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***61 LEGISLATIVE AND REGULATORY EFFORTS TO MINIMIZE EXPANSION OF INVASIVE MUSSELS THROUGH WATERCRAFT MOVEMENTS^{d1}**

In 2007, quagga mussels were found in the Lake Mead National Recreational Area. Since then, the Western states, with assistance from the federal government, have passed legislation, promulgated regulations, and implemented boat inspection programs and public outreach campaigns to prevent the spread of quagga and zebra mussels in the western United States through the movement of watercraft. This Article provides an overview of the quagga and zebra mussel invasion, including environmental and economic impacts, and highlights the recent legislative and regulatory efforts of Western states to slow the geographic expansion of dreissenid mussels. The Article concludes with a brief discussion of the ongoing challenges associated with zebra and quagga mussel prevention.

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*62 INTRODUCTION

In the late 1980s, zebra and quagga mussels were introduced into the Great Lakes, most likely through the discharge of ballast water from a large cargo vessel. Once established, there was little that could be done in the eastern United States to prevent the natural spread of these invasive mussels through the connected waterways of the Great Lakes basin. The subsequent invasion of these two species, which are native to Eastern Europe, has devastated native freshwater ecosystems and inflicted billions of dollars in economic damage.

In 2007, quagga mussels were found in the Lake Mead National Recreational Area located along the border of Arizona and Nevada. As Lake Mead is not hydrologically connected to the Great Lakes basin, the mussels could not have arrived there by natural dispersal. Some human activity, most likely the transportation of a recreational boat over land, brought them to Lake Mead. This first discovery in the western United States triggered aggressive action by federal, state, and local governments to contain the threat and prevent the spread of these mussels to other western waters.

*63 During the past five years, most of the nineteen Western states¹ have passed legislation, promulgated regulations, and implemented boat inspection programs and public outreach campaigns to prevent the spread of quagga and zebra mussels in the western United States through the movement of watercraft. The federal government, through the Western Regional Panel on Aquatic Nuisance Species and the 100th Meridian Initiative, has contributed significantly to these state initiatives. Additionally, resource agencies in the region have engaged in public outreach, investigated control technologies, and amended policies to protect valuable public resources.

On August 22 and 23, 2012, the U.S. Fish and Wildlife Service, the National Association of Attorneys General, Oregon Sea Grant, the National Sea Grant Law Center, and the Western Regional Panel on Aquatic Nuisance Species convened a workshop in Phoenix, Arizona, hosted by the Arizona Game and Fish Department. The purpose of the workshop was to engage assistant attorneys general, natural-resource agency attorneys, law enforcement supervisors, policy makers, and Aquatic Invasive Species (AIS) Coordinators from the nineteen Western states, interstate organizations, and federal partners to establish clear legal and regulatory approaches and opportunities for AIS abatement and reform. To enhance collaborative learning during the workshop and legal reform efforts, the workshop planning committee identified several key legal issues that needed to be addressed in the region. Background papers were drafted for workshop attendees, which were further developed into the five articles recently published in the *Arizona Journal of Environmental Law and Policy*.

This Article, the first in the series, discusses these legal and regulatory efforts to address one of the primary vectors for the spread of invasive mussels in the West--the overland transport of trailered boats. Part I provides an overview of the quagga and zebra mussel invasion, including environmental and economic impacts. Part II highlights the recent legislative and regulatory efforts of Western states to slow the spread of dreissenid mussels. Part III discusses ongoing challenges associated with zebra and quagga mussel prevention.

I. THE PROBLEM: INVASIVE MUSSELS

Invasive species are “alien species [i.e., species not native to an ecosystem] whose introduction does or is likely to cause economic or environmental harm or harm to human health.”² An estimated 50,000 non-native species have been introduced into the United States.³ Many of these species were intentionally introduced as crops, livestock, sport fish, and pets and are considered economically and socially beneficial. Some non-native species, however, have inflicted great economic and environmental damage. In 2005, researchers *64 estimated that the economic damages associated with invasive species and their control was approximately \$120 billion per year.⁴

Eighty-eight species of non-native mussels have been introduced and become established in the United States.⁵ Of these non-native species, zebra (*Dreissena polymorpha*) and quagga (*D. bugensis*) mussels are the “most costly macrofouling and ecological pests ever introduced to North American freshwaters.”⁶ Zebra and quagga mussels are closely related species of small freshwater bivalve mollusks native to the Black, Caspian, and Azov Seas in Eastern Europe.⁷ Zebra mussels were first discovered in the United States in Lake St. Clair, Michigan, in 1988,⁸ and the first report of a quagga mussel sighting occurred about a year later in Lake Erie.⁹ It is believed that the invasive mussels were introduced into the Great Lakes via the ballast water of container ships transporting goods between Europe and the United States.¹⁰

Introduced into a region with favorable environmental conditions and no natural predators, zebra and quagga mussels have thrived. Zebra mussels quickly spread throughout the Great Lakes and connected river systems, including the Mississippi, Ohio, Missouri, and Arkansas River basins. Within ten years, zebra mussels had spread to nineteen states.¹¹ Quagga mussels have not expanded their range as quickly, but the species is now well-established in the lower Great Lakes.¹² As of July 2012, zebra and quagga mussels had been detected in 644 lakes in the United States in addition to the five Great Lakes.¹³

*65 Two physiological features aided the rapid dispersal of dreissenid mussels. First, both zebra and quagga mussels are prolific breeders. Adult females can produce up to one million eggs per year;¹⁴ such “[h]igh fecundity leads to development of massive populations within 3-5 years after initial introduction.”¹⁵ The surviving larvae drift downstream in the current, eventually establishing themselves in new areas to begin another reproductive cycle. Second, adult mussels can attach themselves to any hard surface, including boats and equipment, and survive for up to thirty days out of water depending on temperature and humidity. Once attached to a boat or trailer, mussels can “hitchhike” overland to waters that are not hydrologically connected.

A. Environmental Impacts

Dreissenids are filter feeders, drawing nutrients from the water as it passes through their bodies. Each individual mussel is capable of filtering a liter of water per day.¹⁶ Dreissenid colonies exist at incredible population densities, averaging over 10,000 individuals per square meter. Due to their massive filtering capabilities, dreissenid invasions are associated with significant increases in water clarity and significant decreases in suspended particulate matter, including phytoplankton, which is the primary food source for the mussels as well as for many fish species.¹⁷

These changes can have a significant impact on a freshwater ecosystem. Through their consumption of large quantities of plankton from the water column, invasive mussels deprive native fish and other aquatic organisms of food. The subsequent reduction in the populations of native species dependent on plankton can have ripple effects throughout the food web as other species adjust to new environmental conditions that are either favorable or unfavorable. In addition, as water clarity increases due to the removal of phytoplankton, sunlight can penetrate further, which encourages the growth of benthic organisms including bacteria, algae, and macrophytes (aquatic plants).

Zebra and quagga mussel invasions have also been linked to increases in algal blooms. Research suggests that dreissenids may contribute to blue-green algal blooms because they eat every plankton but the toxic blue-green alga *Microcystis*.¹⁸ The National Oceanographic and Atmospheric Administration’s Great Lakes Environmental Research Laboratory, using special video equipment, has filmed mussels rejecting *Microcystis*.¹⁹ In addition, the mussels excrete nutrients, such as phosphate, which may act as fertilizer *66 promoting additional *Microcystis* growth.²⁰ *Cladophora* blooms also appear to be on the rise. *Cladophora* is a naturally occurring green algae found along Great Lakes coastlines. The frequency of *Cladophora* blooms rose in the 1960s and 1970s as the result of high phosphorus levels, but the passage of the Clean Water Act and tighter restrictions on water pollution reduced *Cladophora* populations. Although the exact causes of the resurgence of *Cladophora* are unknown, the clearer water following dreissenid invasions enables greater light penetration, which may allow for an increase in the abundance and depth distribution of *Cladophora*.²¹

B. Economic Impacts

Dreissenid invasions impose significant costs on power plants, water management agencies, marinas, and boat owners. Juvenile and adult dreissenid mussels secrete fibers, known as byssal threads, that enable them to attach to hard surfaces. Water intake pipes, fish screens, impoundment structures, docks, boat hulls, engines, propellers, and equipment are all susceptible to mussel fouling. Heavy fouling can reduce the pumping capacity of power and water-treatment plants, increasing costs and impacting consumers. Fouling can also impact cooling-water intake systems for hydroelectric dams, increasing operational and maintenance costs as well as negatively affecting energy production. Boats that are moored in one place for long periods of time can become heavily encrusted, with key systems clogged by mussels. To ensure proper operation of water systems and equipment, ongoing efforts are required to remove the attached mussels and control future fouling. From 1993 to 1999, dreissenid mussels cost the power industry in the Great Lakes area an estimated \$3.1 billion in increased maintenance and operational costs.²² The United States is not the only country with dreissenid problems. For example, water providers in southern England spend an estimated £500,000 to £1 million (\$800,000 to \$1.6 million) per year on zebra mussel removal and maintenance.²³

Following the arrival of zebra mussels in southeastern Lake Michigan in 1992, the body condition and size of lake whitefish, a commercially important fish species for human consumption, decreased compared to pre-mussel levels.²⁴ This decline in health is likely due in part to a shift in diet from native shrimp to the less-nutritious invasive mussels.²⁵ In 2010, *67 the Lake Michigan whitefish fishery was valued at over \$4.9 million.²⁶ Although hard data is not available, the economic value of this fishery has likely been depressed by the poorer condition and smaller size of the fish. Similar effects have been documented with other key commercial and recreational fish, such as bluegill, alewives, and Chinook salmon.²⁷

In addition to the direct economic impacts, dreissenid invasions also result in indirect, and hard to quantify, economic impacts caused by the devastation of native ecosystems. Researchers in Florida considered the possible economic impacts of a zebra mussel invasion of Lake Okeechobee and estimated ecosystem damages, in terms of lost wetland functions, at \$62.4 million over twenty years.²⁸ Additionally, mussel shells can accumulate on beaches, creating foul-smelling eyesores that negatively affect visitors' experiences. Improvements in water clarity from the presence of mussels, however, might increase property values along the shoreline because people tend to prefer clear water.²⁹ But, with increased water clarity come increases in macrophytes, which can also reduce recreational use due to swimmer dissatisfaction and boat prop entanglement. The macrophytes, in turn, provide additional protective cover for fish. As with any environmental change, some economic sectors may benefit while others suffer. These conflicting results increase the difficulty of assessing damages.

C. Western Expansion

Through the National Invasive Species Act of 1996, Congress called on the Western Regional Panel on Aquatic Nuisance Species to develop an "education, monitoring (including inspection), prevention, and control program to prevent the spread of the zebra mussel west of the 100th Meridian."³⁰ The 100th Meridian Initiative "represents the first comprehensive and strategically focused effort, involving Federal, State, Tribal and Provincial entities, potentially affected industries, and other interested parties to begin addressing pathways to prevent the westward spread of zebra mussels and other Aquatic Nuisance Species (ANS)."³¹

*68 For a time, it appeared as though the 100th Meridian Initiative was succeeding. For almost ten years, zebra and quagga mussel infestations remained limited to the eastern United States, although sightings of mussel-encrusted boats being hauled overland were frequent in the West.³² Then, on January 6, 2007, a diver found a quagga mussel during a routine inspection of a breakwater in a marina in Lake Mead National Recreation Area.³³ Because Lake Mead is not hydrologically connected to any of the waters in the eastern United States known to harbor quagga mussels, it is likely that the mussels hitchhiked to Lake Mead on a watercraft that had been transported overland from a quagga-infested water body in the Great Lakes region. Today, researchers at the University of Nevada, Las Vegas, estimate that there may be more than 1.5 trillion adult mussels and 320 trillion veligers (larval-stage mussels) in Lake Mead.³⁴

Subsequent surveys triggered by the Lake Mead finding led to the discovery of quagga mussels in Lakes Mohave and Havasu, which are reservoirs located downstream from Lake Mead along the Colorado River.³⁵ Quagga mussels quickly

spread into Arizona and California through the Colorado River Aqueduct and the canal systems of the Central Arizona Project, both of which draw water from Lake Havasu. Quagga mussel veligers have also been collected from reservoirs in Colorado, New Mexico, and Utah, although they are not considered established (i.e., reproducing naturally) in those states, as few adults have been detected.³⁶

Zebra mussels have also been detected in western U.S. water bodies. In 2008, zebra mussels were found in the San Justo Reservoir in California (adults), in Electric Lake in Utah (veligers), and in Pueblo Reservoir (an adult) and Grand Lake (veligers) in Colorado.³⁷ In 2009, a zebra mussel was discovered attached to underwater equipment in Lake Texoma, Texas, located along the border of Texas and Oklahoma.³⁸ The mussels have since been detected in Lake Ray Roberts, which is the first discovery of mussels in the Trinity River *69 Basin.³⁹ The discovery of both species in the West indicates that there have been multiple independent introductions from the East.

D. Threats to the West

Widespread zebra and quagga mussel invasions of waters in the western United States would have devastating environmental and economic impacts, similar to those experienced in the Great Lakes. Established populations of dreissenid mussels would compete with native species for habitat and food, alter water clarity, and change ecosystems. More worrisome are the potential economic costs associated with mussel fouling of intake pipes and infrastructure, given the region's numerous dams, irrigation systems, and massive water projects. A zebra mussel infestation, for example, could increase the operation and maintenance costs of the Central Arizona Project by \$4 to \$5 million per year.⁴⁰

Of particular concern is the risk of mussel introduction to the Columbia River Basin, which includes British Columbia, Alberta, Idaho, Washington, Oregon, Montana, Wyoming, Utah, and Nevada. Dreissenid mussels require certain environmental conditions, such as adequate calcium and pH levels, to survive and reproduce.⁴¹ These conditions are not present in all waters in the Columbia River Basin.

Regardless of the mussels' potential range, the economic and environmental impacts of an invasion into the Columbia River Basin could be severe. The Columbia River provides habitat for commercially and recreationally important species, such as salmon and trout; irrigation and drinking water to farmers, businesses, and individuals; and renewable energy in the form of hydropower. If mussels were to be introduced into the Basin and begin to naturally reproduce and spread, such an invasion could threaten native salmon populations already suffering from habitat alteration and fishing pressures. The economic impacts to the hydropower system would be significant as well. Cost estimates for zebra mussel control associated with the U.S. Army Corps of Engineers' hydroelectric projects include one-time costs of installing control systems ranging from "the hundreds of thousands of dollars to over a million dollars per facility," and maintenance costs over five years at \$52 million.⁴² In 2009, Idaho officials estimated that a dreissenid mussel introduction could cost the state nearly \$100 million per year.⁴³ Nonetheless, the full extent of the risk is unknown at this time.

*70 The primary vector of concern in the Western region, aside from water supply projects,⁴⁴ is trailered recreational boats. Recreational boating is incredibly popular in the United States. In 2010, there were over 3,000,000 vessel registrations in the Western states (excluding Alaska and Hawaii).⁴⁵ California has the highest number of vessel registrations (906,988) and Wyoming the lowest (27,955).⁴⁶ Fortunately, most recreational boaters frequent waters near where they live, and only a fraction of the 3,000,000 registered boats are trailered long distances overland.⁴⁷ Significant numbers of trailered boats, however, are moving around the region. As of August 2012, officials in the Western region had inspected almost 450,000 trailered watercraft, of which 200 were contaminated with dreissenid mussels.⁴⁸ Although almost half of the contaminated vessels originated from Lake Mead,⁴⁹ the threat is widespread, as there are sixty-four boater-utilized waters within the Western region that are infested with quagga or zebra mussels.⁵⁰

In addition to spreading mussels to isolated, non-affected waters, recreational boats can result in multiple introductions to the same water body, thereby increasing the propagule pressure. Propagule pressure refers to the quantity, quality, and frequency of invasive organisms introduced into a particular location.⁵¹ As the propagule pressure increases (as more individuals are introduced into the environment), so does the risk that the species will become established. Boats that have been moored in waters where dreissenid mussels are present for long periods of time pose the greatest risk due to the sheer numbers of individual mussels they might be harboring onboard.

Consider the recent case of the *Fiesta Queen*, a 110-foot paddle-wheel boat intercepted by the Utah Division of Wildlife Resources in April 2012 en route to Saskatchewan.⁵² The *Fiesta Queen* had operated as a dinner and wedding boat on the Colorado River for years and was heavily encrusted with quagga mussels. The vessel had been sold near Laughlin, Nevada, and was being transported to its new owner by a *71 commercial hauler.⁵³ Because of the vessel's size, multiple water circulation systems, and complicated design, it took Utah officials twenty-nine days to decontaminate the vessel at a cost of more than \$12,000.⁵⁴

II. RESPONSE OF THE WESTERN STATES

Since the discovery of quagga mussels in Lake Mead in 2007, Western states and the federal government have taken significant action to prevent the spread of dreissenid mussels in the region. Part II provides an overview of these various programs and initiatives.

A. Boater Outreach and Education

One of the most critical tools in the fight against invasive species is public outreach and education. Because most invasions are caused by human activities, future invasions can only truly be prevented through changes in behavior. In the context of zebra and quagga mussel prevention, boaters need to take individual responsibility to prevent mussels from hitching a ride on their boats to other waters. To raise awareness of the invasive mussel problem and gain public support for state action, the Western states have implemented several coordinated outreach and education initiatives through the 100th Meridian Initiative.

Outreach and education efforts have focused on both the overall aquatic invasive species (AIS) issue and the prevention of zebra and quagga mussels specifically. The national AIS prevention campaign, Stop Aquatic Hitchhikers!, sponsored by the Aquatic Nuisance Species Task Force, is widely used by states and partner agencies throughout the region.⁵⁵ Stop Aquatic Hitchhikers! utilizes a variety of outreach strategies, including informational brochures, boat ramp signs, stickers, videos, and public service announcements.⁵⁶ The 100th Meridian Initiative's *Zap the Zebra* brochure⁵⁷ and the Pacific States Marine Fisheries Commission's *Don't Move a Mussel* video⁵⁸ help states deliver consistent zebra- and quagga-specific messaging. The Utah Division of Wildlife Resources, for example, has an extensive outreach and education component included in its AIS plan, which includes the use of statewide media coverage, brochures distributed to Utah boat owners, one-on-one *72 contact with boaters, boat-launch signs, billboards, posters, and lectures.⁵⁹ In addition, most outreach programs in the region encourage recreational boaters to "Clean, Drain, and Dry" before moving boats to another body of water.⁶⁰

State natural resource agencies have generally been empowered to engage in these public outreach and education efforts by state law. When enacting its aquatic invasive species laws, the Montana Legislature found that "preventing the introduction, importation, and infestation of invasive species is best accomplished through coordinated educational and management activities."⁶¹ The appropriate departments in Montana are directed to collaborate to develop a strategic plan that includes a component of public awareness and education.⁶² These education and outreach programs should "increase public knowledge and understanding of prevention, early detection, and control of invasive species."⁶³

A few states in the region have legislative directives to develop and implement dreissenid mussel outreach and education programs. In California, for example, owners or managers of water bodies are encouraged to "develop and implement a program designed to prevent the introduction of nonnative Dreissenid mussel species."⁶⁴ These programs should include public education, monitoring, and management of recreational, boating, or fishing activities that are permitted.⁶⁵ An example of outreach and education in action is the North Coast Zebra and Quagga Mussel Consortium, a collection of local governments that have worked together to implement an outreach and education plan. The Consortium's outreach efforts include a website that contains maps showing mussel infestation and tips on how to inspect a watercraft before entering waterways.⁶⁶

Washington's state laws are particularly detailed in their description of required outreach efforts. Warning signs created by the Washington Department of Fish and Wildlife (WDFW) must be posted at boat launches. These signs must contain information on the threat of AIS, the penalties associated with the introduction of AIS, and contact information for obtaining a free inspection.⁶⁷ Further, the WDFW must coordinate with the state's parks and recreation commission to include

information in boating publications and agency websites.⁶⁸

***73 B. Identification of Affected Waters**

To effectively address the dreissenid mussel problem, or any other invasive species problem, managers and boaters need to know where the invasives are located. Several Western state legislatures have authorized state agencies to identify and maintain lists of mussel-affected waters to facilitate targeted prevention, control, and eradication efforts. The terminology varies by state. Nevada, for example, defines “impaired body of water” as “any body of water in this State or any other state which the Commission or another governmental entity has identified as containing an aquatic invasive species.”⁶⁹ Idaho rules refer to “Dreissena infested Waterbody.”⁷⁰ The Wyoming Game and Fish Commission recently amended the state’s aquatic invasive species regulations and defined “high risk infested water” as “a water in any state or province known or suspected to contain zebra mussel *Dreissena polymorpha* or quagga mussel *Dreissena rostriformis*.”⁷¹

Arizona law empowers the Director of the Arizona Game and Fish Department to issue orders “establishing a list of waters or locations where aquatic invasive species are present and take steps that are necessary to eradicate, abate or prevent the spread of aquatic invasive species within or from those bodies of water.”⁷² The current list of designated waters in Arizona where quagga mussels are documented and present includes: Lake Pleasant; Lower Colorado River, including Lake Mead, Lake Mohave, Lake Havasu, Imperial Reservoir, Mittry Lake, Martinez Lake, and Topock Marsh; and the Central Arizona Project aqueduct from Lake Havasu to Apache Junction.⁷³

Utah defines “infested water” as “a geographic region, water body, facility, or water supply system within or outside the state that the [Wildlife] Board identifies in a rule as carrying or containing a Dreissena mussel.”⁷⁴ The Wildlife Board may designate a water body, facility, or water supply system within the state as an infested water “when a juvenile or adult mussel from the subject water is visually identified as a Dreissena mussel and that identity is confirmed by two independent positive polymerase chain reaction (PCR) tests.”⁷⁵ Currently, only Sand Hollow Reservoir (quagga mussels) in Washington County has been identified as an infested water, although veligers have been detected in Red Fleet Reservoir *74 (quagga mussels) in Uintah County and Electric Lake (zebra mussels) in Emery County.⁷⁶ The standards are more relaxed for the designation of infested waters outside the state. The Wildlife Board may designate other states’ water bodies, facilities, and water supply systems as infested “when a veliger, juvenile, or adult Dreissena mussel is detected by the state having jurisdiction over the water or when the Wildlife Board has credible evidence suggesting the presence of a Dreissena mussel.”⁷⁷ The Wildlife Board has identified as infested waters all coastal and inland waters in: Colorado; California; Nevada; Arizona; New Mexico; all states east of Montana, Wyoming, Colorado, and New Mexico; Ontario and Quebec; and Mexico.⁷⁸

Similar to Utah, Colorado, through its Department of Natural Resources, requires both visual and molecular identification for veligers and “concurring identification by two or more mollusk identification experts” for adults before identifying a Colorado water as infested with zebra mussels or quagga mussels.⁷⁹ Other legislative standards are less prescriptive. The Director of the New Mexico Department of Game and Fish, in consultation with the Secretary of Energy, Minerals, and Natural Resource and with the concurrence of the Director of the Department of Agriculture, may designate water bodies within the state as infested waters “based on a determination of credible scientific evidence.”⁸⁰

C. Closures

Closure of waters to recreational vessel use is a drastic but effective means of preventing the further spread of invasive species to other waters. It is important to note that a “closure” of a water body, although sometimes referred to as a quarantine, is different from the “quarantine” of a watercraft, which is discussed in more detail below. Water body closures may be permanent, but are more often temporary and imposed simply to provide state or local officials with time to assess the level of infestation and develop a management plan.

The Wyoming Fish and Game Commission, “in consultation with the department of state parks and cultural resources, may restrict watercraft usage on waters of the state ... upon a finding that a specific body of water is threatened with the imminent introduction of an aquatic invasive species or aquatic invasive species has been introduced to the specific body of water.”⁸¹ In California, if dreissenid mussels are present or detected, state officials “may order the affected waters or facilities closed to conveyances or otherwise restrict access *75 to the affected waters.”⁸² In ordering the closure of such waters or facilities, the

California Department of Fish and Game must consult with the Secretary of the Natural Resources Agency, provide updates to the operator of the affected facility for closures lasting longer than seven days, as well as notify the affected local and federal agencies and other appropriate authorities.⁸³ The Department is also required to consult with those responsible for the closed waters or facilities to focus the closure to specific areas to reduce disruption of economic or recreational activity.⁸⁴

The Utah Division of Wildlife Resources (UDWR) may order the closure of, or restrict access to, a water body, facility, or water supply system if it detects or suspects the presence of dreissenid mussels.⁸⁵ If a closure lasts longer than seven days, the UDWR must provide written updates to the operator of the water body, facility, or water supply system every ten days and post such updates on the UDWR's website.⁸⁶ Similar to California, the UDWR must consult with those responsible for the closed waters or facilities "to avoid or minimize disruption of economic and recreational activity."⁸⁷ The UDWR, however, may not close a water supply system if the operator has prepared and implemented a plan to control or eradicate the mussels.⁸⁸ A closure order may (1) close the water entirely to conveyance and equipment; (2) subject conveyances and equipment entering and leaving the water to decontamination requirements; and (3) "impose any other condition or restriction necessary to prevent the movement of Dreissena mussels into or out of the subject water."⁸⁹ The closure order must be issued in writing and set forth the subject water body, facility, or water supply system; the nature and scope of the closure or restriction; the reasons for the closure or restriction; and the conditions upon which the order may be terminated or modified.⁹⁰ Upon the issuance of a closure order, entities that do not already have a control plan are required to cooperate with the UDWR to develop and implement a plan to address the mussel infestation.⁹¹ Entities that develop control plans prior to the detection of mussels can eliminate or minimize the duration and impact of a closure order.⁹²

Federal agencies may also order the closure of waters. In August 2012, for example, Crater Lake National Park "issued an immediate, but temporary closure, prohibiting scuba diving and other use of water gear in the lake."⁹³ The closure was imposed as a precautionary measure, as mussels have not yet been detected in the park. During the closure, the National *76 Park Service (NPS) will work to develop protocols for divers to minimize the risk that their equipment and activities would introduce invasive species into the park. The NPS anticipates that these protocols will be in place before the beginning of the 2013 season.⁹⁴

D. Prohibition on Possession and Transport

State prohibitions on the possession and movement of zebra or quagga mussels are the foundations for many of the state dreissenid mussel prevention and watercraft inspection programs. Most states in the region prohibit the possession and transportation of invasive species into or within the state. State laws vary in language and scope, however. Idaho's law encompasses all taxa (terrestrial and aquatic), prohibiting with few exceptions the possession of "invasive species,"⁹⁵ defined as "species not native to Idaho."⁹⁶ Wyoming and Arizona prohibit the possession of "aquatic invasive species."⁹⁷ States like Utah and California specify that it is unlawful to possess dreissenid mussels.⁹⁸ A few states, like Nevada, prohibit only the possession of "live" mussels.⁹⁹ Violations of possession and transportation prohibitions, which include the movement of mussels while attached to watercraft, can result in civil penalties and, in egregious circumstances, criminal penalties.

Federal law prohibits the interstate transport of live zebra mussels. Congress listed zebra mussels as an "injurious species" pursuant to Title 18 of the Lacey Act in the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990.¹⁰⁰ Title 18 of the Lacey Act prohibits the importation or transportation of species across state lines if the species is "deemed to be injurious or potentially injurious to the health and welfare of human beings, to the interest of forestry, agriculture, and horticulture, and to the welfare and survival of the wildlife or wildlife resources of the United States."¹⁰¹

Although quagga mussels are not federally listed as injurious, violations of state laws prohibiting the possession or transportation of quagga mussels may trigger a violation of the Lacey Act under Title 16. The "wildlife trafficking" provisions of the Lacey Act make it unlawful for any person to "import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce any fish or wildlife taken, possessed, transported, or sold in violation of any law or regulation of any State or in violation of any foreign law."¹⁰² A recreational boater, for example, might violate the Lacey Act by trailering a boat with quagga *77 mussels attached and then transporting the contaminated vessel across state lines. Lacey Act trafficking cases based on violations of state law, however, may pose unique challenges. Underlying violations of state laws or regulations may be subject to interpretation and potential constitutional challenges in federal court, emphasizing the importance of well-crafted, comprehensive state laws as the foundation of AIS prevention and enforcement.

E. Notification of State Officials

When dealing with invasive species, time is of the essence. “Early detection and rapid response ... efforts increase the likelihood that invasions will be addressed successfully while populations are still localized and population levels are not beyond that which can be contained and eradicated.”¹⁰³ Since state agencies do not have the manpower or the resources to routinely monitor and inspect all water bodies, many state AIS laws impose mandatory reporting and notification requirements to ensure rapid-response plans are triggered as soon as possible.

In California, “any entity that discovers dreissenid mussels within [the] state shall immediately report the discovery to the [Department of Fish and Game].”¹⁰⁴ In Colorado, “a person who knows that an aquatic nuisance species is present at a specific location shall immediately report such knowledge and all pertinent information”¹⁰⁵ Reports can be submitted by telephone (1-877-STOP-ANS), email, or through the state’s website.¹⁰⁶ Aquatic nuisance species reports should include the identification of the suspected species, the date and time the species was detected, the exact location of the sighting, and the contact information of the reporter.¹⁰⁷

Idaho law also requires any person who discovers a zebra or quagga mussel or “who has reason to believe that” one may exist within the state to immediately report the discovery to the Department of Agriculture.¹⁰⁸ Reports should contain information on the location of the species, date of discovery, and identification of any conveyance, equipment, or water body in or upon which the mussel may be found.¹⁰⁹ As an incentive to encourage reporting, Idaho will hold reporting parties harmless for violations regarding possession of dreissenid mussels.¹¹⁰

Wyoming also has mandatory reporting requirements. “Any person that becomes aware or suspects an unreported aquatic invasive species being present at a specific location in Wyoming shall report the aquatic invasive species [’] presence within forty-eight (48) hours *78 to the [Wyoming Game and Fish] Department or any peace officer.”¹¹¹ Samples collected of suspected aquatic invasive species must also be submitted to the Department within forty-eight hours.¹¹²

Upon notification, state officials can take appropriate response actions as outlined in applicable rapid response plans such as the *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species*.¹¹³ The Columbia River Basin’s plan sets forth a ten-step process for responding to a dreissenid introduction, including notification of all interested parties, verification of the reported introduction, mobilization of resources, containment of the threat, and implementation of long-term monitoring plans.¹¹⁴ Some federal agencies have also developed rapid-response plans to deal with introductions into water bodies under federal management.¹¹⁵

F. Watercraft Inspection Programs

An important component of Western states’ prevention programs is the inspection of watercraft and equipment by personnel trained to detect quagga and zebra mussels as well as other invasive species. These programs, generally referred to as watercraft inspection programs, are intended to prevent the transfer of AIS through the inspection and decontamination of watercraft and equipment. Watercraft inspection programs often involve either a self-inspection requirement or official inspections at checkpoints strategically located along highways or at particular water bodies. As of January 2012, at least seventy-five jurisdictions in nineteen Western states have implemented some form of a watercraft inspection program on over 400 water bodies.¹¹⁶

Watercraft inspection programs serve several purposes. First, they provide state officials with direct, face-to-face contact with recreational users to conduct outreach and education. Second, the programs provide states with important data regarding the movement of watercraft in the region, frequency of mussel contamination, and efficacy of outreach programs such as “Clean, Drain, and Dry.” Finally, the programs reduce the invasion risk and protect both the environmental and recreational values associated with the region’s waters.

Almost every state in the region is authorized to implement watercraft inspection programs. For example, the Montana Department of Fish, Wildlife and Parks is authorized to establish Aquatic Invasive Species Inspection Stations for the purpose of preventing the *79 spread and introduction of invasive species. All owners, operators, and persons in possession of a vessel must stop at such check stations, where state officials will inspect vessels intended for launch on any water in Montana for the presence of invasive species and compliance with Montana regulations.¹¹⁷ If any aquatic invasive species are

discovered during the inspection, the vessel may not leave until it has been properly cleaned and decontaminated, and it must pass a second inspection prior to launching.¹¹⁸

The locations of check stations vary by state. In Colorado, watercraft inspection stations are located at boat ramps and other points of entry.¹¹⁹ Persons transporting vessels from infested waters must have the vessel inspected prior to leaving.¹²⁰ All other vessels must be inspected prior to launching.¹²¹ In Wyoming, “every conveyance entering the state by land shall be inspected by an authorized aquatic invasive species inspector ... prior to contacting or entering” state waters.¹²² Traditionally, Wyoming’s check stations have been located at major waters around the state. In 2013, border check stations will be added.¹²³ Idaho has roadside inspection stations along major highways and near the state line.¹²⁴ Anyone towing a watercraft or other conveyance is required to stop at the inspection stations during hours of operation.¹²⁵ In 2012, Idaho’s inspection stations performed over 42,000 inspections and intercepted fifty-seven watercraft carrying invasive mussels.¹²⁶

In most states, trailered boats may also be stopped and inspected outside of a check station. For example, in Colorado, qualified peace officers may stop a watercraft if it is visibly transporting aquatic plant materials or if there is a “reasonable belief” that an aquatic nuisance species may be present.¹²⁷ In Idaho, vessels may be stopped and the exterior inspected when there is “reasonable suspicion” that the conveyance is infested.¹²⁸ Wildlife officers in Washington can temporarily stop and inspect watercraft “based upon articulable facts that a person is transporting a prohibited [species].”¹²⁹

***80** Aggressive public outreach and education campaigns in the region encourage all recreational boaters to take personal responsibility for ensuring that they do not transport dreissenid mussels or other AIS by (1) cleaning the boat and trailer and removing any visible plants or animals before leaving the water body; (2) draining the motor, live well, and bilge tanks; and (3) drying the boat and equipment for as long as possible, but for at least five days or longer depending on air temperature and humidity.¹³⁰ Some states, such as Utah and Arizona, require boaters to self-certify that they have taken these steps and that their boats and equipment are free of AIS.

Before leaving listed waters in Arizona, boat owners must remove any clinging material; remove the plug and drain water from the bilge and other components; drain water from the engine; and allow the watercraft and equipment to “dry completely.”¹³¹ In addition, if the person intends to use the watercraft in less than five days at any other Arizona water, he must “disinfect the bilge by pouring not less than one gallon of vinegar into the bilge.”¹³² Owners, operators, and transporters of long-term-use boats (those used in a particular water for more than five days) must submit an Aquatic Invasive Species Boat Inspection Report to the Arizona Game and Fish Department before transporting the watercraft to another Arizona water or out of state.¹³³

Boat owners and transporters are prohibited under federal law from filing false aquatic invasive species inspection reports or other reports to state authorities regarding invasive species transported in interstate commerce. The Lacey Act’s “false labeling” provisions prohibit making or submitting any false record or account for any fish or wildlife that has been or is intended to be transported in interstate or foreign commerce.¹³⁴

G. Watercraft Decontamination

If quagga or zebra mussels are detected during a watercraft inspection, the watercraft must be decontaminated to ensure the watercraft or equipment does not pose a threat of spreading the mussels to other waters. Decontamination protocols vary by state, but watercraft decontamination typically involves a hot-water rinse or spray of the exterior of the watercraft and interior compartments, which kills and removes the mussels. “The general recommendation is to use 140°F water at high pressure (2,500 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 to avoid damaging pumps.”¹³⁵ A hot-water rinse at this temperature for ten seconds will kill adult mussels.¹³⁶

***81** If an inspector at a watercraft inspection station in Oregon determines that decontamination is required, “the decontamination process will include the hull, motor, propulsion system or component, anchor or other attached apparatus, trailer or other device used to transport the watercraft, bilge, live-well or other interior location that could harbor aquatic plants or animals.”¹³⁷ Decontamination methods may include “hot water washing or flushing, high-pressure water jets, hand removal and chemical treatment as determined necessary by the watercraft inspection team.”¹³⁸ In most Western states, professional decontamination involves the application of scalding water (140°F) “to completely wash the equipment or

conveyance and flush any areas where water is held, including ballast tanks, bilges, livewells, and motors.”¹³⁹

Regional uniformity in inspection and decontamination protocols has been encouraged and facilitated by the Pacific States Marine Fisheries Commission (PSMFC). The PSMFC-sponsored Watercraft Inspection Training Program began in 2006,¹⁴⁰ and in 2009, the PSMFC published *Recommended Uniform Minimum Protocols and Standards for Watercraft Interception Programs for Dreissenid Mussels in the Western United States*. An update to these standards, referred to as UMPS II, was released in 2012.¹⁴¹

H. Watercraft Quarantine

For heavily encrusted large vessels, like the previously mentioned *Fiesta Queen*, decontamination at a check station may not be sufficient to kill and remove all mussels. In such situations, officials in some states are authorized to impound and quarantine the watercraft. Utah officials may authorize the detainment and quarantine of a watercraft for up to five days or “the period of time necessary to decontaminate the conveyance or equipment and ensure that a Dreissenid mussel is not living on or in the conveyance or equipment.”¹⁴² In Idaho, mussel-contaminated watercraft are immediately detained and towed to the closest impoundment yard.¹⁴³ Upon impoundment, the watercraft is subject to a hold order issued by the Department of Agriculture until decontamination is complete.¹⁴⁴ The boat is then re-inspected by a third-party inspector before release.¹⁴⁵ Detention and quarantine may also be authorized if the person transporting the vessel or equipment refuses to submit to an *82 inspection or decontamination.¹⁴⁶ Peace officers in Wyoming, for example, may impound and quarantine a watercraft if an AIS is found during an inspection or if the person transporting the watercraft refuses to submit to an inspection or allow decontamination.¹⁴⁷

Quarantine is primarily used to ensure that the watercraft and equipment are properly decontaminated, which often involves simply an extended drying period. “The general recommendation is to keep the boat out of water and let it dry for a minimum of 30 days after cleaning all equipment and draining all possible sources of standing water.”¹⁴⁸ Drying periods may be reduced, however, in areas with higher temperatures and lower humidity. The 100th Meridian Initiative’s Drying Time Estimator can help state officials and boat owners determine how long particular boats should remain out of the water in specific locales.¹⁴⁹

I. Funding

All of the above activities require resources, yet states rarely have adequate funds to implement a comprehensive dreissenid mussel prevention program. Pursuant to the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, state AIS management plans approved by the Aquatic Nuisance Species Task Force are eligible for federal cost-share funding.¹⁵⁰ These funds are extremely limited, however, and state programs need access to stable sources of funding. The legislatures in many states in the Western region have created AIS accounts funded from a variety of sources to support mussel outreach and prevention activities.

Washington’s aquatic invasive species prevention and enforcement programs are primarily funded through dedicated fees on resident recreational watercraft.¹⁵¹ The Washington Department of Fish and Wildlife may use the funds in the account to: inspect recreational and commercial watercraft; educate law enforcement officers on AIS law enforcement issues; evaluate the risk of the spread of AIS by watercraft and float planes; and implement an AIS early-detection and rapid-response plan.¹⁵² In Colorado, the legislature has established aquatic nuisance species accounts funded in part through wildlife license fees and severance taxes.¹⁵³ Idaho requires boaters to display a Protection Against Invasive Species Sticker to launch and operate on state waters.¹⁵⁴ Revenue from the sale of the stickers is *83 deposited in the Idaho Invasive Species Fund. Wyoming’s program is also partially funded through a mandatory AIS decal.¹⁵⁵ In September 2012, the California Legislature passed Assembly Bill Number 2443, authorizing the imposition of an additional quagga- and zebra-mussel-infestation prevention fee on top of the existing registration fee for vessels.¹⁵⁶ The revenue generated by these fees may be used by the state to implement and administer dreissenid mussel monitoring, inspection, and prevention programs.

III. ONGOING CHALLENGES AND NEXT STEPS

Although the Western states have made significant progress in the development of dreissenid mussel prevention programs

over the past five years, a number of large challenges remain. The geographic area each state needs to cover is enormous and many waters have multiple points of entry that are difficult, if not impossible, to continuously monitor. Inspections and decontamination efforts at infested waters are non-existent or ineffective. Lack of funding has always been an ongoing barrier to the implementation of robust dreissenid-monitoring and boat-inspection programs. The Western Regional Plan estimates that it would cost over \$19 million per year to implement mandatory inspection and decontamination at infested waters in the region.¹⁵⁷ Given the current federal and state budget climate, the funding to support dreissenid programs is unlikely to improve anytime soon.

Gaps and inconsistencies in state dreissenid management programs result in confusion among the regulated community (i.e., recreational boaters) and inadequate prevention and enforcement efforts. A trailered watercraft traveling between Arizona and Washington may be stopped several times and subject to varying inspection and decontamination protocols. Not every state official has the authority to impound or quarantine a vessel for refusing to submit to an inspection, which could result in a mussel-contaminated watercraft being launched in an unaffected water. Some states lack the authority to close a water body to boating until adequate management programs are in place.

State efforts to address the trailered watercraft pathway are further hampered by the multi-jurisdictional nature of the problem. Authority for many of the most popular recreational waters in the West is shared with federal authorities who have lagged behind their state counterparts in issuing regulations to prevent the movement of dreissenid mussels to and from federal lands and in implementing watercraft inspection programs. No federal regulations currently address the movement of dreissenid mussels on federal lands. Several federal agencies in the region, however, have imposed restrictions on the movement of boats through use permits and emergency orders. For example, the U.S. Forest Service has prohibited motorized or trailered watercraft at certain boat launch sites within the Arapaho *84 National Recreation Area to prevent further mussel infestations.¹⁵⁸ In Glen Canyon National Recreation Area, the National Park Service (NPS) imposes mandatory boat inspections prior to launching on Lake Powell.¹⁵⁹ An NPS boat inspection is also required to launch any motorized or trailered watercraft in Glacier National Park in Montana.¹⁶⁰

CONCLUSION

Zebra and quagga mussels are firmly established in the eastern United States and are quickly spreading throughout the Southwest. As a result, there will always be the risk that a careless boater will transport and introduce the invasive dreissenid mussels to an unaffected water body.

During the August 2012 invasive mussel workshop in Phoenix, Arizona, described in the Introduction, attendees developed *An Action Plan to Implement Legal and Regulatory Efforts to Minimize Expansion of Invasive Mussels Through Watercraft Movements in the Western United States* to address many of the concerns listed above. A few of the key actions include:

- ?broaden the scope of federal regulations to include preventing the movement of *Dreissena* mussels onto and off of federal lands and waters;
- build on existing *Uniform Minimum Protocols and Standards for Watercraft Interception Programs for Dreissenid Mussels in the Western United States (UMPS)* document with a goal of consistent decontamination protocols and reciprocity across the Western states; and
- develop model statutory and regulatory language for a comprehensive watercraft inspection and decontamination program.¹⁶¹

By working together to implement coordinated and robust containment and prevention programs, federal, state, and local resource managers can significantly reduce the risk and potentially slow the spread of invasive mussels until more effective control and management strategies are developed.

Footnotes

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- ^{a1} J.D., M.S.E.L., Stephanie Showalter Otts is Director of the National Sea Grant Law Center at the University of Mississippi School of Law.
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- ¹ In this Article, “Western states” refers to the states within the geographic scope of the Western Regional Panel on Aquatic Nuisance Species. This area includes all mainland states west of the Mississippi River; Alaska; and Hawaii.
- ² Exec. Order No. 13,112, 64 Fed. Reg. 6183, 6183 (Feb. 3, 1999).
- ³ David Pimentel et al., *Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States*, 52 ECOLOGICAL ECON. 273, 273 (2005).
- ⁴ *Id.* at 282.
- ⁵ *Id.* at 279.
- ⁶ Robert F. McMahon, Quagga/Zebra Mussel Life History, Presentation at Legal and Regulatory Efforts to Minimize Expansion of Invasive Mussels Through Watercraft Movements, Slide 4 (Aug. 22, 2012), available at http://seagrant.oregonstate.edu/sites/default/files/invasivespecies/mussel-workshop-2012/ag_ais_workshop_quagga_zebra_life_history_mcmahon_082212.pdf [hereinafter McMahon Presentation].
- ⁷ See generally Mikhail O. Son, *Native Range of the Zebra Mussel and Quagga Mussel and New Data on Their Invasions Within the Ponto-Caspian Region*, 2 AQUATIC INVASIONS 174 (2007), available at www.aquaticinvasions.net/2007/AI_2007_2_3_Son.pdf.
- ⁸ See *Frequently Asked Questions About the Zebra Mussel*, U.S. GEOLOGICAL SURVEY, http://fl.biology.usgs.gov/Nonindigenous_Species/Zebra_mussel_FAQs/zebra_mussel_faqs.html#firstfound (last modified Dec. 14, 2012) [hereinafter *Zebra Mussel FAQs*].
- ⁹ *Quagga Mussel (Dreissena bugensis)*, U.S. GEOLOGICAL SURVEY, <http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=95> (last modified Nov. 16, 2012) [hereinafter *Quagga Mussel Fact Sheet*].
- ¹⁰ *The Zebra Mussel Invasion*, NAT’L OCEANIC & ATMOSPHERIC ADMIN., http://www.noaa.gov/features/earthobs_0508/zebra.html (last visited Jan. 12, 2013).
- ¹¹ See, e.g., *1997 Zebra/Quagga Mussel Location Map*, U.S. GEOLOGICAL SURVEY, <http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/maps/1997.gif> (last visited Jan. 12, 2013).
- ¹² *Quagga Mussel Fact Sheet*, *supra* note 9.

- 13 See *Zebra and Quagga Mussel Distribution in U.S. Lakes*, U.S. GEOLOGICAL SURVEY, http://fl.biology.usgs.gov/Nonindigenous_Species/Zebra_mussel_distribution/zebra_mussel_distribution.html (last updated Nov. 5, 2012).
- 14 McMahon Presentation, *supra* note 6, at 26.
- 15 *Id.* at 29.
- 16 *Zebra Mussel FAQs*, *supra* note 8.
- 17 S. N. Higgins & M. J. Vander Zanden, *What a Difference a Species Makes: A Meta-analysis of Dreissenid Mussel Impacts on Freshwater Ecosystems*, 80 ECOLOGICAL MONOGRAPHS 179, 183 (2010).
- 18 *Scientists Study Link Between Zebra Mussels and Algae Blooms*, SCI. DAILY (Sept. 22, 1998), <http://www.sciencedaily.com/releases/1998/09/980919115852.htm>.
- 19 GREAT LAKES ENVTL. RESEARCH LAB., NAT'L OCEANIC & ATMOSPHERIC ADMIN., 20 YEARS OF ZEBRA AND QUAGGA MUSSEL RESEARCH AT NOAA'S GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY 2 (2008) [hereinafter 20 YEARS].
- 20 *Id.*
- 21 Harvey Bootsma & John Janssen, *Cladophora*, GREAT LAKES WATER INST., <http://www.glwi.uwm.edu/research/aquaticceology/cladophora/> (last visited Jan. 15, 2013).
- 22 W. REG'L PANEL ON AQUATIC NUISANCE SPECIES, QUAGGA-ZEBRA MUSSEL ACTION PLAN FOR WESTERN U.S. WATERS 4 (2010) [hereinafter QUAGGA-ZEBRA MUSSEL ACTION PLAN].
- 23 Richard Alleyne, *Invasion of the Zebra Mussels Costs Country Million of Pounds*, THE TELEGRAPH, Aug. 5, 2011, <http://www.telegraph.co.uk/news/uknews/8681571/Invasion-of-thezebra-mussels-costs-country-million-of-pounds.html>.
- 24 Steven A. Pothoven et al., *Changes in Diet and Body Condition of Lake Whitefish in Southern Lake Michigan Associated with Changes in Benthos*, 21 N. AM. J. FISHERIES MGMT. 876, 880 (2001).
- 25 20 YEARS, *supra* note 19, at 1.
- 26 *Commercial Fish Production -- Pounds and Value, 2010, Great Lakes Region, U.S. Waters*, U.S. GEOLOGICAL SURVEY (Mar. 23, 2012, 9:08 AM), http://www.glsc.usgs.gov/_files/cfreports/noaa10.txt.
- 27 20 YEARS, *supra* note 19, at 2.
- 28 DONNA J. LEE ET AL., THE ECONOMIC IMPACT OF ZEBRA MUSSELS IN FLORIDA 1 (2007), *available at* <http://edis.ifas.ufl.edu/fe693>.

- 29 See generally Karin E. Limburg et al., *The Good, the Bad, and the Algae: Perceiving Ecosystem Services and Disservices Generated by Zebra and Quagga Mussels*, 36 J. GREAT LAKES RES. 86 (2010), available at www.utoledo.edu/nsm/lec/pdfs/Limburg_et_al.pdf.
- 30 National Invasive Species Act of 1996, Pub. L. No. 104-332, 110 Stat. 4073 (Oct. 26, 1996) (codified in scattered sections of 16, 18, and 33 U.S.C.).
- 31 U.S. FISH & WILDLIFE SERV., THE 100TH MERIDIAN INITIATIVE: A STRATEGIC APPROACH TO PREVENT THE WESTWARD SPREAD OF ZEBRA MUSSELS AND OTHER AQUATIC NUISANCE SPECIES 1 (2001) [hereinafter 100TH MERIDIAN INITIATIVE].
- 32 E-mail from Larry Dalton, Aquatic Invasive Species Coordinator, Utah Div. of Wildlife Res., to author (Nov. 5, 2012, 12:51 PM) (on file with author).
- 33 Erik Stokstad, *Feared Quagga Mussel Turns Up in Western United States*, 315 SCI. 453 (2007).
- 34 Press Release, Univ. of Nev., Las Vegas, Quagga Mussels Reach Record Numbers in Lake Mead, UNLV Research Finds (May 18, 2012), <http://news.unlv.edu/release/quagga-musselsreach-record-numbers-lake-mead-unlv-research-finds>.
- 35 LAKE MEAD NAT'L RECREATION AREA, NAT'L PARK SERV., QUAGGA MUSSELS FREQUENTLY ASKED QUESTIONS 2 (2008), available at <http://www.nps.gov/lame/naturescience/upload/FrequentlyAskedQuestionsPublicVersionMay>.
- 36 *Quagga Mussel Fact Sheet*, *supra* note 9.
- 37 *Zebra Mussel (Dreissena bugensis)*, U.S. GEOLOGICAL SURVEY, <http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5> (last modified June 6, 2012) [hereinafter *Zebra Mussel Fact Sheet*].
- 38 Press Release, Tex. Parks & Wildlife, Lone Zebra Mussel Found in Lake Texoma, (Apr. 21, 2009), <http://www.tpwd.state.tx.us/newsmedia/releases/?req=20090421a&nrtype=all&nrspace=&nsearch=zebra+mussels>.
- 39 Press Release, Tex. Parks & Wildlife, Zebra Mussel Found in Lake Ray Roberts (July 18, 2012), <http://www.tpwd.state.tx.us/newsmedia/releases/?req=20120718a>.
- 40 100TH MERIDIAN INITIATIVE, *supra* note 31, at 5-6.
- 41 See McMahon Presentation, *supra* note 6, at 31.
- 42 100TH MERIDIAN INITIATIVE COLUMBIA RIVER BASIN TEAM, COLUMBIA RIVER BASIN INTERAGENCY INVASIVE SPECIES RESPONSE PLAN: ZEBRA MUSSELS AND OTHER DREISSENIID SPECIES 4 (2011).
- 43 IDAHO AQUATIC NUISANCE SPECIES TASK FORCE, ESTIMATED POTENTIAL ECONOMIC IMPACT OF ZEBRA AND QUAGGA MUSSEL INTRODUCTION INTO IDAHO 2 (2009), available at <http://www.aquaticnuisance.org/wordpress/wp-content/uploads/2009/01/Estimated-Economic-Impact-of-Mussel-Introduction-to-Idaho-Final.pdf>.
- 44 As mentioned earlier, quagga mussels have quickly spread from Lake Mead into the Colorado River and connected reservoirs in

Nevada, Arizona, and California. Water projects within the Trinity River Basin could hasten the spread of zebra mussels in Texas.

45 MARION E. WITTMANN, A RISK ASSESSMENT OF RECREATIONAL BOATING TRAFFIC AND AQUATIC NUISANCE SPECIES (DREISSEID MUSSEL) INVASION TO LAKES, RIVERS AND RESERVOIRS OF THE WESTERN UNITED STATES 12-13 (2012).

46 *Id.*

47 *Id.* at 19-35.

48 PAC. STATES MARINE FISHERIES COMM'N, WATERCRAFT INSPECTION/INTERCEPTION PROGRAM DATA BY STATE (2012) (on file with authors).

49 *Id.*

50 QUAGGA-ZEBRA MUSSEL ACTION PLAN, *supra* note 22, at 8.

51 NAT'L RESEARCH COUNCIL, ASSESSING THE RELATIONSHIP BETWEEN PROPAGULE PRESSURE AND INVASION RISK IN BALLAST WATER 73 (2011).

52 Mike Fowlks, *Case Study: Fiesta Queen: Interdiction, Decontamination, Costs & Enforcement*, OR. SEA GRANT 2 (Aug. 22, 2012), [http:// seagrant.oregonstate.edu/node/678/](http://seagrant.oregonstate.edu/node/678/) [hereinafter Fowlks Presentation] (click ““forward”” arrow in Slideshare presentation window to advance to slide 2).

53 *Id.* at 4. There are 3000 to 5000 commercial watercraft and equipment transport providers operating in North America, with an estimated 500 active in the West. WILLIAM ZOOK & STEPHEN PHILLIPS, PREVENTING THE TRANSFER OF DREISSEID MUSSELS AND OTHER AQUATIC INVASIVE SPECIES BY COMMERCIAL WATERCRAFT AND EQUIPMENT TRANSPORT PROVIDERS 5 (2010), *available at* [http:// www.aquaticnuisance.org/wit/reports](http://www.aquaticnuisance.org/wit/reports).

54 Fowlks Presentation, *supra* note 52, at 9.

55 QUAGGA-ZEBRA MUSSEL ACTION PLAN, *supra* note 22, at 20.

56 *Resources*, PROTECT YOUR WATERS, [http:// www.protectyourwaters.net/resources/](http://www.protectyourwaters.net/resources/) (last visited Jan. 11, 2013).

57 100TH MERIDIAN INITIATIVE, ZAP THE ZEBRA (2011), *available at* <http://www.100thmeridian.org/ZaptheZebra2011.pdf>.

58 Pac. States Marine Fisheries Comm'n, *Don't Move a Mussel HD (2011)*, YOUTUBE (Jan. 30, 2012), <http://www.youtube.com/watch?v=4uLKK09Tlji> (posted by Videoland Productions).

59 UTAH DIV. OF WILDLIFE RES., UTAH AQUATIC INVASIVE SPECIES MANAGEMENT PLAN (2009), *available at* http://wildlife.utah.gov/pdf/AIS_plans_2010/AIS_mgt_plan_full.pdf.

60 *See generally Zebra Mussels*, TEXAS INVASIVES, [http:// texasinvasives.org/action/report_detail.php?alert_id=2](http://texasinvasives.org/action/report_detail.php?alert_id=2) (last visited Jan. 15, 2013).

61 MONT. CODE ANN. § 80-7-1002(1)(f) (2012).

62 *Id.* § 80-7-1006.

63 *Id.*

64 CAL. FISH & GAME CODE § 2302 (West 2012).

65 *Id.*

66 DON'T MOVE A MUSSEL, <http://dontmoveamusel.com> (last visited Oct. 26, 2012).

67 WASH. REV. CODE § 77.12.882(2) (2012).

68 *Id.* § 77.12.882(4).

69 NEV. REV. STAT. § 488.530(6) (2012).

70 IDAHO ADMIN. CODE r. 02.06.09.010(07) (2011).

71 Notice of Intent to Adopt Rules: Chapter 62 -- Aquatic Invasive Species 9 (Wyo. Game & Fish Dep't, proposed Aug. 29, 2012), *available at* <http://legisweb.state.wy.us/ARules/2012/Rules/ARR12-088P.pdf>.

72 ARIZ. REV. STAT. ANN. § 17-255.01(B)(2) (2011).

73 Notice of Public Information -- Director's Order 2 -- R07/12 -- Aquatic Invasive Species -- Designation of Waters or Locations Where Listed Aquatic Invasive Species Are Present, 18 Ariz. Admin. Reg. 1757 (Fish & Game Dep't July 20, 2012), *available at* <http://www.azsos.gov/aar/2012/29/pubinfo.pdf> [hereinafter Arizona AIS Locations].

74 UTAH CODE ANN. § 23-27-102(10) (West 2011).

75 UTAH ADMIN. CODE r. 657-60-7(1)(a) (2012).

76 E-mail from Larry Dalton, *supra* note 32. *See also Waters Affected by Invasive Mussels*, UTAH DIV. OF WILDLIFE RES., <http://wildlife.utah.gov/dwr/affected-waters.html> (last visited Jan. 12, 2013).

77 UTAH ADMIN. CODE r. 657-60-7(1)(b) (2012).

78 *Id.* 657-60-2(2)(h).

79 2 COLO. CODE REGS. § 405-1:806(D) (2012).

80 N.M. STAT. ANN. § 17-4-35(A) (2011).

81 WYO. STAT. ANN. § 23-4-203(c) (2012).

82 CAL. FISH & GAME CODE § 2301(a)(2)(D)(i) (West 2012).

83 *Id.* § 2301(a)(2)(D)(ii).

84 *Id.* § 2301(a)(2)(D)(iv).

85 UTAH CODE ANN. § 23-27-303(1) (West 2012).

86 *Id.* § 23-27-303(2).

87 *Id.* § 23-27-303(4).

88 *Id.* § 23-27-303(6)(a).

89 UTAH ADMIN. CODE r. 657-60-8(1)(c) (2012).

90 *Id.* r. 657-60-8(2)(a).

91 *Id.* r. 657-60-9(3).

92 *Id.* r. 657-60-9(2).

93 Press Release, Nat'l Park Serv., Threat of Invasive Species to Temporarily Close Crater Lake to Scuba (Aug. 28, 2012), <http://www.nps.gov/crla/parknews/temporary-closure-to-scuba.htm>.

94 *Id.*

95 IDAHO CODE ANN. § 22-1905 (2012).

96 *Id.* § 22-1904(3).

97 ARIZ. ADMIN. CODE § 12-4-1102(A) (2012); WYO. STAT. ANN. § 23-4-202(a)(i)-(iv) (2012).

98 UTAH CODE ANN. § 23-27-201(1) (WEST 2012); CAL. CODE REGS. tit. 14, § 671(c)(10) (2013).

99 NEV. ADMIN. CODE § 503.110(g)(2) (2012).

100 Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, Pub. L. No. 101-646, 104 Stat. 4761 (codified as amended in scattered sections of 16, 18, and 33 U.S.C) (adding zebra mussel to list of species prohibited from importation at 18 U.S.C. § 42(a)(1) (2012)).

101 50 C.F.R. § 16.3 (2013).

102 16 U.S.C. § 3372 (2012).

103 NAT'L INVASIVE SPECIES COUNCIL, GENERAL GUIDELINES FOR THE ESTABLISHMENT & EVALUATION OF
INVASIVE SPECIES EARLY DETECTION & RAPID RESPONSE SYSTEMS 4 (2003).

104 CAL. FISH & GAME CODE § 2301(e) (West 2012).

105 COLO. REV. STAT. § 33-10.5-106 (2012).

106 2 COLO. CODE REGS. § 405-1.807(D) (2012).

107 *Id.* § 405-1.807(C).

108 IDAHO ADMIN. CODE r. 02.06.09.201(01) (2012).

109 *Id.* r. 02.06.09.201(02).

110 *Id.* r. 02.06.09.201(04).

111 WYO. GAME & FISH CODE ch. 62, § 8(b) (2012).

112 *Id.*

113 100TH MERIDIAN INITIATIVE COLUMBIA RIVER BASIN TEAM, *supra* note 42.

114 *Id.* at 12.

115 *See, e.g.*, NAT'L PARK SERV., QUAGGA/ZEBRA MUSSEL INFESTATION PREVENTION AND RESPONSE PLANNING
GUIDE (2007), *available at* http://www.nature.nps.gov/water/quagga/QuaggaPlanningGuide_ext.pdf.

116 BILL ZOOK & STEPHEN PHILLIPS, UNIFORM MINIMUM PROTOCOLS AND STANDARDS FOR WATERCRAFT
INTERCEPTION PROGRAMS FOR DREISSENIID MUSSELS IN THE WESTERN UNITED STATES (UMPS II) 11 (2012)
[hereinafter UMPS II].

117 MONT. ADMIN. R. 12.11.341(1)-(2) (2012).

118 *Id.* 12.11.341(4).

119 COLO. PARKS & WILDLIFE, 2012 STATEWIDE WATERCRAFT INSPECTION & DECONTAMINATION STATIONS
(2012), *available at* <http://wildlife.state.co.us/SiteCollectionDocuments/DOW/Fishing/2012WatercraftInspectStationList.pdf>.

120 2 COLO. CODE REGS. § 405-1:803(B) (2012).

- 121 *Id.* § 405-1:803(C).
- 122 WYO. STAT. ANN. § 23-4-203(h) (2012).
- 123 E-mail from Beth Bear, Aquatic Invasive Species Coordinator, Wyo. Game & Fish Dep't, to author (Nov. 5, 2012, 4:32 PM) (on file with author).
- 124 IDAHO CODE ANN. § 22-1908 (2012).
- 125 *Id.*
- 126 2012 *Road-side Inspection Stations*, IDAHO STATE DEP'T OF AGRIC., [http://www.agri.state.id.us/Categories/Environment/InvasiveSpeciesCouncil/Inspection_ Stations_2012/Inspection_Stations_2012.php](http://www.agri.state.id.us/Categories/Environment/InvasiveSpeciesCouncil/Inspection_Stations_2012/Inspection_Stations_2012.php) (last visited Jan. 22, 2013).
- 127 COLO. REV. STAT. § 33-10.5-104(1)(b)(IV) (2012).
- 128 IDAHO CODE ANN. § 22-1910A(2) (2012).
- 129 WASH. REV. CODE § 77.15.080(2) (2012).
- 130 *See, e.g., Aquatic Invasive Species*, OR. STATE MARINE BD. ENVTL. PROGRAMS, <http://www.oregon.gov/OSMB/Clean/Pages/ANS.aspx> (last visited Jan. 12, 2013).
- 131 Arizona AIS Locations, *supra* note 73.
- 132 *Id.*
- 133 *Id.*
- 134 16 U.S.C. § 3372(d) (2012).
- 135 COLO. DIV. OF WILDLIFE, AQUATIC NUISANCE SPECIES (ANS) WATERCRAFT DECONTAMINATION MANUAL 2 (2011).
- 136 *Id.*
- 137 OR. ADMIN. R. 250-010-0660(5)(a) (2012).
- 138 *Id.* 250-010-0660(5)(b).
- 139 *See, e.g.,* UTAH ADMIN. CODE r. 657-60-2(2)(b)(ii) (2012).

140 *Watercraft Inspection and Decontamination Interception Training (WIT) for Zebra/Quagga Mussels*, AQUATIC NUISANCE SPECIES PROJECT, [http:// www.aquaticnuisance.org/wit](http://www.aquaticnuisance.org/wit) (last visited Jan. 12, 2013).

141 UMPS II, *supra* note 116.

142 UTAH CODE ANN. § 23-27-302 (West 2012).

143 IDAHO CODE ANN. § 22-1910A(3) (2012).

144 IDAHO ADMIN CODE r. 02.06.09.203(03) (2010).

145 E-mail from Amy Ferriter, Invasive Species Program Manager, Idaho Dep’t of Agric., to author (Nov. 5, 2012, 11:37 AM) (on file with author).

146 *Id.* See also WYO. GAME & FISH CODE ch. 62, § 7(a) (2012); IDAHO ADMIN. CODE r. 02.06.09.203(01) (2012).

147 WYO. STAT. ANN. § 23-4-203(f) (2012).

148 *Drying Time Estimator for Zebra/Quagga-Mussel Contaminated Boats*, 100TH MERIDIAN INITIATIVE, <http://www.100thmeridian.org/emersion.asp> (last visited Jan. 16, 2013).

149 *See id.*

150 16 U.S.C. § 4724 (2012).

151 LARRY LECLAIR ET AL., WASHINGTON STATE AQUATIC INVASIVE SPECIES PREVENTION AND ENFORCEMENT PROGRAMS: 2012 REPORT TO THE LEGISLATURE 3 (2012), available at <http://wdfw.wa.gov/publications/01392/>.

152 WASH. REV. CODE § 77.12.879(2) (2012).

153 COLO. REV. STAT. § 33-10.5-108 (2012).

154 IDAHO ADMIN. CODE r. 26.01.34.000 to .077 (2012).

155 WYO. STAT. ANN. § 23-4-204(b)(i) (2012) (“An annual fee shall be collected ... for every watercraft before the watercraft enters the waters of the state. Payment of the fees shall be evidenced by a sticker placed on the bow of the watercraft”).

156 A.B. No. 2443, 2012 Leg., Reg. Sess. (Cal. 2012) (codified as enacted at CAL. HARB. & NAV. § 675 (West 2012), effective Jan. 1, 2013).

157 QUAGGA-ZEBRA MUSSEL ACTION PLAN, *supra* note 22, at 8.

158 U.S. FOREST SERV., ORDER NO. 10-08-2009-02, ORDER -- NATIONAL FOREST OCCUPANCY AND USE RESTRICTIONS -- ARAPAHO AND ROOSEVELT NATIONAL FORESTS AND PAWNEE NATIONAL GRASSLAND

(2009).

¹⁵⁹ NAT'L PARK SERV., SUPERINTENDENT'S COMPENDIUM: GLEN CANYON NATIONAL RECREATION AREA AND RAINBOW BRIDGE NATIONAL MONUMENT 3 (2012).

¹⁶⁰ *Help Stop Aquatic Invasive Species*, GLACIER NAT'L PARK, NAT'L PARK SERV., <http://www.nps.gov/glac/planyourvisit/ais.htm> (last updated Nov. 13, 2012).

¹⁶¹ AN ACTION PLAN TO IMPLEMENT LEGAL AND REGULATORY EFFORTS TO MINIMIZE EXPANSION OF INVASIVE MUSSELS THROUGH WATERCRAFT MOVEMENTS IN THE WESTERN UNITED STATES 2-4 (2012) (drafted by workshop participants), *available at* http://seagrant.oregonstate.edu/sites/default/files/invasive-species/mussel-workshop-2012/ag_ais_workshop_actionplan2012_0.pdf.