

California's Marine Invasive Species Program and the United States federal programs that manage vessels as vectors of nonindigenous species:

A comparison of the relative effectiveness at reducing the risk of nonindigenous species introduction from maritime shipping activities

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EXECUTIVE SUMMARY

California's Public Resources Code (PRC) section 71271 requires the California State Lands Commission (Commission) to prepare and submit a report to the Legislature within eight months of the implementation of a federal program and associated regulations that are similar to those of the state's Marine Invasive Species Program. Both the United States Coast Guard (USCG) and the United States EPA (EPA) are set to implement ballast water discharge performance standards in December 2013, prompting the development of this report to satisfy the legislative mandate outlined in PRC section 71271.

California's Marine Invasive Species Program is a statewide, multi-agency program that was established by the Legislature to minimize or reduce the release of nonindigenous species (NIS) into California waters from vessels 300 gross registered tons or greater and capable of carrying ballast water. The Commission, the Department of Fish and Wildlife, the State Water Resources Control Board, and the Board of Equalization all work cooperatively to implement the MISP and carry out the functions of the program, as directed by the Legislature through the Marine Invasive Species Act. At the federal level, the USCG and the EPA both implement comparable programs aimed at reducing the release of NIS from commercial vessels.

While many components of the MISP and the federal programs are analogous, there are key differences that impact the federal programs' relative effectiveness at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state.

California's MISP fills critical management gaps present at the federal level

Federal exemptions from ballast water and biofouling management and reporting requirements

While all three programs provide exemptions for vessels of the armed forces, vessels in innocent passage (i.e. travelling through state or federal waters but not arriving at a port or place), and vessels claiming a safety exemption, the federal programs provide additional exemptions not based on environmental protection or human safety that likely result in increased risk of species introductions. Both the USCG and the EPA do not require ballast water management or reporting when operating within the same USCG Captain of the Port Zone. If not for California's MISP, vessels would be allowed to, for example, discharge unmanaged ballast from San Francisco Bay into Humboldt Bay, a water body that is several hundred miles away and that has significantly fewer NIS than San Francisco Bay. The USCG program also provides exemptions for crude oil tankers engaged in coastwise trade and to vessels that claim conducting ballast water

exchange would result in undue deviation and delay in their voyage, although the EPAs enabling legislation does not allow these exemptions. Both of these exemptions are based on considerations other than environmental protection, and without MISP requirements in place to fill these gaps, both would allow more vessels to discharge unmanaged ballast water into California. This is highlighted by the fact that the number of vessels claiming these exemptions, and therefore discharging unexchanged ballast water, is dramatically decreased in California waters when compared to the rest of the U.S.

Ballast Water management

Because of the risk of introducing and spreading NIS along the coast, California's MISP currently requires discharging vessels traveling along the western North American coast to conduct ballast water exchange prior to discharge. Under current USCG rules, these vessels may discharge unmanaged ballast as long as they remain wholly within 200 nm from land. Without MISP requirements to fill this federal management gap, vessels would be allowed to discharge unmanaged ballast water from Alaska, British Columbia, Washington, Oregon, or other California ports into California, drastically increasing the risk of introducing NIS into the waters of the state.

California's MISP and the federal programs all have ballast water discharge performance standards in place and are scheduled to implement these standards over the next five years. While all of these performance standards set numeric limits on allowable concentrations of aquatic organisms, the California standards are considerably stronger than the federal standards and, once implemented, will provide better protection for California waters. All of these standards will likely require treatment of discharged ballast water, either at a shore-based treatment facility or through the use of a treatment system placed onboard a vessel. California's MISP is actively supporting research to assess the feasibility of shore-based ballast water treatment in California as one option for vessels to comply with the state's requirements; neither the USCG nor EPA have released information on the feasibility of this option for any ports within the U.S. Another option for compliance is the use of shipboard ballast water treatment systems, an emerging technology with an expanding industry. Because none of the state, federal, or international ballast water discharge standards are yet implemented, there is a lack of comprehensive information on system performance on actively trading vessels, across vessel types, and across various routes. The MISP has adopted reporting forms specifically designed to collect much needed data on ballast water treatment technology performance and maintenance, in an attempt to fill this global gap in knowledge. Although the EPA will require annual reporting of certain system data, neither of the federal programs have plans in place to collect per-discharge data on the performance and maintenance of shipboard treatment systems.

Biofouling management

California's MISP and the federal programs all currently have reactive biofouling management requirements in place, essentially requiring the removal of biofouling from vessel surfaces on a regular basis. However, the term "regular basis" is ambiguous, and only California's MISP specifically defines the term to provide clarity to vessel owners and operators on the actual requirement. Because the federal requirements don't define the term "regular basis," they function more as recommendations and are less likely to influence actual biofouling management and reduce the risk of species introduction to California from biofouled vessels.

In addition to the reactive management requirements of the California and federal programs, the California Legislature directed the MISP to develop and adopt comprehensive biofouling management requirements including preventative measures such as the appropriate use of antifouling systems, the development of vessel-specific Biofouling Management Plans and Record Books, and preventative maintenance of surfaces that are highly susceptible to biofouling accumulation (e.g. rudders, propellers, thrusters). Neither of the federal programs has announced plans to develop preventative and comprehensive biofouling management regulations. Because biofouling is believed to be as, if not more, potent than ballast water as a pathway for the introduction of NIS into coastal waters, this lack of federal action is a major gap that, in the absence of the MISP, would leave California at greater risk of species introduction.

An important component in risk-assessment and practical biofouling management regulation development is an understanding of the current hull husbandry practices and patterns of biofouling risk factors (e.g. vessel speed, port residency time) of the vessels operating in California. The MISP has been collecting these data annually since 2008, and is using these details to inform the development of comprehensive regulations that are mandated by the California Legislature. This information is essential for understanding the NIS introduction risk that the biofouling vector presents to California, and although the EPA collects some hull husbandry information every five years, neither they nor the USCG collect these data frequently enough to properly assess the biofouling-mediated risk of species introduction to California or to properly develop management requirements to reduce that risk.

Vessel vector research

Identifying key information gaps and having the ability to support targeted research to fill those gaps is an often overlooked component of successful risk management programs. Both the California MISP and the USCG have funded ballast water research to improve their abilities to effectively carry out their legislative mandates, but each has focused on

different types of questions and therefore different types of research. The MISP-funded ballast water research has primarily focused on two main priorities: encouraging the development and testing of ballast water treatment technologies, both shipboard and shore-based; and tools and technologies to assess compliance with ballast water discharge performance standards. The USCG-funded research has focused primarily on ballast water treatment system type approval-related questions and technologies. The ballast water research funded by each program is important and complimentary, a function of the cooperation between the two programs. However, without the MISPs support for ballast water research, there would be tremendous gaps in overall knowledge of ballast water treatment technology development and testing as well as available compliance assessment tools.

Targeted research is also important to fill knowledge gaps related to vessel biofouling and biofouling management. The MISP has funded and participated in numerous research projects aimed at better understanding the biofouling-mediated risk of species introduction to California. This information is essential for developing practical, science-based biofouling management regulations and because biofouling research has lagged behind ballast water research globally, the MISP coordinates closely with international colleagues on answering questions that are useful not only for California but internationally as well. The USCG and the EPA have primarily focused on ballast water management and therefore neither program has funded biofouling research. This lack of investment on the part of the federal programs in understanding and developing strategies to manage the biofouling-mediated risk of species introduction represents a key federal gap that is filled by the MISP to reduce the likelihood of future NIS introductions into California waters.

California's MISP staffing, expertise, and resources

Staffing and expertise

California's MISP is a multi-agency program that incorporates the expertise of the Commission, the California Department of Fish and Wildlife, the Water Board, and the Board of Equalization. All four agencies coordinate with each other as directed by the California Legislature to implement the MISA. The Commission's portion of the MISP is divided into three components: program administration and policy development, data management, and field operations. One of the keys to the success of the MISP is the local nature of the program. This local presence allows for close communication, coordination, and outreach to the local maritime industry, as well as other state, federal, and international agencies. Outreach is a role shared by all parts of the MISP, with each component of the program exchanging information with various groups.

The data management component consults with shipping agents and owners on a daily to weekly basis over paperwork submission requirements, programmatic changes and general questions about California rules. The MISP administration and policy development component is staffed with marine scientists with backgrounds in biological invasion science who regularly consult with a wide array of stakeholders in order to evaluate the current state of vessel NIS vector knowledge and to guide policy recommendations relevant to California. The field operations component is staffed with inspectors who each have an average of eleven years of experience in conducting ballast water inspections at California ports. The MISP inspectors are the primary conduit for information to ship officers and crew, educating them on state requirements and supplying outreach materials.

While the USCG has similar levels of staffing and expertise for its program administration, the duties of USCG inspectors in ports across the country include many other responsibilities in addition to ballast water; therefore ballast water management only makes up about 10-15 minutes of a multiple-hour inspection. The EPA does not conduct Vessel General Permit (VGP) related inspections and relies on USCG inspectors to assess compliance with the VGP. Comparison of the state and federal programs highlights the differences in staffing levels, particularly with regard to inspectors, their level of expertise, their local presence and the focus of their duties.

Funding sources

The success of programs designed to reduce the risk of NIS introduction from vessel vectors is dependent on a consistent funding source. The MISP is funded through a per-voyage fee assessed on vessels calling on ports within California and deposited into California's Marine Invasive Species Control Fund. This funding model results in a stable, consistent, and dedicated source of funds that enables the MISP to consistently implement the intent of the California Legislature without interruption, even in times of political budget crises. Conversely, both the USCG and EPA programs are dependent on regular acts of Congress to provide supporting funds, either through specific USCG funding bills or general appropriation bills. This type of funding model results in an unsteady and inconsistent source of funds that is reliant on the current political whims of Congress. During the writing of this report, federal budget disagreements resulted in the shutdown of many government programs, including the USCG and EPA programs discussed in this report. This unpredictable congressional funding model has resulted in interruptions in policy development, implementation, and enforcement at the federal level.

Biological monitoring

The California Legislature designed the MISP to include regular biological monitoring of California's coastal waters to identify newly introduced species, range expansions of currently established NIS, and to evaluate the success of the policies implemented by the MISP. The CDFW oversees these regular surveys and produces triennial reports to the Legislature summarizing recent findings. Conversely, neither the USCG nor the EPA is legislatively required to conduct biological surveys aimed at identifying NIS. The monitoring conducted by California's MISP enables the state to better identify new introductions and evaluate the success of current policies to reduce the risk of introducing NIS from vessel vectors.

Ultimate question: Are the federal programs “equally or more effective at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state?”

The Commission finds that the federal programs within the USCG and the EPA are not equally or more effective than California's Marine Invasive Species Program at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state. The MISP fills numerous gaps present at the federal level that would leave the state at an increased risk of species introduction. The MISP can focus its limited resources more on California and regionally relevant issues than the federal programs, allowing the MISP to more effectively implement and fund policies that reduce the risk of NIS introduction from vessel vectors in California waters.

Another factor that influences the ability of all three programs to effectively reduce the likelihood of introducing NIS from vessel vectors is the extent of each program's focus, either statewide or nationwide. The risk of NIS introduction to California is influenced by California's specific vessel traffic patterns, vessel ballasting operations, and vessel biofouling management practices. Effective policies to reduce the risk of species introductions to California must take these NIS introduction risk factors into consideration. These factors are likely to differ from state to state and coast to coast. Federal policies that intend to reduce the risk of NIS introduction broadly across all ports in the U.S. may not be the most protective or appropriate policies for California. By establishing the MISP, the California Legislature recognized the need to focus on addressing the state-specific NIS introduction risk. Aligning with this recognition, California's MISP continues to work cooperatively with the USCG and EPA programs in a complimentary fashion to fill the federal gaps and ensure that the requirements placed on vessels operating in California are robust enough to satisfy the Legislative mandate to move the state expeditiously toward elimination of the discharge of nonindigenous species into the waters of the state.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
ABBREVIATIONS AND ACRONYMS.....	viii
I. PURPOSE.....	1
II. INTRODUCTION.....	2
A. Impacts and Risks of Nonindigenous Species.....	2
B. Vessels as Vectors.....	4
III. CALIFORNIA’S MARINE INVASIVE SPECIES PROGRAM.....	7
A. Legislative Background.....	7
B. Marine Invasive Species Program Components.....	9
IV. U.S. FEDERAL MANAGEMENT OF VESSEL VECTORS OF NONINDIGENOUS SPECIES.....	14
A. United States Coast Guard.....	14
B. United States Environmental Protection Agency	17
V. CALIFORNIA-FEDERAL COMPARISON: GENERAL.....	20
A. Applicability.....	20
B. Funding Sources.....	22
C. Biological Surveys	23
D. Inspections, Enforcement and Outreach.....	24
E. Penalties.....	27
VI. CALIFORNIA-FEDERAL COMPARISON: BALLAST WATER.....	29
A. Ballast Water Management and Compliance.....	29
B. Ballast Water Discharge Performance Standards.....	33
C. Ballast Water Reporting Requirements.....	37
D. Ballast Water Research Funding.....	40
VII. CALIFORNIA-FEDERAL COMPARISON: VESSEL BIOFOULING.....	44
A. Vessel Biofouling Management Requirements - Reactionary.....	44
B. Vessel Biofouling Management Requirements - Comprehensive.....	45
C. Hull Husbandry Reporting Requirements.....	46
D. Biofouling Research Funding.....	48
VIII. CONCLUSIONS	50
IX. REFERENCES.....	56

ABBREVIATIONS AND ACRONYMS

AB	Assembly Bill
AMS	Alternative Management System
BOE	Board of Equalization
BWE	Ballast Water Exchange
BWRF	Ballast Water Reporting Form
CANOD	California Aquatic Non-Native Organisms Database
CDFW	California Department of Fish and Wildlife
CDFW-MISP	California Department of Fish and Wildlife - Marine Invasive Species Program
cfu	Colony-Forming Unit
Commission	California State Lands Commission
COTP	Capitan of the Port
CWA	Clean Water Act
DHS	Department of Homeland Security
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ETV	Environmental Technology Verification
GIS	Geographic Information Systems
GRT	Gross registered tons
HHRF	Hull Husbandry Reporting Form
IMO	International Maritime Organization
m	Meter
MFD	Marine Facilities Divisions
MISA	Marine Invasive Species Act (Chapter 491, Statutes of 2003)
MISP	Marine Invasive Species Program
ml	Milliliter
MOU	Memorandum of Understanding
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NBIC	National Ballast Information Clearinghouse

NIS	Nonindigenous Species
NISA	National Invasive Species Act
nm	Nautical Miles
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
OW	The Office of Water
PCR	Pacific Coast Region
PRC	Public Resources Code
PSC	Port State Control
SB	Senate Bill
SERC	Smithsonian Environmental Research Center
STEP	Shipboard Technology Evaluation Program
μm	Micrometer
U.S.	United States
USCG	United States Coast Guard
VGP	Vessel General Permit
Water Board	State Water Resources Control Board (California)

I. PURPOSE

California Public Resources Code (PRC) Section 71271 states that if a federal program and regulations similar to those adopted by California's Marine Invasive Species Program (MISP) are established and implemented, the California State Lands Commission (Commission) shall submit a report to the State Legislature within eight months of the implementation of the federal program. The report shall compare California's Marine Invasive Species Program with the federal program and make a finding as to the federal program's relative effectiveness in preventing the introduction of marine invasive species from vessels visiting California. Upon completion of the analysis, the Commission is required to recommend repeal of the MISP only if the federal program "is equally or more effective at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state."

In June 2012, the U.S. Coast Guard (USCG) enacted regulations establishing numerical standards for the discharge of living organisms in ships' ballast water. Vessels will be required to comply with the discharge standards beginning on December 1, 2013. In March 2013, the U.S. Environmental Protection Agency (EPA) released the 2013 Vessel General Permit (VGP), which also contains ballast water discharge standards with an effective date of December 19, 2013. The adoption and implementation of numeric standards for the discharge of ballast water at the federal level was determined by Commission staff as an appropriate trigger to initiate the comparison and analysis required by law. This report, prepared for the California Legislature, summarizes this analysis and fulfills the mandate set forth in PRC section 71271.

II. INTRODUCTION

A. Impacts and Risks of Nonindigenous Species

Also known as “introduced,” “invasive,” “non-native,” “exotic,” or “alien,” nonindigenous species (NIS) are organisms that have been transported by human activities to regions where they did not historically occur, and have established viable and reproducing wild populations (Carlton 2001). Once established, NIS can have severe ecological, economic, and human health impacts in the receiving environment. One of the most infamous examples of NIS and their impacts is the zebra mussel (*Dreissena polymorpha*) that was introduced to the Great Lakes from the Black Sea in the mid-1980s via commercial ships (Carlton 2008). Zebra mussels attach to hard surfaces in dense populations (as many as 700,000 per square meter) that clog municipal water systems and electric generating plants, resulting in approximately one billion dollars per year in damages and control costs (Pimentel et al. 2005). In such high densities, zebra mussels filter vast amounts of tiny floating plants and animals (plankton) from the water. Plankton support the foundations of aquatic food webs, and disruptions to this base propagate throughout the ecosystem. By dramatically reducing plankton concentrations and crowding out other species, zebra mussels have altered ecological communities, causing localized extirpation of native species (Martel et al. 2001) and declines in recreationally valuable fish species (Cohen and Weinstein 1998).

In California, zebra mussels have been found in the San Justo Reservoir in San Benito County, which is currently the only known population in the state (CDFG 2012). However, the closely related and equally as invasive quagga mussel (*Dreissena bugensis*) (UC Riverside 2013), first discovered in Lake Mead in January 2007, is currently found in the Colorado aqueduct and all associated water delivery structures (CDFW 2013). It is suspected that both mussel species were brought over land to the western U.S. on the hulls of trailered recreational boats and equipment used for aqueduct infrastructure improvement (CDFG 2012). Over \$14 million has already been spent to control zebra and quagga mussels in California since the species were first identified (Norton, D., pers. comm. 2012). These costs represent only a fraction of the expected cumulative costs over time because eradication is not possible and control is an ongoing expense.

Nonindigenous species can also create environmental impacts that are difficult to quantify economically, but are no less significant. In San Francisco Bay, the overbite clam (*Corbula amurensis*) spread throughout the region’s waterways within two years of being detected in 1986 and can account for up to 95% of the living biomass in some shallow portions of the bay floor (Nichols et al. 1990). It is believed to be a major contributor to the decline of several pelagic fish species in the Sacramento-San Joaquin

River Delta, including the threatened delta smelt, by reducing the planktonic food base of the ecosystem (Feyrer et al. 2003, Sommer et al. 2007, MacNally et al. 2010).

In addition to impacting the coastal economy, ecosystems, and native species, NIS can pose a risk to human health. Vessels and port areas have been connected to the spread of epidemic human cholera in a number of instances (Ruiz et al. 2000b, Takahashi et al. 2008), including the transport of the toxigenic *Vibrio cholerae* serotype O1 from Latin America to Mobile Bay, Alabama in 1991. This introduction led to the closure of nearly all Mobile oyster beds during the summer and fall of 1991 because of the risk to human health, resulting in losses and damages estimated at \$700,000 (Lovell and Drake 2009). In addition to cholera, microbes that have been found in ships include the microorganisms that cause paralytic shellfish poisoning (Hallegraeff 1998), coral pathogens (Aguirre-Macedo et al. 2008), human intestinal parasites (*Giardia lamblia*, *Cryptosporidium parvum*, *Enterocytozoon bieneusi*) and the microbial indicators for fecal contamination (*Escherichia coli* and intestinal enterococci) (Reid et al. 2007). In California, the Japanese sea slug *Haminoea japonica* was first detected in San Francisco Bay in 1999, and was likely introduced via ballast water (Gosliner and Behrens 2006). This slug is a host for parasites that cause cercarial dermatitis, or “swimmer’s itch,” in humans. Since 2005, cases of swimmer’s itch at Robert Crown Memorial Beach in the city of Alameda have occurred on an annual basis and are associated with high densities of *Haminoea japonica* (Brant et al. 2010).

Attempts to eradicate NIS after they have become widely distributed are often unsuccessful and costly (Carlton 2001). Between 2000 and 2006, over \$7 million was spent to eradicate the Mediterranean green seaweed (*Caulerpa taxifolia*) from two small embayments in Southern California (Agua Hedionda Lagoon and Huntington Harbour) (Woodfield 2006). This effort represents one of the few known successful eradication attempts, likely because of early detection and a well-funded rapid response plan. More often, eradication attempts are unsuccessful and eventually transition into control or management efforts. For example, attempts to eradicate the Japanese kelp *Undaria pinnatifida* from marinas in Monterey since 2002 and San Francisco Bay since 2009 initially reduced population sizes, but the lack of resources and the fact that the vector (recreational boats) is still active in these regions has prevented successful eradication (Zabin et al. 2011, S. Lonhart, pers. comm. 2013). Control is likewise extremely expensive and labor-intensive. By the end of 2010, over \$12 million had been spent in San Francisco Bay to control the Atlantic cordgrass (*Spartina alterniflora*) (M. Spellman, pers. comm. 2010); control efforts and associated costs continue today. Prevention of species introductions through vector management is therefore considered the most desirable and cost-effective way to address the NIS issue.

The rate of species introductions, and thus the risk of invasion by species with detrimental impacts, has increased significantly during recent decades. In North America, and particularly in California and the rest of the west coast, the rate of reported introductions in marine and estuarine waters has increased exponentially over the last 200 years (Ruiz et al. 2000a, 2011). Nonindigenous species are introduced into U.S. waters by many mechanisms, or “vectors,” including ships, aquaculture, live bait release, intentional sport fishing introductions, release of aquarium pet and live seafood specimens, transfer via recreational watercraft, association with marine debris, and accidental release from research institutions (Weigel et al. 2005, Minchin et al. 2009).

B. Vessels as Vectors

One of the primary factors leading to the increase of new introductions has been the vast expansion of global trade during the past 50 years, which in turn has led to significantly more ballast water, biofouling, and associated organisms moving around the world. The increased speed of vessels involved in global trade has allowed many more potentially invasive organisms entrained in ballast tanks to survive under shorter transit times (Ruiz and Carlton 2003) and arrive in recipient ports in better condition. Organisms that arrive “healthy” in recipient regions are more likely to thrive and reproduce in their new habitats.

In coastal environments, commercial shipping is considered the most important vector of NIS introductions, accounting for or contributing to 79.5% of introductions to North America (Fofonoff et al. 2003) and 81% to California (Ruiz et al. 2011). Commercial ships transport organisms through two primary mechanisms - ballast water and vessel biofouling.

i. Ballast Water

Ballast water is necessary for many functions related to the trim, stability, maneuverability, and propulsion of large seagoing vessels (National Research Council 1996). Vessels may take on, discharge, or redistribute water during cargo loading and unloading, as they encounter rough seas, or as they transit through shallow coastal waterways. Typically, a vessel takes on ballast water as cargo is unloaded in one port to compensate for the weight imbalance, and will later discharge ballast water when cargo is loaded in another port. This transfer of ballast water from “source” to “destination” ports results in the movement of many organisms from one region to the next. In this fashion, it is estimated that more than 7000 species are moved around the world on a daily basis (Carlton 1999). Moreover, each ballast water discharge has the potential to release over 21.2 million individual free-floating organisms (Minton et al. 2005).

In recognition of the increasing risk of species introductions from ballast water discharge, management programs have been developed at the international, federal and state levels. Nearly all ballast water laws provide multiple management options, including complete retention of ballast water on board the vessel, ballast water exchange, discharge of ballast water to a shore-based reception and/or treatment facility, or the use of an alternative management method or technology. Most of these laws also provide exemptions from management requirements to protect the safety of vessels and vessel crews in extraordinary circumstances.

Commercial vessels intending to discharge ballast water primarily use exchange as the method of ballast water management. During exchange, the biologically rich water that is loaded while a vessel is in port, or near the coast, is exchanged with the comparatively biologically poor waters of the open ocean. Coastal aquatic organisms adapted to the conditions of bays, estuaries and shallow coastal waters are not expected to survive or be able to reproduce in the open ocean due to differences in biology and oceanography. Likewise, aquatic organisms that inhabit the open ocean are not expected to survive in coastal waters (Cohen 1998). Even though it is the primary management method for vessels intending to discharge, ballast water exchange is widely considered an interim ballast water management tool because of its operational limitations and variable efficiency. Ballast water exchange typically eliminates between 70% and 99% of the organisms originally taken into a tank while the vessel is in or near port (Cohen 1998, Parsons 1998, Zhang and Dickman 1999, USCG 2001, Wonham et al. 2001, MacIsaac et al. 2002), and the percentage of ballast water exchanged does not necessarily correlate with a proportional decrease in organism abundance (Choi et al. 2005, Ruiz and Reid 2007). A proper ballast water exchange can take many hours to complete, and in some circumstances, may not be possible without compromising vessel safety due to adverse sea conditions or antiquated vessel design.

Because of the limitations of ballast water exchange, regulatory agencies and the commercial shipping industry looked toward the development of effective ballast water treatment technologies as a promising management option. Ballast water treatment can reduce or eliminate NIS in vessel discharges, even in situations where exchange may be unsafe or impossible. Technologies that eliminate organisms more effectively than exchange will provide a consistently higher level of protection to coastal ecosystems from NIS. The use of effective ballast water treatment technologies will also allow voyages to proceed along the shortest routes, in all operational scenarios, thereby saving time and money, as well as avoiding the safety issues related to ballast water exchange. In response, state and federal agencies and international regulatory organizations have adopted or are in the process of developing performance standards

for ballast water discharge. These performance standards require discharged ballast water to meet benchmark organism concentrations.

ii. Vessel Biofouling

Vessel biofouling refers to aquatic organisms attached to or associated with submerged or wetted hard surfaces of a vessel. These include organisms such as barnacles, algae, and mussels that physically attach to vessel wetted surfaces, and mobile organisms such as worms, crabs, and amphipods (small shrimp-like animals) that associate with the attached biofouling community. As vessels move from port to port, biofouling communities are transported along with their “host” structure. Biofouling organisms are introduced to new environments when they spawn (reproduce) or drop off their transport vector (i.e. vessels). Thus, vessel biofouling has been identified as a significant mechanism for marine NIS introductions in several regions including Australia, North America, Hawaii, the North Sea, and California (Ruiz et al. 2000a, 2011, Eldredge and Carlton 2002, Gollasch 2002).

Biofouling on the hull of vessels can create drag, increasing fuel consumption, and can cause engine strain. In pipes, biofouling can block inflowing seawater meant to cool machinery. These impacts on the operation and profitability of a vessel result in a built-in incentive for biofouling management, and this management can generally be separated into two approaches: reactive and proactive management. Reactive management involves measures that kill or remove biofouling after a vessel has already become fouled. Reactionary biofouling management requirements exist at the international, federal, and state levels. Most require the removal of biofouling organisms from the submerged or wetted surfaces of a vessel on a “regular basis.”

While reactionary biofouling management is one way to reduce the risk of species introduction, this type of management may occasionally increase this risk through the release of larvae or organism fragments during in-water cleaning. Therefore, the preventative nature of proactive management is generally preferable to the reactionary management approach. Proactive measures are typically more effective and can include the use of antifouling systems (e.g. coatings) and proper planning (e.g. Biofouling Management Plans (see IMO 2011)) to prevent biofouling accumulation on a vessel.

III. CALIFORNIA'S MARINE INVASIVE SPECIES PROGRAM

California's Marine Invasive Species Program is a statewide multi-agency program created by the State Legislature to minimize or prevent NIS release into California waters from vessels greater than or equal to 300 gross registered tons (GRT) capable of carrying ballast water. Responsible agencies within the MISP include the Commission, California Department of Fish and Wildlife (CDFW), State Water Resources Control Board (Water Board), and the Board of Equalization (BOE). Each agency works in cooperation with the others to prepare reports and conduct research into the extent of current invasions, the identification of new invasions and the development of policies to reduce the likelihood of successful NIS introductions in California waters.

A. Legislative Background

In 1999, several California-based environmental groups, motivated by the lack of regulatory action by the USCG, sponsored legislation in the California Assembly to address NIS introductions into California from maritime vessels. After several major revisions, the California Legislature passed Assembly Bill (AB) 703, the Ballast Water Management for Control of Nonindigenous Species Act, in late 1999. Assembly Bill 703 (Chapter 849, Statutes of 1999) was enacted to address the introduction of NIS via discharge of ballast water from ships. This law reflected the Legislature's recognition of the potential of NIS to cause economic and environmental damage to the State. Assembly Bill 703 required that vessels originating from outside the 200 nautical mile (nm) Exclusive Economic Zone (EEZ) of the U.S. carry out mid-ocean ballast water exchange or use an alternative environmentally sound method of ballast water management that has been approved by the Commission and that is at least as effective as ballast water exchange in removing or killing NIS before discharging ballast water in California waters.

As mandated by AB 703, the Commission established the California Ballast Water Management Program and was tasked with several specific responsibilities including: receiving and processing ballast management reports submitted by all vessels arriving to California waters from outside the EEZ; monitoring ballast water management and discharge activities of vessels through submitted reports; inspecting and sampling vessels for compliance with the law, and assessing vessel reporting rates and compliance with the law. The Commission was also responsible for establishing a per-vessel fee that would be used to fund the State's ballast water management program. In addition to the tasks required of the Commission, AB 703 mandated that the CDFW conduct a study to establish baseline conditions in the coastal and estuarine waters of the state, which includes an inventory of the location and geographic range of resident

nonindigenous species populations. The Water Board was required to evaluate alternatives for treating and otherwise managing ballast water for the purpose of eliminating the discharge of nonindigenous species into the waters of the state or into waters that impact the waters of the state. Finally, the BOE was tasked with collecting the per-vessel fee from qualifying vessels (see Falkner 2003 and Scianni et al. 2013 for more information).

The Legislature, sensitive to the uncertainties surrounding the development of an effective ballast water management program for the State, included a sunset date of January 1, 2004, in AB 703. Prior to the sunset date, responsible agencies were required to summarize their activities and provide recommendations in a report to the Legislature to improve the effectiveness of the State's Ballast Water Management Program. This report was submitted to the State Legislature in January 2003 (Falkner 2003).

During the 2003 Legislative session, the initial 1999 legislation was revised and recast as AB 433, the Marine Invasive Species Act (MISA) (Chapter 491, Statutes of 2003). In the MISA, the ballast management requirements for vessels originating outside of the EEZ remained similar to those of AB 703, with the exception that crude oil tankers engaged in domestic trade were no longer exempted.

Several recommendations identified during the administration of AB 703 and detailed in the program's first biennial report (Falkner 2003) were incorporated into the MISA. The California ballast water management program was renamed the Marine Invasive Species Program and was charged with several expanded responsibilities, including: the authorization to pursue criminal and/or civil penalties for violations of the law; adoption of ballast water management regulations for vessels originating from within the Pacific Coast Region (PCR); sponsoring a pilot program to evaluate the feasibility of ballast water treatment technologies; recommending performance standards for ballast water discharge, in consultation with a technical advisory panel; and evaluating the risk of non-ballast ship-based vectors for introducing NIS and recommending actions to prevent associated introductions, in consultation with a technical advisory group.

Six additional legislative amendments designed to improve the MISA and better protect state waters have been passed since 2003. In 2006, the Legislature passed the Coastal Ecosystems Protection Act (Chapter 292, Statutes of 2006), directing the Commission to adopt specific ballast water discharge standards and an implementation schedule through the California rulemaking process by January 1, 2008 (see California Code of Regulations Title 2, Section 2291 et seq.). Assembly Bill 740 (Chapter 370, Statutes of 2007) was passed in 2007, clarifying an existing requirement for vessel owners or

operators to remove biofouling on a regular basis by defining the frequency of removal, and requiring submission of information on their hull husbandry practices. Additionally, the Commission was required to develop regulations to manage vessel biofouling. In 2008, AB 1781 (Chapter 696, Statutes of 2008) was passed to extend the implementation date for compliance with California's ballast water discharge standards. In 2009, AB 248 (Chapter 317, Statutes of 2009) required vessel owners or operators to report to the Commission information related to ballast water treatment systems, if installed and operated on their vessel(s). In 2012, Senate Bill (SB) 935 (Chapter 550, Statutes of 2012) made changes to key definitions and extended the date by which vessels could apply to install an experimental ballast water treatment system. Finally in 2013, Senate Bill 814 (Chapter 472, Statutes of 2013) was passed to delay the implementation of California's ballast water standards for two years.

B. Marine Invasive Species Program Components

i. California State Lands Commission

The Marine Facilities Division of the Commission administers the MISP and utilizes an inclusive, multi-faceted approach to: develop sound, science-based policies in consultation with technical experts and stakeholders; track and analyze ballast water and vessel biofouling management practices of the California vessel fleet; enforce laws and regulations to prevent or reduce introductions; and facilitate outreach to promote information exchange among scientists, legislators, regulators, the regulated community, and other interested stakeholders.

To carry out the requirements of the MISA and to ensure effective management, the Commission's portion of the MISP consists of three interrelated and equally important components: Data Management, Field Operations, and Program Administration (Figure III.1).

MISP Data Management - MISP data management staff, comprised of one analyst and four technicians, monitor compliance with ballast water and biofouling reporting requirements, enter vessel-reported data from submitted forms, and identify and clarify reporting inconsistencies of more than 800 monthly vessel arrivals. MISP data management staff has continual contact with ship officers and agents, relaying to them information about MISP requirements. MISP data management staff coordinates information requests with Marine Facilities Division (MFD) field operations staff so necessary information is delivered to, or gathered from, a vessel's crew during compliance inspections

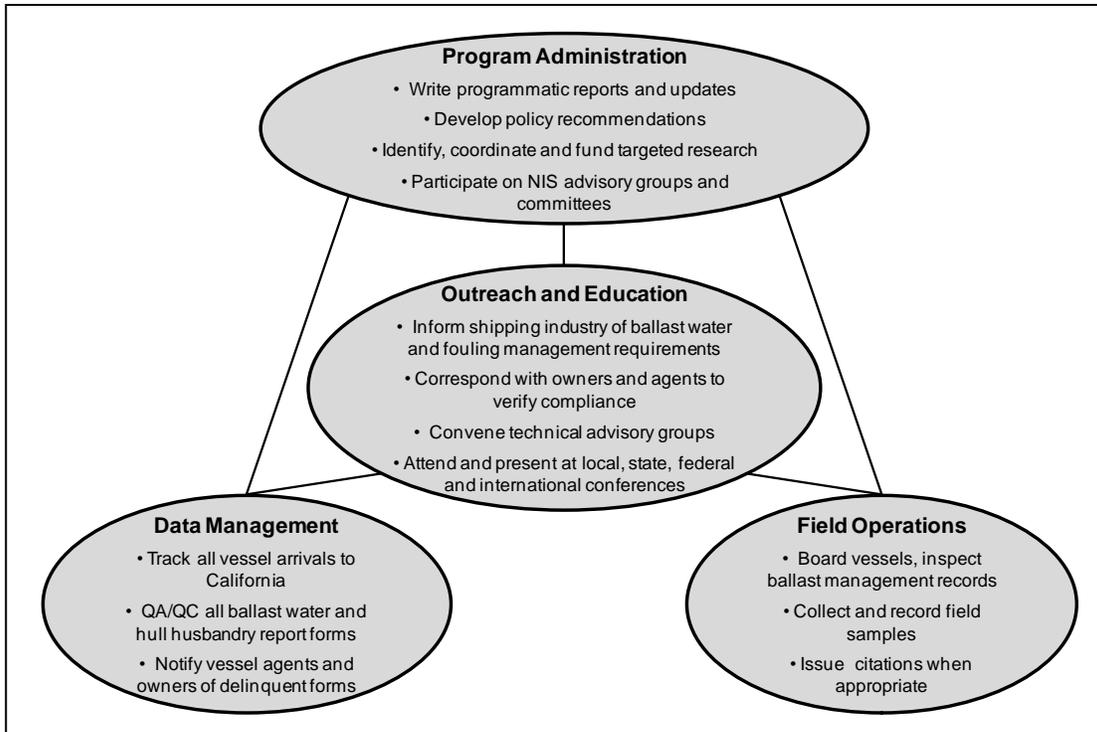


Figure III.1. The Commission’s Marine Invasive Species Program Components and Associated Functions

MISP Field Operations (Inspections) - MISP field operations are based out of two field offices, one located in northern California and the other in southern California. Currently, 20 Commission Marine Safety personnel (Inspectors), each with an average of 11 years of experience conducting ballast water inspections, are operating out of these field offices. Inspectors at these field offices implement an extensive vessel boarding, monitoring, and outreach program to ensure compliance with program requirements. Although the central role of Inspectors and inspections is to enforce requirements that vessels must obey in order to reduce the risk of introducing NIS in California waters, MISP Inspectors do much more. They are the primary conduit providing regulatory information to vessel personnel. Inspectors help crew understand their complicated and ever-changing legal obligations, how to properly complete and maintain paperwork, and the agencies to which paperwork must be submitted. Education and outreach is considered one of the key drivers for the high compliance rates observed within California (Scianni et al. 2013).

In addition to assessing compliance with the management requirements of the MISP, the inspection program plays a key role in MISP activities by providing vessel access for researchers collecting data that are used to improve the management of the NIS vector.

Assistance may involve escorting scientists onboard vessels to collect samples, or may involve Marine Safety personnel collecting the samples directly.

MISP Administration – The MISP administrative staff, comprised of 5 marine scientists with expertise in biological invasion science, works closely with data management and field operations staff in order to: assess vessel compliance; develop regulations; make policy recommendations for the Legislature; and coordinate research to prevent or reduce the spread of NIS from vessel vectors. The administrative staff regularly consults with a wide array of stakeholders in order to evaluate the current state of vessel NIS vector knowledge and to guide policy recommendations. The stakeholders include: scientists; state, federal, and international regulators; non-governmental organizations; and the maritime industry. The administrative component of the MISP directs and funds targeted and applied research that advances the development of region or state specific strategies for NIS prevention from the ballast water and vessel biofouling vectors. Administrative staff also represents the MISP at conferences, advisory panels, and committees related to invasive species science and management. Communication with other regulatory jurisdictions (state, federal, international) serves to increase efficiency, consistency, and effectiveness by sharing successes and failures amongst programs.

The Shared Role of Outreach - One of the key components in the success of the MISP continues to be the close communication, coordination, and outreach to the maritime industry, and other state, federal, and international agencies. Outreach is a role shared by all parts of the MISP, with each component of the program exchanging information with various external stakeholder groups. Program administration staff interacts primarily with science, policy, and decision making representatives to coordinate and develop improved management policies. Data management staff consults with shipping agents and owners on a daily to weekly basis over paperwork submission requirements and general questions about California rules. Field Inspectors are the primary conduit for information to ship officers and crew, educating them on state requirements and supplying outreach materials.

ii. California Department of Fish and Wildlife - Biological Monitoring

Pursuant to the Marine Invasive Species Act of 2003 and the Coastal Ecosystems Protection Act of 2006, the CDFW's portion of the MISP (CDFW-MISP) monitors the location and geographic ranges of native and nonindigenous species in the state's marine coastal and estuarine waters. A baseline species inventory began under mandate by AB 703. The purpose of subsequent ongoing monitoring is to detect new introductions and assess the effectiveness of vessel vector management requirements implemented under current laws and regulations. The CDFW-MISP also manages a

database, known as the California Aquatic Non-native Organism Database (CANOD) that was developed to record the baseline information about marine and estuarine NIS on the California Coast. Using CANOD, CDFW-MISP staff monitor new introductions and the patterns associated with those introductions. The database includes information about the likely vector(s) of introduction (e.g. ballast water, vessel biofouling), date of detection, locations observed, and native region of each species.

In addition to conducting biological surveys to monitor California's coastal and estuarine waters to identify and track NIS populations, the CDFW-MISP recently funded a two-year pilot program to detect NIS using a "next-generation" sequencing process. This program analyzes the DNA extracted from samples collected from artificial settling plates in a collaborative study with the Smithsonian Environmental Research Center (SERC) and Moss Landing Marine Laboratories that examines the vectors likely responsible for introductions of NIS to the state (CDFW-OSPR 2011).

iii. State Water Resources Control Board – Consultation

Pursuant to Section 71210 of the Ballast Water Management for Control of Nonindigenous Species Act of 1999, the Water Board prepared a report in consultation with the CDFW, the Commission, the USCG, the regulated industry, and other stakeholders. The report presented ballast water treatment alternatives available at the time, those under development, or those potentially available in the future for managing ballast water for the purpose of eliminating the discharge of NIS into waters of the state. The report was submitted to the State Legislature in December 2002 and its recommendations informed the development of the MISA (SWRCB-Cal EPA 2002). Since the passage of the MISA in 2003, the Water Board has taken on a consultative role with both the Commission's MISP and the CDFW-MISP on NIS management strategies and potential interactions and impacts with state water quality standards and objectives.

iv. Board of Equalization – Fee Collection

All aspects of California's MISP are funded through a per-voyage fee assessed on vessels and deposited into the state's Marine Invasive Species Control Fund. The fee amount is set in regulation, and therefore is adjustable to account for inflation and changes to vessel arrival statistics. The amount of the fee has been raised and reduced several times since implementation, each time in consultation with a stakeholder advisory group. Under PRC Section 71215, the BOE collects the fee from the owner or operator of each vessel that arrives at a California port or place from a port of place outside of California. The BOE also provides MISP administrative staff with quarterly Activity Reports, summarizing "Qualifying Fee" submission compliance numbers. These

quarterly reports along with the Fund Status reports that are generated internally assist MISP administrative staff in determining an appropriate fee amount.

IV. U.S. FEDERAL MANAGEMENT OF VESSEL VECTORS OF NONINDIGENOUS SPECIES

Ballast water discharges in the U.S. are under the jurisdiction of both the USCG and the EPA. This chapter highlights the focus, legislative background, and components of the programs of both of these federal departments.

A. United States Coast Guard

i. USCG – Regulatory Overview

In response to concerns regarding NIS in the Great Lakes in the mid-1980s, Congress enacted the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA). NANPCA targeted three key areas: preventing the introduction of new NIS; ensuring prompt detection and monitoring of existing NIS; and controlling established NIS in an environmentally sound manner. In addition to several other NIS related actions, NANPCA called for the development of ballast water management regulations for the Great Lakes. In 1996, the National Invasive Species Act (NISA) reauthorized NANPCA and, along with other NIS related actions, it expanded the USCG regulatory authority over ballast water to include ships entering all U.S. waters from outside the U.S. EEZ. This law also authorizes the USCG to negotiate ballast water management internationally at the International Maritime Organization (IMO).

Beginning in 1999, the USCG promoted voluntary ballast water management while requiring mandatory reporting of ballast water management and discharge activities from all ships arriving to U.S. ports from outside of the U.S. EEZ. Except for vessels entering the Great Lakes from outside the U.S. EEZ, the NISA did not authorize the USCG to require mandatory ballast water management until it had reported to Congress on the effectiveness of its program. In 2001, the USCG submitted a report to Congress (Ruiz et al. 2001), concluding that mandatory reporting alone was inadequate to determine whether the voluntary guidelines were sufficiently being implemented by vessels to reduce the risk of introducing NIS. In 2004, the USCG promulgated rules instituting penalties for non-reporting and making ballast water management mandatory for vessels arriving to U.S. ports after operating outside the U.S. EEZ (See Section VI).

In March 2012, the USCG published regulations establishing federal discharge requirements for ballast water management. These requirements include performance standards for allowable concentrations of living organisms in ships' ballast water discharged in U.S. waters, as well as other practices, such as the use of potable water from public water systems. This rule became effective on June 21, 2012. The USCG rule also establishes procedures for the USCG to approve ballast water treatment systems for use in U.S. waters.

ii. USCG – Program Components

The USCG is a military, multi-mission, maritime service within the Department of Homeland Security. Its core roles are to protect the public, the environment, and U.S. economic and security interests in any maritime region in which those interests may be at risk, including international waters and America's coasts, ports, and inland waterways. The USCG Headquarters, located in Washington, DC, is composed of several operational and support units implementing the core roles of the agency. The USCG is further organized into Districts covering a portion of the Nation's coastline. Within each District, large operational shore-side units known as Sectors are responsible for mission execution within their area of responsibility.

The USCG's ballast water management program is administered by the Headquarters Office of Environmental Standards (OES-3). There are seven full time personnel assigned to OES-3, four of whom work exclusively on ballast water program issues, with two additional personnel contributing significant time to the program. In addition, seven other personnel assigned to other offices within the USCG Headquarters spend significant time on the ballast water management program in different functions including; type approval of ballast water treatment systems, review of alternate management systems, compliance and enforcement, and legal issues. Additionally, the USCG Research and Development Center, outside of USCG Headquarters, provides six staff to assist on ballast water research projects and studies. The USCG, through a contract with the Smithsonian Institute, has 9 people working full time at the SERC to review and process ballast water reports to the National Ballast Information Clearinghouse from ships discharging into U.S. waters. The USCG also funds 2 full time and approximately 5 part-time scientists conducting research on topics related to ship-mediated invasions by aquatic invasive species. The USCG also has a contract with the Volpe National Transportation Systems Center where approximately 8 people provide expertise in the evaluation of the performance of ballast water treatment systems. Finally, every USCG Sector has personnel conducting extensive inspections or examinations, including inspection of ballast water management.

iii. USCG – Data Management

The NISA directed the USCG, in conjunction with SERC, to develop a National Ballast Information Clearinghouse (NBIC). The primary purpose of the NBIC is to collect, manage, and analyze nationwide data on vessel reported ballast water discharge and management. Since July 1999, the NBIC and the USCG have managed a nationwide program to evaluate ballast water management and discharge patterns of vessels that arrive to U.S. ports. The NBIC tracks and quantifies rates of reporting under mandatory ballast water reporting requirements, rates of compliant ballast water management

under the mandatory program (in place since 2004), and changes in the rate and patterns of ballast water discharge.

iv. USCG – Ballast Water Program Inspections

An assessment of ballast water management compliance has been incorporated into the existing USCG inspection and examination job description. This assessment is conducted during every annual USCG inspection of domestic vessels or Port State Control exams for foreign vessels. Port State Control (PSC) is the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules. PSC exams are used to identify and eliminate substandard foreign flagged vessels. By utilizing international protocols, PSC exams can prevent substandard ships from sailing until conditions meet minimum international standards. USCG Inspectors have real-time access to ballast water reporting form data via the NBIC; however it is unclear how often these data are accessed in advance of vessel inspections or PSC exams.

v. USCG - Shipboard Technology Evaluation Program

In an attempt to encourage vessel owners and operators to participate in evaluating NIS management technologies for shipboard application, the USCG developed and launched the Shipboard Technology Evaluation Program (STEP) in January 2004. This program reviews experimental plans and treatment technology installations aboard ships. Provided they perform largely as designed and show promise for reducing the risk of introductions, treatment technology installations will be granted an equivalency with regulations for ballast water management and the Ballast Water Discharge Standard. In order to be accepted, treatment technology developers must assess the efficacy of systems for removing biological organisms, the residual concentrations of treatment chemicals, and the water quality requirements of the discharged ballast water (USCG 2004). Vessels accepted into the program are authorized to operate the system to comply with existing USCG ballast water management requirements and will be grandfathered for operation under future ballast water discharge standards. For vessels accepted prior to promulgation of the Coast Guard's ballast water discharge standard, the grandfather period is the life of the vessel or the life of the treatment system, whichever is shorter. For vessels accepted after promulgation of the standard, the grandfather period is 10 years.

As of October 2013, five vessels are enrolled in the STEP (USCG 2013). The lengthy STEP review process and recent uncertainties regarding requirements for biological testing have delayed significant testing of treatment systems on STEP vessels. The USCG has, however, made efforts to streamline the review process for future

applicants. The USCG plans to continue the STEP even after the implementation of the Ballast Water Discharge Standard, as the STEP will serve to facilitate system shipboard testing for USCG approval, and will continue to promote vessel access for the research and development of promising experimental technologies.

vi. USCG – Type Approval and Alternative Management System

The USCG 2012 rule established procedures for the USCG to approve ballast water treatment systems for use in U.S. waters. The USCG Type Approval process includes requirements for land-based and shipboard evaluation of ballast water treatment system performance. The USCG rule also requires vessels to install ballast water sampling ports to facilitate compliance verification testing, although no specific compliance assessment procedures are established by the rule.

Because the USCG anticipates that it may take several years to approve treatment systems, the final rule includes an Alternative Management System (AMS) provision. AMS acceptance is not U.S. Type Approval, but rather a “bridging strategy” that temporarily accepts the use of foreign type approved ballast water management systems in U.S. waters. Acceptance of a ballast water treatment system as an AMS will allow vessels to use that system for up to five years after the applicable discharge standards implementation date while the USCG reviews the treatment system for U.S. Type Approval. As of October 2013, there are thirteen Alternative Management Systems accepted by the USCG.

B. United States Environmental Protection Agency

i. EPA – Regulatory Overview

In December 2008, as required in the results of a court decision (*Northwest Env'tl. Advocates v. United States EPA*, (N.D. Cal. Sept. 18, 2006, No. C 03-05760 SI) 2006 US Dist. LEXIS 69476), the EPA began regulating ballast water discharges under the Clean Water Act (CWA) through a National Pollutant Discharge Elimination System (NPDES) general permit. The Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (Vessel General Permit or VGP) regulates 26 vessel discharges, including ballast water and biofouling-related underwater ship husbandry discharges.

The 2008 VGP is a five-year general NPDES permit and will expire on December 18, 2013. In March 2013, the EPA released the final 2013 Vessel General Permit. The final 2013 VGP will become effective on December 19, 2013, and will require vessels to meet ballast water discharge performance standards equivalent to those established by the USCG. The 2013 VGP implementation schedule for ballast water discharge performance standards is similar to that established by the USCG (see Table VI.2 and

VI.4). The 2013 VGP will require vessel owners and or operators to report annual results from monitoring of select bacteria taxa (*Escherichia coli*, intestinal enterococci, and heterotrophic bacteria), sensors and control equipment, and residual biocides.

Finally, state agencies were given the opportunity to add state-specific provisions to the VGP under the authority of Section 401 of the CWA. Eight states, including California have added ballast water provisions above and beyond those proposed by EPA to the final 2013 VGP through their Section 401 certification of the permit.

ii. EPA – Program Components

The 2013 VGP is administered by the EPA Office of Water (OW). The OW ensures drinking water is safe, and restores and maintains oceans, watersheds, and their aquatic ecosystems to protect human health, support economic and recreational activities, and provide healthy habitat for fish, plants, and wildlife. The OW is responsible for implementing the Clean Water Act, as well as the Safe Drinking Water Act, and portions of the Coastal Zone Act Reauthorization Amendments of 1990, Resource Conservation and Recovery Act, Ocean Dumping Ban Act, Marine Protection, Research and Sanctuaries Act, Shore Protection Act, Marine Plastics Pollution Research and Control Act, London Dumping Convention, the International Convention for the Prevention of Pollution from Ships and several other statutes. Headquartered in Washington, DC the OW works with the ten EPA regional offices located throughout the country and the USCG to implement the 2013 VGP. It is important to note that there are no EPA inspectors affiliated with the EPA VGP.

iii. EPA – Data Management

The owner or operator of vessels subject to the VGP is required to submit a Notice of Intent (NOI) to receive permit coverage. The EPA has estimated that approximately 72,000 vessels would be covered under the VGP. The majority of these documents are expected to be submitted electronically. The EPA is currently developing a model that will allow macro-level analysis of these data (Albert, R., pers. comm. 2013).

iv. EPA – VGP Inspections

The EPA does not have inspectors to assess compliance with the VGP; rather the USCG will assist with verifying compliance of the VGP. In addition to ballast water management compliance verification assessments, VGP compliance inspections have been incorporated into the existing USCG inspection and examination duties.

v. EPA and USCG Collaborative Activities

The EPA and USCG have been working collaboratively on the development of the EPA VGP, the USCG performance standards, and on programs to evaluate ballast water

treatment system performance. For example, in 2001, the USCG and the EPA established a formal agreement to implement an Environmental Technology Verification (ETV) program focused on ballast water management. The ETV program is an effort to accelerate the development and marketing of environmental technologies such as ballast water management technology. In September 2010, the EPA released the “Generic Protocol for the Verification of Ballast Water Treatment Technology” (see EPA 2010). The protocol established specific methods and procedures for verifying shipboard ballast water treatment system performance at land-based testing facilities. In 2012, the USCG incorporated the ETV protocol into its regulations as part of the testing process to approve ballast water treatment technologies. The EPA and USCG are currently pursuing the development of an ETV shipboard protocol to verify treatment system performance for type approval purposes. Commission staff has participated on the advisory team for the development of both the land-based and shipboard protocols.

In February 2011 the USCG and the EPA completed a Memorandum of Understanding (MOU). This MOU establishes that these two agencies will cooperate and coordinate on implementation and enforcement of the VGP requirements. The MOU will likely be updated in accordance with the 2013 VGP in the near future and will remain in effect unless terminated by one of the two parties.

V. CALIFORNIA-FEDERAL COMPARISON: GENERAL

The increased risk of species introductions from the vessel vector has resulted in the development of vector management programs at both the state and federal level. While the goal of the federal and State of California programs are to minimize the risk of new NIS introductions from vessels, several key differences exist.

A. Applicability

Some of the central differences between the California MISP and the federal programs for managing NIS discharges from vessels stem from the general applicability of the state and federal laws and exemptions for certain types of vessels or vessels engaged in particular practices. California’s MISA applies to all vessels 300 gross registered tons or more that carry or are capable of carrying ballast water (See Table V.1). There is no explicit distinction between commercial and recreational vessels, although in practice the MISA applies almost exclusively to commercial vessels because most private vessels are not large enough (over 300 gross registered tons) to be subject to the law.

Table V.1

CALIFORNIA	FEDERAL
General Requirements – Part 1	
Applicability	
Applies to vessels ≥ 300 GRT that carry or are capable of carrying ballast water [PRC 71201(a)]	<i>USCG</i> – Applies to non-recreational vessels that carry or are capable of carrying ballast water [33 CFR 151.2010] <i>EPA</i> – Applies to vessels ≥79 feet in length [U.S. EPA, 2013 VGP, Part 1.2.]

At the federal level, the USCG regulations apply to non-recreational vessels that carry or are capable of carrying ballast water. The EPA 2013 Vessel General Permit, applies to discharges incidental to the normal operation of non-recreational vessels greater than 79 feet in length.

Both the California MISA and the federal regulations provide exemptions for specific vessel classes or vessels engaged in particular activities (See Table V.2). For example, California’s MISA and the USCG regulations do not apply to vessels of the armed forces, as defined by the United States Code, and vessels in innocent passage through California waters (i.e. not arriving to a California port or place). But the USCG regulations exempt many more vessels from management requirements, including

vessels operating within one Captain of the Port (COTP) zone, unmanned-unpowered barges, and U.S flagged and U.S. crewed tank vessels that carry crude oil domestically.

Table V.2

CALIFORNIA	FEDERAL
General Requirements	
Exemptions	
<ul style="list-style-type: none"> • Vessels of the armed forces, as defined in paragraph (14) of subsection (a) of Section 1322 of Title 33 of the United States Code [PRC 71202] • Vessels in Innocent Passage [PRC 71202] • Vessels claiming Ballast Water Safety Exemption (until performance standards are implemented) [PRC 71203] 	<p><i>USCG -</i></p> <ul style="list-style-type: none"> • Vessels of the Armed Forces, as defined in the Federal Water Pollution Control Act (33 U.S.C. 1322(a)) [33 CFR 151.2015(a)] • Vessels in Innocent Passage [33 CFR 151.2020] • Vessels operating in the same Capitan of the Port Zone (COTP) [33 CFR 151.2015(b)(2)] • Vessels claiming Ballast Water Safety Exemption (until performance standards are implemented) [33 CFR 151.2040] • Crude Oil Tankers engaged in coastwise trade [33 CFR 151.2015(b)(1)] • Vessels claiming exemption due to delay or deviation (until performance standards are implemented) [33 CFR 151.2055] <p><i>EPA -</i></p> <ul style="list-style-type: none"> • Vessels of the Armed Forces as defined in section 312(a)(14) of the CWA [U.S. EPA, 2013 VGP, Part 1.2] • Vessels in Innocent Passage [U.S. EPA, 2013 VGP, Part 1.15] • Vessels claiming Ballast Water Safety Exemption (until performance standards are implemented) [U.S. EPA, 2013 VGP, Part 2.2.3.6.6] • Vessels operating in the same Capitan of the Port Zone [U.S. EPA, 2013 VGP, Part 2.2.3.5.3]

The EPA VGP exemptions are similar to those of the USCG; however, the EPA does not exempt U.S. flagged crude oil tankers from compliance with the VGP. In addition, the EPA specifically exempts certain classes of vessels from compliance with the ballast water performance standards including vessels engaged in short-distance voyages, unmanned-unpowered barges, vessels that operate exclusively on the Laurentian Great

Lakes and were built before January 1, 2009, and inland and seagoing vessels less than 1600 GRT.

In the absence of California’s Marine Invasive Species Act, the additional exemptions allowed under the federal programs would result in greater amounts of unmanaged ballast water being discharged into California waters. California’s lawmakers recognized the potential risks associated with these specific vessel types and determined there was no biological reason to exempt them from California’s MISA (Falkner 2003).

B. Funding Sources

All aspects of California’s Marine Invasive Species Program are funded through a per-voyage fee assessed on vessels and deposited into the state’s Marine Invasive Species Control Fund. The current fee amount of \$850 for the first California arrival of a voyage has remained steady since it was adjusted in November 2009 and is currently sufficient to cover all aspects of California’s MISP (See Table V.3).

Table V.3

CALIFORNIA		FEDERAL
Program Funding		
A fee of \$850 is assessed on vessel’s first port call in California per voyage. Fees are collected by BOE and deposited into Marine Invasive Species Control Fund. [2CCR2271(a)]		USCG - H.R. 2838, The Coast Guard and Maritime Transportation Act, 2012 EPA - Appropriations by US Congress
Budget (CY 2012-13)		
<u>Agency</u>	<u>Budget</u>	USCG Budget – Not Available* EPA Budget – Not Available* *Information was requested but not provided
Commission	\$2,820,000	
Board of Equalization	\$453,000	
CA Dept. of Fish & Wildlife	\$1,347,000	
CA State Water Board	\$98,000	
State Controller’s Office	\$10,000	
Financial System for CA	\$26,000	
All Programs funded through the Marine Invasive Species Control Fund.		

The USCGs ballast water management program and EPAs VGP are both funded through federal appropriations and are relatively small components of much larger federal agency budgets. Neither program has line-item funding specific to ballast water

management. Both federal programs have been subject to the current “sequestration” action and are subject to sequester cuts in excess of 8% for fiscal year 2013 (OMB 2012). Additionally, during the preparation of this report, both programs, as well as a portion of the federal government had been shut down due to the expiration of the most current federal budget. No vessel inspections have occurred during the government shut down. The uncertainty of consistent funding at the federal level further highlights the importance of California’s MISP. The secure funding mechanism associated with California’s MISP has resulted in a stable, consistent, and dedicated multi-agency statewide program.

C. Biological Surveys

Per California PRC Section 71211, the CDFW has been monitoring California coastal waters for new or expanded ranges of NIS, in part to assess the effectiveness of the MISP in reducing NIS introductions from vessel vectors. Neither the USCG nor EPA are mandated to conduct biological surveys aimed at identifying NIS transported in ballast or through vessel biofouling (See Table V.4).

The most recent CDFW-supported field survey of San Francisco Bay conducted during 2010, as part of the MISPs long-term monitoring effort in ports, harbors, estuaries, and the outer coast, identified 497 species. Ninety-eight (20% of all species identified) were classified as introduced, 92 were classified as cryptogenic (unknown whether native or introduced), and 307 were classified as native to California. The survey also revealed three NIS that are new records for San Francisco Bay and were likely spread from other locations in California (CDFW-OSPR 2011). Results of the CDFW’s long-term monitoring efforts indicate that California, especially San Francisco Bay, plays a critical role in marine invasion dynamics for western North America, providing an entry point from which many species spread. This type of information provides critical feedback and informs MISP policy decisions to reduce the risk of species introductions in California and other regional states.

Table V.4

CALIFORNIA	FEDERAL
Biological Surveys	
California Department of Fish and Wildlife performs biological surveys of “the coastal and estuarine waters of the state that includes open coastal waters and bays and estuaries.” [PRC 71211]	USCG – No surveys are conducted EPA – No surveys are conducted

D. Inspections, Enforcement and Outreach

Per PRC Section 71206, the Commission is required to take samples and assess compliance with ballast water and biofouling management and reporting requirements for a minimum of 25% of qualifying voyages arriving to California. Upon boarding a vessel, Inspectors interview crew and review paperwork, including but not limited to Ballast Water Reporting Forms, ballast water management plans, ballast water and engine logbooks, and Hull Husbandry Reporting Forms. Inspectors may also take samples of ballast water to assess compliance with management requirements.

Though the central role of inspectors/inspections is to enforce laws that vessels must obey in order to reduce the release of NIS in California waters, inspectors for the MISP do much more. Inspectors are the primary conduit for regulatory information to vessel crew, helping them understand their complicated and ever-changing legal obligations, how to properly complete and maintain paperwork, and who to submit paperwork to. Commission inspectors have an average of 11 years of experience in assessing ballast water and biofouling management and reporting compliance. In contrast, uniformed USCG inspectors are rotated to new billets every 1-3 years. As a result of this rotation schedule, it is rare that the same USCG inspector conducts two consecutive inspections of the same vessel or that the inspector who conducted the first inspection is even in the same geographical location when the next inspection is conducted (Goodwin and McClave 1994).

Education and outreach is considered one of the key components for the high compliance rates observed with the MISP. MISP inspectors board the vessel for the sole purpose of assessing compliance with California's Marine Invasive Species Act and associated regulations, and therefore can take as much time as needed to be certain the vessel's crew understands the State's requirements.

Since vessel outreach and ensuring compliance are central to the program, the MISP utilizes a tiered approach to selecting vessels that will be boarded by the inspectors. A vessel will be more likely to be boarded and inspected if any of the following are true (in order of importance):

- It is the vessel's first arrival to a California port or place;
- The vessel has a previous violation;
- The vessel has not been boarded during the previous 24 months; or
- The vessel has been previously flagged in the MISP Ballast Water Database.

Inspecting and providing outreach to vessels reduces the number of repeat violations occurring within California's regulated fleet. From the last half of 2006 through the first

half of 2012, a total of 564 unique vessels were assessed violations (both operational and administrative) in California. Of those 564 vessels, 407 (72.1%) returned to a California port or place at least once after receiving the violation. Only 48 (11.8%) of those returning vessels were assessed a repeat violation (Scianni et al. 2013). The MISIP is currently reviewing and revising protocols and enforcement procedures in an effort to provide targeted outreach to increase compliance beyond current levels.

While Commission inspections are focused on assessing ballast water and biofouling management and reporting compliance, the USCG’s assessment of ballast water management compliance has been incorporated into their scheduled inspections of domestic vessels or Port State Control exams of foreign flagged vessels (See Table V.5).

Table V.5

CALIFORNIA	FEDERAL
Inspections/ Enforcement	
<p>≥ 25 % of qualifying voyages annually. MISIP inspections are focused exclusively on Ballast Water and Biofouling Management</p>	<p><i>USCG</i> – The inspections are incorporated into existing USCG surveys for domestic vessels and port state control exams for foreign vessels. <i>EPA</i> – No inspections Both entities (USCG and EPA) base their enforcement on the data collected by the USCG, as agreed by the USCG and EPA MOU of 2008.</p>
Triggers for inspection	
<ul style="list-style-type: none"> • First time arrivals • Previous violations • Vessel that have not been boarded in the last two years • Vessels that have been flagged for inspection for inconsistent reporting or management 	<p><i>USCG</i> – Receiving a non-compliant ballast water reporting form [C. Fluke, pers. comm. 2013] <i>EPA</i> – N/A, as no inspections are conducted</p>

The only time a vessel would be inspected by the USCG solely for ballast water management compliance would be if the USCG received a report of non-compliance from either an internal USCG source or external organization (e.g. EPA, NBIC) (C. Fluke, pers. comm. 2013). In addition to checking ballast water records, scheduled

domestic vessel inspections include (not an exhaustive list) evaluations of the function and compliance of all engineering systems, equipment and materials, hull examinations, pollution prevention systems, marine facilities and structures, offshore activities and proper carriage of hazardous materials. Foreign flagged vessels receive annual PSC examinations to ensure the vessel is complying with all applicable international conventions as well as the laws and regulations of the U.S. In addition to the components of a domestic vessel examination, a PSC exam also includes an examination of the vessel's certificates, licenses and documents, and the entire vessel. The entire vessel examination includes the inspection and testing of specific equipment, and conducting of operational testing and emergency drills with the vessel's crew. Given the amount of information the USCG inspector is responsible for, he/she will generally only spend 10-15 minutes out of a multiple hour vessel visit reviewing the vessel's Ballast Water Management Plan (C. Curtian, pers. comm. 2013).

In addition to their regular inspections, the USCG, through a Memorandum of Understanding with the EPA, is also responsible for assessing a vessel's compliance with the VGP. During a USCG inspection or exam, any discrepancies identified associated with the 2013 VGP will be transmitted to EPA Headquarters. Any subsequent enforcement action is determined by the appropriate EPA Regional Office (R. Albert, pers. comm. 2013).

From 2008-2011, Commission Inspectors examined an average of 21% of qualifying vessel arrivals to California (Takata et al. 2011), whereas the USCG inspected 8% of qualifying vessel arrivals to California (Minton and Miller 2013). This difference highlights the important role that Commission Inspector's play in maintaining compliance with California's laws.

In addition to the Commission's Inspectors, the MISP has dedicated staff that perform quarterly ballast water management compliance assessment analyses for every ballast tank on every vessel visiting a California port or place. Utilizing Geographic Information Systems (GIS) software, MISP staff can accurately determine which vessels improperly conducted exchange (e.g. exchange at shorter distance from shore than what is required by law) using the data supplied by the vessel on their Ballast Water Reporting Form. If vessels are found to be out of compliance with ballast management laws, violation letters are sent to the appropriate shipping agent and vessel owner. The vessel will be flagged for a follow up visit for inspection and outreach upon its next arrival to California. While the USCG has access to similar capabilities with the NBIC database, analyses pertaining to compliance and enforcement are not routinely carried out by USCG Inspectors. The regular compliance assessment analyses conducted by

Commission staff enables better follow-up and outreach, which improves compliance and therefore reduces the risk of NIS introductions.

E. Penalties

There are penalties associated with both the state and federal programs for vessels that fail to comply with the ballast water and biofouling reporting and management rules (See Table V.6). In California, a person who intentionally or negligently fails to comply with the Commission’s reporting or management requirements may face an administrative civil penalty of up to \$27,500 per violation, with each day of a continuing violation constituting a separate violation (PRC section 71216). A person who knowingly or intentionally falsifies or attempts to deceive the reporting requirements may be found guilty of a misdemeanor (PRC section 71217).

Table V.6

CALIFORNIA	FEDERAL
Civil and Criminal Penalties and Liability	
<ul style="list-style-type: none"> Up to \$27,500 per violation per day [PRC 71216] If a person knowingly violates the regulations – Misdemeanor [PRC 71217] 	<p><i>USCG</i> – Up to \$35,000 per violation per day [33 CFR 151.2080 (a)]</p> <ul style="list-style-type: none"> If a person knowingly violated the regulations – Class C Felony [33 CFR 151.2080 (b)] <p><i>EPA</i> – Up to \$20,000 per violation per day or imprisonment of up to 4 years, or both [U. S. EPA, 2013 VGP, Part 1.4]</p>

The penalty for failing to comply with USCG reporting and management requirements may result in a fine of up to \$35,000 per violation per day (33 CFR 151.2080(a)), with intentional or knowingly falsifying documents resulting in a possible class C felony charge (33 CFR 151.2080 (b)).

The EPA VGP has similar penalties. As stated Section 1.4 of the 2013 VGP, “any person who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under the CWA shall, upon conviction, be punished by a fine of not more than \$10,000, or by imprisonment for not more than 2 years, or both.” Additional convictions may result in fines of not more than \$20,000 per day of violation, or by imprisonment of not more than 4 years.

Due to continued and expanded intensive outreach by Commission staff, a monthly electronic notification system, daily interactions with the maritime industry, and the

potential for civil and criminal penalty action, compliance with all aspects of California's law continues to exceed 93% (Scianni et al 2013).

VI. CALIFORNIA-FEDERAL COMPARISON: BALLAST WATER

A. Ballast Water Management and Compliance

In order to manage ballast water discharges, both the California MISIP and the U.S. federal programs offer multiple management strategies to vessel operators to enable compliance with applicable laws (See Table VI.1).

Table VI.1

CALIFORNIA	FEDERAL
Ballast Water Management Requirements	
Options for Complying with Ballast Water Management Requirements	
MISIP – [PRC 71204.2] <ul style="list-style-type: none"> • BW Exchange (until Performance Standards) • BW Retention • BW Management Systems (after Performance Standards are implemented) [2CCR2293] • Approved Shoreside Facility • Alternative, environmentally sound method of BW management that is approved by Commission/ USCG • Alternative Exchange Location (until Performance Standards) • Discharge in Same Location (within one nautical mile) 	USCG – [33 CFR 151.2025] <ul style="list-style-type: none"> • BW Exchange (until Performance Standards) • BW Retention • BW Management Systems (USCG Approved) • Shoreside Facility (EPA Approved) • Potable Water from U.S. EPA – [U. S. EPA, 2013 VGP, Part 2.2.3.5.1] <ul style="list-style-type: none"> • BW Exchange (until Performance Standards) • BW Retention • BW Management Systems • Shoreside Facility (EPA approved) • Potable Water from U.S. and CAN
Mid-Ocean BW Exchange (until Performance Standards are Implemented)	
≥ 200 nm from land and ≥ 2000 meters depth	USCG – ≥ 200 nm from land, no depth requirement EPA – ≥ 200 nm from land, no depth requirement
Coastal Ballast Water Exchange “for vessels arriving from a Pacific Coast Region (PCR) port and carrying ballast water from the PCR” (until Performance Standards are Implemented)	
≥ 50 nm from land and ≥ 200 meters depth	USCG – No requirements for ballast water management for vessels engaged in coastal voyages EPA – ≥ 50 nm from land and ≥ 200 meters depth for Pacific nearshore voyages. No requirements for ballast water management for vessels engaged in coastal voyages

The management strategy that a vessel operator chooses to employ will depend on vessel design and layout, cargo operations, route and previous ports of call, and safety concerns. Both state and federal programs permit retention of all ballast water on board the vessel. This strategy is the most protective of state and federal waters, as it eliminates the risk of species introductions from ballast water discharge (although not from vessel biofouling, see Section VII for further information). Also, both California and federal rules permit discharge of ballast water to approved shoreside facilities, although currently there are no approved facilities available anywhere in the U.S. Ballast water exchange has been required for vessels that must discharge ballast water into state or federal water by both authorities since 2000 and 2004, respectively. For a discussion of the processes involved in ballast water exchange, see Scianni et al. (2013).

i. Arrivals from inside the Pacific Coast Region

State and federal ballast water exchange requirements differ for vessels operating coastally. In California, the Commission adopted regulations for vessels transiting within the Pacific Coast Region (PCR), defined as coastal waters of the Pacific Coast of North America east of 154 degrees West longitude and north of 25 degrees North latitude, exclusive of the Gulf of California (Figure VI.1). Vessels arriving to a California port or place after departing a port or place within the PCR, and carrying ballast water sourced within the PCR, are permitted to exchange ballast water at least 50 nm from land and in waters at least 200 meters (m) deep. Conversely, the USCG does not require management of ballast water for vessels that operate wholly within the U.S. EEZ, even when transiting from ports within disparate biogeographic regions (e.g. from southern California to Puget Sound). Furthermore, if vessels remain within 200 nm of any coast along the western United States and Canada (such as when transiting from Vancouver, British Columbia to California), the vessel operators do not need to manage their ballast water prior to discharge.

The EPA, through their VGP program, has adopted existing Pacific coast state requirements and requires ballast water management for “Pacific nearshore voyages,” defined as vessels that carry and take on ballast in areas less than 50 nm from shore. This coastal management requirement does not apply to vessels operating exclusively within one USCG COTP zone (see Figure VI.2). Based solely on federal requirements, a vessel departing the San Francisco Bay and carrying ballast water sourced from the San Francisco Bay would be permitted to discharge their unmanaged ballast water into other California ports, such as Humboldt Bay, which has significantly fewer nonindigenous species than San Francisco Bay (Boyd et al., 2002) and therefore is at risk for NIS moving from the San Francisco Bay. Without the MISF requirements, California would be at much greater risk of species introduction and spread if the state was reliant solely on federal management requirements.

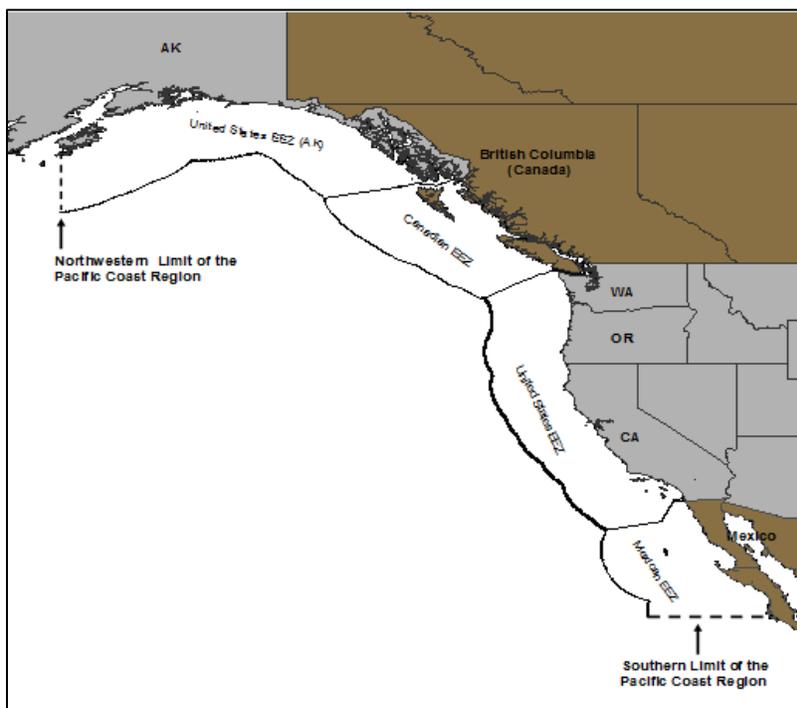


Figure VI.1. Exclusive Economic Zones (EEZ) of Pacific North America (200 nm), and the Pacific Coast Region (PCR). The PCR extends from approximately Cook Inlet, Alaska (154° west longitude) to ¾ down the Baja California Peninsula in Mexico (25° north latitude) and 200 nm offshore.

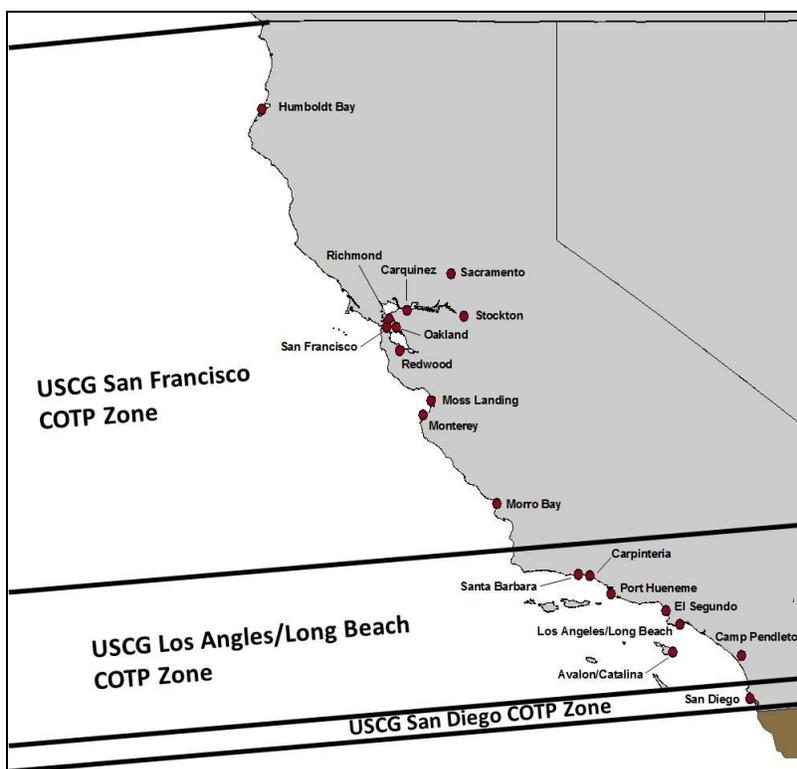


Figure VI.2 – USCG Recognized Captain of the Port Zones (COTP)

ii. Arrivals from outside the Pacific Coast Region

State and federal ballast water exchange requirements differ slightly for vessels arriving to California from outside the PCR (See Table VI.2). California rules require ballast water exchange (BWE) to be conducted at least 200 nm from land in water at least 2,000 m deep prior to discharge. The USCG regulations require BWE to be conducted at least 200 nm from land for vessels arriving from outside of the U.S. EEZ, but do not include a depth requirement.

iii. Ballast Water Exchange Exemptions

Mid-ocean ballast water exchange may not be feasible under abnormal operating situations. Under California law, ballast water management is not required if it is determined that the procedure would threaten the safety of the vessel, its crew, or its passengers. The California exemptions may occur due to adverse weather conditions, vessel design limitations, equipment failure, or other extraordinary circumstances (PRC section 71203). In these cases, a safety exemption is granted and unexchanged ballast water may be discharged without violation. If the vessel's master determines that the safety exemption is necessary and warranted, all feasible measures that do not compromise the safety of the vessel must be taken to minimize the discharge of untreated ballast water, such as discharging the minimum amount of water possible or retaining all water on board. Federal regulations have similar safety exemptions.

According to USCG rules, vessels that would experience undue delay or deviation as a result of BWE are also exempted from the exchange requirement, and instead are asked to discharge the minimum amount possible. The number of vessels claiming the USCGs deviation and delay exemption (and therefore discharging unexchanged ballast into states' waters) is dramatically decreased in California when compared to the rest of the U.S. ports (Figure VI.3). Because this USCG exemption is not based on NIS introduction risk-reduction, California's MISP, by not providing a similar exemption, is filling a large NIS management gap that is present in the federal law.

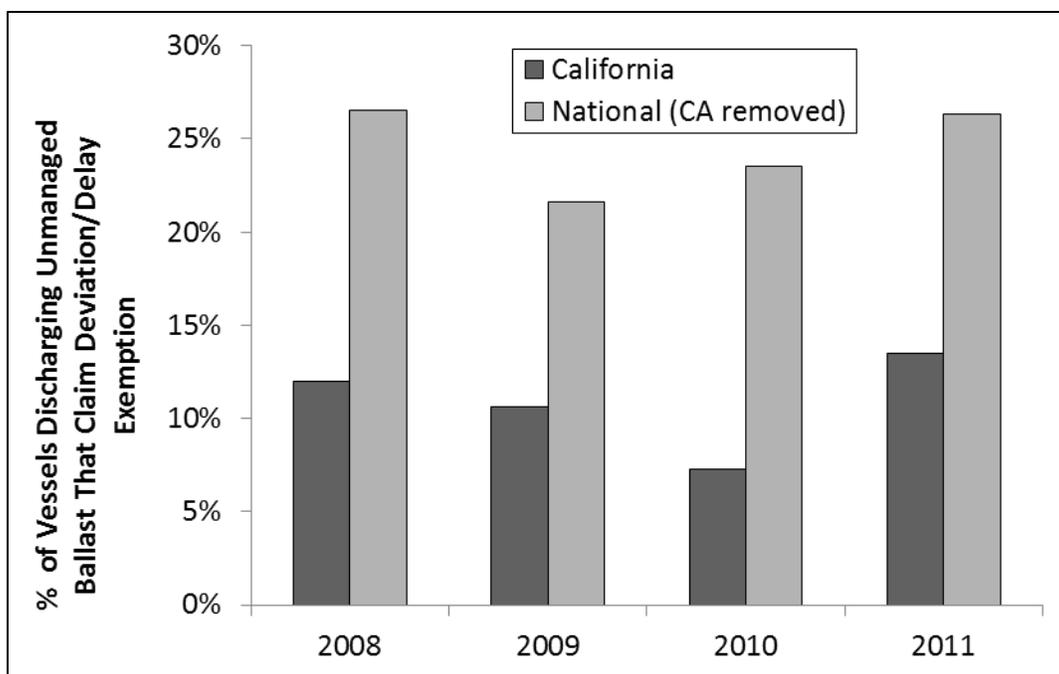


Fig VI.3 Percent of vessels discharging unmanaged ballast water that claim deviation or delay exemption in California and nationally (with CA removed). Note: these are federal data provided by National Ballast Information Clearinghouse.

B. Ballast Water Discharge Performance Standards

Given the limitations of ballast water exchange, California and the federal government have been working over multiple years to develop and implement performance standards for ballast water discharge. The state and federal performance standards differ in the actual concentrations of living organism permitted at discharge, the specific organism size classes regulated, and the implementation schedule (see Tables VI.2, VI.3, and VI.4).

In order to comply with the discharge standards, both at the state and federal levels, vessels operators will need to manage or treat their ballast water. Vessels may continue to retain all ballast on board, as this is the most protective management strategy. Once available, vessels may also discharge ballast water to an approved shore-based reception facility. The Commission is currently funding a study to investigate the feasibility of shore-based ballast water treatment at California ports. The federal government has approved the use of potable water from the U.S. or Canada as ballast that could be discharged in compliance with the federal performance standards. California law does not specifically approve the use of potable water, but vessels may apply to use potable water from the U.S. or Canada as an alternative, environmentally sound method of ballast water management (see Table VI.5).

Table VI.2 Ballast Water Treatment Performance Standards

Organism Size Class	U.S. Federal ^[1]	California ^[2]
Organisms greater than 50 µm^[3] in minimum dimension	< 10 viable organisms per cubic meter	No detectable living organisms
Organisms 10 – 50 µm in minimum dimension	< 10 viable organisms per ml ^[4]	< 0.01 living organisms per ml
Living organisms less than 10 µm in minimum dimension		< 10 ³ bacteria/100 ml < 10 ⁴ viruses/100 ml
<i>Escherichia coli</i>	< 250 cfu ^[5] /100 ml	< 126 cfu/100 ml
Intestinal enterococci	< 100 cfu/100 ml	< 33 cfu/100 ml
Toxicogenic <i>Vibrio cholerae</i> (O1 & O139)	< 1 cfu/100 ml or < 1 cfu/gram wet weight zooplankton samples	< 1 cfu/100 ml or < 1 cfu/gram wet weight zoological samples

[1] See Table VI-2 below for dates by which vessels must meet U.S. Ballast Water Performance Standards.

[2] See Table VI-3 below for dates by which must meet CA Ballast Water Performance Standards

[3] Micrometer – one-millionth of a meter

[4] Milliliter – one-thousandth of a liter

[5] Colony-forming unit – a measure of viable bacterial numbers

Table VI. 3 Implementation Schedule for California Performance Standards

Ballast Water Capacity of Vessel	Standards apply to new vessels in this size class constructed on or after	Standards apply to all other vessels in this size class beginning in ^[1]
< 1500 metric tons	2016	2018
1500 – 5000 metric tons	2016	2016
> 5000 metric tons	2016	2018

^[1]In California, the standards apply to vessels in this size class as of January 1 of the year of compliance.

Table VI.4 Implementation schedule for U.S. Federal ballast water performance standards.

Implementation Schedule for Approved Ballast Water Management Methods			
Vessel ballast water capacity (m ³) ^[1]		Vessel construction date	Vessel compliance deadline
New vessels	All	On or after Dec. 1, 2013	On Delivery
Existing vessels	Less than 1,500	Before Dec. 1, 2013	First scheduled dry docking after Jan. 1, 2016
	1,500 - 5,000	Before Dec. 1, 2013	First scheduled dry docking after Jan. 1, 2014
	Greater than 5,000	Before Dec. 1, 2013	First scheduled dry docking after Jan. 1, 2016

^[1] Cubic meter = 1,000 liters

Both the federal government and the state of California permit the use of shipboard ballast water treatment systems to meet the discharge standards, however the USCG requires that systems be Type Approved by the USCG before they are installed on board vessels. California does not require advanced system approval, nor does the EPA under the 2013 VGP. As of the writing of this report, no shipboard treatment systems have yet received USCG Type Approval. Until systems become approved, the USCG is accepting the use of AMS that have received type approval from foreign governments and have been deemed acceptable by the USCG for ballast water management. California allows the use of USCG-accepted AMS in state waters to comply with ballast water exchange requirements; however any vessels subject to California's performance standards will need to comply regardless of whether the treatment system is a USCG-accepted AMS or a USCG-Type Approved system. As of October 11, 2013 the USCG has accepted 13 treatment systems under the AMS designation (USCG 2013).

Both California and the federal government require ballast water discharges to comply with the applicable performance standards. The Commission is required by statute to inspect at least 25% of arriving vessels to ensure compliance with the California standards, and the MISP is in the process of developing protocols to assess compliance. USCG plans to inspect vessels for compliance as well, although no compliance assessment protocols have yet been made public. The EPA 2013 VGP requires vessels to report discharge monitoring of *E. coli*, enterococci, and total heterotrophic bacteria (see EPA 2013 VGP Part 2.2.3.5.1.1.4) as indicators of meeting the discharge standards in the 2013 VGP.

Although not yet implemented, California's ballast water discharge performance standards are stronger than those scheduled to be implemented at the federal level, and will result in reduced risk of NIS introduction to California's waters. The development of compliance assessment protocols in California but not at the federal level implies that the Commission's ability to detect compliance while providing outreach to at least 25% of the arriving vessels will result in better active monitoring of compliance and risk reduction as well as a better understanding of treatment system performance on the fleet of vessels arriving to California ports.

Comparison Table VI.5

CALIFORNIA	FEDERAL
Ballast Water Management Requirements – Part 1	
Ballast Water Performance Standards	
BW Performance Standards are established - See Tables VI.2 and VI.3 [PRC 71205.3(a) and 2CCR2293]	<i>USCG</i> – Performance Standards are established - See Tables VI.2 and VI.4 [33 CFR 151.2030] <i>EPA</i> – Performance Standards are established – See Tables VI.2 and VI.4 [U.S. EPA, 2013 VGP, Part 2.2.3.5]
Ballast Water Treatment Technology Reporting	
Reporting is required: <ul style="list-style-type: none"> • Ballast Water Treatment Technology Annual Reporting Form [PRC 71205 (g)] • Ballast Water Treatment Supplemental Reporting Form [PRC 71205 (g)] 	<i>USCG</i> – Does not require reporting on Ballast Water Treatment Technology <i>EPA</i> – Requires reporting as part of the annual reporting [U.S. EPA, 2013 VGP, Part 2.2.]
Alternative Management System (AMS) Approval	
MISP accepts alternative management systems that have been approved by the USCG [PRC 71204.3(d)]	<i>USCG</i> – A manufacturer whose ballast water management system (BWMS) has been approved by a foreign administration pursuant to the standards set forth in the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, may request in writing, for the Coast Guard to make a determination that their BWMS is an alternate management system [33 CFR 151.2026] <i>EPA</i> – Accepts systems that have received “Alternative Management System” designation by the U.S. Coast Guard under 33 CFR 151.2026 [U.S. EPA, 2013 VGP, Part 2.2.3.5.1.1]
Ballast Treatment Technology Assessment and Legislative Report	
Required 18 months in advance of each implementation date [CSLC 2013, Dobroski et al. 2011, CSLC 2010, Dobroski et al. 2009(a), Dobroski et al. 2009(b), Dobroski et al. 2007] See table III.2	<i>USCG</i> – Will complete practicability review no later than January 1, 2016. [33 CFR 151.2030] <i>EPA</i> – None

C. Ballast Water Reporting Requirements

To gather information about vessel movements and ballast water management practices, both California and the federal government require vessels to submit a Ballast Water Reporting Form for each port call. The California Legislature adopted the USCG “Ballast Water Reporting Form” (BWRF) (OMB Control Number 1625-0069) to maintain uniformity between state and federal reporting forms. However, the timing of when reports are due differs between the two jurisdictions. The USCG requires ballast water reporting forms to be submitted at least 24 hours in advance of arrival to a U.S. COTP zone, while the MISA requires that vessels submit the BWRF upon departure from every California port or place (see Table VI.6). Despite these differences, the levels of reporting compliance remain similar, with both the USCG and the Commission reporting annual submission rates greater than 95%. Additionally, although each vessel must provide an annual report detailing certain management practices as part of the VGP, the EPA currently has no specific per-voyage reporting requirement.

There are advantages and disadvantages to the strategies of requiring submission either before arrival or after departure. Advanced reporting should enable the USCG to review forms to assess the risk of NIS introduction before a vessel discharges ballast water at U.S. ports, although this is contingent upon the USCG having sufficient staff to devote to this process. Because the MISP receives BWRFs upon vessel departure, it is likely that the reporting forms submitted to the MISP more accurately reflect a vessel’s actual ballasting operations, which may change once a vessel arrives. Therefore, the MISP database likely contains more accurate documentation of discharge volumes and other ballasting activities. However, unlike the USCG, the MISP will not be able to review forms and assess the risk of NIS introduction prior to a vessel’s discharge of ballast water.

Requiring a separate BWRF from each port of call (Figure VI.4), rather than each COTP zone, allows MISP staff to more precisely track the movement of vessels and their management of ballast water while in California. Vessels moving to different ports within the same COTP zone are not required to submit additional BWRFs to the USCG, so any ballasting activity within those areas is unreported. To increase compliance with the reporting requirements, MISP staff developed a system that provides monthly notices to vessel owners and ship agents regarding missing forms. Neither of the federal programs have systems in place to track and subsequently collect missing forms from vessel owners or ship agents.

Table VI.6

CALIFORNIA	FEDERAL
Ballast Water Management Requirements – Part 2	
Ballast Water Management Reporting	
<p>Vessels are required to submit USCG Ballast Water Reporting Form upon departure from each port call in State waters [PRC 71205]</p>	<p><i>USCG</i> – Vessels are required to submit USCG Ballast Water Reporting Form 24 hours in advance of arrival to each COTP Zone [33 CFR 151.2060(b)(3)] <i>EPA</i> – None. However Annual VGP Report including all analytical monitoring results is required [U. S. EPA, 2013 VGP, Part 4.4.]</p>
Ballast Water Management Plan	
<p>Plan should be prepared specifically for the vessel and be made available for inspection and review. MISP provides some guidelines on what the BW management plan should consist of [PRC 71204 (h)]</p>	<p><i>USCG</i> – Provides more prescriptive guidelines on the contents of BW management plan [33 CFR 151.2050(g)] <i>EPA</i> – Same as USCG</p>
Ballast Water Log	
<p>Log outlining ballast water management activities for each ballast water tank and retained for 2 years [PRC 71205 (d)]</p>	<p><i>USCG</i> – No requirements <i>EPA</i> – No requirements</p>
Ballast Water Reporting Form Retention	
<p>Ballast Water Reporting Forms to be retained on vessel for 2 years [PRC 71205(c)(1)(H)(2)]</p>	<p><i>USCG</i> – Ballast Water Reporting Forms to be retained for 2 years [33 CFR 151.2070(b)] <i>EPA</i> - None</p>
Mandated Legislative Reports	
<p>Programmatic Biennial Reports since 2005</p>	<p><i>USCG</i> – None - however annual periodic review and revision by USCG is required. <i>EPA</i> – None</p>



Figure VI.4 – California’s Marine Invasive Species Program 19 recognized port zones

At this time, the federal government has no additional reporting forms related to ballast water management, the implementation of ballast water performance standards, and the use of ballast water treatment technologies. California has adopted two additional forms to gather more information about the use, installation, and maintenance of ballast water treatment technologies on vessels arriving to California ports. The “Ballast Water Treatment Technology Annual Reporting Form” collects information once annually on the type of treatment system in use, the presence of active substances, maintenance, and performance verification of treatment systems used on any vessel that discharges treated ballast into state waters. Vessels are also required to submit the “Ballast Water Treatment Supplemental Reporting Form” on a per-treated discharge basis to allow

MISP staff to track treatment system usage and maintenance from voyage to voyage. These forms enable MISP staff to determine patterns of the types of treatment systems being used, system malfunctions, and other issues that may arise from the fleet of vessels operating within California waters. As ballast water discharge performance standards are only scheduled to be implemented, and treatment systems have not been installed on a large number of vessels, this type of novel dataset will be important to assess how treatment systems perform over an extended period, on multiple vessel types, and at treating water from multiple geographic areas (with associated variations in physical, chemical, and biological profiles of the ballast water being treated). At this time, it is not clear how the federal government will track ballast water treatment system usage, maintenance, and operation. Because of this, the MISP will continue to perform a central role in protecting California's waters, reduce the risk of NIS introductions, and provide useful data to federal, international, and other interested parties.

D. Ballast Water Research Funding

For California, PRC Section 71201 declares that the purpose of the Marine Invasive Species Program is "to move the state expeditiously toward elimination of the discharge of nonindigenous species into the waters of the state." The MISP advances this goal through a comprehensive multi-pronged approach to vessel vector management including funding and coordination of targeted, applied research that advances the development of strategies to prevent the introduction of NIS from ballast water and vessel biofouling. Specifically, PRC Section 71213 mandates the Commission to:

" . . . identify and conduct any other research determined necessary to carry out the requirements of this division. The research may relate to the transport and release of nonindigenous species by vessels, the methods of sampling and monitoring of the nonindigenous species transported or released by vessels, the rate or risk of release or establishment of nonindigenous species in the waters of the state and resulting impacts, and the means by which to reduce or eliminate a release or establishment . . ."

In an effort to advance the goals of the MISP, the Commission has funded specific research addressing many of the NIS-related issues for which information has been limited or lacking, including research related to emerging technologies which may strengthen the Commission's ability to reduce or prevent NIS introductions into California waters. For example, since 2001 the Commission has been actively involved in the testing of three emerging technologies on sea going vessels (See Tables VI.7 and VI.8). The Commission has also funded several compliance monitoring-related research projects that will enable compliance assessment of technologies used to reduce or prevent NIS introductions.

For the USCG, research funding has primarily been focused on Type Approval testing-related issues. For example, the USCG has funded studies on: ballast water sampling port design; the development of sampling techniques for rare organisms; and the development of sampling techniques using specific indicator dyes. Additionally, USCG and EPA have collaborated on two key research projects. The first involved assessing the relationship between propagule pressure and invasion risk in ballast water (NRC 2011), which assisted both agencies in developing numeric ballast water discharge limits. The second joint project, evaluated the efficacy of ballast water treatment technologies (U.S. EPA-SAB 2011).

Table VI.7

CALIFORNIA	FEDERAL
Overall Research Funding Available	
\$300K dedicated annually	<i>USCG</i> – Not available <i>EPA</i> – Not available

While the MISP and the federal agencies have all supported ballast water research, the focus of the research varies. The USCG has primarily funded projects that better enable the Type Approval process, while the MISP has funded projects that push the performance of ballast water treatment technologies and that will enable MISP Inspectors to better evaluate ballast water discharge compliance rates. The practical, targeted research supported by the MISP is crucial to better understanding the current and future capabilities of ballast water management technologies.

Table VI.8

CALIFORNIA	FEDERAL
Ballast Water Research	
<p>Research projects funded by the MISP and conducted by the Smithsonian Environmental Research Center:</p> <ul style="list-style-type: none"> • Ballast Water Exchange Verification: Testing Application of Chemical Tracers on the U.S. Pacific Coast • Verifying Ballast Water Exchange at Sea: A Full-scale Demonstration of its Application by Regulatory Agencies <p>Research projects funded by MISP and conducted by the Moss Landing Marine Laboratories:</p> <ul style="list-style-type: none"> • Development of a Rapid, Bulk Assay for Determination of Plankton Viability <p>Research projects funded by MISP and conducted by the Glostien Associates:</p> <ul style="list-style-type: none"> • Compliance Monitoring Tool for Ballast Water Management <p>Ballast Water Treatment Demonstration Projects funded by MISP:</p> <ul style="list-style-type: none"> • R. J. Pheiffer with Hyde system • Sea Princess with Hyde system • Moku Pahu with Ecochlor system • American President Lines with NEI system <p>Other Projects funded by MISP:</p> <ul style="list-style-type: none"> • <i>T/S Golden Bear</i>, Shipboard Ballast Research Development Testing and Evaluation (RDTE) Facility • Feasibility Study of Shore-based Ballast Water Reception 	<p><i>USCG**</i></p> <p>Research projects conducted by the USCG Research and Developments Center:</p> <ul style="list-style-type: none"> • Analysis of Ballast Water Sampling Port Designs Using Computational Fluid Dynamics • Evaluation of Representative Sampling for Rare Populations Using Microbeads <p>Research projects conducted by the US Naval Research Laboratory:</p> <ul style="list-style-type: none"> • Design and Preliminary Use of a Commercial Filter Skid to Capture Organisms $\geq 50 \mu\text{m}$ in Minimum Dimension (Nominally Zooplankton) for Evaluating Ships' Ballast Water Management Systems at Land-Based Test Facilities • Multi-site validation of a method to determine the viability of organisms $\geq 10 \mu\text{m}$ and $< 50 \mu\text{m}$ (nominally protists) in ships' ballast water using two vital, fluorescent stains • Development of a Method to Determine the Viability of Organisms $\geq 10 \mu\text{m}$ and $< 50 \mu\text{m}$ (Nominally Protists) in Ships' Ballast Water: A Combination of Two Vital, Fluorescent Stains • Development of a method to determine the number of viable organisms $> 50 \mu\text{m}$ (nominally zooplankton) in ships' ballast water: a combination of two vital, fluorescent stains <p>** This list of research projects was provided by USCG.</p>

Table VI.8 continued

CALIFORNIA	FEDERAL
Ballast Water Research - continued	
	<p><i>EPA – Unknown</i> <i>USCG and EPA collaborations **</i></p> <p>Study conducted by the National Research Council:</p> <ul style="list-style-type: none"> • Assessing the relationship between propagule pressure and invasion risk in ballast water <p>Study led by EPA's Science Advisory Board</p> <ul style="list-style-type: none"> • Efficacy of Ballast Water Treatment Systems <p>** This list of research projects was provided by USCG.</p>

VII. CALIFORNIA-FEDERAL COMPARISON: VESSEL BIOFOULING

A. Vessel Biofouling Management Requirements – Reactionary

There are existing biofouling management requirements to reduce the risk of species introductions that are currently in place in California and at the U.S. federal level (See Table VII.1). These existing requirements are primarily focused on reactionary (i.e. after the fact) cleaning obligations at defined or undefined intervals. In California, PRC section 71204(f) requires the removal of biofouling organisms from the hull, piping, propellers, sea chests, and other wetted portions of a vessel on a regular basis, with “regular basis” defined as either of the following: 1) no longer than by the date of expiration on the vessel's full-term Safety Construction Certificate or an extension of that expiration date; 2) no longer than by the date of expiration of the vessel's full-term USCG Certificate of Inspection or an extension of that expiration date by the United States Coast Guard; or 3) no longer than 60 months since the time of the vessel's last out-of-water drydocking.

The USCG has a similar requirement in the U.S. Code of Federal Regulations Title 33 Part 151.2050(f) to remove fouling organisms from the vessel's hull, piping, and tanks on a regular basis, but the term “regular basis” is not defined. This ambiguous regulatory language leads to an unenforceable requirement that unfortunately functions more as guidance rather than mandatory management.

Similarly, the EPA 2013 VGP contains a requirement in Part 2.2.20 to remove biofouling organisms from seawater piping on a regular basis, but the term “regular basis” is again not defined and therefore remains ambiguous and difficult to enforce. The 2013 VGP also includes reactionary management language in Part 2.2.23, describing measures that are to be taken during in-water cleaning activities to reduce the release of living organisms during the cleaning process.

These examples of reactionary management at the California and U.S. federal levels are all similar in that they require the removal of biofouling organisms from the submerged or wetted surfaces of a vessel on a regular basis. The primary difference, however, is that the California MISP requirements define the term regular basis to remove the ambiguity surrounding the USCG and EPA requirements. The inclusion of this definition in California's statutory language enables this law to be enforceable, in contrast to the USCG and EPA unenforceable requirements that operate more like recommendations than actual mandatory requirements.

Table VII.1

CALIFORNIA	FEDERAL
Biofouling Management Requirements – Part 1	
Preventative Biofouling Management	
Comprehensive BF management regulations are in development as mandate by PRC 71204.6	<i>USCG</i> – No preventive management requirements <i>EPA</i> – No preventive management requirements
Reactive Biofouling Management	
“Remove biofouling organisms from the hull, piping, propellers, sea chests, and other wetted portions of a vessel arriving at a California port or place, on a regular basis, and dispose of removed substances in accordance with local, state, and federal law.” <u>Defines</u> “regular basis” [PRC Section 71204 (f)]	<i>USCG</i> – “Remove fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, State and Federal Regulations.” <u>Does not define</u> “regular basis” [33 CFR 151.2050(f)] <i>EPA</i> – “Vessel owner/operators must remove fouling organisms from seawater piping on a regular basis and dispose of removed substances in accordance with local, state, and federal regulations.” <u>Does not define</u> “regular basis” [U. S. EPA, 2013 VGP, Part 2.2.20]
Biofouling management requirements for high-risk Extended Residency Vessels	
Regulations are in development [PRC 71204.6]	<i>USCG</i> – No regulations in place <i>EPA</i> – No regulations in place

B. Vessel Biofouling Management Requirements – Comprehensive

Reactionary biofouling management measures can be useful tools in certain circumstances, but they are limited in their effectiveness because they generally only address biofouling management at the end of a vessel’s in-service period (i.e. inter-dry docking period) or when biofouling has already accumulated to an excessive level. Conversely, proactive management measures like the use of appropriate antifouling systems are generally more effective than reactionary measures because they focus on preventing or limiting the initial accumulation of biofouling.

Both reactive and proactive management measures can be useful tools, and the most effective way to manage the risk of NIS introduction from biofouling is through comprehensive management that takes both approaches into account. The California

Legislature recognized this fact, and in 2007 placed a mandate on the MISP to develop comprehensive vessel biofouling management regulations (PRC section 71204.6). The MISP is currently consulting with technical advisors to develop these comprehensive regulations. The focus of these draft regulations will primarily be on prevention, relying on effective and coherent biofouling management plans that are specific to each vessel. Other areas of focus will be on reducing risk related to certain vessel surfaces, referred to as “niche areas,” that are more susceptible to biofouling accumulation, such as sea chests and thrusters, and on vessels that remain stationary for prolonged periods of time. This type of approach, relying on management plans and preventative measures coupled with reactionary measures when necessary, is consistent with the recently adopted IMO biofouling guidelines (IMO 2011) and regulations currently being developed and implemented in New Zealand, Australia, and Western Australia (see Section IV in Scianni et al. 2013 for a description of international biofouling policy development).

At the U.S. federal level, the USCG has not publicized any plans for developing preventative or comprehensive biofouling management policies. Instead, the USCG has encouraged the voluntary implementation of the IMO biofouling guidelines, specifically the development of vessel-specific Biofouling Management Plans and Record Books. However, these are voluntary measures, and levels of voluntary implementation are currently unknown. The EPA has included certain preventative management provisions in Part 2.2.23 of the 2013 VGP, primarily by requiring the minimization of the transport of attached living organisms. The EPA recommends several preventative and reactionary management measures as possible methods to ensure compliance, including the use of antifouling systems and in-water cleaning. The primary difference between the comprehensive biofouling management policies at the state and federal levels is that the California MISP is working under a legislative mandate to develop mandatory comprehensive requirements while the USCG and EPA are either encouraging the use of the voluntary IMO biofouling guidelines or have unenforceable vague requirements to minimize the transport of attached organisms. Because there are no public plans to develop more comprehensive mandatory biofouling management requirements at the U.S. federal level, California’s MISP has continued to work collaboratively with the federal governments of New Zealand and Australia to develop and implement coherent management policies for vessels that travel across the globe.

C. Hull Husbandry Reporting Requirements

A key ingredient for the development of effective and well-informed policies is detailed information on current biofouling management practices and current levels of NIS introduction risk. MISP staff has been collecting information on the biofouling

management and hull husbandry practices of the vessels operating in California on an annual basis since 2008. These data are collected via annual submission of the eleven-question Hull Husbandry Reporting Form (HHRF) that highlights current vessel practices that are expected to increase or decrease risk (see Section VI in Scianni et al. 2013 for a summary of HHRF data analyses). In addition to informing the development of biofouling management policies in California, the HHRF has served as the template for the development of a similar reporting form for the state of Hawaii. The data collected with the HHRF have also been used outside of California to validate the Australian Marine Growth Risk Assessment (MGRA; DAFF 2013), and has been used to assess biofouling-mediated risk in the states of Alaska, Oregon, and Washington (Cordell et al. 2009, Paul 2011, Davidson et al. in prep). The widespread use of MISP-collected data, and the use of the HHRF as a template for further data collections in other jurisdictions, points to the leadership of the MISP in the regulatory environment of biofouling management.

While the MISP has been at the global forefront of biofouling management and hull husbandry data collection, the USCG and EPA have been primarily focused on the collection of data related to ballast water management rather than biofouling management (See Table VII.2). Specifically, the USCG does not require vessel-specific information on biofouling management or hull husbandry practices to be submitted in order to inform future policy decisions. The EPA requires submission of general hull husbandry information via the Notice of Intent for vessels that claim coverage under the VGP; however the information collected via the NOI lacks the level of detail and standardization of the data collected via the HHRF. In addition, because the NOI is submitted once per VGP cycle, this information is collected from vessels once every five years, less frequently than the annual submission of the California HHRF.

Table VII.2

CALIFORNIA	FEDERAL
Biofouling Management Requirements – Part 2	
Biofouling Management Reporting Requirements	
Data is collected annually through the Hull Husbandry Reporting Form [PRC 71205 (e)] and [2CCR2298]	<i>USCG</i> – No biofouling management reporting required <i>EPA</i> – Data is collected once every five years as part of the Notice of Intent (NOI). The NOI is submitted every VGP cycle. [U.S. EPA, 2013 VGP, Appendix E] and [U.S. EPA, 2013 VGP, Part 1.14]

The primary difference between biofouling-related reporting requirements at the state and federal levels is that the California MISP collects detailed annual data on hull husbandry practices and biofouling-related voyage characteristics on a mandatory basis from each vessel operating in the state, while the USCG collects no biofouling management data and the EPA collects minimal data every five years. The ability of the MISP to gather this important data in a more detailed and more frequent fashion allows the California program to better understand the biofouling-related practices of the vessels operating in the state in order to develop more well-informed science-based policies to reduce the likelihood of NIS introductions.

D. Biofouling Research Funding

Understanding how a vessel's hull husbandry practices relate to biofouling accumulation is an important component of a well-rounded and well-informed policy development process. To achieve this understanding, the MISP routinely funds and collaborates on targeted research aimed at providing insight into patterns of organism accumulation and distribution associated with various underwater and wetted vessel surfaces and across vessel types (See Table VII.3). These studies include research utilizing in-water biological sample collection from active vessels, biological sample collection from vessels in dry dock, laboratory-scale experimental studies, and desktop reviews and reevaluations of multiple existing datasets (see Section VII of Scianni et al. 2013 for a description of recently completed and ongoing research). This approach allows the MISP to identify information gaps, to put resources towards filling those gaps, and to identify local risk of biofouling-mediated species introductions to California. Neither the USCG nor EPA support targeted research aimed at informing the development of biofouling management policies. Other federal departments, such as the U.S. Navy and U.S. Maritime Administration, fund biofouling-related research, but these projects are often focused on managing vessels owned by these federal agencies and are generally aimed at identifying management practices to reduce biofouling-induced increases in fuel consumption.

The primary difference between the funding of targeted biofouling research at the state and federal levels is that the California MISP regularly funds and collaborates on targeted research projects that are needed to provide data necessary for developing effective management policies, while neither the USCG nor EPA have put resources towards better understanding biofouling risk or management. The MISP's ability to identify important questions and to answer them with focused research sets California's program apart from the USCG and EPA, and allows for a more well-rounded approach to policy development.

Table VII.3

CALIFORNIA	FEDERAL
Biofouling Research	
<p>Research projects funded by MISP and conducted by the Aquatic Bioinvasions Research and Policy Institute (ABRPI):</p> <ul style="list-style-type: none"> • The implications of maritime vessel traffic, wetted surface area and port connectivity for hull mediated marine bioinvasions on the US west coast • Protocol for Sampling Commercial Vessel Biofouling Using a Remotely Operated Vehicle (ROV) • Sampling efficacy comparison of divers vs. ROV for assessment of vessel biofouling • Ship fouling: A Review of an enduring worldwide vector of nonindigenous species • Biofouling as a vector of marine organisms on the US west coast: a preliminary evaluation of barges and cruise ships • Analysis of Salinity Shock on Biofouling communities: A Pilot Study • Richness, extent, condition, reproductive status and parasitism of fouling communities on commercial vessels • Evaluating Ship fouling and emerging regulatory policies for reducing biofouling mediated species incursions 	<p><i>USCG</i> – No biofouling research projects <i>EPA</i> – No biofouling research projects</p>

VIII. CONCLUSIONS

This report compares California's Marine Invasive Species Program to the comparable federal programs within the U.S. Coast Guard and the U.S. Environmental Protection Agency. Specifically this report evaluates the relative effectiveness of each program at reducing the risk of NIS introduction to California from maritime shipping activities. At the conclusion of this report, the Commission finds that neither the USCG Ballast Water Management Program nor the EPA Vessel General Permit program are equally or more effective than California's MISP at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state. This report highlights the many federal management gaps that are filled by the MISP and the expertise and resources available to the MISP that are not present at the federal level, all of which allow the MISP to more effectively reduce the risk of species introduction to California's coastal waters and to align with the legislatively declared purpose of the MISP to move the state expeditiously toward elimination of the discharge of nonindigenous species into the waters of the state. The following are some of the key findings of this conclusion.

California's MISP fills critical management gaps present at the federal level

Federal exemptions from ballast water and biofouling management and reporting requirements

While all three programs provide exemptions for vessels of the armed forces, vessels in innocent passage (i.e. travelling through state or federal waters but not arriving at a port or place), and vessels claiming a safety exemption, the federal programs provide additional exemptions not based on environmental protection or human safety that likely result in increased risk of species introductions. Both the USCG and the EPA do not require ballast water management or reporting when operating within the same USCG Captain of the Port Zone. If not for California's MISP, vessels would be allowed to, for example, discharge unmanaged ballast from San Francisco Bay into Humboldt Bay, a water body that is several hundred miles away and that has significantly fewer NIS than San Francisco Bay. The USCG program also provides exemptions for crude oil tankers engaged in coastwise trade and to vessels that claim conducting ballast water exchange would result in undue deviation and delay in their voyage, although the EPA's enabling legislation does not allow these exemptions. Both of these exemptions are based on considerations other than environmental protection, and without MISP requirements in place to fill these gaps, both would allow more vessels to discharge unmanaged ballast water into California. This is highlighted by the fact that the number of vessels claiming these exemptions, and therefore discharging unexchanged ballast water, is dramatically decreased in California waters when compared to the rest of the U.S.

Ballast Water management

Because of the risk of introducing and spreading NIS along the coast, California's MISP currently requires discharging vessels traveling along the western North American coast to conduct ballast water exchange prior to discharge. Under current USCG rules, these vessels may discharge unmanaged ballast as long as they remain wholly within 200 nm from land. Without MISP requirements to fill this federal management gap, vessels would be allowed to discharge unmanaged ballast water from Alaska, British Columbia, Washington, Oregon, or other California ports into California, drastically increasing the risk of introducing NIS into the waters of the state.

California's MISP and the federal programs all have ballast water discharge performance standards in place and are scheduled to implement these standards over the next five years. While all of these performance standards set numeric limits on allowable concentrations of aquatic organisms, the California standards are considerably stronger than the federal standards and, once implemented, will provide better protection for California waters. All of these standards will likely require treatment of discharged ballast water, either at a shore-based treatment facility or through the use of a treatment system placed onboard a vessel. California's MISP is actively supporting research to assess the feasibility of shore-based ballast water treatment in California as one option for vessels to comply with the state's requirements; neither the USCG nor EPA have released information on the feasibility of this option for any ports within the U.S. Another option for compliance is the use of shipboard ballast water treatment systems, an emerging technology with an expanding industry. Because none of the state, federal, or international ballast water discharge standards are yet implemented, there is a lack of comprehensive information on system performance on actively trading vessels, across vessel types, and across various routes. The MISP has adopted reporting forms specifically designed to collect much needed data on ballast water treatment technology performance and maintenance, in an attempt to fill this global gap in knowledge. Although the EPA will require annual reporting of certain system data, neither of the federal programs have plans in place to collect per-discharge data on the performance and maintenance of shipboard treatment systems.

Biofouling management

California's MISP and the federal programs all currently have reactive biofouling management requirements in place, essentially requiring the removal of biofouling from vessel surfaces on a regular basis. However, the term "regular basis" is ambiguous, and only California's MISP specifically defines the term to provide clarity to vessel owners and operators on the actual requirement. Because the federal requirements don't define the term "regular basis," they function more as recommendations and are

less likely to influence actual biofouling management and reduce the risk of species introduction to California from biofouled vessels.

In addition to the reactive management requirements of the California and federal programs, the California Legislature directed the MISP to develop and adopt comprehensive biofouling management requirements including preventative measures such as the appropriate use of antifouling systems, the development of vessel-specific Biofouling Management Plans and Record Books, and preventative maintenance of surfaces that are highly susceptible to biofouling accumulation (e.g. rudders, propellers, thrusters). Neither of the federal programs has announced plans to develop preventative and comprehensive biofouling management regulations. Because biofouling is believed to be as, if not more, potent than ballast water as a pathway for the introduction of NIS into coastal waters, this lack of federal action is a major gap that, in the absence of the MISP, would leave California at greater risk of species introduction.

An important component in risk-assessment and practical biofouling management regulation development is an understanding of the current hull husbandry practices and patterns of biofouling risk factors (e.g. vessel speed, port residency time) of the vessels operating in California. The MISP has been collecting these data annually since 2008, and is using these details to inform the development of comprehensive regulations that are mandated by the California Legislature. This information is essential for understanding the NIS introduction risk that the biofouling vector presents to California, and although the EPA collects some hull husbandry information every five years, neither they nor the USCG collect these data frequently enough to properly assess the biofouling-mediated risk of species introduction to California or to properly develop management requirements to reduce that risk.

Vessel vector research

Identifying key information gaps and having the ability to support targeted research to fill those gaps is an often overlooked component of successful risk management programs. Both the California MISP and the USCG have funded ballast water research to improve their abilities to effectively carry out their legislative mandates, but each has focused on different types of questions and therefore different types of research. The MISP-funded ballast water research has primarily focused on two main priorities: encouraging the development and testing of ballast water treatment technologies, both shipboard and shore-based; and tools and technologies to assess compliance with ballast water discharge performance standards. The USCG-funded research has focused primarily on ballast water treatment system type approval-related questions and technologies. The ballast water research funded by each program is important and complimentary, a

function of the cooperation between the two programs. However, without the MISPs support for ballast water research, there would be tremendous gaps in overall knowledge of ballast water treatment technology development and testing as well as available compliance assessment tools.

Targeted research is also important to fill knowledge gaps related to vessel biofouling and biofouling management. The MISP has funded and participated in numerous research projects aimed at better understanding the biofouling-mediated risk of species introduction to California. This information is essential for developing practical, science-based biofouling management regulations and because biofouling research has lagged behind ballast water research globally, the MISP coordinates closely with international colleagues on answering questions that are useful not only for California but internationally as well. The USCG and the EPA have primarily focused on ballast water management and therefore neither program has funded biofouling research. This lack of investment on the part of the federal programs in understanding and developing strategies to manage the biofouling-mediated risk of species introduction represents a key federal gap that is filled by the MISP to reduce the likelihood of future NIS introductions into California waters.

California's MISP staffing, expertise, and resources

Staffing and expertise

California's MISP is a multi-agency program that incorporates the expertise of the Commission, the California Department of Fish and Wildlife, the Water Board, and the Board of Equalization. All four agencies coordinate with each other as directed by the California Legislature to implement the MISA. The Commission's portion of the MISP is divided into three components: program administration and policy development, data management, and field operations. One of the keys to the success of the MISP is the local nature of the program. This local presence allows for close communication, coordination, and outreach to the local maritime industry, as well as other state, federal, and international agencies. Outreach is a role shared by all parts of the MISP, with each component of the program exchanging information with various groups.

The data management component consults with shipping agents and owners on a daily to weekly basis over paperwork submission requirements, programmatic changes and general questions about California rules. The MISP administration and policy development component is staffed with marine scientists with backgrounds in biological invasion science who regularly consult with a wide array of stakeholders in order to evaluate the current state of vessel NIS vector knowledge and to guide policy recommendations relevant to California. The field operations component is staffed with

inspectors who each have an average of eleven years of experience in conducting ballast water inspections at California ports. The MISP inspectors are the primary conduit for information to ship officers and crew, educating them on state requirements and supplying outreach materials.

While the USCG has similar levels of staffing and expertise for its program administration, the duties of USCG inspectors in ports across the country include many other responsibilities in addition to ballast water; therefore ballast water management only makes up about 10-15 minutes of a multiple-hour inspection. The EPA does not conduct VGP inspections and relies on USCG inspectors to assess compliance with the VGP. Comparison of the state and federal programs highlights the differences in staffing levels, particularly with regard to inspectors, their level of expertise, their local presence and the focus of their duties.

Funding sources

The success of programs designed to reduce the risk of NIS introduction from vessel vectors is dependent on a consistent funding source. The MISP is funded through a per-voyage fee assessed on vessels calling on ports within California and deposited into California's Marine Invasive Species Control Fund. This funding model results in a stable, consistent, and dedicated source of funds that enables the MISP to consistently implement the intent of the California Legislature without interruption, even in times of political budget crises. Conversely, both the USCG and EPA programs are dependent on regular acts of Congress to provide supporting funds, either through specific USCG funding bills or general appropriation bills. This type of funding model results in an unsteady and inconsistent source of funds that is reliant on the current political whims of Congress. During the writing of this report, federal budget disagreements resulted in the shutdown of many government programs, including the USCG and EPA programs discussed in this report. This unpredictable congressional funding model has resulted in interruptions in policy development, implementation, and enforcement at the federal level.

Biological monitoring

The California Legislature designed the MISP to include regular biological monitoring of California's coastal waters to identify newly introduced species, range expansions of currently established NIS, and to evaluate the success of the policies implemented by the MISP. The CDFW oversees these regular surveys and produces triennial reports to the Legislature summarizing recent findings. Conversely, neither the USCG nor the EPA is legislatively required to conduct biological surveys aimed at identifying NIS. The monitoring conducted by California's MISP enables the state to better identify new

introductions and evaluate the success of current policies to reduce the risk of introducing NIS from vessel vectors.

Ultimate question: Are the federal programs “equally or more effective at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state?”

The Commission finds that the federal programs within the USCG and the EPA are not equally or more effective than California’s Marine Invasive Species Program at implementing and funding effective controls on the release of aquatic invasive species into the waters of the state. The MISP fills numerous gaps present at the federal level that would leave the state at an increased risk of species introduction. The MISP can focus its limited resources more on California and regionally relevant issues than the federal programs, allowing the MISP to more effectively implement and fund policies that reduce the risk of NIS introduction from vessel vectors in California waters.

Another factor that influences the ability of all three programs to effectively reduce the likelihood of introducing NIS from vessel vectors is the extent of each program’s focus, either statewide or nationwide. The risk of NIS introduction to California is influenced by California’s specific vessel traffic patterns, vessel ballasting operations, and vessel biofouling management practices. Effective policies to reduce the risk of species introductions to California must take these NIS introduction risk factors into consideration. These factors are likely to differ from state to state and coast to coast. Federal policies that intend to reduce the risk of NIS introduction broadly across all ports in the U.S. may not be the most protective or appropriate policies for California. By establishing the MISP, the California Legislature recognized the need to focus on addressing the state-specific NIS introduction risk. Aligning with this recognition, California’s MISP continues to work cooperatively with the USCG and EPA programs in a complimentary fashion to fill the federal gaps and ensure that the requirements placed on vessels operating in California are robust enough to satisfy the Legislative mandate to move the state expeditiously toward elimination of the discharge of nonindigenous species into the waters of the state.

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