Watercraft Inspection and Decontamination (WID) Manual

WID Training Curriculum for Level I and Level II Inspectors and Decontaminators

Revised on December 1, 2021

westernais.org

WESTERN REGIONAL PANEL
ON AQUATIC NUISANCE SPECIES

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The original WID Manual titled the *Official Colorado Watercraft Inspection and Decontamination Procedures: Certification Curriculum for Authorized Agents* was drafted by Elizabeth Brown and published by Colorado Parks and Wildlife on February 10, 2013.

- Revised for the Western Regional Panel on ANS: January 28, 2015.
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- Latest revision by Elizabeth Brown and published by the Pacific States Marine Fisheries Commission on December 1, 2021.

This Watercraft Inspection and Decontamination Manual
is comprised of information from the following documents:

- Watercraft Inspection Training Slideshows. Wen Baldwin. 2007.
- Aquatic Nuisance Species Watercraft Inspection and Education Handbook. Colorado Department of Natural Resources. 2009.
- Aquatic Nuisance Species Watercraft Decontamination Manual. Colorado Division of Wildlife. 2011.
- Boat Compendium for Aquatic Nuisance Species Inspectors. Colorado Parks and Wildlife. 2012.
- Containment Manual for Watercraft Inspection and Decontamination Stations. Colorado Parks and Wildlife. 2013.
- Building Consensus in the West Workgroup: Final Activity Report 2011-2019. Western Regional Panel on ANS. 2019.
- The Updated Recommendations for the Quagga Zebra Action Plan for Western Waters (QZAP 2.0). Western Regional Panel on ANS. 2020.
- The Uniform Minimum Protocols and Standards (UMPS IV). Pacific States Marine Fisheries Commission. 2021.

Acknowledgments

This document has been prepared for the Pacific States Marine Fisheries Commission to further the efforts of the Western Regional Panel on Aquatic Nuisance Species (WRP), and to fulfill priorities within the *Updated Recommendations for the Quagga Zebra Action Plan for Western U.S. Waters* (QZAP 2.0). The protocols and procedures documented in this Manual were developed by the WRP's Watercraft Inspection and Decontamination (WID) Think Tank Committee, approved by the ANS Task Force, and are based on the *Uniform Minimum Protocols and Standards* (UMPS). A special thank you to the members of WID Think Tank Committee for their input, review, and discussion which contributed to the revision of this Manual, and for their dedication to preventing the spread of AIS through watercraft inspection and decontamination.

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9:30 AM	Introduction
10:00 AM	Zebra and Quagga Mussel Biology
10:30 AM	How Many Mussels Can You Find? (outside)
10:45 AM	Other AIS Biology
11:15 AM	Watercraft 101
12:00 PM	Watercraft Anatomy (outside)
12:30 PM	**LUNCH**
1:00 PM	The IDEAL Inspector
1:15 PM	Inspection
2:45 PM	Inspection Practice (outside)
4:15 PM	Review Day 1. Q&A.
5:00 pm	Adjourn

STUDENT HOMEWORK—MEMORIZE INSPECTION PROCEDURES AND ANSWER QUESTIONS AT THE END OF EACH CHAPTER.

Breaks will be given approximately every 90 minutes, sometimes longer.

Watercraft Inspection and Decontamination Training Agenda—Day 2

9:00 AM Welcome! Chapter Review Questions

9:30 AM Exit Inspection Demonstration (outside) and Review

10:00 AM Inspection Practice (outside)

10:30 AM Decontamination Overview

11:00 AM Decontamination Unit Standard Operating Procedures and Attachments

12:00 PM LUNCH

1:00 PM **Group 1**—Decontamination Procedures

- When to Decontaminate
- Standing Water Decontamination of Interior Compartments
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- Standing Water Decontamination of Interior Compartments
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- Hull and Trailer Rinse and Spray

3:30 PM Review Day 2. Q&A.

4:00 PM Exam

5:00 PM Adjourn

Outdoor Demonstration—Entrance and Off-Water Inspection

What Did You Observe?

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Chapter 1

Introduction

Chapter 1: Introduction

What are Aquatic Nuisance Species (ANS) or Aquatic Invasive Species (AIS)?

Aquatic nuisance species (ANS) or aquatic invasive species (AIS) are also called non-native species, exotic species, non-indigenous species, noxious weeds, or pests. AIS can be plants or animals. Invasive aquatic plants are introduced in areas that allow them to be partially or completely submerged in the water and out-compete native species for light, space and nutrients creating a dense monoculture. Invasive aquatic animals also out-compete native species and require a watery habitat, but do not necessarily have to live entirely in water.

AIS plants and animals not only threaten native species but also interfere with recreational activities and municipal, industrial, commercial, and agricultural water supply, storage, and distribution. In their native environments, AIS populations are typically held in check and controlled by predators, parasites, pathogens, or competitors. However, when they are transported to a new environment, the natural checks are usually left behind. This gives invasive plants and animals an advantage over native species and makes them very difficult, if not impossible, to control. Long-term management of invasive species is costing the U.S.A. over $200 billion dollars a year (Pimentel et al 1996).

How are ANS defined?

"Aquatic Nuisance [Invasive] Species means a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters"

Nonindigenous Aquatic Nuisance
Prevention and Control Act of 1990

Reauthorized—National Invasive Species Act of 1996

"Invasive species' means, with regard to a particular ecosystem, a non-native organisms whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health."

Executive Order 13751 signed by
President Barak Obama on December 5, 2016

What is the purpose of this Watercraft Inspection and Decontamination Manual?

The Watercraft Inspection and Decontamination (WID) procedures described in the following pages and taught in the WID Training Course have been proven to reduce the risk of mussels and other AIS being introduced into our precious waters, through implementation of a science-based prevention and containment activities.

There are two training options provided in this WID manual—Level 1 (Inspection) and Level 2 (Inspection and Decontamination). Individuals that complete the Level 2 training can further their education by attending the Advanced Decontamination or Level 3 WID Trainer Training. The types of WID trainings are described in more detail in the WID Trainer's Manual and online at westernais.org.

Legal Basis

The laws and regulations for WID vary by jurisdiction. However, the western states have been striving for more consistent legal provisions and guidance to effectively implement WID programs. Through the WRP's Building Consensus in the West Workgroup from 2012-2019, and with the support of the U.S. Fish and Wildlife Service (USFWS), the National Sea Grant Law Center (NSGLC) and the Association of Fish and Wildlife Agencies (AFWA) provided technical legal guidance to western state AIS programs. Building Consensus included extensive facilitated dialogue among state AIS coordinators and the National Park Service to develop a model legal framework and science-based standards for implementing WID programs. This multifaceted partnership made tremendous progress, including the development and publication of operational program standards for early detection field monitoring and laboratory procedures, WID protocols and procedures, training, quality control, data sharing, and communications. The *Building Consensus in the West Workgroup: Final Activity Report 2011-2019* (WRP, 2019) details the operational standards produced by western states and partners during the project.

Multiple legal publications resulted from Building Consensus including the Model Legislative Provisions to Promote Reciprocity Among State WID Programs, Model Regulations for State WID Programs, Model Memorandum of Understanding for WID Programs, and Comparison of State WID Program. In addition, NSGLC developed a specific Comparative Analysis of WID Requirements along the Lower Colorado River

and a Local Government AIS Toolkit in the years after Building Consensus. These legal pieces have been instrumental in gaining alliance between state programs. States and other jurisdictions responsible for managing recreational waters are strongly encouraged to adopt the model legal provisions and harmonize requirements across jurisdictions to provide optimal resource protection, improve customer service, and strengthen programs and partnerships. To obtain the complete legal framework documents or more information, please visit NSGLC.

The regional WID training program administered by the Pacific States Marine Fisheries Commission (PSMFC) is taught to a variety of audiences at many locations around the nation. The legal basis portion of the training may be customized to the specific audience or generalized if the audience spans multiple jurisdictions.


American Bullfrog

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What AIS are we concerned about?

While this Manual puts special emphasis on preventing introductions of two species that have the most significant economic, cultural and natural resource impacts—zebra and quagga mussels or ZQM—the procedures apply to all aquatic invasive species, both plant and animal. The following table lists the AIS plants and animals identified by the Western Governors' Association in a 2019 survey to determine the worst invasive species in the west.


Didymo

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TOP 25 AQUATIC INVASIVE SPECIES IN THE WEST

	Common Name	*Scientific Name*
1.	Eurasian Watermilfoil	*(Myriophyllum spicatum)*
2.	Quagga and Zebra Mussel	*(Dreissena rostriformis bugensis and Dreissena polymorpha)*
3.	New Zealand mudsnail	*(Potamopyrgus antipodarum)*
4.	Asian Clam	*(Corbicula fluminea)*
5.	Curly-leaved pondweed	*(Potamogeton crispus)*
6.	Silver carp	*(Hypophthalmichthys molitrix)*
7.	Northern pike	*(Esox lucius)*
8.	Purple loosestrife	*(Lythrum salicaria)*
9.	Hydrilla	*(Hydrilla verticillata)*
10.	Whirling disease	*(Myxobolus cerebralis)*
11.	Common carp	*(Cyprinus carpio)*
12.	American bullfrog	*(Lithobates catesbeianus)*
13.	Bighead Carp	*Hypophtalmichthys nobilis*
14.	Rusty crayfish	*(Faxonius rusticus)*
15.	Brazilian elodea	*(Egeria densa)*
16.	Nonnative crayfish	*(Orconectes spp., Procambarus clarkii)*
17.	Giant salvinia	*(Salvinia molesta)*
18.	Golden algae	*(Prymnesium parrum)*
19.	Didymo	*(Didymosphenia geminate)*
20.	Nutria	*(Myocastor coypu)*
21.	White Perch	*(Morone americana)*
22.	Grass Carp	*(Ctenopharyngodon idella)*
23.	Water Hyacinth	*(Eichornia crassipes)*
24.	Red shiner	*(Cyprinella lutrensis)*
25.	Phragmites Common Reed	*(Phragmites australis)*

The Problem

AIS threaten the diversity and abundance of native species, the ecological stability of infested waters, and water-dependent commercial, agricultural, aquaculture, and recreational activities. The zebra mussel *(Dreissena polymorpha)* and quagga mussel *(Dreissena rostriformis bugensis)*, collectively referred to as zebra and quagga mussels (ZQM), are among the most devastating AIS to invade North American freshwaters. 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. As a result, ZQM significantly impacts water supply and distribution infrastructure for municipal, industrial, and agricultural uses, as well as fisheries and all forms of water-based recreation.

Their ecological legacy in the East has included competition with native mussels, disruption of food webs, and bioaccumulation of toxins. The invaders are creating similar problems in the western waters where they have become established, putting the long list of imperiled fish and other aquatic life at an even greater risk.

"Without increased and immediate action, quagga and zebra mussels will cause irreparable ecological damage to western waters and long-term costs will be in the billions."
—QZAP, 2010

Quagga

© U.S. GEOLOGICAL SURVEY

Zebra

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The History of Zebra and Quagga Mussel Management Efforts in the West

The first zebra mussel detection within the western region was in Oklahoma in 1993. Next, Kansas detected zebra mussels in the Missouri River in 2001. A few years later in 2003, Kansas detected a large infestation in El Dorado Reservoir that made other western states take notice.

The first coordinated western efforts to prevent ZQM fell under the 100th Meridian Initiative. Select watershed level basin teams were established which 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 Team was established

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in 2003 and the Missouri River Basin Team was established in 2004. PSMFC and the USFWS coordinate basin team meetings. There is new interest to coordinate additional basin teams per the *Updated Recommendations for the Quagga Zebra Action Plan for Western US Waters* (QZAP 2.0) published by the WRP in 2020.

In 2007, invasive quagga mussels were detected in Lake Mead National Recreation Area and subsequently in the Colorado River Basin and associated waters. These detections were hundreds of miles away from any known detections and confirmed that recreational watercraft had transported invasive mussels over land great distances. This forever changed boating in the West by serving as the catalyst for the implementation of a new cross-jurisdictional management practice—prevention and containment watercraft inspection and decontamination programs—to stop the spread of mussels and other AIS by recreational watercraft.

In 2008, Senator Feinstein requested an action plan to identify management options to stop the spread of invasive mussels from the Lower Colorado River into other western waters. The original Quagga Zebra Mussel Action Plan for Western US Waters (QZAP) was written by the WRP and approved by the ANS Task Force in 2010.

The QZAP summarized strategies that addressed the zebra and quagga mussel invasion in the West. It also identified and prioritized specific and comprehensive actions needed to prevent further spread of these mussels, respond to new infestations, and manage existing infestations. The original QZAP, and the new QZAP 2.0, are intended to serve as the common 'road map' of priorities for water or recreational management entities and their partners in the West.

In 2011, the western state ANS coordinators formed the Western Invasive Species Coordinating Effort (WISCE). The purpose of the WISCE organization is to provide an open dialogue among states regarding ANS management and WID program implementation. They recognize the tremendous distances boaters travel and the value of working together to provide better resource protection against invasive mussels while gaining program efficiencies and maintaining outstanding outdoor recreation opportunities. WISCE's original focus was to engage with and encourage the National Park Service (NPS) to contain quagga mussels at Lake Mead and other infested waters through mandatory WID. This remains a primary focus of WISCE but has since expanded to encourage all federal agencies that own or manage infested or high priority waters to implement prevention and containment WID in partnership with state, tribes, local governments, and privately managed waters.

Quagga Mussels
(Dreissena rostriformis bugensis)

© MICHAEL PORTER, U.S. ARMY CORPS OF ENGINEERS

Zebra Mussels
(Dreissena polymorpha)

© MINNESOTA DEPARTMENT OF NATURAL RESOURCES

The WRP formed its Building Consensus in the West Workgroup (BC) in 2013 following a workshop held the previous year in Phoenix, Arizona, hosted by NSGLC, Oregon Sea Grant (OSG), the National Association of Attorneys General (NAAG) and the USFWS. Assistant attorney generals, state law enforcement chiefs, state AIS coordinators, federal agency representatives, and a representative from the Department of the Interior (DOI) Solicitor's Office attended the meeting to better understand legal barriers that were hindering the implementation of mandatory watercraft inspection and decontamination at infested waters per the QZAP.

From 2013 to 2019, WRP's membership engaged in BC, which included extensive facilitated dialogue among state ANS coordinators and the NPS, to develop a model legal framework and science-based standards for implementing state WID programs. In addition to the legal framework described earlier in this Manual, this multifaceted partnership made tremendous progress, including the development of standards for early detection field monitoring, laboratory procedures, WID protocols and procedures, training, quality control, data sharing, and communications. *The Building Consensus in the West Workgroup: Final Activity Report 2011-2019* (WRP, 2019) details the agreements and operational standards produced by western states and partners during the project. It is recommended that all persons attending WID training, read the BC Final Activity Report available on the WRP's website.

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

From 2017–2020, the 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 worked on its implementation.

The Western Governors' Association (WGA) engaged with DOI and the western states on STW and numerous other projects related to invasive species. In 2018, the WGA embarked on its 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 WGA's 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 forum was originally planned for January 2019 but was rescheduled because of a partial government shutdown and later held in August 2019 in Las Vegas, Nevada.

Through these efforts, a long-awaited increase in federal dollars and overall engagement has been realized which has bolstered state invasive mussel WID activities across the West. To provide current information relevant to ongoing dialogues with USACE, DOI, WGA, and other partners, the WRP published the *Quagga and Zebra Mussel Action Plan for Western Waters: Status Update Report* in April 2019. The report compiled relevant information and accomplishments under each original action item and documented the status of western progress on each item. Following the publication of the *Quagga and Zebra Mussel Action Plan for Western Waters: Status Update Report* and *Building Consensus in the West Workgroup: Final Activity Report 2011-2019*, the WRP completed an updated QZAP 2.0 in 2020 to inform future management.

The 100th Meridian Initiative, the original QZAP, the BC Final Activity Report, the QZAP Status Update Report, and QZAP 2.0 all highlight the importance and effectiveness of watercraft inspection and decontamination, coupled with education, enforcement, and monitoring, to prevent the further spread of ZQM and other AIS. Over the years, the knowledge and connection among AIS managers and WID experts have grown exponentially through these collaborative efforts. There continues to be general consensus that these described WID management practices, along with communication and partnership across jurisdictions, provide optimal protection against future invasion.

Participants from a diverse array of organizations in front of an infested mussel boat at Lake Mead National Recreation Area during the WGA Invasive Mussel Leadership Forum in August 2019.

© LAKE MEAD NATIONAL RECREATION AREA

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From 2020–2021, the WRP's Decon Think Tank Committee evaluated and updated the inspection and decontamination procedures used throughout the West. The Decon Think Tank also contributed to updating the WID Trainer's Manual, UPMS IV, and publishing a new Advanced Decontamination Manual. The WRP submitted the WID procedures to the ANS Task Force for consideration and approval as the national standard procedures for WID. Through this process, the WID procedures have been evaluated by the five other Regional Panels and the ANS Task Force's Prevention Committee. The inspection procedures detailed later in this WID Manual were officially approved by the ANS Task Force on November 17, 2021.

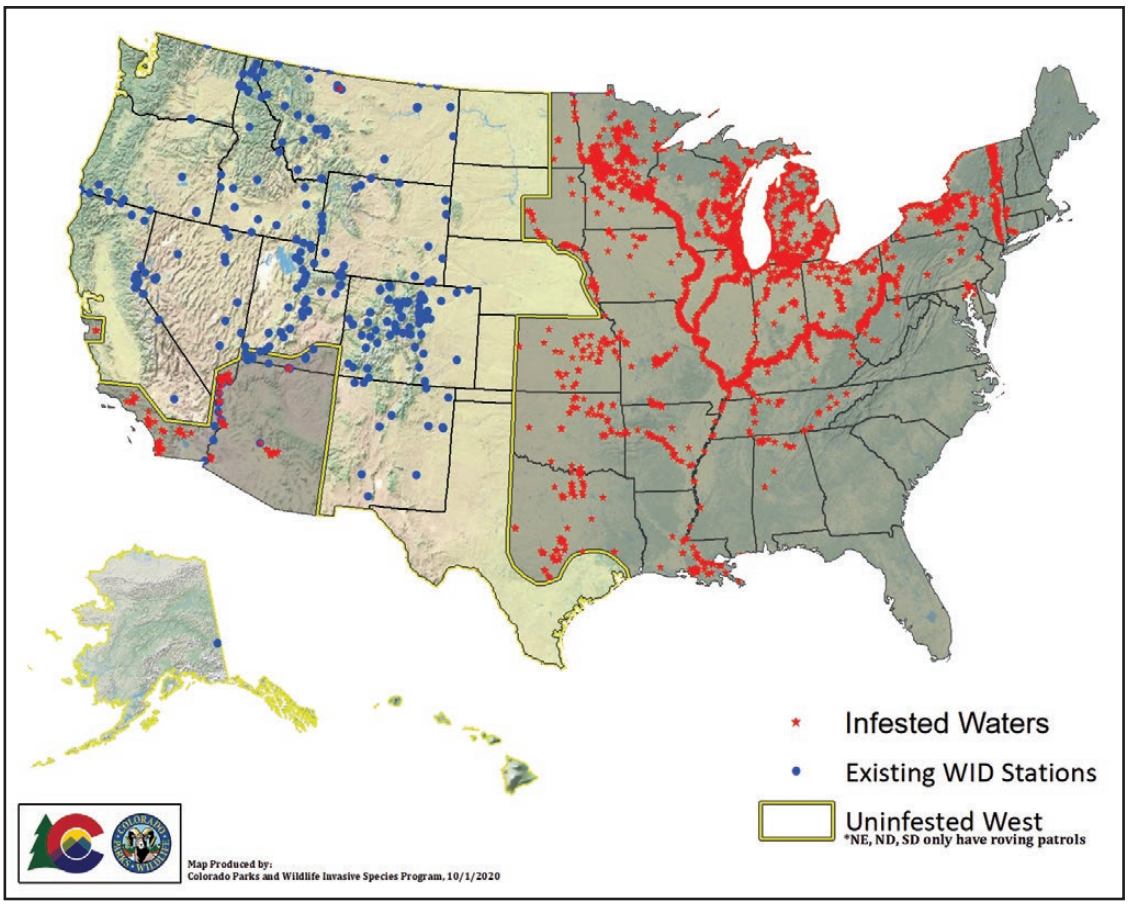
This WID Manual includes the approved final WID standards and incorporates the latest available information from the above mentioned projects or publications. A timeline of the *Significant Moments in the History of ZQM in the West*, which includes links to publications, is available in Appendix B.

The Current Status of ZQM in the West

For current AIS distribution data, please visit the Nonindigenous Aquatic Species (NAS) database maintained by the U.S. Geological Survey (USGS) at https://nas.er.usgs.gov/.

When the QZAP was approved in 2010, there were 64 infested waters within the WRP boundary but by 2020 that number had more than doubled (USGS, 2020). Infestations continue to occur in locations that do not have WID protections in place. Implementing WID collaboratively has proven effective across boundaries to stop the spread of invasive mussels and other AIS into new areas. ZQM has yet to be detected in the vast majority of western waters, which presents important opportunities to prevent significant damage if more WID programs are established and greater coordinated action is taken.

The Uninfested West



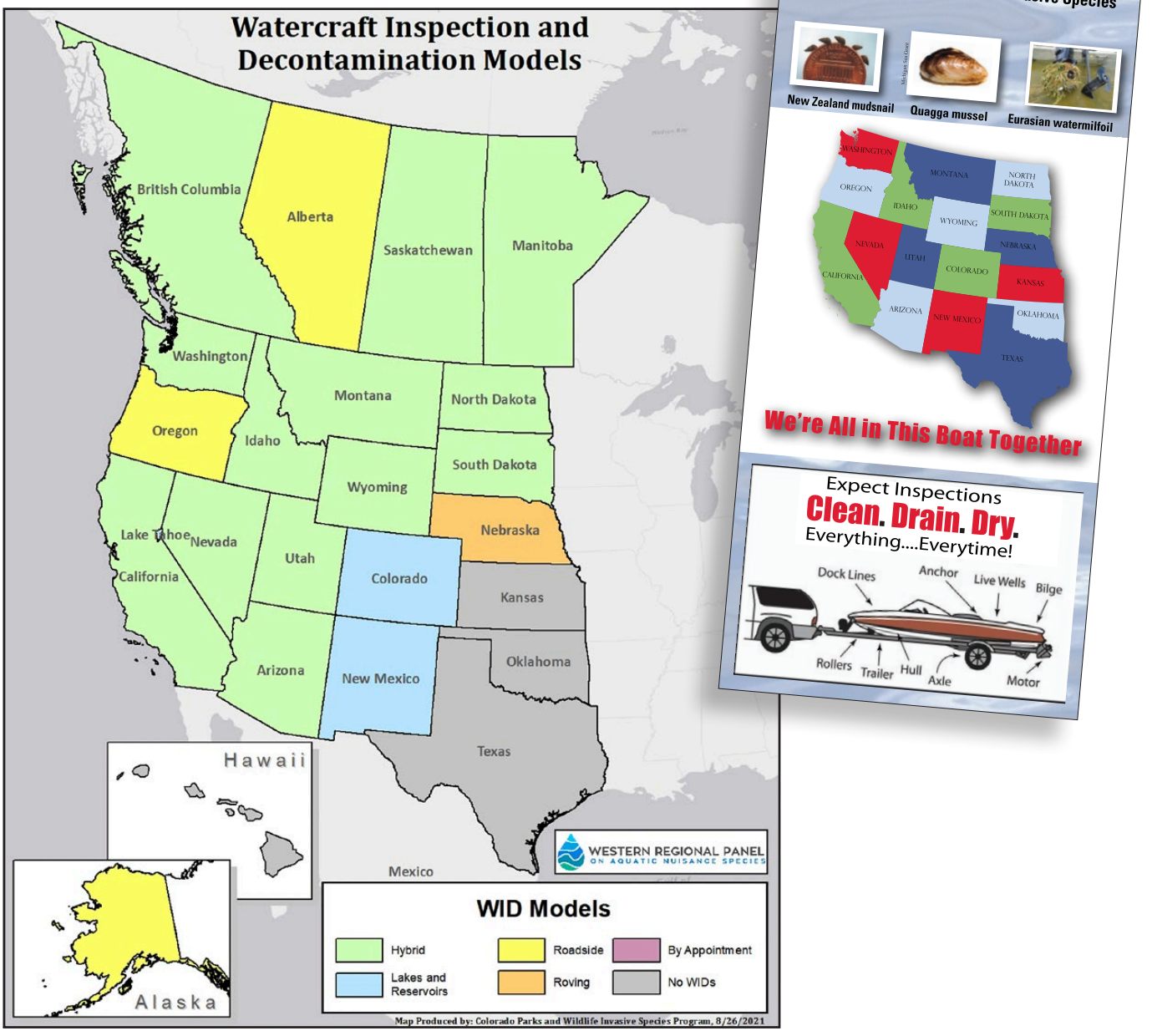
Western AIS Programs

The West is united and mobilized to prevent the introduction and spread of ZQM to additional waters through the implementation of science-based WID and monitoring programs. This coordination of efforts has been beneficial and continues to be relevant for successful management. Without a coordinated multi-jurisdictional strategy, ZQM will cause irreparable ecological damage to western waters, and costs will be in the billions of dollars.

Preventing the spread of ZQM and other AIS requires indefatigable cooperation and coordination between federal, state, tribal, county, and municipal governments, districts, marinas, concessionaires, private entities, and recreationists. There are currently no proven methods to control the downstream movement of ZQM veligers in natural environments.

The mission is to protect wildlife, natural resources, recreation, infrastructure, agriculture, and the economy by (1) preventing the introduction of zebra and quagga mussels and other invasive species and (2) by containing current infestations at the source.

It is a shared objective among WID stations to protect natural resources from the harm caused by invasive species. By working together, we are protecting our most precious water supplies for wildlife, municipal, agriculture, and industrial uses, providing unbeatable outdoor recreational opportunities for future generations, along with optimal customer service, and utilizing limited fiscal and human resources in the most effective and efficient manner possible.



Water Body Sampling and Monitoring

Water body sampling and monitoring is a critical component of any AIS program. The results of sampling activities will determine if prevention or containment WID procedures should be applied. The sooner an occurrence is detected, and rapid response is initiated, the more likely it is to be contained or controlled mitigating the long term negative impacts to the environment and economy.

AIS programs should adhere to the sampling protocol described in the WRP ZQM Field Sampling and Monitoring Protocol for the early detection of zebra or quagga mussels: (1) conduct plankton tows to find veligers, (2) deploy and check substrates to find juvenile "settlers" or attached adult mussels, and (3) conduct surveys along the shoreline and existing structures for settled juveniles or attached adult mussels.

The following definitions, water body classifications, standards, and guidance were documented through the BC process by participants related to sampling and monitoring of waters for invasive zebra and quagga mussels.

DEFINITIONS

Verification—The scientifically-based process to confirm the presence of AIS.

Detection, detect or detected—The verified presence of AIS.

Minimum to verify detection and the identity of a given suspect organism—The scientifically based process to confirm the presence of AIS which must include two independent results from the same sample using scientifically accepted techniques. Scientifically accepted techniques may be cross polarized microscopy, PCR or gene sequencing on the organism tissue. Currently, eDNA is not a scientifically accepted technique to verify a dreissenid mussel detection.

Sampling event—Samples collected on one day in a unique water body—each sample has a unique identifier/label, and all equipment must be decontaminated between sampling events.

Subsequent—Any positive results should require additional sampling events to verify the initial detection (because of potential contamination). Subsequent means samples taken on different days, or another sample not taken on the same day after the previous sampling event using decontaminated equipment. Dedicated nets should be used for any water bodies categorized as inconclusive, suspect, positive or infested.

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ADDITIONAL DEFINITIONS

Gene Sequencing—A process for species identification using advanced molecular analysis.

Larval—The larvae or initial life stage of a zebra or quagga mussel (and Asian clams or other mollusks) is the free-floating infant stage, also called a veliger.

Microscopic—Too small to be seen by the unaided eye but large enough to be studied under a microscope.

Microscopy—The science of examining and identifying organisms under the microscope.

Plankton—passively floating, drifting, or somewhat motile organisms occurring in a body of water, primarily comprising microscopic algae and protozoa. Often the bottom of the food chain.

PCR—Polymerase Chain Reaction—A process for amplification of DNA for species identification.

Plankton Tow—A cylindrical net with a fine mesh is dropped into a body of water to capture any plankton, veligers, or other organisms in the net, where it can then be analyzed in a lab.

Settlers—Or juvenile mussels. As a veliger grows out of the veliger or larval stage, it undergoes a metamorphosis. The animal begins to grow a shell and will settle onto a semi-hard or hard surface to finish developing. At this stage, the settlers will feel like sandpaper or grit.

Substrate—1.) A device used to monitor for the settler stage of zebra or quagga mussels, typically consisting of a black, rough PVC pipe suspended in the water body between a buoy at the surface and a weight at the bottom. 2.) The bottom of the water body, where organisms live—the benthos or benthic area.

Veliger—The free-swimming larva of a mollusk. During the veliger stage, the mollusk begins to develop a shell. They are microscopic at this state and can only be seen under a microscope.

WATERBODY CLASSIFICATIONS

- **Not Sampled:** Waters that have not been monitored.
- **Undetected/Negative:** Sampling/testing is ongoing and nothing has been detected or nothing has been detected within the time frames for de-listing.
- **Inconclusive (temporary status):** Water body has not met the minimum criteria for detection.
- **Suspect:** Water body that has met the minimum criteria for detection.
- **Positive:** A minimum of one subsequent sampling event that meets the minimum criteria for detection. Positive must include the initial detection plus at least one subsequent detection for a total of 2 verified detections.
- **Infested:** A water body that has an established (recruiting or reproducing) population of AIS.

DE-LISTING A WATER BODY FOR ZEBRA OR QUAGGA MUSSELS

- **Inconclusive:** 1 year of negative testing including at least one sample taken in the same month of subsequent year as the positive sample (accounting for seasonal environment variability) to get to undetected/negative.
- **Suspect:** 3 years of negative testing to get to undetected/negative.
- **Positive:** 5 years of negative testing to get to undetected/negative.
- **Infested:** Following a successful eradication or extirpation event including a minimum of 5 years post-event testing and monitoring with negative results.

COMMUNICATING SAMPLING AND MONITORING RESULTS

- **Not Sampled:** As necessary, communications about which water bodies are not monitored.
- **Undetected/Negative:** As necessary, communications about which water bodies are monitored.
- **Inconclusive (temporary status):** AIS coordinator notifies key individuals within region (need to know basis, ANS coordinators).
- **Suspect:** Informal or formal notification within region (western ANS coordinators, public).

- **Positive:** Formal notification system (AIS coordinators, USGS NAS, public).
- **Infested:** Formal notification system (AIS coordinators, USGS NAS, public).

Detailed sampling and monitoring procedures can be found in the BC Final Activity Report, WRP ZQM Field Sampling and Monitoring Protocol, and the WRP Laboratory Standards for Zebra and Quagga Mussel Veliger Analysis.

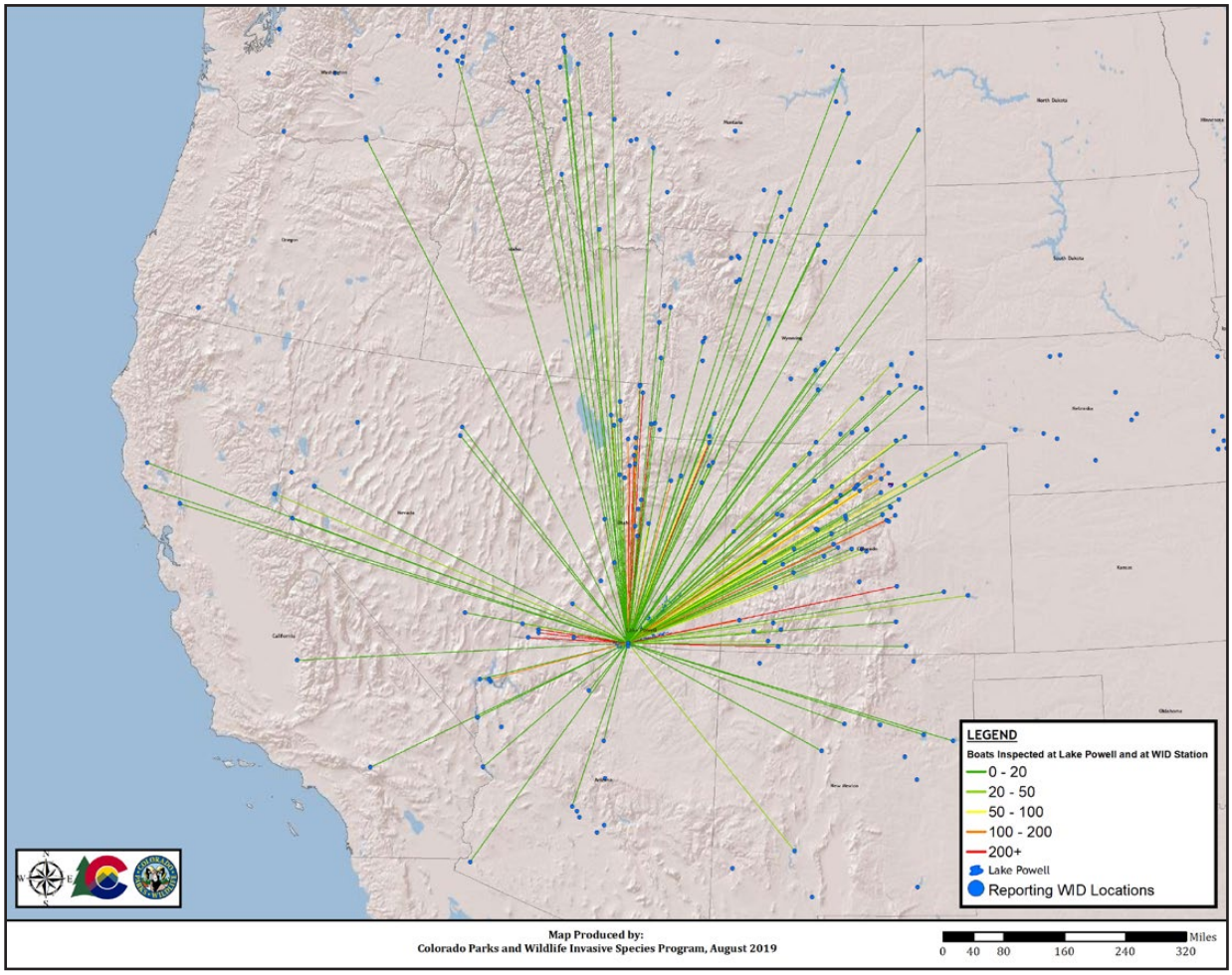
Watercraft Inspection and Decontamination (WID)

The vast network of WID stations throughout the west and across the country is growing each year. Most western states have WID elements in place and there are several WID programs established in the Eastern US. These WID programs vary based on legal authority and available resources. Some WID requirements are mandatory with strict enforcement in place, while others are voluntary, or education based. WID stations are operated by federal agencies, state and local governments, tribes, private industry, and non-governmental organizations. The variety of organizations performing WID, and the long distances recreational boaters are traveling across the nation to recreate, have contributed to the need for science-based standards including WID protocols and procedures, training, quality control, data sharing, and communications. WID programs really do work to stop the continued inoculation of our waters with harmful zebra and quagga mussels and other AIS!

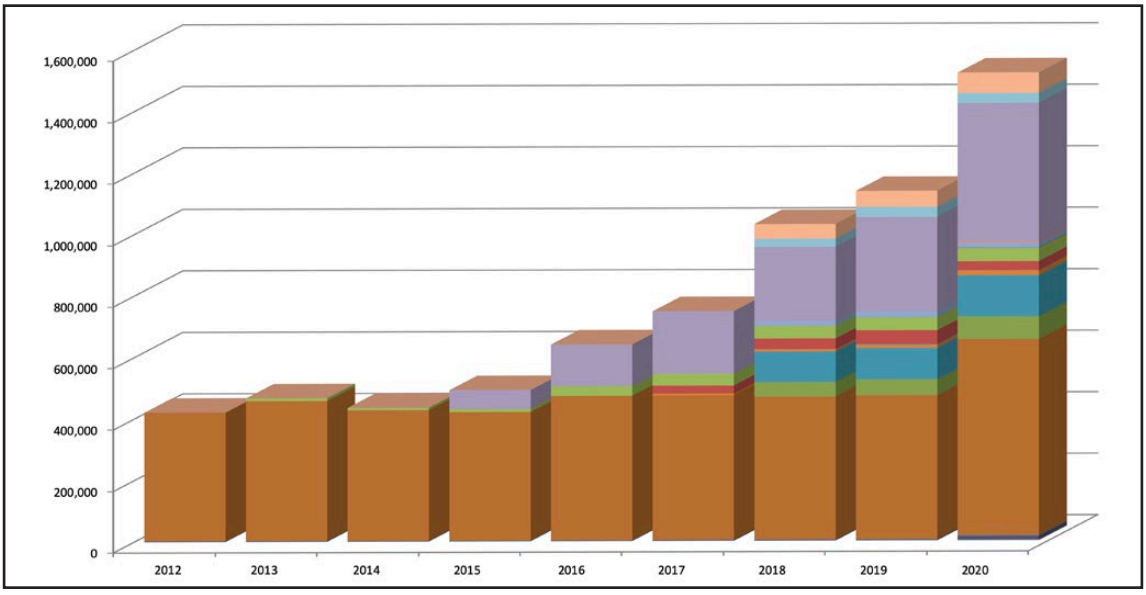
TYPES OF WID STATIONS

- **Off-Water Locations:** WID stations that are not located at a water body. These are usually on highways, at offices, and at business locations.
- **Negative Prevention Waters:** Waters that have never had a verified detection of any AIS or have not had a detection within the time frame for de-listing.
- **Other AIS Containment Waters:** Waters that are positive for an AIS other than ZQM. AIS Positive waters are often prevention waters for mussels and other AIS.
- **ZQM Containment Waters:** Waters that have had a verified zebra or quagga mussel detection.

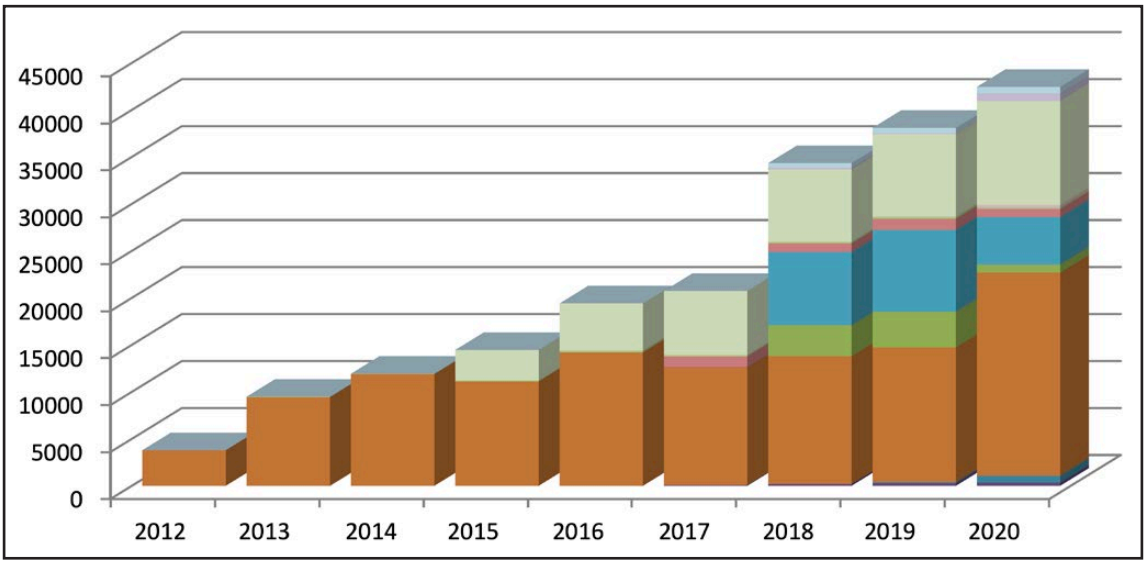
Boats Inspected at Western WID Stations That Were Also Inspected at Lake Powell



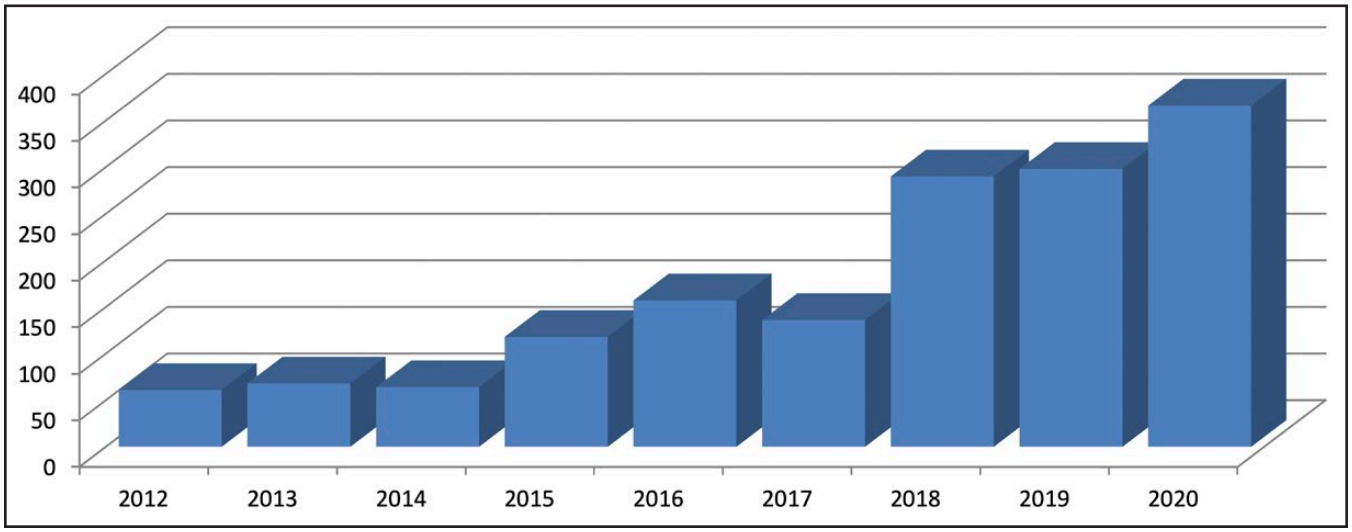
Inspections



Decontaminations



WID Locations



REGIONAL WID DATA SHARING SYSTEM

The Regional WID Data Sharing System (System) was envisioned by WISCE more than a decade ago and is now in use at more than 200 locations across the west. Colorado Parks and Wildlife (CPW) developed the System and maintains ownership and oversight. The System has been supported with federal grant dollars through the USFWS and the US Bureau of Reclamation.

The purpose of the System is to record information related to WID electronically and to share information in a timely manner across jurisdictions to aid collaborative efforts to prevent the spread of zebra and quagga mussels and other AIS. The System consists of a mobile application, website, and shared database hosted on a private server. The System is used for data entry, viewing, editing, querying, and reporting. Inspectors will learn to use the mobile app in the inspection chapter later in this Manual.

WID QUALITY CONTROL

Entities that are performing WID are encouraged to perform quality control or quality assurance evaluations. The goal is to verify WID procedures are being followed and stations are adequately stocked with educational materials and proper signage to ensure that boaters get consistent, timely and accurate information from inspectors. This also provides an opportunity for performing on the job training to inspectors and supervisors. Quality control may include secret shopper evaluations, customer service phone evaluations, announced site visits and on the job training. Examples of quality control forms will be used in this course during outdoor sessions and are available for use. There is more detailed information on quality control in the BC Final Activity Report and WID Trainer's Manual.

SAFETY

The safety of inspectors, decontaminators and the public are the highest priority. Inspectors must take caution to ensure their own personal safety and the safety of those around the WID station. Boat ramps, offices, or highway check stations are busy places with large moving vehicles. Be careful to avoid slips, trips and falls. Ask for permission to board the watercraft and inquire the best way to board. When working on or in watercraft, always maintain at least three points of contact with the watercraft when getting in or getting off the watercraft. Never use a swim ladder to board the watercraft, and never jump off watercraft. Always wear personal protective equipment when performing inspections or decontaminations. Take extra caution when working with hot water or high pressure sprayers. Operating safely is in everyone's best interest!

Education and Outreach

Education and outreach are the MOST important things! There will never be enough money to have inspectors on all boat ramps all the time. Each inspection is a face-to-face opportunity to educate the boater and change their behavior by teaching them to clean, drain, dry every time they boat. Consistency in messaging is key for boaters to learn to Clean, Drain, Dry!

WE TRAIN YOU. YOU TRAIN BOATERS!

There are a variety of tools to help the inspectors provide education and outreach to boaters and the public. Spend time learning the information provided in this Manual to ensure inspectors across the landscape provide consistent information to customers.

There are many additional resources available to you through the following national education campaigns:

- **Stop Aquatic Hitchhikers:** https://stopaquatichitchhikers.org/
- **PlayCleanGo:** https://playcleango.org/
- **Habitattitude:** https://www.habitattitude.net/
- **Don't Let it Loose:** https://www.dontletitloose.com/
- **Don't Move Firewood:** https://www.dontmovefirewood.org/

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Chapter 1 Review Questions

1. What are Aquatic Invasive Species (AIS)?

   _____

   _____

   _____

2. What two AIS are WID stations the most concerned about?

   _____

3. The mission of AIS Programs is to protect wildlife, natural resources, recreation, infrastructure, agriculture and the economy by:
   a. Preventing the introduction of ZQM and other invasive species
   b. Containing current infestations/introductions
   c. Stopping the spread of invaders to new waters
   d. All of the above

4. What website can you go to get current information on where ZQM and other AIS have been detected?

   _____

5. Fill in the blank next to the following definitions with the letter of the corresponding classification.

   A. Inconclusive B. Positive C. Suspect D. Infested E. Negative

   _____ Testing is ongoing and no evidence of Dreissena mussels has been discovered.

   _____ eDNA detection with no confirmation.

   _____ One verified detection of mussel veliger or adults.

   _____ More than one verified detection of mussel veliger or adults.

   _____ A reproducing and recruiting population of mussels is established.

6. Why is education the most important aspect of being an inspector?
   a. So that boaters learn to keep their boats and equipment clean, drained, and dry, and do it themselves without inspectors every single time.
   b. Because we cannot put inspectors on all of the lakes and reservoirs all the time.
   c. The best way to change a behavior is through education.
   d. All of the above

7. Quality control programs are encouraged and can include secret shoppers, customer service phone evaluations, announced visits, and on the job training. (circle one) True or False

8. Define the WID training levels provided:

   Level 1 = _____

   Level 2 = _____

   Level 3 = _____

   Bonus: AD = _____

9. Name and describe the types of WID stations:

   1.) _____

   2.) _____

   3.) _____

   4.) _____

10. What document was updated in 2020 and is considered the "road map" for western ZQM management?

    _____

11. Why is it important to use the Regional WID Data Sharing System?

    _____

    _____

12. How many years of negative testing does it take to de-list a suspect reservoir? _____

13. How many years of negative testing does it take to de-list a positive reservoir? _____

14. It is the inspector's job to educate every boater and customer about how they can help to prevent invasive species? (circle one) True or False

15. Please describe why you think it is important to prevent the introduction of zebra or quagga mussels, and other AIS, into our waters.

    _____

    _____

    _____

    _____

    _____

Chapter 2

Biology

Chapter 2: Biology

Zebra and Quagga Mussel Biology

It is important to understand the biology and ecology of AIS to answer questions from the public and partner agencies, and to be best equipped to find ZQM and other AIS attached to watercraft or equipment. The WID program is grounded in the biology of ZQM.

- For example, all watercraft should be cleaned (to prevent moving adults or settlers), drained and dry (to prevent moving veligers in water).
- Another example is how AIS Programs perform early detection for mussels (plankton tows for veligers, substrates for settlers and shoreline surveys for adults).
    - We know that mussels can be light sensitive and begin establishment in the depths of the water where we physically can't get to. Therefore, efforts are prioritized to detect veligers in the water column with the goal of detecting the introduction, and not the invasion that happens years later. This enables managers to contain the spread to other waters by hitchhiking on, or in watercraft.

DEFINITIONS:

Benthic—Refers to the bottom of a water body.

Byssal threads—A spider-web like appendage that enables the zebra or quagga mussels to attach to surfaces. Native species do not have byssal threads.

Dreissenids—A term referring to all species in the genus Dreissenid which includes zebra and quagga mussels.

Exotic—An exotic species is a species that is not native to a given environment. Exotic species often invade an ecosystem displacing or destroying the native plants and animals.

Macrophyte—An aquatic plant, large enough to be seen by the naked eye.

Maturation—The action or process of maturing.

Metamorphosis—The process of transformation from an immature form to an adult form in two or more distinct stages.

Non-Native/Non-Indigenous—A species that has been introduced to a new environment, either intentionally or unintentionally, outside of its native range.

Phytoplankton—Plankton consisting of microscopic plants in water.

Water Column—The concept of the entire water depth of a water body, from its bottom (benthic zone) to the water surface.

Zooplankton—Plankton consisting of microscopic animals in water.

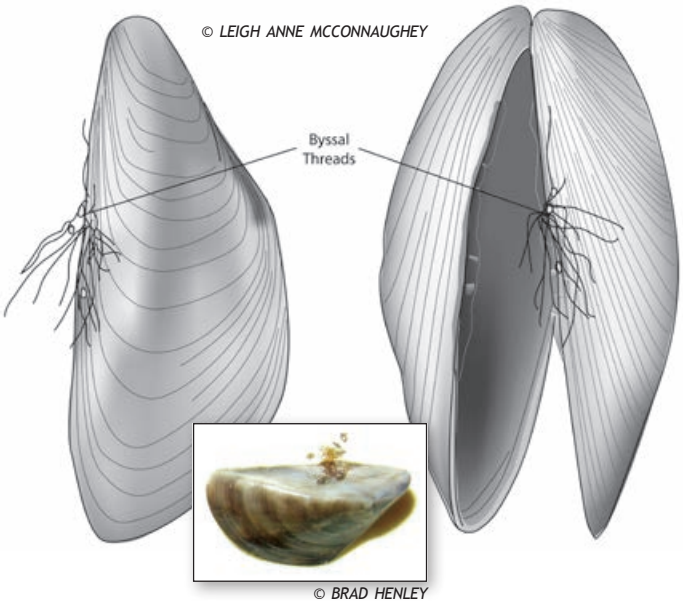
Zebra Mussel

Quagga Mussel

Actual Size

Quagga Mussel

Zebra Mussel



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Identification

Quagga mussels (*Dreissena rostriformis bugensis*) and zebra mussels (*Dreissena polymorpha*) are small freshwater bivalve mollusks (animals with two shells). They are relatives of clams and oysters. It is very difficult for a non-expert to tell the two species apart. The shell color of both mussels alternate between a yellowish and darker brown, often forming stripes. Color patterns are highly variable and can be attributed to environmental factors. They range in size from microscopic up to about two inches long.

Several diagnostic features aid in identification. Quagga mussels have a rounded angle, or carina, between the ventral and dorsal surfaces. They also have a convex ventral side that can sometimes be distinguished by placing the shells on a flat surface. The quagga mussel will topple over when stood on its ventral side, whereas a zebra mussel will not topple due to its triangular shape. Quagga mussels have a small byssal grove on the ventral side near the hinge. They also have asymmetrical valves when viewed from the front or ventral side.

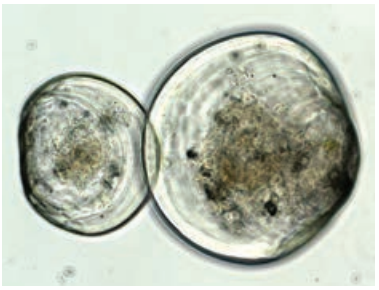
Unlike native North American freshwater mussels, which burrow in soft sediment, adult zebra and quagga mussels can attach to most hard and semi-soft surfaces via tiny threads called byssal threads. ***Native species do NOT have byssal threads!*** These **byssal threads** are one of three main invasive characteristics that give zebra and quagga mussels an advantage over natives, along with **rapid reproduction** and their ability to **filter feed** at amazing rates.

Ecology of Zebra and Quagga Mussels

Both zebra and quagga mussels can survive cold waters, but cannot tolerate freezing. They can endure temperatures between 1°–30°C (33°–86°F). Zebra mussels need waters above 12°C (54°F) to reproduce, while quagga mussels can reproduce in waters as cold as 9°C (48°F). Adult mussels are thought to be light sensitive and prefer to live in water around 200 to 300+ feet deep. They are able to thrive in a wide range of conditions including oxygen-depleted water.

Life Cycle

It is important that inspectors understand the life cycle of ZQM because the inspection, decontamination, and sampling protocols are based on their biology. ZQM have three life stages; (1) veliger, (2) settler, and (3) adult.



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1. The embryos are microscopic larvae, called **veligers**. They are free-floating plankton in the water column and impossible to see with the naked eye. The veligers float in the water column or are carried in the current for about four to eight weeks.
2. The veligers undergo metamorphosis and develop shells while settling out of the water column onto a solid surface (which could include a grain of sand or the skin or shells of native aquatic species). This juvenile form of the mussel is

known as the **settler** stage. At this point in their life cycle, they settle into the deep benthic zone of the water column.

3. Upon maturation, **adult** mussels become sessile, meaning fixed in one place or immobile. They are attached semi-permanently with their byssal threads. Adult mussels typically form dense clusters in which they pile up on top of each other essentially smothering the generation beneath them. Their typical lifespan is four to five years.

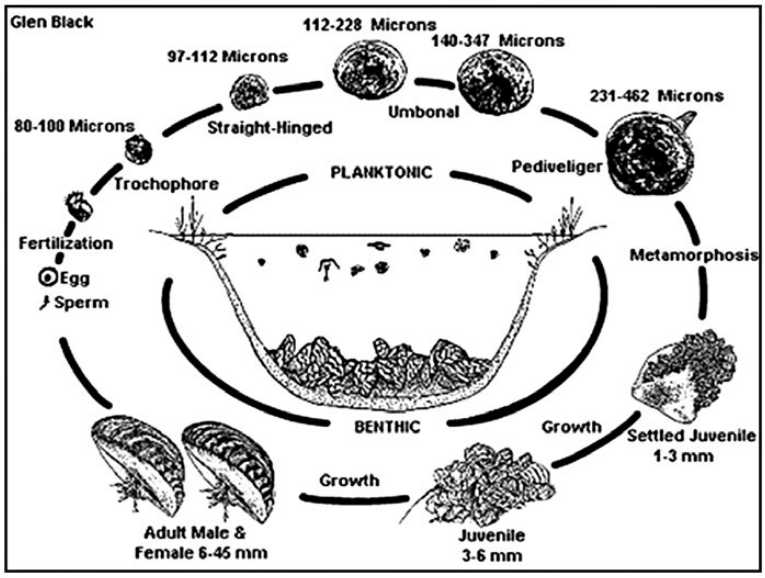
Where Do Mussels Like to Hide?

- Right Angles
- Darker Spaces
- Moist Places
- Rough Surfaces

Where Did They Come From?

Zebra mussels are native to the Black, Caspian, and Azov Seas of Eastern Europe. They were discovered in the Great Lakes in Lake St. Clair in 1988 and have since spread to 31 states in the United States.

Quagga mussels are native to the Dnieper River Drainage in the Ukraine. They were discovered first in the Great Lakes in the Erie Canal and Lake Ontario in 1989 and have since spread to 34 states.



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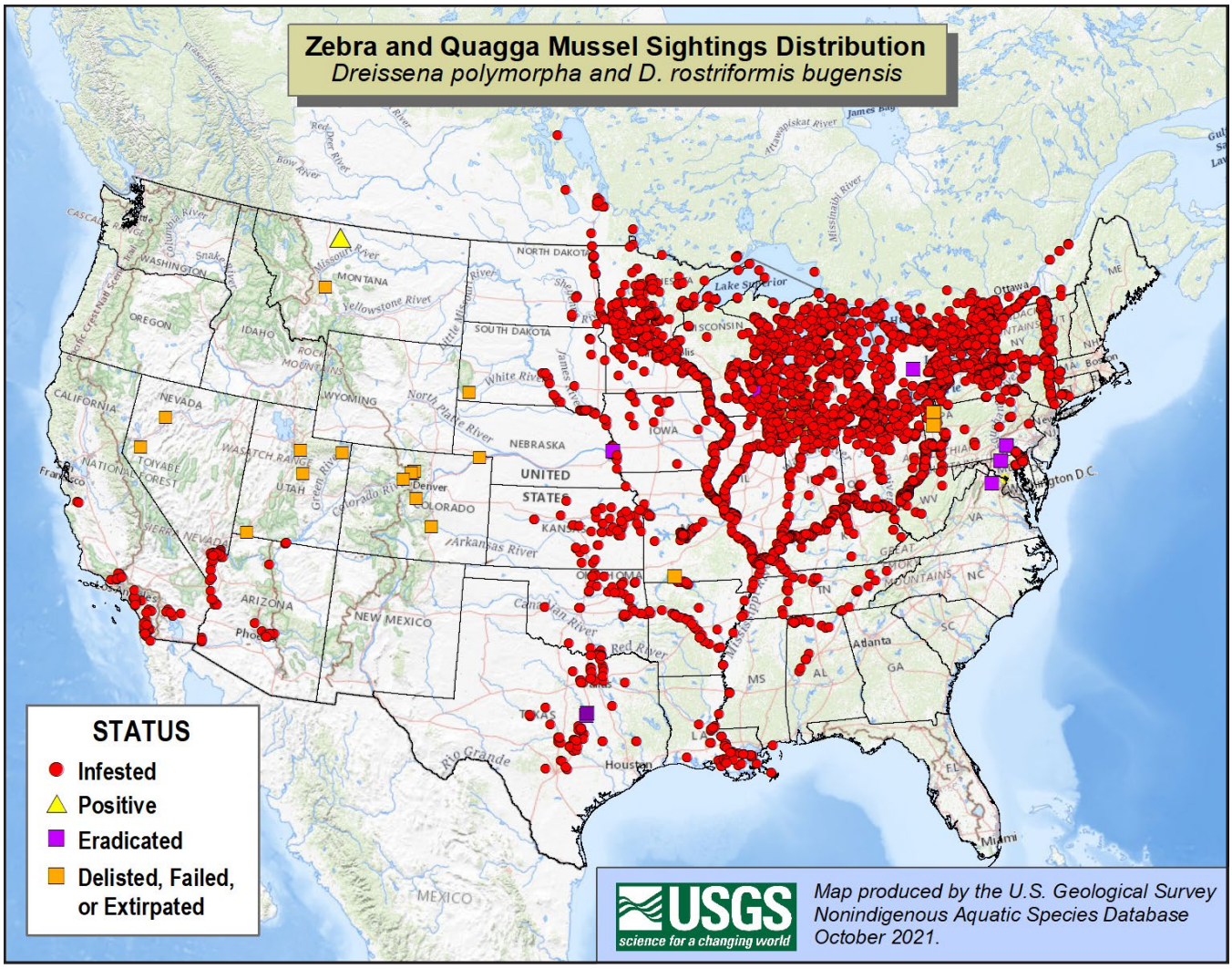
How Did They Get Here?

Many AIS, including zebra and quagga mussels, were introduced into the Great Lakes in the discharged ballast water of ocean-going ships. Another method of dispersal from Europe to the United States is through the transportation of attached mature adults on anchors stored internally in compartments on transoceanic vessels. AIS often hitch rides to other bodies of water on the boats, trailers, and equipment that people transport from place to place. Boaters and anglers can inadvertently transport AIS on waders, in bait buckets, and live wells.

Zebra and quagga mussels likely made their way to the Western USA on trailered recreational watercraft. The first discovery west of the 100th Meridian was in Lake Mead. The invasive quagga mussels found in Lake Mead in 2007 were 1,000 miles farther west than any other known colony of quagga mussels at the time. The primary method of overland dispersal of these mussels is through human-related activities, especially trailered watercraft. Given their ability to attach to hard surfaces and survive out of water for extended periods [30 days!], many infestations have occurred by adult mussels hitching rides on watercraft. The microscopic larvae also can be transported in bilges, ballast water, live wells, engines, or any equipment that holds water.



Impacts

Zebra and quagga mussels pose a great ecological and financial threat to the nation. The invasion of these mussels can affect every citizen in some way with devastating impacts.

WHY BE CONCERNED?

- Ecological Impacts
- Recreational Impacts
- Economic Impacts
- Social Impacts
- Industrial Impacts
- Agricultural Impacts

INVASIVE CHARACTERISTIC #1

Prolific Reproduction—Zebra and quagga mussels reproduce exponentially. They can spawn year-round if conditions are favorable. A single female mussel can produce up to one million eggs a year! If only ten percent of the offspring survive, there would be ten septillion mussels in the waterway at the end of five years! As the mussel population explodes, they cover the bottom and sides of a waterway.

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INVASIVE CHARACTERISTIC #2

Byssal Threads—As mentioned before, zebra and quagga mussels can attach via byssal threads to any stable substrate in the water column such as rocks, aquatic plants, artificial surfaces (cement, steel, rope, etc.), crayfish, native clams, and other

mollusks. They attach to most underwater structures and can form dense clusters that impair facilities and impede the flow of water. They clog intake pipes and trash screens, canals, aqueducts, and dams—disrupting water supply to homes, farms, factories, and power plants. Zebra and quagga mussels also degrade water quality and can alter the taste and smell of drinking water.

Byssal threads are made up of proteins that are secreted from a gland inside the mussel. Scientists have identified three types of byssal threads in zebra and quagga mussels: belaying, temporary, and permanent. Belaying byssal threads are 20–30 times the length of the mussel and are used by relocating juvenile and adult mussels to reach out and attach to surfaces. Juvenile and small adult mussels also produce temporary byssal threads in order to move and relocate. These threads are thinner, longer and attach in a tripod shape for greater stability. Permanent byssal threads are grown and an enzyme is secreted to release the temporary threads. Permanent byssal threads form within a few minutes after attaching.

INVASIVE CHARACTERISTIC #3

Filter Feeding—Ecological Impacts—Invasive species have the ability to change aquatic ecosystems and native plant and animal communities. As filter feeders, these species remove large amounts of microscopic plants and animals that form the base of the food chain, leaving little or nothing for native aquatic species. The amount of food the mussels eat and the waste they produce has life-altering effects on the ecosystem and can harm fisheries. ZQM attach to and encrust native organisms, essentially smothering them and removing them from the food chain. Zebra and quagga mussels are one of the few species that have the ability to crash the entire food web by removing the base of the food chain—plankton—and by smothering benthic organisms that are a source of food for larger fish.

Zebra and quagga mussels are able to remove substantial amounts of phytoplankton and suspended particulate from the water. Each mussel can filter over a liter of water per day. They decrease the availability of food for smaller life forms, which in turn increases water clarity, elevating the amount of light penetration causing an increase in vegetation and a shift in species dominance, which potentially alters the entire ecosystem permanently.

Filter feeders reject unwanted mucous covered food from their body known as pseudofeces. Pseudofeces accumulate and create an unsuitable environment. As waste from the mussels decomposes, oxygen availability is depleted, and the pH becomes very acidic causing toxic byproducts to be produced. The accumulation of organic pollutants within the tissue of the mussel is passed up the food chain, causing increased exposure by wildlife.

RECREATIONAL IMPACTS

Invasive mussels encrust docks and boats. Attachment of mussels can cause corrosion of steel and concrete affecting its structural integrity. Attached mussels increase drag on boats and can even sink navigational buoys with their weight. Veligers or settlers can get sucked up into the engine cooling system and clog the engine from the inside causing it to overheat and be damaged. Increased hull and motor fouling will result in increased maintenance costs on vessels moored for long periods of time. Zebra and quagga mussels also impact fish populations and reduce sport-fishing opportunities. Their sharp shells can cut the feet of unsuspecting swimmers and beach goers.

ECONOMIC IMPACTS

As maintenance costs for power plants, water treatment facilities and water delivery infrastructures increase following a mussel infestation, so does the cost of food and utilities. In the Great Lakes area, maintenance costs for water treatment plants, power plant intakes and dams have been in the billions of dollars. The destruction of native fisheries causes a wider economic losses in terms of tourism and recreation dollars not spent. Marinas and watercraft dealers could suffer business declines. Lake side homeowners have experienced decreased property values following invasion.

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MANAGEMENT

The eradication of zebra mussels first occurred in a closed, isolated 12-acre quarry in Virginia in the 90s. A large volume of potassium chloride chemical was used to treat the water and kill the adults and larvae. More recently, the Department of Defense attempted eradication in 2010 at Offutt Air Force

Base in Nebraska. However, the treatment in Offutt was not successful. Eradicating or treating zebra or quagga mussels in large water bodies and/or connected waterways may not be possible because current treatments would also kill other aquatic life forms. New tools are being developed and tested. As of today, there are no viable, cost-effective, and environmentally friendly control mechanisms available for open water systems. Therefore, prevention is very important. **If watercraft are cleaned, drained, and dried in between water bodies, the risk of transporting attached mussels or other AIS will be eliminated.**

The rapid invasion of United States waterways has been attributed to the mussel's ability to disperse during all stages of its life. Mussels can spread to other bodies of water by attaching to watercraft hulls and anchors, trailers, and fishing equipment. Larvae can be transported in bilge water, ballast water or live bait wells. Mussel larvae also disperse naturally, and can be carried by water currents to other lakes or reservoirs downstream or through water diversions.

Since there are no viable control methods once mussels are introduced in open water bodies, prevention is our only defense. As a watercraft inspector, **your most important task is educating the public** both coming into and exiting your WID station.

Many lakes and reservoirs do not have inspections, therefore, it is essential that you:

1. Show the boaters how to inspect their boats themselves.
2. Explain why inspection is critical to find ZQM and other AIS.
3. Impress on the boater how ZQM damage boats, ruin recreational opportunities, harm the environment and impair water infrastructure.

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Inspectors need to drive home the primary educational message to **Clean/ Drain/Dry** and explain why boaters need to do it **each time** they use their watercraft. Teaching boaters and anglers to clean, drain, dry their boats and gears themselves in between each and every launch is invaluable! If boaters and anglers do this, mussels will not spread!

Outdoor Session—How Many Mussels Can You Find?

List the names of locations you find mussels on the watercraft.

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Zebra and Quagga Mussel Biology Review Questions

1. Why is it important to learn about ZQM biology?

   _____

   _____

2. Which are the three characteristics of zebra and quagga mussels that make them invasive?
   a. Grow larger than most other mollusks, reproduce quickly, clear the water
   b. Attach with byssal threads, rapid reproduction, filter feeding
   c. Alter water chemistry, attach with byssal threads
   d. Feed on aquatic weed beds and reduce native plant communities, attach with byssal threads, prolific or rapid reproduction

3. The larval life stage of a mussel in which they are a free-floating planktonic organism is called a _____. These juveniles then begin to develop shells and attach to solid surfaces which is known as the _____ stage. Upon maturation, _____ mussels are sessile, meaning fixed in one place or immobile.

4. In addition to ecological impacts ZQM and other AIS cause major _____ and _____ impacts.

5. Because many lakes and reservoirs do not have inspections, it is essential to:
   a. Show the boaters how to inspect their boats themselves.
   b. Explain why inspection is critical to find mussel settlers and other AIS.
   c. Impress on the boater how zebra and quagga mussels damage boats, ruin fishing opportunities, harm the environment and impair water infrastructure.
   d. All of the above

6. Where do mussels like to hide on watercraft?

   _____ angles, _____ or _____ places, _____ surfaces.

7. Mussel veligers are microscopic and can be transported in standing water. (circle one) True or False

8. What is the primary message we want boaters to learn?

   _____

   _____

9. Where were zebra and quagga mussels first found in the USA?

_____

10. What was the first water body infested with quagga mussels west of the 100th Meridian?

_____

11. How did mussels get to western waters?

_____

12. ZQM can range in size from microscopic up to _____ inches in length.

13. Native species also have byssal threads. (circle one) True or False

14. The quagga mussels has a _____ angle or carina and a _____ ventral side.

15. The zebra mussel has a _____ shape with a _____ angle or carina.

Other AIS Biology

As you learned in the introduction module, there are many species of aquatic plants and animals that are invasive. The watercraft inspection and decontamination program prevents AIS from being introduced into new waters.

Boat inspectors have detected New Zealand mudsnails, Eurasian watermilfoil, and rusty crayfish in the past. While zebra and quagga mussels are the highest priority, this program is aimed at protecting resources from all invaders being transported on watercraft.

In 2019, the Western Governors' Association recognized the enormous environmental challenge that invasive species pose to western states and territories and published the Top 50 Invasive Species in the West. This chapter focuses on the top aquatic invasive species.

1. **Eurasian watermilfoil**
2. **New Zealand mudsnail**
3. **Asian clam**
4. **Curly-leaf pondweed**
5. **Asian carp**
   - Bighead carp
   - Silver carp
   - Black carp
   - Grass carp

Top 25 Aquatic Invasive Species in the West

Aquatic Invasive Species, clockwise from left: **No. 5 Curly-leaved pondweed** (Potamogeton crispus); **No. 8 Purple loosestrife**; Lythrum salicaria; **No. 1 Eurasian Watermilfoil** (Myriophyllum spicatum); **No. 14 Rusty crayfish** (Orconectes rusticus)

1. Eurasian Watermilfoil (Myriophyllum spicatum)
2. Quagga and Zebra Mussel (Dreissena polymorpha)
3. New Zealand mudsnail (Potamopyrgus antipodarum)
4. Asian Clam (Corbicula fluminea)
5. Curly-leaved pondweed (Potamogeton crispus)
6. Silver carp (Hypophthalmichthys molitrix)
7. Northern pike (Esox lucius)
8. Purple loosestrife; Lythrum salicaria
9. Hydrilla (Hydrilla verticillata)
10. Whirling disease (Myxobolus cerebralis)
11. Common carp (Cyprinus carpio)
12. American bullfrog (Lithobates catesbeianus)
13. Bighead Carp, Hypophtalmichthys nobilis
14. Rusty crayfish (Orconectes rusticus)
15. Brazilian elodea (Egeria densa)
16. Nonnative crayfish (Orconectes spp., Procambarus clarkii)
17. Giant salvinia (Salvinia molesta)
18. Golden algae (Prymnesium parrum)
19. Didymo (Didymosphenia geminate)
20. Nutria (Myocastor coypu)
21. White Perch (Morone americana)
22. Grass Carp (Ctenopharyngodon idella)
3. Water Hyacinth (Eichornia crassipes)
24. Red shiner (Cyprinella lutrensis)
25. Phragmites Common Reed (Phragmites australis)

TOP 50 INVASIVE SPECIES IN THE WEST • 3

You can find more information about AIS of concern in your area by visiting the State Wildlife Agency's website or the USGS NAS database online.

Eurasian Watermilfoil (*Myriophyllum spicatum*)


© ELIZABETH BROWN

Eurasian watermilfoil is native to Europe, Asia, and northern Africa. It was once commonly sold as an aquarium plant and was introduced to the eastern U.S. in the 1940s, but it may have arrived much earlier in the late 1800s.

Identification: Eurasian watermilfoil is a submerged, rooted perennial with long, branching stems and soft feathery leaves attached in whorls of four. Each leaf has 12 to 21 pairs of leaflets, which are closely spaced, and about ½ inch long. Eurasian watermilfoil produces small yellow, four-parted flowers on a spike that projects two to four inches above the water surface.

Habitat: Tolerates a wide range of water conditions and depths; prefers nutrient-rich substrate.

Pathway of Introduction and Spread: Eurasian watermilfoil reproduces by seeds, fragmentation, and winter buds. Fragmentation and winter buds are believed to be more important in spreading the plant. Any plant fragment can start a new infestation. Winter buds are tight leaf clusters that break off and fall to the bottom, where they overwinter. In the spring, the buds grow and form new plants.

Impacts: Eurasian watermilfoil forms dense mats that restrict swimming, fishing, and boating, and clog water intakes. The mats alters water chemistry by choking and shading out other native aquatic plants. The decaying plants decrease oxygen levels in the water and foul lakeside beaches. This disrupts the food chain and destroys habitat and food needed by fish and birds. Eurasian watermilfoil slows the flow of water in irrigation ditches and canals and creates standing water that is ideal mosquito habitat.


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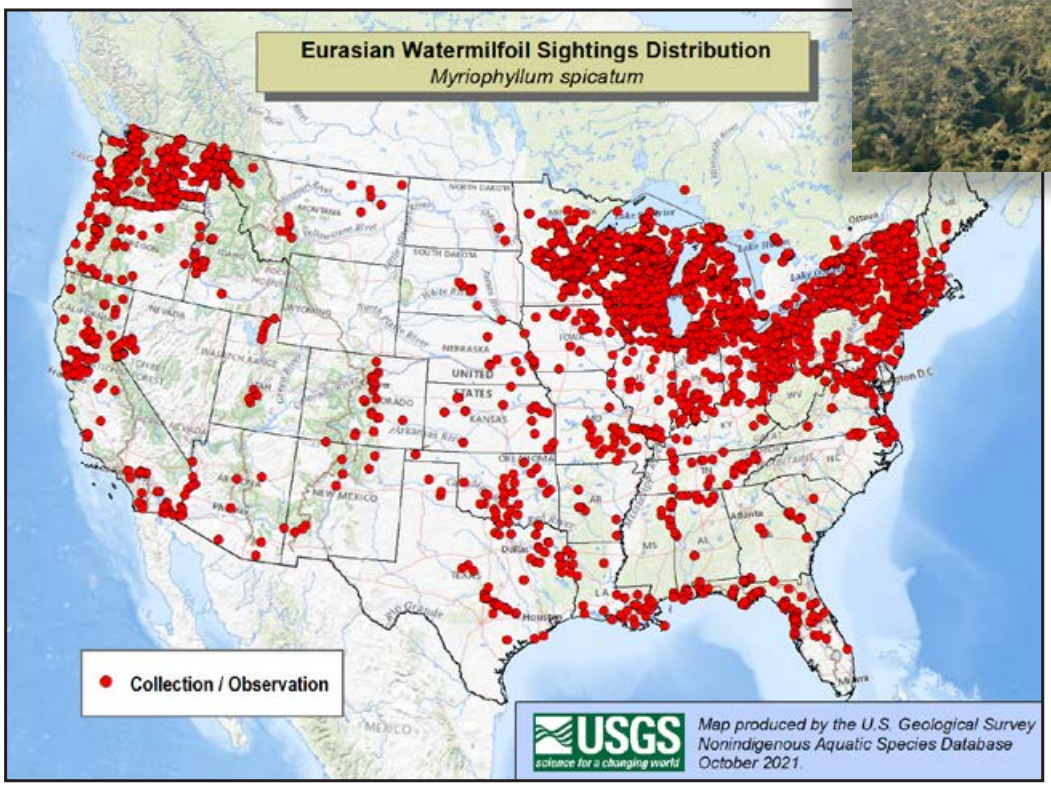

New Zealand Mudsnail (*Potamopyrgus antipodarum*)

New Zealand mudsnails (NZMS) are small aquatic snails native to fresh waters of New Zealand. They were first discovered in North America in the late 1980s in the Snake River, Idaho and Madison River, Montana.

Identification: NZMS range in size from a grain of sand to 1/8 inch in length and are black or brown in color. The shell has about 5 1/2 spirals. If the shell is held tip up with the opening toward you, the opening is on the right. There is an attached operculum (cover) which can close off the opening.

Habitat: Found in freshwater, brackish, or saline waters with almost any substrate. Populations in saline conditions produce fewer offspring and grow more slowly. Also tolerates a wide range of temperatures, ranging from near freezing to 82°F.

Pathway of Introduction and Spread: New Zealand mudsnails are spread into new river systems primarily by humans, although they can be carried on the feet of dogs and wildlife. Anglers, boaters, researchers, and others can carry NZMS to uninfested locations on their boots and gear. They can survive up to 50 days on a damp surface, giving them ample time to be transferred from one body of water to another on fishing gear.

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Impacts: NZMS compete with native invertebrates, including native mollusks, for space and food resources. NZMS may reduce the availability of native invertebrate prey for fish—particularly mayflies, caddis flies, and chironomids. They are not a viable food sources themselves because their hard shell allows them to pass through a fish gut unharmed.

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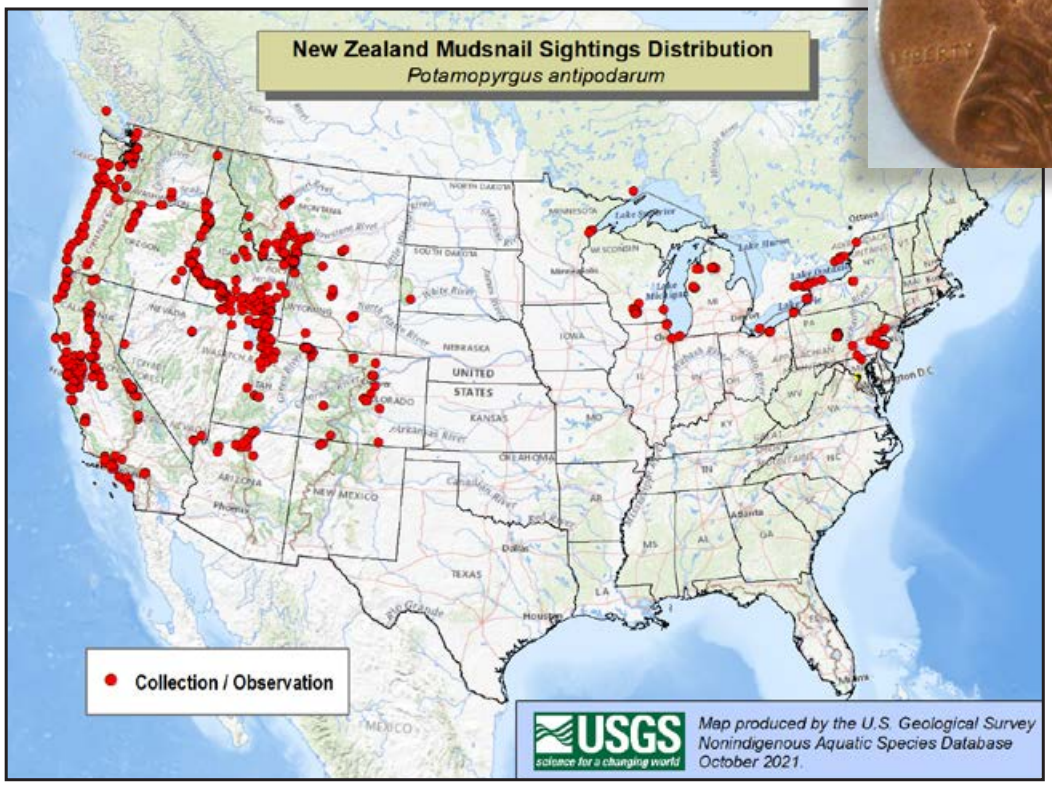

Asian Clams (*Corbicula fluminea*)

© ELIZABETH BROWN

A ZQM "Look-a-Like" Invader

Asian clams or Corbicula are small non-native bivalves that are commonly mistaken for zebra and quagga mussels. They are often observed littering shorelines and beaches with shells, and therefore are commonly confused with zebra or quagga mussels. Its shells have striations (or ridges) which give it the appearance of having stripes.

Corbicula	*Zebra or Quagga Mussels*
• Ridges or Striations on Shells	• Smooth Shells with Stripes or Colorations
• Does Not Have Byssal Threads	• Has Byssal Threads

Identification: Adults can reach 50 to 65 mm in length, although 25 mm is typical. Shell is oval, but not elongated, and is deep on the hinge side. The outer layer of shell has well defined, thick growth rings and varied coloration. Older clams have a darker colored shell, while younger clams are lighter brown or tan.

Habitat: They prefer fast moving water because currents provide food for these suspension feeders. However, they are commonly found on the shorelines of lakes and reservoirs.

Pathway of Introduction and Spread: Corbicula is used in Asia as a food source and may have been cultivated in the United States. It is also used for fish bait, which is probably another way it has been spread throughout North America. It is sold in the aquarium trade as pygmy clam, or golden clam.

Impacts: The Corbicula invasion in North America has created problems for power plants and water canals because large numbers of clams block water intake valves. They also compete with native bivalves for food, and competition increases as Asian clam populations explode.

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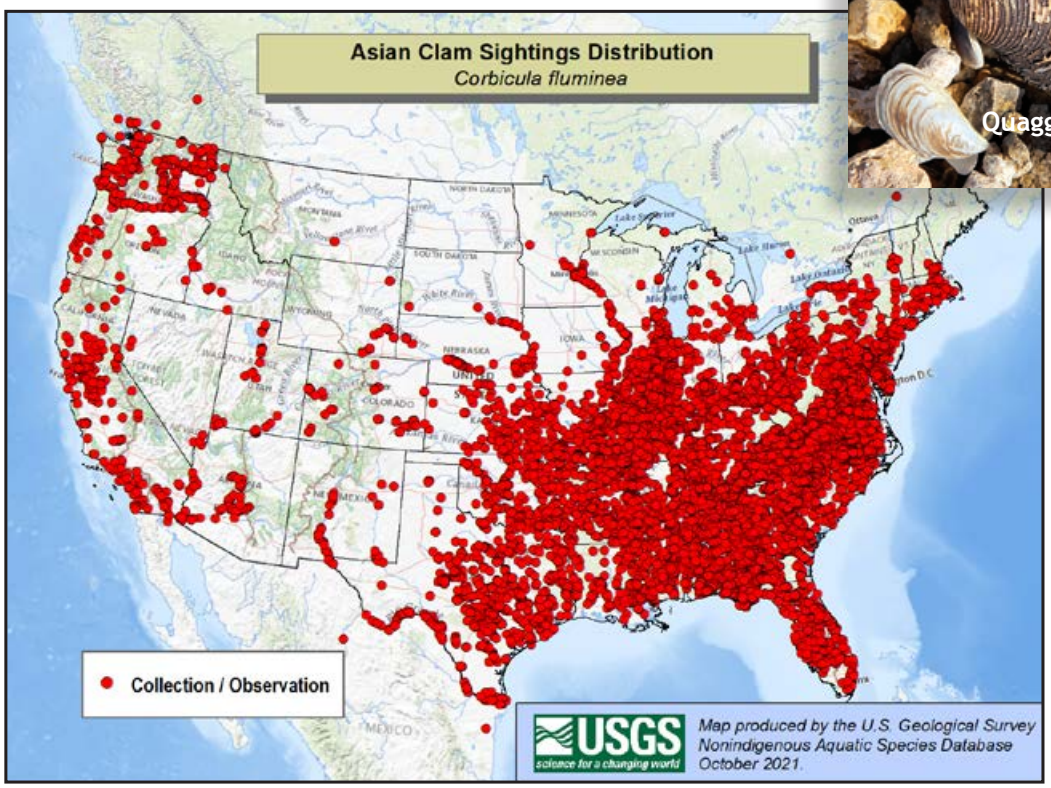

Curly-leaf Pondweed (*Potamogeton crispus*)


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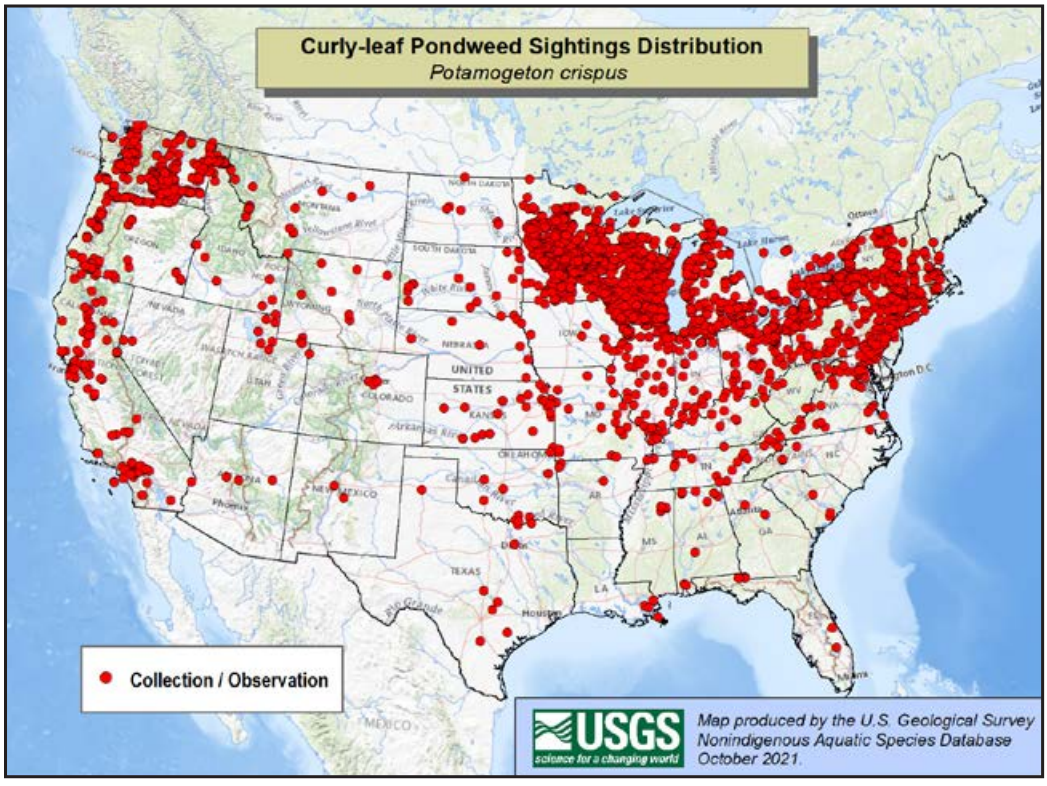
Curly-leaf pondweed is native to Eurasia, Africa, and Australia. It was accidentally introduced into US waters in the mid-1800s by hobbyists who used it as an aquarium plant. It was also possibly introduced accidentally with fish stocking operations. It can become dominant and invasive due to its tolerance for low light and low water temperatures.

Identification: Curly-leaf pondweed is a submerged, rooted, herbaceous, perennial. The leaves are submerged with no leaf stalk. Leaves are oblong with distinctly wavy edges with fine teeth and three main veins. Leaves may appear reddish green in the water. The "lasagna-like" leaves are approximately a half inch wide and two to three inches long; arranged alternately around the stem becoming denser toward the end of the branches. The stem of the plant is flat, reddish-brown to olive-green, and grows from one to three feet long. Fruits are a seed-like achene 4–6 mm long including a 2–3 mm beak back ridge. Flowers are tiny with four petals and found in spokes 1–3 cm long on stalks up to 7 cm long.

Habitat: Nearly worldwide. Found in lakes, ponds, ditches, marshes, and canals. This species can tolerate a wide range of conditions from fresh to slightly brackish waters; most often found in shallow waters with muddy bottoms. It can tolerate low light and low water temperatures.

Pathway of Introduction and Spread: Curly-leaf pondweed reproduce vegetatively from rhizomes and stem fragments, and by seed. The aquatic plant also spreads through specialized stem buds that survive unfavorable conditions, called turions, which develop in the leaf axils and/or the tops of short axillary branches before dormancy. Turions are composed of few to several reduced overlapping leaves resembling pinecones 7–25 mm long that float through the water. Turions germinate in late summer or fall. New plants form under the ice in winter. Curly-leaf pondweed has been documented to spread by plant fragments attached to boats and equipment.



Impacts: Curly-leaf pondweed grows in early spring and throughout the growing season. It shades and chokes out native aquatic plants before their growing season begins. Dense mats interfere with water-based recreation, including boating and angling. It also causes an increase in phosphorus concentrations, resulting in increased algae blooms and a pile-up of decaying plant material along the shore.

Invasive Carp

Bighead Carp
(*Hypophthalmichthys nobilis*)

Silver Carp
(*Hypophthalmichthys molitrix*)

Black Carp
(*Mylopharyngodon piceus*)

Grass Carp
(*Ctenopharyngodon idella*)

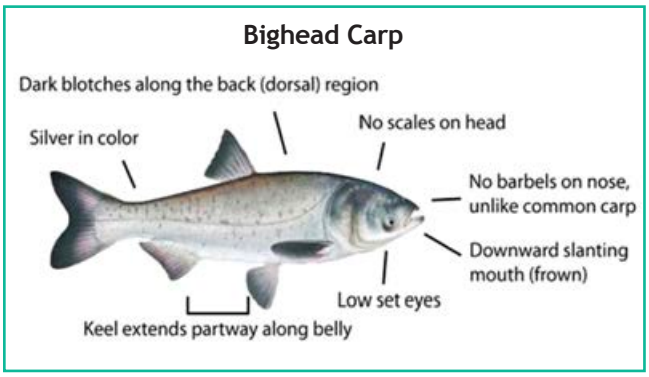
Invasive carp get a lot of attention in the media and national forums, alongside zebra and quagga mussels. There are several species but we are going to focus on the bighead, silver, black, and grass carp. Sterile grass carp are often stocked for sport and aquatic plant control. Common carp has been in the US for more than 100 years.

Invasive carp are native to Asia—from southern China into eastern Russia and possibly northern Vietnam. They were first introduced in the U.S. in the early 1960s and 1970s. Bighead, silver, and grass carp were first introduced to control algae and aquatic vegetation in aquaculture facilities and farm ponds. Black carp were introduced to control a snail that is a parasite host commonly found in aquaculture facilities. By the 1980s, three of the species had escaped and spread into local water bodies.

Invasive carp escaped private ponds and aquaculture facilities due to flood events. Humans also spread them around through bait releases, intentional stocking, and by creating man-made canals. These carp have spread quickly, reproduced rapidly, and became VERY abundant

Identification:

Bighead carp—is a wide fish with a toothless mouth and very large head, as the name suggests. Their eyes are located forward and low on the head below the body's axis. Coloration is dark grey above and light below with dark blotchy patches or spots. They mature in 2-3 years and can also grow as large as 110 pounds, although the average size is around 30-40 pounds.



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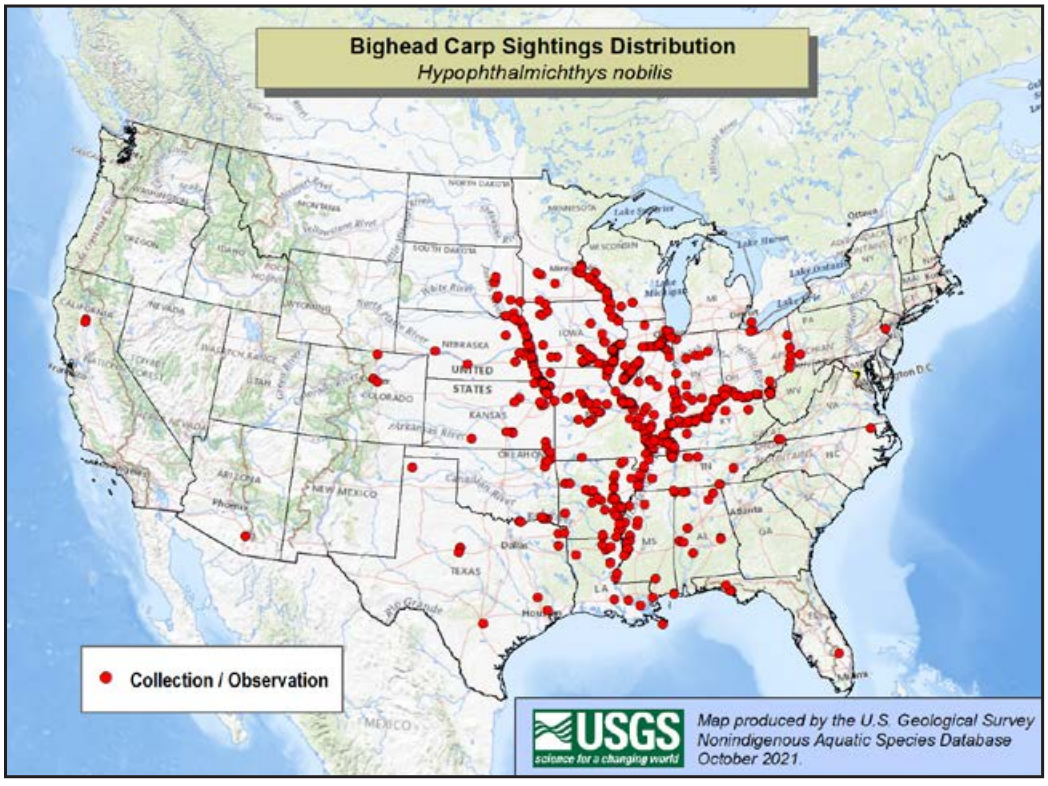

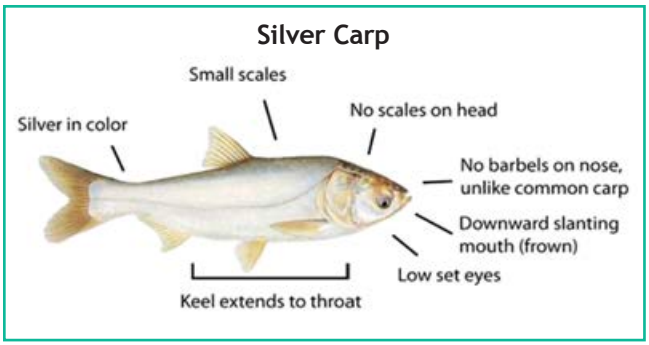

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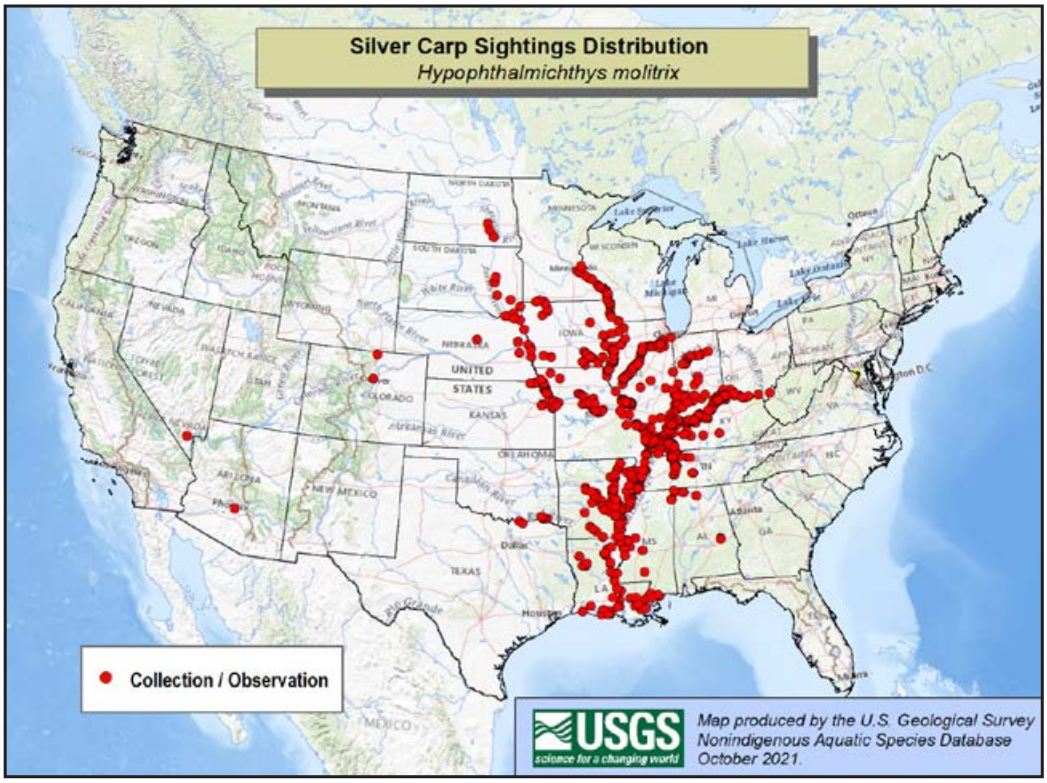
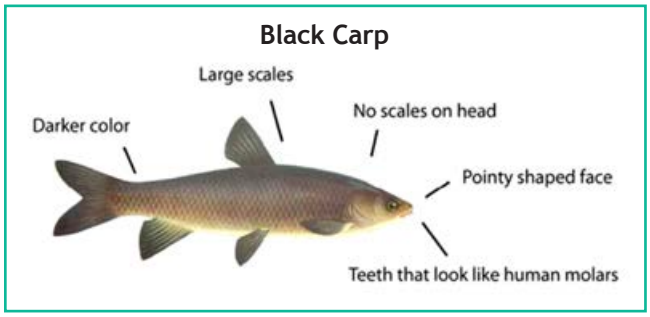
Bighead carp are voracious eaters and consume a wide range of zooplankton, detritus, and small invertebrates. The bighead carp lacks a true stomach requiring it to eat nonstop. They are capable of eating 5–20 percent of their body weight each day, which causes a decline in zooplankton and can also cause algae blooms. They strip the food web of the key source of food for small and big fish.

Silver carp—are also wide bodied fish with a large head that makes up 1/3 of the body size. They have a toothless upturned lower jaw and eyes are below the body axis. Their body as silver, as their name suggests. Silver carp mature in 2–4 years and commonly weigh 20 pounds, although they can reach a size of 80 pounds.

Like the bighead carp, silver carp lack a true stomach which requires them to feed almost continuously. Silver carp also feed primarily on plankton and can out-compete native fish. They can efficiently strain suspended material from the water with specialized gill rakers that resemble sponge-like plates. The silver carp is skittish and easily startled by the sound of a boat motor. The sound can cause the fish to leap as high as ten feet out of the water, earning them the nickname "the flying fish." Some of these fish weigh more than twenty pounds. They land in boats, damage property, and injure people.



Black carp—are long, laterally compressed fish with a pointed head and small toothless mouth. Their body is brown to black in color with a lighter bluish-grey belly. Their fins are dark brown-black with lighter coloration at the base. Black carp reach maturity in 4–6 years. They can grow 3–5 feet in length and weigh on average 35 pounds, although they have been documented to grow up to 7 feet in length and over 150 pounds.



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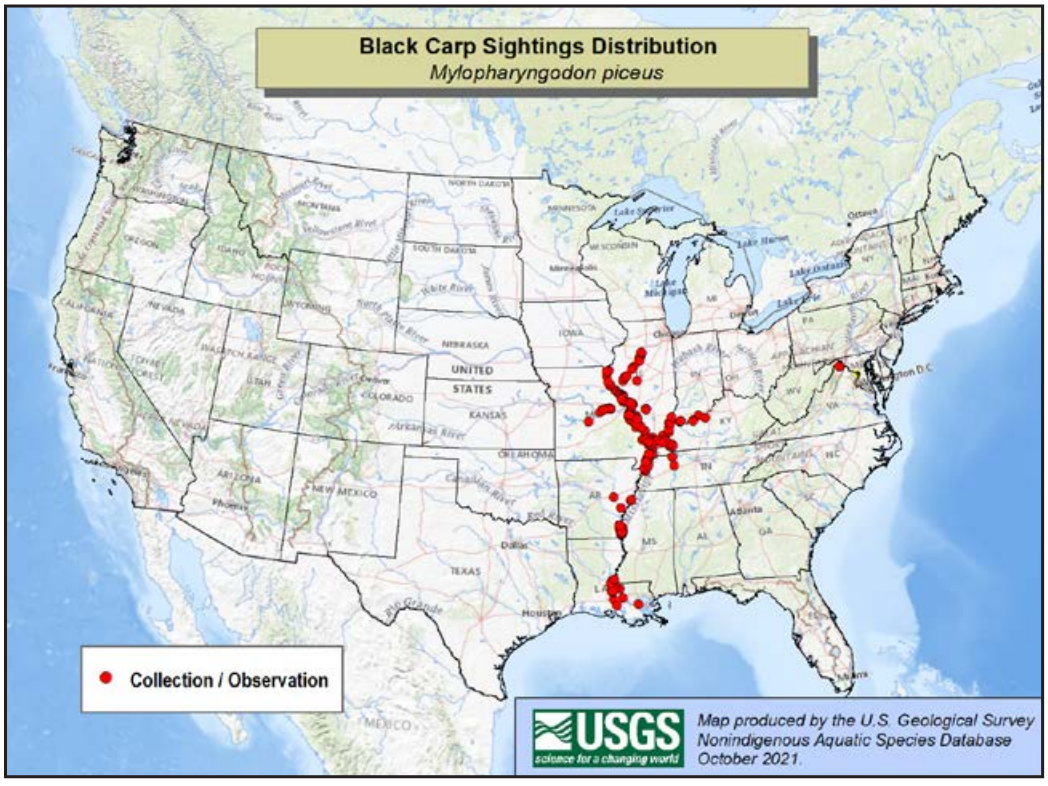
The black carp is different because as an adult, it is not a filter feeder. Young black carp feed primarily on zooplankton and later on insect larvae and detritus.

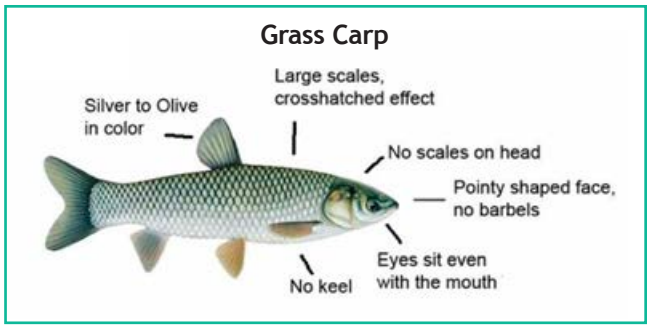
Adult black carp feed primarily on mollusks, such as mussels and snails. They have teeth in the back of their throat that allows them to crush mollusk shells. They also eat freshwater shrimp, crawfish, and insects. Black carp can negatively impact native wildlife through competition for food.

Grass carp—have an oblong body shape with a flattened head. Their small eyes are located on the sides of the head. They have large overlapping scales that vary in color from olive-brown to silver. Grass carp can mature in 2 years but it often takes them more than a decade to grow to full size of more than 80 pounds.

Grass carp feeds on aquatic plants and also consumes insects, small fish, worms and other invertebrates. They consume up to 40 percent of their body weight per day. Grass carp can significantly change the composition of habitat by reducing food sources, shelter, and spawning areas for native fish and wildlife. Despite consuming so much biomass, they actually only digest half of it expelling the other nutrient rich half which later promotes more harmful algal blooms.

Habitat: They prefer large slow moving rivers with high turbidity. They can also be found in smaller rivers and streams, and lakes and ponds. They can also survive in a wide range of temperatures (32–100˚F) but their preferred temperature range is around 78˚F.





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Management: There is a National Management and Control Plan for Invasive Carp that was produced by the ANS Task Force and is coordinated by the USFWS. Since its publication, basin teams, and regional organizations have created a framework to guide the coordinated cross-jurisdictional management of invasive carp. Congress has appropriated funding to the USFWS to support the implementation of the National Plan and the basin framework. To learn more and get involved, visit invasivecarp.us.

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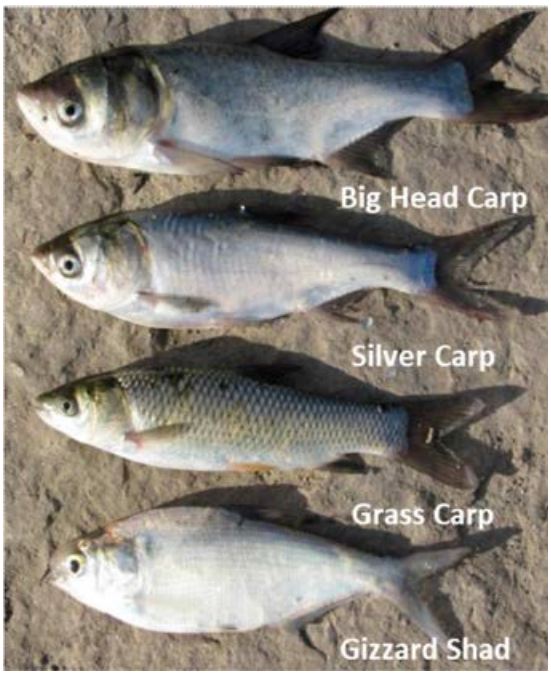

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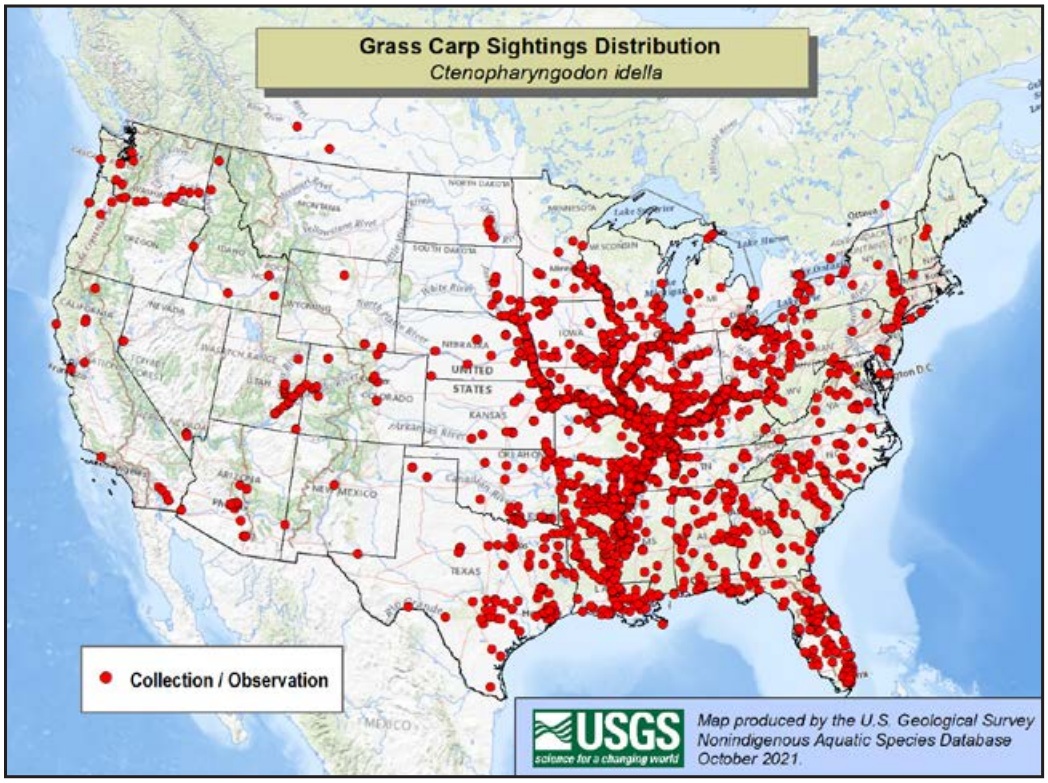
Pathway of Introduction and Spread: Once established in waters, invasive carp can spawn and disperse themselves. Juvenile carp are popular as bait and infestations may be caused by dumping unused bait into the water. Illegal stocking contributes to invasive fish dispersal into new waters. Live aquatic bait and illegal fish can be transported on watercraft.



Other AIS Biology Review Questions

1. Corbicula is a look-a-like invasive species that is somewhat widespread. What are two characteristics that make it different than ZQM?

   1.) _____

   2.) _____

2. Which group lists other AIS of concern for transportation overland on recreational watercraft?
   a. Northern Pike, Rainbow Trout, Brown Trout
   b. Eurasian watermilfoil, Curly-leaf pondweed, New Zealand Mudsnails
   c. Boreal Toad, Round Goby, Arkansas River Darter
   d. Northern watermilfoil, Bullfrog, Purple Loosestrife

3. Which of the following are invasive carp?
   a. Bighead Carp
   b. Black Carp
   c. Grass Carp
   d. Silver Carp
   e. All of the Above

4. List ways that people commonly spread New Zealand mudsnails.

   _____

   _____

5. The Corbicula invasion in North America has created problems for power plants and water canals because large numbers of clams block water intake valves. (circle one) True or False

6. Eurasian watermilfoil is a rooted _____ with feathery leaves in whorls of _____.

   Each leaf has _____ - _____ pairs of leaflets closely spaced.

7. Eurasian watermilfoil _____ can spread on boats and infest new waters—which is why it's important that boats leaving EWM positive waters get inspected and don't transport plant parts.

8. What does black carp eat differently from silver and bighead carp?

   _____

   _____

9. The shell of NZMS has about _____ spirals and if the tip is held up, with the opening towards you,

   the opening is on the _____.

10. How can boaters prevent the spread of other AIS?

    _____ , _____ , & _____ !

Chapter 3

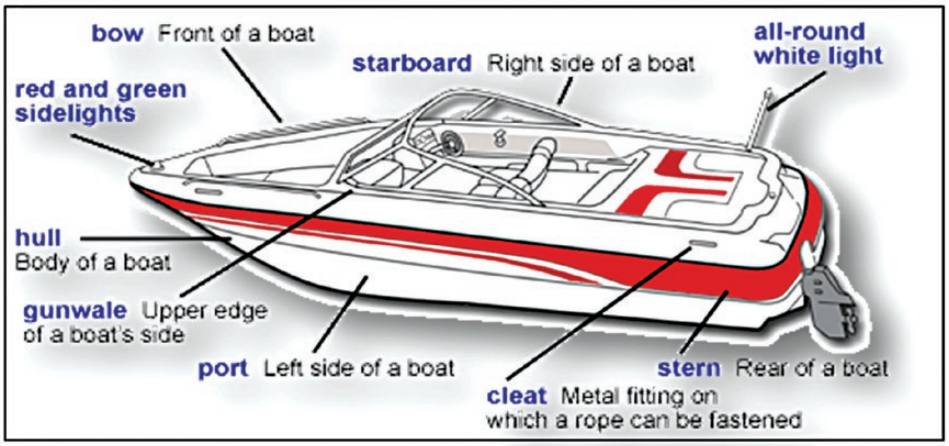
Watercraft 101

westernais.org

Chapter 3: Watercraft 101

Boat Terminology

The following definitions are the most common terms you will need to know as an inspector.



aft—A nautical term that refers to the rear or stern of the boat.

anchor storage—An interior compartment area on the boat, typically in the bow of the boat, where the anchor is stored.

bait well—An interior compartment that specifically holds live aquatic bait. Sometimes it is a separate container on the boat or incorporated in the live well compartment. May also be a pull out bucket.

ballast tank—A compartment within a boat, ship or other floating structure that holds water. Adding water (ballast) to a vessel lowers its center of gravity and increases the draft of the vessel. A ballast tank can be filled or emptied in order to adjust the amount of ballast force. Small sailboats designed to be lightweight for being pulled behind automobiles on trailers are often designed with ballast tanks that can be emptied when the boat is removed from the lake or reservoir.

bilge—The lowest compartment on a boat where the two sides meet at the keel. The word is sometimes also used to describe the water that collects in this compartment. Water that does not drain off the side of the deck drains down through the boat into the bilge.

bilge plug—A plug located either on the transom wall or in the bottom of the hull that keeps lake water from entering the boat. It must be removed when exiting the water body.

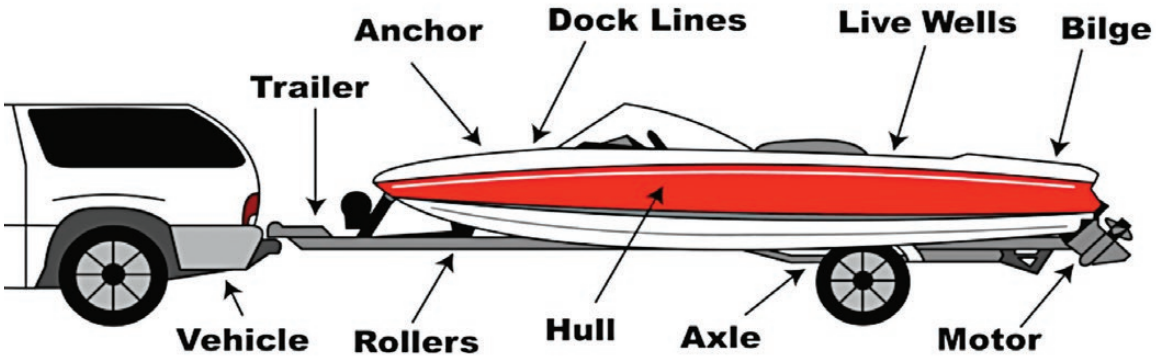
bilge pump—A water pump used to remove excessive bilge water. The water that collects in the bilge must be pumped out to prevent the bilge from becoming too full and threatening to sink the boat on the lake or reservoir.

bow—A nautical term that refers to the forward part of the hull of a boat.

cavitation plate—A flat metal fitting mounted horizontally above the propeller of an outboard motor, which helps direct the flow of water into the propeller and reduces cavitation. Cavitation is the effect caused when air is drawn down into the water by a propeller, resulting in loss of power, overspending of the engine and propeller, and pitting of the metal surfaces of the propeller.

centerboard—A retractable keel which pivots out of a slot in the hull of a sailboat, known as a centerboard trunk. A centerboard is used to provide lift to counter the lateral force from the sails.

complex boat—A boat that has one or more interior compartments or a closed hull or more than one motor.



daggerboard—A retractable keel used by various sailing craft. While other types of centerboard may pivot to retract, a daggerboard slides in a casing. The shape of the daggerboard converts the forward motion into a windward lift, countering the leeward push of the sail.

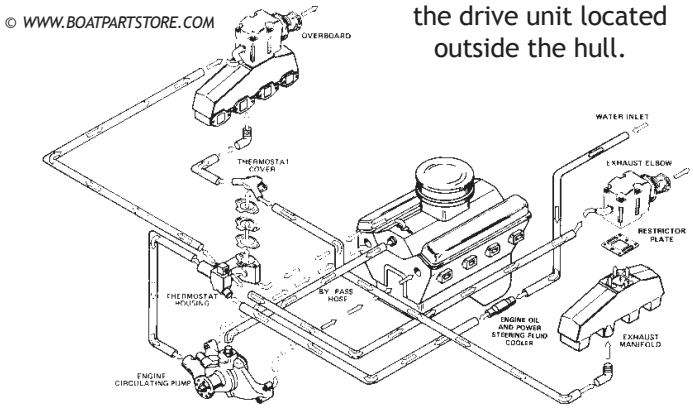
fish box—An interior compartment in a boat where fish are kept.

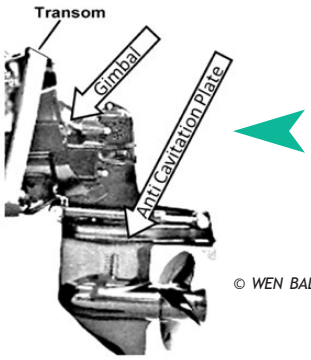
gimbal—A pivoted support that allows the rotation (up and down and side to side movement) of the outdrive of an I/O engine and outboard motor.

hull—The body or frame of a boat.

inboard engine—A marine propulsion system enclosed within the hull of the boat.

inboard/outboard engine—(I/O) is located inboard just forward of the transom (stern) and provides power to the drive unit located outside the hull.





This drive unit (or lower unit or outdrive) resembles the bottom half of an outboard motor.

jet boat—A boat propelled by a jet of water ejected from the back of the craft. A jet boat draws the water from under the boat into a pump inside the boat, and then expels it through a nozzle at the stern.

keel—Runs in the middle of the boat, from the bow to the stern, and serves as the foundation or spine of the structure, providing the major source of structural strength of the hull. Keels are different from centerboards and other types of foils in that keels are made of heavy materials to provide ballast to stabilize the boat. Keels may be fixed, or non-movable or they may retract to allow sailing in shallow waters.

live well—An interior compartment found on many fishing boats that is used to keep caught fish alive. It works by pumping fresh water from the water body into the tank, as well as keeping the water aerated.

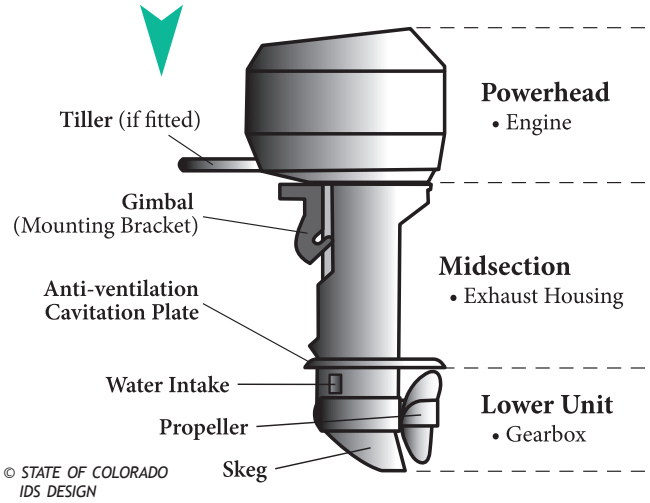
live well pump—A pump that assists in filling a live well with lake water.

lower unit—The bottom portion of an outboard motor or an inboard/outboard engine. The water found in this portion is lake water that has not been heated by the motor/engine.

macerator pumps—Pumps designed to empty holding tanks when fitted onto the plumbing in boats. The function of the pump is to suction the solids and liquids from the lines connected to the holding tanks and grind the effluent with the rotating cutter head down to a small particle size and discharge the waste.

outboard motor—A propulsion system for boats, consisting of a self-contained unit that includes engine, gearbox, and propeller. It is designed to be affixed to the outside of the transom and is the most common motorized method of propelling small watercraft. As well as providing propulsion, outboards provide steering control,

as they are designed to pivot over the gimbal (mounting bracket) and control the direction of the thrust. The skeg also acts as a rudder when the engine is not running.



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IDS DESIGN

pitot tube—A pressure measurement instrument used to measure the velocity of a boat at a given point and is usually attached to the transom.

port—A nautical term that refers to the left side of the boat as perceived by a person who is in the boat facing the bow.

PWC—Personal Water Craft: A recreational watercraft that the user sits or stands on, rather than inside of, as in a boat. Models have an inboard engine driving a jet pump that has a screw-shaped impeller to create thrust for propulsion and steering.


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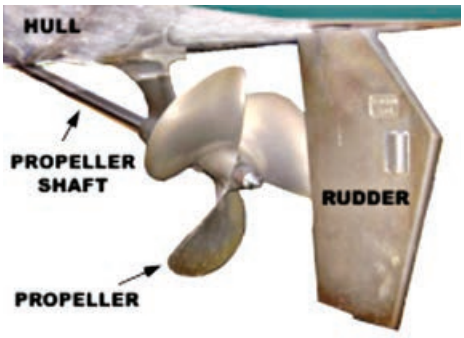
rudder—A device used to steer a boat when moving through water. A rudder operates by redirecting water that has passed the hull, imparting a turning motion to the craft.



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sailboat—A boat propelled partially or wholly by sail.

sea strainer—A filtration device used to prevent solids from reaching internal compartments, such as pumps on engines or ballast tanks.

simple boat—A boat with an open hull, no containers or compartments and a single outboard motor.

skeg—A support at the bottom of a rudder.

starboard—A nautical term that refers to the right side of the boat as perceived by a person who is in the boat facing the bow.

stern—The rear or aft-most part of a boat.

transducer—An instrument that projects a sound wave into the water. When the wave strikes something such as a fish, it is reflected back and displays size, composition, and shape of the object on a screen inside the boat.

transom—The surface that forms the flat back panel of the stern of a boat.

transom well—A recessed area where water collects that is formed by the transom. Good examples of this include the stern of a pontoon boat or the area where an outboard motor is attached.

trim tabs—The small surfaces (shelves) that are connected to the transom on a boat mostly found on cruisers, sport fishing boats, and center console boats ranging from 20 feet and up.


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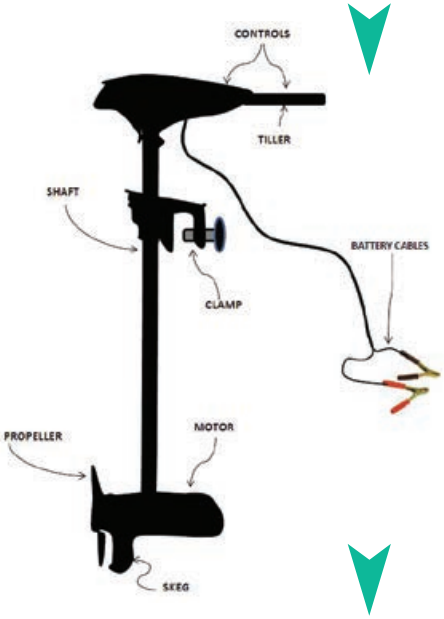
Marine Propulsion Systems

The purpose of this section is to inform the boat inspector about the propulsion systems that are used to power watercraft. There are electric and gas trolling motors, outboard motors, inboard/outboard engines (I/O), inboard engines, and jet drives.

TROLLING MOTORS

An **electric trolling motor** is a marine propulsion system consisting of a self-contained unit that includes an electric motor, propeller and controls, and is affixed to a boat, either at the bow or stern.



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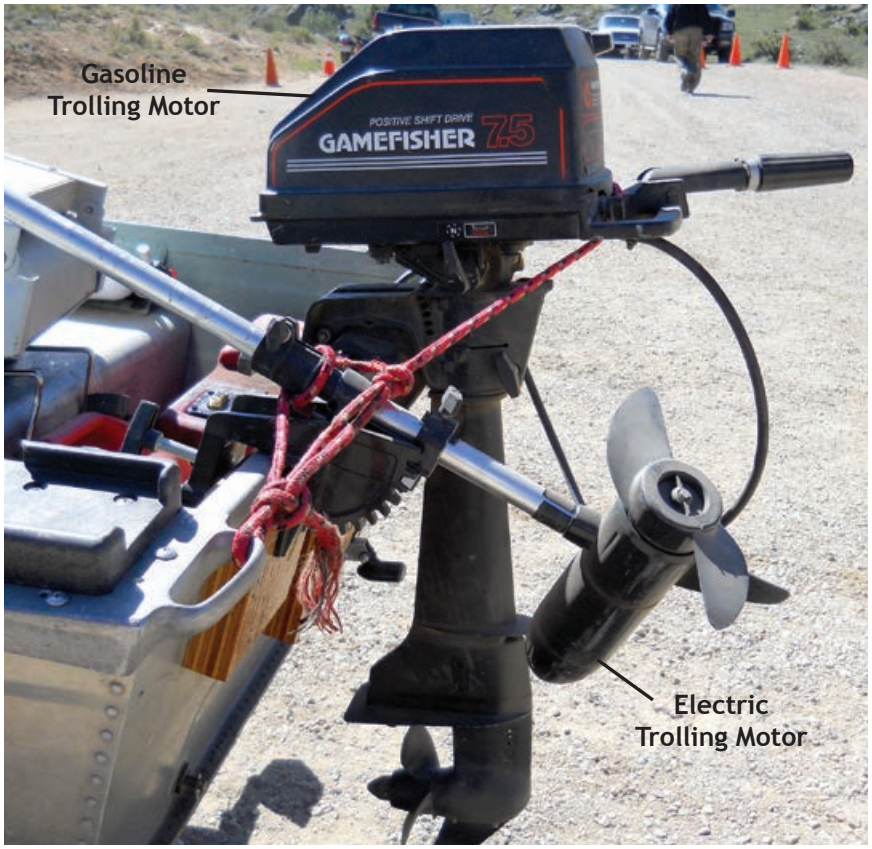
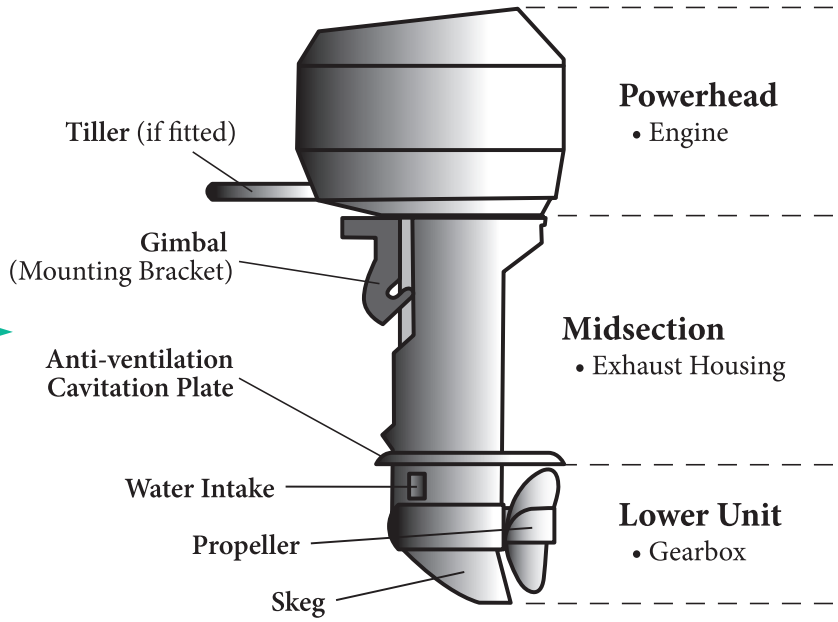


A **gasoline-powered outboard**, if it is not the vessel's primary source of propulsion, may also be referred to as a **gasoline trolling motor**. Small outboard motors are frequently used as trolling motors on boats with much larger engines that do not operate as efficiently or quietly at trolling speeds. These typically are designed with a manual pull start system, throttle, and gearshift controls mounted on the body of the motor, and a tiller for steering. Trolling motors are often lifted from the water to reduce drag when the boat's primary engine is in operation.

As shown in the first photo, the intakes on some of the gas trolling motors are underneath the cavitation plate. Others are so close to the edge that most muffs do not cover them in order to perform a decontamination, as shown in the second photo.

OUTBOARD MOTORS

An **outboard motor** is a marine propulsion system, consisting of a self-contained unit that includes engine, gearbox, and propeller, designed to be affixed to the outside of the transom. This is the most common motorized method of propelling small watercraft. As well as providing propulsion, outboards provide steering control, as they are designed to pivot over the gimbal (mounting bracket) and control the direction of the thrust. The skeg also acts as a rudder when the engine is not running.

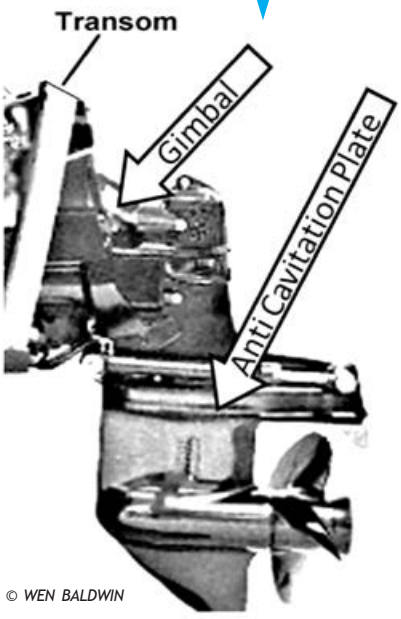


The intakes on this Evinrude outboard motor are only on one side and are shown as the small rectangle.

This photo shows an outboard motor on a pontoon boat with a back up gas trolling motor.

INBOARD/OUTBOARD ENGINES

An **inboard/outboard (I/O) engine** is located inboard just forward of the transom (stern) and provides power to the drive unit located outside the hull. This drive unit (or lower unit or outdrive) resembles the bottom half of an outboard motor.



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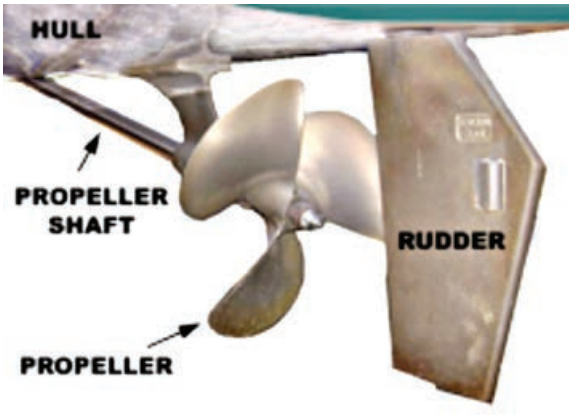
After an I/O has exited the lake or reservoir there is water in the hose from the water inlet to the engine circulating pump. When the engine is started in another water body, this water goes through the "cold" engine and is expelled into the water. If this water is from a positive reservoir the chance of live veligers being present in the water is very high.

INBOARD ENGINES

An **inboard engine** is a marine propulsion system enclosed within the hull of the boat. Inboard engines have a raw water cooling system where water from the reservoir is pumped by the engine to cool it.



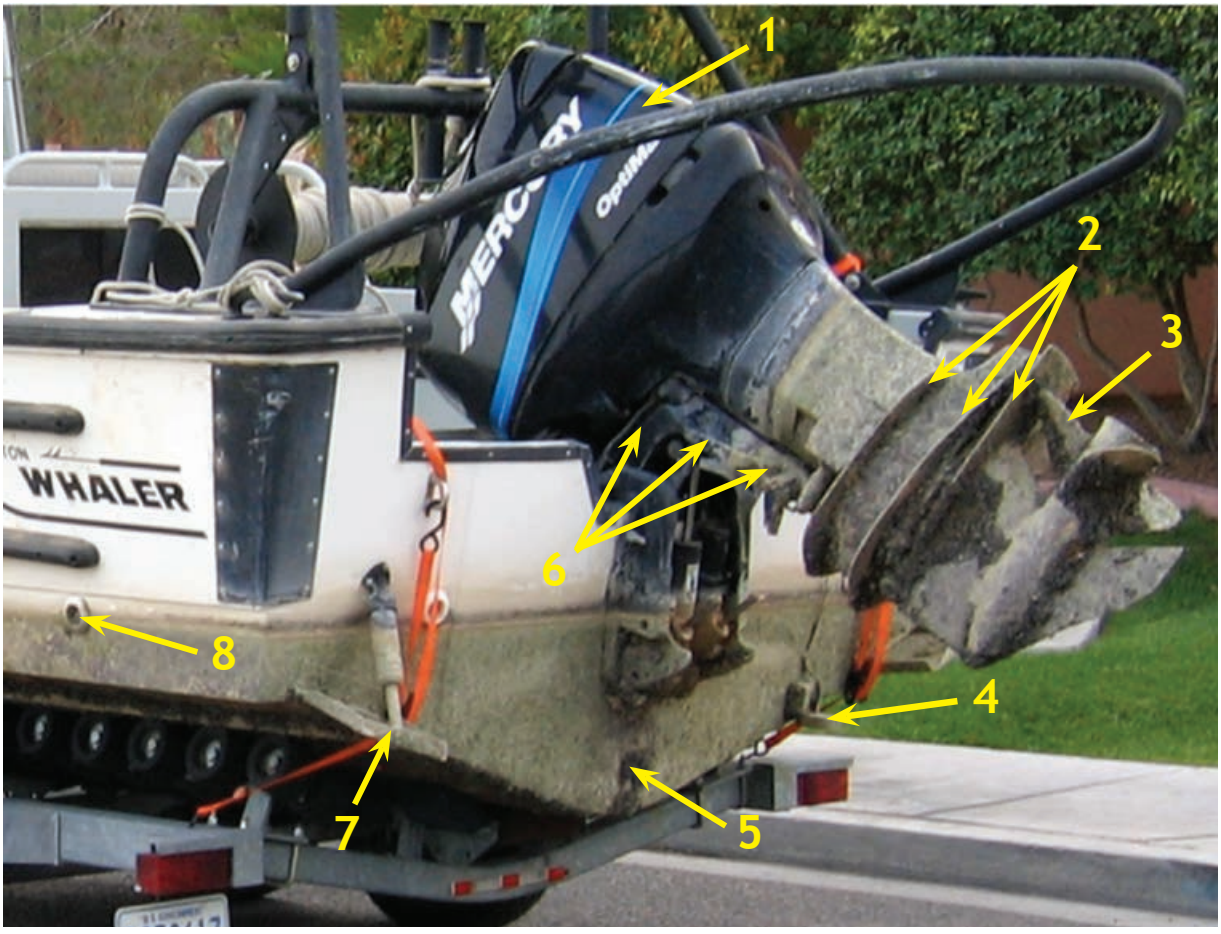
Attached to the hull of the boat is the propeller shaft and propeller which propels the boat through the water. The rudder acts as the "steering wheel" to guide the boat.

After opening the inboard engine compartment, the bilge area around the engine can be inspected and/or decontaminated for standing water.

JET BOAT

A **jet boat** is a boat propelled by a jet of water ejected from the back of the craft. Unlike a powerboat or motorboat that uses a propeller in the water below or behind the boat, a jet boat draws the water from under the boat into a pump inside the boat. The water then passes through a series of impellers and stators—known as stages—which increase the velocity of the water flow. The water is then expelled through a nozzle at the stern. Most modern jets are single stage while older waterjets may have as many as three stages. The tail section of the waterjet unit extends out through the transom of the hull above the waterline. This jet stream exits through a small nozzle at high velocity to push the boat forward.

Fill in the blanks with the correct boat terminology



1. _____
2. _____
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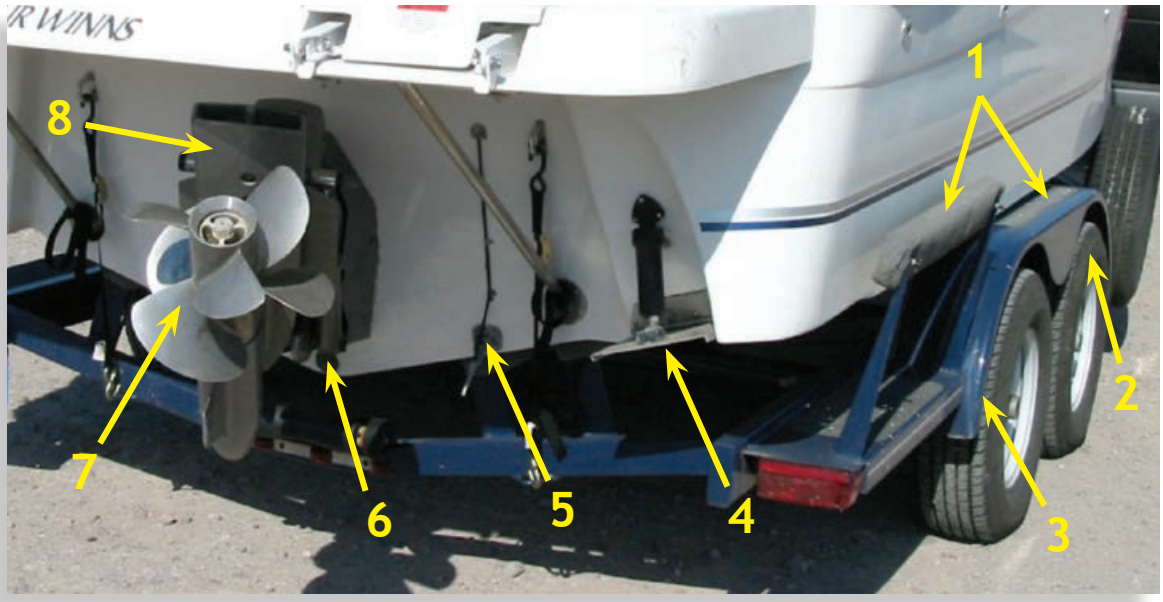


1. _____
2. _____
3. _____
4 . _____
5. _____
6. _____
7. _____
8 .(engine type) _____

1. _____
2. (engine type) _____
3. _____
4 . _____
5. _____
6. _____
7. _____
8 . _____

Watercraft Risk Assessment

There are four categories of boats:

NON-MOTORIZED, HAND-LAUNCHED BOATS

- These boats are not launched from trailers.
- These boats do not have motors or engines.
- These boats may, or may not, have compartments.

SIMPLE BOATS

- A boat with an open hull **and** no containers **and** compartments **and** a single outboard motor.

COMPLEX BOATS

- A boat that has one or more interior compartments **or** a closed hull **or** more than one motor or engine.

VERY COMPLEX BOATS

- A complex watercraft with more than one internal raw water device (e.g. generator, air conditioner, swamp cooler, etc.).

What is the Biological Risk of Moving AIS Relative to the Complexity of the Watercraft?

Generally speaking, the more complex a watercraft is, the higher risk it is for transporting AIS. Compartments that can hold water inside the boat, engines, and trailers all increase the risk of AIS being moved into new locations.

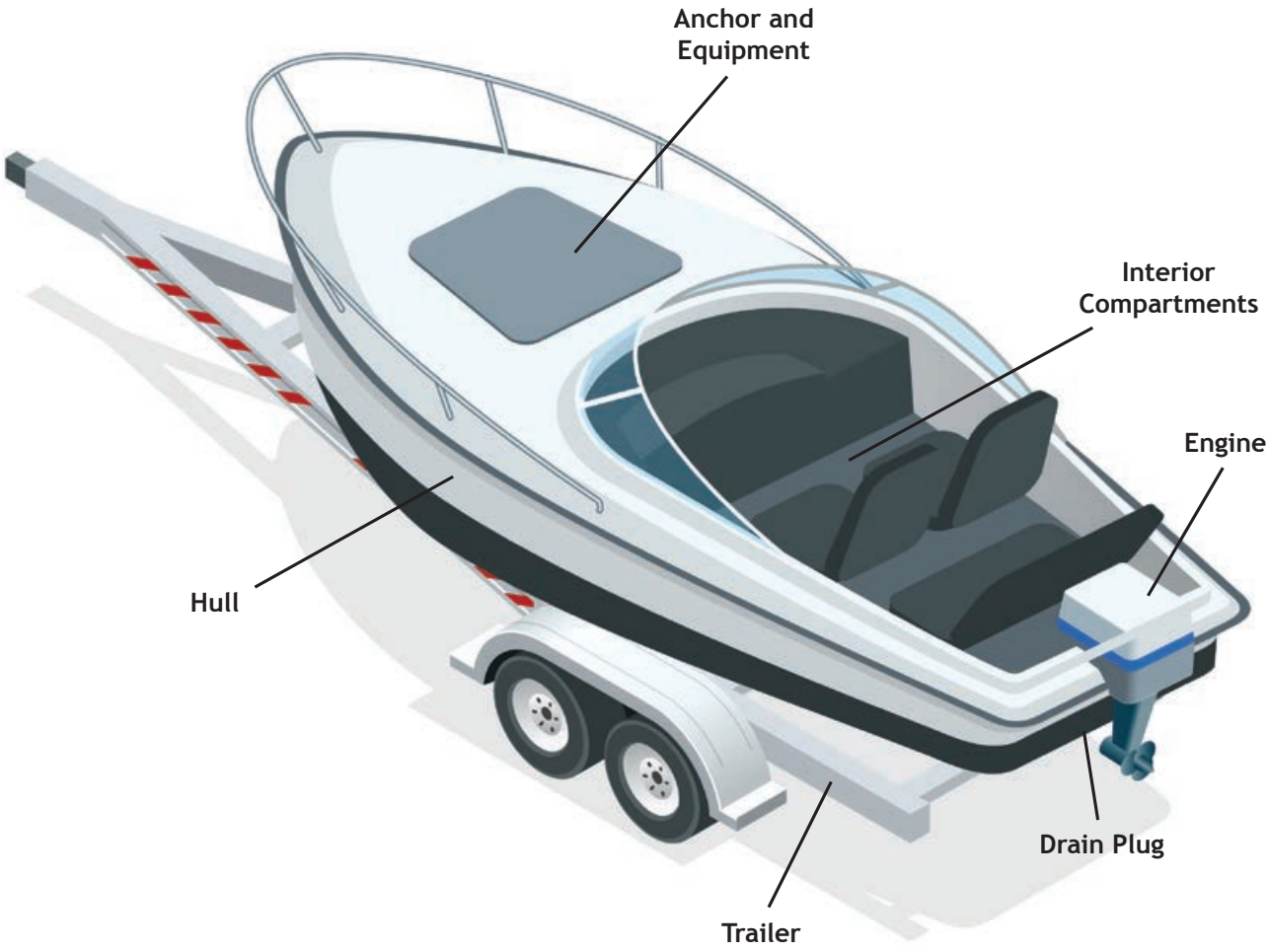
Category	Watercraft Type	Risk Level
Very Complex	House Boats, Cabin Cruisers, Ski Boats, and Wakeboard Boats with Ballast Tanks	Very High Biological Risk
Complex	Large Open Boats, Sailboats, Ski Boats, Wakeboard Boats with no ballast tanks, and Personal Watercraft (PWC)	High Biological Risk
Simple	Open Hull, Single Motors, No Interior Containers or Compartments	Medium Biological Risk
Non-motorized, Hand-launched	Canoe, Kayak, Windsurfer Board, Sail Board, Belly Boats, Rafts, Float Tubes, Inner Tubes, Foldable Plastic Boat, Standup Paddleboard, and Rowing Shell	Low Biological Risk

Where Do We Look?

H.E.A.D. is an acronym that can help you remember where to look for mussels on boats during entrance and exit inspections.

- **H** = Hull and Trailer
- **E** = Engine or Motor (including Transom)
- **A** = Anchor, Anchor Line, and Equipment
- **D** = Drain Interior Compartments

Outdoor Session—Boat Anatomy



Name That Boat Game

Boat Type
Agency Boat
Exempt Boat
Cabin Cruiser
Fishing Boat
House Boat
Jon Boat
Non-Motorized, Hand-Launched
Other
Personal Watercraft
Pontoon
Sail Boat
Simple Boat
Ski Boat
Wakeboard Boat

Near each photograph:

A. Circle if the watercraft is Non-Motorized, Hand-Launched (NM/HL), Simple, Complex, or Very Complex.

B. Circle the type of marine propulsion system.

C. Label the Boat Type using the key to the right.

1A. NM/HL Simple Complex Very Complex

1B. Outboard I/O Inboard Jet

1C. Boat Type: _____

2A. NM/HL Simple Complex Very Complex

2B. Outboard I/O Inboard Jet

2C. Boat Type: _____

3A. NM/HL Simple Complex Very Complex

3B. Outboard I/O Inboard Jet

3C. Boat Type: _____

4A. NM/HL Simple Complex Very Complex

4B. Outboard I/O Inboard Jet

4C. Boat Type: _____

5A. NM/HL Simple Complex Very Complex

5B. Outboard I/O Inboard Jet

5C. Boat Type: _____

6A. NM/HL Simple Complex Very Complex

6B. Outboard I/O Inboard Jet

6C. Boat Type: _____

7A. NM/HL Simple Complex Very Complex

7B. Outboard I/O Inboard Jet

7C. Boat Type: _____

8A. NM/HL Simple Complex Very Complex

8B. Outboard I/O Inboard Jet

8C. Boat Type: _____

9A. NM/HL Simple Complex Very Complex

9B. Outboard I/O Inboard Jet

9C. Boat Type: _____

10A. NM/HL Simple Complex Very Complex

10B. Outboard I/O Inboard Jet

10C. Boat Type: _____

11A. NM/HL Simple Complex Very Complex

11B. Outboard I/O Inboard Jet

11C. Boat Type: _____

12A. NM/HL Simple Complex Very Complex

12B. Outboard I/O Inboard Jet

12C. Boat Type: _____

13A. NM/HL Simple Complex Very Complex

13B. Outboard I/O Inboard Jet

13C. Boat Type: _____

14A. NM/HL Simple Complex Very Complex

14B. Outboard I/O Inboard Jet

14C. Boat Type: _____

Chapter 3 Review Questions

1. List four examples of non-motorized, hand-launched watercraft:

   1.) _____ 3.) _____

   2.) _____ 4.) _____

2. List three reasons why non-motorized, hand-launched watercraft are a lower risk for transporting AIS than very complex watercraft:

   1.) _____

   2.) _____

   3.) _____

3. A simple boat has a(n) _____ hull AND _____ interior compartments AND a _____ outboard motor.

4. Circle the one item you need to inspect on a sailboat that is different from other boats.
   a. Hull
   b. Centerboard Box
   c. Trailer
   d. Motor

5. Match the watercraft type with the appropriate risk level.

Risk Level	Watercraft Type
a. Low Biological Risk	_____ House Boats, Cabin Cruisers, Ski Boats and Wakeboard Boats with Ballast Tanks.
b. Medium Biological Risk	_____ Large Open Boats, Sailboats, Ski Boats and Wakeboard Boats with no ballast tanks, Personal Watercraft (PWC).
c. High Biological Risk	_____ Open Hull, Single Motor, No Interior Containers or Compartments.
d. Very High Biological Risk	_____ Canoe, Kayak, Windsurfer Board, Sail Board, Belly Boats, Rafts, Float Tubes, and Inner Tubes.

6. Match the definition to the engine or motor:

Engine or Motor		Definition
a. Inboard/Outboard Engine	_____	A marine propulsion system consisting of a self-contained unit that includes a motor, propeller and controls, and is affixed to an angler's boat, either at the bow or stern. Typically electric but also gas powered.
b. Outboard		
c. Trolling Motor		
d. Inboard Engine		
e. Jet Engine	_____	Enclosed within the hull of the boat. These have a raw water cooling system where water from the reservoir is pumped by the engine to cool it. Attached to the hull of the boat is the propeller shaft and propeller which propels the boat through the water. The rudder acts as the "steering wheel" to guide the boat.
	_____	Located just forward of the transom (stern) and provides power to the drive unit located outside the hull. This drive unit (or lower unit or outdrive) resembles the bottom half of an outboard motor.
	_____	This propulsion system draws the water from under the boat into a pump inside the boat. The water then passes through a series of impellers and stators—known as stages—which increase the velocity of the water flow. The water is then expelled through a nozzle at the stern. The tail section of the unit extends out through the transom of the hull above the waterline. This water stream exits through a small nozzle at high velocity to push the boat forward.
	_____	A marine propulsion system for boats, consisting of a self-contained unit that includes engine, gearbox, and propeller, designed to be affixed to the outside of the transom and is the most common motorized method of propelling small watercraft. As well as providing propulsion, these provide steering control, as they are designed to pivot over the gimbal (mounting bracket) and control the direction of the thrust. The skeg also acts as a rudder when the engine is not running.

7. Which compartments cannot be fully drained on a watercraft? (circle all that apply).
   a. Ballast Tank or Bag
   b. Inboard Engine
   c. Inboard/Outboard Engine
   d. Outboard Engine
   e. Bait Well
   f. All of the above

8. 8. A complex boat has _____ interior compartments OR a _____ hull OR _____ engine or motor.

9. Which of the following are systems that may be found on a very complex watercraft? (circle all that apply)
   a. swamp cooler
   b. air conditioner
   c. bathroom plumbing
   d. bait well

10. What is the acronym that helps us to remember where to look for AIS on a watercraft?

_____

_____

Chapter 4

Inspection

Chapter 4: Inspection

The Ideal Inspector

What characteristics, traits, or qualities make up the Ideal Inspector?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

Inspector Roles, Expectations, and Guidance

The Role of the Inspector

1. Inspect Watercraft for AIS.
2. Decontaminate Watercraft for AIS.
3. Educate and Inform the Public about AIS.

The inspector's role is to teach boat operators to inspect their own watercraft each time they launch and to ensure it is clean, drained, and dry in between every use.

The Goal for Every Boat:

Clean, Drain, Dry in between each and every use!

No Water. No Animals/Mussels. No Plants. No Mud.

Types of WID Stations

Negative Prevention Waters—Waters that have never had a verified detection of any AIS or have not had a detection within the time frame for de-listing.

Other AIS Containment Waters—Waters that are positive for an AIS other than ZQM. Most AIS Positive waters are also prevention waters for mussels and other AIS.

ZQM Containment Waters—Waters that have had a verified zebra or quagga mussel detection.

Off-Water WIDS—Stations that are not located at a water body (e.g. highways, ports of entry, offices or business locations).

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What Are the Priorities As a Watercraft Inspector?

1. **Ensure Personal and Public Safety**—The safety and the safety of the public is top priority at all times. Many vehicles and boats will be moving around the inspection area. People will be looking under wheels and through the watercraft. You will need to ensure the safety of all involved.
2. **Educate Boaters**—Every contact made with boaters is an educational opportunity to teach them about the importance of controlling zebra and quagga mussels and other AIS. Boaters must realize that AIS are spread by their actions (or inaction). They must understand that they can

lose access and their recreational opportunities if they do not help in this effort. The primary education message is **Clean, Drain, and Dry**:

Clean: Remove all plants, animals, and mud. Thoroughly wash everything.

Drain: Drain every space or item that can hold water. Remove all water drain plugs.

Dry: Make sure the watercraft is completely dry which means sponging, toweling or pumping all water out.

3. **Inspecting Watercraft—Assessing the Risk of the Watercraft**—By following the inspection procedure detailed later in this chapter, inspectors are ensuring that the biological risk of the watercraft is reduced prior to launching and that watercraft are leaving clean, drained, and dry.
4. **Draining Standing Water**—WID procedures are largely based on mitigating the risks associated with transporting organisms from one water body to another in standing water. These organisms (e.g. mussel veligers, pathogens or plant fragments) are typically microscopic so it is essential that standing water be drained in between each and every use.
5. **Decontamination**—If there is a known or suspect AIS on a watercraft, or standing water that can not be drained, the watercraft may be decontaminated.

1. **Incoming Entrance and Off-Water Inspection:** This is the complete inspection that is performed at WID stations on watercraft entering the lake or reservoir regardless of status (infested, positive, suspect, or negative), in addition to WID stations that are not located on a lake or reservoir (e.g. offices, businesses, or roadsides). This procedure includes both a screening interview and a visual and tactile inspection of all portions of the watercraft and trailer that could come into contact with water.
2. **Exit Inspection—Prevention Waters:** Exit inspections are performed at lakes, rivers, and reservoirs. It is critically important to make an additional educational contact with the boater reinforcing that watercraft should be clean, drain and dry in between each use. It also verifies that the boater has followed the proper procedures to clean off the watercraft and completely drain all compartments prior to leaving. Repeat the primary educational message Clean, Drain, Dry and explain why boaters need to do it each time they use their watercraft.

   The priority for exit inspections is to inspect for invasive species, drain water, remove plants, and apply a seal and receipt to the watercraft. Perform the exit inspection below to ensure the watercraft leaves clean and drained to the best of the inspector's ability.

What Are The Types of Inspections?

These procedures have been proven effective in identification and interception of watercraft that have zebra or quagga mussels, New Zealand mudsnails, rusty crayfish, and noxious weeds. Following these procedures and educating the boater **WILL** prevent the spread of AIS.

There are three inspection procedures that will be described in detail later in the Chapter.

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3. **Exit Inspection—Containment Waters:** Exit inspections verify that the boater has followed the proper procedures in cleaning the watercraft and completely draining all compartments prior to leaving. It is critically important to make additional educational contacts with the boater to reinforce the message that it is the boater's responsibility to ensure the watercraft is clean, drain and dry in between each use. The priorities for exit inspections are to inspect the watercraft and trailer for invasive species, drain water, and decontaminate if necessary.

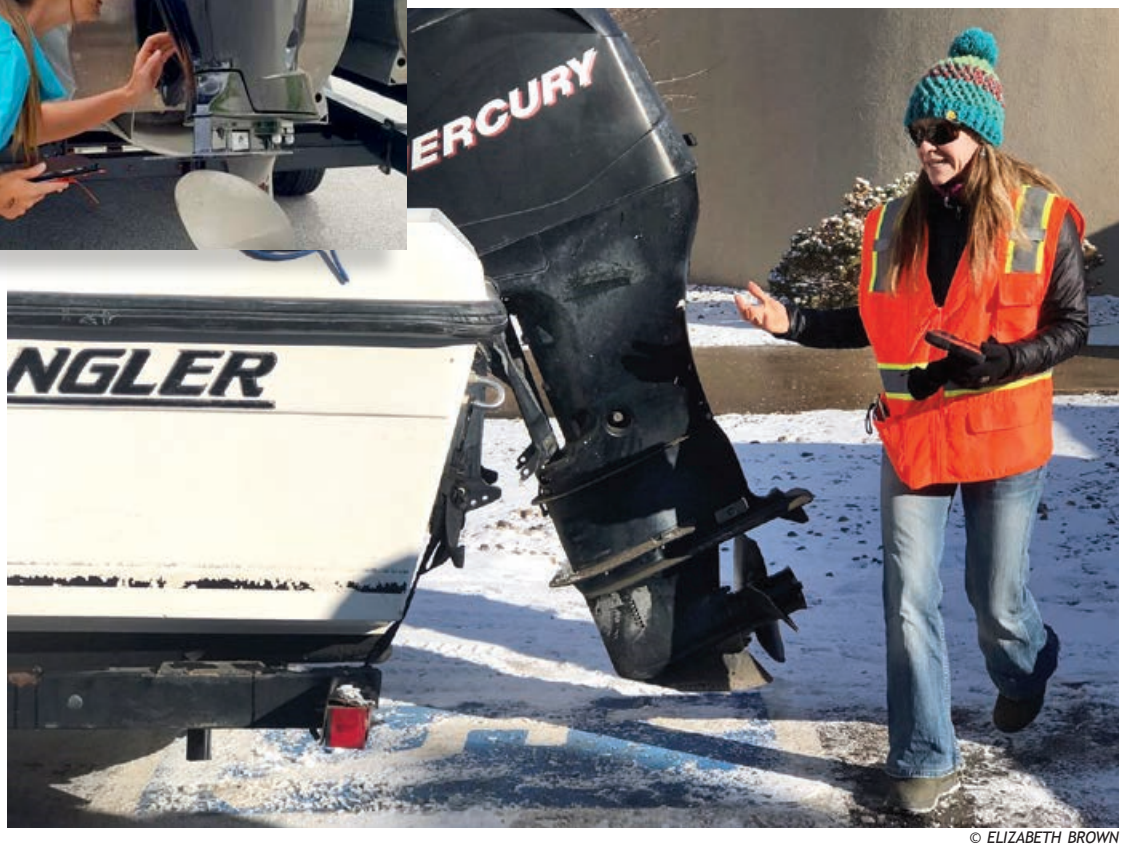
   Watercraft exiting containment waters should (1) be recorded in the Regional WID Data Sharing System, (2) have a seal applied to the boat securing it to the trailer, and (3) provided a receipt to the boater. The exit inspection ensures the watercraft leaves clean and drained to the best of the inspector's ability.

What Equipment Do I Need?

Every inspector should have the following items when performing inspections:

- Uniform and Safety Vest
- Tablet for Data Collection
- Educational Materials
- L.E.D. Flashlight
- Mirror
- Magnifier
- Seals
- Wire
- Wire Cutter
- Receipts
- Digital Camera
- Sample Collection Kit

Supervisors will need to be sure the equipment and materials on the following page are available.



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SAFETY EQUIPMENT

- ❑ Traffic cones
- ❑ Orange traffic safety vests
- ❑ Chocks for the trailer *(optional)*
- ❑ Rolling stepladder for boat access *(optional)*
- ❑ First Aid Kit
  *(**For use by first aid trained staff only.** If not first aid trained, use only on self—not for use on anyone else or members of the public.)*
- ❑ Personal Protective Equipment (PPE)— refers to protective clothing such as closed toe shoes, gloves, hats, sun protection, sunscreen, eye protection, insect protection, bugscreen, water proof suit, etc.

INSPECTION EQUIPMENT

- ❑ WID Activity Log Form or Data Collector
- ❑ Green seals, wire, and seal receipts
- ❑ Wire cutters
- ❑ Crescent wrench to take out bilge plugs
  *(9/16" socket also handy to give boater if they need it. **Inspectors—don't use tools on other's boats**.)*
- ❑ Digital camera
- ❑ Hand wipes
- ❑ Hand sanitizer
- ❑ Paper towels
- ❑ Inspection mirrors
- ❑ Flashlights
- ❑ Magnifying glass
- ❑ Sample collection kit
- ❑ Work lights
- ❑ Method of communication
  (Radio, cell phone, etc.)
- ❑ Weather radio
- ❑ Clipboards
- ❑ Pens/pencils
- ❑ Vise grips
- ❑ Buckets
- ❑ Nets
- ❑ Bilge pump

STAFF EQUIPMENT

- ❑ Uniforms
  (shirts, vests, name tags, hats, etc.)
- ❑ Chairs
- ❑ Access to drinking water
- ❑ Access to restrooms
- ❑ Access to shelter in case of weather
- ❑ Sun block
- ❑ Trash can

Educational Materials

- ❑ Mussel education brochures
- ❑ Boating regulation brochures
- ❑ Fishing regulation brochures
- ❑ Maps of reservoir/lake/etc.

Seals and Receipts

Overview of AIS Seals and Receipts

A critical step in the entrance and off-water inspection procedure is to check for a seal and verify the receipt. The last step in the exit inspection procedure is to apply a seal and receipt. Therefore, it is very important that inspectors understand the seal system before learning the full inspection procedures.

WHAT IS THE WID SEAL SYSTEM?

WID stations use a wire seal, coupled with a receipt, to communicate the location of the boat's last inspection or decontamination and associated information to the next inspector. The seal locks the watercraft to the trailer indicating that it has not launched since the seal was issued. The receipt accompanies the seal and provides documentation regarding date and location of last inspection, procedure used, type of decontamination, if any, and other important information.

WHERE ARE SEALS APPLIED?

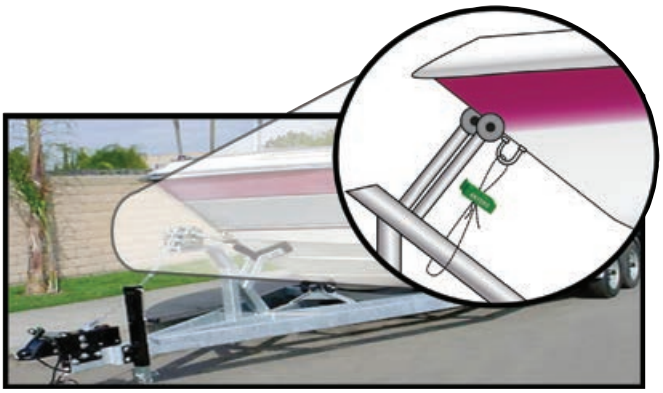
The seal must be attached in a way that ensures it will be broken if the watercraft is separated from the trailer. Typically, the wire seal goes between the eyebolt and a hard welded part of the trailer. Be advised that some winches can be unrolled completely and separated from the seal without breaking.

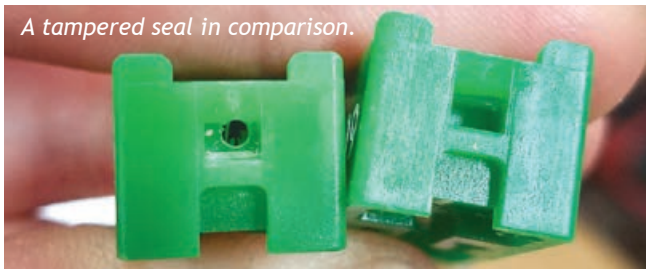
> ***Note:*** *The inspector must physically and visually inspect the seal itself and the wire to make sure it has not been tampered with.*

SEAL RECEIPTS

Seals are typically only valid with a matching receipt. The seal tells you that the watercraft has not launched since its last inspection. The receipt tells the next inspector what kind of inspection or decontamination was performed at the last site, in addition to when it was performed and by whom. This information will help to determine the risk this watercraft poses and what type of inspection or decontamination needs to be performed before allowing the boater to launch.

When applied properly, seals with receipts should decrease the amount of time for the boater and the inspector. In most cases, the watercraft will not need to be inspected or decontaminated upon entry if they have a seal with a valid receipt.





A tampered seal in comparison.

SEALS EXPLAINED TO THE PUBLIC:

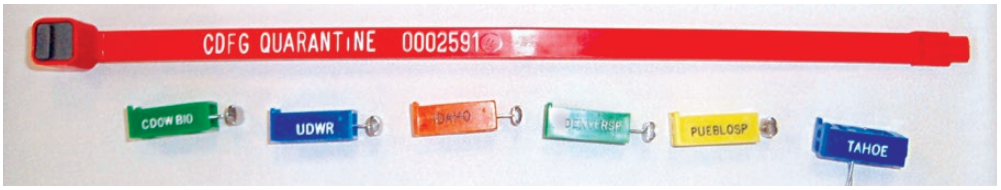
- Seals are not a free pass.
- A seal is proof of prior inspection.
- It may speed up your entry to the next water.
- The boat operator still has to stop at the inspection station and have the seal and receipt verified.
- The boat may be allowed to launch if it is returning to the same location, been out of the water for more than 30 days, or the watercraft is clean, drained, and dry.
- If the boat is not returning to the same location or has not been out of the water for more than 30 days, it may get an inspection prior to launching.
- If the watercraft is not clean and dry, it will most likely get re-inspected.
- Keep watercraft clean, drained, and dry and get on the water fast!

Regional WID Data Sharing System

The Regional WID Data Sharing System (System) is in use at more than 200 locations across the west. CPW developed the System and maintains ownership and oversight. The states of Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming, as well as the Lake Tahoe Regional Planning Agency, Solano County Water Agency, Mussel Dogs, and TiGE are now using the System as their primary form of data collection and management.

The purpose of the System is to record information related to WID electronically and to share information in a timely manner across jurisdictions to aid collaborative efforts to prevent the spread of zebra and quagga mussels and other AIS.

The System consists of a mobile application, website, and shared database hosted on a private server. The mobile application is compatible on all iOS and Android devices. This reduces the operating costs for mobile data collection and data entry while increasing accuracy. It provides for improved reliability in data collected in the field at WID stations, in addition to rapid query capacity for on-demand reporting. Lead agencies are able to customize the user interface of the mobile application in alignment with both western regional standards and state laws, regulations, and priorities.



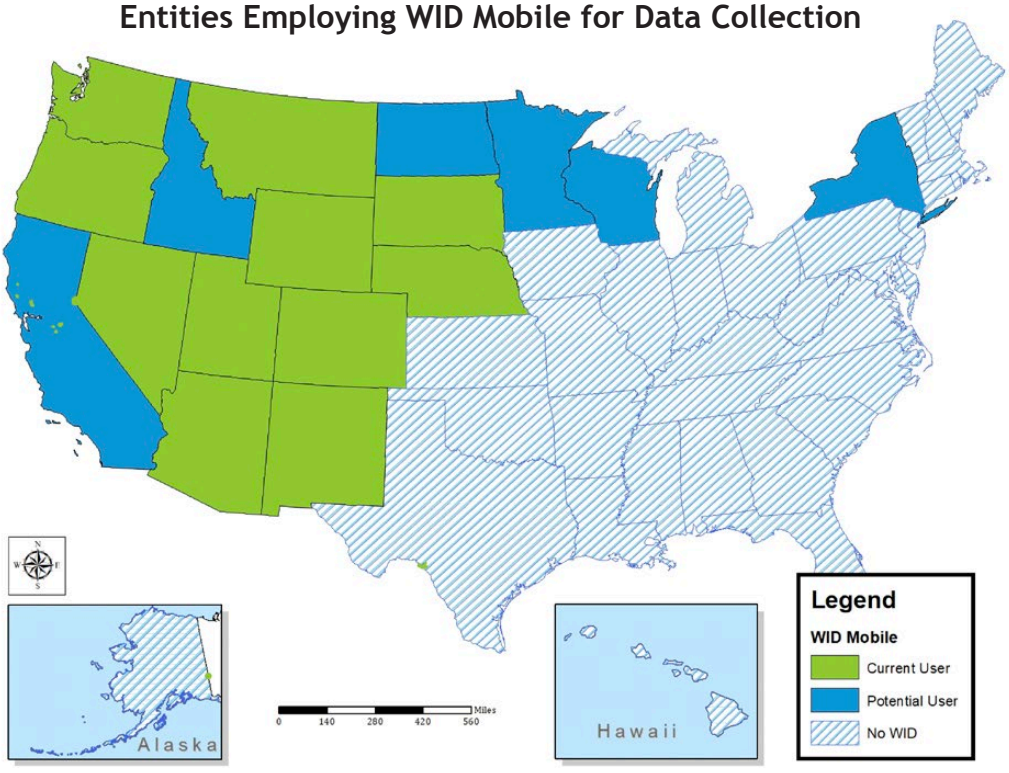
The System is used for data entry, viewing, editing, querying, and reporting. An included risk assessment tool shows where boats are moving after launching in mussel infested waters and sends an alert to the next known destination. With the benefits of data sharing proving to be abundant, the states of Arizona, Nevada and Utah have been using the System to send out timely electronic alerts of watercraft leaving infested waters. This increased timely communication has directly increased the number of infested watercraft being intercepted within the western region before launching in uninfested waters.

CPW manages and operates the System through a private industry contract utilizing federal grant dollars. The data itself is the property of the agency that input the information. CPW leads a Governance Committee, consisting of user organizations that is charged with evaluating and prioritizing requests, changes and enhancements. The Governance Committee works to collectively determine the viability and usefulness of new technologies.

It is expected that this System will become industry standard for entities performing WID. As users increase, this system will continue to improve communications among jurisdictions to enable field staff and managers to accurately focus resources towards effective risk mitigation related to the prevention and containment of zebra and quagga mussels and other harmful AIS.

Inspectors should use the system in real time in order to benefit from the many features that help to determine risk at the ramp. The data collected is imperative to inform budget allocations and other decisions related to WID operations. Obtaining accurate and timely information is imperative for success.

Entities Employing WID Mobile for Data Collection



Inspection Procedures

The following science-based standard procedures were drafted by the Western Regional Panel and approved by the ANS Task Force. They have proven effective to identify and intercept watercraft harboring zebra or quagga mussels, New Zealand mudsnails, and noxious weeds including Eurasian watermilfoil. By following these procedures and educating boaters, you WILL prevent the spread of AIS.

Step-By-Step Procedures for Inspections:

Incoming or Entrance and Off-Water Inspection Procedure

This is the complete inspection that is performed at WID stations on watercraft entering the lake or reservoir regardless of status (infested, positive, suspect, or negative), in addition to WID stations that are not located on a lake or reservoir (e.g. offices, businesses, or roadsides). This procedure includes both a screening interview and a visual and tactile inspection of all portions of the watercraft and trailer that could come into contact with water.

Step 1: Greeting, Safety and Educate the Boater

- Introduce yourself.
- Inspectors should ask the driver to turn off the engine, put on the parking brake and step out of the vehicle.
- Provide the boater with a brochure or educational item.
- Provide a brief verbal explanation of the purpose of the inspection.
- Provide an explanation of what you are looking for (e.g. mud, water, plants, and animals).
- Provide guidance on Clean, Drain, Dry practices

Note: *Consider putting chocks under the wheels of the vehicle and the trailer. The inspectors may have to get under the trailer and climb on the watercraft, so it is important to prevent boats or the trailer from rolling.*

Step 2: Initial Assessment

- Record on the Activity Log or in the Mobile Application (Data Collector) the following information:
  - Incoming or Off-water
  - Boat Registration or HIN Number
  - Boat Trailer License Plate
  - Boat Type
- Check for Seal and Receipt
  - If present, determine if the boat is a low risk or high-risk conveyance:
    - *Low-risk boats are defined as those with:*
      - Seal + matching receipt from the same location
      - Seal + matching receipt from a known negative location

      Perform Seal Removal for Low-risk Boats:
      - Verify seal and receipt match and seal has not been tampered with
      - Ask about live aquatic bait and follow bait procedure, if applicable
      - Thank the boater and allow launch
    - *High-risk boats are defined as those that:*
      - Do NOT have a seal with matching receipt
      - Have a seal that has been tampered with
      - Have a seal from a suspect, positive, or infested location

      ***Continue onto steps 3-6 for High-Risk Boats.*

Step 3: Ask about Live Aquatic Bait

- Ask the boater if they have live aquatic bait.
  - If yes, follow bait procedure
  - If no, continue with the inspection

Note: *Some jurisdictions may not have the authority to inspect for live aquatic bait.*

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Step 4: Determining Risk Factors.

This is like airport security—you are screening for rare events. Inspectors will need to look at a lot of boats quickly to determine if there is a high risk. There are two very important questions that should be asked first. Record in the Mobile Application (Data Collector) the answers provided to the following questions:

- Has the boat launched out of state in the last 30 days?
    - If yes, where?
- Where has the boat launched in the last 30 days?
    - Listen carefully and pay attention to notice if any of the locations listed are suspect, positive, or infested.

Step 5: Perform the visual and tactile entrance inspection of the watercraft, using the acronym H.E.A.D. to ensure that the watercraft is properly inspected.

Hull and Trailer—Rapid Exterior Inspection

- Look over (visual) and feel (tactile) the entire watercraft on both sides of the hull and trailer.
- Physically inspect the through hull fittings.
- Check trailer bunks or rollers, tire wells, lights and electrical.
- Remove any plants or plant fragments that are present.
- Check to see if the bilge plug(s) are installed. If it is installed, check for water in bilge prior to removing the plug.
- If it is installed, ask the boater to remove the bilge plug away from the water to allow draining. Many states require the drain plug to be out while transporting the watercraft.
- Physically and visually inspect the bilge area and use a flashlight to visually see if any AIS or standing water are present.
- If applicable, have the boater activate the bilge pump.

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- If the watercraft has an inboard engine, be certain to carefully inspect the prop, prop shaft, and rudder.
- Inspect intakes for ballast, engines, and other interior systems and compartments.

Note: *Through hull intakes and discharge ports will be a good indicator that more complicated systems may be on board.*

Note: *It is important to explain what you are looking for and educate boaters so that they can inspect their own boats. It is important to start and end the inspection at the same place on watercraft. Look the boat over and feel the hull with the boater. The young mussels may feel like bumps or sandpaper on the watercraft. Trailers can pose as high of a risk as boats, so carefully check trailer rails, lights and electrical wires, as well as the license plate and trailer pads. This is a good opportunity to use your inspection mirrors and flashlights to look at difficult nooks and crannies on the underside of the boat.*

Engine or Motor

- Visually and physically inspect the drive unit with a flashlight when it is in trailer mode (up).
- Ask for the outboard or I/O to be lowered.
- Visually and physically inspect the gimbal area of the outboard or I/O with a flashlight.
- Visually and physically inspect the transom or rear of the boat and any attached instruments including but not limited to:
    - Pitot tubes, trim tabs, transducers, etc.
- Ask the boater to raise the drive unit to avoid damage during transport.

Anchor and Equipment Checked

- Ask to see the anchor and anchor line or chain.
- Visually and physically inspect the anchor and line or chain for mud, plants, and or AIS.
- Ensure all water related equipment is clean and dry including but not limited to:
    - Bait buckets, water toys, fenders, auxiliary pumps, etc.

Drain and Check Interior Compartments

For larger craft, you will need to get into the watercraft to inspect interior compartments that could hold standing water (e.g. live wells). For smaller craft, you may be able to see without entering the watercraft. Ensure that the watercraft is drained to the best of your ability.

- Ask for permission to board the watercraft and ask the boater to climb in first. Follow the boater into the watercraft the same way they entered. Be careful to prevent either the boater or inspection staff from falling or getting hurt. Always maintain three points of contact with the watercraft and never jump off. Ask the boater if they would like you to remove your shoes, if allowable.
- Ask the boater to open compartments so you can see all bait wells, live wells, equipment lockers and verifiable ballast tank.
    - If the watercraft has standing water in the bait well or in any container, the inspector should work with the boater to remove standing water from the watercraft using a pump, sponge, or towel. If the watercraft can't be drained, it should be decontaminated.

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- If the watercraft has a ballast system, inspect for standing water.
    - Request that the boater activate all discharge pumps and open any water restricting gates for the ballast system.
    - Inspect any accessible ballast tanks/bags through ballast ports.
        - Refer to decontamination procedure for reference on how to address standing water in ballast systems:
- If the watercraft has an inboard or I/O engine, inspect the engine compartment and its bilge. Have the operator run the bilge pump, if applicable. These engines do not drain fully and may require a standing water decontamination prior to launching.
- If the watercraft has any sea strainers or water filtration devices, request that they be removed by the boat owner. Inspect all sea strainers once removed from the watercraft. Have the boat operator re-install the strainers following inspection.

Step 6: Closeout

- Remind the boater to replace bilge plug prior to launch. The boater is responsible to ensure the watercraft is watertight before launching.
- Ensure the drive unit has been raised to avoid damages during transport.
- Seal and Receipt
    - If working at a lake or reservoir, encourage the boater to get an exit inspection with a seal and receipt upon exit to make the inspection process much quicker next time around.
    - If working at an off-water location, apply a seal and provide the boater a seal receipt.
- Ensure all inspectors have completed inspection and that nothing was found.
- Provide the boater with any additional educational materials.
- Thank the boater for their efforts to Clean, Drain, and Dry.
- Yell "Stand Clear" to ensure the safety of staff and the public.
- Complete the WID Activity Log or submit the mobile application record.

Exit Inspection Step-By-Step Procedure—Prevention Waters

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Exit Inspections are performed at lakes, rivers, and reservoirs only. It is critically important to make an additional educational contact with the boater reinforcing that watercraft should be clean, drain and dry in between each use. It also verifies that the boater has followed the proper procedures to clean off the watercraft and completely drain all compartments prior to leaving. Repeat the primary educational message Clean, Drain, Dry and explain why boaters need to do it each time they use their watercraft.

The priority for exit inspections is to inspect for invasive species, drain water, remove plants, and apply a seal and receipt to the watercraft. Perform the exit inspection below to ensure the watercraft leaves clean and drained to the best of the inspector's ability.

Step 1: Greeting, Safety and Educate the Boater

- Introduce yourself.
- Inspectors should ask the driver to turn off the engine, put on the parking brake and step out of the vehicle.
- Provide a brief verbal explanation of the purpose of the exit inspection.
- Provide guidance on Clean, Drain, and Dry practices.

Step 2: Initial Assessment

- Record on the Activity Log or in the Mobile Application (Data Collector) the following information:
    - Outgoing
    - Boat Registration or HIN Number
    - Boat Trailer License Plate
    - Boat Type

Step 3: Live Aquatic Bait

- Ask if they have live aquatic bait.
    - If yes, follow bait procedure in the decontamination chapter.
    - If not, continue with inspection.

Note: *Some jurisdictions may not have the authority to inspect for live aquatic bait.*

Step 4: Perform the visual and tactile exit inspection of the watercraft, using the acronym H.E.A.D. to ensure that the watercraft is properly inspected.

Hull and Trailer—Rapid Exterior Inspection

- Look over (visual) and feel (tactile) the entire watercraft on both sides of the hull and trailer.
- Physically inspect the through hull fittings.
- Check trailer bunks or rollers, tire wells, lights and electrical.
- Remove any plants or plant fragments that are present.
- Ask the boater to remove the bilge plug to drain the watercraft when inspecting the transom.
- Physically and visually inspect the bilge area and use a flashlight to visually see if any AIS or standing water are present.
- If applicable, have the boater activate the bilge pump.
- If the watercraft has an inboard engine, be certain to carefully inspect the prop, prop shaft and rudder.
- Inspect intakes for ballasts, engines, and other interior compartments.

Note: *Through hull intakes and discharge ports will be a good indicator that more complicated systems may be onboard.*

Engine or Motor

- Visually and physically inspect the drive unit with a flashlight when it is in trailer mode (up).
- Ask for the outboard or I/O to be lowered.
- Visually and physically inspect the gimbal area of the outboard or I/O with a flashlight.
- Visually and physically inspect the transom or rear of the boat and any attached instruments including but not limited to:
    - Pitot tubes, trim tabs, transducers, etc.
- Ask the boater to raise the drive unit to avoid damage during transport.

Anchor and Equipment Checked

- Ask to see the anchor and anchor line or chain.
- Visually and physically inspect the anchor and line or chain for mud, plants, and/or AIS.
- Ensure all water related equipment is clean and dry including but not limited to:
    - Bait buckets, water toys, fenders, auxiliary pumps, etc.

Drain and Check Interior Compartments

If all interior compartments cannot be fully inspected from outside the watercraft, you will need to enter the watercraft to inspect interior compartments that could hold standing water. Ensure that the watercraft is drained to the best of your ability.

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- Ask for permission to board the watercraft and ask the boater to climb in first. Follow the boater into the watercraft the same way they entered. Be careful to prevent either the boater or inspection staff from falling or getting hurt. Always maintain three points of contact with the watercraft and never jump off. Ask the boater if they would like you to remove your shoes, if allowable.
- Ask the boater to open up compartments so you can see all bait wells, live wells, equipment lockers and verifiable ballast tanks. The inspector should work with the boater to remove standing water from the watercraft using a pump, sponge, or towel. Ensure that the compartments are drained to the best of your ability. Remind the boater to dry at home.
- If the watercraft has a ballast system, inspect for standing water.
    - Request that the boater activate all discharge pumps for the ballast system.
    - Inspect any accessible ballast tanks/bags through ballast ports.
- If the watercraft has an inboard or I/O engine, inspect the engine compartment and its bilge. Have the operator run the bilge pump, if applicable.
- If the watercraft has any sea strainers or water filtration devices, request that they be removed by the boat owner. Inspect all sea strainers once removed from the watercraft. Recommend sea strainers remain out during transport.

Step 5: Apply Seal and Provide Valid Receipt

- Properly apply a seal to watercraft and trailer.
- Provide a copy of the seal receipt properly filled out.
- Explain that the seal is valid only if the receipt is kept and the seal remains intact.

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Step 6: Closeout

- Ask the boater to leave the bilge plug out during transport to ensure extra dry time. Many states require drain plugs to be out while transporting the watercraft.
- Ensure the drive unit has been raised to avoid damage during transport.
- Ensure all inspectors are finished looking at the watercraft and that nothing was found.
- Provide the boater with any additional educational materials.
- Thank the boater for their efforts to Clean, Drain, and Dry.
- Yell "stand clear" to ensure the safety of staff and the public.
- Complete the WID Activity Log or submit the mobile application record.

Important Notes for ZQM Containment Reservoirs

At containment reservoirs, it is recommended that all boats be inspected upon exit. The main focus of containment is to make sure adults, settlers, or veligers in standing water do not leave the reservoir on a watercraft.

The difference between containment and prevention exit procedures is that at containment reservoirs the priority is finding adults or settlers, draining standing water and performing decontaminations, in addition to ensuring that no plants, mud, or animals leave the lake or reservoir on or in watercraft.

The goal for containment waters is such that exiting boats get a thorough and complete inspection and are issued a seal and a receipt. If the watercraft can't be drained during the exit inspection, and is intended to launch in a different location next, it should get a standing water decontamination prior to leaving.

All watercraft using ZQM Containment waters should be recorded in the Regional WID Data Sharing System.

If at any point AIS are found, or the watercraft can't be drained, the boat should be sent to decontamination.

Exit Inspection Step-By-Step Procedure—Containment Waters

Exit inspections verify that the boater has followed the proper procedures in cleaning the watercraft and completely draining all compartments prior to leaving. It is critically important to make additional educational contacts with the boater to reinforce the message that it is the boater's responsibility to ensure the watercraft is clean, drain and dry in between each use.

The priorities for exit inspections are to inspect the watercraft and trailer for invasive species, drain water, and decontaminate if necessary. Watercraft exiting infested waters should (1) be recorded in the Regional WID Data Sharing System, (2) have a seal applied to the boat securing it to the trailer, and (3) provided a receipt to the boater. Perform the exit inspection below to ensure the watercraft leaves clean and drained to the best of the inspector's ability.

Step 1: Greeting, Safety and Educate the Boater

- Introduce yourself.
- Inspectors should ask the driver to turn off the engine, put on the parking brake and step out of the vehicle.
- Provide a brief verbal explanation of the purpose of the exit inspection.
    - Be sure to inform the boater that they are leaving a containment water and what species are present.
- Provide guidance on Clean, Drain, and Dry practices.

Step 2: Initial Assessment

- Record on the Activity Log or in the Mobile Application (Data Collector) the following information:
    - Outgoing
    - Boat Registration or HIN Number
    - Boat Trailer License Plate
    - Boat Type
- Ask the boater "where are you going to launch next?"

Step 3: Ask About Live Aquatic Bait, if applicable

- Ask the boater if they have live aquatic bait.
    - If yes, follow bait procedure in the decontamination chapter.
    - If not, continue with inspection.

Note: *Some jurisdictions may not have the authority to inspect for live aquatic bait.*

Step 4: Perform the visual and tactile exit inspection of the watercraft, using the acronym H.E.A.D. to ensure that the watercraft is properly inspected.

Hull and Trailer—Rapid Exterior Inspection

- Look over (visual) and feel (tactile) the entire watercraft on both sides of the hull and trailer.
- Physically inspect the through hull fittings.
- Check trailer bunks or rollers, tire wells, lights and electrical.
- Remove any plants or plant fragments that are present.
- Ask the boater to remove the bilge plug(s) to drain the watercraft when inspecting the transom.
- Physically and visually inspect the bilge area and use a flashlight to visually see if any AIS or standing water are present.
- If applicable, have the boater activate the bilge pump.
- If the watercraft has an inboard engine, be certain to carefully inspect the prop, prop shaft and rudder.
- Inspect intakes for ballasts, engines, and other interior compartments.

Note: *Through hull intakes and discharge ports will be a good indicator that more complicated systems may be onboard.*

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Engine or Motor

- Visually and physically inspect the drive unit with a flashlight when it is in trailer mode (up).
- Ask for the outboard or I/O to be lowered.
- Visually and physically inspect the gimbal area of the outboard or I/O with a flashlight.
- Visually and physically inspect the transom or rear of the boat and any attached instruments including but not limited to:
    - Pitot tubes, trim tabs, transducers, etc.
- Ask the boater to raise the drive unit to avoid damage during transport.

Anchor and Equipment Checked

- Ask to see the anchor and anchor line or chain.
- Visually and physically inspect the anchor and line or chain for mud, plants, and/or AIS.
- Ensure all water related equipment is clean and dry including but not limited to:
    - Bait buckets, water toys, fenders, auxiliary pumps, etc.

Drain and Check Interior Compartments

If all interior compartments cannot be fully inspected from outside the watercraft, you will need to enter the watercraft to inspect interior compartments that could hold standing water. Ensure that the watercraft is drained to the best of your ability.

- Ask for permission to board the watercraft and ask the boater to climb in first. Follow the boater into the watercraft the same way they entered. Be careful to prevent either the boater or inspection staff from falling or getting hurt. Always maintain three points of contact with the watercraft and never jump off. Ask the boater if they would like you to remove your shoes, if allowable.
- Ask the boater to open up compartments so you can see all bait wells, live wells, equipment lockers and verifiable ballast tanks. The inspector should work with the boater to remove standing water from the watercraft using a pump, sponge, or towel. Ensure that the compartments are drained to the best of your ability. Remind the boater to dry at home.
    - If the watercraft cannot be drained, it should be decontaminated.

- If the watercraft has a ballast system, inspect for standing water.
    - Request that the boater activate all discharge pumps and open any water restricting gates for the ballast system.
    - Inspect any accessible ballast tanks/ bags through ballast ports.
    - If the ballast system cannot be fully drained, it should be decontaminated.
- If the watercraft has an inboard or I/O engine, inspect the engine compartment and its bilge. Have the operator run the bilge pump, if applicable. These engines do not drain fully and may require a standing water decontamination.
- If the watercraft has any sea strainers or water filtration devices, request that they be removed from the watercraft by the boat owner. Inspect all sea strainers once removed from the watercraft. Recommend sea strainers remain out during transport.

Step 5: Apply Seal and Provide Valid Receipt

- Properly apply a seal to watercraft and trailer.
- Provide a copy of the seal receipt properly filled out.
- Explain that the seal is valid only if the receipt is kept and the seal remains intact.

Step 6: Closeout

- Ask the boater to leave the bilge plug out during transport to ensure extra dry time.
- Ensure the drive unit has been raised to avoid damage during transport.
- Ensure all inspectors have completed inspection and that nothing was found.
- Provide the boater with any additional educational materials.
- Thank the boater for their efforts to Clean, Drain, and Dry.
- Yell "stand clear" to ensure the safety of staff and the public.
- Complete the WID Activity Log or submit the mobile application record.

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Additional Considerations for Inspecting a Personal Watercraft (PWC)

Personal Watercraft (PWC) have a unique configuration and specific components that require additional considerations when performing an inspection. While the majority of the inspection procedure is unchanged when inspecting a PWC, the following modifications to the visual and tactile inspection of the watercraft should be implemented to ensure a fully cleaned, drained, and dry watercraft.

Perform the visual and tactile inspection of the watercraft, using the acronym H.E.A.D. to ensure that the watercraft is fully inspected.

Hull and Trailer—Rapid Exterior Inspection

- Look over (visual) and feel (tactile) the entire watercraft on both sides of hull and trailer.
- Physically inspect the through hull fittings.
- Check trailer bunks or rollers, tire wells, lights and electrical.
- Inspect the intake grate on the underside of the PWC.
- Remove any plants or plant fragments that are present.
- Ensure the boater has removed the bilge plug(s) when inspecting the transom. There are often two bilge plugs on a PWC—one on each side of the jet.
- Physically and visually inspect the bilge area (e.g. feel the bilge area) and use a flashlight to visually see if any ANS are present.
- If applicable, have the boater activate the bilge pump.

Jet Engine

- Visually and physically inspect the jet (steering nozzle) with a flashlight.
- Visually and physically inspect the transom or rear of the watercraft with a flashlight.
- Stand clear and ask the operator to start the PWC.
- Once started, have the operator rev the engine 2–3 times to ensure the engine and exhaust cooling systems are free of water.
- If water is expelled from the jets during this process the watercraft should be sent for decontamination.

Anchor and Equipment Checked

- Ask to see the anchor and anchor line or chain.
- Visually and physically inspect the anchor and line or chain for mud, plants and/or AIS.
- Check any additional equipment such as life vests, buoys, paddles, ropes, nets, etc.
- Ensure all equipment is clean and dry.

Drain and Check Interior Compartments

- Ask the operator to raise the seat of the PWC.
- Inspect the engine compartment for mud, water, plants and mussels using a flashlight.
- Ask the boater to open the compartment in front of the handlebars.
- Inspect the engine compartment for mud, water, plants and mussels using a flashlight.
- If the watercraft has standing water in either of these compartments, the inspector should work with the operator to remove standing water from the watercraft using a pump, sponge, or towel. If the watercraft cannot be drained, it should be decontaminated.
- Ensure that the compartments are fully drained to the best of your ability prior to launch.

Rules for Standing Water

It is imperative that standing water be drained from watercraft to prevent the movement of microscopic mussel larvae or veligers, plant fragments, diseases, and other animals from being transported. Inspectors need to pay careful attention to any compartment that cannot be completely drained and therefore may contain standing water. Zebra and quagga mussel veligers are microscopic and can be transported in water, capable of surviving up to 27 days in watercraft compartments.

There are two types of water on boats:

Verifiable Water—This is water in compartments that you can see, feel, or visually inspect, such as in wells or bilges. This is the majority of water on the boats you will inspect.

Unverifiable Water—This is water in compartments that you **cannot** see, feel, or visually inspect. Ballast, I/O engines, and Inboard engines all carry unverifiable water.

Rule #1—Watercraft from ZQM Containment Waters

If the watercraft has been in suspect, positive, or infested waters and has any standing water, it is recommended to send the watercraft to decontamination.

Especially in cases where the watercraft has an I/O or Inboard engine, or a ballast tank or bag, it is wise to send the watercraft to decontamination and thoroughly flush those compartments.

Rule #2— Watercraft with Verifiable Water

Watercraft should be clean, drained, and dry in between each use. Incoming watercraft that is not sealed from unknown sources should be clean, drained, and dry. Sponge, pump, or towel out standing water, or decontaminate, prior to allowing launch.

On exit from prevention waters, drain to the best of your ability including pulling water drain plugs and remind the boater to dry.

Rule #3—Watercraft with Unverifiable Water (e.g. Ballast, I/O, and Inboard Engines)

Follow the procedures A–C below for boats with unverifiable water in ballast tanks

A. Watercraft without a seal and receipt should get a standing water decontamination.

B. Watercraft returning to the same location with a seal and receipt must be drained and should not require decontamination.

C. Watercraft moving between prevention (negative) waters with a seal and receipt must be drained and should not require decontamination.

Educate all boaters to get seals and receipts when exiting the WID Station!

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Live Aquatic Bait

What are the rules about live aquatic bait?

Some regulations prohibit live aquatic bait use, while others require that all live aquatic bait be purchased from an authorized bait dealer and need to be accompanied by a dated receipt. Inspectors must learn the specific bait rules for your site.

Out of state bait is typically not permitted for use.

When the boater leaves the WID station, encourage him/her to properly dispose of bait in the trash, never in the water. Completely drain the live/bait well and any other containers. Inspectors may need to sponge or hand pump the water from the live/bait well out so that no water leaves the WID station.

What options does the angler have if the live aquatic bait is not allowed?

If the live aquatic bait is not allowed, the angler has a few options:

- Leave the bait in the car or truck.
- Dispose of the bait in the trash.
- Go fishing at a different lake or reservoir where that bait is allowed.

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Reporting

All persons have a duty to immediately report suspect or known AIS to state wildlife agency. If you see something you think is an AIS while you are working or playing in the outdoors, please report it.

WID Reporting

System users will send data from the mobile app into the online database via cellular or MiFi. For assistance with the System (web or mobile application), please contact the Istonish help desk at helpdesk@istonish.com or 1-888-390-7275.

If you suspect that there is an AIS on a watercraft or in the reservoir (e.g. unidentifiable bumps on a boat or plants/animals in the reservoir), it is recommended that you collect the specimen, properly document, and report prior to decontamination. See the next chapter for detailed procedures regarding suspect watercraft and intercepting "mussel boats". You or your supervisor should notify the State AIS Program immediately via email, text or phone call. Documentation, samples, and photographs should be sent in to the appropriate office within 24 hours.

Full Decontamination:

- Report
- Document
- Collect
- Decontaminate
- Re-Inspect

Do not allow a known mussel boat to leave the WID Station without decontamination. Call law enforcement officers if the boat operator is not compliant and you need help!

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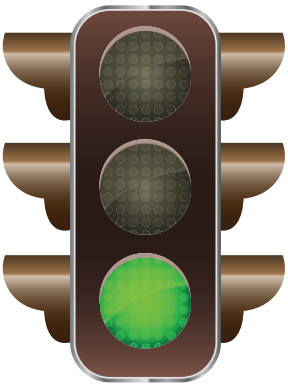
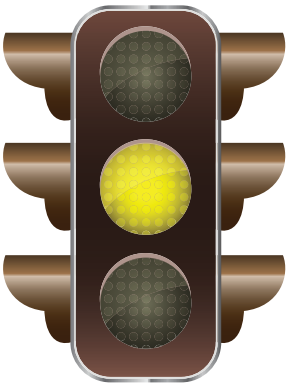
Outdoor Small Group Session—Inspection Practice

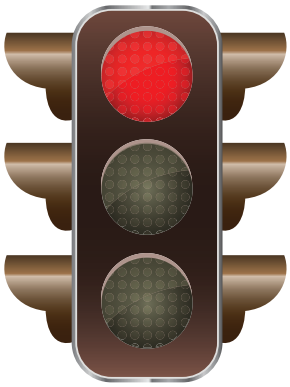
Practice performing inspections and learn the protocols and procedures. Work in small groups of 2–3 people: Inspector, Boater, and Observer.

- The Inspector should use the Data Collector or Activity Log.
- The Boater should answer questions following the scenarios below.
- The Observer should use the Quality Control Form.

Once the practice inspection is complete, the Observer can report back to the group what the inspector did well and what needs to be improved upon. Then switch jobs until each group member has been an Inspector, Boater, and Observer.







Outdoor Hands-On Inspection Practice—Boater Scenarios

BOATER #1

The last place you were boating is Lake Tahoe. You have not been out of the state in the last 60 days. You have not been to any suspect, positive or infested waters in the last 60 days. You have been inspected before but are not well educated. You have no live aquatic bait. You have no ballast tanks.

BOATER #2

The last place you were boating is Blue Mesa Reservoir. You have not been out of the state in the last 60 days. You have not been to any suspect, positive or infested waters in the last 60 days. You have been inspected before and appear to be well educated. You have no live aquatic bait. You have no ballast tanks.

BOATER #3

The last place you were boating is Sylvan State Park in South Dakota. Let the boat inspector ask you **BOTH** questions to learn that your last boating place was out of state. You have not been to any suspect, positive or infested waters in the last 60 days. You have never been inspected before. You have no live aquatic bait. You have no ballast tanks.

BOATER #4

The last place you originally say you were boating at is Lon Hagler Reservoir (there is no WID station there). In the last 60 days you claim to have boated at Chatfield, Elephant Butte, Lake John, Eleven Mile, Glendo, McPhee, and Wild Horse (four different states). You later change your story and tell the inspector that you were really at Lake Mojave last weekend. You appear very well educated about boat inspections and AIS—almost too well educated as if you are trying to avoid an inspection or decontamination by hiding the fact that you were at Lake Mojave. You have no live aquatic bait. You have no ballast tanks.

BOATER #5

The last place you were boating is Crater Lake. You have not been out of state or to any suspect, positive or infested waters in the last 60 days. You have wild harvested crayfish with no receipt in standing water in your live well. You have no ballast tanks. Your boat is really dirty, crusty, and slimy.

Chapter 4 Review Questions

1. Our goal as inspectors for every boat is no _____ , _____ , _____ , and _____.

2. Rank the following in order of priority as an inspector (1–5, with one being most important).

   _____ Drain _____ Inspect—Assess Risk _____ Safety

   _____ Educate the Boater _____ Decontaminate

3. Name three items that are recommended equipment for an inspector during an inspection.

   _____

4. Circle true or false for the following statements about green seals.

   a. A seal means go! True or False

   b. A seal is proof of prior inspection. True or False

   c. It may speed up your entry to the next water. True or False

   d. You do not have to stop at the inspection station and have the seal and receipt verified. True or False

   e. You will be allowed to launch if the watercraft is clean and dry. True or False

   f. If the watercraft is not clean and dry, you will most likely get re-inspected. True or False

5. As a civilian inspector you have the authority to:

   a. Impound watercraft

   b. Order a decontamination

   c. Search watercraft for alcohol and drugs

   d. Perform an inspection or decontamination with the permission of the operator

   e. None of the above

6. Which of the following is a way to remember how to do the hands-on part of an inspection?

   a. **H.E.A.D.**—**H**ull/Trailer, **E**ngine/Motor, **A**nchor and Anchor Rope, **D**rain Interior Compartments

   b. **B.O.A.T.**—**B**ait, **O**utboard, **A**nchor, **T**ransom

   c. **F.I.S.H.**—**F**ront, **I**nterior, **S**ails, **H**andrails

   d. **C.D.D.**—**C**lean, **D**rain, **D**ry

7. At containment waters, if the inspector can't get all of the water out of the boat upon exit, they should perform a _____

_____

8. Which boat(s) should get a mandatory decontamination after boating in a containment reservoir? (circle all that apply)
   a. Boats with verifiable water that you can easily sponge out.
   b. Boat with unverifiable water in a single ballast tank.
   c. A canoe with an electric motor.
   d. A cabin cruiser that has an inboard engine.

9. When should you ask to see the anchor?
   a. Only when the boater does not have a seal.
   b. Only when you see fishing poles on the boat entering the reservoir.
   c. Every time a boater enters or leaves your location, even when they have a seal attached.
   d. Never. Checking anchors is not part of the inspection process.

10. Boats with unverifiable water (ballast, I/O, inboards) should get a standing water decontamination if they do not have a valid seal and receipt. True or False

11. What should you do if you suspect you have a mussel boat? (circle all that apply)
   a. Report
   b. Document
   c. Collect
   d. Decontaminate
   e. Panic

12. Name the three roles of the inspector and decontaminators:
   1. _____
   2. _____
   3. _____

13. WID Trainers educate boat inspectors and decontaminators. It is the job of the inspectors to train whom?
    a. Boaters
    b. Anglers
    c. Members of the Public
    d. All of the Above

14. Why is it important to drain water from boats and leave plugs out during transport?
    a. To help with the drought and combat climate change.
    b. To stop the spread of microscopic mussel veligers, plant fragments, and other hitchhikers from moving in water and invading new locations.
    c. To reduce the amount of gas/diesel needed to haul the conveyance.
    d. None of the above.

15. What are the names for the two types of water found on boats?
    a. Fresh water and salt water
    b. Distilled water and spring water
    c. Dirty water and clean water
    d. Verifiable water and unverifiable water

16. Watercraft with ballast tanks, I/O, and Inboard engines should get a standing water decontamination leaving containment waters if they intend to go somewhere else next. True or False

17. Which of the following watercraft are considered "High Risk"? (Select All That Apply)
    a. A boat that does not have a seal and receipt.
    b. A boat that was in Lake Powell last week and was not decontaminated.
    c. A boat that was in Lake Mead six weeks ago and was decontaminated.
    d. A paddleboard that was last used in the same water body.

Level 1—Test Out Now!

Level 2—You Have Homework!

Memorize the Inspection Procedures

Answer All Questions at the End of Chapters 1–4

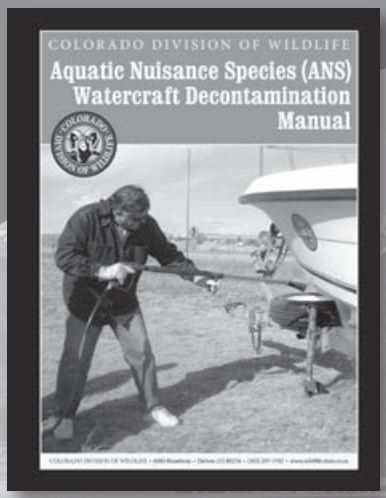
Outdoor Demonstration—Exit Inspection

What Did You Observe?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____

Chapter 5

Content updated from the *CDOW Aquatic Nuisance Species (ANS) Watercraft Decontamination Manual, 2011*



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We do not endorse any products or brands pictured or mentioned in this manual.

Revised December 2021

Decontamination

Chapter 5: Decontamination

Why watercraft decontamination?

Invasive species, such as ZQM, are able to travel great distances over land by "hitchhiking" on watercraft. They can survive up to 30 days out of water depending on temperature or humidity. Through a comprehensive education, inspection, and decontamination program, we can stop the spread of these costly invasives in the West. Once detected on watercraft, ZQM and other AIS can safely and effectively be killed and removed from the watercraft by certified personnel. The Western Regional Panel, and most western states, follow the Uniform Minimum Protocols and Standards (UMPS), which requires the use of hot water with high or low pressure to decontaminate boats, motors and engines, trailers, personal gear, and other equipment. The objective of decontamination is to **kill** and **remove**, to the extent practical, all mussels or suspected AIS. Killing AIS prevents establishment of new populations as a result of watercraft and equipment transfer.

When may decontamination be required?

Most inspections will not result in a decontamination being performed. However, there are numerous circumstances that may result in a decontamination being performed:

- If ZQM are found attached to a watercraft.
- If any other AIS is positively identified or suspected on a watercraft.
- If suspect unidentifiable bumps are detected on a watercraft.
- If the watercraft is from a suspect, positive, or infested water and has any water in it and has not been decontaminated.
- If the watercraft has unverifiable water (e.g. ballast tank, inboard or inboard/outboard engine) and does not have a seal and receipt.
- If the watercraft or trailer has plants attached that can't be removed by hand.
- If the watercraft has live aquatic bait without a valid receipt.
- If the inspector deems a decontamination is necessary.

What does watercraft decontamination generally consist of?

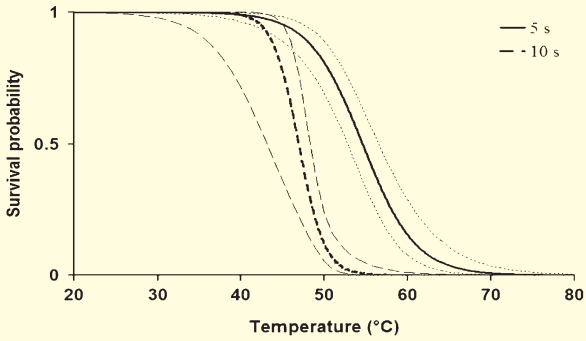
Watercraft decontamination consists of a very hot water rinse or spray at high or low pressure. There are no soaps, bleaches, or chemicals used or recommended at this time. The hot water kills the ZQM and other AIS, and the high pressure spray removes them from the watercraft.

The protocol is to use 140°F water at high pressure (3,000 psi) to decontaminate the hull and 140°F water at low pressure to decontaminate motors/engines. Interior compartments are decontaminated with 120°F at low pressure.

Figure 1 tells us that a 140°F (60°C) hot water rinse for ten seconds will kill all adult mussels. A 176°F (80°C) rinse for five seconds will kill all adult mussels. Higher temperatures are not recommended for the protection of the watercraft.

FIGURE 1

This graph shows the relationship between hot water temperature, time of rinse and survival probability of adult mussels.

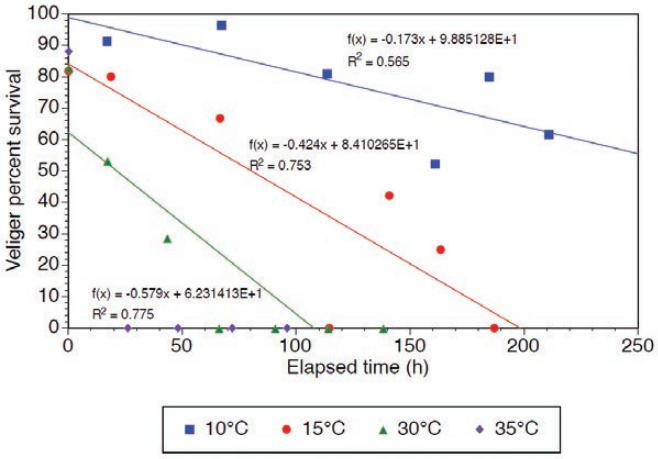


Morse, John T.(2009) 'Assessing the effects of application time and temperature on efficacy of hot-water sprays to mitigate fouling by Dreissena polymorpha (zebra mussels Pallas)', Biofouling, 25:7, 605-610

Figure 2 shows that there was 0% survival of quagga mussel veligers in water temperatures of 95°F (35°C). Therefore, the reduced temperature of 120°F for interior compartment standing water decontaminations for the protection of the watercraft is more than sufficient to kill veligers in those interior compartments. This research reinforces the importance of standing water decontaminations for boats leaving listed waters, even if no adults or settlers are found on the vessel, because it proved that veligers can live in standing water for up to 24 days at 50°F (10°C), 8.5 days at 59°F (15°C) or 4.5 days at 86°F (30°C).

FIGURE 2

The graph below shows the combined effects of time and temperature on the percentage survival of quagga mussel veligers held at 10, 15, 30, and 35°C (50°F, 59°F, 86°F and 95°F).



Christopher D. Craft and Christopher A. Myrick, Ph.D. (2011) Evaluation of Quagga Mussel Veliger Thermal Tolerance Final Report, prepared for Colorado Division of Wildlife, Invasive Species Program, p. 19.

What are the types of decontaminations?

There are four different types of watercraft decontaminations. Each of these will be described in greater detail later in the chapter.

STANDING WATER DECONTAMINATION

This procedure is performed to kill veligers or other microscopic AIS in standing water that can't be fully drained from the watercraft. This type of decontamination applies to engines and interior compartments that contain water or have equipment that has come in contact with the water body. The interior compartments include but are not limited to: live wells, bait wells, bilge areas, anchor lockers, equipment storage, sea strainers, and ballast tanks. Equipment includes but is not limited to: anchor, mooring and anchor lines, PFD's, swim platform, inflatables, down-riggers planning boards, water skis, wake boards, ropes, ice chests (used for bait or for holding fish), fishing gear, drift socks, bait buckets, and stringers. Standing water decontamination also includes flushing the outboard motor, I/O engine, or inboard engine of a watercraft.

Standing water decontamination is recommended if the:

- Watercraft did not get a decontamination when leaving a suspect, positive, or infested water body and has **ANY** water in it.
- Watercraft has unverifiable water (ballast, I/O or inboard engines) and does **NOT** have a valid seal and receipt.
- If the watercraft is unable to be fully drained and the water can't be sponged, toweled or pumped out.

The standing water decontamination procedure requires that temperature ratings are taken into account when flushing or rinsing a compartment for standing water. Some, but not all, marine pumps are rated to withstand temperatures above 140°F. If the pump is rated to a lower temperature and is flushed with 140°F water, damage could occur. For this reason, the procedure requires applying 120°F in all interior compartment flushes or standing water decontaminations. Standing water decontaminations of engines are performed at 140°F at low pressure.

PLANT DECONTAMINATION

This decontamination is performed whenever plant material cannot be removed from the watercraft or trailer by hand. The hot water application is localized and requires using 140°F hot water for 15 seconds directly on the plant material.

BAIT TREATMENT

This procedure prevents the potential transfer of AIS being used as bait and as contaminants in standing water in a bait well or bucket.

FULL DECONTAMINATION FOR SUSPECTED OR KNOWN ZEBRA AND QUAGGA MUSSELS

This procedure is performed when adult or settler ZQM, unidentifiable bumps, or other AIS are detected on the watercraft. This decontamination is the most complicated of the four types and ensures that the boat has been completely decontaminated inside and out. The inspector should take photos and collect samples for identification prior to doing a full decontamination.

In rare instances, you may require the assistance of law enforcement personnel to decontaminate, quarantine, or impound a boat. A few of the situations that would require a law enforcement officer to assist include an uncooperative boat owner, an unavailable or broken decontamination unit, or instances in which an inspector simply can't get a fully encrusted watercraft decontaminated.

Where should watercraft decontamination stations be located?

Watercraft inspection, draining, and decontamination should be located in the same general area. The location should be far enough from the water or boat ramp that drained bilge, ballast, well water, and water from the decontamination unit can't flow into the water body. WID Stations are ideally on an access road where all boats pass prior to launch and after exiting the boat ramp. The station should be far enough away from the ramp to allow users, especially overnight campers, to move through the interior of the property or park without going through the inspection and decontamination station unnecessarily.

Decontaminations should be conducted "high and dry," away from the water. The minimum requirements for decontamination unit placement include:

- Must be in a location where the water does not run off into the reservoir or lake.
- Should be on semi-permeable surface (gravel or dirt) where water absorbs into the ground or evaporates off.
- Should be in a location where the inspector can maintain visual and auditory contact with the inspection station (which in many instances is the boat ramp but not always).
- Should be in a secure facility where the decontamination unit is locked up over night or when inspectors are not present.
- Should be protected from the elements—rain, wind, excessive cold or heat.
- Must be in compliance with all waste water disposal requirements in local and state laws and regulations.

When should a water containment pad be used?

If a suitable site (high and dry, away from the water source, and on a semi-permeable surface) is not available, or you are using a large enough amount of water that it is not absorbing into the ground and is ponding, you will be required to use a water containment pad to ensure waste water is collected and properly disposed of.

What are the minimum requirements for a decontamination unit?

- Operating temperature recommendations are no greater than 120°F internal or 140°F external/ engines at the point of contact with fluctuation less than 2 degrees.

  Note: *Operating temperatures must be constantly checked to ensure proper performance at the above specifications.*

- Minimum flow of five gallons per minute.
- 3,000–3,500 pounds per square inch
- Proper attachment tools, including 40-degree angle nozzles

Please refer to the Decontamination Unit Minimum Standards (WRP, 2019) and the Trailer Decontamination Unit Specifications (WRP, 2019) for more complete information on decontamination units.

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What are the standard operating procedures for a decontamination unit?

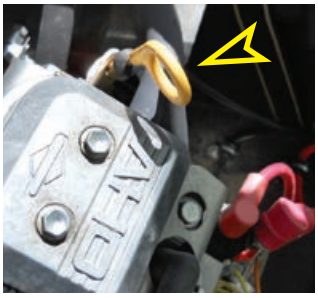
Be sure to follow the manufacturer's standard operating procedures specific to your decontamination unit.

Step-by-Step Operating Instructions for Trailered Hydro Tek Decontamination Units

BEFORE START UP

1—Check pump oil. Check pump oil by locating the yellow oil dip stick on top of the pump.

2—Check fluid levels. Check engine oil by locating the yellow dip stick on the engine. Check the gasoline and diesel fuel levels in the tank.



3—Roll out the hose all the way and and double check all quick connects.

4—Connect the water supply and turn water on. Maintain an adequate supply of water using a ¾ inch I.D. hose with a pressure between 25 and 60 psi. Burner power switches should be off before starting. If the decontamination unit is tank fed, be sure there is water in the tank and the valve is switched for supply tank feed. **Do not run dry.**

OPERATION

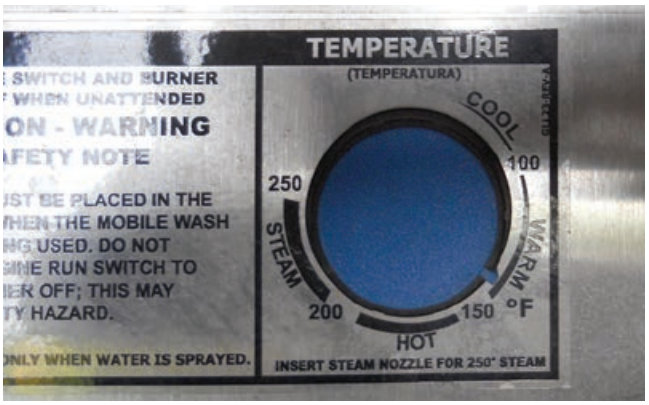
1—Starting. Pull out choke and turn the key to start position only until engine starts. Push the choke in immediately after engine starts.

2—Purge air from system. Squeeze the trigger on the spray gun until a constant stream of water comes out.

3—Select desired nozzle. Connect a 40° nozzle securely to the spray wand. Hold the gun firmly, squeeze the trigger for high-pressure spray.

CAUTION: gun kicks back—hold with both hands.

4—Start the burner. To create hot water on high pressure washers equipped with heat exchangers, release the trigger on the gun, turn the burner to the "on" position, and turn the thermostat to the desired temperature.



Squeeze the trigger on the spray gun and the burner will begin heating the water. The burner will stop heating the water whenever the water spray is off or if the temperature setting is exceeded.

Be sure to test the water temperature prior to decontaminating to ensure you are working at the correct temperature for that procedure (either 140°F or 120°F).

5—Bypass mode. System will go into bypass mode when the machine is left running and the trigger gun is released. Bypass mode is when the inlet water coming into the pump re-circulates through the unloader across the pump head. If left in bypass too long—more than one minute—friction created by the movement of the water will begin to heat the water at a rapid rate. If equipped with a bulk water tank, water can be bypassed back through the tank allowing for a larger volume of water to be re-circulated through the pump head, thus reducing heat on the pump seals.

WARNING: Do not leave in bypass for longer than one minute to prevent the pump from overheating. Shut off the unit when not spraying water.

6—Perform appropriate decontamination procedure.

SHUT DOWN

WARNING: Cool down the burner before shutting off the decontamination unit.

1—Turn the burner switch to the off position.

2—Squeeze the trigger on the spray gun until the water becomes cool.

3—Turn the engine switch off.

4—Turn off water supply.

5—Squeeze the trigger to release any trapped pressure in discharge hose.

6—Drain water out of the hose and roll up.

7—Disconnect attachments and store properly.

What is included in the decontamination procedures?

To ensure that zebra and quagga mussels and other AIS are killed and removed, watercraft decontamination procedures include:

SAFETY!

Keep staff and the public safe by wearing all personal protective equipment including a heat resistant suit, taking care to avoid slips, trips, falls, and burns. Use caution when operating the high pressure spray wand.

EDUCATION

Explain to the boater why decontamination is important and why we are doing it. You can direct them to the *Western States Boat Inspections* brochure and have them read it in a safe location while you perform the decontamination.

REMOVAL

All mud, plants, water, and organisms must be removed from the vessel.

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DECONTAMINATION

Thoroughly flush the interior compartments and spray the exterior of the watercraft with hot water.

- All discharge ports or through hull fittings should be flushed with **120°F** water at **low pressure** for one minute or until the water back flushes.
- All interior compartments that may hold water, including, but not limited to: live/bait wells, ballast, bilge areas and intakes should be flushed at **low pressure** with **120°F** water.
- If a bilge pump is present, then it must be run until the bilge appears to be empty.
- The lower unit of the engine should be thoroughly flushed with **140°F** water at **low pressure** until exiting water temperature is 140°F.
- The gimbal area must be sprayed with **low pressure 140°F** water for 2 minutes.
- The exterior of the watercraft and trailer must be thoroughly decontaminated with **140°F** water with **low** and **high pressure**.

When doing a full decontamination for suspect or known AIS, be sure to fill out all required paperwork, take photos before and after decontamination, collect samples, and do a thorough inspection both before and after the decontamination.

BAIT

Depending on the location and type of live aquatic bait, the inspection or treatment will vary. See the bait section later in this manual.

REPORT

Report a mussel boat to your supervisor. Inspectors should report all suspect mussel boats and/or full decontaminations to the State AIS Program office immediately. Inspectors should also fill out the full decontamination workflow in the mobile app and submit that record electronically at the time of interception and/or decontamination. Photos can be emailed and samples mailed with paperwork to the appropriate lab within 48 hours.

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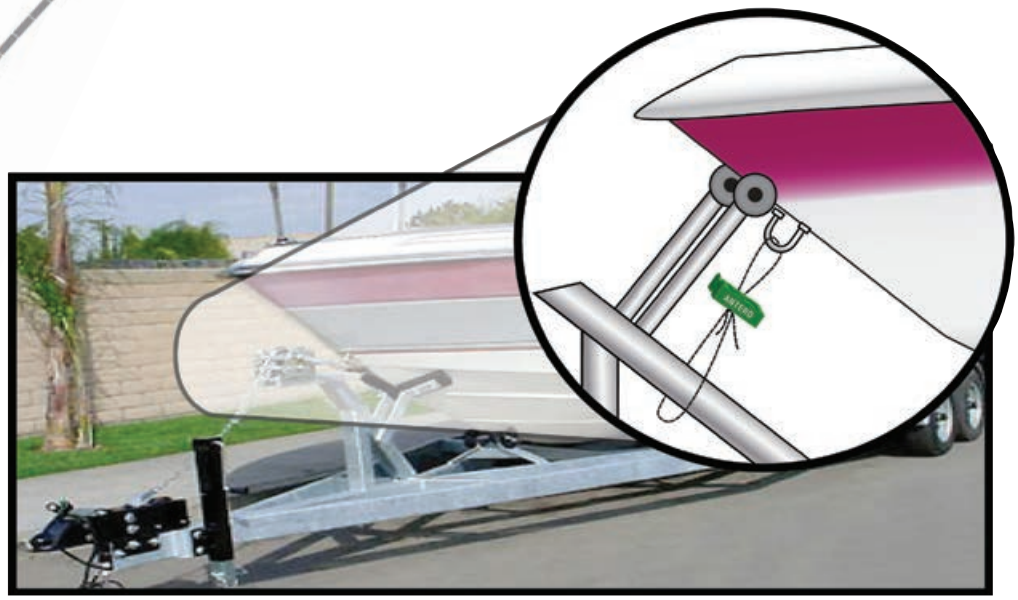
All other decontaminations are documented in the Data Collectors or the Activity Log.

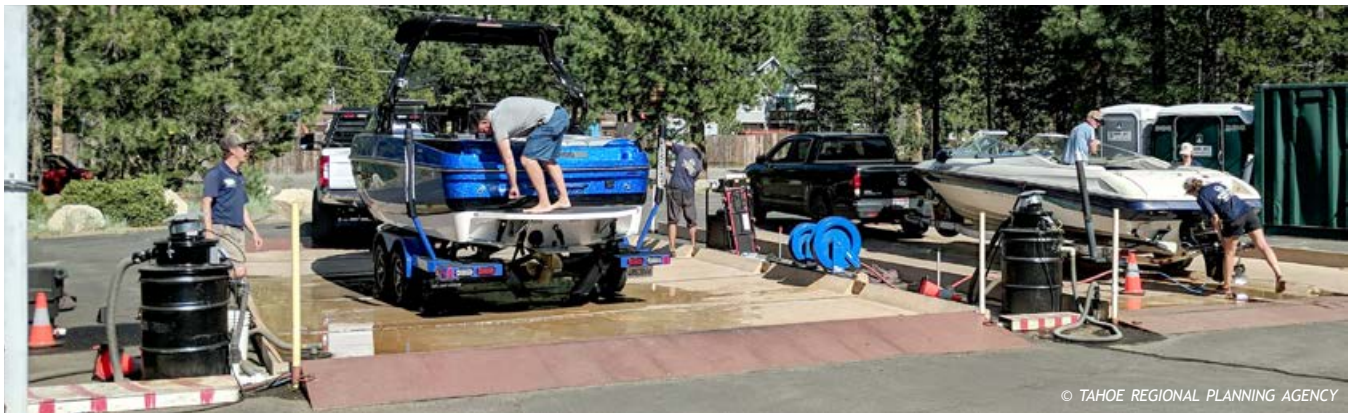
SEALS AND RECEIPTS

If the boat is leaving your site following any decontamination, apply a seal and give the boat operator a receipt. Write in notes section if anything wasn't working—for example, if a flush wasn't done because the engine battery was dead.

What is the procedure for standing water decontaminations?

Zebra and quagga mussels start off life as microscopic, free-floating organisms called veligers that are too small to see with the naked eye. They can be transported to new locations in standing water in live wells, bilge areas, and other interior compartments on boats. ZQM aren't the only unseen invasive species. Others, such as the waterflea, are also microscopic and transported in water from the lake or reservoir. Small plant fragments that get sucked up in water onto the boat could start a new infestation in another lake. To prevent the overland movement of all invasive species through standing water on boats, the lake or reservoir water must be





fully drained out of the boat in between each use. If the standing water cannot be fully drained, the compartment needs to be decontaminated.

This procedure is used to force potentially infested water out of the boat while killing veligers and other AIS in the water. The water must reach 120°F coming out of the boat for interior compartments, or 140°F for engines and motors. The high pressure wand is never used in this procedure.

If boats have been drained to the fullest extent possible and still contain standing water in the bilge, ballast tanks, live/bait wells, or engines, then you will need to follow the guidance below to determine if decontamination is required.

- A boat from suspect, positive or infested water that was not decontaminated upon exit and has **ANY** standing water present, should be decontaminated. This includes water in ballast tanks, inboards, and I/O engines.
- For an undocumented boat (no seal and receipt) with unverifiable water (ballast tanks, inboards and I/O engines), a standing water decontamination is recommended.
- If a boat has small amounts of standing water and the boat has **not** been in suspect, positive or infested waters, inspectors must still remove the water from the boat. The inspector should have a small pump and sponges/towels available at the inspection station to assist with the draining of boats. If using these tools does not ensure a fully drained vessel (e.g. gravity emptied live wells with long discharge hoses) then the interior compartments with water remaining should be flushed with 120°F water.

Be cautious with out of state boats because some states do not have extensive sampling programs focused on early detection. We do not know which lakes are or are not infested in those states. If a watercraft from out of state has standing water that can't be removed (e.g. unverifiable water) it should get a standing water decontamination.

Interior compartments that may hold water, including, but not limited to live/bait wells, ballast, anchor compartments, bilge areas and their corresponding intake ports, should be flushed with 120°F water at **low pressure**. This can be accomplished by using the diffuser attachment.

Due to research findings about ballast, bilge, and live/bait well pumps it is important to adjust the temperature of the decontamination unit to 120°F to ensure that no damage is done to the pump during the decontamination process.

Note: *Prior to decontaminating interior compartments with pumps, be sure that you have tested the temperature of the water to ensure that your unit is operating at 120°F and verify using a digital thermometer that the water reaches 120°F exiting the boat. Engines and motors are flushed using 140°F low pressure hot water.*

What are pump temperature ratings?

Pump manufacturers were consulted during the drafting of these procedures. In rare occasions, marine transfer pumps could be damaged by the use of hot water temperatures during the decontamination process. The following is a list of some popular manufacturers, pump types and their recommended temperature ratings. Due to the complexity of pumps and the various brands and ratings, it is required that interior compartments are decontaminated at 120ºF with low pressure which is sufficient to kill ZQM veligers and settlers.

Pump Temperature Rating Table

Manufacturer	Temperature Rating
Atwood Corporation	130°F
Johnson Pumps of America	170°F
SHURflo Pumps	140°F
ITT Manufacturers	120°F

Step-by-Step Procedure for Standing Water Decontaminations

STANDING WATER DECONTAMINATION OF INTERIOR COMPARTMENTS (NOT BALLAST)

1—Put on all required personal protective equipment.

2—Have the boat operator open all interior compartments that need to be decontaminated.

3—Start the decontamination unit following the standard operating procedures.

4—Turn on the burner and measure the temperature of the water.

- 120°F exit temperature
- Low pressure

5—If equipped with a discharge pump, fill the compartment until the pump is submerged. Make sure to keep the tip of the diffuser close to the sides of the compartment to prevent temperature loss. Have the boater turn on the discharge pump for the compartment and measure the temperature of the water at the through hull discharge port. Once the exit temperature has reached 120°F, have the boater turn off the discharge pump.

6—Remove drain plugs and continue flushing until the exit temperature of the water maintains 120°F.

7—Allow the compartment to drain.

8—Turn off the decontamination unit when you have completed decontaminating all necessary interior compartments. Turn the burner off first, run water through the boiler and then turn off the decontamination unit. Follow the standard operating procedures for shutting down your decontamination unit.

9—In your data collector, indicate "Standing Water Decontamination" under the "Results" section. Indicate which components were decontaminated.

10—If exiting, apply a seal and give the boater a properly filled out receipt. Remind the boater to clean, drain, and dry.

• 140°F exit temperature
• Low pressure

STANDING WATER DECONTAMINATION OF OUTBOARD MOTORS AND INBOARD/OUTBOARD ENGINES

Outboard Motor

Inboard/Outboard Engine

All decontamination stations should have at least two models of decontamination muffs; a type for the newer Mercury engines that threads through the intake ports that are completely open; and another clamp style muff for all other engines.

1—Attach the whip hose to the end of the trigger and attach the muffs to the whip hose.

2—Make sure the motor/engine is completely lowered. Place the muffs so that all the intake openings are completely covered.

3—Put on all required personal protective equipment.

4— Start the decontamination unit following the standard operating procedures.

5—Start the water by engaging the trigger. Check to make sure the intake openings are still covered on both sides and that the muffs are tight.

6—Stand clear of the propeller and have the boat operator start the motor/engine in **Neutral**.

Note: *If operating in colder climates, allow the engine to warm up by running water through prior to starting the burner.*

Note: *If the engine is not uptaking water when it is turned on in neutral, turn off the boat engine, release the trigger, and re-adjust the muffs.*

7—Start the burner and flush the engine until the water temperature maintains 140°F when measured by a thermometer at the discharge port(s).

8—Have the boat operator turn off the motor/engine.

9—Remove the muffs and allow the motor/engine to drain; have the boat operator raise the engine.

10—Turn off the decontamination unit by turning the burner off first, run some water through the boiler and then turn off the decontamination unit. Follow standard operating procedures for shutting down your decontamination unit.

11—In your data collector, indicate "Standing Water Decontamination" under the "Results" section. Indicate which components were decontaminated.

12—If exiting, apply a seal and give the boater a properly filled out receipt. Remind the boater to clean, drain and dry.

Note: *Do not utilize salt water flush ports on outboard engines for decontamination.*

Note: *Some complex marine propulsion systems require specialized equipment and procedures to be decontaminated. Please consult with your supervisor if you are uncertain.*

- 140°F exit temperature
- Low pressure

STANDING WATER DECONTAMINATION OF INBOARD ENGINES

Note: *Most inboards, but not all, that have the engine in the center of the boat do not have ballast tanks.*

All inboard intakes, which are located on the bottom of the hull directly under the engine, have a cover over the opening that protects the engine from sucking up large particulates.

1—Attach the whip hose to the gun and then attach the fake-a-lake.

2—The fake-a-lake must be placed securely against the bottom of the hull covering the intake port for the inboard

3—Put on all required personal protective equipment.

4—Start the decontamination unit following the standard operating procedures.

5—Start the water by engaging the trigger. Visually confirm the fake-a-lake did not shift.

6—Stand clear of the propeller and have the boat operator start the engine in **Neutral**.

Note: *If operating in colder climates, allow the engine to warm up by running water through prior to starting the burner.*

Note: *If the engine is not uptaking water when it is turned on in neutral, turn off the boat engine, release the trigger, and re-adjust the fake-a-lake.*

7—Start the burner and flush the engine until the water temperature maintains 140°F when measured by a thermometer at the discharge port(s).

8—Have the boat operator turn off the engine.

9—Remove the fake-a-lake from under the boat.

10—Turn off the decontamination unit by turning the burner off first, run some water through the boiler and then turn off the decontamination unit. Follow standard operating procedures for shutting down your decontamination unit.

11—In your data collector, indicate "Standing Water Decontamination" under the "Results" section. Indicate which components were decontaminated.

12—If exiting, apply a seal and give the boater a properly filled out receipt. Remind the boater to clean, drain and dry.

Note: *Some inboard engines are equipped with flushing ports. Consult your supervisor before utilizing these flushing ports.*

Note: *Some complex marine propulsion systems require specialized equipment and procedures to be decontaminated. Please consult with your supervisor if you are uncertain.*

Step-by-Step Procedure for Standing Water Decontaminations (cont.)

STANDING WATER DECONTAMINATION OF BALLAST TANKS AND BAGS

Note: *Most inboards, but not all, that have the engine in the center of the boat do not have ballast tanks.*

- 120°F exit temperature
- Low pressure

1—Attach the whip hose to the end of the wand and then attach the fake-a-lake.

2—Put on all required personal protective equipment.

3—Request that the boater discharge all water from the ballast system.

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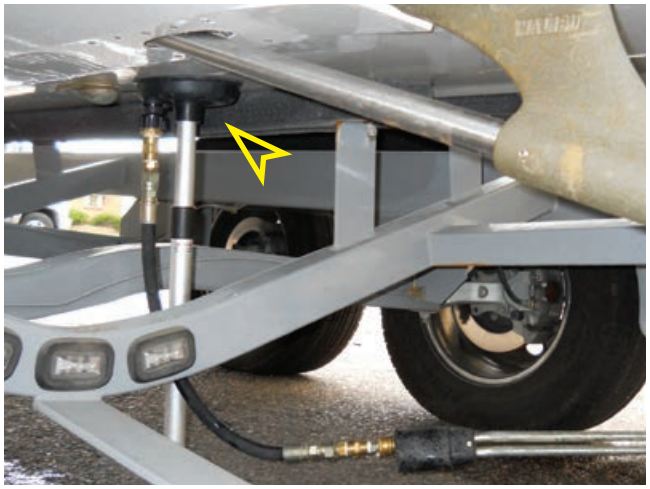
4—Identify which ballast intakes go to which ballast tanks/bags prior to initiating decontamination.

5—The fake-a-lake must be placed securely against the bottom of the hull covering the intake port for the ballast tank or bag.



6—Start the decontamination unit following the standard operating procedures.

7—Start the water by engaging the trigger. Visually confirm the fake-a-lake did not shift.

8—Start the burner and have the boat operator turn on the corresponding intake ballast pump. Fill up the ballast tank/bag until the gauge at the helm reads a minimum of 25% utilizing 120ºF. If there are no gauges, allow the tank to fill for a minimum of 3 minutes.

Note: *If the ballast pump is not uptaking water when it is turned on, turn off the pump, release the trigger, and re-adjust the fake-a-lake. If this does not resolve the issue, consult with your supervisor.*

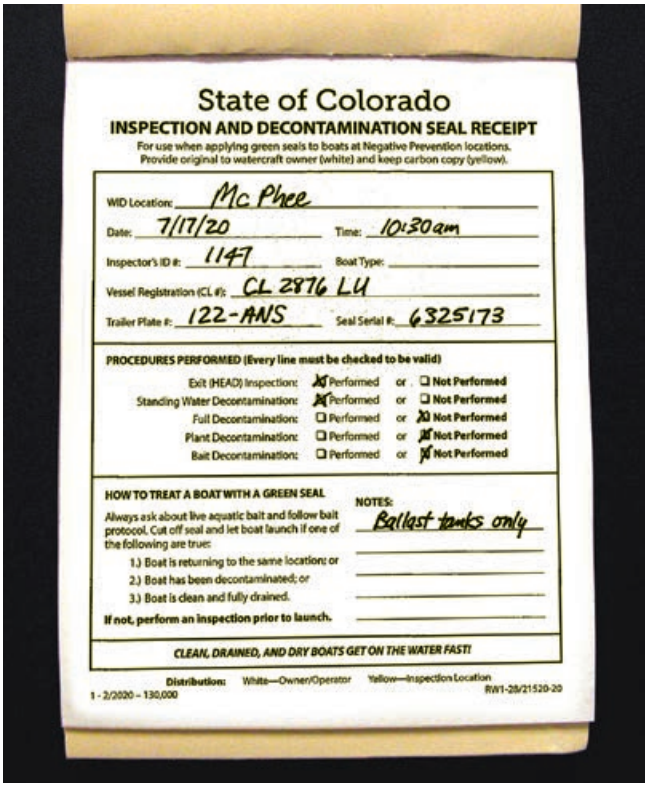
9—Have the boat operator turn off the intake ballast pump. Release the trigger to stop the water flow. Allow the water to rest (marinate) for a minimum of 3 minutes.

10—Have the boat operator discharge the water. If the discharge water is 105ºF or greater this bag/tank is complete. Have the operator continue to run the discharge pump to drain the tank as much as possible. If conditions are not met drain bag/tank and repeat steps 8-10.

11—Repeat this process for EACH ballast tank/bag. Ensure each tank/bag has been exposed to 120ºF water.

12—In your data collector, be sure to mark "Standing Water Decontamination" under the "Results" section. Indicate which components were decontaminated.

13—If exiting, recommend sea strainers remain out during transport, apply a seal and give the boater a properly filled out receipt. Remind the boater to clean, drain, & dry.



State of Colorado

INSPECTION AND DECONTAMINATION SEAL RECEIPT

For use when applying green seals to boats at Negative Prevention locations.
Provide original to watercraft owner (white) and keep carbon copy (yellow).

WID Location: Mc Phee
Date: 7/17/20 Time: 10:30am
Inspector's ID #: 1147 Boat Type:
Vessel Registration (CL #): CL 2876 LU
Trailer Plate #: 122-ANS Seal Serial #: 6325173

PROCEDURES PERFORMED (Every line must be checked to be valid)

Exit (HEAD) Inspection:	☒ Performed	or	☐ Not Performed
Standing Water Decontamination:	☒ Performed	or	☐ Not Performed
Full Decontamination:	☐ Performed	or	☒ Not Performed
Plant Decontamination:	☐ Performed	or	☒ Not Performed
Bait Decontamination:	☐ Performed	or	☒ Not Performed

HOW TO TREAT A BOAT WITH A GREEN SEAL

Always ask about live aquatic bait and follow bait protocol. Cut off seal and let boat launch if one of the following are true:

1.) Boat is returning to the same location; or
2.) Boat has been decontaminated; or
3.) Boat is clean and fully drained.

If not, perform an inspection prior to launch.

NOTES: Ballast tanks only

CLEAN, DRAINED, AND DRY BOATS GET ON THE WATER FAST!

Distribution: White—Owner/Operator Yellow—Inspection Location

1 - 2/2020 - 130,000 RW1-28/21520-20

If you have a "mussel boat" and are doing a full decontamination, fill up each ballast tank to 100% capacity and drain it twice with hot water at 120ºF.

All other scenarios, ballast tanks will be flushed until the decontamination water temperature exiting the watercraft is 120ºF.

What is the procedure for plant decontamination?

True aquatic plants are defined as plants that are normally completely or mostly submerged in water and are unable to survive for long periods outside of water. Submerged aquatic weeds are commonly transported via watercraft and trailers, usually by getting tangled around motors, engines, and anchors. Most aquatic weeds can establish new populations with only a tiny fragment of the parent plant. Those tiny fragments can be carried overland on watercraft, trailers, anchors, fishing equipment, water ski equipment, etc. It is the inspector and the operator's responsibility to ensure plants are not transported on boats.

During the entrance and exit inspection, any plant or plant fragment should be hand removed and properly disposed of away from the lake or reservoir by the inspector or boat operator. However, there may be a situation when plant material is caught between the hull of the vessel and the trailer bunk or roller, or is wrapped around the propeller or transducer, and can't be completely removed by hand.

It is mandatory for the boat inspector to decontaminate those areas of the vessel where the plant fragments remain. **Remember**—heat kills.

Step-by-Step Procedure for Plant Decontamination

1—Put on all required personal protective equipment.

2—Start the decontamination unit following the standard operating procedures.

3—Apply low pressure 140°F water directly to the plants or plant fragments for 15 seconds.

4—Decontaminate areas where plants are located and can't be removed:

If plant material is found on a boat with ballast tanks, the tanks should be flushed to eliminate possible fragments within.

a. **Trailer's carpeted bunk.** Use 140°F water at low pressure. Move the wand/diffuser **slowly** along the length of the bunk. Keep the tip of the wand/diffuser close to the bunk to maintain an even temperature for at least 15 seconds.

- 140°F exit temperature
- Low or high pressure
- 15 seconds

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b. **Trailer's frame, and rollers.** Use 140°F water at high pressure. Move the wand/diffuser **slowly** along the length of the trailer. Keep the tip of the wand/diffuser close to the trailer to maintain an even temperature for at least 15 seconds.

c. **Propeller.** Use 140°F water at high pressure. Be thorough and remove 100% of the plant material. In order to avoid excess splashback when decontaminating the propeller, the decontaminator can turn the wand handle one quarter turn away from him/herself to lower the pressure.

d. **Transducer.** Use 140°F water at low pressure. The wiring and "water wheel" attached to this instrument dictate that low pressure is used in order to prevent damage.

e. **Interior compartments.** Follow standing water decontamination procedure.

5—Turn off the decontamination unit by turning the burner off first, run some water through the boiler and then turn off the decontamination unit. Follow standard operating procedures for shutting down your decontamination unit.

6—In your data collector, be sure to mark "Plant Decontamination" under the "Results" section. Indicate which components were decontaminated.

7—If exiting, apply a seal and give the boater a properly filled out receipt. Remind the boater to clean, drain, & dry.

Remove all plant material and dispose of it in the trash. If a complete removal is not possible, decontaminate the sections of the watercraft that are affected.

Note: *Some watercraft are complex and may require specialized equipment or procedures to be decontaminated. Please consult with your supervisor if you are uncertain.*

What is the procedure for a live aquatic bait treatment?

Please ask your supervisor when a bait treatment would be required based on laws and regulations.

If a vessel has live aquatic bait in a container or a well with standing water, ask the boater for a bait receipt.

In places where live bait is allowed, the inspection or treatment will vary depending on the location and type of bait.

Out-of-state bait is typically not permitted for use.

When the boater leaves your waters, encourage them to properly dispose of bait in the trash, never in the water. Completely drain the live/bait well and any other containers. You may need to sponge or hand pump the water from the live/bait well out so that no water leaves your site.

What options does the angler typically have if the live aquatic bait is not allowed? If the live aquatic bait is not allowed, the angler has a few options:

- Leave the bait in their car or truck.
- Dispose of the bait in the trash.
- Go fishing at a different lake or reservoir where that bait is allowed.

Step-by-Step Procedure for Bait Treatment

As much as possible, **minimize transferring water to the holding container**. The live/bait well or container should be drained and decontaminated using 120°F low pressure water before the bait is restocked in the container that has been re-filled with water from the lake the boat will be entering. If a decontamination unit is unavailable or not working properly, completely dry out the original container using a paper towel or cloth. If exiting, do not allow water from any reservoir, especially a containment reservoir, to leave in a bait bucket or live well.

- 120°F exit temperature
- Low pressure

1—Using a net, transfer the bait to a holding container filled with reservoir water. Minimize the transfer of water from the original container as much as possible.

2—Drain the original container or compartment (e.g. live well).

3—Put on all required personal protective equipment.

4—Start the decontamination unit following the standard operating procedures.

5— Start the water by engaging the trigger. Flush the live/bait well, compartment or container with low pressure until the exit temperature of the water reaches 120°F. Be sure to keep the tip of the attachment close to the sides of the compartment to prevent temperature loss. If using the wand, be sure to **remove the nozzle** so that you are using low pressure.

- If there is a discharge pump for the live/bait well, you can use a thermometer and measure the temperature exiting the through hull discharge port for that compartment.

6—Turn off the decontamination unit by turning the burner off first, run some water through the boiler and then turn off the decontamination unit. Follow standard operating procedures for shutting down your decontamination unit.

7—Whenever possible, water from the reservoir the boat is entering should be used for restocking the bait. Do not use tap water, as chlorinated water can kill live aquatic bait.

8—If exiting, the container or well water will be replaced with water from a sealed container or non-chlorinated source. Do not allow water from any reservoir, especially a containment reservoir, to leave in a bait bucket or live well.

9—Decontaminate all nets, buckets and equipment used with low pressure 120°F water at the end of the procedure.

10—In your data collector, indicate "Bait Treatment" under the "Results" section. Indicate which components were decontaminated.

11—If exiting, apply a seal and give the boater a properly filled out receipt. Remind the boater to clean, drain & dry.

Note: *Laws and regulations regarding the use of live aquatic bait vary by jurisdiction. Be sure to know the rules for the WID station where you are working.*

Note: *Some watercraft are complex and may require specialized equipment & procedures to be decontaminated. Please consult with your supervisor if you are uncertain.*

Full Decontamination for Suspect or Known Zebra or Quagga Mussels

- 120°F low pressure in interior
- 140°F low pressure on engine
- 140°F high pressure on exterior

If you suspect that you have found ZQM or another AIS, or you know you have a mussel boat, the following are the steps that you should perform. Even if only one single adult mussel shell is found, the watercraft should get a full decontamination. Any evidence or suspicion of adult or juvenile mussels should result in a full decontamination.

Remember it is recommended that you **report, document, collect, and decontaminate**. Follow these documentation and reporting procedures and do not allow the boater to leave with ZQM or other AIS attached to the boat.

If a watercraft is highly encrusted with zebra or quagga mussels, it can be quite difficult to effectively remove all the mussels from the watercraft. It can take several days for the dead mussels' byssal threads to detach and for gravity to pull them out of the watercraft. Always try to remove all mussels from the watercraft prior to releasing it. If a boat is too highly infested to fully remove mussels at the inspection station, make arrangements for the boat to be serviced at a certified marina or marine business prior to releasing it. If the boat owner is not cooperative, you will need

the assistance of law enforcement to quarantine or impound the watercraft or escort it to a certified marina or marine business to ensure all mussels are dead, removed, and not being transported illegally.

REPORT

Report your suspected AIS discovery immediately by calling your supervisor and notifying the State AIS Program.

The initial report can be brief but should include the following essential information:

- Date/Time
- Location—**both** the boat's current location and it's history (e.g. waters visited in the last 60 days)
- Home state of the boat
- Location where the boat became infested
- Suspected species of AIS
- Name of Reporter (Inspector)
- Name and contact information for the boat owner and the boat operator (if different)

DOCUMENT

1—Once mussels are found (or suspect mussels or other AIS), a full decontamination is required. You should first conduct a full inspection on the vessel to identify all areas that are infested. Be certain to fill out the Data Collector record completely and accurately. Be as detailed as you can and inspect every part of the boat.

2—Take **digital photos** of the entire boat before, during (if possible), and after the decontamination. Always have extra batteries ready for the camera, set the date on the camera, and practice taking close up photos.

- Start taking photos at the watercraft registration number and work your way around the boat to end at the same registration number. Note any damage or AIS on the boat. If available, take a video of the boat while you walk around it. Both video and photos are desired. Photograph an overview of the entire boat, the registration number, the rear of the boat (to verify the name of the boat), and note any areas where existing damage occurs on the boat, and the area(s) of the boat where the specimen is detected. End with a photo of the registration number. The standard number of photos is 10, but there is no maximum.
- For boats with gimbals (inboard, inboard/outboard, stern drives, etc.) get good photos of gimbal boots from several angles to document the before and after condition.
- Take **digital photos** of the AIS specimen. Take both far away and close up photos of the specimen on the boat. Take photos of where the specimens are located on the boat. There may be numerous places, so be sure to photograph each location. Change your camera setting to close up mode (icon is a flower) and then take close up photos. If specimen is a zebra or quagga mussel, try to get a good close up photo of the byssal threads. Next, place a common object such as a pencil or penny next to the specimen and photograph the combination to show the relative size of the specimen.
- **Photograph the watercraft after decontamination** in the same fashion and same locations as you photographed the boat before the decontamination.

3—In the Data Collector, be sure to accurately complete the data record for the full decontamination and submit.

Be sure to document specifically where the boat has launched, along with where it became infested and any waters it has launched in since infestation. If it is not known where it became infested, document all waters the boat visited in the last six months. Record as much information about the boat's history as possible.

COLLECT

After photographing the vessel, collect several **samples** of the mussels or suspect AIS. Make sure the photos are in focus and the suspect AIS is clearly visible before the samples are detached from the boat. If possible, take photos of the sample collection being performed. Be sure to properly preserve the samples. Check with your supervisor for the proper procedures for sample collection and where to send the sample for final identification. An example procedure is listed below for reference. After the sample is removed, take photos of the infested area.

1—Only fill 50% of the vial with 70% ethanol or grain alcohol, **not rubbing alcohol**. Even trace amounts of chlorine from tap water, or "de-chlorinated" tap water can completely destroy sample DNA. Collect as many specimens as will fit in the vial without it overflowing. It is ok to send more than one vial.

2—Tightly seal the vial. Write the date, location, and contact information on the vial's label. If there are numerous areas of attachment on the boat, take samples from each of those areas as well.

3—Place the vials in a Ziploc® bag and wrap in bubble wrap to help protect it during shipment.

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4—Complete the lower half of the *AIS Collection Form for WID Stations* and place in the padded envelop with the sample(s).

5—Overnight the envelope to the appropriate laboratory and notify them that a sample has been shipped.

6—Email or call the laboratory to notify them that the sample is being shipped.

DECONTAMINATE

For a full decontamination, all parts of watercraft that has come into contact with the water body must be exposed to hot water at the appropriate temperature and pressure to ensure the AIS are killed and removed.

WID stations should have a decontamination unit available. If you do not, and you know you have a mussel boat, call your Supervisor and/or the AIS Program Office for help and try not to allow that boat to leave without decontamination. If needed, ask a law enforcement officer (Wildlife Manager, Park Ranger, Sheriff, etc.) to escort the watercraft to a nearby WID station or to quarantine the vessel until a decontamination unit can be brought to you.

Similar to inspection, it is critically important that you perform full decontaminations in a standardized and repeatable fashion every single time. Use the acronym TIME to help you remember the order of a full decontamination. **Use your HEAD to inspect. Take your TIME to decontaminate.**

T—Through Hull Fittings

Flush all discharge ports with 120°F hot water at low pressure for one minute or until the water back flushes.

I—Interior Compartments

Bilge area and pump, live or bait wells and other interior compartments need to be flushed with 120°F water at low pressure. This includes soaking all

carpets, anchors, ropes, chains, gear, life jackets, fenders, sea strainers, drift socks, and other equipment that has come into contact with the water with 120°F water at low pressure.

M—Motor or Engine

The motor should be flushed with 140°F water at low pressure. The gimbal unit on an outboard or I/O must also be soaked. The engine compartment for an inboard should get a standing water decontamination.

E—Exterior

The hull needs to be first rinsed with 140°F water at low pressure to kill the AIS, and then sprayed with high pressure to remove any attached AIS. The trailer should be sprayed and carpets soaked with 140°F water. If the boat has an inboard engine, be sure to decontaminate the prop, prop shaft, and prop shaft support.

Only certified individuals should operate decontamination units. Personal and public safety should always be top priority. Never allow a member of the public, volunteer, or an untrained employee to decontaminate a boat. Be sure to document all procedures used to decontaminate the boat, including photographs or videos of the decontamination being performed.

It is recommended that you decontaminate in the following order:

a. Flush the **Through hull discharge ports**.

b. Flush the **Interior compartments on the boat**.

c. Flush the **Motor/engine**.

d. **Rinse the Exterior of the boat and trailer** with 140°F water to kill the mussels or AIS. **High pressure spray the hull** or infected areas to remove the mussels or AIS.

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Step-by-Step Procedure for Full Decontamination

Once the inspector has reported the suspect or known infested watercraft, completed the paperwork, taken before photographs, and collected samples, the watercraft is now ready to be decontaminated.

- 120°F low pressure in interior
- 140°F low pressure on engine
- 140°F high pressure on exterior

1—Put on all required personal protective equipment.

2—Connect the wand to the trigger to the whip hose.

3—Start the decontamination unit following the standard operating procedures.

4— Start the water by engaging the trigger. Check the temperature of the water and adjust the temperature depending on the procedure being performed at that time.

5—Before beginning decontamination, follow the boat owner into the boat. Work with the boater to prepare the interior compartments that need to be decontaminated. With help of the boat operator, identify the discharge ports for the interior compartments.

Remember the acronym **TIME** to guide you through the procedure:

6—T = Through Hull Fittings

Decontaminate the through hull discharge ports. Press the diffuser up against the opening of the through hull discharge ports and decontaminate each port with 120°F water under low pressure for one minute or until the water back flushes. Turn off the decontamination unit. (Turn the burner off first and then turn off the key.)

7—I = Interior Compartments

Decontaminate the interior compartments. Reposition the hose and wand to the forward interior compartments. Start the decontamination unit and work from the front to the back of the boat using low pressure 120°F water to decontaminate every compartment that has standing water or has equipment that has come into contact with the water body.

- If the boat has an inboard/outboard or inboard engine have the boater raise the lid of the engine compartment and place the wand behind the engine to decontaminate this area.

- Turn off the decontamination unit. After all interior compartments have been decontaminated have the boat operator activate the pumps to drain the interior compartments as much as possible.

8—M = Motor or Engine

Decontaminate the motor/engine. Turn the temperature of the unit to 140°F.

- ***Procedure for outboard motors and inboard/ outboard motors/engines.***
  - Have the boat operator lower the motor/engine to a vertical position. Attach the hose to the end of the wand using the quick connect fitting.

  - Attach the muffs to the hose and place over the intake holes on the lower end of the motor/engine.

  - Start the decontamination unit and start the water flowing through the muffs. Check to make sure the intake holes are completely covered. Have the boater start the motor/engine in **Neutral**. Run until the exiting water reaches 140°F. Turn off the decontamination unit.

  - The gimbal area of the inboard/ outboard engine must be soaked for a minimum of 2 minutes (it is important to do both a top flush and a side flush to ensure 100% mortality) with 140°F water under low pressure to ensure adequate exposure time.

- ***Procedure for inboard engines***
  - Find the engine inlet. This intake always has a screen cover and is located directly under the engine on the hull.

  - Attach the fake-a-lake to the hose. Adjust the fake-a-lake so that it covers the engine intake port.
  - Start the decontamination unit and start the water flowing. Have the boater start the engine in **Neutral**. Run until the exiting water reaches 140°F. Turn off the decontamination unit.

Step-by-Step Procedure for Full Decontamination (cont.)

- Flush the bilge with 120°F low pressure water.

  a. Make sure that the bilge plug, located in the center access area, is **in**.

  b. Add **4-5** gallons of water into the bilge by putting the wand (nozzle removed) down behind the engine next to the floor.

  c. Have the boat owner **remove** the bilge plug and continue to flush until the exiting water reaches 120°F. Don't stand in front of the discharge port—be aware the auto flow will come on.

- On an inboard engine, the strut bearing and the rudder port must be decontaminated.

  a. Flush the strut bearing with low pressure. Remove the adult mussels with plastic scrapers and then flush with low pressure 140°F. Use high pressure if attached mussels are found.

  b. Flush the rudder port.

9—E = Exterior

Decontaminate the hull and trailer. First, remove adult mussels with plastic scrapers or other tools. Next, rinse the hull and trailer with 140°F hot water at low pressure to kill the ANS.

Connect the 40° nozzle with the quick connect to the end of the wand so you can use high pressure spray to remove the ANS. Start the decontamination unit. Keep the wand at a 45° angle and work methodically in one direction. Do not use the wand to "scrub" the hull. Keep the tip of the wand approximately 6–12 inches away from the hull and trailer as you move around the boat. Water temperature decreases approximately 15 to 20° per foot of distance when sprayed from a power nozzle.

WARNING: Use low pressure on all carpeted areas, decals, electrical connections, gimbal area on the inboard/outboard engine, interior compartments, transducers, and depth sounders and their wiring.

On trailers, be sure to decontaminate the openings of the tubular frames.

Turn off the decontamination unit. Turn the burner off first, run some water through the boiler and then turn off the key. Follow the standard operating procedures for your unit.

9—The gimbal area of the inboard/outboard engine must be decontaminated for two minutes with 140°F water under low pressure to ensure adequate exposure time.

Step-by-Step Procedure for Full Decontamination (cont.)

10—Following full decontamination, give the boat some time to fully **drain**. In most cases of badly infested vessels, dead mussel shells will be released from the vessel and will drain out in the water following decontamination.

- If mussel shells are still coming out of the areas draining or can be seen in interior compartments, you will need to **re-flush** those areas to remove all mussels.
- Some jurisdictions may require a mandatory or voluntary dessication or drying time for infested watercraft following decontamination.

11—Conduct a final thorough inspection of the vessel. Be sure to check all areas that were previously noted as infested prior to inspection. Also check all other areas of the boat to be sure that there are no mussels (dead or alive) remaining on the vessel. Be as accurate as possible when checking the numerous areas of the boat. If staff allows, it is preferable that the second inspection following decontamination is done by someone other than the person who did the initial inspection and decontamination.

a. If there's any evidence that mussels or other AIS remain—begin decontamination again!

b. If it's a highly encrusted watercraft you may consider quarantining or impounding the watercraft (if you're authorized to do so) to allow the byssal threads to release and the mussels to be removed by subsequent decontaminations. You may also want to consider sending the boat with an escort to a certified marine business for servicing. If the boater is not cooperative with these options and you feel they are necessary, you may require the assistance of a law enforcement officer to order the quarantine or escort the watercraft to the dealer.

12—**Within 24 hours**—email the photos and mail the samples to the appropriate AIS office or laboratory.

13—If exiting, **apply a seal** and give the boater a properly filled out receipt. Be sure to fill out all procedures that were and were not performed on the seal receipt.

14—Remind the boater to clean, drain, and dry. Leave all water drain plugs out during overland transport.

15—In your data collector, indicate "Full Decontamination" under the "Results" section. Indicate which components were decontaminated.

16—If the boat is not being launched at the station where it was decontaminated, and the destination is known, send a Watercraft Movement Notice using the Data Collector.

17—If the boat has launched in any waters since becoming infested, notify those lake managers or state coordinators.

Full Decontamination
Temperature and Pressure Table

Area	Temp	Pressure	Time	Exit Temp
Through Hull Ports	120°F	Low	1 Minute	120°F
Interior Compartments, Carpeted Areas, Equipment	120°F	Low	130 Seconds	120°F
Motor	140°F	Low	130 Seconds	140°F
Gimbal	140°F	Low	132 Seconds	140°F
Hull, Trailer—to kill	140°F	Low	10 Seconds	N/A
Hull, Trailer—to remove	140°F	High, 45° angle	10 Seconds	N/A
Inboard—Prop Shaft Support/ Rudder	140°F	Low	10 Seconds	N/A
Inboard Engine Compartment	120°F	Low	130 Seconds	120°F
PFDs, Anchor, Line/Chain, Paddle, etc.	140°F	Low	10 Seconds	N/A

Standing Water, Plant, Bait
Decontamination Table

Treatment	Location	Temp	Pressure	Time	Exit Temp
Standing Water	Interior Compartments	120°F	Low	130 Seconds	120°F
Standing Water	Ballast Tank	120°F	Low	130 Seconds	120°F
Standing Water	Engine	140°F	Low	130 Seconds	140°F
Standing Water	Gimbal	140°F	Low	132 Seconds	140°F
Plant	Carpeted Bunks, Transducer	140°F	Low	15 Seconds	140°F
Plant	Frame, Rollers, Prop	140°F	High	15 Seconds	140°F
Bait	Interior Compartments or Live Wells	120°F	Low	130 Seconds	120°F

Source: UMPS IV

What if the boater will not allow an inspection or decontamination?

The goal is to gain the boater's support for the program and process. Do everything that you can to get the boater's approval to inspect the boat and decontaminate. If the owner is unwilling to cooperate, you may need the assistance of law enforcement officers to order decontamination, impound, or quarantine a boat.

GUIDELINES CONCERNING QUARANTINE DEPENDING ON YOUR LEGAL AUTHORITY:

- If a boater is entering a water body and there is no evidence of mussels or other AIS on the boat, and the boater refuses an inspection, the boat may be turned away but should not quarantined.
- If the boater is leaving a suspect, positive, or infested water body and the boater refuses an inspection, then the boat should be inspected prior to launching in another water body. If the boat owner is not compliant, call law enforcement to quarantine the vessel until proper inspection and/or decontamination can be performed.
- If suspected or known mussels or other AIS are present on a boat and the boater will not consent to an inspection or decontamination, or if decontamination equipment is not available or working, then the boat should be quarantined or impounded by law enforcement until decontamination can be performed.

Try not to let a vessel leave the inspection station without a law enforcement escort if it is infested or you suspect it is infested. If you are not able to safely detain the vessel until law enforcement can arrive, be sure to have all of the boater's information and a physical description of the boater, the watercraft, and the towing vehicle so an officer can follow up.

What options does the boater have if the decontamination unit is broken or if the WID station doesn't have a decontamination unit?

Possession of ZQM or other AIS is illegal. A boat is not allowed to transport ZQM or any AIS. If there is a reasonable belief that the watercraft has AIS present, call the nearest law enforcement officer (e.g. Wildlife Manager, Park Ranger, County Sheriff, etc.) and alert your supervisor. If ZQM are confirmed, try not to let the boat leave until law enforcement officials arrive. Options include:

- Quarantine the boat on site until a working decontamination unit can be brought there.
- Escort the boat to the nearest decontamination station.
- Direct the boater to the nearest decontamination station, although this option is not preferred.

Watercraft inspection and decontamination stations are placed at various locations throughout the U.S. For the most updated list of these sites, visit westernais.org.

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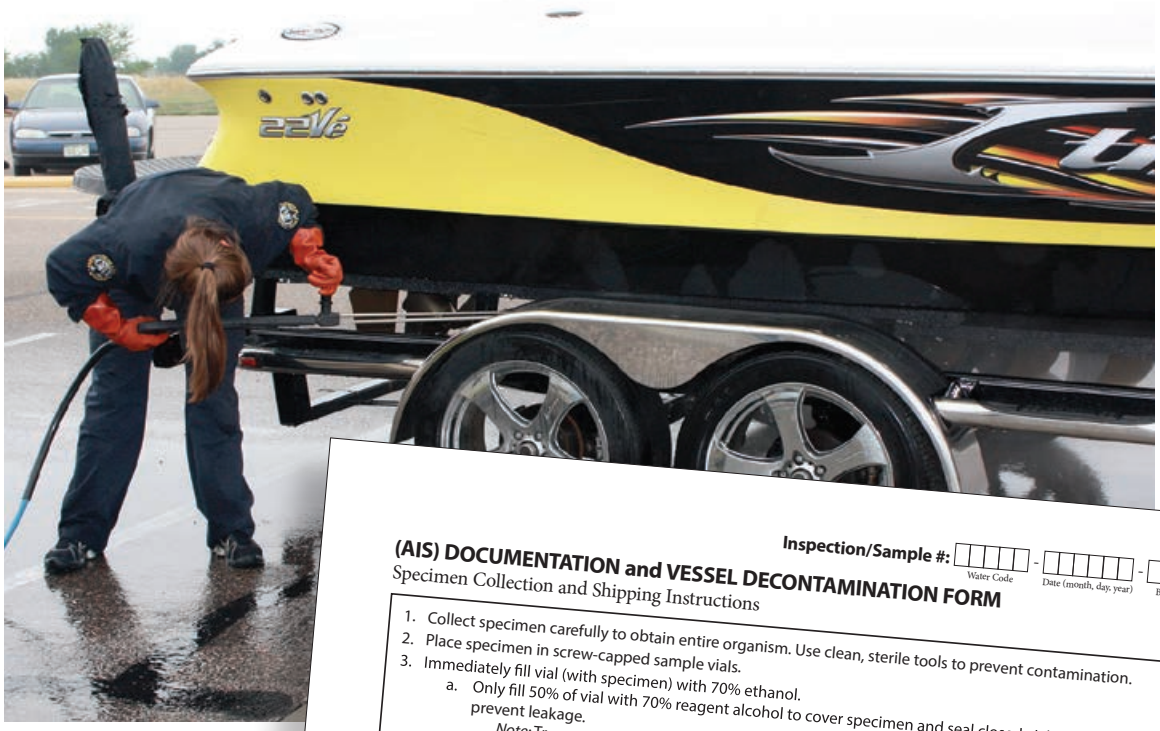


Inspection/Sample #: ☐☐☐☐☐ - ☐☐☐☐☐☐ - ☐☐☐☐☐☐☐☐
Water Code — Date (month, day, year) — Boat Registration Number

(AIS) DOCUMENTATION and VESSEL DECONTAMINATION FORM

Specimen Collection and Shipping Instructions

1. Collect specimen carefully to obtain entire organism. Use clean, sterile tools to prevent contamination.
2. Place specimen in screw-capped sample vials.
3. Immediately fill vial (with specimen) with 70% ethanol.
   a. Only fill 50% of vial with 70% reagent alcohol to cover specimen and seal closed vial with electric tape to prevent leakage.
   Note: Trace amounts of chlorine from tap water, or "dechlorinated" tap water can completely destroy sample DNA. Do **not** use formaldehyde.
4. Write the date, boat registration number and authorized location directly on the sample tube with alcohol resistant permanent sharpie marker.
5. Place sample tubes in Ziploc bag and wrap in bubble wrap.
6. Place Ziploc bag and the completed form below in bubble mailer or padded box.
7. Overnight sample the appropriate state authorized AIS Lab. (within 24 hours).
8. Email the lab to notify them that the sample is being shipped.
9. If you have questions, call your State AIS Program office.
10. Remember to disinfect all collection tools by soaking them with 140ºF hot water or storing them in acidic acid or vinegar solution.

▼ *Remove bottom half of page and include in mailer with vials being shipped to AIS Lab for analysis.*

SUSPECTED (AIS) COLLECTION FORM FOR WATERCRAFT INSPECTION STATIONS

Inspector's Name: _____

Inspector ID Number: _____ Email: _____

WID Station Supervisor Name: _____

Phone Number: _____ Email: _____

WID Station Name: _____

Address: _____

Date and Time of Collection: _____ Watercraft Registration Number: _____

Trailer Plate Number: _____ Watercraft Seal Code: _____

REASON FOR COLLECTION (check all that apply)

❑ Visual ID of AIS ❑ Bumps on Boat/Trailer ❑ Zebra or Quagga Mussels Attached ❑ Plants on Boat/Trailer ❑ Unidentifiable Organic Material

LOCATION OF SUSPECTED ANS PRIOR TO COLLECTION

❑ Watercraft Hull ❑ Motor ❑ Live Well ❑ Anchor ❑ Bilge ❑ Watercraft Interior

❑ In Lake/Reservoir ❑ Other: _____

Date Mailed: _____

▼ *Do Not Write Below Line:* ***For Lab Use Only***

Date Received at AIS Lab: _____ Unique ID #: _____

Date Identified: _____ Notes: _____

Technician: _____ Further Analysis Needed: _____

Collector Contacted with Results: _____

DISTRIBUTION: White—Statewide Invasive Species Coordinator Yellow—Inspection Location Pink—Owner/Operater

9/2021 14-EB2-2422/3079-14

Decontamination Unit Photo Glossary

Burner on/off switch—This switch activates the burner to heat the water. Squeeze the trigger on the spray gun and the burner will begin heating the water. It will stop firing whenever the water spray is off or if the temperature setting is exceeded. After turning the switch off, be sure to run water through the system to cool the boiler.

Choke—When first starting the decontamination unit, pull the choke out and turn the key until the engine starts. Push the choke in immediately after the unit starts.

Diffuser—This attachment connects directly to the spray gun and is used to decontaminate discharge ports, soak carpeted areas on the boat and/or trailer and standing water flushes for any interior compartments. It provides low pressure and a rubber tip to prevent scratching any surface.

Dual lance wand—This attachment connects directly to the spray gun. The other end has a quick connect fitting so that a nozzle or connecting hose can be "quickly" attached by pressing down the outer ring and pressing the "other half" of the quick connect fitting into its center. The handle, when turned clockwise, directs the water through the lance with the quick connect fitting only. If a nozzle is attached the water exiting the wand will be at high pressure. The handle, when turned counter clockwise, directs the water through both lances and lowers the pressure of the water. A dual lance wand can be used for low pressure standing water flushes if there is no nozzle attached and the water is exiting both lances.

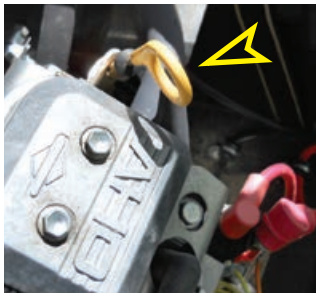
Fake-a-lake—This attachment is used for decontaminating inboard engines and ballast tanks. It has a telescoping leg and the hose attachment threads into the connection on the "plunger," joining the fake-a-lake to the hose to the wand.

Hose for connecting attachments—This six foot hose has a quick connect fitting that connects to the end of the wand. The other end threads into the fake-a-lake or muff attachments needed for a decontamination.

Muffs—Muffs are used to decontaminate the lower unit of an outboard motor or inboard/outboard engine. The muffs pictured at the top of the photo are used for all new models of the outboard motor and inboard/outboard Mercury engines that have open intake ports. The lower muffs are used on all other outboard and inboard/outboard motors or engines.

Nozzle and nozzle storage—The Nozzle Storage area shows the degree of the nozzle written below the nozzle and its spray pattern is shown above the nozzle. The preferred spray pattern is 40º. Nozzle color and degrees can vary by manufacturer. A nozzle is attached to the end of the wand with a quick connect fitting. Be sure the quick connect "clicks" into place when attaching the nozzle. Point the wand and nozzle towards the ground when you first engage the trigger to start the water. This is a safety issue and will ensure that no one or nothing will be hurt or damaged if the nozzle blows off the wand.

Oil dip-stick for the decontamination unit's engine—This should be checked prior to every use. Use 30-weight detergent oil to keep the oil reservoir topped off.



Oil dip-stick for the decontamination unit's pump—This should be checked prior to every use. Pump oil is used to keep the oil reservoir topped off.

Quick connect fitting—This fitting comes in two parts. The part that is attached to the end of the wand has to have the external circle pressed down before the "male" portion of the fitting can be inserted. The external circle then must "click" in place to make a proper connection.

Spray gun with trigger—This photo of the gun has the trigger held open. The wand or the diffuser attachment thread directly onto the gun.

CAUTION: The spray gun kicks back when the trigger is engaged—hold with both hands.

Thermometer—Thermometers are essential to the decontamination process. It is used to initially test the temperature of the water prior to the decontamination. It is also used to check the exiting water temperature when performing a standing water decontamination for interior compartments and engine flushes.

Thermostat—The thermostat allows the water temperature to be adjusted so that different decontamination temperature protocols and procedures can be adhered to by the inspector. Every machine's temperature is different depending on the altitude of its location and the temperature of the water in the tank. Be sure to test the temperature of the water with a thermometer prior to beginning and during all decontaminations.

Chapter 5 Review Questions—Decontamination

1. The goal of decontamination is to _____ and _____ AIS from a watercraft and trailer.

2. Although it is rare, we sometimes use chemicals to kill AIS during decontamination. True or False

3. What are the four types of decontamination and what are they used for?

   1. _____
   2. _____
   3. _____
   4. _____

4. Why is the location important when we perform decontaminations?

   _____

5. Put the following in the correct order when performing a full decontamination.

   1. _____ a. Document
   2. _____ b. Decontaminate
   3. _____ c. Collect
   4. _____ d. Report

6. According to the AIS protocols, which boat should get decontaminated?
   a. A boat from a positive or suspect water from last weekend that is completely dry everywhere.
   b. A boat from a positive or suspect water from 90 days ago with 2 gallons of water in an oily bilge.
   c. A boat from a positive or suspect water from 21 days ago with standing water.
   d. A boat from out of state that has no standing water.

7. When performing a flush of an I/O or outboard motor, always be clear of the prop and ask the boater to start the boat in: (circle one) a. drive b. neutral c. reverse.

8. What are the temperature requirements for decontamination?
   a. Interior Compartments = 100°F; Exterior = 160°F
   b. Interior Compartments = 120°F; Exterior = 140°F
   c. Interior Compartments = 140°F; Exterior = 180°F
   d. Interior Compartments = 180°F; Exterior = 200°F

9. What order is recommended for a **full decontamination** of a boat?
   a. Hull, trailer, engine, back of boat, interior compartments, anchor
   b. Through hull discharge ports, interior compartments, motor/engine, rinse exterior and trailer, then high pressure hull and trailer.
   c. Engine, trailer, interior compartments, hull, back of boat, anchor
   d. Anchor, back of boat, trailer, hull, engine, interior compartments

10. How long do you back-flush discharge ports with low pressure, 120°F water?

    _____

11. How long do you decontaminate plants with low pressure, 140°F water?

    _____

12. How long do you flush the gimbal area with low pressure, 140°F water?

    _____

13. How often do you need to start up and use your decontamination unit if not performing regular decontaminations?

    _____

14. Which one of these boats does get a mandatory standing water decontamination if they have no seal and receipt? (circle all that apply)
   a. Ski boat with an inboard/outboard engine
   b. Wakeboard boat with a ballast tank
   c. Fishing boat with an outboard motor
   d. Ski boat with an inboard engine

15. What attachment do you use to flush a ballast tank or inboard engine?
   a. Diffuser
   b. Dual Lance Wand
   c. Fake-a-Lake
   d. Engine muffs

Appendices

Appendix A: Links to Complementary Resources for WID Staff and Managers

Click on the document title to open the link to the full document.

AIS PROGRAM MANAGEMENT AND REGIONAL COORDINATION

- The Quagga Zebra Action Plan for Western U.S. Waters (WRP and ANS Task Force, 2010)
- The Quagga Zebra Action Plan for Western U.S. Waters: Status Update Report (WRP, 2019)
- Building Consensus in the West Workgroup: Final Activity Report 2011–2019 (WRP, 2019)
- The Updated Recommendations for the Quagga Zebra Action Plan for Western U.S. Waters (WRP, 2020)
- Summary of Western States' Aquatic Invasive Species Outreach Campaigns: Target Audiences, Messaging, Delivery, and Lessons Learned (WRP Education and Outreach Committee, 2021)

EARLY DETECTION

- Zebra and Quagga Mussel Field Sampling and Monitoring Protocol (WRP, 2020)
- Laboratory Standards for Zebra and Quagga Mussel Veliger Analysis (WRP, 2020)

LEGAL DOCUMENTS

- Model Legal Framework for Watercraft Inspection and Decontamination Programs
  - 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)
  - Model Regulation for State Watercraft Inspection and Decontamination Programs (Otts and Nanjappa, eds 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)
- State Clean Drain Dry Provisions and Related Requirements (NSGLC-17-04-03) (Otts, 2017)
- Comparative Analysis of Watercraft Inspection and Decontamination Requirements along the Lower Colorado River (Otts and Bowling, 2019)
- Role of Local Governments in Aquatic Invasive Species Prevention Efforts (Otts, S. and Debrukeyere, L., 2020)
- Local Government AIS Toolkit (Otts, S. and Debrukeyere, L., 2020)

WATERCRAFT INSPECTION AND DECONTAMINATION

- Western Regional Panel Approved WID Procedures
  - Decontamination Unit Minimum Standards (WRP, 2019)
  - Trailer Decontamination Unit Specifications (WRP, 2019)
  - COVID-19 Guidelines for Watercraft Inspection and Decontamination Stations (WRP, 2020)
  - Incoming Entrance and Off-Water Inspection Procedure (WRP, 2020)
  - Outgoing Exit Watercraft Inspection—Containment Waters (WRP, 2020)
  - Outgoing Exit Watercraft Inspection—Prevention Waters (WRP, 2020)
  - Standing Water Decontamination of Inboard Engines (WRP, 2020)
  - Standing Water Decontamination of Interior Compartments (Not Ballast) (WRP, 2020)
  - Standing Water Decontamination of Outboard Motors and Inboard/Outboard (I/O) Engines (WRP, 2020)
  - Advanced Watercraft Decontamination Manual (Lake Tahoe Invasive Species Program, 2020)
  - Aquatic Nuisance Species Inspection Procedures for Amphibious Aircraft (WRP, 2020)

- Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination Programs for Dreissenid Mussels in the Western United States IV (Phillips and Elwell, 2021)
- T-32: Design and Construction in Consideration of Aquatic Invasive Species (ABYC, 2018)
- A Review of Chemical Use Associated with Watercraft Decontamination to Address Aquatic Invasive Species; a special supplement to UMPS (Phillips and Elwell, 2018)
- Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations (NWCG, 2017)
- The Student Training Curriculum for Watercraft Inspectors and Decontaminators to Prevent and Contain the Spread of Aquatic Invasive Species (Brown, 2016)
- The Voluntary Guidelines to Prevent the Introduction and Spread of Aquatic Invasive Species through Recreational Activities (ANS Task Force, 2013)
- Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (BOR, 2012)

Watercraft Inspection and Decontamination Training Videos

https://www.westernais.org/trainer-resources

- Video Links:
  - An Overview of Watercraft Inspection and Decontamination Programs
  - Safety Guidelines for WID
  - How to Perform a Boat Inspection
  - How to Perform a Full Decontamination
  - How to Collect an AIS Sample from Watercraft
  - How to Perform a Ballast Tank Decontamination
  - How to Perform a Bait Treatment
  - How to Perform a Inboard Engine Decontamination
  - How to Perform a Inboard/Outboard Engine Decontamination
  - How to Perform a Plant Decontamination
  - How to Perform a Seaplane Inspection and Decontamination
  - Pathways, Coordination, and Legislative Update for Aquatic Invasive Species Prevention and Management

Quagga Mussels at Lake Mead National Recreation Area

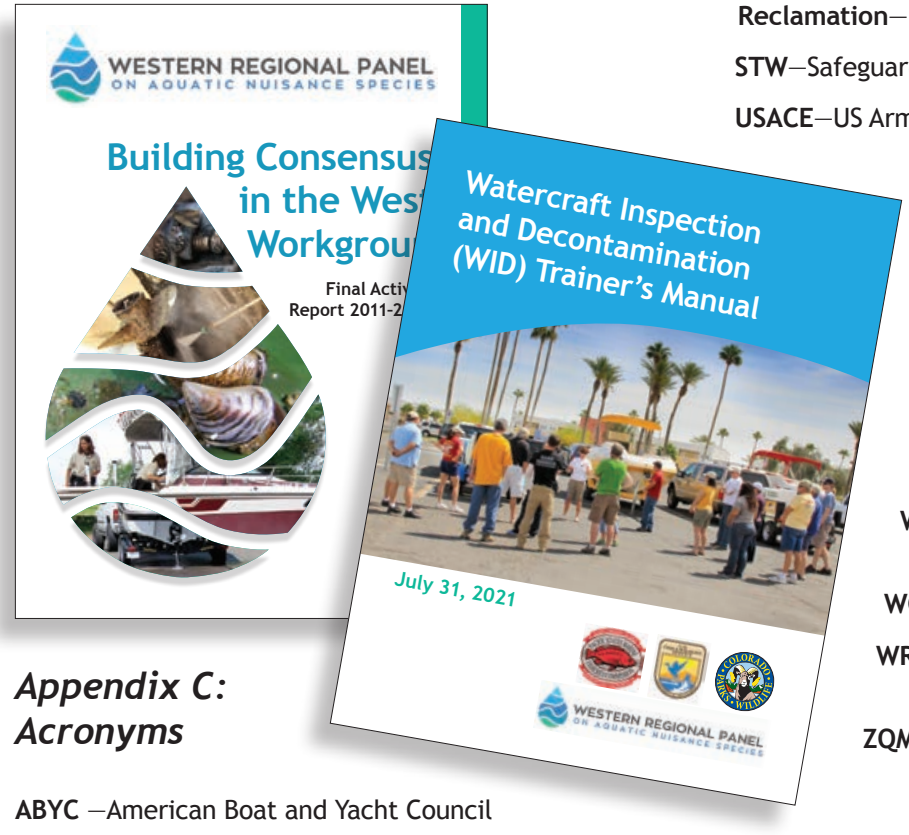
Appendix B: Significant Moments in the History of ZQM in the West

- **1993**—Oklahoma reports first zebra mussel infestation in the West.
- **1993**—California makes its first interception of a mussel infested watercraft at the Needles WID Border Protection Station.
- **1997**—The WRP is formed.
- **1999**—The Pacific States Marine Fisheries Commission (PSMFC) begins the ANS Education and Prevention Program.
- **2001**—The first meeting of the 100th Meridian Initiative's Colorado River Basin Team.
- **2003**—The first meeting of the 100th Meridian Initiative's Columbia River Basin (CRB) Team.
- **2003**—Kansas detects infestation of zebra mussels.
- **2004**—The first meeting of the 100th Meridian Initiative's Missouri River Basin Team.
- **2005**—Montana's WID Program begins.
- **2006**—PSMFC begins watercraft inspection training (WIT) at Lake Mead.
- **2007**—Quagga mussels discovered in Lake Mead.
- **2007**—Utah's WID Program begins.
- **2008**—Colorado's WID Program begins.
- **2008**—Zebra mussels discovered in San Justo Reservoir, California.
- **2008**—Senator Feinstein (CA) requests that the ANS Task Force draft the Quagga Zebra Action Plan for Western Waters (QZAP). The WRP was tasked with developing the QZAP and formed a steering committee and writing committee of members to complete the document.
- **2008**—Lake Tahoe WID Program begins.
- **2009**—Wyoming's WID Program begins.
- **February 2009**—Colorado publishes the *ANS Watercraft Inspection and Education Handbook*.
- **September 2009**—PSMFC publishes the *Recommended Uniform Minimum Protocols and Standards for Watercraft Interception Programs for Dreissenid Mussels in the Western United States* (UMPS I; Zook and Phillips).
- **November 2009**—The WRP presented the draft QZAP to the ANS Task Force, which was conditionally approved pending incorporation of additional edits requested.
- **February 2010**—The ANS Task Force approves the QZAP.
- **2010**—Congress begins appropriating funding to USFWS for the implementation of the QZAP.
- **June 2011**—Colorado publishes the *ANS Watercraft Decontamination Manual*.
- **September 2011**—WISCE forms to unite states in a common fight against zebra and quagga mussels and to coordinate state programs.
- **October 2011**—The USFWS shifts coordination obligations directly to the WRP. Subsequently, the WRP hires a full-time coordinator.
- **January 2012**—PSMFC publishes the *Uniform Minimum Protocols and Standards for Watercraft Interception Programs for Dreissenid Mussels in the Western United States* (UMPS II; Zook and Phillips).
- **January 2012**—Colorado publishes the *Boat Compendium for ANS Inspectors*.
- **2012**—WISCE scopes out Regional WID Data Sharing System specifications. Colorado Parks and Wildlife (CPW) moves forward with adapting its system for regional use.
- **2012**—WISCE meets jointly with federal partners at WRP in Salt Lake City UT to specifically discuss early detection discrepancies which result in a Reclamation notification policy.
- **August 2012**—The *Legal and Regulatory Efforts to Minimize Expansion of Invasive Mussels through Watercraft Movements—a Co-Learning Workshop* is held in Phoenix, AZ.
- **2013**—New Mexico's WID Program begins.
- **2013**—Quagga mussels are discovered in Lake Powell in Glen Canyon National Recreation Area.
- **August 2013**—The first BC meeting is held in Denver.
- **September 2013**—Colorado publishes the *Containment Manual for WID Stations*.
- **September 2013**—WISCE meets to review BC I agreements (e.g. water body definitions, listing and de-listing standards) at the WRP Annual Meeting in Portland, OR.
- **January 2014**—CO, NM and UT pilot data sharing and use of the new Regional WID Data Sharing System.
- **January 2014**—CO and UT become the first states to de-list waters following five years with no detections according to BC definitions and standards.
- **February 2014**—The second BC meeting is held in Denver.
- **March 2014**—PSMFC's WIT incorporates the *Regional WID Training Curriculum* developed through a BC subcommittee.

- **March 2014**—CPW hosts the first Advanced Decontamination course at Lake Pueblo State Park.
- **April 2014**—CPW hosts the first WID Trainer Training course at Chatfield State Park with PSMFC, AZ, and WY.
- **April 2014**—NSGLC and AFWA publishes the *Model Legislative Provisions to Promote Reciprocity Among State WID Programs*.
- **September 2014**—WISCE dedicates their annual meeting to the BC Workgroup at WRP's Annual Meeting in Houston, TX.
- **October 2014**—Congress passes WRRDA, which authorizes WID in the CRB.
- **January 2015**—The American Boat and Yacht Council (ABYC) and the National Marine Manufacturers' Association (NMMA) host the Industry Summit on ANS and WID in Las Vegas.
- **August 2015**—The National Invasive Species Council (NISC) and the ANS Task Force publish the *Federal Policy Options Addressing the Movement of AIS Onto and Off of Federally Managed Lands and Waters*.
- **October 2015**—WISCE dedicates their annual meeting to the BC workgroup at WRP's Annual Meeting in Lake Tahoe, NV.
- **2016**—Evidence of quagga mussels detected in Tiber and Canyon Ferry Reservoirs in Montana.
- **2016**—The watercraft movement notice is deployed in the *Regional WID Data Sharing System* with AZ and NV participating to alert states that infested watercraft are in transit.
- **2016**—The Tahoe Regional Planning Agency joins the Regional WID Data Sharing System.
- **February 2016**—CPW and PSMFC publish the *Student Training Curriculum for Watercraft Inspectors and Decontaminators* and the *Trainer's Manual for WID Certification Courses*.
- **April 2016**—The third BC meeting is held in Denver.
- **July 2016**—The Western Association of Fish and Wildlife Agencies (WAFWA) passes a resolution recommending states require the removal of water drain plugs and aquatic vegetation from watercraft and conveyances prior to overland transport.
- **August 2016**—PSMFC publishes the *Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination* (UMPS III, Elwell and Phillips).
- **September 2016**—Congress reauthorizes WRRDA, adding monitoring and rapid response to WID in the CRB.
- **October 2016**—WISCE meets jointly with WAFWA's Aquatic Invasive Species Workgroup members at WRP's Annual Meeting in Jackson Hole, WY.
- **December 2016**—NSGLC and AFWA publish *Model Regulations for State WID Programs*.
- **January 2017**—The National Wildfire Coordinating Group published the *Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations*.
- **January 2017**—CPW de-lists Lake Pueblo State Park in Colorado, following five years with no detections per BC guidelines.

- **April 2017**—NSGLC published the national legal gap analysis titled *From Theory to Practice: A Comparison of State WID Programs to the Model Legal Framework*.
- **June 2017**—DOI announced its *Safeguarding the West Initiative* to strengthen collaborations with the Western Governors' Association, states, tribes, and other federal agencies to prevent, contain, and control quagga and zebra mussels in western waters.
- **April 2017**—The BC IV meeting is held in Albuquerque, New Mexico.
- **October 2017**—The ANS Task Force and the WRP Annual Meetings are cancelled as a result of the Department of Interior's review of its federal advisory committees.
- **November 2017**—The Advanced Decontamination course is held at Lake Mead.
- **December 2017**—BLM convenes an inter-agency workshop at Lake Havasu in Arizona to develop a multi-jurisdictional strategy for the Lower Colorado River from Lake Havasu downstream.
- **2017-2018**—The USFWS QZAP grant provides funding to CPW for the Regional WID Data Sharing System (current users include AZ, CO, NM, NV, MT, WA, WY, UT, Tahoe, local waters in CA, and several National Parks).
- **May 2018**—PSMFC publishes *A Review of Chemical Use Associated with Watercraft Decontamination to Address Aquatic Invasive Species; A special supplement to UMPS* (Elwell and Phillips, 2018).

- **July 2018**—ABYC publishes the *Technical Information Report on AIS* (T-32).
- **September 2018**—ABYC hosts the 2nd Invasive Mussel Marine Industry Summit in Baltimore, Maryland.
- **July-December 2018**—WGA conducts *Biosecurity and Invasive Species Initiative*.
- **October 2018**—WRP publishes the *Dreissenid Mussel Field Sampling and Monitoring Protocol* and the *Laboratory Standards for Dreissenid Veliger Analysis*.
- **October 2018**—Congress passes the 2018 Water Resources Development Act (WRDA-18) which authorizes WID, monitoring, and rapid response in the Columba, Upper Colorado, South Platte, Upper Missouri, and Arizona [sic] (corrected to Arkansas) river basins.
- **October 2018**—Reclamation funds the Regional WID Data Sharing System for 2019.
- **December 2018**—NSGLC publishes the *Model MOU for WID Programs*.
- **January 2019**—WISCE meets in Denver to develop the *QZAP Status Update Report* and conclude the WRP *Building Consensus in the West Workgroup Final Summary Report*.
- **April 2019**—WRP publishes the *QZAP Status Update Report*.
- **April 2019**—WRP publishes the *Building Consensus in the West Workgroup: Final Activity Report*.
- **April 2019**—WRP publishes standard specifications for *Trailered Mobile Decontamination Units and On-Demand Tankless Water Heater Decontamination Systems*.
- **May 2019**—Lake Tahoe Regional Planning Agency hosts the ANS Task Force spring meeting on behalf of the WRP. The WRP presents the *QZAP Status Update Report* and the *Building Consensus in the West Workgroup: Final Activity Report* and proposes to the ANS Task Force that these *Updated Recommendations for the QZAP* (QZAP 2.0) be completed.
- **August 2019**—WGA holds the Leadership Summit on Zebra and Quagga Mussels in Las Vegas, NV.
- **September 2019**—WRP publishes the *Aquatic Nuisance Species Inspection Procedures for Amphibious Aircraft*.
- **October 2019**—The USFWS QZAP grant funds the Regional WID Data Sharing System for 2020.
- **October 2019**—WRP and WISCE meet in Missoula, MT.
- **December 2019**—NSGLC publishes the *Comparative Analysis of Watercraft Inspection and Decontamination Requirements along the Lower Colorado River*.
- **December 2019**—US Senators Bennet (CO), Daines (MT) and Tester (MT) introduce the *Stop the Spread of Invasive Mussels Act of 2019*.
- **February 2020**—Montana de-lists Canyon Ferry as no evidence of mussels were found per BC guidelines.
- **February 2020**—WISCE meets in Denver, CO to develop this QZAP 2.0.
- **March 2020**—US Representatives McAdams (UT) and Tipton (CO) introduce the *Stop the Spread of Invasive Mussels Act of 2020*.
- **June 2020**—WRP's Executive Committee approved updated WID standard procedures developed by the Decon Think Tank Committee—*Exit Inspection at Containment Waters*, *Exit Inspection at Prevention Waters*, *Incoming Entrance and Off-Water Inspections*, and a *COVID Guidance Document for WID Stations*.
- **July 2020**—Alaska's WID program begins at the US-Canadian border after a three-year pilot study.
- **September 2020**—WRP approves updates to the *Dreissenid Mussel Field Sampling and Monitoring Protocol*, the *Laboratory Standards for Dreissenid Veliger Analysis*, and the *Inspection Procedure for Amphibious Aircraft*.
- **September 2020**—WRP publishes the *QZAP 2.0*.
- **November 2020**—WRP approves updated WID standard procedures developed by the Decon Think Tank—Standing Water Decontamination of an Inboard Engine, Standing Water Decontamination on Interior Compartments (not ballast), and Standing Water Decontamination of Outboard Motors and Inboard/Outboard Engines.
- **December 2020**—The ANS Task Force approves the Updated Recommendations for the Quagga Zebra Action Plan for Western Waters (QZAP 2.0).
- **December 2020**—Lake Tahoe Invasive Species Program publishes the Advanced Decontamination Manual.
- **July 31, 2021**—PSMFC publishes the updated WID Trainer's Manual.
- **October 2021**—PSMFC publishes the updated UPMS IV.
- **November 2021**—ANS Task Force approves the WRP inspection procedures as the national standard for WID programs.
- **December 2021**—PSMFC publishes this updated WID Manual.



Appendix C: Acronyms

ABYC —American Boat and Yacht Council

AFWA—Association of Fish and Wildlife Agencies

AIS—Aquatic Invasive Species

ANS—Aquatic Nuisance Species

ANS Task Force—Aquatic Nuisance Species Task Force

BC—Building Consensus in the West Workgroup

CPW—Colorado Parks and Wildlife

CRB—Columbia River Basin

eDNA—Environmental deoxyribonucleic acid

DOI—Department of the Interior

NANCPA—Nonindigenous Aquatic Nuisance Control and Prevention Act of 1990

NAS—Nonindigenous Aquatic Species Database

NISA—National Invasive Species Act of 1996

NPS—National Park Service

NSGLC—National Sea Grant Law Center

OSG—Oregon Sea Grant

PSMFC—Pacific States Marine Fisheries Commission

QZAP—Quagga Zebra Mussel Action Plan for Western Waters

QZAP 2.0—Updated Recommendations for the 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

WAFWA—Western Association of Fish and Wildlife Agencies

WID—Watercraft Inspection and Decontamination

WISCE—Western Invasive Species Coordinating Effort

WGA—Western Governors Association

WRP—Western Regional Panel on Aquatic Invasive Species

ZQM—Zebra and Quagga Mussels

Appendix D: Glossary

Aft—A nautical term that refers to the rear or stern of the boat.

Anchor—A heavy object attached to a line and used to moor a vessel to the bottom of the water body.

Anchor Line—A device that connects the anchor to the boat. This could be a rope, chain, or other type of tether.

Anchor Storage—An interior compartment area on the boat, typically in the bow of the boat, where the anchor is stored.

Anti-Cavitation Plate—A flat metal fitting mounted horizontally above the propeller of an outboard motor, which helps direct the flow of water into the propeller and reduces cavitation. Cavitation is the effect caused when air is drawn down into the water by a propeller, resulting in loss of power, overspending of the engine and propeller, and pitting of the metal surfaces of the propeller.

Aquatic Nuisance Species (ANS) or Aquatic Invasive Species (AIS)—Aquatic Nuisance Species means a nonindigenous species, including their seeds, eggs, spores, larvae, or other biological material capable of propagation, that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters.

Bait—Food that is used to entice fish or other animals as prey.

Bait Treatment—A type of decontamination that prevents the potential transfer of AIS being used as bait and as contaminants in standing water in a bait well or bucket.

Bait Well—An interior compartment that specifically holds live aquatic bait. Sometimes it is a separate container on the boat or incorporated in the live well compartment. May also be a pull out bucket.

Ballast Tank or Bag—A compartment within a boat, ship or other floating structure that holds water. Adding water (ballast) to a vessel lowers its center of gravity and increases the draft of the vessel. A ballast tank can be filled or emptied in order to adjust the amount of ballast force. Small sailboats designed to be lightweight for being pulled behind automobiles on trailers are often designed with ballast tanks that can be emptied when the boat is removed from the lake or reservoir.

Benthic—Refers to the bottom of a water body.

Bilge—The lowest compartment on a boat where the two sides meet at the keel. The word is sometimes also used to describe the water that collects in this compartment. Water that does not drain off the side of the deck drains down through the boat into the bilge.

Bilge Plug—A plug located either on the transom wall or in the bottom of the hull that keeps lake water from entering the boat. It must be removed when exiting the water body.

Bilge Pump—A water pump used to remove excessive bilge water. The water that collects in the bilge must be pumped out to prevent the bilge from becoming too full and threatening to sink the boat on the lake or reservoir.

Bow—A nautical term that refers to the forward part of the hull of a boat.

Burner on/off switch—This switch on a decontamination unit activates the burner to heat the water.

Byssal threads—A spider-web like appendage that enables the zebra or quagga mussels to attach to surfaces. Native species do not have byssal threads.

Centerboard—A retractable keel which pivots out of a slot in the hull of a sailboat that is used to provide lift to counter the lateral force from the sails.

Choke—A device on some decontamiantion units that must be pulled out prior to turning the key to start the engine and pushed in immediately after starting the unit.

Clean—A watercraft, trailer or equipment that does not show visible AIS or attached vegetation, dirt, debris, surface deposits, or non-verifiable water. This includes mussel shells or other biological materials and is inclusive of dirt or other residue that could mask the presence of attached mussels or AIS.

Complex Boat—A boat that has one or more interior compartments, or a closed hull, or more than one motor.

Containment—To stop or attempt to stop AIS from spreading to other waterbodies.

Control—To mitigate against the effects of AIS through reductions in the species population size.

Conveyance—A motorized or non-motorized recreational watercraft and its associated trailer and equipment that may come in contact with water or that is able to transport water. Conveyance includes trailers, engines and motors, wells, ballast tanks or bags, bilge areas, anchors, and other items that may come in contact with water or are able to transport water which could harbor an aquatic invasive species.

Daggerboard—A retractable keel used by various sailing craft which slides in a casing converting the forward motion into a windward lift, countering the leeward push of the sail.

Decontamination—A process used to kill, destroy, or remove aquatic invasive species and other organic material that may be present in or on a conveyance, to the extent technically and measurably possible.

Detection—The verified presence of AIS.

Diffuser—This is a decontamination unit attachment that connects directly to the spray gun and is used to provide low pressure hot water for rinsing or flushing with a rubber tip to prevent scratching surfaces.

Drain—To the extent practical, all water drained from any live-well, bait-well, storage compartment, bilge area, engine compartment, deck, ballast tank, water storage and delivery system, cooler or other water storage area on the watercraft, trailer, engine, or equipment.

Drain Plug—A valve or device used to control the drainage of water from a compartment designed to hold water, such as a bilge, well, or ballast.

Dreissenids—Dreissenids are the common term associated with the family Dreissenidae which are small freshwater mussels who attach themselves to hard surfaces using byssal threads. Two invasive dreissenid species of interest in North America are the quagga (*Dreissena rostriformis bugensis*) and the zebra mussel (*Dreissena polymorpha*).

Dry—No standing water; opposite of wet. A watercraft is completely dry if there is no detectable water on the exterior or interior surfaces of the watercraft, and no dampness can be felt on the interior of the watercraft.

Drying Time—The amount of time out of the water required to assure that all AIS are killed through desiccation. This time requirement varies widely depending on temperature and humidity conditions. Drying time is not a substitution for decontamination.

Dual Lance Wand—This decontamination unit attachment connects directly to the spray gun. The handle, when turned clockwise, directs the water through the lance with the quick connect fitting only. If a nozzle is attached the water exiting the wand will be at high pressure. The handle, when turned counter clockwise, directs the water through both lances and lowers the pressure of the water. A dual lance wand can be used for low pressure standing water flushes if there is no nozzle attached and the water is exiting both lances.

Environmental DNA (eDNA)—DNA collected not directly from the tissue of an organism, as is normally done, but filtered from an environmental sample such as stream, lake or reservoir water.

Exit Inspection—Containment Waters—Inspections performed at lakes, rivers, and reservoirs that have a verified presence of ZQM when boats are exiting or leaving to make an additional educational contact with the boater and to verify that the boater has followed the proper procedures to clean off the watercraft and completely drain all compartments prior to leaving.. The priorities for containment waters' exit inspections are to inspect the watercraft and trailer for invasive species, drain water, decontaminate, if necessary, record data in the Regional WID Data Sharing System, and apply a seal and receipt to the watercraft.

Exit Inspection—Prevention Waters—Inspections performed at negative lakes, rivers, and reservoirs when boats are exiting or leaving to make an additional educational contact with the boater and to verify that the boater has followed the proper procedures to clean off the watercraft and completely drain all compartments prior to leaving. The priority for prevention waters' exit inspections is to inspect for invasive species, drain water, remove plants, and apply a seal and receipt to the watercraft.

Exotic—An exotic species is a species that is not native to a given environment that often causes environmental and economic harm.

Fake-a-Lake—This decontamination unit attachment is used for decontaminating inboard engines and ballast tanks. It has a telescoping leg and the hose attachment threads into the connection on the "plunger," joining the fake-a-lake to the hose to the wand.

Fish Box—An interior compartment in a boat where fish are kept.

Full Decontamination—A decontaminaiton procedure that is applied to watercraft with suspected mussels, attached ZQM, or other suspected AIS. Flush engine with hot water, as defined in WID Manual, and flush internal compartments and equipment that may have come in contact with water. Apply a hot water rinse of the hull and use of high pressure to remove attached mussels or other AIS. Physical removal of adult mussels or suspect mussels/AIS.

Gene Sequencing—A process for species identification using advanced molecular analysis.

Gimbal—A pivoted support that allows the rotation (up and down and side to side movement) of the outdrive of an I/O engine and outboard motor.

High-Risk Watercraft or Conveyance—High risk conveyance, watercraft, or equipment can include one or more of the following;

(a) watercraft that has operated on or in any suspect, positive or infested waterbody within the last 30 days;

(b) watercraft that is not clean, drained and dry;

(c) watercraft that is complex or very complex;

(d) watercraft that does not have a seal or receipt; or

(e) the boat operator or hauler is non-compliant, non-cooperative, and deceptive.

Hose—This six foot hose has a quick connect fitting that connects to the end of the wand. The other end threads into the fake-a-lake or muff attachments needed for a decontamination.

Hull—The body or frame of a boat.

Impound—A law enforcement action to seize a watercraft and hold it to ensure the drying time is met or decontamination procedures are performed.

Inboard Engine—A marine propulsion system that is enclosed within the hull of the boat. These have a raw water cooling system where water from the reservoir is pumped by the engine to cool it. Attached to the hull of the boat is the propeller shaft and propeller which propels the boat through the water. The rudder acts as the "steering wheel" to guide the boat.

Inboard/Outboard (I/O) Engine—An I/O is located inboard just forward of the transom (stern) and provides power to the drive unit located outside the hull. The drive unit (or lower unit or outdrive) resembles the bottom half of an outboard motor.

Incoming Entrance and Off-Water Inspection—This is the complete inspection that is performed at WID stations on watercraft entering the lake or reservoir regardless of status (infested, positive, suspect, or negative), in addition to WID stations that are not located on a lake or reservoir (e.g. offices, businesses, or roadsides). This procedure includes both a screening interview and a visual and tactile inspection of all portions of the watercraft and trailer that could come into contact with water.

Inconclusive—A temporary status for a water that has not met the minimum criteria for detection.

Infested Water—A water that has an established (recruiting or reproducing) population of AIS.

Inspection—A process to determine whether a conveyance is harboring any organisms or organic materials that may present a risk of spreading AIS risk by physically and visually examining it following the protocols and procedures supplied in this WID Manual.

Inspector—An individual that is certified to perform watercraft inspection for AIS.

Inspector and Decontaminator—An individual that is certified to perform watercraft inspection and decontamination for AIS.

Invasive Species—Invasive species means, with regard to a particular ecosystem, a non-native organisms whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.

Jet Boat—A boat propelled by a jet of water ejected from the back of the craft. A jet boat draws the water from under the boat into a pump inside the boat. The water then passes through a series of impellers and stators—known as stages—which increase the velocity of the water flow. The water is then expelled through a nozzle at the stern. Most modern jets are single stage while older waterjets may have as many as three stages. The tail section of the waterjet unit extends out through the transom of the hull above the waterline. This jet stream exits through a small nozzle at high velocity to push the boat forward.

Keel—Runs in the middle of the boat, from the bow to the stern, and serves as the foundation or spine of the structure, providing the major source of structural strength of the hull, which may be fixed or retractable to allow sailing in shallow waters.

Larval—The larvae or initial life free-floating planktonic life stage of a zebra or quagga mussel (and some other molluscs including Corbicula), also called a veliger.

Live Well—An interior compartment found on many boats that is used to keep caught fish alive. It works by pumping fresh water from the water body into the tank, as well as keeping the water aerated.

Live Well Pump—A pump that assists in filling a live well with lake water.

Lower Unit—The bottom portion of an outboard motor or an inboard/outboard engine. The water found in this portion is lake water that has not been heated by the motor/engine.

Low-Risk Watercraft or Conveyance—Low risk conveyances, watercraft or equipment include the following: (a) watercraft with a valid seal and receipt from an undetected or negative waterbody; (b) watercraft with a valid seal and receipt that is returning to the same waterbody; (c) watercraft that is clean, drained, and dry; (d) a non-motorized, hand-launched or simple watercraft; or (e) watercraft that has been out of the water for more than 60 days.

Macerator Pump—A pump designed to empty holding tanks when fitted onto the plumbing in boats. The function of the pump is to suction the solids and liquids from the lines connected to the holding tanks and grind the effluent with the rotating cutter head down to a small particle size and discharge the waste.

Macrophyte—An aquatic plant, large enough to be seen by the naked eye.

Maturation—The action or process of maturing.

Metamorphosis—The process of transformation from an immature form to an adult form in two or more distinct stages.

Microscopic—Too small to be seen by the unaided eye but large enough to be studied under a microscope.

Microscopy—The science of examining and identifying organisms under the microscope.

Minimum to Verify Detection—The scientifically based process to confirm the presence of AIS which must include two independent results from the same sample using scientifically accepted techniques. Scientifically accepted techniques may be microscopy (cross polarization), gene sequencing, or PCR on the organism tissue. Currently, eDNA is not a scientifically accepted technique to verify a Dreissenid mussel detection.

Muffs—Muffs are used to decontaminate the lower unit of an outboard motor or inboard/outboard engine.

Negative Prevention Waters—Waters that have never had a verified detection of any AIS or have not had a detection within the time frame for de-listing.

Non-Motorized, Hand-Launched Boats—These boats are not launched from trailers, and they do not have engines or motors. They may or may not have compartments or containers that hold water.

Non-Native—A species that has been introduced to a new environment, either intentionally or unintentionally outside of its native range.

Not Sampled Waters—Waters that have not been sampled or monitored for AIS.

Nozzle and Nozzle Storage—The nozzle storage area on most decontamination units show the degree of the nozzle written below the nozzle and its spray pattern is shown above the nozzle. The preferred spray pattern is 40°. Nozzle color and degrees can vary by manufacturer. A nozzle is attached to the end of the wand with a quick connect fitting. Be sure the quick connect "clicks" into place when attaching the nozzle. Point the wand and nozzle towards the ground when you first engage the trigger to start the water. This is a safety issue and will ensure that no one or nothing will be hurt or damaged if the nozzle blows off the wand.

Off-Water WID Stations or Locations—WID stations that are not located at a water body (e.g. highways, ports of entry, offices or business locations).

Oil Dip Stick for Decontamination Unit Engine—The oil dip stick for the decontamiantion unit's engine should be checked prior to every use to ensure proper function.

Oil Dip Stick for Decontamination Unit Pump—The oil dip stick for the decontamination unit's pump should be checked prior to every use to ensure proper function.

Other AIS Containment Waters—Waters that are positive for an AIS other than ZQM. AIS Positive waters are often prevention waters for mussels and other AIS.

Outboard Motor—A propulsion system for boats, consisting of a self-contained unit that includes engine, gearbox, and propeller. It is designed to be affixed to the outside of the transom and is the most common motorized method of propelling small watercraft. As well as providing propulsion, outboards provide steering control, as they are designed to pivot over the gimbal (mounting bracket) and control the direction of the thrust. The skeg also acts as a rudder when the engine is not running.

Personal Watercraft (PWC)—A recreational watercraft that the user sits or stands on, rather than inside of, as in a boat. Models have an inboard engine driving a jet pump that has a screw-shaped impeller to create thrust for propulsion and steering.

Phytoplankton—Plankton consisting of microscopic plants in water.

Pitot Tube—A pressure measurement instrument used to measure the velocity of a boat at a given point and is usually attached to the transom.

Plankton—Passively floating, drifting, or somewhat motile organisms occurring in a body of water, primarily comprising microscopic algae and protozoa, which are often the bottom of the food chain.

Plankton Tow—A cylindrical net with a fine mesh is dropped into a body of water to capture any plankton, veligers, or other organisms in the net, where it can then be analyzed in a lab.

Plant Decontamination—Apply hot water as defined in WID Manual to kill plants that can't be physically removed by hand during inspection.

Polymerase Chain Reaction (PCR)—A process for amplification of DNA for species identification.

Port—A nautical term that refers to the left side of the boat as perceived by a person who is in the boat facing the bow.

Positive Water—A water that has had at east one subsequent sampling event that meets the minimum criteria for detection. Positive must include the initial detection plus at least one subsequent detection for a total of 2 verified detections within the prescribed timeframe.

Positive Water—A water where the presence of an AIS has been detected in multiple subsequent sampling events.

Prevention—To stop or attempt to stop the introduction of an AIS.

Prop Shaft—The propeller shaft knows by many different names, such as drive shaft, prop shaft, or driveline, and is a component of the drive train, with the purpose of delivering torque from the transmission to the differential, which then transmits this torque in order to move the vehicle.

Quarantine—The voluntary or mandatory act of securing a watercraft out of water for a required period of time.

Quick Connect Fitting—This decontamination unit fitting comes in two parts: (1) the part that is attached to the end of the wand has to have the external circle pressed down before the other portion of the fitting can be inserted; and (2) the external circle then must click in place to make a proper connection.

Receipt—A written or electronic document issued by an inspector that contains data about the conveyance itself plus the type inspection or decontamination performed, date, time, location, and information associated with a corresponding seal, if applied.

Rudder—A device used to steer a boat when moving through water which operates by redirecting water that has passed the hull, imparting a turning motion to the craft.

Sailboat—A boat propelled partially or wholly by sail.

Sampling event—Sample collected on one day in a unique water body—each sample has a unique identifier/label, and all equipment must be decontaminated between sampling events.

Screening Interview—Asking the watercraft operator a series of questions per the procedures in this WID Manual that are designed to determine the level of risk based on the history of use.

Sea Strainer—A filtration device used to prevent solids from reaching internal compartments, such as pumps on engines or ballast tanks.

Seal—A tamper-proof device that locks the watercraft to the trailer to indicate that the boat has not been launched since it was last inspected, decontaminated, and/or quarantined. Seals should be accompanied by a valid seal receipt.

Settlers—The juvenile stage of Dressenids and some other molluscs that follows the veliger or larval stage and is before the adult stage. As a veliger grows out of the veliger or larval stage, it undergoes a metamorphosis and begins to grow a shell and will settle onto a semi-hard or hard surface to finish developing into an adult. At this stage, the settlers will feel like sandpaper or grit on a boat.

Simple Boat—A boat with an open hull, and no containers or compartments, and a single outboard motor.

Skeg—A support at the bottom of a rudder.

Spray Gun with Trigger—The spray gun is the controlling mechanism to deploy water out of the decontamiantion unit. The hose, wand, or diffuser attachment thread directly onto the gun.

Standing Water Decontamination—Hot water flush, rinse, or spray as defined in WID Manual of the exterior or internal compartments that can hold water.

Starboard—A nautical term that refers to the right side of the boat as perceived by a person who is in the boat facing the bow.

Stern—The rear or aft-most part of a boat.

Subsequent—Related to sampling, subsequent means samples taken on different days, or another sample not taken on the same day after the previous sampling event using decontaminated equipment. Dedicated nets should be used for any water bodies categorized as inconclusive, suspect, positive or infested.

Substrate—1.) A device used to monitor for the settler stage of zebra or quagga mussels, typically consisting of a black, rough PVC pipe suspended in the water body between a buoy at the surface and a weight at the bottom.

2.) The bottom of the water body, where organisms live—the benthos or benthic area.

Suspect Water—A water body that has met the minimum criteria for detection once.

Thermometer—A device to measure temperature which is essential to the decontamination process and should be used before, during, and after decontamiantion.

Thermostat—A device that allows the water temperature to be adjusted so that different decontamination temperature protocols and procedures can be adhered to.

Through Hull Fitting—A device that's secured to and creates an opening through the hull, to which a pipe or duct can be attached, allowing the passage of water or gas into or out from the boat.

Trailer—A vehicle that is towed which is designed to launch, retrieve, carry and sometimes store boats. The boat may sit on rollers or carpet depending on the type of trailer.

Trainer—An individual who is certified to train others in watercraft inspection and decontamination for AIS.

Transducer—An instrument that projects a sound wave into the water. When the wave strikes something such as a fish, it is reflected back and displays size, composition, and shape of the object on a screen inside the boat.

Transom—The surface that forms the flat back panel of the stern of a boat.

Transom Well—Recessed area where water collects that is formed by the transom.

Trim Tabs—The small surfaces (shelves) that are connected to the transom on a boat mostly found on cruisers, sport fishing boats, and center console boats ranging from 20 feet and up.

Trolling Motor—A marine propulsion system consisting of a self-contained unit that includes a motor, propeller and controls, and is affixed to an angler's boat, either at the bow or stern. Typically electric but can be gas powered.

Undetected or Negative Water—A water in which sampling and monitoring is ongoing and nothing has been detected, or nothing has been detected within the time frames for delisting.

Unverifiable Water—Water that is found within compartments that cannot be visually seen or physically inspected, such as in wells, ballast, bilge, or engines.

Valid Seal Receipt—A document issued by an inspector in conjunction with a seal that contains a number matching the serial number on the seal, and information regarding the status of the conveyance relative to absence of AIS (e.g. date, location and type of last inspection or decontamination).

Veliger—The initial life stage which is the free-floating larval form of a dreissenid mussel and some other molluscs.

Verifiable Water—Water that is found within compartments that you can see, feel, and physically inspect, such as in wells, or storage areas.

Verification—The scientifically-based process to confirm the presence of an AIS.

Very Complex Boats—A complex watercraft with more than one internal raw water device (e.g. generator, air conditioner, swamp cooler, etc.).

Water Column—The concept of the entire water depth of a water body, from its bottom (benthic zone) to the water surface.

Watercraft Inspection and Decontamination (WID)—Any program which seeks to prevent the spread of dreissenid mussels and other AIS on watercraft or equipment by inspecting to verify the conveyance is clean, drain, dry, or decontaminated, prior to launching or upon exiting.

Waters—Public or private locations such as rivers, streams, lakes, ponds, and reservoirs.

West—A geographic reference that includes the 19 states west of the 100th Meridian, including those bisected by the 100th Meridian.

Whip Hose—A connector hose that functions to connect attachments or the main hose to the decontamination unit.

WID Location—A location or an address where an inspector or decontaminator may be available to conduct an inspection and/or decontamination.

Zooplankton—Plankton consisting of microscopic animals in water.

ZQM Containment Waters—Waters that have had a verified zebra or quagga mussel detection.

Zebra Mussels

westernais.org