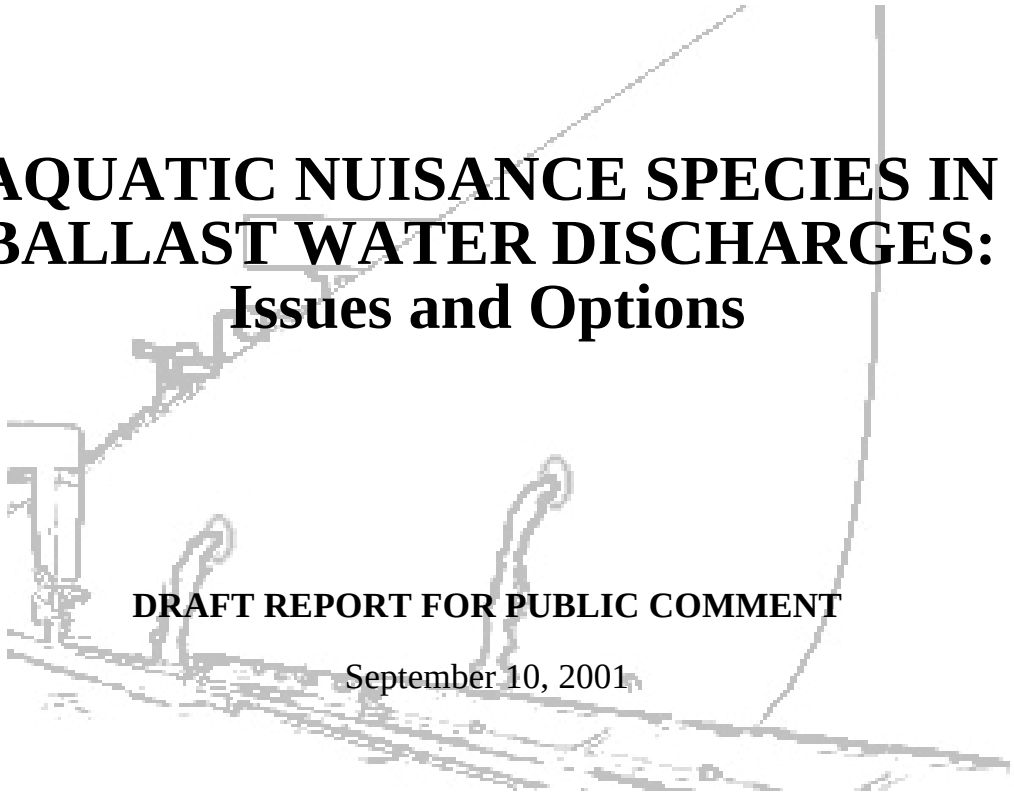
AQUATIC NUISANCE SPECIES IN BALLAST WATER DISCHARGES: Issues and Options



DRAFT REPORT FOR PUBLIC COMMENT

September 10, 2001

Prepared by:
U.S. Environmental Protection Agency Office of Water
Office of Wetlands, Oceans and Watersheds
Office of Wastewater Management
Washington, DC

PREFACE

This draft report, *Aquatic Nuisance Species in Ballast Water Discharges: Issues and Options* was prepared in response to a petition the U.S. Environmental Protection Agency (EPA) received on January 13, 1999, from the Pacific Environmental Advocacy Center. The petition was filed on behalf of fifteen nongovernmental and State and Tribal governmental organizations. The petition asked that EPA eliminate a regulatory exemption that currently prevents ballast water discharges from vessels from needing permits under EPA's National Pollutant Discharge Elimination System (NPDES) program. The petition was closely followed by a letter from eighteen members of Congress, requesting that EPA examine whether the Clean Water Act can be used to provide effective regulation of aquatic nuisance species in vessel ballast water.

In response to the petition, Congress's inquiry, and the growing national concern about aquatic nuisance species introductions, former Assistant Administrator for Water J. Charles Fox directed Office of Water staff to research the issue of aquatic nuisance species in ballast water discharges, and report back what mechanisms are available under the Clean Water Act or other relevant statutes or programs to effectively control the introduction of aquatic nuisance species through ballast water.

EPA is seeking public comment on this draft report, and will finalize the report, taking into account public comments received.

If you have information or comments, please email them to *Ballast.Water@epa.gov*, or mail them to: Marine Pollution Control Branch, ATTN: Ballast Water, US Environmental Protection Agency (4504F), 1200 Pennsylvania Avenue, NW, Washington, DC, 20460. Please include your name, affiliation, address, phone number and/or email address. All comments received before January 11, 2002, will be made part of the official record, and will be considered when finalizing the report.

An electronic copy of the entire draft report can be viewed or downloaded from EPA's internet web site at "*http://www.epa.gov/owow/invasive_species/petition.html*". A paper copy of the draft report can be obtained by sending a written request to: Marine Pollution Control Branch, ATTN: Ballast Water, US Environmental Protection Agency (4504F), 1200 Pennsylvania Avenue, NW, Washington, DC, 20460.

CONTENTS

1.. EXECUTIVE SUMMARY

a. Purpose of Report

This draft report examines the issue of aquatic nuisance species (ANS) introduction by the discharge of ballast water from vessels. It first discusses vessel traffic and the technical aspects of ballast water management. It then surveys existing Federal, State and international actions to address ANS. The draft report then discusses options for controlling ballast water through legal, technical, and practical mechanisms. It identifies regulatory and non-regulatory actions that the EPA and other agencies are taking or might take to minimize the spread of aquatic nuisance species in ballast water. Finally, the draft report proposes recommendations about what actions EPA should take to address the issue of preventing aquatic nuisance species spread by ballast water.

b. Summary of Draft Recommendations

This draft report finds that the greatest impediment to effectively controlling ANS introductions from ballast water discharges is the current lack of technical solutions to remove ANS from ballast water discharges. While mid-ocean ballast water exchange may offer some relief from ANS introductions, it has significant shortcomings. It is not effective in removing 100% of organisms in ballast water, it can involve significant safety risks to vessels during adverse weather, it cannot be practically applied to most domestic U.S. traffic, and it is difficult to inspect for compliance. However, regulatory and scientific developments are expected to provide significant new tools in the fight against ballast water ANS, and EPA believes it can best combat ANS introductions by taking a leadership role in those developments. Therefore, this draft report proposes the following recommendations for EPA actions:

One: EPA should promote the development of effective ballast water treatment technologies by:

- Actively promoting research, outreach, and technology development through its participation in the ANS Task Force, the Invasive Species Council, and their appropriate committees and working groups on ballast water;
- Promoting technology development, for example through its Environmental Technology Verification (ETV), Small Business Innovative Research, and Green Ships and Green Ports programs;
- Establishing the prevention of ANS introductions as an EPA research priority;
- Providing technical assistance to ANS research projects initiated or funded by the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), the U.S. Coast Guard, or other government, academic, or non-governmental organizations;
- Supporting the U.S. Coast Guard's efforts to evaluate the effectiveness of its regulations and to revise them, if necessary to enhance their effectiveness in preventing ANS introductions, including the development of domestic ballast water standards and encouraging the development and adoption of new technologies; and
- Continuing EPA's participation on the U.S. delegation to the Ballast Water Working group of the Marine Environmental Protection Committee of the International Maritime Organization, which is working toward an international ballast water agreement, including developing standards.

Two: EPA should work to prevent species introductions by:

- Encouraging public participation and education/outreach (e.g., through the National Estuary Programs, Great Waters programs, Aquatic Nuisance Species Task Force, National Invasive Species Council, Interagency Committee on the Marine Transportation System, and web sites);
- Working with the U.S. Coast Guard to maximize compliance with its regulations at 33 CFR 151 by:
  - Providing technical assistance, coordination, and advocacy support to U.S. Coast Guard outreach, education, and research projects; and
  - Participating actively on the ANS Task Force, its regional Panels, and its Ballast Water Committees.
- In cooperation with other Federal agencies, engaging the regulated community in a government-shipper partnership emphasizing the use of Environmental Management Systems (EMS) to address all aspects of ship-borne transfers of ANS, by:
  - Formally recognizing the efforts of shipping interests which commit to real, significant actions that reduce the risk of ANS transfer;
  - Providing technical assistance, coordination, and where appropriate, financial support to shippers' projects designed to address ANS; and
  - Where appropriate, providing regulatory flexibility for ANS prevention projects using EPA's Project XL program;[1]
- Providing encouragement for national consistency and coordination to State and local governments' efforts to control ANS invasion from ballast water;
- Developing EPA's Invasive Species Management Plan to identify appropriate EPA-specific activities to implement the Invasive Species Council's National Invasive Species Management Plan;
- Using EPA's authority to review NEPA documents and other documentation, to promote the adequate consideration of the effects of ANS in Federal actions which involve ballast water; and
- Deferring consideration of the application of National Pollutant Discharge Elimination System (NPDES) permits to ballast water discharges pending these actions**.** The effectiveness of other programs, including the level of compliance with the U.S. Coast Guard's program under NISA, will be a factor in EPA's future consideration of this issue.

c. Other Options for Addressing Ballast Water

The report describes a number of different approaches by which EPA or other agencies might prevent or minimize the spread of ballast water ANS. They include:

- Working with the U.S. Coast Guard, using CWA Section 402(g), to incorporate National Invasive Species Act (NISA) requirements into NPDES permits;
- Using EPA's authority to review NEPA documents and other documentation, to promote the adequate consideration of the effects of ANS in Federal actions which involve ballast water; and

- Invoking EPA's Emergency Powers authority under CWA §504, to halt the discharge if a situation is found where the discharge of ballast water containing exotic species presents an imminent and substantial endangerment to public health or public welfare, for example, the ability to market shellfish.

2.. BACKGROUND

a. Petition

On January 13, 1999, the Pacific Environmental Advocacy Center submitted on behalf of the California Assembly, the Chippewa-Ottawa Treaty Fishery Management Authority, and a number of environmental advocacy groups, a petition to the Administrator stating that invasive species in ballast water were a major cause of environmental degradation in U.S. waters, and requesting that EPA eliminate the exemption under 40 CFR 122.3(a) for discharges that are incidental to normal operation of a vessel. The petition requested that ballast water be regulated under the NPDES program. The petition was closely followed by letter from eighteen members of Congress requesting that EPA examine whether the Clean Water Act can be used to provide effective regulation of ANS in vessel ballast water.

In response to the petition, Congress's inquiry, and the growing national concern about ANS introductions, the Assistant Administrator for Water directed Office of Water staff to research and report back what mechanisms are available under the Clean Water Act, or other relevant statutes or programs, to effectively control the introduction of ANS through ballast water.

b. Ballast Water ANS

Ships have been sailing the world's seas for thousands of years. The suitability of ships as long-term homes to a wide variety of creatures led to use of the term "biological island" to describe the ship ecosystem.[2] The organisms that live aboard or in a ship have the opportunity to depart, or to disperse eggs or young, at each port of call, which resulted in extensive dispersal of many of the marine, estuarine, and even terrestrial species. Many species we usually consider native are really the result of anthropogenic introductions by ships over the last 500 years.

As the nature of ships and shipping changed, so did the nature of the organisms which lived and moved with the ships. Trade routes changed, creating new "donor regions" of potentially invasive species.[3] Ships traveled faster, so hitchhiking species were more likely to survive the voyage from the donor area to receiving waters. Ships' hulls were coated with antifouling paint to render them less hospitable to hitchhiking species, so that although some ANS are still transported on ship hulls, the primary vector for ANS transport at this time is probably ballast water.

As a ship's cargo is loaded and unloaded, the ship must accommodate changes in its weight and trim by taking on or discharging ballast water. For this purpose, ships use dedicated ballast water tanks, empty cargo or fuel tanks, or some combination of the three. A modern tanker ship working on the Great Lakes can contain as much as 14 million gallons of ballast water,[4] most of which would be discharged in port as the ship takes on its cargo. Seagoing tankers can carry twice that amount. Other kinds of cargo ships can carry from 100,000 to 5,000,000 gallons of ballast water. The total amount of ballast water discharged in U.S. waters each year is in excess of 21 billion gallons.[5]

It is estimated that more than 10,000 marine species each day hitch rides around the globe in the ballast water of cargo ships.[6] The volume of water is so enormous, and the transit time that organisms spend in ballast water tank is so short, that the number of species successfully invading new habitats via shipping pathways is increasing at an increasingly higher rate.[7] Table 1 shows a listing of all the species found in ballast water in a recent sampling research project.[8]

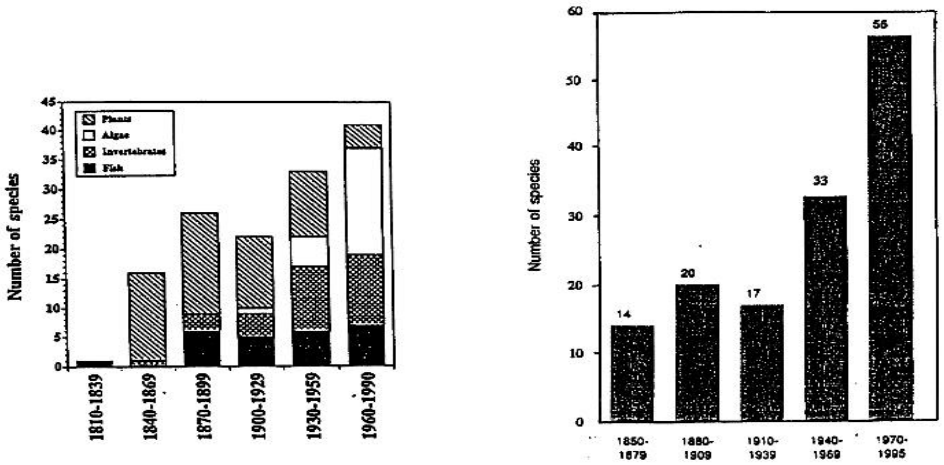
Table 1. Frequency of occurrence and abundance of organisms in ballast water from ships arriving from Japan to the Port of Coos Bay, Oregon, after a transoceanic trip of 11 to 21 days [average 15.1 (SD 1.9) days]. Specificity of identification depended on the phylum or division considered.

Taxon	Species (n)	Ships (%) in which taxon was				Adult	
		Abundant (>100/ replicate)	Common (10 to 100/ replicate)	Rare (<10/ replicate)	Present	Habitat*	Trophic group†
Crustacea							
Cirripedia	5	11.0	31.0	41.0	83.0	HE	S
Harpacticoida	5	17.0	29.0	28.0	74.0	HE, SE, PL, EB	SC, H
Calanoida and Cyclopoida	25	61.6	25.7	11.3	98.6	PL, SE	C, H, SC
Decapoda	14	3.1	4.4	40.8	48.3	SE, HE, EB	O, H, C, D, SC, S
Euphausiacea	1	0	0	1.3	1.3	PL	O
Stomatopoda	1	0	0	2.5	2.5	HE, SE	C
Cumacea	3	0.6	1.3	11.3	13.2	SE, I, PL	D
Mysidacea	2	0.6	5.0	28.0	33.6	SE, PL	H, D
Isopoda	4	0	1.3	32.1	33.4	HE, EB	SC, O, D, H, P
Caprellidea	1	0	0	2.5	2.5	EB	C, O
Gammaridea	8	0	1.4	22.0	23.4	SE, HE	H, D, S
Hyperiidea	1	0	0	10.7	10.7	PL	C
Ostracoda	1	0	0	2.5	2.5	HE, SE, PL	H
Cladocera	1	0	0	0.6	0.6	PL	H
Chelicerata							
Acarina	1	0	0	5.0	5.0	HE	D, SC
Echinodermata							
Asteroidea	1	1.2	1.9	11.3	14.4	HE, SE	C, SC
Echinoidea	2	0.6	1.9	15.0	17.5	HE, SE	H, SC
Ophiuroidea	1	0	0	3.1	3.1	HE, SE	D, SC
Holothuroidea	2	0	0	5.7	5.7	I, HE, SE	D, S
Chordata							
Urochordata	10	0.6	0	5.7	6.3	HE, EB	S
Pisces	2	0	0	3.2	3.2	PL	C
Hemichordata							
Enteropneusta	1	0	0	0.7	0.7	I	D
Chaetognatha	3	3.1	14.5	29.5	47.1	PL	C
Phoronida	1	0.6	3.8	24.5	28.9	HE, SE	S
Bryozoa	3	3.1	5.7	20.8	29.6	HE, EB	S
Annelida							
Spionidae	11	23.9	40.3	20.7	84.9	SE, HE	D, H, C, S
Polynoidae	3	1.2	3.1	38.0	42.3	SE, HE	D
Other Polychaeta	28	5.0	18.8	45.3	69.1	I, EB, SE, HE	SC, C, S
Hirudinea	1	0	0	0.7	0.7	PL	P
Platyhelminthes	33	0.6	8.8	55.3	64.7	SE, HE	C, SC, P
Nemertea	1	6.3	0	5.7	12.0	SE, HE, I	C
Mollusca							
Bivalvia	9	22.0	23.9	25.2	71.1	HE, SE, I	D, S
Gastropoda	10	2.5	16.4	42.8	61.7	SE, HE	D, SC, H, C
Sipuncula	1	0	0	2.5	2.5	SE, HE	D
Nematoda	1	0	0	9.4	9.4	SE, HE, EB	D, SC
Rotifera	1	0	0	8.2	8.2	PL	O, H
Cnidaria							
Anthozoa	2	0	0	1.3	1.3	HE	S, C
Scyphozoa	1	0	0	1.9	1.9	PL	S, C
Hydrozoa: *Obelia*	1	0	1.4	21.4	22.8	HE, EB, PL	S, C
Other Hydrozoa	21	0	0.6	19.5	20.1	HE, EB, PL	S, C
Radiolaria	2	0	0	18.9	18.9	PL	C, O
Foraminifera	3	0.6	2.5	6.3	9.4	EB, HE, SE, PL	C, D, SC
Tintinnida	2	15.7	11.3	16.3	43.3	PL	C, SC
Other ciliata	4	‡	‡	‡	‡		
Dinoflagellata	4	6.7	11.4	9.5	27.6	PL	PP
Diatomacea	128	54.7	20.7	17.6	92.4	SE, HE, PL	PP
Chlorophyta	2	0	0	3.8	3.8	SE, HE	PP
Rhodophyta	2	0	0	1.2	1.2	SE, HE	PP
Zosteraceae	1	0	0	0.7	0.7	SE	PP

*EB, epibiotic (living on other organisms); HE, hard bottom epifaunal; I, infaunal; PL, planktonic; SE, soft bottom epifaunal. †C, carnivore; D, deposit feeder; H, herbivore; O, omnivore; P, parasite; PP, primary producer, S, suspension feeder; SC, scavenger. ‡Ciliate abundance not estimated.

from J. T. Carlton and J. B. Geller, "Ecological roulette: the global transport of nonindigenous marine organisms," Science, 261 78-82 (1993)

The following figure shows the rate of known successful introductions of nonindigenous species into two well-studied areas since the early nineteenth century.[9]



Introductions of nonindigenous aquatic plants and animals in (left) the Great Lakes and (right) the San Francisco Bay region.

The threat to the environment and the economy of ANS introduction via ballast water is well established (see section 2.d.iv), and there is growing concern of the possibility of direct threats to human health from pathogens such as cholera in ballast water that was taken up in foreign ports.[10] Methods to manage ballast water to reduce these threats are undergoing extensive study in this country[11,12] and internationally.[13,14]

c. Other Pathways for ANS Introductions

Aquatic nuisance species are introduced by means other than ships. A recent study of ANS in the Great Lakes concluded, as shown in the figure below, that while ships were the most frequent pathway for species introductions, they were by no means the only pathway.[15] While most studies agree that ballast water discharges are the primary source of ANS introductions from vessels, ships can also transport living organisms on the hull, in sea chests, in seawater piping systems, on the rudder, entangled in the anchor or in the anchor chain, in chain lockers or caught up in fishing nets.[16]

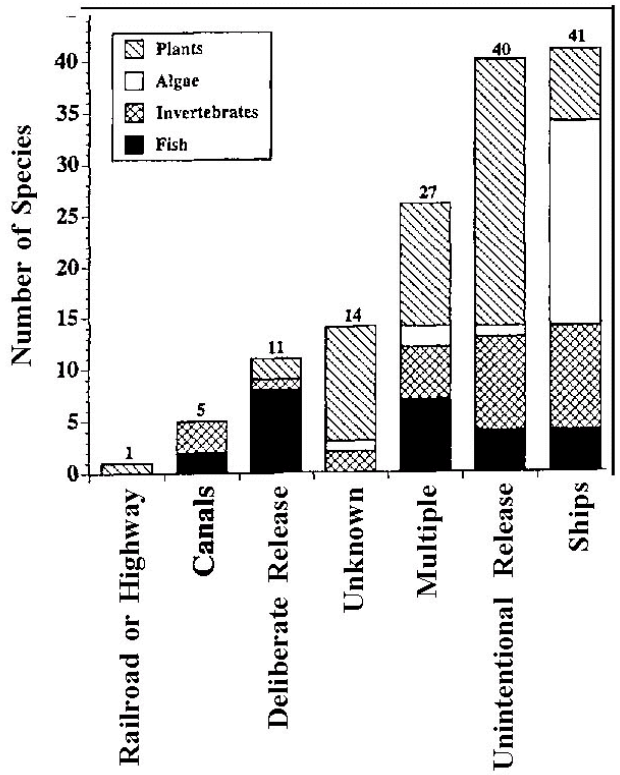


Figure II-2. Entry Mechanism of Aquatic Species Introduced to the Great Lakes (n=139) Sorted by Taxonomic Group [Mills et al, 1993a]

d. Vessel Traffic Information

i. Description of Vessels

In developing its regulations implementing NISA, the U.S. Coast Guard estimated that approximately 31,000 voyages occur annually from beyond the Exclusive Economic Zone (EEZ)* into waters of the U.S.[17] This number represents voyages made by U.S.-flagged, international, and recreational vessels.

U.S.-Flagged vessels. Nearly 40,000 vessels flew U.S. flags as of 1995.[18] About three-fourths of these were non-self-propelled barges. (Most of these barges do not carry ballast water.) Some of these U.S.-Flagged vessels travel beyond the U.S. EEZ.

International vessels. In addition to U.S.-flagged vessels, DOT has estimated that 7520 internationally flagged commercial cargo vessels visited U.S. ports in 1997. These vessels made about 78,000 calls at

*The Exclusive Economic Zone (EEZ) is an area of the ocean under national jurisdiction beyond the territorial seas. In the National Invasive Species Act of 1996 (see section 3.a.ii), the EEZ is defined as "the Exclusive Economic Zone of the United States established by Proclamation Number 5030, dated March 10, 1983, and the equivalent zone of Canada."

U.S. ports in 1997, and passenger vessels made about another 6,000 port calls.[19] (Note: During a single voyage into the U.S., international vessels may call into multiple ports.)

Recreational vessels. About 78 million Americans participated in recreational boating in 1997, using 16 million boats of all types, with the number of recreational users expected to grow by over 65 percent to more than 130 million annually in the next 20 years.[20] Some of these U.S.-Flagged vessels travel beyond the U.S. EEZ.

ii. Economics of Vessel Commerce

The following excerpt from a recent Department of Transportation report to Congress provides a picture of the significant place in the U.S. economy held by vessel commerce:

> The U.S. Marine Transportation System (MTS) consists of waterways, ports and their intermodal connections, vessels, vehicles, and system users. Each component is a complex system within itself and is closely linked with the other components. It is primarily an aggregation of State, local, or privately owned facilities and private companies. As with the U.S. economy as a whole, decision making and investment are primarily driven by the marketplace. In addition, national, State, and local governments participate in the management, financing, and operation of the MTS.
>
> More than 1,000 harbor channels and 25,000 miles of inland, intracoastal, and coastal waterways in the United States serve over 300 ports, with more than 3,700 terminals that handle passenger and cargo movements. The waterways and ports link to 152,000 miles of rail, 460,000 miles of pipelines, and 45,000 miles of interstate highways. Vessels and vehicles transport goods and people through the system. The MTS also contains shipyards and repair facilities crucial to maritime activity.
>
> As the world's leading maritime and trading nation, the United States relies on an efficient and effective MTS to maintain its role as a global power. The MTS provides American businesses with competitive access to suppliers and markets in an increasingly global economy. The MTS transports people to work; provides them with recreation and vacation opportunities; puts food on their tables; and delivers many of the items they need in their professional and personal lives. Within the United States, the MTS provides a cost-effective means for moving major bulk commodities, such as grain, coal, and petroleum. It is a key element of State and local government economic development and job-creation efforts and the source of profits for private companies. With its vast resources and access, the MTS is an essential element in maintaining economic competitiveness and national security.
>
> Annually, the U.S. marine transportation system:
>
> - Moves more than 2 billion tons of domestic and international freight;
> - Imports 3.3 billion barrels of oil to meet U.S. energy demands;
> - Transports 134 million passengers by ferry;
> - Serves 78 million Americans engaged in recreational boating;
> - Hosts more than 5 million cruise ship passengers; and
> - Supports 110,000 commercial fishing vessels and recreational fishing that contribute $111 billion to State economies.
>
> The MTS provides economic value by affording efficient, effective, and dependable all-weather transportation for the movement of people and goods. Waterborne cargo alone contributes more than $742 billion to U.S. gross domestic product and creates employment for more than 13 million citizens.[21]

iii. Potential Costs of Controlling Ballast Water ANS

Published estimates of the cost of employing ballast water treatment methods vary depending on the source of the estimate, and on the assumptions made, but in general they range from thousands to hundreds of thousands of dollars per vessel.[22] (Section 2.e.iii details some cost estimates for specific control technologies.) If a rough estimated initial cost of $30,000 per vessel is combined with an equally rough

estimate of 17,500 vessels regulated (about 10,000 domestic and about 7520 foreign-flagged vessels), the initial cost of regulation may be over $500 million. If a cost analysis shows costs closer to $100,000 or more per vessel, or if the number of regulated vessels is much larger than 17,500, the costs could exceed a billion dollars. These estimates are in no sense a cost analysis–they are based on reasonable but unsupported assumptions about the number of vessels regulated and on inadequately validated cost estimates. The estimations are included in this report to demonstrate that the possibility of significant costs indicates the need for a thorough cost analysis accompanying any regulatory effort. EPA will explore the full range of options, including any lower cost regulatory approaches that can significantly reduce ANS introductions.

iv. Potential Costs of Not Controlling Ballast Water ANS

Invasive species have caused extensive economic damage to the United States. A recent report estimated that over $5 billion per year in economic damage are caused by ANS.[23] The same report estimated that the costs from non-aquatic invasive species are even greater, due primarily to impacts on U.S. agriculture. Those costs are estimated at over $100 billion per year.

The ecological damage caused by invasive species can also be enormous. Fully half of all threatened or endangered species are imperiled by invasive species, making it the second greatest cause of endangered species imperilment (second only to habitat loss).[24] In the well-studied San Francisco estuary, the environmental damage attributable to invasive species includes: reduction or local extinction of native species to the extent that some Bay waters now contain virtually no native species; disruption of the aquatic food chain by elimination of phytoplankton by highly efficient invasive filter feeders; erosion of shorelines by invasive burrowers; and other ecosystem alterations which extend to bird and wildlife populations.[25] Coral reef ecosystems in the Florida Keys, Gulf of Mexico and wider Caribbean have been identified as vulnerable to ANS, as a result of heavy ship traffic in the region.[26]

Indigenous or domestic species of economic importance can be driven out, resulting in both ecological and economic loss. The accidental introduction of the Atlantic Coast comb jelly to the Azov and Black Seas shut down the Azov fisheries and nearly eliminated the Black Sea fisheries, at a loss of $250 million per year.[27]

e. Ballast Water Management Methods

A technical challenge facing any effort to set policy regarding ballast water is the fact that there are currently no ballast water management methods that are both universally applicable and proven effective at preventing ANS introductions. While mid-ocean ballast water exchange has been used and is still being used, it presents some safety risks and other limitations which prevent it from being the sole technical solution to the problem of ballast water ANS. Indeed, no single technique can fill this role. The Department of Transportation noted that "It is not appropriate to single out one alternative as 'the most' likely or viable–rather, a synthetic approach, choosing a number of alternative simultaneously from a broad menu of possibilities will eventually maximize the strength of ballast management."[28]

i. Mid-ocean Exchange

The most widely accepted method of ballast water management, indeed the only method that can be characterized as currently in common practice, is mid-ocean exchange of ballast water, typically at distances greater than 200 nautical miles from shore, and in water greater than 500 meters deep. Other methods such as ballast water treatment or dockside treatment are used only in special cases, or are currently in the research, development, or demonstration stages. The National Invasive Species Act of 1996 (NISA) (16 USC 4701 et seq.), and the U.S. Coast Guard implementing regulations at 33 CFR 151, require ships entering the Great Lakes from beyond the EEZ to conduct ballast water exchange or an alternative method determined by the U.S. Coast Guard to be "as effective as ballast water exchange."

However, as a ballast water control strategy, mid-ocean exchange has been only moderately effective in reducing the risk of invasions by nonindigenous species. The success of this management method relies on the physical flushing of organisms entrained in exchanged ballast water with mid-ocean organisms (which presumably are less suited to establishing populations in coastal environments), and with the immersion of any organisms not flushed out during the exchange to saline ocean water (which is presumably less hospitable to most organisms that could establish and flourish in the freshwater Great Lakes). Yet, this method is not completely successful, as demonstrated by the establishment of the tubenose and round gobies, and more recently the water flea *Cercopagis pengoi,* in the Great Lakes during the period where mid-ocean ballast water exchange was mandatory.[29,30] Various studies of ballast water tanks in actual field conditions have found that a 95 percent exchange of the original water resulted in flushing of only 25 to 90 percent of the organisms studied.

Where ballast water is taken up and discharged in saltwater ports, it can be expected that mid-ocean ballast water exchange will be even less successful, because the success of the method will depend on the efficiency of flushing of organisms, and the effect of changes in salinity in the ballast tank will be much less significant. Drawbacks to the mid-ocean exchange method of ballast water management include:

- Many ships are not structurally designed to safely allow ballast water exchange at sea;
- Exchange is sometimes impossible in rough weather due to safety concerns;
- Some organisms can survive under a very wide range of salinity conditions;
- Some ports have salinities very similar to mid-ocean salinities;
- Despite flushing of the ballast tanks with open ocean water, "pockets" of unexchanged water (and entrained organisms) may still remain in nooks and crannies of the ballast tanks;
- Ballast water tanks often contain a layer of sediment, in which organisms can escape being flushed out in a ballast water exchange, to reinocculate the exchanged ballast water;
- The method is unusable by the many ships that travel coastal or inland waterways and never reach the high seas; and
- If mid-ocean exchange does not lead to significant shifts in salinity of ballast water, verification that exchange occurred can be problematic.[31]

ii. Special-Case Ballast Water Management Methods

In addition to mid-ocean exchange, other ballast water management methods have been employed on a limited basis.

(1) Shore reception facilities

Tankers which pick up oil from the Alaska pipeline and deliver it to ports along the west coast typically do not travel routes that take them across mid-ocean, so they cannot engage in mid-ocean ballast water exchange. They normally travel north to Alaska with their cargo tanks full of ballast water, which they discharge to take on their cargo of oil. Tankers picking up crude oil at the Valdez Marine Terminal in Alaska discharge their ballast water to the Alyeska Ballast Water Treatment Facility, which was specifically built to accommodate this water. The entire treatment facility cost $1.4 billion to build and covers 1,000 acres of land space. The ballast water treatment facility processes about 16 million gallons of ballast water daily. Although the purpose of the facility is to prevent any oil contaminating the ballast water from entering Prince William Sound, it may be that the shoreside treatment has the effect of

removing some hitchhiking organisms as well.[32,33]

A similar situation takes place at some Canadian ports. A survey of Canadian reception facilities for marine wastes in the Great Lakes system listed nine facilities that have the capacity to receive ballast water. In all instances, the fixed reception facilities are petrochemical industries that maintain docking for the transport of their products. The facilities currently handle ballast water from vessels trading with that industry.[34]

It has been suggested that the risk of species invasion may be reduced by greatly expanding this practice of discharging ballast water to shore-based treatment facilities. This approach presents some significant technical and logistical challenges, including the large volume of water this practice would introduce to the treatment facility, the risk of poisoning the treatment facility treatment system with saline water, and the need to develop an extensive infrastructure on ships and at port terminals to direct the ballast water to the treatment facility. The feasibility of shore-based ballast water treatment options has been discussed in reviews of ballast water management technologies,[35,36] and is the subject of ongoing studies funded by the National Oceanic and Atmospheric Administration (NOAA) Seagrant program and EPA's Green Ports program.

(2) Chlorine treatment on some passenger vessels

Some passenger vessels are equipped with systems that generate chlorine in-situ and introduce it into the sea chest, from which engine cooling water is drawn. The purpose of the system is to reduce or eliminate fouling organisms in the seawater used for cooling. On some vessels, ballast water is drawn from this same seachest, and there is some indication that the chlorine treatment has the serendipitous effect of minimizing living organisms in the ballast tank as well. Congress afforded this ballast water treatment technology the presumption of effectiveness when they exempted from ballast water exchange requirements in NISA, any "passenger vessel equipped with a functioning treatment system designed to kill aquatic organisms in the ballast water," unless it was determined that the system was not as effective as ballast water exchange.[37] However, one potentially significant adverse environmental impact from this treatment technology is the discharge of large amounts of chlorine.

Treatment of ballast water with chlorine for the specific purpose of controlling ANS is one of the developing technologies discussed in section 2.e.iii.

iii. Alternative Methods in Research, Development or Demonstration Stages[38,39]

Research and development projects funded by the U.S. Coast Guard, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, EPA and other Federal, State and non-governmental organizations are studying other methods of reducing the risk of species invasion in ballast water. EPA-funded projects on treatment technology research and development include:

- Support from EPA's Great Lakes National Program Office (GLNPO) to the Northeast/Midwest Institute for development and demonstration of UV light as an effective secondary treatment tool to be used with filtration to remove the smallest microorganisms as part of the Institute's work on the Great Lakes Ballast Technology Demonstration Project (see section 3.a.ii.(4));

- Cooperation between GLNPO and NOAA's Great Lakes Environmental Research Laboratory on a project examining the risk of invasions associated with so-called "no ballast on board" (NOBOB) vessels, and to guide the development of treatments to better manage NOBOB vessels;

- Small Business Innovative Research grant funding in 2001 for two proposals to develop ballast water treatment technologies;[40]

- A Green Ports program grant to the California Association of Port Authorities to study the feasibility of shore-based ballast water treatment methods;[41] and

- A Memorandum of Agreement between EPA Office of Research and Development's Environmental Technology Verification (ETV) program and the U.S. Coast Guard, to jointly verify the performance of private sector, commercially available ballast water control technologies.[42]

A 1996 National Research Council report suggested that the ballast water management methods with the most promise were based on filtration, biocides, and thermal treatment.[43] A 1992 Canadian report found the most promising methods to be filtration, UV treatment, and discharge to a shore facility.[44]

The most advanced of these studies deal with installation and operation of a pilot treatment system on a ship. Systems which use waste heat from ship engines to treat ballast water have also been studied on board ships. Australian research on the bulk carrier *Iron Whyalla* demonstrated a kill rate of organisms comparable to the removal rate of ballast water exchange.[45,46] Similar results were observed on trials on the ore carrier *Onde Maru.*[47]

Filtration of ballast water has been the subject of several shipboard studies. Actual ballast water was filtered on board the Great Lakes carrier *Algol North* with a pilot filtration system. The study estimated the cost to implement a fully operational onboard backwash filtration system capable of filtering 4000 cubic meters of ballast water (about 18,000 gallons) an hour at about a million dollars per ship.[48,49] Removal of most aquatic organisms was shown to be effective, and practical problems with the system seem surmountable. Extremely small organisms were not removed, as expected. The possibility that no single treatment technology could remove or inactivate all types of organisms in ballast water has lead to predictions in several studies that an effective treatment system would involve a physical separation step supplemented with a second technology targeted towards the organisms missed by the first.[50,51]

In May 2000, a prototype ballast water treatment system which combines a cyclonic separation unit with treatment by UV light, was installed on the cruise ship *Regal Princess*.[52] Test results are expected to be published shortly, but were encouraging enough that Princess Cruise Lines has contracted to install units, with design improvements indicated by prototype results, on two more of its ships which call on California ports.[53]

In May 2001, a pilot project was initiated on the U.S. Maritime Administration cargo vessel *Cape May* which will test a ballast water filtration unit, followed by secondary treatment of ballast water by either UV light or a peroxyacid-based biocide. Test results are expected in the summer or fall of 2001.[54]

A recent report commissioned by the Port of Oakland included a table attributed to the Pacific Merchant Shipping Association, which estimated the costs of installation and use of some ballast water treatment options, once the technology to implement the option is complete.[55] The report estimated that a shipboard filtration system would cost about $200,000 to install, and $250,000 annually to operate. The following table is reproduced from that report. Estimated costs are in line with a rough order of magnitude estimate of "$1000s to $100,000s per vessel" in the 1992 DOT shipping study mandated by the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990.[56]

In response to its charge to determine the best way to stop introductions of ballast water ANS in twelve months, Michigan's Ballast Water Technical Work Group (discussed in section 3.c.i.(1)) has been studying treatment technologies that are currently available, that may be quickly applied to ballast water. The Work Group concluded that the only currently available methods of improving the control of ballast water ANS were improved management practices and treatment of ballast water with biocides.

The Work Group recognized the additional complications involved with using chemical biocides for ANS control, over nonchemical ANS management methods. These complications include the need to consider

safety issues associated with the chemicals' use, the environmental effect that discharge of residual biocide or biocide byproducts may cause on receiving waters, and the possibility of corrosion or other damage to the ballast water tank from the use of the biocide. The Work Group designed a shipboard testing program of the three currently available biocides they found most promising: glutaraldehyde, hypochlorite, and copper ion.[57] The testing is planned for the summer 2001 shipping season, and results are expected to be reported to the Council of Great Lakes Governors Task Force (discussed in section 3.c.i.(1)) the following shipping season.

Estimated Costs to Vessel operators for Ballast Water Invasive Species Control[58]

Option	Estimated Cost Breakdown				Comments
	Design	Material Acquisition	Installation	Annual Operating	
Ballast Water Exchange	$10,000	$5,000	$20,000	$30,000	Exchange ballast in deeper water. Easy method with very little retrofitting required. Could result in stability and structural stress issues.
	Hull penetration analysis, piping re-design	Hull penetration, some piping	Assumed during yard period	Extra overtime may be required for ship with unmanned machinery spaces	Continuous flushing method. Piping modifications for inlet and discharge on ships with common hull penetration
Ballast Water Management	$15,000	$15,000 to $75,000	$30,000	$25,000 to $250,000 depending on water source	Lower probability of foreign species getting into ballast water (high ballast suction, fresh water from port, city water, cleaning ballast tanks more regularly)
	Hull penetration analysis, piping re-design	Hull penetration, some piping, possibly new BW pumps	Assumed during yard period	Potential delays, also, if ballasting is done from/to shore facility	Piping system changes for high suction and shoreside manifold.
Ballast Water Filtration	$25,000	$100,000	$60,000	$250,000	Filter the intake or discharge (or both) of ballast systems. Feasible, but potentially ineffective if it interferes with the ship's cargo operations or is by-passed by crew.
	Piping re-design, filtering system design	Filters and piping (assume 10" pipe)	Assumed during yard period	High maintenance & repair burden potential delays, waste disposal uncertain	Piping system changes for inlet discharge strainers. Filtered material disposal could be costly and difficult.
Ballast Water Treatment Aboard Ship	$15,000 to $25,000, depending on system	$25,000 to $150,000, depending on system	$25,000 to $75,000, depending on system	$50,000 to $1,00,000, depending on system	Chemical and physical treatments on board ship. Problem with discharging chemicals from tanks. Heat treatment is energy intensive. UV light treatment is promising. Difficult to currently approximate costs due to need for R&D.
	Treatment systems design		Assumed during yard period		Heat treatment of large volumes of ballast is cost prohibitive, exceeding $1,000,000/year. Engine jacket water waste heat cannot be used as it does not have ΔT to raise BW temperature to 50°C.
Shoreside Treatment	$10,000	$15,000 to $75,000	$15,000 to $45,000	$30,000 exclusive of delays	Transfer of ballast to and from a port facility. Requires retrofit of ship to accept connection to shore and requires port facility construction.
	Piping re-design	Piping, new BW pumps, if required	Assumed during yard period	Potential port delays for ballasting	Piping system changes for shoreside manifold. Other than potential delays in port and new larger pumps, this may be the best option for ships.
Vessel Design Changes for Internal Ballast Transfer	$15,000	$15,000	$30,000	$30,000 to $1,000,000	Newer larger container ships are less stability sensitive. Some have large SW ballast systems, some do not. Need to load and/or transfer ballast is driven more by factors such as fuel burn-out and shoreside cargo loading plans. Virtually all container ships frequently experience large changes in draft and displacement.
	Piping re-design	Piping	Assumed during yard period	Potential cargo dead weight ton reductions and increased fuel cost for a large system	Piping system changes for container ships to provide capability to transfer ballast from and to any tank.

Source: Pacific Merchant Shipping Association

The following table presents the stage of development of some ballast water treatment technologies.[59,60,61] No technology is undergoing large-scale implementation yet as an alternative to ballast water exchange.

PROJECT	TECHNOLOGY LEVEL
Ballast exchange–ship efficacy studies	Pilot (shipboard)
Ballast exchange–ship design studies	Requirements for effective exchange
Chlorination	Equipment testing
Electrical discharge + filter	Concept study
Filtration + UV or biocide	Pilot (shipboard)
Filtration + disinfection	Pilot (dockside)
Filtration	Pilot (shipboard)
Glutyraldehyde	Concept study
Heat	Pilot (shipboard)
Hydrocyclone + UV	Pilot (dockside)
Hydrogen Peroxide	Concept study
Magnetic, acoustic	Concept study
Vacuum deaeration	Pilot (dockside)
Oxygen deprivation chemicals	Concept screen
Ozone	Concept study
Risk assessment/ decision support	In practice (limited cases); theoretical development & empirical testing
Shore-side reception and treatment	In practice (limited cases); concept study
Tank coatings	Concept screen
Ultrasound	Concept study
Uptake of ‘organism-free’ water	Concept study
UV, ozone, bromine	Laboratory study
Various biocides + heat	Laboratory study

3.. CURRENT ACTIONS TO ADDRESS ANS

a. Federal Actions

i. Executive Order 13112

On February 3, 1999, President Clinton signed an Executive Order which instructed Federal agencies to:

- Identify their actions which may affect the status of invasive species;
- Use existing programs and authorities to prevent the introduction of invasive species; and
- Refrain from carrying out actions which promote the introduction or spread of invasive species.

The order also established an Invasive Species Council, co-chaired by the Secretaries of Interior, Agriculture and Commerce, with membership including the Administrator of EPA and Secretaries of Defense and Transportation. The Council is charged with:

- overseeing the implementation of the order by Federal agencies;
- developing guidance for Federal agencies and making recommendations for international cooperation; and
- preparing, within 18 months, a national Invasive Species Management Plan.

The Invasive Species Management Plan was finalized on January 18, 2001. While dealing with all aspects of terrestrial and aquatic invasive species prevention and control, it included a discussion of ballast water. The Plan contained a national action plan, in which the following specific actions for the prevention of unintentional introductions were included:

> 16. Federal agencies will take the following steps to interdict pathways that are recognized as significant sources for the unintentional introduction of invasive species:
>
> a. By July 2001, NOAA, the Coast Guard, Interior, and EPA will sponsor research to develop new technologies for ballast water management, because the current method of ballast water management--ballast water exchange--is recognized as only an interim measure to address non-native species introductions.
>
> b. By January 2002, the U.S. Coast Guard will issue standards for approval of ballast water management technologies, because actual deployment of new ballast water technologies on ships is contingent on a standard by which to judge their efficacy.[62]

The Plan is available online at *"http://www.invasivesspecies.gov"*. Section 2.e.iii discusses some of the Federally sponsored research into ballast water technologies.

ii. National Invasive Species Act of 1996 (NISA)[63]

In 1996, Congress reauthorized and expanded the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA). The new legislation, titled the National Invasive Species Act of 1996 (PL 104-332) (NISA), established a national ballast management program targeted at all U.S. coastal regions, continues the mandatory Great Lakes ballast water management requirements, and expanded invasive species management programs within the Department of Interior and NOAA. The legislation also called for mandatory detailed ballast exchange reporting by all vessels, and authorized a Ballast Technology Demonstration Program, bringing more resources to the search for technological and management practice tools to replace ballast exchange.[64]

NANPCA and NISA are included in Appendix B.

(1) NISA's Ballast Water Regulations (33 CFR 151)

NISA authorized the U.S. Coast Guard to establish regulations and guidelines to control the invasion of aquatic nuisance species in ballast water. The U.S. Coast Guard's interim final rule was issued on May 17, 1999. The rule provides for:

- Mandatory ballast water exchange (or use of an equally effective technology) for ships entering the Great Lakes from beyond U.S. waters;
- Mandatory ballast water reporting and sampling procedures for most vessels; and
- Voluntary ballast water management guidelines for most vessels, to ensure to the maximum extent practicable that ANS are not discharged into waters of the United States.

At the direction of NISA, the U.S. Coast Guard regulation exempts two classes of vessels from parts of its requirements: oil tankers engaged in coastwise trade, and certain passenger vessels possessing ballast water treatment systems.[65]

NISA gave the U.S. Coast Guard the responsibility to decide whether any proposed ballast water treatment technology is as effective as ballast water exchange in preventing ANS. The U.S. Coast Guard recently published a *Federal Register* notice asking for comments on a proposed outline for approval of alternative ballast water technologies. The notice also asked for comments on how the U.S. Coast Guard could best provide incentives for developing new ballast water technologies.[66]

NISA also required the Secretary of Transportation to report to Congress in this year on the effectiveness of voluntary ballast water exchange management guidelines, and to amend the regulations and guidelines if they are not effective.[67] If the reason they are not effective is inadequate compliance, or if the level of reporting is inadequate to assess the level of compliance, NISA provided the U.S. Coast Guard the authority to make the voluntary guidelines mandatory.[68]

NISA gave the U.S. Coast Guard broad authority to establish procedures that "all vessels equipped with ballast water tanks that operate in waters of the United States"[69] should follow to prevent ANS introductions in ballast water, and the authority to make the procedures mandatory and enforceable, with civil and criminal penalties for noncompliance ($25,000 per violation per day civil penalties are set; knowing violation is a Class C felony).[70] Despite this broad grant of authority, NISA did limit U.S. Coast Guard action. Except for vessels entering the Great Lakes from beyond the U.S. EEZ, NISA does not authorize the Coast Guard to make its ballast water management guidelines mandatory until it has reported to Congress on the effectiveness of its program.

The U.S. Coast Guard has long had a program in place to disseminate information on ANS, and on methods to reduce or prevent their spread in ballast water, and to encourage compliance with the previous ballast water management requirements and guidelines under 33 CFR 151. With the modification of 33 CFR 151 to implement NISA, the U.S. Coast Guard is adapting its program to the new regulations.

The Commandant of the U.S. Coast Guard recently affirmed the Coast Guard's commitment to control of ballast water ANS by writing that "establishing a regime that effectively and efficiently addresses the introduction and transfers of potentially harmful aquatic organisms via ballast water is my highest marine environmental protection priority."[71]

(2) National Ballast Water Clearinghouse

The U.S. Coast Guard was directed by NISA to develop a National Ballast Water Information Clearinghouse in conjunction with the Smithsonian Environmental Research Center (SERC). This national database, located at SERC, plays a central role in the management and analysis of data on the transfer and invasion of nonindigenous species associated with ballast water, including compilation of the ballast water management reporting forms required of ships by 33 CFR 151.

The first annual report of the Clearinghouse included a description of the Clearinghouse's function of collecting data on national ballast water management practices, in the form a "National Ballast Survey":

> A key element of NISA involves tracking the effectiveness of voluntary guidelines, as measured by (a) the level of compliance with voluntary guidelines, (b) changes in the rate and patterns of ballast water delivery, and (c) reduction in the rate of ballast-mediated invasions. The Clearinghouse was created to provide these analyses on a national scale. The Clearinghouse and the USCG have implemented a nationwide program, the National Ballast Survey (NABS), to measure ballast water management and delivery patterns for commercial vessels that arrive to U.S. ports from outside the nation's EEZ.
>
> The NABS was designed explicitly to create a national database on ballast water to be used to measure: (1) Rates of compliance with the ballast water reporting requirement; (2) Rates of compliance with the voluntary management guidelines for holding or exchanging ballast water; (3) Patterns of ballast water delivery and management (including exchange) according to vessel class for geographic region and season of arrival; (4) Among-year changes in ballast water management by vessel class and geographic region; and (5) Accuracy of data through use of multiple, independent data sources.
>
> The NABS currently relies on three primary sources of data. These include:
>
> 1. Ballast water information reported directly to the Clearinghouse by arriving vessels;
>
> 2. Foreign waterborne Transportation statistics collected by the U.S. Customs Service and the U.S. Army Corps. of Engineers. These data on vessel arrivals to U.S. ports are compiled by the Department of Transportation's Maritime Administration (MARAD);
>
> 3. Verification surveys of vessels, arriving from outside the EEZ, that are conducted nationwide by the USCG.[72]

The report found a low level of compliance with mandatory reporting of ballast water management practices: Only 20.8% of arrivals subject to the reporting requirement submitted reports in the first 12 months of the regulatory program.

With such a low reporting rate, it was difficult to estimate the overall level of compliance with ballast water management guidelines. The report found that, of all ships that submitted reports:

- 70.7% indicated no intention to discharge ballast water within U.S. territory;
- 14.1% declared no exchange of ballast water prior to discharge;
- 8.9% declared partial exchange of ballast water prior to discharge; and
- 6.3% declared complete exchange of ballast water prior to discharge.

The report concluded, "Vast improvements in both reporting compliance by ships and implementation of the U.S. Coast Guard Verification Surveys are required to characterize compliance with the voluntary guidelines as requested under NISA. Without improved reporting, we cannot estimate nationwide compliance from submitted information and must rely on U.S. Coast Guard Verification Surveys, which remain inadequate for this purpose."[73] As discussed in section 3.a.ii.(1), NISA provided the U.S. Coast

Guard the authority to make voluntary requirements mandatory if the level of reporting was inadequate to allow compliance to be assessed.

(3) Aquatic Nuisance Species Task Force (ANSTF)

Established under NISA, the ANSTF is an interagency group responsible for coordinating governmental efforts related to ANS in the United States with those of the private sector and other North American interests.[74] The ANSTF is chartered under the Federal Advisory Committee Act.[75] Recently the ANSTF drafted a resolution which committed the body to "eliminate, as soon as possible, ships' ballast water as a significant pathway for the introduction of invasive species into American waters."[76]

The role of the ANSTF in approving State ANS Management Plans is discussed in section 3.c.i.

EPA has been represented on the ANSTF since its inception. EPA also has representatives on the Ballast Water and Shipping Committee of the ANSTF, which works closely with the U.S. Coast Guard to help identify alternative ballast water management technologies and gauge their effectiveness. EPA is also a member of the Ballast Water Program Effectiveness and Adequacy Criteria Committee, which provides to the ANSTF, to be forwarded to the U.S. Coast Guard, recommended criteria for assessing whether the requirements and guidelines implemented by the U.S. Coast Guard program are effective at reducing the risk of species invasion.

(4) Ballast Technology Demonstration Program

Section 1104 of NISA instructed the Secretary of the Interior and the Secretary of Commerce, with the concurrence of, and in cooperation with, the Secretary of Transportation, to undertake a demonstration of technologies and practices which may prevent introduction and spread of nonindigenous species through ballast discharge. The demonstration program was authorized at $2.5 million over 3 years. NISA directed that technologies and practices identified as promising in the 1996 National Research Council study (discussed in section 2.e.iii) be given priority.[77]

(5) Environmental Protection Agency's Role under NISA

The primary agents of the Executive Branch charged with implementing NISA were the U.S. Coast Guard, the Secretary of the Department in which the Coast Guard is operating (the Secretary of Transportation, in peacetime), and the Aquatic Nuisance Species Task Force. EPA also has some explicit responsibilities under NISA. They include:

- Participating on the Aquatic Nuisance Species Task Force,[78] and
- Providing, in cooperation with the National Science Foundation and the Task Force, competitive research grants for projects that identify environmentally sound methods for controlling the dispersal of aquatic nuisance species.[79]

iii. Act to Prevent Pollution from Ships (APPS)[80]

This statute is the U.S. implementation of several Annexes to the MARPOL (also known as "the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978" or "MARPOL 73/78"). Regulations implementing APPS are promulgated and enforced by the U.S. Coast Guard. APPS applies to all U.S. flag ships anywhere in the world, and to all foreign flag vessels operating in the navigable waters of the United States or while at a port or terminal under the jurisdiction of the United States. APPS's regulations limit discharges of substances covered by MARPOL, establish report requirements for discharges, and establish specific requirements for monitoring equipment and record-keeping aboard vessels. Ballast water is currently not covered by MARPOL (unless it is contaminated with

oil or other substances covered by MARPOL), or by APPS.

iv. Current Activities Under the Clean Water Act (CWA)[81]

(1) Section 303

Section 303(c) of the Clean Water Act requires States to consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial and other purpose, when adopting or revising water quality standards.[82] Under §303(d), States must list waters "for which the effluent limitations ... are not stringent enough to implement any water quality standard applicable to such waters."[83] and list the sources of impairment of those waters. State waters extend three miles. In the current State list, 26 water bodies in five States (California, Iowa, North Dakota, Idaho, Oklahoma) are listed as impaired from "exotic species," "exotic plant species," "exotic vegetation," or specific nonindigenous plants such as Eurasian Watermilfoil. Over 800 waters are listed as impaired from "noxious aquatic plants." Whether these noxious plants are alien or native was not specified.

The California State Water Resources Control Board and the San Francisco Bay Regional Water Quality Control Board have listed waters of San Francisco Bay as impaired by exotic species as a high priority for TMDL development.

EPA has not previously issued any national regulation or guidance of general applicability that would require an NPDES permit for discharges associated with ballast water. Furthermore, EPA has not made any determination under 33 USC 1342(a)(2) about the suitability of TMDLs for exotic species in ballast water.[84] However, in its response to the Water Quality Control board, EPA stated its strong support for the State's emphasis on protecting the Bay ecosystem from the effects of exotic species, including its development of TMDLs for exotic species.[85]

(2) Section 311

Section 311 of the Clean Water Act prohibits the discharge of oil or hazardous substances, in such quantities as may be harmful, into or upon: U.S. navigable waters, adjoining shorelines, waters of the contiguous zone, and in certain other waters in connection with activities that may affect natural resources. The discharge of ballast water into these waters is prohibited if it contains a harmful quantity of oil or a CWA section 311 hazardous substance. Oil discharges are generally considered to be harmful if they violate a water quality standard or cause a film, sheen, discoloration, sludge or emulsion. However, the discharge of oil is not considered harmful in some circumstances, such as when it is permitted under MARPOL 73/78, Annex I, as provided in 33 CFR 151, Subpart A.

(3) Section 312

EPA and the Department of Defense recently promulgated regulations under CWA 312(n) which identify ballast water and other discharges specifically from Armed Forces vessels as subject to enforceable discharge standards.[86] Note that the CWA definition of "pollutant" was amended in 1996 to exclude Armed Forces vessel discharges covered under Section 312(n).[87] This means that rather than being subject to NPDES permit requirements, the 312(n) standards are directly applicable to Armed Forces vessels.

v. Other Federal Laws

Appendix B discusses other laws with possible application to ballast water, including the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA).

b. International Actions

i. Foreign Laws

Several countries that have had particular problems with ballast water ANS have taken action to minimize or prevent the introduction of other species in the future. The following table briefly summarizes several other countries' programs to control ballast waters discharges.[88]

Country	Ballast Water Rules
Australia	As of July 2001, Australia requires mandatory ballast water management arrangements for all international vessels arriving in Australian ports or waters. The arrangements incorporate a decision support system which provides vessels with a risk assessment of the ballast water for introductions of ANS, establishes a ballast water reporting system, and verification inspections.[89]
Bonaire	Prohibits dumping of ballast water in its coastal waters[90]
Canada	The Canada Shipping Act was revised on Oct 31, 1998 to authorize regulations respecting the control and management of ballast water. These regulations have not yet been written.[91]
Israel	All ships destined for Israeli ports must exchange any ballast water in open seas, beyond any continental shelf or fresh water current effect. Ships visiting Eilat must exchange outside the Red Sea and ships visiting the Mediterranean ports must exchange in the Atlantic.
Chile	Mandatory requirements on ballast water were introduced in 1995. Any ship coming from zones affected by cholera or similar contagious epidemic should renew ballast water at least 12 nautical miles from coast. Where no proof of ballast water exchange is available, chemicals (powdered sodium hypochlorite or powdered calcium hypochlorite) must be added to ballast water prior to deballasting in port.
Panama Canal	Discharges of any kind are prohibited in the Panama Canal.
Argentina	Since the early 1990s, Buenos Aires port authorities require chlorination of ballast water for ships calling at the port. Chlorine is added to ballast water via the ventilation tubes of ballast tanks.
New Zealand	Voluntary guidelines have been in place since 1992. Vessels should provide (1) evidence of origin of ballast water, and certification that it is free from toxic dinoflagellates, (2) evidence of ballast water exchange at sea, or (3) evidence that ballast water has been disinfected.

ii. International Agreements

(1) International Maritime Organization (IMO)

In 1997, the IMO adopted voluntary ballast water management guidelines to minimize the transfer of harmful aquatic organisms and pathogens. Members of the Ballast Water Working Group of the Marine

Environmental Protection Committee (MEPC) of the IMO are now attempting to draft an international agreement that would make mandatory the management of ballast water discharges. EPA actively participates as a member of the U.S. delegation in the preparations for, and the negotiations during, the meetings of the Ballast Water Working Group of the Marine Environmental Protection Committee of the IMO. In April 2001 the MEPC considered a draft text of an international ballast water instrument drafted by the United States. The U.S. draft was accepted by the MEPC as the base document for further development of the treaty. In addition, over the next year, the U.S. is coordinating an international correspondence group to help develop an effective international standard. The U.S. has taken on this role to chair an intercessional standards drafting group, because the U.S. believes that development of an effective international standard is necessary for, and should be the basis of, this agreement. The United States will need to address to what extent, if any, the international agreement would limit what it and individual States can do to regulate ballast water discharges in their jurisdictions. U.S. domestic implementation of this instrument is expected to be accomplished through existing domestic legislation.

(2) International Joint Commission (IJC)

The 1909 Boundary Waters Treaty established the IJC to assist the governments of the United States and Canada in finding solutions to problems in the rivers and lakes that lie along, or flow across, their common border. The problem of ANS has been recognized by the IJC since at least 1988, when they called upon the Canadian and United States to respond to the discovery of the ruffe and the zebra mussel in the Great Lakes.[92]

In May 2000, the Water Quality Board of the IJC released a report which singled out ballast water discharges as the most important source for ANS entering the Great Lakes basin. The report recommends the following to the Canadian and United States governments:

- Development of binational ballast water discharge standards, to be enforced on all ships in the Great Lakes basin;
- Investment in resources directed to ballast water treatment technology development;
- Adoption of short-term emergency ballast water treatment measures, such as use of chemical biocides, until long-term treatment technologies are developed;
- Implementation of a program to publicly recognize the efforts of shippers entering the Great Lakes basin that engage in best management practices for ballast tank sediment control;
- Encouragement of vessel design modifications as appropriate for existing and new vessels, as a means of facilitating ballast water exchange on the open seas, and the effectiveness of other measures being considered; and
- Development and implementation of effective contingency plans for responding to (i) the accidental discharge of untreated ballast water resulting from a collision or grounding of a vessel in the Great Lakes basin; (ii) the initial discovery of a new ANS in the Great Lakes basin ecosystem; and (iii) the discovery of an ANS in a region previously thought to be free of such organisms.[93]

(3) Other Treaties and Agreements [94]

- The General Agreement on Tariffs and Trade (GATT) in which Article XX(b) acknowledged the need for parties to protect themselves from harmful ANS. This article legitimized trade restraints, such as quarantine regulations, that are necessary to protect the life or health of humans, animals, or plants.

- The International Plant Protection Convention (1972), covered agricultural pests.

- The International Convention on Biological Diversity (signed in 1993, but not yet ratified by the U.S. Senate) contains a provision to control, eradicate, or prevent the introduction of those alien species that threaten ecosystems, habitats, or species.

- The United Nations Convention on the Law of the Sea (UNCLOS) is the sole multinational convention with provisions specific to marine introductions. (In 1994, UNCLOS came into force provisionally; the U.S. has signed, but not ratified, this agreement.) In particular, Article 196, paragraph 1 states:

  "States shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto." (Emphasis added)

- The United Nations Conference on Environment and Development (UNCED 1992) (a.k.a. "Agenda 21") is entitled "Protection of the Oceans, All Kinds of Seas, Including Enclosed and Semi–enclosed Seas, and Coastal Areas and The Protection, Rational Use and Development of Their Living Resources." Section 17.30(a)(vi) of this agreement considers "the adoption of appropriate rules on ballast water discharge to prevent the spread of non-indigenous organisms."

- Section 11.64 of the Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES) primarily addresses trade in alien species; however, it recognizes the threat alien species pose to biodiversity, and the need for a synergistic association between this agreement and the International Convention on Biological Diversity.

c. State And Regional Programs

i. State ANS Management Plans

NISA directed States to develop ANS Management Plans. NISA provides the opportunity for Federal cost–share support for a Plan's implementation once it is approved by the ANS Task Force. NISA requires that each Plan:

- Identify and describe State and local programs to prevent and control ANS;

- Identify Federal activities that may be needed to prevent and control ANS, and describe the manner in which those activities should be coordinated with State and local government activities;

- Identify any authority that the State does not have at the time of the development of the plan that may be necessary for the State to protect public health, property, and the environment from harm by ANS; and

- Have a schedule of implementing the plan, including a schedule of annual objectives, and enabling legislation.[95]

The following States and regions have approved ANS Management Plans:

- Iowa
- Illinois
- Michigan
- New York
- Ohio
- Washington
- St. Croix National Scenic Riverway (MN/WI)
- Lake Champlain Basin (VT/NY).

States and regions in various stages of preparing ANS Management Plans include:

- Alaska
- California
- Florida
- Hawaii
- Massachusetts
- Minnesota
- Missouri
- Oregon
- South Carolina,
- Wisconsin,
- Chesapeake Bay (MD/VA/PA/WV/NY)
- Colorado River Basin (AZ/CO/NM/WY/NV).

The Plans of a few active States are discussed briefly below.

(1) Michigan

Michigan was one of the first States to complete an ANS Management Plan. Michigan's Plan calls for information and education, impact assessment, monitoring, research, regulation and policy development. The Plan details these objectives and specifies activities for achieving them. The Plan also provides the framework for a long-term commitment by the State to combat ANS. The Plan does not advocate the development or adoption of specific new laws or regulations, nor does it specify modifications to existing controls.

Although essentially a plan for State action, Michigan's Plan recognizes the importance of a global approach to ballast water control:

> Long-term strategies for effectively eliminating the risk of intercontinental transfers of harmful organisms by shipping will require a coordinated regional approach, possibly a global one. Examination of ships and their discharges, new and continued research and development, and implementation of existing and anticipated measures will necessitate coordination worldwide if programs are to be as effective as they could be at preventing introductions of harmful organisms.[96]

The plan also notes the value of cooperation with shippers, and of a balanced approach employing both regulatory and voluntary elements:

> Similarly the cooperation of shippers and ships' crews should be actively recruited wherever possible in order to maximize the effectiveness of preventive programs. Keys to shipping industry cooperation are an understanding of the problem, reasonable-cost preventive procedures, and positive feedback to cooperators. Preventive programs should be as effective and environmentally safe as possible. Although regulations may or may not be necessary or desirable in the short term or in certain circumstances, resource managers should seek legislative authority which would permit rapid action as necessary. Comprehensive regulations will almost certainly be needed eventually in order to implement long-term solutions and to help ensure responses that are consistent with the magnitude of the problem.
>
> An excellent example of cooperative efforts was the adoption of voluntary ballast water management guidelines by the maritime industry to control the range expansion of the ruffe from Duluth Harbor, Minnesota. Support of the guidelines came from the Lake Carriers' Association, U.S. Great Lakes Shipping Association, Seaway Port Authority of Duluth, Thunder Bay Harbor Commission, Canadian Shipowners Association, and the Shipping Federation of Canada. The guidelines demonstrate that owners and operators of vessels in the domestic and international trade on the Great Lakes recognize their role in assisting the governments of United States and Canada in controlling the introduction and spread of nonindigenous species.[97]

As part of Michigan's plan implementation, the Governor of Michigan recently requested that a task force be established under the Council of Great Lakes Governors. The purpose of the task force is to explore, outline and advise the Great Lakes Governors on a range of options to inhibit the further introduction of ANS from ballast water. The Governor also expressed his wish to enhance protection efforts by addressing ships reporting "no ballast on board" (NOBOBs) under the current federal regulatory regime. These vessels are not subject to the high-seas ballast water exchange program pursuant to federal law yet contain a large amount of residual sediment that may harbor ANS.

In response to the Governor's request, the Michigan Department of Environmental Quality convened in April

2001 a Work Group of technical experts from international and lake carriers and the U.S. Coast Guard to examine potential ballast water treatment options. The goal statement of the workgroup is to prevent future introductions via ballast water within twelve months. The Ballast Water Technical Work Group will advise the Council of Great Lakes Governor's task force.[98]

(2) Washington

Washington's ANS Management Plan has the goal to fully implement a coordinated strategy that will:

- Minimize the risk of further ANS introductions into Washington waters through all known pathways;
- Where practical, stop the spread of ANS already present; and
- Eradicate or control ANS to a minimal level of impact, by the year 2002.

The Plan is focused on the identification of feasible, cost-effective management practices to be implemented in partnership with tribes, private, and public interests for the environmentally sound prevention and control of ANS.[99]

ii. Historical State Laws and Regulations

Many States have long had laws or regulations governing management of ballast water. Historically, most of these laws and regulations were designed to prevent discharge of oil from tanks that hold both fuel or cargo oil and ballast water. Some, such as California and Illinois, explicitly excluded segregated ballast tanks (tanks which are dedicated to ballast water and never hold oil) from their regulations. Some, such as Virginia, excluded all ballast water discharges from certain regulations that prevent the discharge of chemicals. Appendix A contains excerpts from some of these laws and regulations.

iii. Recent State Laws to Address Ballast Water ANS

(1) California

On October 8, 1999, the Governor of California signed Assembly Bill 703, which deals specifically with the problem of ballast water ANS. The bill references the Porter-Cologne Water Quality Control Act, under which the State Water Resources Control Board and the California Regional Water Quality Control Boards are the principal State agencies with regulatory authority for water quality.

The bill does not specify ballast water treatment technologies, discharge standards, or specific ballast water permitting requirements, but instead charges the Regional Water Quality Control Boards to develop these requirements and permitting procedures. The Bill, however, does require in the short-term mandatory ballast exchange or equivalent treatment, and in the long-term, updated treatment technologies phased in as they become economically and technologically achievable. The bill also requires ships to prepare ballast water management plans, and to report ballast water discharges using the U.S. Coast Guard reporting form. The bill took effect on January 1, 2000. Assembly Bill 703 is included in Appendix A.

(2) Washington

On February 14, 2000, the Washington Senate unanimously passed Substitute Bill 6293, "An act relating to ballast water management; adding a new chapter to Title 75 RCW; and prescribing penalties." The bill, which drew upon the California Bill, NISA, and NISA's regulations, calls upon the Washington Department of Natural Resources to establish discharge standards for ballast water, which "where practical and

appropriate, ... shall be compatible with standards set by the United States Coast Guard and shall be developed in consultation with Federal and State agencies to ensure consistency with the Federal Clean Water Act."

After July 1, 2002, ballast water discharges from a vessel are only authorized if the water has been exchanged, or if the ballast water meets State standards. The bill also requires reporting of ballast water discharges using U.S. Coast Guard-acceptable forms, and directs the Department to work with the private sector and Federal and State agencies on a project to establish a ballast water treatment operation that is capable of servicing vessels at all Washington ports. Substitute Bill 6293 is included in Appendix A.

(3) Maryland

On May 11, 2000, the Governor of Maryland signed into law (Chapter 473) House Bill 1305, "Ballast Water Management - Reporting and Prohibition." The law took effect October 1, 2000, and requires the reporting of ballast water management activities by all vessels entering Maryland waters. In contrast, the U.S. Coast Guard requires reporting by ships arriving from beyond the EEZ, and only at the first port of call, in their regulations implementing NISA (discussed in section 3.a.ii.(1)). The bill also calls for the adoption of Federal ballast water management guidelines, and establishment of consistent State guidelines for vessels not covered by the Federal guidelines. The bill also calls for cooperation between Maryland and the U.S. Coast Guard and the States of Virginia, Pennsylvania, and Delaware in the development and implementation of uniform standards for ballast water management, but places no time limits on this development or implementation. House Bill 1305 is included in Appendix A.

(4) Virginia

The General Assembly of Virginia approved on March 19, 2001, an act to amend the Code of Virginia by adding into Chapter 1 of Title 28.2 language relating to ballast water management. The language, included in Appendix A, establishes the same ballast water treatment and reporting requirements on ships entering Virginia waters from beyond the EEZ that are required for ships entering the Great Lakes from beyond the EEZ by U.S. Coast Guard regulations (discussed in section 3.a.ii.(1)).

(5) State Bills Introduced

Bills on the regulation of ballast water have been recently introduced in several other State legislatures, including Hawaii (HB 1164), Illinois (SB 25), Michigan (SB 955), New York (AO 2334), and Oregon (SB 895). A common feature of bills introduced in Great Lakes States is language requiring stricter controls on ballast water management than the U.S. Coast Guard regulations require. This language, from Michigan Senate Bill 955, is typical of the Great Lakes States' bills:

"SEC. 3109C. (1) A Person shall not operate a vessel on the waters of the State that contains ballast water that was acquired outside of the waters of the State unless the ballast water and any sediments have been sterilized as required by the Department."[100]

d. Local programs[101]

i. Humboldt Bay Harbor, Recreation and Conservation District, California

The Humboldt Bay Harbor, Recreation and Conservation District adopted a resolution in 1996 that established ballast water management requirements for all vessels entering the Bay. The resolution states:

> All vessels entering Humboldt Bay with ballast originating from a foreign port shall perform a mid-ocean exchange of ballast with due regard for the safety of the vessel. This shall be accomplished by voiding each ballast tank and refilling each ballast tank with mid-ocean water.

A "foreign port" as defined here shall include any port except those located on the west coast of North America.

If the Master deems the situation not safe for voiding tanks due to weather conditions or hull stress parameters, he may partially empty tanks, fill with mid-ocean water, and continue pumping through the overflow or vent until full exchange is reasonably assured.

The Master shall keep a record of all ballasting activities and file a statement of such activities with the Humboldt Bay Harbor, Recreation and Conservation District of its designee upon arrival in Humboldt Bay.

ii. Port of Oakland, California

In Oakland, port expansion necessitated a study of the environmental impact of increasing vessel calls and the resultant increase in the volume of ballast water discharged into the waters of the San Francisco Bay. The Board of Port Commissioners established Tariff No. 2-a to address the need to find mitigation for the impact of their expanded facilities. The tariff provisions, summarized below, were adopted in June of 1999, with an effective date of August 1, 1999.

General requirements: No vessel using Port terminal facilities shall discharge water ballast from the vessel into San Francisco Bay or the Gulf of the Farallones National Marine Sanctuary offshore of San Francisco Bay, including open waters within the Port Area of the City of Oakland, unless the vessel immediately before arrival in the San Francisco Bay has carried out an ocean ballast water exchange to limit the possibility of transferring non-indigenous species into San Francisco Bay. Exchange shall occur in the oceans westerly of the western boundaries of established marine sanctuaries adjacent to the West Coast of California.

Exceptions to the general requirements:

- Vessels arriving from ports located between the southern boundary of Baja California and the northern boundary of Alaska, if the ballast water to be discharged originated from those waters.
- Vessels providing proof of compliance with International Maritime Organization (IMO) Resolution A774(18) (Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens form Ships' Ballast Water and Sediment Discharges);
- Vessels on which ocean exchange was not made because of stress of weather or stability or hull stress concerns.[102]

iii. Ports of Los Angeles and Long Beach, California

The Ports of Los Angeles and Long Beach do not currently have an established program to control the introduction of ballast water ANS. These ports do, however, have a policy of encouraging their customers to comply with the U.S. Coast Guard's (voluntary) exchange guidelines.

NONREGULATORY APPROACHES TO BALLAST WATER CONTROL

e. Support the U.S. Coast Guard's Ballast Water Regulation Program

As discussed in section 3.a.ii.(1), the U.S. Coast Guard has had a program in place to encourage compliance with the previous ballast water management requirements and guidelines under 33 CFR 151. With the modification of 33 CFR 151 to implement NISA, the U.S. Coast Guard is adapting its program to the new regulations. If an international agreement on ballast water is implemented domestically by APPS, the U.S. Coast Guard will presumably adapt its program to encourage compliance with APPS as well.

The U.S. Coast Guard has recognized that the success of its ballast water regulations depends not just on the efficiency and completeness of enforcement efforts, but on the regulated community's awareness of the problem posed by ballast water ANS, and acceptance of the measures in place to combat this problem. For this reason, the foremost effort of the U.S. Coast Guard's ballast water program is educating the maritime community of the impacts of ANS and the need for control.[103]

Other elements of the U.S. Coast Guard's program include collection of information gathered on ballast water management practices, research and development of new ballast water management technologies, and coordination with the International Maritime Organization and other organizations working toward control of species invasion in ballast water.

EPA has the experience and infrastructure to contribute substantially to U.S. Coast Guard's education and outreach, research and development, and coordination efforts (e.g., working with States and Tribes).

f. Establish a National Voluntary Partnership that Emphasizes Environmental Management Systems (EMS) Approaches to Controlling Ballast Water ANS

Building on existing programs and other partnerships with Ports, shippers, and key States like Michigan and California, EPA could work with the U.S. Coast Guard and other agencies to form a broad-based partnership to address all significant causes of ANS from ships.

This partnership could include representation from leading Federal agencies, States, industry representatives, and non-governmental organizations. Its primary objective would be to foster the adoption of best management practices, through EMSs, that would address a broad range of possible pathways for the introduction of ANS from ships and other sources. The Partnership would concentrate its efforts on developing tools that could be used by organizations that voluntary chose to participate. Each organization would adopt Best Management Practices (BMPs) through an EMS designed to address the most significant threat to waters from the introduction of ANS, and share information on the performance of the BMPs and other aspects of its EMS with the public. (BMPs are discussed further in section 3.i.) Initial funding and support for the Partnership could be provided by participating agencies and/or leading industry associations.

This approach would be generally modeled on the National Biosolids Partnership (NBP). The NBP was formed to complement the existing biosolids regulations and to address the very serious public acceptance problems many POTWs were facing when trying to land dispose of their biosolids. A primary goal of the NBP was the development of methodologies and other tools to assist POTWs in complying with regulatory requirements and performing beyond those requirements. To help facilities adopt EMSs for their particular biosolids programs, the NBP has developed or is developing:

- A Code of Good Practice which lays out aspirational goals for facilities to aim for;
- A National Manual of Good Practice which compiles a number of existing biosolids management practices and gives facilities guidance on which practices are most appropriate for a given biosolids

disposal method (i.e., land application, incineration, etc.);

- A set of Common Procedures for facilities to use when establishing their EMSs and accompanying EMS guidance. These are quite similar to the elements of the ISO 14001 Voluntary International Standard for EMSs; and

- A system for qualified third parties (i.e., auditors) to certify that the EMS is operating effectively as a way to increase public confidence.

All of this is being done through a consensus approach involving POTWs, contractors, regulators (State and Federal), and others. It is not intended to supplant existing biosolids regulations.

Compliance with applicable regulations is a must for an effective EMS, but the EMS is intended to go further. Its real goal is to identify and, over time, reduce impacts from a full range of environmental insults to all media.

This last point is relevant to the ballast water issue. There are undoubtedly a number of ways for ANS to get into waterways, not just through ballast water. The ANS problem should be addressed comprehensively; just focusing on ballast water may be short-sighted.

EPA believes this approach is preferable as a first step because it facilitates the development of a technologies. It is very important to note that while this approach has been listed as a "non-regulatory approach" it could also be used to supplement a regulation change to bring ballast water discharges into the NPDES program. In fact, the Voluntary Partnership may lay the ground work for the regulation change and it is likely to enhance the effectiveness of those regulations.

g. Support Other ANS Programs

i. Aquatic Nuisance Species Task Force (ANSTF)

As discussed in section 3.a.ii.(3), EPA sits on the Aquatic Nuisance Species Task Force, and on the ANSTF's regional panels, the Ballast Water and Shipping Committee, and the Ballast Water Treatment Effectiveness and Criteria Committee. The Task Force works closely with States, regional bodies, and the U.S. Coast Guard, and active participation on the Task Force and its panels and committees continues to be an effective way to maximize EPA's contribution to resolving the ANS problem.

ii. Invasive Species Council

EPA also sits on the Invasive Species Council, and was active in the preparation of the National Invasive Species Management Plan described in section 3.a.i. EPA supports the Council in the implementation of the National Invasive Species Management Plan's recommendations.

iii. Interagency Committee on the Marine Transportation System

An interagency workgroup led by DOT and including EPA was established to address the problems that threaten the ability of U.S. ports, waterways, and intermodal connectors to remain safe, environmentally sound, and competitive into the next century. A National Marine Transportation System Conference brought together high-level government and nongovernment representatives in November, who identified issues and recommended actions. Ballast water ANS was identified as a major environmental issue. The conference supported ballast water regulations under U.S. Coast Guard lead and recommended further research.[104]

iv. National Estuary Program (NEP)

Nonindigenous species invasion has been recognized by the National Estuary Program as a serious concern. In Congressional testimony on July 13, 1999, Deputy Assistant Administrator for Water Dana Minerva listed introduction of invasive species as one of the seven most common problems affecting the 28 estuaries in the NEP. Nine of the 28 National Estuary Programs have identified introduced species as a high or medium priority, and many NEP Comprehensive Conservation and Management Plans include measures to prevent or mitigate damage from invasive species.

v. Coral Reef Task Force

The interagency Water and Air Quality Working Group of the Coral Reef Task Force has recognized that the discharge of ballast water at coral reef sites may be harmful to reef ecosystems, and that the introduction of ANS may be one aspect of this harm. They have recommended that the U.S. Coast Guard consider the impacts of ballast water management on coral reefs when preparing their regulations to implement NISA.

vi. Voluntary Partnership with Ports

As part of the "Green Ports" program, EPA has worked with the American Association of Port Authorities, the Urban Harbors Institute, and the California Association of Port Authorities to support port-initiated efforts that address environmental issues, including ballast water management. Recently this program was expanded to include a "Green Ships" program, in which EPA, working with the Chamber of Shipping of America and perhaps other partners, will address environmental issues (including ballast water) of particular interest to ships.

h. Support State Ballast Water Programs

State ANS Management Plans often emphasize nonregulatory over regulatory approaches at the State level. Michigan's plan, for example states that:

> This Management Plan does not advocate the development or adoption of specific new laws or regulations, nor does it specify modifications to existing controls. Additional research, public comment and a review of non-regulatory alternatives will be needed to determine whether new or modified laws, rules or policies are feasible and appropriate. In particular, the regulatory approach should be employed only where it will be more effective than alternative methods of control.[105]

At the same time, State plans often depend on a coordinated Federal plan. Michigan's plan continues, "In addition, the plan sends the message that the Federal government has not met its responsibility to control further introductions of ANS."

REGULATORY APPROACHES TO BALLAST WATER

i. Overview of the NPDES Program

The NPDES program regulates the discharge of pollutants from point sources to waters of the United States. The terms which trigger NPDES requirements: "point sources", “waters of the United States” and "discharges of pollutant" are defined broadly, thus extending the reach of the NPDES program to a large number of facilities. At this time, there are approximately 60,000 State and Federal NPDES permits covering some 250,000 facilities. NPDES coverage can be provided by individual or general NPDES permits. General NPDES permits cover a number of similar dischargers usually within a specified geographic area, whereas an individual permit will cover a single discharger.

NPDES permits typically impose numeric effluent limits based on technology-based treatment or control standards including:

- Limits based on Best Available Technology Economically Achievable (BAT) for the direct discharge of toxic and nonconventional pollutants;
- Limits based on Best Conventional Pollutant Control Technology (BCT) for conventional pollutants (total suspended solids (TSS), biological oxygen demand (BOD), fecal coliform, bacteria, oil and grease, and pH) from industrial sources;
- Limits based on Secondary Treatment requirements for direct discharges from municipal sewage treatment facilities; and
- Limits based on Best Available Demonstrated Control Technology for new sources.

When technology-based limits alone are insufficient to meet water quality standards in receiving waters, NPDES permits also impose water quality-based effluent limits.

Permits may also impose non-numeric permit conditions known as best management practices (BMPs) on dischargers in place of, or in conjunction with, numeric effluent limits to prevent or control the discharge of pollutants. The focus of most BMPs is pollution prevention. They often consist of procedures or practices to control plant site runoff, spillage, leaks, sludge or waste disposal, and treatment of drainage from raw materials storage. Finally, NPDES permits impose a number of standard conditions, including reporting and monitoring requirements.

Violation of any of these conditions is subject to a wide range of enforcement actions, including administrative, civil, and criminal penalties as well as third-party citizen suits. All NPDES-permitted facilities are subject to inspection by EPA and/or States.

The NPDES program is largely implemented by States authorized by EPA to operate their own NPDES programs (known as “authorized State programs”) under State law. Tribes and U.S. Territories may also receive EPA approval to operate their own NPDES programs. States are not required to have NPDES requirements that are identical to those of the Federal government, provided that minimum Federal requirements are met. State regulations frequently differ from those of the Federal government and from other States. When EPA revises an NPDES regulation that is applicable to States, States must adopt comparable provisions within one year (or within two years if a State has to amend its authorizing statute).[106]

Once a State receives authorization, EPA stops issuing permits in that jurisdiction. However, EPA can continue to conduct enforcement in authorized States. This includes enforcing against State NPDES permit violations. EPA retains permitting authority in Indian Country, and for Federal facilities if a State has not

received authorization to regulate Federal facilities. At present, forty-four States and one U.S. territory (U.S. Virgin Islands) have approved NPDES permitting programs. EPA still issues permits for Alaska, Idaho, Arizona, New Mexico, Massachusetts, New Hampshire, U.S. Territories (other than the U.S. Virgin Islands), discharges in Indian Country, and Federal facilities in Colorado, Vermont, Delaware, Florida, and Washington.

State permitting authority is considered to extend to the territorial seas. For point sources that operate beyond the territorial seas, EPA is the permitting authority.

j. Ballast Water ANS as Pollutants

The NPDES program regulates discharges of pollutants. A pollutant is defined in CWA section 502(6) broadly to include "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water." Several types of materials are expressly excluded from this definition, including sewage from vessels, discharges incidental to normal operation of a vessel of the Armed Forces, and certain materials related to oil or gas production. Different biological organisms, such as bacteria (e.g., fecal coliform), algae, dead fish, live fish, fish remains, and plant materials have been considered pollutants under this definition by various courts. Although some ballast water ANS may be pollutants, EPA has not determined whether all ANS meet this definition.

k. The Current Vessel Exemption from NPDES Permit Requirements

The NPDES regulations at 40 CFR 122.3(a) exclude from NPDES requirements:

> Any discharge of sewage from vessels, effluent from properly functioning marine engines, laundry, shower, and galley sink wastes, or any other discharge incidental to the normal operation of a vessel. This exclusion does not apply to rubbish, trash, garbage, or other such materials discharged overboard; nor to other discharges when the vessel is operating in a capacity other than as a means of transportation such as when used as an energy or mining facility, a storage facility or a seafood processing facility, or when secured to a storage facility or a seafood processing facility, or when secured to the bed of the ocean, contiguous zone or waters of the United States for the purpose of mineral or oil exploration or development.

This exclusion was first promulgated in May 22, 1973 and its basis is found in the Clean Water Act.[107] Section 402 of CWA establishes the NPDES permit program to regulate the discharge of pollutants from point sources to waters of the United States. While CWA defines the term “point source” to include a “vessel or other floating craft,”[108] it distinguishes vessels from other point sources in several respects.

First, the discharge of sewage from vessels is regulated under a separate, non-NPDES program. The CWA’s definition of “pollutant” expressly excludes “sewage from vessels” within the meaning of Section 312.[109] Section 312 in turn, defined “sewage” to mean “human body wastes and the waste from toilets and other receptacles intended to receive or retain body wastes except that, with respect to commercial vessels on the Great Lakes, such term shall include gray water”.[110] As discussed in section 3.a.iv.(3), the CWA definition of “pollutant” excludes discharges incidental to the normal operation of a vessel of the Armed Forces, as part of the Uniform National Discharge Standard (UNDS) requirements of Section 312(n).

Second, the CWA defined “discharge of a pollutant” to include: “(A) any addition of any pollutant to navigable waters from any point source, (B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft”[111] (emphasis added). This distinction is significant, because the Clean Water Act treats navigable waters, the contiguous zone, and the ocean as distinct entities. “Navigable waters” are defined in Section 502(7) to mean the waters of the U.S., including the territorial seas. The “territorial seas” are defined in Section 502(8) as “the belt of the

seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three miles." The "contiguous zone" is defined in Section 502(9) to mean the entire zone established or to be established by the U.S. under article 24 of the Convention of the Territorial Sea and the Contiguous Zone. The Convention provides that "the contiguous zone may not extend beyond twelve miles from the baseline from which the breadth of the territorial sea is measured.[112] The "ocean" is defined in Section 502(10) as any portion of the high seas beyond the contiguous zone.*

The initial exclusion extended to "discharges of sewage from vessels, effluent from properly functioning marine engines, laundry, shower, and galley sink wastes, or any other discharge incidental to the normal operation of a vessel."[113] It did not apply to "rubbish, trash, garbage, or other such materials discharged overboard, nor to discharges when the vessel is operating in a capacity other than a vessel, such as when a vessel is being used as a storage facility or cannery."[114] When promulgating the exclusion, EPA explained in the preamble that "[m]ost discharges from vessels to inland waters are now clearly excluded from the [NPDES] permit requirements. This type of discharge generally causes little pollution and exclusion of vessel wastes from the permit requirements will reduce administrative costs drastically."[115]

In 1979, EPA modified the vessel exclusion to clarify that it does not extend to discharges when the vessel is operating in a capacity other than as a means of transportation, such as when being used as an energy or mining facility, a storage facility, or a seafood processing facility, or when secured to the bed of the ocean, contiguous zone, or waters of the United States for the purpose of mineral or oil exploration or development.[116] In proposing this language, EPA concluded that Congress did not intend to exclude discharges from vessels that are not used for the primary purpose of transportation from NPDES requirements.[117]

The regulatory history of Section 122.3(a) does not describe what types of discharges are incidental to the normal operation of a vessel, other than those specifically enumerated in the exclusion. However, it does give examples of discharges which would not qualify for the exclusion (e.g., discharges of rubbish, trash, garbage, or other such materials discharged overboard; and discharges when the vessel is operating in a capacity other than a means of transportation).

It is important to note that vessel exclusion is not a required element for State NPDES programs.[118] Thus, the NPDES national regulations do not prohibit States from using NPDES permits to regulate ballast water. This could result in a lack of uniformity as the ballast water discharges could be subject to multiple State and Federal regulatory regimes. Given the nature of vessel commerce, a coordinated national approach is preferred to a patchwork of regulations.

l. Approaches for Regulating Ballast Water Discharges with NPDES Permits

The use of NPDES permits to regulate ballast water discharges would present significant challenges to EPA and authorized States. NPDES permits can be a regulatory tool with enforceable requirements for controlling pollutant discharges. However, NPDES permits may have significant shortcomings with respect to the regulation of vessels.

First, the fact that States have primary responsibility for the NPDES program hampers its utility in providing uniform regulation of point sources, such as vessels that routinely move between States. EPA believes that as a general matter, it is better that mobile point sources such as vessels be subject to uniform

*On September 3, 1999, it was announced that President Clinton had signed a proclamation giving U.S. authorities the right to enforce environmental and other laws at sea within 24 nautical miles from shore, doubling the current 12 mile area. The Executive Order will not have the effect of amending any statutory definitions found in Section 502(9). It might, however, result in a movement to amend such definitions legislatively.

controls. While EPA has used the NPDES permits to regulate vessels and other floating craft, most of that regulation was directed towards vessels engaged in non-transportation related activities (such as oil and gas exploration, seafood processing, and seabed mining) in Federal waters (outside the three mile limit). Those sources could be regulated through a small number of EPA-issued general permits.[119]

However, most U.S. ports or other loading or off-loading facilities are in State waters where EPA does not issue NPDES permits. Cargo vessels bringing goods to U.S. ports or transporting goods between those ports could encounter multiple State permits, if ballast water were to be regulated under the NPDES program. Under such circumstances, it would be difficult for vessels to obtain coverage from, and comply with, those State permits, if they impose different or even conflicting requirements. This is especially true for riverine traffic, such as that in the Mississippi basin, or when foreign-flagged vessels travel to U.S. ports. Also, because ports may be engaged in stiff competition for vessel commerce, uniform requirements would prevent ports from seeking economic advantage over their competitors by having less stringent ballast water treatment requirements. In this report, EPA has attempted to consider some permitting approaches that may promote the use of uniform treatment standards.

Second, using the NPDES program to regulate ballast water discharges could subject ballast water discharges to overlapping regulatory regimes. NISA already imposes ballast water management requirements and there appear to be a number of existing and emerging State laws to control the introduction of ballast water ANS. The imposition of NPDES requirements on top of NISA and State laws may detract from those other efforts.

Third, using NPDES permits to cover ballast water discharges may impose permit requirements which cannot be met with current technology. For example, it is likely that a permit would have to prohibit the discharge of ballast water ANS to prevent violations of applicable water quality standards. However, the only known practical technology for ballast water treatment is mid-ocean exchange and that is ineffective in removing 100% of ballast water ANS 100% of the time. Also, if mid-ocean ballast water exchange is the primary treatment requirement imposed by NPDES permits, it will difficult to determine compliance with permit conditions. For example, it would be difficult for permitting authorities and citizens to determine whether a ballast water exchange had taken place.

If EPA concludes that regulating ballast water through the NPDES program is the best response to the issue of ballast water ANS, then EPA must determine how best to implement that conclusion. Three approaches for revising the NPDES program regulations to better control ANS introductions from vessel ballast water are discussed below:

- Revising the NPDES regulations to regulate ballast water discharges, using individual and or general permits, containing conditions based upon based on best professional judgement of the permit writer;
- Developing effluent limitation guidelines for discharges from vessels; and
- Working with U.S. Coast Guard on developing Section 402(g) provisions to regulate ANS.

i. Revising the NPDES Regulations

Under this approach, EPA would revise the vessel exclusion at 40 CFR 123.3(a) so that it would not extend to the discharge of ballast water. This scope of this revision could range from a relatively simple revision to the exclusion language to the establishment of a separate subpart in the regulations for regulating ballast water. The advantage of the latter approach is that it would provide clearer direction to States, stakeholders, and EPA permit writers on how ANS introductions can best be prevented through NPDES permits. This is similar to existing regulatory provisions for specific categories of point sources such as concentrated animal

feeding operations,[120] concentrated aquatic animal production facilities,[121] aquaculture projects,[122] municipal and industrial storm water discharges,[123] and silvicultural activities.[124] Regardless of scope, this rulemaking would be a complex undertaking with enormous implications for the NPDES program. It would extend NPDES permitting requirements to thousands of previously unregulated sources. Difficulties in promulgating the rule would be exacerbated if there are still no widely applicable treatment technologies to rid ballast water of ANS.

EPA believes it would probably couple any such rulemaking with the development of a general permit for ballast water discharges. This permit would provide coverage to EPA permitting jurisdictions and serve as a model for authorized States. A general permit would provide the benefits of increased uniformity and predictability over individual permits, and would reduce the administrative burden associated with this approach.

Time Required

This would be a complex undertaking due to the jurisdictional issues involved in regulating vessels under the Clean Water Act, the possibility of adding thousands of new dischargers to the NPDES program, and the potential economic impacts of such regulation. EPA would expect to receive and respond to a large number of comments and would have to prepare a detailed economic analysis for this rulemaking. EPA believes it could revise the vessel exclusion in two to three years.

Advantages

- A national regulation would allow the full force of the Clean Water Act, including its enforcement provisions, to be employed to prevent ANS introductions from ballast water discharges.
- A regulation could be probably drafted in a manner to allow States and permittees flexibility in meeting Federal requirements.
- EPA could involve the U.S. Coast Guard in developing and implementing the rule. With careful coordination between EPA and U.S. Coast Guard, it may be possible to harmonize NPDES and NISA requirements.

Disadvantages

- Failure to harmonize NPDES and NISA requirements would impose different regulatory regimes on the same activity.
- Regulation of ANS through NPDES permits may impinge on other State efforts to control ANS, because NPDES permit coverage would have to be obtained for ballast water discharges, even if they are covered by other ANS control programs.
- It will take time for any revisions to the NPDES regulations to be implemented through NPDES permits. It would take between two and three years for EPA to revise its NPDES requirements for ballast water. EPA's regulations provide that authorized States would then have between one and two years to revise their programs to reflect those changes to the NPDES national regulations. Issuing permits would likely take even more time. (The lag in issuing permits could be substantially shortened if EPA and the States were to develop permits at the same time they revised their programs.)
- As discussed previously, there is currently a lack of effective technologies to control or prevent ANS introductions. Further, NPDES permits can impose treatment levels but generally do not mandate specific treatment technologies. This limitation might cause problems depending on the

type of solution sought to control ballast water ANS. However, treatment practices can sometimes be imposed as best management practices (BMPs).

- The approach may lead to a lack of uniform requirements among authorized States, including the possibility of States exercising their right under CWA Section 510 to set more stringent standards.[125]

- The approach would significantly increase the number of permitted point sources and could entail high administrative costs and pose special challenges for EPA and the States.

ii. Development of a National Effluent Guideline under 304(b)

Once the NPDES regulations have been revised to regulate ballast water discharges, one way to promote more uniform requirements would be to establish an effluent guideline, applicable to all NPDES permits regulating ballast water. Effluent guidelines impose technology-based treatment or control standards on an industry-by-industry basis. An effluent guideline imposes a national level of treatment that must be met by all permittees subject to it, regardless of whether the permit is issued by EPA or an authorized State. While States can develop equivalent or more stringent effluent guidelines, in practice, most States rely on the Federal guidelines.

The development of an effluent guideline is a complex undertaking. To determine the best available technology economically achievable, EPA generally considers the affordability to the industry in question of the control technology upon which limitations are based. (Traditionally, EPA has looked at facility closures and firm failures, i.e., bankruptcies, to assess this statutory factor.) Because so many different industries use vessels and have vessel discharges, it would be a challenge for EPA to develop a methodology that will make sense for all vessel discharges. Also, because of the diversity of vessels at issue, it may be difficult to develop requirements that could technically be achieved by all vessels; it would be more likely that EPA would have to undertake separate analyses for different subcategories of vessels, thereby increasing the resources necessary to develop a rule.

Time Required

EPA believes that such a regulation would take between four to six years to develop.

Advantages

- Effluent guidelines promote uniform levels of treatment by imposing a national standard for State and Federal NPDES permits. While States can impose more stringent technology-based requirements, most States tend to rely on the national effluent guidelines.

- An effluent guideline provides clearer direction to EPA and authorized States on how to write permits to control ANS introductions in ballast water discharges.

Disadvantages

- Effluent guidelines take a great deal of time and resources to develop. EPA is required to collect a large amount of information for any industry it plans to regulate, so that the appropriate minimum level of treatment can be determined. This includes the consideration of economic impacts and the availability of treatment technologies. The costs and length of time for this guideline could be higher than normal because of EPA's lack of experience in regulating vessels, and the paucity of information on treatment technologies, which are mostly new and emerging.

iii. Ballast Water Treatment Requirements Based on CWA §402(g)

Another approach to promote uniform requirements once the NPDES regulations have been revised to regulate ballast water discharges may be for EPA to utilize Section 402(g) of the CWA, which provides that:

> Any permit issued under this section for the discharge of pollutants into the navigable waters from a vessel or other floating craft shall be subject to any applicable regulations promulgated by the Secretary of the Department in which the Coast Guard is operating, establishing specifications for safe transportation, handling, carriage, storage, and stowage of pollutants.[126]

This requirement is incorporated into EPA's NPDES regulations at 40 CFR 122.44(p) which provide that:

> When a permit is issued to a facility that may operate at certain times as a means of transportation over water, a condition that the discharge shall comply with any applicable regulations promulgated by the Secretary of the department in which the Coast Guard is operating, that establish specifications for safe transportation, handling, carriage, and storage of pollutants.

Section 402(g) applies to EPA and State NPDES programs. If the vessel exclusion is lifted as described in this report, then Section 402(g) may allow for the imposition of uniform standards, provided that the U.S. Coast Guard can establish those standards for ANS. If it is possible for the U.S. Coast Guard to establish these standards under NISA, then Section 402(g) may be a way to harmonize NPDES and NISA requirements. Moreover, if there are any jurisdictional gaps in NISA's coverage with respect to vessel commerce in internal waters, then coverage through an NPDES permit might fill those potential gaps.

4.. OTHER POSSIBLE APPROACHES FOR ADDRESSING BALLAST WATER DISCHARGES

m. Other Clean Water Act authorities

i. Ballast Water Treatment by Publicly Owned Treatment Works (POTWs)

One approach that has been suggested to manage ballast water to reduce the risk of species invasion is to discharge ballast water to POTWs, rather than directly to receiving waters. Although this is already being done in some limited cases (see section 2.e.ii.(1)), there are serious technical questions about the ability of most POTWs to handle ballast water. The vast majority of POTWs are designed to provide primary (separation and settling) and secondary treatment (biological treatment) for municipal waste consisting primarily of sewage. They are not designed to remove or kill ballast water ANS. Large volumes of saline ballast water may poison some POTWs systems. Moreover, few docks will have conveyances to POTWs that can handle the large volume of liquid necessary for ballasting and deballasting. Although some States or localities may elect to take this approach, EPA believes it is unlikely to provide a widespread solution for preventing ANS introductions from ballast water.

ii. Section 504

CWA provides in Section 504(a), "Emergency Powers," that:

> ... the Administrator upon receipt of evidence that a pollution source or combination of sources is presenting an imminent and substantial endangerment to the health of persons or to the welfare of persons where such endangerment is to the livelihood of such persons, such as inability to market shellfish, may bring suit on behalf of the United States in the appropriate district court to immediately restrain any person causing or contributing to the alleged pollution to stop the discharge of pollutants causing or contributing to such pollution or to take such other action as may be necessary.[127]

This Section could be invoked if there were evidence that ballast water discharges were presenting an imminent and substantial endangerment to the health or welfare of persons (as qualified above).

n. National Environmental Policy Act (NEPA)

NEPA requires that Federal agencies proposing major actions significantly affecting the environment prepare detailed environmental impact statements of the environmental effects of those actions. While there is no explicit mention of ANS in the language of NEPA, the Act gives broad latitude to the interpretation of what issues should be considered in NEPA documents. EPA believes, as do most Federal agencies, that ANS issues should be considered when germane to the action being considered in the NEPA document. NEPA regulations issued by the Council on Environmental Quality (CEQ) define environmental "effects" to include "ecological" effects, "such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems." Several agencies have established categorical exclusions in their NEPA regulations for activities relating to ANS, such as the reintroduction (stocking) of native or established species into suitable habitat within their historic or established range.

EPA has the authority to review certain Federal actions that may deal with the control or inadvertent introduction of ANS. Section 309 of the Clean Air Act requires that EPA review and comment on the environmental impact of any matter relating to the duties and responsibilities of the EPA Administrator contained in legislation proposed by a Federal agency, newly authorized Federal projects for construction, actions subject to NEPA's environmental impact statement requirement, and proposed regulations published by any agency of the Federal government. Such comments must be made public at the conclusion of any review. If the EPA Administrator determines such legislation, action, or regulation to be unsatisfactory from the standpoint of public health, welfare, or environmental quality, the Administrator must publish the determination and refer the matter to the CEQ.

DRAFT CONCLUSIONS

At this time, the greatest impediment to preventing ANS introductions to U.S. waters is the lack of effective and affordable ballast water treatment technologies. While mid-ocean ballast water exchange has been used to remove ANS from ballast water, it is only partially effective in achieving that goal. Furthermore, it cannot be applied to most vessel traffic between U.S. ports, and cannot be required of ocean-going vessels in situations where the safety of the vessel might be compromised. However, the Federal government, States, local governments, ports, the shipping community, and environmental groups are in agreement that ANS introductions from ballast water are a serious problem, and substantial resources are being spent developing ballast water treatment technologies. The U.S. Coast Guard has been working with several technology developers and expects to approve some alternative technologies for shipboard trial use within several months. EPA believes that these technologies will be widely available for commercial use within several years.

A substantial opportunity exists with NISA to control ANS introductions. With NISA, Congress gave the U.S. Coast Guard a mandate to develop a program with significant voluntary components, to prevent ANS introduction by the discharge of ballast water from vessels. NISA required the U.S. Coast Guard to monitor the effectiveness of its program, report back to Congress in several years, and if necessary, revise its program. If the compliance rate with the voluntary parts of the program is determined to be inadequate, NISA authorizes the U.S. Coast Guard to make the program mandatory. NISA also delegates to the U.S. Coast Guard the responsibility for deciding whether any proposed ballast water treatment procedure is as effective as ballast water exchange in preventing ANS, which in turn could then be included in U.S. Coast Guard regulations. Under NISA, the ANSTF and U.S. Coast Guard are involved in a number of research activities, some in partnership with States and industry, to develop effective and affordable ballast water treatment technologies. Moreover, State development and implementation of ANS Management Plans is expected to play a role in reducing ANS introductions.

A key element in control of ANS is the research into control technologies, and a key step toward development and implementation of ANS control technologies is the development of environmentally-based criteria that could be used to guide the development of such technologies. The Invasive Species Management Plan, discussed in section 3.a.i, includes specific actions for NOAA, the U.S. Coast Guard, the Department of the Interior, and EPA to sponsor research to develop new technologies for ballast water management, and for the U.S. Coast Guard to issue standards for approval of ballast water management technologies. The U.S. Coast Guard recently published in the *Federal Register* a request for comments on approaches they are considering for developing ballast water standards.[128]

Thus, the opportunity under NISA is one of ANS control technology development and implementation though U.S. Coast Guard regulations under NISA, with ANS standards development in a partnership approach, lead by U.S. Coast Guard, under the ANSTF.

In contrast, control of ANS introductions by CWA authorities, while possible, appears more problematic. While EPA could conceivably amend the vessel exclusion so that NPDES permits could be used to regulate ballast water discharges, NPDES permits alone have significant shortcomings with respect to imposing uniform requirements on vessels which routinely move across national and State boundaries. While there are Clean Water Act mechanisms to promote uniform permit conditions in NPDES permits (model permits, effluent guidelines, or Section 402(g)), those mechanisms will require a great deal of Federal and State agency resources, and may not necessarily provide protections from ANS introductions that are greater than those found under NISA.

Also, using NPDES permits for ballast water discharges is likely to subject ballast water discharges to multiple State and Federal regulatory regimes in light of other ongoing Federal and State efforts to regulate ballast water. As discussed in section 3.k, the vessel exclusion is 40 CFR 122.3(a) is not a required element of State programs. Thus, it would not prohibit States from regulating ballast water discharges with NPDES permits should they choose to do so.

Given the nature of vessel commerce, a coordinated national approach is preferable to a series of uncoordinated local responses. However, any national approach must have sufficient flexibility to address local or regional needs. The problem of ANS should be coordinated with State and local interests including a broad range of stakeholders, other Federal agencies, the Aquatic Nuisance Species Task Force, and the Invasive Species Council, as discussed in section 3.a.ii.(3).

Environmental Management System techniques should be considered for any solution for preventing ANS introductions from ballast water discharges, as discussed in section 3.f.

DRAFT RECOMMENDATIONS

One: EPA should promote the development of effective ballast water treatment technologies by:

- Actively promoting research, outreach, and technology development through its participation in the ANS Task Force, the Invasive Species Council, and their appropriate committees and working groups on ballast water;

- Promoting technology development, for example through its Environmental Technology Verification (ETV), Small Business Innovative Research, and Green Ships and Green Ports programs;

- Establishing the prevention of ANS introductions as an EPA research priority;

- Providing technical assistance to ANS research projects initiated or funded by the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), the U.S. Coast Guard, or other government, academic, or non-governmental organizations;

- Supporting the U.S. Coast Guard's efforts to evaluate the effectiveness of its regulations and to revise them, if necessary to enhance their effectiveness in preventing ANS introductions, including the development of domestic ballast water standards and encouraging the development and adoption of new technologies; and

- Continuing EPA's participation on the U.S. delegation to the Ballast Water Working group of the Marine Environmental Protection Committee of the International Maritime Organization, which is working toward an international ballast water agreement, including developing standards.

Two: EPA should work to prevent species introductions by:

- Encouraging public participation and education/outreach (e.g., through the National Estuary Programs, Great Waters programs, Aquatic Nuisance Species Task Force, National Invasive Species Council, Interagency Committee on the Marine Transportation System, and web sites);

- Working with the U.S. Coast Guard to maximize compliance with the NISA regulations at 33 CFR 151 by:

    - Providing technical assistance, coordination, and advocacy support to U.S. Coast Guard outreach, education, and research projects; and

    - Participating actively on the ANS Task Force, its regional Panels, and its Ballast Water Committees.

- In cooperation with other Federal agencies, engaging the regulated community in a government-shipper partnership emphasizing the use of EMS to address all aspects of ship-borne transfers of ANS, by:

    - Formally recognizing the efforts of shipping interests which commit to real, significant actions that reduce the risk of ANS transfer;

    - Providing technical assistance, coordination, and where appropriate, financial support to shippers' projects designed to address ANS; and

- Where appropriate, providing regulatory flexibility for ANS prevention projects using EPA's Project XL program;[129]

- Providing encouragement for national consistency and coordination to State and local governments' efforts to control ANS invasion from ballast water;

- Developing EPA's Invasive Species Management Plan to identify appropriate EPA-specific activities to implement the Invasive Species Council's National Invasive Species Management Plan;

- Using EPA's authority to review NEPA documents and other documentation, to promote the adequate consideration of the effects of ANS in Federal actions which involve ballast water; and

- Deferring consideration of the application of National Pollutant Discharge Elimination System (NPDES) permits to ballast water discharges pending these actions**.** The effectiveness of other programs, including the level of compliance with the U.S. Coast Guard's program under NISA, will be a factor in EPA's future consideration of this issue.

4.. LIST OF ACRONYMS

ANS - Aquatic Nuisance Species.

ANSTF - Aquatic Nuisance Species Task Force.

APPS - Act to Prevent Pollution from Ships.

BMP - best management practice.

CFR - Code of Federal Regulations.

CITES - The Convention on International Trade in Endangered Species of Wild Fauna & Flora

CWA - Clean Water Act. Also known as the Federal Water Pollution Control Act, as amended.

DOT - Department of Transportation; normally referring to the U.S. DOT.

EEZ - Exclusive Economic Zone.

EMS - Environmental Management Systems.

EPA - U.S. Environmental Protection Agency.

ESA - Endangered Species Act.

ETV - Environmental Technology Verification.

GATT - General Agreement on Tariffs and Trade.

GLNPO - U.S. EPA's Great Lakes National Program Office.

IJC - International Joint Commission of the Boundary Waters Treaty.

IMO - International Maritime Organization.

MARPOL - International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978.

MTS - Marine Transportation System.

NABS - National Ballast Survey.

NANPCA - Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990.

NEP - National Estuary Program.

NEPA - National Environmental Policy Act.

NISA - National Invasive Species Act of 1996.

NOBOB - No Ballast Onboard.

NPDES - National Pollutant Discharge Elimination System;(CWA §402)

ORD - U.S. EPA's Office of Research and Development.

POTWs - Publicly Owned Treatment Works.

SERC - Smithsonian Environmental Research Center

UNCED - United Nations Conference on Environment and Development.

UNCLOS - United Nations Convention on the Law of the Sea.

USCG - United States Coast Guard.

UV - Ultra Violet Radiation.

REFERENCES

1. see http://www.epa.gov/projectxl

2.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

3.James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no. CG-D-XX-92, 1992.

4. G. J. Ryan, "The shipping industry's role in slowing ruffe expansion throughout the Great Lakes," **Fisheries**, **21**(5) 22-23 (1996).

5.James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no. CG-D-XX-92, 1992.

6.Dr. Jim Carlton, "Invasive species in ballast water," presented at MEPC 43, June 27, 1999, London, England.

7.Cohen, Andrew and Jim Carlton, "Accelerating invasion rate in a highly invaded estuary, **Science**, **279** 555-558 (1998).

8.J. T. Carlton and J. B. Geller, "Ecological roulette: the global transport of nonindigenous marine organisms," **Science, 261** 78-82 (1993).

9.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

10.Ruiz, Gregory M., et al., "Ballast water discharged from vessels harbors a cocktail of potential pathogens," **Nature 406**, 49-50 (2000).

11.James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no. CG-D-XX-92, 1992.

12.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

13.International Maritime Organization, "Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens," Resolution A.868(20), adopted Nov 27, 1997.

14.Pollutech Environmental Ltd., "A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes," prepared for the Canadian Coast Guard, March 31, 1992.

15.Michael Parsons, et al., "Great Lakes ballast water demonstration project–phase I," University of Michigan, May, 1997.

16. Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

17."Implementation of the National Invasive Species Act of 1996 (NISA), interim final rule (preamble)" U.S. Coast Guard, DOT, **64 Federal Register** 26672, May 17, 1999.

18.**Profile of the Water Transportation Industry**, EPA Office of Compliance Sector Notebook Project, EPA/310-R-97-003, U.S. Environmental Protection Agency, September 1997.

19."An Assessment of the U.S. Marine Transportation System: A Report to Congress," U.S. DOT, September 1999.

20."An Assessment of the U.S. Marine Transportation System: A Report to Congress," U.S. DOT, September 1999.

21."An Assessment of the U.S. Marine Transportation System: A Report to Congress," U.S. DOT, September 1999.

22. James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no. CG-D-XX-92, 1992.

23.David Pimentel, Lori Lach, Rodolfo Zuniga, and Doug Morrison, "Environmental and economic costs associated with non-indigenous species in the United States," presented at AAAS Conference in Anaheim, CA, Jan 24, 1999.

24.David S. Wilcove, et al., "Quantifying threats to imperiled species in the United States," **Bioscience 48**(8), 607-615, August 1998.

25. Andrew N. Cohen and James T. Carlton, "Nonindigenous aquatic species in a United States estuary: a case study of the biological invasions of the San Francisco Bay and delta," A Report for the United States Fish and Wildlife Service, Washington DC and the National Sea Grant College Program Connecticut Sea Grant, December 1995.

26.Ms. C. Renee Cooper, Executive Director, Caribbean Marine Research Center, testimony before the Senate Commerce, Science And Transportation Subcommittee Hearing on Coral Reefs and Marine Sanctuaries, June 30, 1999.

27.Janet N. Abramovitz, "Inland waters - rich and imperiled," **Biodiversity Bulletin** #3 (Biodiversity Action Network, Washington, DC), August 1997.

28.James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no. CG-D-XX-92, 1992.

29.Michael Parsons, et al, "Great Lakes ballast water demonstration project," University of Michigan, 1998.

30.J. Raloff, "New flea imperils fish, fouls gear," **Science News, 156**(20), 308, Nov 13, 1999.

31.Michael Parsons, et al, "Great Lakes ballast water demonstration project," University of Michigan, 1998.

32.Hameedi, M. J., "Ballast water treatment plant," in **Environmental Studies in Port Valdez, Alaska. Lecture Notes on Coastal and Estuarine Studies, vol 24,** Springer-Verlag, New York, 1988.

33.Greenman, Debra, Kevin Mullen, Shardool Parmar, Worcester Polytechnic Institute, and ENS Chris Friese, United States Coast Guard Office of Response, "Ballast Water Treatment Systems: a Feasibility Study," December 17, 1997.

34.Pollutech Environmental Ltd., "A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes," prepared for the Canadian Coast Guard, March 31, 1992.

35.Pollutech Environmental Ltd., "A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes," prepared for the Canadian Coast Guard, March 31, 1992.

36.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

37.16 USC 4711(c)(2)(K)

38."Ballast Water Exchange and Treatment," Dames & Moore report for the California Association of Port Authorities, Pacific Merchant Shipping Association, Steamship Association of Southern California & Western States Petroleum Association, June, 1999.

39.Pollutech Environmental Ltd., "A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes," prepared for the Canadian Coast Guard, March 31, 1992.

40.see *http://www.epa.gov/ncerqa/sbir*

41.see *http://www.epa.gov/owow/oceans/greenports*

42.see *http://www.epa.gov/etv*

43.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

44.Pollutech Environmental Ltd., 1992. "A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes," prepared for the Canadian Coast Guard, March 31, 1992.

45.G.R. Rigby, G.M. Hallegraeff, and C. Sutton, "Novel ballast water heating technique offers cost-effective treatment to reduce the risk of global transport of harmful marine organisms," **Marine Ecology Progress Series 191**, 289-293, Dec 30, 1999.

46.Australian Minerals & Energy Foundation, "Treatment of ballast water: the issue heats up," **Groundwork 4**(1), June 1998.

47.Japanese Shipowners' Association, "Unwanted aquatic organisms in ballast tank: report of the ballast water management by heat treatment using main engine water cooling circuit and findings of the on-board research," 1995 (from *http://globallast.imo.org* research database).

48."Great Lakes ballast water demonstration project," Michael Parsons, et al, University of Michigan, 1998.

49.Parsons, M. G. and R. W. Harkins, "Filtration mechanical test results from the Great Lakes Ballast demonstration project," presented at the National Conference on Marine Bioinvasions Abstracts of Presentations, Jan 26, 1999.

50.James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no. CG-D-XX-92, 1992.

51.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

52.P&O Princess Cruises plc, 2000 Annual Report.

53.George Wright, Princess Cruises, personal communication, May 22, 2001.

54.Richard E. Fredricks, Jeffrey G. Miner, Ph.D., and Christopher P. Constantine, "Maritime Solutions ballast water treatment system: a shipboard trial," to be presented at the Society of Naval Architects and Marine Engineers Marine Technology meeting, June 2001.

55. Dames and Moore, "Ballast water management technical memorandum for Port of Oakland," Job No. 02801-028-086, November 6, 1998.

56.James T. Carlton, Donald M. Reid, Henry van Leeuwen, "Shipping Study–The role of shipping in the introduction of nonindigenous aquatic organisms to the coastal waters of the United States (other than the Great Lakes) and an analysis of control options," U.S. Coast Guard Report no.

CG-D-XX-92, 1992.

57.William McCracken, "Michigan Project: Ballast Water Treatment With Currently Available Biocides," International Ballast Water R&D Symposium, International Maritime Organization Headquarters, London, United Kingdom, March 26-27, 2001.

58.Dames and Moore, "Ballast water management technical memorandum for Port of Oakland," Job No. 02801-028-086, November 6, 1998.

59.Marine Board, National Research Council, **Stemming the Tide: Controlling the Introduction of Nonindigenous Species by Ships' Ballast Water** (Washington, DC, National Academy Press, 1996).

60.Pollutech Environmental Ltd., "A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes," prepared for the Canadian Coast Guard, March 31, 1992.

61.Wilson Browning, W. J. Browning, Co., Inc, Norfolk, VA, personal communication, June 22, 2001.

62.National Invasive Species Council, **Meeting the Invasive Species Challenge**, January 18, 2001.

63.16 USC chapter 67.

64.Allegra Cangelosi, "NISA Passes!" **ANS Digest**, March 1997.

65.16 USC 4711(c)(2)(K)-(L).

66.66 FR 28213.

67.16 USC 4711(d).

68.16 USC 4711(f)(1).

69.16 USC 4711(c)(2)(B).

70.16 USC 4711(g).

71.letter from the Commandant of the U.S. Coast Guard to the American Maritime Congress dated May 1, 2001.

72.G. M. Ruiz, A. W. Miller, R. A. Everett, B. Steves, K. Lion, C. Whitcraft, A. Arnwine, E. Colinetti, M. Sigala, and D. Lipski, "National Ballast Information Clearinghouse Interim Report. Results of the First Year of Data Management and Analysis: Shipping Industry Compliance with Mandatory Ballast Water Reporting Requirements Shipping Industry Compliance with Voluntary Ballast Water Management Guidelines," (October 2000).

73.G. M. Ruiz, A. W. Miller, R. A. Everett, B. Steves, K. Lion, C. Whitcraft, A. Arnwine, E. Colinetti, M. Sigala, and D. Lipski, "National Ballast Information Clearinghouse Interim Report. Results of the First Year of Data Management and Analysis: Shipping Industry Compliance with Mandatory Ballast Water Reporting Requirements Shipping Industry Compliance with Voluntary Ballast Water Management Guidelines," (October 2000).

74.16 USC 4721.

75.5 USC Appendix.

76."Aquatic Nuisance Species Task Force Resolution on the Elimination of the Transfer of Invasive Species Through Ships' Ballast Water," Duluth, Minnesota, April 30, 1999.

77.16 USC 4714(b).

78.16 USC 4721(b).

79.16 USC 4722(i)(2)(A).

80.33 USC chapter 33.

81.33 USC chapter 26.

82.33 USC 1313(c).

83.33 USC 1313(d)(1)(A).

84.see 33 USC 1313(d)(3).

85.Letter from U.S. EPA notifying California State Water Resources Control Board of decisions relating to TMDL submission for the San Francisco Bay area, May 12, 1999.

86. 40 CFR 1700.

87.33 USC 1362(6).

88."Alien invaders–putting a stop to the ballast water hitchhikers," in **Focus on IMO**, International Maritime Organization, 4 Albert Embankment, London SE1 7SR, United Kingdom, October 1998.

89. "Tough New Rules to Keep Marine Invaders Out" Australian Minister for Agriculture, Fisheries and Forestry media release AFFA99/37WT, September 15, 1999.

90.Kieran Mulvaney, "A Sea of Troubles: In the International Year of the Ocean, Are We Reaching the Limits?" **E/The Environmental Magazine**, Jan-Feb 1998

91.Eric Reeves, "Analysis of laws & policies concerning exotic invasions of the Great Lakes," report to the Office of the Great Lakes, Michigan Department of Environmental Quality (Lansing, MI: MDEQ OGL, Mar 15, 1999).

92.Eric Reeves, "An IJC White Paper On Policies for the Prevention of The Invasion of the Great Lakes by Exotic Organisms," presented at the International Joint Commission Workshop on Exotic Policy in Milwaukee, Wisconsin, September 23, 1999.

93.Report of the Water Quality Board to the International Joint Commission, "Alien Invasive Species and Biological Pollution of the Great Lakes Basin Ecosystem," May 1, 2000.

94.Washington Aquatic Nuisance Species Planning Committee, Scott S. Smith, Washington Department of Fish and Wildlife, *chair*, "Washington State Aquatic Nuisance Species Management Plan", June 1998.

95. 16 USC 4724(a)

96."Nonindigenous Aquatic Nuisance Species State Management Plan: A Strategy to Confront Their Spread in Michigan," 1995.

97."Nonindigenous Aquatic Nuisance Species State Management Plan: A Strategy to Confront Their Spread in Michigan," 1995.

98."ANS State Management Plan Progress Report - 2000" Michigan Department of Environmental Quality, January 16, 2001 (from *http://www.deq.state.mi.us/ogl/).*

99.Washington Aquatic Nuisance Species Planning Committee, Scott S. Smith, Washington Department of Fish and Wildlife, *chair*, "Washington State Aquatic Nuisance Species Management Plan", June 1998.

100.Michigan Senate bill No. 955, A bill to amend 1994 PA 451, entitled "Natural resources and environmental protection act," introduced February 1, 2000, Introduced by Senators Sikkema, Young, Goschka, Hammerstrom, Stille, North, Gougeon, Van Regenmorter, Gast, Bennett, Rogers, Dunaskiss, Steil, Mc Cotter, Emmons, Bullard, Schwarz, Shugars, Schuette, Johnson, Peters and De Beaussaert.

101.Pacific Ballast Water Group, "Report and Recommendations," July 28, 1999 (DRAFT).

102.Board of Port Commissioners of the City of Oakland, "An Ordinance Amending Port Ordinance No. 2833 Relating to Ballast Water." effective date August 1, 1999.

103.Scott Newsham, Commander, USCG, "Ballast Water Management," presentation to the Chemical Transportation Advisory Committee, March, 1999.

104.Department of Transportation, **Proceedings of the National Conference on the Marine Transportation System: Waterways, Ports and their Intermodal Connections**, Airlie Center, Warrenton, Va, November 17-19, 1998.

105."Nonindigenous Aquatic Nuisance Species State Management Plan: A Strategy to Confront Their Spread in Michigan," 1995.

106. 40 CFR 123.63(e).

107. 38 FR 13530.

108. 33 USC 1362(14).

109. 33 USC 1362(6)(A).

110. 33 USC 1322(a)(6).

111. 33 USC 1362(12).

112.15 USC 1606 (Article 24(2)).

113. 38 FR 13530.

114. 38 FR 13530.

115. 38 FR 13528.

116. 44 FR 32902.

117. See 43 FR 37079.

118. See 40 CFR 123.25.

119. See, Issuance of Final General NPDES Permits for Oil and Gas Operations on the Outer Continental Shelf (OCS) of Alaska, Norton Sound and Beaufort Sea, 48 FR 54881 (Dec. 7, 1983); Issuance of Final General NPDES Permits for Portions of Deep Seabed Mining Activities in the Pacific Ocean, 49 FR 39442 (Oct. 5, 1984); Final NPDES General Permit for Offshore Oil and Gas Operations on the Outer Continental Shelf (OCS) and State Waters of Alaska: Arctic NPDES General Permit (No. AKG284200), 60 FR 27508 (May 24, 1995); Authorization to Discharge Under the National Pollutant Discharge Elimination System for Seafood Processors in Alaska, 60 FR 34992 (Jul. 5, 1995); Final NPDES General Permit for New and Existing Sources in the Offshore Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico (GMG290000), 61 FR 41609 (Aug. 9, 1996).

120. 40 CFR 122.23.

121. 40 CFR 122.24.

122. 40 CFR 122.25.

123. 40 CFR 122.26.

124. 40 CFR 122.27.

125. 33 USC 1370.

126. 33 USC 1342(g).

127. 33 USC 1364(a).

128.66 FR 21807.

129. see http://www.epa.gov/projectxl