Addressing the Challenge of Mutual Acceptance of Dreissenid Mussel Vessel Certification Programs – A Pathway to Reciprocity

A report to the California Department of Fish and Game
Aquatic Invasive Species Program

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STATEMENT OF NEED

Collectively, quagga (*Dreissena bugensis*) and zebra (*D. polymorpha*) mussels (Dreissenid mussels) in their non-native environments, a recognized and accepted threat to aquatic resources, have become established in numerous waterbodies throughout California with the potential threat of expansion to other sites recognized by Federal, state, municipal and private interests. A need exists to coordinate a shared dialog between the concerned interests currently involved in the prevention and control of mussel expansion in order to identify potential collaborative and reciprocal efforts to maximize individual program efforts. Furthermore, given the dispersive nature of the pest and the importance of increasing boaters' awareness of their responsibility and potential role of serving as a catalyst for mussel expansion, a thorough examination of newly developed social networking communication technologies that allow for "real-time" exchange of information is warranted to maximize information exchange between stakeholders (Giusti 2008).

CONTRACT GOAL

Using a conceptual model recognized both nationally and internationally (Giusti 1994; 2004), the goal is to design and implement a transparent, inclusive and interactive approach that

connects stakeholders in a participatory project that honors existing programs while challenging participants to explore alternative strategies that will minimize the threat of Dreissenid mussel range expansion within California.

EXECUTIVE SUMMARY

The desire shared by many to develop a standardized, reciprocal program of vessel certification is fraught with many challenges. Among these is the need to better incorporate boaters' involvement regarding their role in moving aquatic invasive species (AIS) among disconnected waterways and improve compliance with boat cleaning protocols (Cal. Res. Agency 2008). It has been suggested (Zook 2009) that reciprocal vessel inspection programs be given prominence and advanced when addressing ways to minimize the threat of Dreissenid mussels to California's waterways.

It would be presumptuous to suggest that the development of reciprocal vessel certification systems could evolve naturally among the 25-30 water managers in the state (Zook 2009). Significant jurisdictional barriers exist even if a template could be developed that would demonstrate a pathway toward reciprocity. The complex array of federal, state, municipal, and private interests involved in the management of water does not afford one supreme authority that can dictate policy or procedures. Recognizing this reality is paramount to identifying plausible pathways that may provide a successful result.

Rather than suggesting a multi-agency, collaborative effort that attempts to address reciprocal vessel certification programs simultaneously, this reports suggests recognizing the cultural and systematic differences that exist among these various interests and working within these constraints. Specifically, this report suggests building *intra*-agency programs as a pathway to incremental, yet progressive, movement toward the larger goal of broad scale reciprocity.

Though more energy intensive, this strategy provides a pathway for each jurisdiction to identify its own capacities, subsequently allowing the opportunity to take "ownership" of a program that suits its needs as it aims to achieve reciprocal recognition among like-managed waterbodies. Furthermore, this allows for "trust" to be built among cohorts who are comfortable working within the "culture" of their respective agencies. Additionally, it begins a process of consistency to aid the boating public in becoming familiar with interception programs targeting AIS and in particular Dreissenid mussels.

The report outlines suggested steps to initiate a pathway toward reciprocal certification programs that begins by acknowledging that some jurisdictions still have yet to adopt policies that institutionalize AIS prevention as a priority concern. Until such time that this single impasse is addressed it will be difficult, if not impossible, to broaden any discussions addressing

reciprocal program recognition simply due to the lack of trust that exists between those programs that rely on vessel interception and those who do not.

The task of designing and implementing a reciprocal vessel certification system in a state as diverse as California is a herculean undertaking that has stifled expansive advancement of this concept due to the enormity of the task. Though the task is challenging the potential impact to California's water from unwanted Dreissenid mussels is too great to ignore.

WHAT WE HAVE – CURRENT ACTIVITIES ADDRESSING THE MUSSEL THREAT

The State of California, through the Department of Fish and Game (DFG), has taken the threat of Dreissenid mussels very seriously. Even though zebra and quagga mussels were discovered in California during a period of acute financial stress, the Department's response has been both affirmative and aggressive. It is widely recognized that invasive species pose both significant and widespread negative impacts to aquatic and terrestrial resources throughout the state and unfortunately, Dreissenid mussels represent only one group of invasives threatening California.

This statement is consistent with the findings of the **California Invasive Species Advisory Committee** (2008) who state "*California's diverse peoples and landscapes are world-renowned. Our Mediterranean climate and varied topography provide for a stunning array of ecosystems, while rich soils provide abundant agricultural productivity. However, California's natural environment, agriculture, public health, and economy are all at risk.*

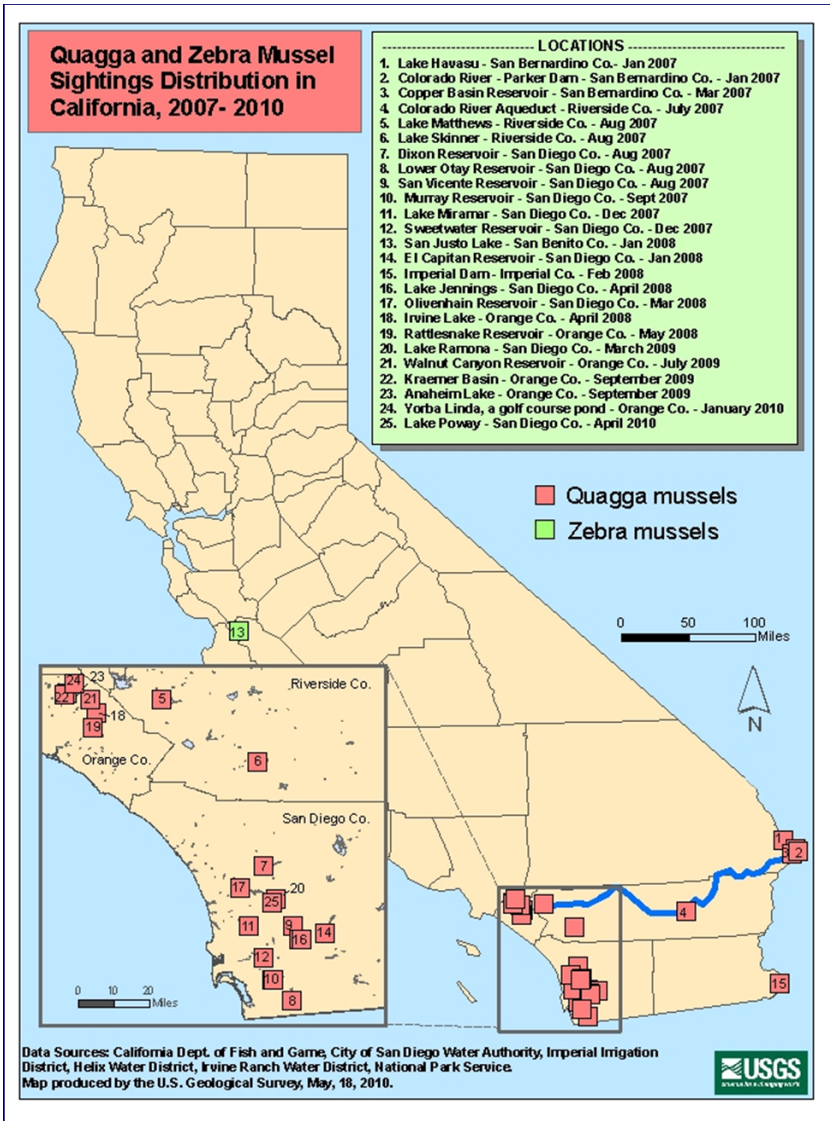
Invasive species, defined as "non-native organisms which cause economic or environmental harm," present a significant risk to the top agricultural economy in the country, valued at $36 billion. While difficult to quantify, the impacts to the environmental health of the state are also indisputably substantial. The risk continues to increase as modern travel and trade open new and broader avenues for the introduction of these harmful organisms into California."

This "new reality" challenges both resource agencies and individual citizens to remain vigilant and involved in local and regional attempts to limit both the introduction and spread of invasive mussels. In a state the size and complexity of California, this is no easy task.

With the discovery of invasive mussels in 2007, DFG initiated a number of actions which continue today. Initially the Department undertook the challenge of identifying both the range and extent of distribution of zebra and quagga mussels (Fig. 1).

Fortunately, mussel distribution and presence has been static since 2008. These initial discoveries initiated funding and survey activities and prompted the formation of a Science Advisory Panel (2007) to help guide the State's effort.

Fig. 1. Known distribution of quagga mussels in California as of 2010.



The DFG's strategic policy is currently based on the Science Advisory Panel's recommendations that include:

- Preventing further introductions of mussels into the state;
- Containing the mussels within currently infested waters; and
- Eradicating mussels from infested waters if feasible.

The Department is capable of establishing statutes that can guide and direct independent efforts to achieve its stated goals. Specifically these include:

- Title 14 CCR § 671 – Restrictions on importation, possession, and transport of live animals;
- Fish and Game Code § 2118 – Unlawful to Import, Etc. Specified Wild Animals;
- Fish and Game Code § 2301 – Inspection of Conveyances and Responses Plans;
- Fish and Game Code § 2302 – Prevention programs; and
- Fish and Game Code § 5650 – Water Pollution; Prohibited Materials.

In addition, the DFG initiated a publicly favored program using K-9 units to assist in the detection of Dreissenid mussels. These K-9 units were initially used to assist local prevention and inspection program training and increased public awareness about the threat.

It was soon evident that jurisdictional constraints affect the DFG's ability to implement its strategic policies in all waterbodies since the Department owns or manages only a limited number within the State.

To address this challenge, and to protect all aspects of California's environment and economy from invasive mussels, a multi-agency task force [Incident Command System (ICS) 2007] was convened to improve strategic support between state and Federal jurisdictions responsible for water management including California Department of Fish and Game (DFG), California Department of Water Resources (DWR), California Departments of Food and Agriculture (CDFA), California Department of Parks and Recreation (CDPR), California Department of Boating and Waterways (CDBW), California Forest and Fire Protection (CalFire), California Department of Transportation (Caltrans), and the State Water Resources Control Board (SWRCB). In addition, Federal agency representation was provided by U.S. Fish and Wildlife Service (USFWS), Bureau of Reclamation (BOR), National Park Service (NPS), U.S. Forest Service (USFS), and the Army Corps of Engineers (ACE). The Metropolitan Water District of Southern California (MWD) and other key constituents (e.g., PG&E, etc.) were also included.

This multi-agency approach was essential to address both efficiencies and prevention efforts in the state's program. Efforts were also undertaken to address the role and responsibilities of:

- CDFA Border Protection Stations;
- Hatcheries and aquaculture facilities;
- Fire fighting equipment inspections and fire fighting operations;
- Seaplanes; and
- Commercial watercraft and equipment.

The enormity of this undertaking is illustrated by the statistics provided by the CDFA Border Stations who from January 2007 through January 2011 inspected 521,372 vessels. Of those inspected vessels, 33,906 (6.5%) needed on site "cleaning" (did not meet the minimum standard of Clean, Drained or Dry), while 788 (0.15%) of those were discovered to have either live or dead mussels attached to the vessel or trailer.

Other identifiable "stakeholder groups", such as Fishing Tournament organizers which are permitted through the DFG, required special consideration given the transitory nature of tournament anglers. These provisions included the development or modification of existing rules addressing:

- Conditions to provide for the welfare of tournament fish;
- Live-well inspection requirements and expectations;
- Definition of what is prescribed as a "clean and dry" vessel; and
- Development and distribution of educational outreach materials.

Other stakeholder groups that require special consideration to address the peculiarities of their activities included seaplane owners and operators, yacht clubs, competitive water ski organizations, and the yet undefined "recreational (casual) boater", by far the most ephemeral and elusive "group" to reach.

This last group provides a challenge to Federal, state and local jurisdictions since it includes anyone who owns a vessel and may or may not be part of a formal or organized group. To help address this potentially huge "stakeholder" group, the DFG developed and distributed a publication entitled the "*Invasive Mussel Guidebook for Recreational Water Managers and Users*" (2008) which served as the basis for many local programs as they initiated their efforts.

Over time a number of other guidance publications have been developed and distributed to address the sheer size of the challenge including:

- Quagga and Zebra Mussel Action Plan (QZAP);
- Protect Your Boat: A Guide to Cleaning Boats:

- Guidelines for Recommended Uniform Protocols and Standards for Watercraft Inspection Programs;
- Seaplane guidelines;
- Commercial watercraft and equipment transport operations guidelines.

The collective input from the above mentioned stakeholder groups and resource agencies have identified future priorities that need to be pursued, including:

- Implementation of mussel action plans that address and include other aquatic invasive species and potential vectors;
- Continued refinement and adjustments to current laws and regulations;
- Identify future stable funding sources; and
- Greater improvement of the knowledge base of mussel water chemistry requirements to better identify waters at high risk of infestation.

WHAT WE HAVE – MONITORING AND PREVENTION EFFORTS

Overview of Quagga/Zebra Research and Early-detection Monitoring

The threat of Dreissenid mussels becoming widely established in California, and the effort to prevent their spread, has the potential to affect many individuals and groups who currently interact with water. Similarly, the need to better understand how to prevent their spread, with the need to address the immediate threat to water by those systems already affected, has created a need for collaboration across traditional jurisdictional boundaries. A variety of efforts are underway between the DFG, DWR , MWD, University of Nevada at Reno and Las Vegas, the University of California, Sea Grant, USFWS, and Marrone Bio Innovations to address the risk and threats posed by these species.

Current research and evaluations are addressing:

- Validation and analysis of early detection methods;
- Growth and mortality rates of mussels;
- Basic research trying to identify spawning and settlement rates of mussels in differing waterbodies;
- Limitations on mussel survival, reproduction, and establishment posed by chemical composition of water bodies;

- Magnitude and rates of impacts from "biofouling" of water systems by mussels; and
- Antifouling products and coatings to limit mussel settlement.

Additionally, both the DFG and USFWS have aggressively provided trainings and support to local jurisdictions interested in developing site-specific prevention and monitoring programs (Culver 2009). Currently, many waterbodies throughout the state have taken advantage of the support being offered by these agencies, universities, and private companies (Fig. 2). The California Department of Fish and Game maintains a database of monitoring results.

Fig. 2. Current distribution of mussel detection survey efforts. Source: CDFG. Updated survey locations can be found at the 100th Meridian Initiative web page: http://www.100thmeridian.org/usa.asp?place=CA&Submit=Get+Summary

WHAT WE HAVE – OUTREACH EFFORTS

The emergence of various electronic forms of communication has both assisted and compounded the ability to share information among interested members of the public. The challenge for resource agencies is to break through the mélange of information being produced and insure that, before they arrive at a waterbody, stakeholders have access to accurate science-based information and awareness of pertinent policies and laws addressing the prevention and movement of mussels.

In the face of this challenge, a number of agencies and organizations in California are using electronic media to provide information to those who are computer savvy and may be using these media in preparation for an upcoming trip. Examples of these outreach sources include:

- Department of Fish and Game
  http://www.dfg.ca.gov/invasives/quaggamussel/

This site contains many of the guidance documents thus far mentioned in this report.

- Department of Boating and Waterways
  http://www.dbw.ca.gov/BoaterInfo/QuaggaLoc.aspx

This link includes site specific boating restrictions and information on local mussel prevention programs and restrictions.

- Department of Parks and Recreation
  http://www.parks.ca.gov/?page_id=24696

This link provides prevention programs currently in place for specific parks

- 100th Meridian Initiative
  http://www.100thmeridian.org/zebras.asp

This link provides a national perspective on the mussel threat and a drying time calculator.

This approach can work well for organized groups who have internal networking systems to direct their members or participants in finding sources of mussel information, e.g., fishing clubs and tournaments, yacht clubs, water ski clubs, etc. However, relying solely on this type of centralized, electronic outreach poses obvious challenges particularly when trying to direct information to those who are not involved in a formal or structured group who may not be aware of the mussel threat until they arrive at their destination.

CHALLENGE #1 – Addressing the way the public receives boating information and designing an effective communication tool to inform boaters of their responsibilities for limiting the movement of Dreissenid mussels

WHAT WE KNOW – HOW MUSSELS MOVE

It is generally accepted that mussels can not move overland without some help (Padilla and others 1996; Kraft and Johnson. 2000). The catalyst for such movement is further accepted and recognized as involving some form of human intervention. This intervention can be in the form of water conveyance (canals, channels, pipes, pumps, etc.), watercraft (various recreational and commercial types) and associated boating equipment (ropes, anchors), direct and/or inadvertent movement of water (with live bait), or fishing equipment (boots, clothing, gear). Each of these means of transport requires a degree of human activity to physically provide a mechanism to connect an infested waterbody to one that is not naturally "connected".

Water Craft as a Vehicle of Conveyance –

Table 1. Relative comparison between California, Nevada boating statistics. Source: M. Wittman, U.C. Davis, Tahoe Environmental Research Center. 2010. Arizona: source: State of Arizona Chamber of Commerce.

State	State Area (sq.mi.)	Number of Registered boats 2005 ranking	Statewide population	Boats per capita	Approximate number of boatable inland water bodies	Boat Ramps	Boat ramp per registered boat	Number of boatable water bodies per registered boat
California	163,707	963,758 (2)	36,457,549	38	404	355	0.0004	0.0004
Nevada	110,567	57,726 (40)	2,495,529	43	200	41	0.0007	0.0035
Arizona	113,998	147,294 (43)	6,392,017	43	31	----	---	0.0002

The potential for vessel-related human conveyance as outlined in Table 1 illustrates the U.S. boating statistics in 2005 and the ranking of California (2^{nd}) in number of registered vessels

(only Florida has relatively more registered boats/person). Nevada and Arizona, bordering infested states, are shown for comparison. Unfortunately, though a state that is relatively barren of water, Nevada's concentrations of both human population and waterbodies are in relatively close proximity to California's borders.

A recent survey of boaters visiting Lake Tahoe demonstrates the relationship between distances traveled to a particular destination. In this example recreationists are attracted to the Lake in an east – west axis (Fig. 3). This illustrates how the proximity of counties to Interstate Highway 80 and US Hwy 50 facilitate this directional trend. Similarly, infrastructural systems (highways and freeways) appear to further influence the frequency of trips to a particular waterbody.

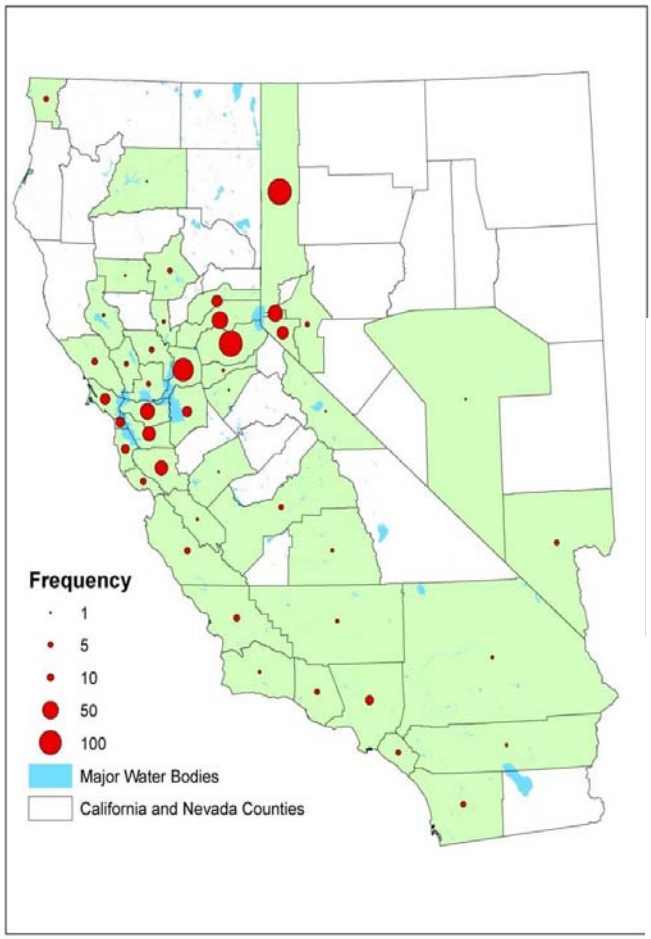


Fig. 3. Illustrates the distances traveled by visitors to Lake Tahoe (N= 778) from "county of origin". Source: UCD TERC.

Fig. 4 Demonstrates travel frequency of boaters from "county of origin" Lake Source: 100th Meridian. (N=1312).

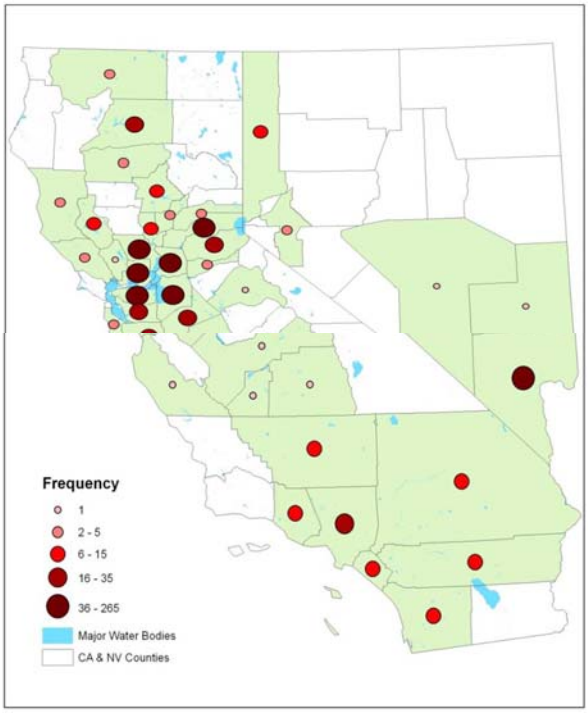


Figure 4 illustrates "gravity models" (Leung and others 2006) initially designed to estimate the volume of traffic moving between places – these models are based on inputs of **distance** and **attractiveness** of a destination, and can help determine how people move from one location to another and assist in the assessment of risk of vessels moving from invested to non-infested waterbodies.

To further illustrate this point, a similar analysis concluded that although both distance and attractiveness are important, they may not necessarily reflect an a priori selection process on the part of a traveler; in other words, *attractiveness* of a destination may outweigh the *distance* needed to travel (Fig. 5).

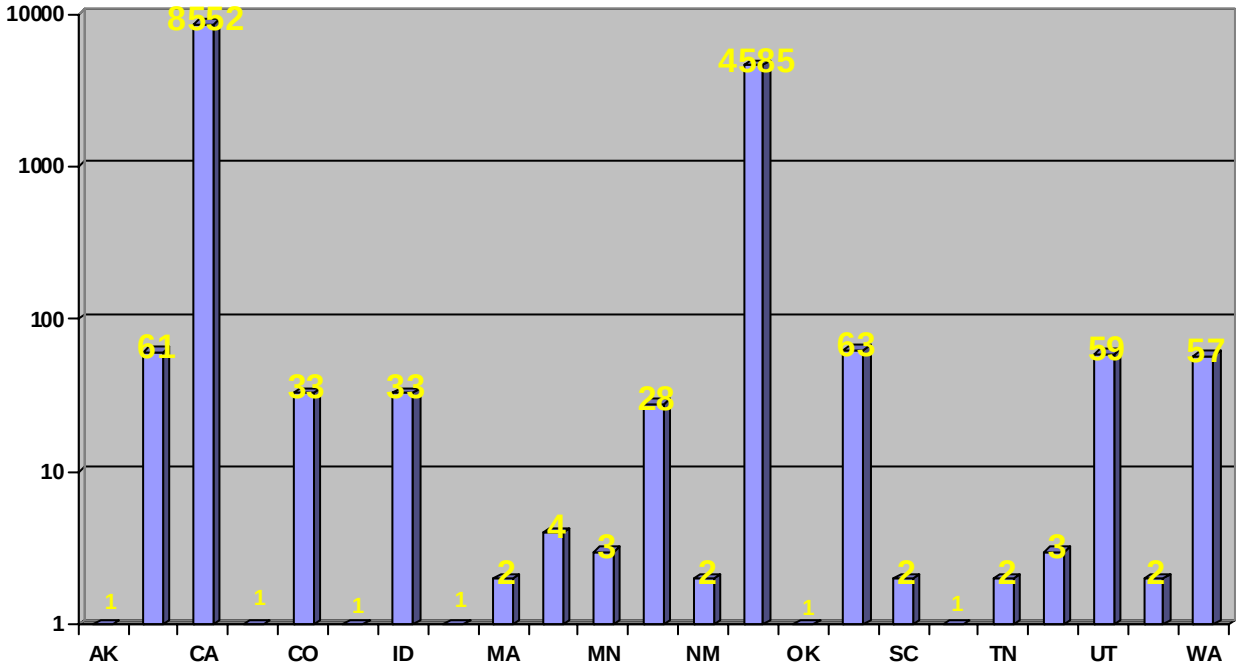


Fig. 5. State originations of trailered recreational boats launching at Lake Tahoe in 2009, N = 13,748 Source: Lake Tahoe Boat Launch Inspection Survey Dataset (TRCD, TRPA)

In this data set, it is obvious boaters are passing several suitable waterbodies and choosing to travel to Lake Tahoe for reasons other than proximity to their point of origins.

Finally, travel also reflects a boater's destination preference for purely personal reasons including angling opportunities, water sports, weather, congestion, and even aesthetics (Fig. 6). The data demonstrates how both proximity and personal preference affect how a boater chooses a destination. For example, not surprisingly, boaters from Sacramento County often take trips to

Folsom Lake, a lake of relative close proximity from anywhere within the county. However, Lake Tahoe is the second most visited waterbody of boaters from Sacramento.

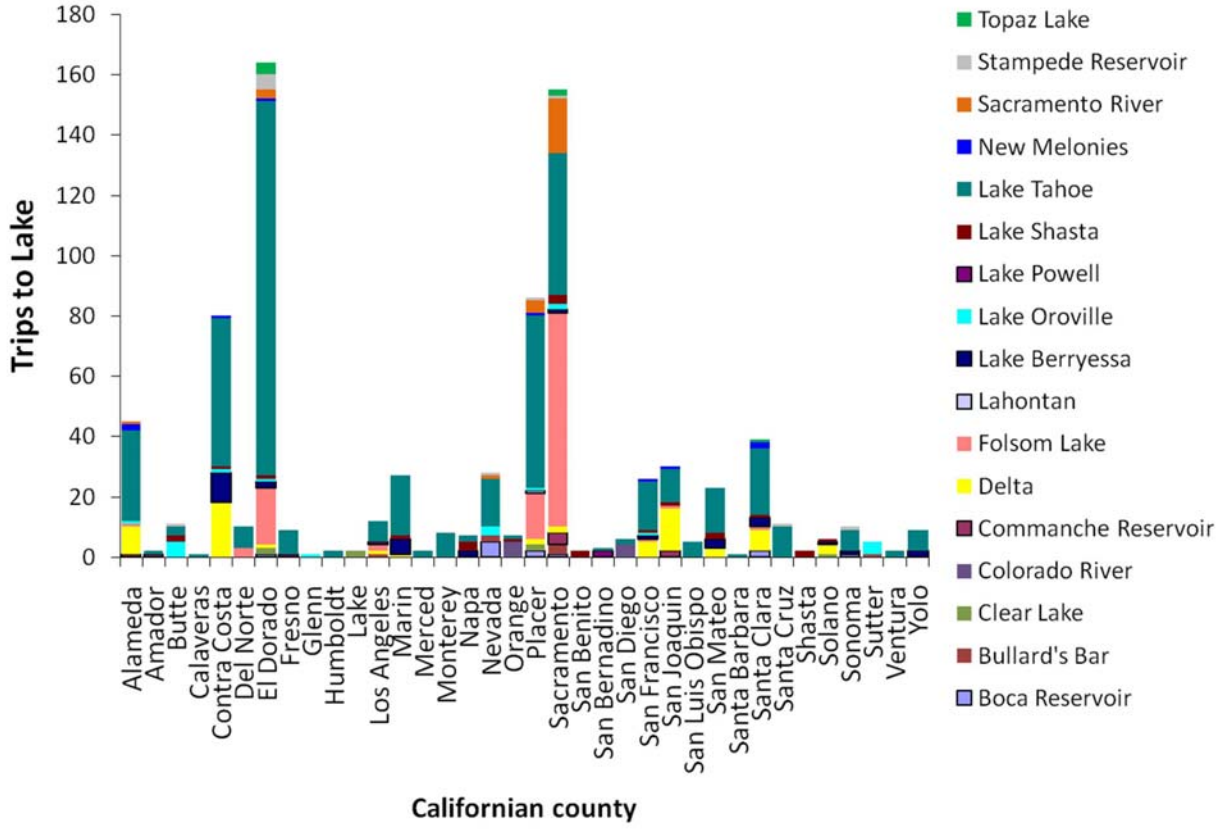


Fig. 6. Demonstrating how both proximity and personal preferences affect boating choices in California. Source: UCD TERC.

Likewise, even though Lake Tahoe is the "resident lake" of El Dorado County, some boaters take frequent trips to Folsom. [Distance difference from Placerville City Hall to Lake Tahoe = 49 miles (78 km); Placerville City Hall to Folsom Lake = 30 miles (48 km)]

To further illustrate this last point, there are a number of lakes in California that support warm water fisheries. Anglers will travel great distances to fish in lakes for which they may have a particular affinity, or for economic and/or competitive purposes. For example, Clear Lake in Lake County is widely regarded as a premier largemouth bass (*Micropterus salmoides*) fishery that attracts anglers for both recreational and tournament fishing opportunities. In 2008, as part of the County's mussel prevention program, data were collected assessing the number of non-resident boats visiting the lake. A total of 6,349 non-resident boat screenings were conducted over 12 months; of those, 164 boats (2.5%) came from out-of-state locations (in order of

frequency AZ, NV, OR, WA, TN, MT, MO, TX, CO, WY, ID, UT, and NY); additionally, of the total, 245 (3.9%) came from within California from counties deemed to be "high risk" meaning that known infested waters are present within the county including San Diego, Imperial, San Bernardino, Riverside, Orange, and San Benito Counties.

These examples and data validate the point that California boat owners are mobile and enjoy using multiple bodies of water, further identifying vessel movement from one point to another as a primary vector for unintended mussel dispersal.

Water as a Vehicle of Conveyance –

"Invasion of Aquatic Invasive Species (AIS) is a Process" (S. Chandra, pers. comm.). This simple statement captures the gist of the challenge facing California. No one action or event can be considered when addressing the spread of Dreissenid mussels but rather a multiplicity of strategies must be considered simultaneously.

The distribution of California's population depends on its ability to deliver large amounts of water to geographic regions that are historically arid. In order to achieve this remarkable engineering feat, the State has arguably designed and implemented the largest and most complex water delivery system seen throughout human history.

This extraordinary water delivery system poses the single-most important mechanism of mussel dispersal facing resource agencies. The collection of dams, canals, channels, and river systems links waterbodies that would otherwise be isolated and insulated from AIS introductions. This reality is clearly evident in the current (2011) distribution of Dreissenid mussels in southern California. The movement of mussels throughout the Colorado River system demonstrates how one isolated introduction can quickly spread over a large geographic area putting otherwise insulated waterbodies at risk from adjacent infested sources.

The chain of events leading to mussel presence is described in the literature (Lodge and others 2006) as:

Transport → Introduction → Establishment → Spread → Impact

For the purposes of this section, "transport" in this equation can be considered the passive movement of water carrying mussel veligers or adults from one waterbody to another. The term "spread" implies that when the newly infested waterbody has achieved a critical mass of

planktonic veligers, the surplus juveniles can then be transported once again to an adjoining waterbody downstream. A California colloquial idiom states "*only in California does water run uphill*". This phrase is given validity with the state's ability to pump water up and over large geographic landscape features which further exacerbates the challenge of keeping mussels isolated.

Herein lays one of the most obvious challenges facing the resource agencies of California and in particular DFG. In short, the Department does not have jurisdictional authority over the vast majority of waterbodies within the State's borders and therefore does not have direct influence over water management and movement. Similarly, in many instances DFG does not have the authority or resources to directly affect boating activity on lakes.

Prevention vs. Monitoring

The 2007 Science Advisory Panel (SAP) clearly recognized the value of *prevention* when addressing the threat to California's water resources when it wrote *"California and federal agencies should institute a mandatory boat inspection and cleaning system before allowing entry to high priority water bodies in California where access is under state or federal control. California and federal agencies should work with local entities to implement inspection and cleaning at other waters."*

The inability to eradicate Dreissenid mussels once established in open waterbodies necessitated the SAP's use of such strong language. The situation with regard to eradication has not changed as of 2011. Managers of infested waterbodies continually have to deal with the consequences of mussel introductions and the need to contain mussels within their current distribution is paramount to the efforts to minimize their overall impact to the State.

Though some State and local agencies have implemented the SAP's recommendations, a number of agencies and waterbodies have limited their programs to *monitoring* the presence/absence of mussels without a corresponding program component of *prevention.* Relying solely on a monitoring program may not address the fundamental stated desire to contain the mussels and prevent their spread.

The SAP report identified the value of monitoring when they wrote "*California and federal agencies should institute a core monitoring program for early detection of zebra mussels at high priority water bodies; and should work with local entities to augment the level of*

monitoring and extend it to other water bodies." However, this statement was preceded by their recommendation to develop "*Protocols to prevent the accidental transport of mussels should be implemented by all relevant activities in infested waters, including eradication/control, research and recreational activities."* Clearly, they viewed monitoring as part of a larger, comprehensive program that identified containment on an equal plane with quickly identifying and addressing any inadvertent spread of the species.

The obvious inadequacy of any local or institutionalized program that relies solely on *monitoring* without a corresponding program stressing *prevention* inhibits the state's ability to develop a shared or reciprocal approach to mussel management simply because threatened waterbodies will not accept a vessel certification from an under-regulated waterbody.

Consequently, any mussel program that relies solely on *monitoring* is not addressing the risk to the State's water conveyance system and thereby ignoring the system's ability to transport mussels widely. There are currently no viable options available to water purveyors to eradicate the mussels once established, thereby threatening the state's ability to provide clean, reliable water deliveries.

Any program that assumes an insular focus on monitoring is arguably in direct conflict with the widely accepted standard being promoted by the Science Advisory Panel (and others) who stress the need to restrain the mussel's movements. Clearly, the widely used message, "*Don't Move a Mussel*" (Oregon Sea Grant) is predicated on the importance of addressing the invasion formula provided earlier. Monitoring alone is ignoring the "transport" component of the invasion process. A simple monitoring program only identifies when mussels have achieved the "establishment" phase of the invasion formula, at which time options for the spread of the mussels become seriously limited. In order to provide comprehensive program prevention *and* monitoring must be considered in tandem to be sufficient to maximize effectiveness.

CHALLENGE #2 – Convey a message of urgency to those jurisdictions that have yet to initiate a program of mussel prevention in addition to any Dreissenid mussel monitoring program.

CHALLENGE #3 – Identify and modify jurisdictional policies or directives that allow recreational access to waterbodies without inspection of vessels prior to launch.

WHAT IS BEING DONE – A BASIS FOR RECIPROCAL APPROACHES

"In most cases, certification is offered as a public service to eliminate the need for re-inspection of local watercraft or as a way to screen-out low risk watercraft so that interception program assets can be focused on higher risk watercraft and equipment" (Zook and Phillips 2009).

California has committed available resources to combat the spread of Dreissenid mussels. Those resources have initiated active programs that recognize the different risk factors associated with vessel types, place of origin, and risks associated with proximal distance to known infested water.

Subsequently, a great deal of effort is currently being invested by a myriad of agencies, municipalities, organizations, and individuals to address this threat. A fundamental challenge for an effort of this magnitude is to try and gather the existing energies being expended and combine them (in some reasonable fashion) to create synergies between independent programs to improve efficiencies and efficacies and to minimize the confusion for the boating public.

A review of 14 existing prevention programs across the state has identified some similarities that demonstrate, at the least, a minimal level of success of past awareness efforts. Specifically, the "**Clean, Drained and Dry**" slogan has been universally accepted and used in local programs. At the very least the use of this motto insures a consistent, simple message that boaters are seeing at every waterbody that has initiated a prevention program. Moreover, this same slogan is widely used by all web-based sources of information providing a consistent message across jurisdictions and geographic boundaries.

Program Delivery Bundles -

Prevention programs have the choice to remain independent from surrounding efforts or "bundle" their efforts to address more than one waterbody and expand their effectiveness and efficiencies. The fundamental criterion to insure successful reciprocal recognition between programs is the "*trust*" that must be developed and maintained between locations to insure cooperation and transparency. There are examples of such collaboration in existence but there is certainly room for more. It was quite evident at the Dreissenid Mussel Summit held in October 2010 that people are interested in expanding these types of efforts.

Table 2 compares existing programs across the state to indentify similarities and serve as a basis for a discussion about reciprocal opportunities.

Waterbody	Mandatory Inspection	Pre-Launch survey required	Access restricted/denied	Quarantine restrictions	Decontamination available	Vessel information retrieval system*
Crowley	X	X	X	---	---	X
East Bay Lakes‡	X	X	X	---	---	X*†
Casitas	X	X	X	X		X*
Lake County	X	X	---	X	X	---
Tahoe	X	X	X	---	X	X
Santa Clara Parks‡	X	X	X	--	X	--
Cachuma	X	X	X	X	X	X
Perris, Silverwood, Hemet	X		--	X	---	X†
Arrowhead	X	X	X	X	X	---
Big Bear	X	X	---	---	X	X
Lopez and Santa Margarita	X	X	X	--	X	X*†

Table 2. A comparison of 14 "Prevention Programs" identifying similarities among them.
* refers to any system that allows ready access or denial information based on a previous contact, i.e. bands, pre-inspections, launch data retrieval.
† reciprocal acceptance of "program" bands.
‡ part of the Bay Area Consortium

This comparison readily indicates that each program utilizes both a written survey and pre-inspection prior to launch. These two criteria are universally applied and are being considered in lakes that have yet to institute programs (Nacimiento and Antonio; SLO and Monterey Counties). Of the programs examined, other comparisons illustrate:

- 57% (8 of 14) restrict or deny access if the basic tenet of Clean, Drained and Dry is not realized or if the vessel is known to have been in contact with a known infested waterbody; or if the vessel originates in a defined geographic region know to be infested. The others allow launching after decontamination;

- 35% (5 of 14) include a quarantine or isolation procedure as part of the program to decrease the risk of introduction prior to launch;
- 50% of the programs offer decontamination services to assist boat owners with access;
- 57% of the programs have initiated a form of vessel data "retrieval" system to facilitate identification of boats that 1) have not entered other waters (banding), 2) received "pre-inspection" within 24 hours of launch to access waters in early morning hours, and 3) launch data retrieval to "track" boats that may have been denied access at a participating lake;
- Only 21% (n=3) of those surveyed programs have reciprocal recognition of inspection programs and of these, only 2 (14%) have mutual reciprocity. The other example recognizes another's bands but their bands are not reciprocally recognized elsewhere.

In a broader comparison (Appendix 1) of mussel prevention efforts prepared by the Western Regional Panel of the National Aquatic Nuisance Species Task Force Watercraft Interception Programs (WIP; January 2009), an on-line survey of all WIP Programs in 20 western states identified:

- 72 programs in 20 western states (28 in CA);
- 46 questions defined program parameters and gauged support for uniform minimum protocols and standards;
- Enjoyed a 97% return rate;
- More than 500 FTE's involved in WIP programs across the respondents;
- Programs in place on 300+ waters;
- 3 of 4 WIP programs used WIP training to establish program principles, protocols and standards – some commonality;
- Programs ranged from spot checks to comprehensive programs; and
- Less than 5% of these programs accepted the work of others.

The last data point underscored the need for more cooperation and collaboration between programs because …..

- Neither mussels nor boaters recognize political jurisdictions;
- There is an obvious need to encourage and support the use of region-wide interception strategies and the best available science and technology to prevent spread of the mussels;

- Collaboration can potentially maximize efficiency and continuity of efforts through combination of limited resources;
- Achieving consistency between programs in order to reinforce the prevention message with boaters, the public, lawmakers, and policy makers is key to long-term success;
- Reciprocity makes it easier for the boating public to understand, anticipate, and comply with "clean boating" principles; and
- QZAP recognizes and stresses as one of its highest priority action items that "the development of consistent inspection and decontamination protocols" is necessary to minimize the spread of mussels among waterbodies.

This more expansive and comprehensive survey can be found at *www.aquaticnuisance.org* and validates the majority of issues and attitudes shared by participants of the statewide mussel summit convened in October.

CHALLENGE #4 – Identify criteria and procedures that can improve reciprocity among mussel prevention programs.

In order to address the challenge, a number of elements need to be shared by programs in order to move toward reciprocity. Fundamental to achieving progress for acceptance among programs is the recognition of the vast differences in individual agency/organization "capacity" e.g. authority, resources, political and public support, etc. This can be viewed as either a challenge or an opportunity as we advance the discussion of "bundling" efforts.

Any cooperating programs must agree to an aggressive intervention program that includes, at a minimum, the following elements in order to provide the level of comprehensive scrutiny necessary to insure trust between reciprocating parties:

1. Screening interviews
2. Inspection
3. Decontamination
4. Quarantine/Drying
5. Exclusion
6. Certification

Addressing Capacity –a key to moving forward

Before scenarios can be considered for advancing ideas of mutual acceptance between programs, there must be broad recognition and acceptance of a fundamental belief that every

jurisdiction operating within the State of California must be committed to the *prevention* of introducing Dreissenid mussels (and all aquatic invasive species) if the public is allowed access. In the absence of this conviction and the necessary policy adjustments to make this conviction a reality, it is not reasonable to assume that on-going efforts to limit their introduction and dispersal will be effective.

Some components of mutual program acceptance can move forward without regard to jurisdictional constraints and should be viewed as a starting point for further dialog. Specifically, prevention programs should all agree to:

- *Uniform protocols and standards;*
- *Adequately trained and motivated personnel;*
- *On-going peer reviewed research on efficacy and implementation.*

Significant advancement and progress have already been achieved in each of these categories as described earlier. There is reasonably good acceptance of existing protocols and standards and it is apparent that most jurisdictions are not willing to design or supportive of boutique procedures, but are willing to amend existing guidelines to meet their particular needs. It will be important to insure that newly emerging jurisdictional programs are aware and have access to knowledgeable people who can assist them in implementing existing standards.

Beyond these three key foundational elements, the challenge of designing reciprocal programs morphs into a test of addressing the reality of *implementation.* The reality facing California is that there are:

- *25-30 different entities who have control over the state's water (Zook 2010)*
- *Authorization, priorities, motivation and political will differ among them;*
- *Budgets, facilities and resources differ;*
- *Interagency reluctance "to give up any control" to a coordination/regional oversight authority controlled by one Department;*

and in some cases

- *Trust among agencies has been tainted from past experiences.*

A first step in addressing these real and vast obstacles could be **a proclamation from each jurisdiction that states their willingness to employ watercraft/equipment *interception* programs, recognizing that they all share the common goal of *preventing* an inadvertent**

introduction of Dreissenid mussels or other aquatic nuisance species via trailered watercraft moving between affected and unaffected waterways.

Two key phrases are incorporated into this language that should not be trivialized. The expectation to design and implement an "*interception* program" and a goal of "*preventing*" mussel introduction would be a fundamental shift in focus for some jurisdictions and one that would require focused and possibly third-party facilitation to achieve.

This one act would:

1) Standardize water managers' approaches to addressing the link between the spread of Dreissenid mussels and their reliance on watercraft for transport between disconnected waterbodies;
2) Help the public receive a consistent message regarding the important role they play in protecting California's waters;
3) Accentuate the sense of urgency and commitment of all responsible jurisdictions regarding their role in protecting California's waters; and
4) Make the necessary amendments in existing policies to coordinate and minimize regulatory inconsistencies, thereby reducing opportunities for confusion among the boating public.

Addressing Challenges #1, 2, & 3 - a proclamation from each jurisdiction that states their willingness to employ watercraft/equipment *interception* programs, would recognize that they each share a common goal of *preventing* an inadvertent introduction of Dreissenid mussels or other aquatic nuisance species via trailered watercraft moving between affected and unaffected waterways.

Such a proclamation should not be viewed as trivial; it would represent a monumental shift in governance by some of those who manage California's water resources. However, Dreissenid mussels and the threat they pose to California's water conveyance systems and its natural resources, is of such magnitude that a paradigm shift needs to be seriously considered.

To be effective, this reality creates a need to assess those waterbodies that have the infrastructural capacity to restrict access and maximize the opportunity for interception prior to launching. Simply stated, there may be some waterbodies whose access is so porous that it is

virtually impossible to insure that every vessel is inspected prior to launch or certified when it leaves the water, for example Clear Lake in Lake County with over 750 points of vessel access (private + public launches); the Colorado River system with its multiple entry points over a larger geographic region. Using the Clear Lake example, it may simply not be palatable for another waterbody to accept a certificate or band from Clear Lake even with its current level of commitment to prevention of mussel introduction. Clear Lake and the Colorado River are extreme examples. Most other lakes, particularly constructed reservoirs, do not have this number of launch sites and it can be relatively simple to monitor ingress and egress.

Subsequently, any program that relies on *interception* and *prevention* inherently has to rely on personnel to visually inspect a water craft. This may require jurisdictions to address their capacities to meet this challenge.

Matching Apples to Apples –

This simple, often-used metaphor is applicable when discussing capacity in the context of reciprocal recognition of mussel programs. *If*, a proclamation as proposed was deemed acceptable by a stakeholder agency, it may be prudent to limit the scope of the proclamation to initiating departmental discussion on how such a program could be implemented. In other words, at least initially, reciprocity may have to be limited to within *intra*-departmental programs to take advantage of existing communication networks and *trust* among cohorts.

To some extent, this approach is naturally evolving among those entities who are on the cusp of reciprocal programs, e.g. State Parks at the Lake Casitas Recreation Area; the Bay Area Consortium. These programs have addressed the basic elements identified in this report as being a necessary starting point for cooperation (budgets, personnel, and knowledge of waterbody infrastructures). It may simply be unrealistic to expect a jurisdiction to accept another program's "certification" in the absence of a high level of comfort, something that can only be accomplished through a close working relationship and understanding of each other's program. Their approach recognizes and accepts that their "customers" will often limit their boating time to local waters for reasons of ease of access and familiarity, rendering certification among participants acceptable due to an acceptance of low risk among participants of their "working group".

Conceptually, a similar approach could be considered at a larger scale by agencies and utilities, who design, develop and implement a program on the waterbodies for which they are responsible for their "customers". The demographics shared earlier in this report demonstrate that boaters have an affinity for their "favorite" lakes (for a number of reasons). For example, those who launch vessels from State Park facilities are accepting of kiosk facilities, park oversight and launch fees. Similarly, those who are less amenable to that level of government supervision or costs may choose to visit waters that have minimal on-sight supervision and costs with launching, e.g., ACE or BOR facilities. An *intra*-agency specific program would address those boaters who frequent certain "types" of waters and provide consistent messaging and expectations at related waterbodies.

Expanding on this approach, if an interceptive prevention program were initiated at BOR managed waters it could insure: 1) consistent messaging and expectations of boaters (assuming they, or their concessionaires, would be using existing standardized protocols and procedures), and 2) BOR could design and implement a program that reasonably meets its needs and mission. Ideally, once implemented, a vessel that was certified clean at one BOR facility could be "banded" and this certification would be accepted by another BOR facility (if the band was not disturbed). Under these examples, boaters who visited Lakes Folsom, New Melones or Berryessa would all be subject to similar messaging and vessel inspection requirements, thus maximizing consistencies among a number of waterbodies. Similar *intra*-departmental approaches could be considered by the ACE, public utilities, State Parks, etc.

Given the level and number of complexities that have been articulated in this report, it may not be feasible to consider *inter*-departmental reciprocity immediately. Rather, what may be required is a one-on-one, facilitated process *within* departments to identify the obstacles and inhibitions that could delay or even prevent reciprocal opportunities. With time *inter*-departmental reciprocity should be the goal as programs evolve and mature.

PATHWAYS TO MUTUAL ACCEPTANCE OF VESSEL CERTIFICATION

Options are always available in resource management challenges; however, some may simply not be good enough to achieve a desired result. Arguably, it is not acceptable to ignore the threat of invasive Dreissenid mussels by not initiating a program that actively *prevents* their inadvertent introduction in waters that are not currently impacted. If this paradigm should

become a universally-accepted principle, then progress on the issue of reciprocity can be realized. How such progress moves forward provides another set of challenges.

Goal #1 –All waterbodies within the State that allow public, water vessel access have designed and implemented a program of interception and prevention to minimize the threat of Dreissenid Mussels (and other AIS).

Challenge #1 – In order to achieve reciprocal recognition of vessel certification programs the fundamental issue of trust among water purveyors can not be overstated. Trust between water managers is the key if the advancement of reciprocity among waterbodies is to be realized in the State. Without a shared confidence among participants that other programs are taking the issue of prevention seriously, it is unreasonable to assume mutual acceptance of certifications among water bodies will be achieved.

Step #1 –

Initiate discussions with those jurisdictions that currently do not intercept vessels prior to launching to enlist their guidance on how to best instigate the process toward an *intra*-agency proclamation that states their willingness to employ watercraft/equipment *interception* programs, recognizing that they share in a common goal of *preventing* the inadvertent introduction of Dreissenid mussels or other aquatic nuisance species via trailered watercraft. A number of existing protocols and/or examples from various sources are available as guides to assist agencies in developing vessel interception programs (Zook and Phillips 2009).

Step #2 –

Once codified through proclamation, the discussion could then focus on how a program is developed and applied across jurisdictional areas of responsibility. This could require the use of a facilitated, third party process to assist in the identification of challenges and barriers (institutional and infrastructural) that need to be identified and modified in order to successfully achieve changes in identified barriers.

Goal #2 – Mussel prevention activities are coordinated with existing and future threat-management programs for maximum efficiency.

Challenge #2 –

Resources are limited. Dreissenid mussels are only one potentially devastating threat to California's water resources and are additive to an already daunting list of dangers, e.g., chemical pollution, structural failures, bio-terrorism, and many others.

Step #1 -

Given this reality it may be prudent for those agencies that allow public vessel access, but yet do not have an interception program, to consider bundling various water protection measures to consider advancing prevention programs. Each of the examples cited above (AIS, pollution, bio-terrorism) share a common denominator in that people serve as the principle vector for each of these threats. A vessel interception program could address each of these threats simultaneously.

Step #2 –

Resource constraints offer another reason to evaluate capacities and efficiencies within individual jurisdictions. *Intra*-agency reciprocity of vessel interception programs could address both economic efficiencies while at the same time being environmentally effective since a number of waterways are connected. Once conceptually designed, it would be possible to assess capacity within jurisdictional waters to determine which sites could accept a program of mutual recognition of the other's protocols i.e. Lake Shasta –Folsom Lake - Lake Berryessa (BOR); Lake Mendocino – Lake Sonoma (ACE).

Intra-agency program reciprocity advances the concept forward while providing an opportunity for managers to address similar and divergent capacities among lakes and incorporate implementation strategies for similar situations while segregating those that pose other logistical challenges. Addressing this challenge in such a manner could allow for regionalized application of prevention programs in a measured fashion to better address internal capacities.

Goal #3 A capacity-building program is implemented to bring more jurisdictions up to a standard suitable for reciprocity.

Challenge #3 -

The vast inconsistency currently among agencies, counties, municipalities, utilities, and others in how they address the threat of mussels (monitoring vs. prevention) is a fundamental challenge compounding the lack of trust among representatives.

To advance the notion of reciprocity among widely divergent interests;

Steps 1 - 4

- The Department of Fish and Game should establish a list of priority lakes due to either resource or economic values to publicize the need for these waterbodies to receive immediate attention in minimizing the threat of AIS establishment.
- It may then be necessary to approach each jurisdiction independently to identify those internal challenges that are inhibiting positive progress toward implementation of an interception and prevention program.
- Additionally, such a dialog could be used to identify issues of capacity, concerns, and/or constraints within a jurisdiction to assist in the identification of which water bodies could be immediately incorporated into a prevention program and those that may prove too difficult, initially, to affectively intercept incoming vessels. Then a dialogue could be initiated that would identify those waterbodies that may require public access closures until a prevention program can be designed, developed and implemented.
- To assist positive progress toward initiation of a prevention program, the compilation of existing, standardized protocols, training manuals and related products could be consolidated into a syllabus format that could be distributed to participating jurisdictions to serve as “training guide” for agency personnel. (Ideally, these materials would be provided through formalized, individualized training programs that can be designed to accommodate agency needs).

SUMMATION

The pathway to address reciprocal acceptance of vessel certifications will most likely require a multi-pronged, concurrent tactic recognizing that the assortment of jurisdictions involved in water management are not reliant on each others decisions.

It will be necessary to address the lack of commitment on the part of some jurisdictions that have languished in their responsibility to prevent unintentional infestation from AIS due to the absence of affirmative vessel interception programs designed to assure that boats meet the minimum conventional standard of Clean, Drained and Dry prior to launching.

Initially this commitment will require an acceptance on the part of these jurisdictions that their missions must include the *prevention* of AIS into the waters they manage per 2302. If this commitment can be formalized in policy through proclamation or resolution it will represent a significant advancement in the state's ability to work collaboratively with its water partners to advance the goal of containing Dreissenid mussel within the current range.

By following 2302, a pathway toward *intra*-departmental reciprocal programs could begin in earnest. The process could then focus on evaluating statewide, regional or even district capabilities, challenges and constraints recognizing the scope of the task might require a measured approach to initiate progress. This process may require the assistance of third party facilitators familiar with the issues and who could play a neutral role in assisting the advancement of the process.

Initially the path forward may need to realize that multi-agency reciprocal acceptance of vessel certification might be unacceptable to a number of important stakeholder groups while a measured, *intra*-agency reciprocal program would advance the goal of broader prevention measures across the state resulting in greater overall protection of the state's water.

The process shared here recognizes:

1. the need to move all responsible stakeholder groups forward in a concerted effort to make *prevention* of inadvertent mussel introductions (and all AIS) a top *intra*-agency priority;
2. the challenge of addressing the issue of mutual trust among divergent program participants;
3. that each jurisdiction has a particular "culture" that does not always merge comfortably with that of other jurisdictions;

4. that cultural divides exist and they won't easily be overcome because of this particular threat;
5. Dreissenid mussels are but one issue for which jurisdictions must allocate resources;
6. that multiple concerns and threats may be addressed by bundling a program that intercepts vessels that can serve as a vector for AIS, pollution, or other illegal activities;
7. the need to for each authority to take ownership in developing *their* own prevention measures based on standardized procedures and protocols;
8. that simply telling an agency to develop a vessel interception program may be incorrectly assuming that the agency has the ability or capacity to know how to move the directive forward;
9. that these scenarios represent only a first step in trying to coalesce a massive, independent yet interconnected water conveyance system that requires present and future adaptive management strategies to address logistical and administrative capacities;
10. *inter*-agency reciprocity of vessel certification in California on a broad scale must build upon a foundation of *intra*-agency coordination that would demonstrate a commitment to preventing the movement and introduction of mussels and other AIS through California's "water system".

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Appendix 1. California water bodies with active vessel interception programs.

Waterbody	Self-Inspec	Screening Interview	Inspection	Decontami	Quarantine Drying	Exclusion	Other	
Lake Henshaw				X				
Clear Lake		X	X	X	X	X		
Whiskeytown Lake	X	X	X					
Big Bear Lake								
Pinto Lake		X	X			X		
Lake Piru			X		X			
Lake Cachuma		X	X		X	X		
Anderson Reservoir	X	X	X		X	X		
Southerland Reservoir		X				X		
Lake Casitas	X	X	X	X	X	X		X
Loch Lomond		X				X		
San Justo Reservoir						X		
Lake Tahoe		X	X	X		X		
Crowley Lake		X	X	X		X		
Camanche Reservoir	X	X	X	X	X	X		
Lake Dixon						X		
Lake Pillsbury	X	X						
Callero Reservoir	X	X	X		X	X		
Coyote Reservoir	X	X	X		X			
Stevens Creek Reservoir			X					
Contra Loma Reservoir	X	X	X		X	X		
Vail Lake	X	X	X		X	X		
Diamond Valley Lake		X	X	X	X	X		
Diaz Lake	X							
Klondike Reservoir	X							
Indian Valley Reservoir	X	X						
Highland Springs Reservoir		X	X		X	X		
Cache Creek Reservoir	X		X					
Metcalf Pond	X		X					
Lexington Reservoir	X		X			X		
Uvas Reservoir						X		
Vasona Lake			X			X		
Lafayette Reservoir		X	X			X		
Jim Baker Reservoir						X		
Pardee Reservoir	X	X	X	X	X	X		
San Pablo Reservoir		X	X			X		