WRP Executive Committee on December 10, 2018. The Executive Committee retained access to the Report on a Google team drive and provided detailed review and edits through January 2019.
- The WRP Chair discussed the draft Report with the WGA Invasive Mussel Leadership Forum planning team on its monthly calls on November 29, 2018, December 17, 2018 and January 17, 2019.
- The WRP Chair solicited information from the US Bureau of Reclamation (Reclamation), USACE and USFWS in December 2018 and January 2019.
- The WRP Executive Committee continued to discuss the Report at its monthly call on January 14, 2019 and every month thereafter until they voted the document final.
- WISCE reviewed the Report via conference call on January 21, 2019.
- WISCE discussed the Report in detail at its meeting on January 29, 2019 hosted by Colorado Parks and Wildlife (CPW) in Denver, Colorado.

- The WRP Chair incorporated input and edits received in February 2019.
- Contributor review took place in March 2019.
- WRP review took place in early April 2019.
- The WRP Executive Committee voted to approve the Report as final on April 15, 2019

The WRP Chair presented the Report at the following events:

- **Association of Fish and Wildlife Agencies—**March 2019
- **WRP All Member Call—**April 2019
- **ANSTF Spring Meeting—Hosted by WRP at Lake Tahoe—**May 2019
- **Western Governors Association Annual Meeting—**June 2019
- **Western Association of Fish and Wildlife Agencies (WAFWA)—**July 2019
- **WGA Invasive Mussel Forum—**August 2019
- **WRP Annual Meeting—**October 2019
- **Colorado River Fish and Wildlife Council—**November 2019
- Other appropriate partner events as opportunities arise



The Problem: Zebra and Quagga Mussels

The zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena rostriformis bugensis*), collectively referred to as dreissenids, are among the most devastating ANS to invade North American fresh waters. ANS, specifically zebra and quagga mussels (ZQM), can result in severe impacts to water supply and distribution infrastructure for municipal, industrial and agricultural uses. These invasive mussels negatively impact fisheries and all forms of water-based recreation, particularly boating and angling. ZQM can cause damage to watercraft and inhibit access opportunities. Once established, these mussels can clog water intake and delivery pipes, infest hydropower infrastructure, adhere to watercraft and pilings, foul recreational beaches, and inflict many other costly problems. Their ecological legacy in the east has included competition with native mussels, disruption of food webs, and bioaccumulation of toxins. These invaders are creating similar problems in the West, putting the long list of imperiled fish and other aquatic life at an even greater risk.

The first zebra mussel detection within the WRP was in Oklahoma in 1993, before the WRP was formed in 1997. Kansas detected zebra mussels in the Missouri River in 2001 and then again in 2003. The western states taking notice when El Dorado Reservoir in Kansas was determined to have an infestation.

The first coordinated western efforts to prevent ZQM fell under the 100th Meridian Initiative which was endorsed by WRP. Watershed level basin teams included state, federal and university partners. The Colorado River Basin Team was first to form in 2001 but was not supported and is not active today. The Columbia River Basin (CRB) Team was established in 2003 and the Missouri River Basin Team was established in 2004, both still active today. Pacific States Marine Fisheries Commission (PSMFC) and USFWS coordinate basin team meetings. USFWS funded 100th Meridian Initiative activities including boater surveys conducted by state agencies on their large reservoirs. Portland State University developed a lake monitoring program. USFWS also worked with the University of Texas-Arlington on a national database of boater surveys and a national website. WRP panel funding (2007-2011) also supported boater surveys, development of state management plans, risk assessments and research projects.

When quagga mussels were found in Lake Mead in 2007, the West began to unite further and mobilize to

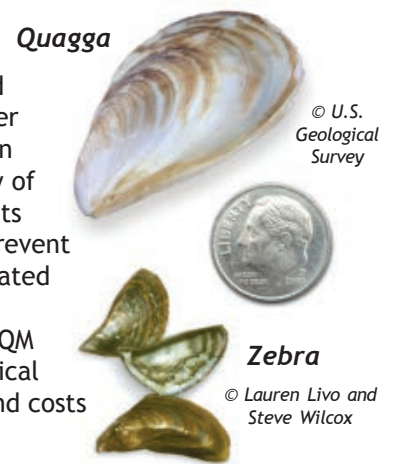
stop the invasive mussels and protect precious limited water resources. ZQM have not been detected in the vast majority of western waters which presents important opportunities to prevent significant damage if coordinated action is taken immediately. Without immediate action, ZQM will cause irreparable ecological damage to western waters and costs will be in the billions.

The WRP places a high importance on preventing and controlling mussels to protect invaluable aquatic resources in addition to sustaining our recreation and tourism industry, water storage and distribution systems, agricultural production and the West's overall economy. Over the last decade, the WRP has provided a forum for communication and collaboration among agencies tasked with preventing the spread of invasive mussels via recreational boating. Through the ANSTF, WRP members have partnered with the boating and marine industry to seek public-private, non-regulatory solutions to mitigate mussel spread on recreational watercraft, such as utilizing innovations in boat design.

The WRP encourages water providers, including hydroelectric and irrigation facilities, to conduct facility assessments and implement preventive measures to reduce the risk of transport through, and invasion of, water distribution systems. There are currently no proven methods to control downstream movement of mussel veligers in natural environments. WRP encourages waters users to take every precaution to stop the spread of ZQM and ANS.

Preventing the spread of ZQM and other ANS requires indefatigable cooperation and coordination between federal, state, county and municipal agencies, marina operators, private entities and recreationists. When QZAP was approved by the ANSTF in 2010, there were 53 infested water bodies within the WRP boundary, but by 2019 that number has more than doubled to 136 (USGS, 2019. Nonindigenous Aquatic Species Database (NAS), Gainesville, FL. <http://nas.er.usgs.gov>). While significant strides have been made, infestations continue to colonize locations with no protections in place. This Report is a call to action for all partners to work together and coordinate efforts to stop the spread of invasive mussels into new areas.

Due to the multi-jurisdictional nature of western waters, the QZAP action items may apply to various organizations; as no single entity is responsible for, or capable of, implementing all of the necessary actions needed to protect waters from invasive mussels and other ANS.



Current Status of QZAP Action Items

The following is a status update of the QZAP (2010) action items. Please refer to the QZAP document for detailed descriptions of each action item. Status categories for action items in this Report are as follows:

Ongoing =

activities have been initiated to address this objective and further actions are expected to continue or to be needed in the future. These action items are considered as ongoing activities and do not have an end date.

Completed =

activities have been completed and this objective is considered complete.

Not Started =

no activities have been initiated to address this objective.

* Action items identified as “priority action items”

A. Increasing Capacity to Address Invasive Mussels

*A.1. State and Interstate ANS Management Plan funding and QZAP implementation

Status: **Ongoing**

- The NANCPA authorized \$4 million for the implementation of State and Interstate ANS Management Plans (State Plan).
 - State Plan funds were appropriated \$1M per year from 2010-2015.
 - Beginning in 2016, State Plan allocations were increased to \$2M—\$1M from USFWS NISA implementation line and \$1M from USFWS ANS Branch’s ZQM line for QZAP.
 - In 2009, there were 31 approved State Plans, with each plan receiving \$32,000 annually.
 - By 2018, there were 44 approved State Plans, with each plan receiving \$45,000 annually.
- QZAP funds were provided to grant recipients at \$2M in 2010, and \$1M per year from 2012-2019 (see Appendix B).



- Congress appropriated \$2M per year for zebra and quagga mussel management, however, as mentioned above, \$1M of that appropriation is directed by USFWS to fund state plans nationally.
- At the spring and fall ANSTF meetings, the WRP urges ANSTF to increase or at least maintain funds allocated to QZAP, State Plans and for Regional Panel coordination.
 - From 2005 to 2011, Regional Panels were funded \$300K (\$50K/panel)
 - Beginning 2012, as a result of sequestration, Regional Panel funding was reduced to \$240K (\$40K/panel).
 - Expected in 2020, Regional Panels will be funded at \$276K (\$46K/panel).

A.2. Federal coordination and implementation of QZAP

Status: **Ongoing**

- Federal coordination is necessary to ensure full implementation of QZAP given the large roles federal agencies play in ownership and management of western waters. However, because state agencies have primary ANS management authority, full support of state ANS programs also remains a high priority.

- Many cooperative agreements have been put in place to facilitate state-federal partnerships related to the implementation of watercraft inspection and decontamination stations for prevention or containment. A few examples include:
 - NPS Lake Mead Cooperative Agreement with Nevada Division of Wildlife
 - NPS Lake Powell Memorandum of Understanding with Utah Division of Wildlife Resources
 - NPS Cooperative Agreement with Washington Department of Fish and Wildlife
 - Reclamation Cooperative Agreement with New Mexico Game and Fish
 - Reclamation Cooperative Agreement with Colorado Parks and Wildlife
 - US Forest Service (USFS) Cooperative Agreement with Oregon and Washington
 - USFS Challenge Cost Share Agreement with Colorado Parks and Wildlife
 - USFS Participating Agreements with Utah, Wyoming and Idaho
- In 2014, USACE was authorized by the Water Resources and Reform Development Act to engage in the CRB ANS programs, and established support for existing WID stations, establishment of new WID stations and monitoring for ZQM.
 - In 2018, the authorization was expanded to include the Upper Missouri, Upper Colorado, South Platte and Arkansas River Basins
- In 2017, DOI embarked on the STW initiative intended to bolster efforts to combat ZQM and improve upon partnerships between federal, state and tribal agencies working collectively on invasive mussel prevention and containment. Many WRP members contributed to six committees that formulated the STW action plan and continue to work on its implementation.

B. Prevention

*B.1. Implement mandatory watercraft inspection and decontamination (WID) at infested waters [Containment]

Status: Ongoing

Note: Implementing WID remains the highest priority prevention and containment need. A majority of USFWS QZAP grant funds, along with

NPS and Reclamation grants, have contributed to WID at infested waters, primarily on the lower Colorado River. When QZAP was published in 2010, there were 53 ZQM infested water bodies within the western region; today there are 136.

- Containment Manual for Watercraft Inspection and Decontamination Stations (Brown, 2013) was completed to address Action Items B.1 and B.4.
- Federal Policy Options: Addressing the Movement of Aquatic Invasive Species Onto and Off of Federal Lands and Waters (NISC and ANSTF, 2015) is a guide to identifying existing federal laws, regulations, and policies that can be utilized by agencies or bureaus to address the movement of invasive species both onto and off of federally managed waters, and especially to examine mandatory exit inspection and decontamination requirements from infested federal waters.

*B.2. Continue the development of effective watercraft inspection and decontamination protocols and standards

Status: Ongoing

The following items were completed to address this process:

- Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination Programs for Dreissenid Mussels in the Western United States (Phillips and Elwell, 2016)
- The Student Training Curriculum for Watercraft Inspectors and Decontaminators to Prevent and Contain the Spread of Aquatic Invasive Species (Brown, 2016)
- The Trainer Manual for Aquatic Invasive Species Inspection and Decontamination Courses (Brown, 2016)
- A Review of Chemical Use Associated with Watercraft Decontamination to Address Aquatic Invasive Species; a special supplement to UMPS (Phillips and Elwell, 2018)
- American Boat and Yacht Council's Aquatic Invasive Species Technical Information Report (T-32—July 2018)
- The Regional WID Data Sharing System was developed by CPW, in collaboration with the western states, to provide timely electronic communications regarding potentially infested watercraft moving into the uninfested West.
 - Several jurisdictions currently utilize the system to communicate both among inspection station staff and to coordinate

among leadership, including ten states, Lake Tahoe, numerous counties and cities, and National Parks. CPW funded the system from 2012-2016 and continues to provide staff time and resources to manage and oversee the system's operations, coordination and support for using agencies; QZAP provided a grant for 2017-2018; and Reclamation provided a grant for 2019. User organizations such as the Lake Tahoe Regional Planning Agency, Montana Fish, Wildlife & Parks and Utah Division of Wildlife Resources have contributed funding for development. This system is a foundational element for the western communications and must be maintained in perpetuity.

- The WRP formed a standing committee known as the “Decon Think Tank” to address new challenges in watercraft decontamination and provide an open forum for continued dialogue.
 - This committee addresses new challenges such as improving decontamination procedures and improving decontamination units so that they maintain water temps.

****B.3. Develop standard and effective equipment inspection and decontamination protocols***

Status: **Ongoing**

The following documents were completed to address inspection and decontamination protocols:

- Technical Memorandum No. 86-68220-07-05 Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (Reclamation, 2012)
- Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations Fire Manual (National Wildfire Coordinating Group, 2017)
- Crane Load Test Water Bags: Pathway, Inspection and Decontamination (Reclamation)
- ANS Scuba Manual (USGS)

****B.4. Adopt standard watercraft and equipment inspection and decontamination protocols in Western States***

Status: **Ongoing**

QZAP references the need for model legislation and agreements between states or basin-wide to enable full adoption of standard inspection and decontamination protocols, including training and quality control standards. The following documents

have been finalized and are available for adoption and implementation by western agencies:

- Preventing the Spread of Aquatic Invasive Species by Recreational Boats: Model Legislative Provisions & Guidance to Promote Reciprocity among State Watercraft Inspection and Decontamination Programs (Otts and Nanjappa, eds. 2014)
- Federal Policy Options: Addressing the Movement of Aquatic Invasive Species Onto and Off of Federal Lands and Waters (NISC and ANSTF, 2015)
- Model Regulation for State Watercraft Inspection and Decontamination Programs (Otts and Nanjappa, eds. 2016)
- Western Association of Fish and Wildlife Agencies Watercraft Drain Plug and Plant Removal Resolution (WAFWA, 2016)
- Model Memorandum of Understanding for Watercraft Inspection and Decontamination Programs (Otts, 2018)
- From Theory to Practice: A Comparison of State Watercraft Inspection and Decontamination Programs to Model Legislative Provisions (Otts, 2018)

****B.5. Establish and implement strong, consistent law enforcement programs in each western state***

Status: **Ongoing**

- Efforts exist in specific states or geographic areas with dedicated law enforcement for ANS (e.g. Lake Powell in Utah, Washington State).
- Action Item B.5 is a call for adequate law enforcement personnel to enforce the legal framework referenced in B.4 and remains an important need at all levels for effective prevention and containment.

****B.6. Develop a standardized risk assessment model and strategy for water bodies***

Status: **Not Started; Ongoing**

- Not Started—B.6 calls for a west-wide risk assessment model to prioritize early detection monitoring and prevention efforts, which has not happened to date. State, federal and basin entities have worked to standardize risk assessment modeling utilizing water quality as well as boating use and other parameters. Expanding on current state and federal projects to evaluate western priorities remains of high importance.

- Ongoing—Prioritizing Zebra and Quagga Mussel Monitoring in the CRB (Wells et al. 2011) provides a framework for prioritization of water bodies in the CRB and surrounding areas for early detection monitoring for dreissenid mussels, and addresses this need.

B.7. Expand mandatory watercraft inspection and decontamination capacity for uninfested regions

Status: **Ongoing**

- Prevention WID stations across the western states have increased since 2009. However, resources are needed for stations at points-of-entry into uninfested states and at high priority water bodies.

B.8. Develop and implement programs to intercept contaminated equipment

Status: **Ongoing**

- Specific states and organizations have mechanisms (such as permits) to prevent the movement of ANS on construction and other equipment.

B.9. Expand use of ANS Hazard Analysis Critical Control Point (HACCP) Planning

Status: **Ongoing**

- USFWS requires HACCP planning for all fisheries program activities. HACCP has been offered as a tool for other agencies to use through courses available to partners. Nine HACCP classes have been taught in western states since 2012. Three new instructors are offering four classes in 2019.

C. Early-Detection Monitoring

****C.1. Expand early-detection monitoring programs to all western water jurisdictions***

Status: **Ongoing**

- More waters are monitored today than in 2009. Some states do not have the capacity to implement monitoring programs and therefore have no monitoring, and some states are not able to meet WRP minimum standards for field monitoring.

****C.2. Develop standard field protocols for early-detection monitoring***

Status: **Completed**

- Dreissenid Mussels Field Sampling Protocol (WRP, 2018) addresses this need.

C.3. Improve veliger sample analysis methods

Status: **Ongoing**

- Lab Standards for Dreissenid Veliger Analysis (WRP, 2018) fulfills this need.

Note: This Lab Standards document is expected to be updated in 2019 following an evaluation of preservative and buffer agents by Reclamation.

C.4. Coordinate early detection monitoring programs

Status: **Not Started; Ongoing**

- Not Started—C.4 calls for completion of the centralized monitoring and reporting database under development by the 100th Meridian Initiative.
- Ongoing—All western states currently report final monitoring results (i.e. ZQM occurrence records) to the USGS database and utilize the NAS alert system.
- Ongoing—As with other action items, there are disparate monitoring and reporting database systems in place at various levels. For example, the CRB Monitoring Database maintained by PSMFC could be expanded to the entire western region. The CRB provides a forum for dialogue on monitoring within the basin. Reclamation posts their monitoring data on a SharePoint site which could be expanded to other jurisdictions. Most states have their own sampling and monitoring databases. WISCE serves as a forum for dialogue and coordination among states on monitoring.

D. Rapid Response

****D.1. Create and maintain a rapid response fund***

Status: **Not Started; Ongoing**

- Not Started—No dedicated rapid response fund for dreissenids exists that spans the West.
- Ongoing—In a January 2019 survey, only two western states reported a rapid response fund within state government.

- Ongoing—USACE has had rapid response funding authorized within the WRRDA and available within the CRB since 2014. In 2019, USACE with support from participating states will develop guidance on how to expand the program and capabilities to Upper Missouri, South Platte, Upper Colorado and Arkansas River basins. This program requires a 50/50 match.
- Ongoing—USFS contributes rapid response funds for invasive species through the Animal and Plant Health Inspection Service (APHIS), but it is only available for ZQM if the infested reservoir or waterbody is connected to irrigation or agriculture and has a direct nexus to agricultural production.

***D.2. Finalize rapid response notification database**

Status: **Not Started**

- Not Started—D.2 Calls for a 100th Meridian Initiative database internal to key managers to provide early notification of a newly infested water.

Note: D.2 May be better accomplished through the USGS NAS database, which is the standard data collection, reporting and notification platform for western ANS managers.

D.3. Complete and maintain rapid response plans for all western states

Status: **Ongoing**

- In 2010, four of the 19 western states had a rapid response plan; in January 2019 ten western states reported having a rapid response plan. Rapid response plans for some jurisdictions are waterbody specific.
- The WRP developed a *Model Rapid Response Plan for Aquatic Nuisance Species*.
- Montana developed a geodatabase for in-state rapid response planning (2018).
- The *CRB Rapid Response Plan for Dreissenid Mussels* has been updated several times in the past ten years and is undergoing a significant revision in 2019.

D.4. Designate and train rapid responders

Status: **Ongoing**

- The CRB Team holds annual rapid response dreissenid exercises in the basin and uses an Incident Command System structure and training.

- Montana held their first rapid response training in June 2018.

D.5. Planning for short-term environmental impacts resulting from rapid response

Status: **Ongoing**

- The CRB Team is working on an Endangered Species Act Manual. This is specific to the basin but can later be expanded for western regional use.

E. Containment or Management of Existing ZQM Populations

Note: Status updates for action items in this section were provided by Reclamation, unless otherwise noted.

***E.1. Develop tools and best management practices for preventing and minimizing mussel movement and settlement within water distribution systems and other infrastructure**

Status: **Completed; Ongoing**

- Completed—Microfiltration and self-cleaning filters tested at Parker Dam.
- Completed—Zequanox tested in generator cooling system at Davis Dam.
- Completed—pH manipulation.
- Ongoing—Antifouling and foul release coatings.
- Completed—Endothal treatment.
- Completed—Turbulence for mussel settlement prevention tested at Davis Dam.
- Completed—Salinity manipulation at Davis Dam.
- Completed—Ultraviolet light treatment tested at Hoover, Davis and Parker Dams.
 - http://www.reabic.net/journals/mbi/2017/3/MBI_2017_Pucherelli_Claudi.pdf
 - http://www.reabic.net/journals/mbi/2018/4/MBI_2018_Pucherelli_etal.pdf
- Completed—Laser pulsed pressure tested at Davis Dam
- Completed—Centrifugal separator tested at Davis Dam
 - <https://www.usbr.gov/research/projects/detail.cfm?id=8169>
- Ongoing—Carbon dioxide treatment

- Ongoing—Electrical methods for settlement prevention.
- Ongoing—Utilization of facility vulnerability assessments across Reclamation projects.
- Ongoing—Survey of mussel infested facilities to determine best practices and best system design for mussel control and mitigation.
- Ongoing—Zebra Mussel Mitigation: Durable and Non-Toxic Anti-Macrofouling Technologies to Protect Critical Hydraulic Infrastructure (USACE, FY18-22).
- Completed—Installed UV light systems at Gavins Point Dam for Hydropower plant cooling water intake (USACE, 2018).
- Completed—Draw down of Cunningham Lake after Zebra mussels found. Cunningham Lake is approximately 337 surface acre reservoir (USACE, 2018).

E.2. Implement reliable and cost-efficient control tools for water distribution systems

Status: **Ongoing**

- Full scale implementation of ultraviolet light treatment units for mussel settlement prevention on all generator cooling systems at Parker and Hoover Dams.

E.3. Develop open-water control tools

Status: **Completed; Ongoing**

- Completed—Designed and implemented a prize challenge to solicit novel ideas for the eradication of invasive mussels in open water.
 - <https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=63426>
 - http://www.reabic.net/journals/mbi/2018/4/MBI_2018_Pucherelli_etal.pdf
- Ongoing—Developing research project with prize challenge winners investigating induction of lethal dreissenid mussel-specific cancer utilizing CRISPR/cas9-mediated genome modification.
- Ongoing—Biological control research, use of novel parasites to control North American dreissenid populations.
- Ongoing—Development of a chimeric biopesticide
- Ongoing—Sequencing the quagga mussel genome as a tool for biocontrol.

E.4. Develop closed-water system control tools

Status: **Ongoing**

- See accomplishment list for E.1 which also apply here.

E.5. Support designing infrastructure for long-term control

Status: **Completed; Ongoing**

- Ongoing—Survey of mussel infested facilities to determine best practices and best system design for mussel control and mitigation.
- Ongoing—Testing self-cleaning strainers and filtration to mitigate mussel impacts.
- Completed—Centrifugal separation for shell debris removal.
 - <https://www.usbr.gov/research/projects/detail.cfm?id=8169>
- Ongoing—Testing antifouling and foul release coatings.
- Completed—Modernization of trash rack raking systems to manage mussel settlement.
 - <https://www.usbr.gov/research/projects/detail.cfm?id=2675>
- Completed—Testing ability of widely used fish screens to resist quagga mussel fouling.
 - <https://www.usbr.gov/research/projects/detail.cfm?id=4923>

E.6. Improved understanding of mussel control

Status: **Completed**

- Microsatellite analysis of quagga mussel genetic variability in the Colorado River system to determine the amount of genetic variability which may impact the effectiveness of control techniques.
 - Manuscript in Southwestern Naturalist—<https://bioone.org/journals/The-Southwestern-Naturalist/volume-63/issue-1/0038-4909-63.1.26/Patterns-of-Genetic-Structure-Among-Invasive-Southwestern-United-States-Quagga/10.1894/0038-4909-63.1.26.full>
- Testing the effectiveness of potash for zebra mussel eradication at San Justo Reservoir.

E.7. Develop programmatic National Environmental Policy Act guidance

Status: **Ongoing**

- The DOI is exploring the development of categorical exclusions to address invasive species management when specific parameters are met.

F. Outreach and Education

**F.1. Adopt consistent outreach messaging and enhance coordination of efforts*

Status: **Ongoing**

- Clean, Drain, Dry is the primary message for recreational users and is broadly accepted and implemented across the West. However, there are still numerous variations.



F.2. Conduct social science research

Status: **Not Started**; **Ongoing**

- Not Started—F.2 entails a professional social marketing review for states, tribes and federal agencies, which will include consistent outreach messaging, annual review of the campaigns, surveys of user groups, strategy updates, and materials for increased effectiveness.

- Ongoing—While there have been many independent social science research studies, there has been no coordinated evaluation across the West. Social science research studies include:

- Boater surveys in Arizona, California, Nebraska and South Dakota
- Preventing the transfer of dreissenid mussels and other aquatic invasive species by commercial watercraft and equipment transport providers (PSMFC, 2010)
- Exploring stakeholders' attitudes and beliefs regarding behaviors that prevent the spread of invasive species (OR Sea Grant, 2011)

F.3. Increase audience effectiveness assessments

Status: **Not Started**

- No coordinated assessments have occurred at the regional level.

F.4. Expand availability of existing outreach material

Status: **Ongoing**

These products were created to address this need.

- Western WID Information Rack Card (PSMFC, 2015)
- Standard education for trailer owners (National Association of Trailer Manufacturers, 2015)
- Non-motorized outreach in the lower Colorado River (Invasive Species Action Network, 2016-2018)
- Sticker a Mussel Program (Lake Havasu Marine Association, 2013-2018)
- Slide Anchor Education Plates (Lake Havasu Marine Association, 2018)
- Standard education in watercraft and engine owner's manuals (National Marine Manufacturers Association and American Boat and Yacht Council, 2018)
- WRP Education Committee Materials Clearinghouse (2018)

F.5. Make better use of television and radio

Status: **Ongoing**

- No coordinated expansion of the use of television and radio has occurred, although there have been isolated efforts in individual states or geographic areas.

F.6. Provide more opportunities for youth education

Status: **Ongoing**

- There have been no coordinated efforts to develop new youth education materials, expand delivery of ANS education, or to help western educators integrate ANS and invasive mussel issues into their curricula. However, isolated efforts have occurred in individual states or geographic areas.
- Providing opportunities for youth education is a regular function of fish and wildlife agencies. In Wyoming and Texas, ANS are part of standard science/water curricula.
- Oregon Sea Grant has developed resources such as the *Aquatic Invader Investigator: Invasive Comic Challenge* or *Stone Soup: Invasive Species Cartooning Teacher Lesson Plan*.
- USACE has implemented a 'traveling trunk' program that was updated in 2018. Science, Technology, Engineering and Math programs are being developed.
- Invasive Species Action Network does classroom visits across Montana teaching on ANS, and also teaches a one-day course aimed at preparing agency personnel to provide ANS programs.

G. Research

In 2015, a group gathered to discuss and prioritize research needs to address dreissenid management. *Dreissenid Mussel Research Priorities Workshop* (Sytsma et al. 2015) summarizes the results of that workshop.

This section does not document all ZQM research, but rather key western projects that further QZAP objectives in QZAP.

G.1. Determine ZQM physiological tolerances

Status: **Completed; Ongoing**

- Ongoing—Reclamation and USACE are collaborating to develop a predictive model for dreissenid mussel spread in western United States.
- Ongoing—Reclamation and USACE are collaborating to refine habitat suitability models for western waters.
- Completed—Reclamation has developed habitat suitability parameters for invasive mussels at Reclamation managed facilities along the lower Colorado River.

- <https://www.usbr.gov/research/projects/detail.cfm?id=6714>

G.2. Develop method to track dispersal via genetic fingerprints

Status: **Ongoing**

- Optimization of polymerase chain reaction (PCR) primers for early detection of invasive mussels (Reclamation).
- Development of a Real Time eDNA machine (University of Montana Flathead Lake Biological Station, 2018).

G.3. Develop alternative decontamination methods

Status: **Ongoing**

- Reclamation is developing effective and safe decontamination methods for underwater inspection equipment (e.g. diver gear) exposed to invasive mussels.

G.4. Develop biological control methods

Status: **Ongoing**

G.4 overlaps with E.3

- Ongoing—Reclamation is developing research project with prize challenge winners investigating induction of lethal dreissenid mussel-specific cancer utilizing CRISPR/cas9-mediated genome modification.
- Ongoing—Biological control research, use of novel parasites to control naïve North American dreissenid populations.
- Ongoing—Development of a chimeric biopesticide.
- Ongoing—Sequencing the quagga mussel genome as a tool for biocontrol.

G.5. Develop eco-friendly chemical control methods

Status: **Unknown**

Summary

Substantial strides have been made in the last decade to stop the spread of invasive mussels in the western US. For example, the containment program at Lake Mead National Recreation Area, which was the main focus of QZAP, improved significantly under management of Nevada Division of Wildlife in partnership with NPS. The WRP has facilitated a common language for ANS managers, as well as standards for watercraft inspection, decontamination, training, quality control, monitoring and laboratory analyses. NSGLC and AFWA published a legal framework for watercraft inspection and decontamination programs. CPW manages the Regional WID Data Sharing System that is used by almost all western states. The CRB banded together in perimeter defense of the last uninfested basin. Reclamation, USGS, and USACE continue to expand our understanding of ZQM through research and control testing.



Despite this significant progress, many of the same problems that prompted the development of QZAP still exist today. ZQM infestations in Arizona (Lake Pleasant and the lower Colorado River basin) and throughout California remain uncontrolled with no containment in place, posing a serious threat to the West. Similarly, ZQM populations in Kansas, North Dakota, Oklahoma, South Dakota, Texas and throughout the eastern US continue to spread with no prevention in place. As a result, an increasing number of mussel-infested boats arrive in western waters. There remain no viable control methods for ZQM in open water systems.

New ZQM infestations have increased the risk to western waterbodies. Within the WRP states, the number of infested water bodies more than doubled in the last 10 years, growing to 136 sites at the time of publication. The number of impacted watersheds (8-digit hydrologic units) has grown from 44 to 105. Exponential growth of mussel populations in Lake Powell (Glen Canyon National Recreation Area) has drastically increased the workload among western ANS managers as they struggle with the large numbers of watercraft departing this popular boating destination. While the Utah Division of Wildlife Resources, in partnership with NPS and State of Arizona, has implemented a WID containment program at Lake Powell, additional actions are needed to reduce the number of boats leaving infested waters. Similarly, Lewis and Clark Lake (Nebraska-South Dakota) and Lake Texoma (Texas-Oklahoma) have advanced populations that pose a great threat to the western US. Neither of these lakes, like many other infested western waters, have complete containment programs in place.

The WRP will continue to provide a forum for dialogue on ZQM management and will produce an updated priorities and recommendations document for the further implementation of the QZAP. Western partners must continue to work collaboratively to stop the spread of invasive mussels, making wise use of watercraft inspection and decontamination programs, early detection monitoring, research, and control innovations. States should consider adopting the model legislative provisions listed in B.4. and establish the staff and fiscal capacity to implement containment and prevention WID programs and monitoring programs according to WRP standards. Federal agencies may work in tandem with states to provide law enforcement, give permission to conduct mandatory WID on federally managed or owned properties, and provide long term funding agreements for the implementation of WID containment and prevention strategies.

Appendix A— WRP Member List 2019

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Appendix B— USFWS Reported Expenditures of QZAP Appropriations Fiscal Year 2010-Fiscal Year 2018

In Fiscal Year (FY) 2010, Congress appropriated \$2 million for quagga-zebra mussel prevention in the West. From this \$2 million, \$800,000 was awarded to the Lake Tahoe Region for an inspection and decontamination program designed to protect Lake Tahoe specifically. The remaining \$1.2 million was divided into halves. USFWS divided the first half, \$600,000, equally among all ANS-Task-Force-approved state and interstate management plans that requested funding and included projects that referenced zebra or quagga mussels. Only entities

with state or interstate management plans approved by the ANS Task Force were eligible for this funding. The second half of the \$1.2 million (\$600,000) was made available to any entities with projects focusing on the highest priorities of the 2010 Quagga Zebra Mussel Action Plan for Western US Waters (QZAP). A request for proposals was announced in 2010 and a team convened by the ANS Task Force ranked proposals. The USFWS's Branch of Invasive Species made the final funding decisions. Funded projects are listed below:

Project funded with FY2010 QZAP Funds (\$2M)	Funds
Tahoe Regional Planning Agency —Watercraft inspection and decontamination implementation at Lake Tahoe	\$800K
State/Interstate ANS Management Plans Funding for ANS Plans Nationwide	\$600K
University of Nevada—Las Vegas Develop effective decontamination protocols for wildland firefighting equipment to quagga/zebra mussels: testing the efficacy of quaternary ammonium compounds on killing dreissenid veligers and adults (QZAP Priority B.3)	\$118K
University of Nevada—Las Vegas Using pressurized hot water spray to kill and remove dreissenid mussels on watercraft: field testing on the efficacy of water temperature, high pressure, and duration of exposure (QZAP Priority B.2)	\$100K
US Bureau of Reclamation Pilot laboratory testing program for the early detection of zebra and quagga mussels in Western US waters (QZAP Priority B.2, C.1, C.2, C.3)	\$103K
US Bureau of Reclamation Dreissena mussel early detection monitoring methods and quality assurance workshops (QZAP Priority C.2, C.3, C.4)	\$72K
Pacific State Marine Fisheries Commission (PSMFC) Update and adopt the recommended uniform minimum protocols and standards for watercraft interception programs for dreissenid mussels in the Western United States (QZAP Priority B.2)	\$28K
Colorado Division of [Parks and] Wildlife (CPW) Development of a manual for containment activities in infested water bodies (QZAP Priority B.2)	\$40K
Portland State University Early-detection monitoring for quagga and zebra mussels in Oregon (QZAP Priority C.1)	\$45K
The University of Texas at Arlington Early-detection monitoring for quagga and zebra mussels in Texas (QZAP Priority C.1)	\$55K
Montana Fish, Wildlife and Parks Early-detection monitoring for quagga and zebra mussels in Montana (QZAP Priority C.1)	\$29K

In FY2011, following a Continuing Resolution, the USFWS redirected the \$2 million originally appropriated for quagga/zebra mussels to other USFWS priorities.

In FY2012 Congress directed \$1 million to the USFWS to help prevent the spread of mussels by

watercraft at Federally-managed water bodies, particularly the lower Colorado River, including Lake Mead and provided \$1 million for implementation of up to 43 State/Interstate ANS Management Plans (approximately \$25,000 each).

Project funded with FY2012 QZAP Funds (\$1M)	Funds
Lake Mead National Recreation Area Funds were provided to complete a decontamination station at Henenway Harbor, for supplies and maintenance of decontamination equipment, for a quagga-mussel specialist, and for outreach	\$455K
States of NV, AZ, UT, CA, OR, and WA Funding was provided for law enforcement activities related to zebra/quagga mussels	\$180K
Glen Canyon National Recreation Area Funding was provided for monitoring boat ramps at Lake Powell	\$100K
New Mexico Game and Fish Funding was provided for monitoring boat ramps at Lake Navajo	\$100K
States of AZ and NV Funding was provided to increase outreach and education	\$60K
Pacific States Marine Fisheries Commission Funds were provided to increase Watercraft Inspection Training (Level II) at Lakes Mead and Havasu	\$60K
USFWS Administrative Costs 3% of the overall budget was used for administrative costs in Region 2	\$30K
The University of Texas at Arlington Funds were provided to develop an online Information Sharing System	\$11.5K

In FY2013 Congress directed \$1 million to the USFWS to help prevent the spread of mussels by watercraft at Federally-managed water bodies, particularly the lower Colorado River, including Lake Mead,

and provided \$1 million for implementation of up to 43 State/Interstate ANS Management Plans (approximately \$25,000 each).

Project funded with FY2013 QZAP Funds (\$900K)	Funds
NDOW Containment at Lake Mead	\$391K
AZGFD Decontamination station (Havasu)	\$260K
NPS—Lake Mead Supplement Nevada Division of Wildlife (NDOW) WID program	\$29K
PSMFC Watercraft Inspection and Decontamination Training	\$68K
Lake Havasu Marine Association (LHMA) Outreach/Containment	\$25K
NPS—Glen Canyon Outreach/Containment	\$100K
State University of New York, Albany Research: Field test for living mussels	\$28K

In FY2014, Congress directed the National Park Service (NPS) to provide \$2 million for quagga and zebra mussel containment, prevention, and

enforcement as prescribed in QZAP, thereby freeing the USFWS to address other high priority sources of spread in the West.

Project funded with FY2014 QZAP Funds (\$930K)	Funds
AZGFD Mobile Decontamination Unit and Staff	\$80K
CPW Regional WID Data Sharing System	\$154K
LHMA Outreach and Education	\$100K
NDOW Decontamination and Outreach at Lake Mead NRA	\$122K
PSMFC Watercraft Inspection and Decontamination Training	\$74K
UTDWR Inspection and Containment program at Lake Powell	\$400K

FY2015—Congress directed the USFWS to provide \$2 million for quagga and zebra mussels. USFWS allocated \$1M to the West through a merit based

grant program to implement QZAP, and \$1M to approved State/Interstate ANS Management Plans nationally.

Project funded with FY2015 QZAP Funds (\$941K)	Funds
AZGFD Mobile Decontamination Unit and Staff	\$60,000
ISAN Non-motorized boater education	\$35,970
ABYC Boat Design and Construction	\$106,859
NDOW Decontamination and Outreach at Lake Mead NRA	\$191,104
PSMFC Watercraft Inspection and Decontamination Training	\$179,592
UTDWR Inspection and Containment program at Lake Powell	\$171,231
University of Arizona Re-establish Colorado River Team	\$78,072
Working Dogs for Conservation Northeast Texas Detection & Outreach Project	\$52,829
Western Biological Services Outreach materials for free to partner agencies	\$65,506



FY2016—Congress directed the USFWS to provide \$2 million for quagga and zebra mussels. USFWS allocated \$1M to the West through a merit based

grant program to implement QZAP, and \$1M to approved State/Interstate ANS Management Plans nationally.

Project funded with FY2016 QZAP Funds (\$930K)	Funds
AZGFD Containment and Decontamination in lower Colorado River	\$75,000
ISAN Non-motorized boater education	\$35,145
LHMA Outreach and Education	\$55,000
NDOW Decontamination and Outreach at Lake Mead NRA	\$185,400
United Water Conservation District Lake Piru Containment	\$130,019
UTDWR Inspection and Containment program at Lake Powell	\$124,297
CPW Regional WID Data Sharing System	\$117,720
Lake County California Outreach and Education in CA	\$137,061
Working Dogs for Conservation NE Texas Detection & Outreach Project	\$70,357

FY2017—Congress directed the USFWS to provide \$2 million for quagga and zebra mussels. USFWS allocated \$1M to the West through a merit based

grant program to implement QZAP, and \$1M to approved State/Interstate ANS Management Plans nationally.

Project funded with FY2017 QZAP Funds (\$930K)	Funds
PSMFC Watercraft Inspection and Decontamination Training	\$81,420
PSMFC Outreach Video Development	\$39,580
LHMA Outreach and Education	\$67,000
NDOW Decontamination and Outreach at Lake Mead NRA	\$260,260
UTDWR Inspection and Containment program at Lake Powell	\$200,000
CPW Regional WID Data Sharing System	\$153,970
University of Montana Flathead Lake Biological Station Real Time eDNA Machine Development	\$127,770



FY2018—Congress directed the USFWS to provide \$2 million for quagga and zebra mussels. USFWS allocated \$1M to the West through a merit based

grant program to implement QZAP, and \$1M to approved State/Interstate ANS Management Plans nationally.

Project funded with FY2018 QZAP Funds (\$960K)	Funds
PSMFC Watercraft Inspection and Decontamination Training	\$77,499
ISAN Non-motorized boater outreach	\$103,400
LHMA Anchor outreach program	\$10,000
NDOW Decontamination and Outreach at Lake Mead NRA	\$222,633
UTDWR Inspection and Containment Program at Lake Powell	\$225,338
AZGFD Containment and Decontamination in lower Colorado River	\$200,000
University of Montana Flathead Lake Biological Station Real Time eDNA Machine Development	\$121,100

FY2019—Congress directed the USFWS to provide \$2 million for quagga and zebra mussels. USFWS allocated \$1M to the West through a merit based

grant program to implement QZAP, and \$1M to approved State/Interstate ANS Management Plans nationally. At the time of publication, the QZAP grant is open for applications and awards for FY2019 have not been issued.

Appendix C— Acronyms

ABYC—American Boat and Yacht Council

AFWA—Association of Fish and Wildlife Agencies

ANS—Aquatic Nuisance Species

ANSTF—Aquatic Invasive Species Task Force

APHIS - Animal and Plant Health Inspection Service

AZGFD—Arizona Game and Fish Department

BC—Building Consensus

CPW—Colorado Parks and Wildlife

CRB—Columbia River Basin

eDNA—Environmental deoxyribonucleic acid

DOI—Department of the Interior

HACCP—Hazard Analysis and Critical Control Points

ISAN—Invasive Species Action Network

LHMA—Lake Havasu Marine Association

NAAG—National Association of Attorney Generals

NANCPA—Nonindigenous Aquatic Nuisance Control and Prevention Act of 1990

NAS—Nonindigenous Aquatic Species Database

NDOW—Nevada Department of Wildlife

NISA—National Invasive Species Act of 1996

NISC—National Invasive Species Council

NPS—National Park Service

NSGLC—National Sea Grant Law Center

OSG—Oregon Sea Grant

PCR—Polymerase Chain Reaction

PSMFC—Pacific States Marine Fisheries Commission

QZAP—Quagga Zebra Mussel Action Plan for Western Waters

Reclamation—US Bureau of Reclamation

STW—Safeguarding the West

USACE—US Army Corp of Engineers

USFS—US Forest Service

USFWS—US Fish and Wildlife Service

USGS—US Geological Survey

UTDWR—Utah Division of Wildlife Resources

WAFWA—Western Association of Fish and Wildlife Agencies

WID—Watercraft Inspection and Decontamination

WISCE—Western Invasive Species Coordinating Effort (i.e. Western State ANS Coordinators)

WGA—Western Governors Association

WRP—Western Regional Panel on Aquatic Invasive Species

ZQM—Zebra and Quagga Mussels



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WESTERN REGIONAL PANEL
ON AQUATIC NUISANCE SPECIES